MAYO CLINIC

Mayo Clinic on Osteoporosis

Keep your bones strong and reduce your risk of fractures

Ann E. Kearns, M.D., Ph.D.

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Contents

Preface

Bones form the physical foundation of the body, your skeleton. As with many aspects of health, it's easy to pay little attention to your skeleton until a problem occurs, such as a broken bone. Then you're keenly aware of how your daily routine depends on the health of this foundation.

Building a strong skeletal foundation begins in childhood with good nutrition and exercise. In adulthood, maintaining strong bones means continuing these good habits and avoiding bad habits, like smoking and other substance abuse. However, even with a healthy lifestyle, the bones change with age. They may also be affected by other health problems. These changes can lead to osteoporosis, a weakening of your bones. With osteoporosis, broken bones (fractures) may result from simple activities like a cough, an exhuberant hug or lifting a grandchild.

My passion is helping people avoid broken bones so they can enjoy their lives to the fullest. Even after developing osteoporosis, you can take action to limit or reverse bone loss. Every day in my practice I see people who have had weakened and broken bones, and I work with them to design a treatment program to lower the risk of more fractures.

With contributions from my colleagues, *Mayo Clinic on Osteoporosis* brings the passion and expertise of Mayo Clinic health care providers to the page. This book covers state of the art, proven medical strategies to prevent and treat osteoporosis, incorporating recent advances in imaging and medications. It also provides the latest information and guidance on promoting bone health through nutrition, exercise and your lifestyle.

This book is organized into three parts. In Part 1, you'll learn how osteoporosis develops through an imbalanced bone maintenance system. These first chapters also cover risk factors for osteoporosis, fractures and falls, and bone density testing to help you understand the disease and how it's diagnosed.

Part 2 discusses the prevention and treatment of osteoporosis, focusing on nutrition, physical activity and medication. In addition, this section addresses other health issues that can lead to or result from osteoporosis, which may affect the best approach to prevention and treatment. Chapter 11 focuses on understanding and improving bone health in men.

Part 3 is a guide to living with a weakened bone structure, including tips for posture and basic movements that can help protect your skeleton. You'll also learn ways to reduce the risk of falls or fractures at home and in your daily routine. Chapter 14 reviews what to expect if you do experience a fracture — and how to optimize your recovery.

You may be reading this book to inform yourself because you have osteoporosis or low bone mass or because someone in your life does. Either way, my hope is you will gain

confidence in what you can do, or help others do, to keep the skeletal foundation standing strong.

Ann E. Kearns, M.D., Ph.D. is an endocrinologist at Mayo Clinic in Rochester, Minnesota, and an associate professor at Mayo Clinic College of Medicine and Science. A graduate of Brown University and the University of Chicago Pritzker School of Medicine, she completed her residency in Chicago and a fellowship in endocrinology at Harvard University's Massachusetts General Hospital. Since joining Mayo Clinic in 1998, Dr. Kearns has been dedicated to improving osteoporosis care and secondary fracture prevention. She has also contributed to national efforts to close the gap between recommendations and typical care, working toward better diagnosis and treatment of people with osteoporotic fractures.

PART 1 UNDERSTANDING OSTEOPOROSIS

Chapter 1

What is osteoporosis?

You may not think of your bones as being alive, but they are. Every day, your body breaks down old bone and replaces it with new. As you get older, however, you lose more bone than you gain. If you lose too much, you can develop the bone disease osteoporosis.

Osteoporosis causes bones to become weak, brittle and prone to fracture. The word *osteoporosis* means “porous bones.” Due to this loss of bone tissue, bones that were once dense and strong may be unable to withstand the stress of even normal activity, such as bending over or twisting to look behind you.

Having some bone loss is a natural part of aging, similar to getting gray hair or developing wrinkles. However, losing several inches of height goes beyond what’s considered healthy aging. And it certainly isn’t normal to break a bone from coughing or receiving a hug.

But that’s precisely what can happen if you’re one of about 54 million people in the United States who have osteoporosis or are at high risk of it due to low bone mass.

Wondering about weak vs. strong bones, or bone mass vs. bone strength? Here are some key terms.

- Bone mass is the total amount of bone tissue you have in your skeleton.
- Bone density refers to how tightly that tissue is packed within a given area of bone.
- Bone strength refers to the ability of bone to withstand stress and is dependent on bone quality, including mass and density as well as the

structure.

The good news is that osteoporosis is as preventable and treatable as it is common. The keys to avoiding the disease are building a strong skeleton when you're young and slowing the rate of bone loss as you age. Getting the right nutrients and being active can help with both.

Even if you already have osteoporosis, good nutrition, exercise and medications can slow, or even reverse, its progression. Treatment can lower your chance of being sidelined by a broken bone. It's never too late to do something about your bone health.

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Osteoporosis through the ages

Ancient Egyptian mummies with the telltale evidence of hip fractures suggest that osteoporosis has been a problem for humankind through the millennia. But until fairly recently, osteoporosis wasn't considered a disease. It was thought to be an inescapable part of aging. Stereotypes from literature, art and even television reinforced this idea. From the old woman who lived in a shoe (of nursery rhyme fame) to Sophia from the 1980s sitcom *The Golden Girls*, older female characters have often been portrayed with a tottering walk and stooped over with the so-called dowager's hump.

In the 1830s, a French doctor studying the effects of disease on the human body observed that some people's bones were honeycombed with large holes that greatly weakened the bone structure. He was the first person to describe this condition, which he termed osteoporosis. Unfortunately, the French doctor didn't consider this to be a sign of disease and continued his investigation along different paths.

In the 1940s, Fuller Albright, M.D., of Massachusetts General Hospital, made the connection between the hormone estrogen and osteoporosis. He noticed that many of his patients who had problems with weak bones and fractures were older women past menopause. Dr. Albright believed that the sharp drop in estrogen that occurs during menopause was causing the abnormal loss of bone. He identified the condition as postmenopausal osteoporosis.

Still, old notions prevailed. Until the 1990s, doctors had limited options beyond calcium and estrogen to offer as prevention or treatment for osteoporosis. But newer discoveries have transformed doctors' understanding of the disease. Osteoporosis is an issue not only for older women but also for younger people. Building strong bones when you're young and growing is just as important as slowing bone loss as you age.

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OSTEOPOROSIS RISKS

Each year osteoporosis is responsible for an estimated 9 million fractures, including more than 2 million in the United States. Typically, these fractures occur in the spine, hip or wrist (forearm), but they may happen in other bones as well. A compression fracture of the spine causes your vertebrae to collapse and may lead to lost inches of height and a stooped posture. Fractures of the hip can change lives. As many as one-third to one-half of those who break a hip don't return to the same level of daily activity and independence they had before the fracture. And around 1 in 5 people who has broken a hip requires long-term care in a nursing home. What's more, it's common for health issues such as chronic pain, anxiety and depression to occur with osteoporosis.

Osteoporosis is most common among postmenopausal women. In fact, for women age 50 and older, their chances of breaking a bone during their remaining years of life may be as high as 50%. Fewer men than women get osteoporosis, but men also have a higher risk of fracture as they age.

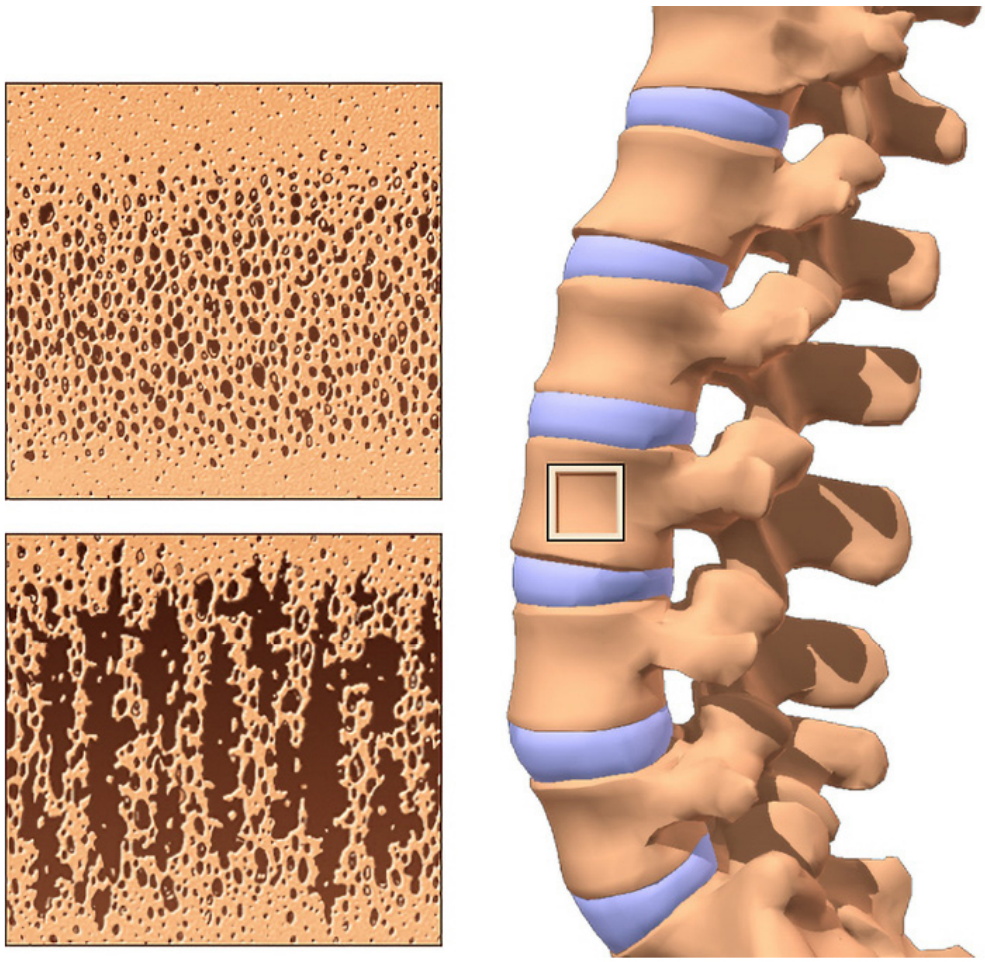
Many people have weak bones and don't even know it. That's because bone loss typically happens over a long period of time, and it doesn't hurt. A broken bone is often the first and only indication that a person may have osteoporosis. Unfortunately, by the time a fracture occurs, the disease may be well established. A bone density test is the best way to predict fracture risk.

YOUR BONE BANK

Think of your skeleton as a bone bank. Just as your financial health benefits from funds that you put aside and can draw on in times of need, your bone health benefits from a fund of calcium, other minerals and protein that you store in your skeleton. Good bone health depends on keeping your bone bank account well supplied with nutrients that are able to meet all of your body's needs.

Lots of transactions take place in your bone bank account. That's because throughout your life, new bone is constantly being formed and deposited while old or worn-out bone is constantly being broken down and withdrawn. Through this process, your skeleton renews and maintains

itself. Ideally, during adulthood, the deposits should balance out the withdrawals.



Weakened bone: Compared with normal bone (top left), osteoporotic bone (bottom left) is more porous and likely to fracture.

The more bone you have and the denser it is, the stronger your skeleton is — and the better shape your bone bank account is in. Strong bones make it less likely that you'll develop osteoporosis or experience fractures.

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Osteoporosis is not osteoarthritis

Osteoporosis and osteoarthritis are different bone conditions with very different signs and symptoms, but it can be easy to confuse the two. Osteoarthritis affects your joints, the points of connection between bones. It wears away the cartilage that cushions your bones and keeps them from rubbing against each other. Osteoporosis weakens your bones. Painful and deformed joints are common in osteoarthritis. Osteoporosis often goes unnoticed until a bone is broken.

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Not enough bone in the bank

During your younger years, you're constantly making deposits to your bone bank account. But around age 30 things begin to change. Withdrawals from your account begin to exceed your deposits. You gradually start losing bone mass and bone density. This is normal.

What's not normal is when withdrawals exceed deposits at such a rate that portions of your skeleton become weak and brittle. Researchers have yet to learn all of the reasons why this occurs. Many factors are likely involved.

Of course, bone loss doesn't mean that you actually lose whole chunks of bone. It's the protein and mineral content of your bones that's depleted, with fewer internal connections within bone to give it strength. The outer shell of bone becomes thinner, and the interior becomes more porous. This weakens your skeleton.

Under a microscope, a bone affected by osteoporosis looks like a steel bridge with many girders missing. Like a weakened bridge, the bone may no longer be able to endure the everyday stresses and strains placed on it.

Your risk of osteoporosis doesn't depend only on your current rate of bone loss. It also depends on how much bone you banked in your account

when you were young and growing. This makes the disease as concerning to a younger person as it is to an older adult.

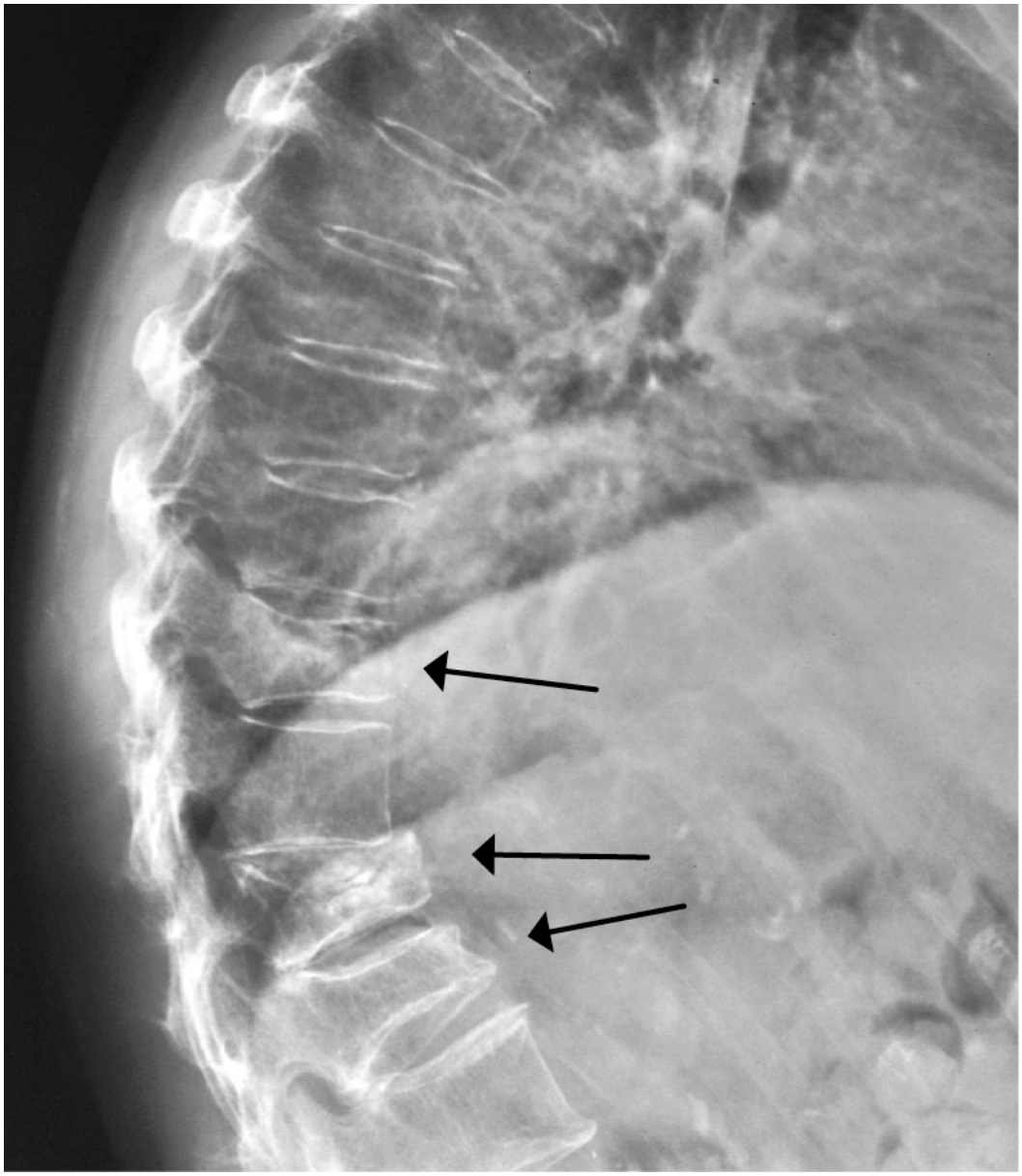
SIGNS AND SYMPTOMS

Osteoporosis is often referred to as a silent disease because bone loss occurs painlessly over many years. And even in instances when the loss is abnormally rapid, during the early stages you may not experience any signs or symptoms.

Then, one day, you break a bone while doing a routine task — maybe you crack a rib while lifting the laundry basket or fracture a vertebra while bending down to tie your shoes. At this point, the disease may already be well established and parts of your skeleton may already be quite weak and susceptible to fracture.

Other signs and symptoms may occur if you've experienced a compression fracture of the spine, including:

- Back pain
- Loss of height
- Stooped posture



Compression fractures: This X-ray image shows compression fractures in three vertebrae (see arrows). These compressed bones can cause abnormal curvature of the spine and result in a stooped posture.

Remember that back pain, loss of height or stooped posture doesn't mean you have osteoporosis. Only if you've experienced a compression fracture does the disease generally produce back pain. The most common causes of back pain are muscle strain and disk injury. However, because there's the possibility that back pain could stem from an osteoporosis-related fracture, it's important to see a doctor to determine the cause and take appropriate action.

In the early stages of osteoporosis, there might be no clues that you have the disease. Because of this, it's important to be aware of factors that put

you at increased risk (see Chapter 4). If you're concerned that you may be at increased risk of the disease, talk with your doctor about whether you should have a bone density test. Remember, the best time to act is before you break a bone — not after.

TYPES

Osteoporosis develops for different reasons. In order to choose the correct course of treatment, your doctor will want to determine the type of osteoporosis you have and what caused it.

In women, osteoporosis most often results from bone loss that occurs after menopause. Often, it's a combination of postmenopausal bone loss and age-related bone loss that causes the condition. Most adults reach their peak bone mass in their late 20s or early 30s. They gradually lose bone mass in the years that follow.

Bone loss may occur as a result of another disease or from the use of certain medications. This type of bone loss can lead to secondary forms of osteoporosis — due to causes outside of the typical effects of aging. However, secondary osteoporosis is less common.

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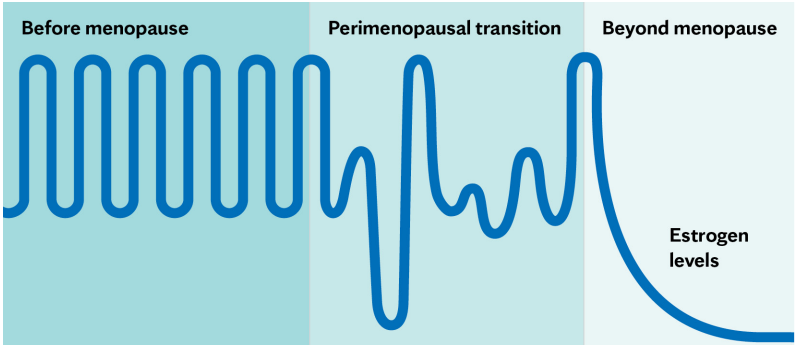
Changing estrogen levels with menopause



Lower estrogen levels during and after menopause can lead to osteoporosis in women.

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Postmenopausal osteoporosis

Postmenopausal osteoporosis happens in the years following menopause as levels of the hormone estrogen decline. In most women, menopause occurs around age 50. Two to three years before a woman experiences her last menstrual cycle, estrogen levels are already starting to drop. The reduction continues for another three to four years after the last cycle. During this time, bone loss accelerates because estrogen, which is needed to maintain bone health, is no longer present at sufficient levels. Women can lose up to 10% or more of their bone mass during the five to seven years after menopause.

In women around age 70, bone loss slows but doesn't stop. By their 80s, women may have lost 35% to 50% of their bone mass. If you enter menopause with low bone mass, or if you rapidly lose bone after menopause, you're more likely to develop osteoporosis. That's why it's important to take steps to build bone mass in your early years and maintain it as an adult.

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Men get osteoporosis, too

While women may be most at risk, men also get osteoporosis. Beginning in their mid-30s men may start to lose bone mass at a rate of up to about 1% a year. By around age 70 they lose bone mass at a similar rate as women do.

Many men may think of osteoporosis as a disease that affects women and ignore simple steps to help prevent it. In fact, approximately 2 million men in the United States have osteoporosis, and another 12 million are at risk of getting it. It's estimated that up to 25% of men older than age 50 will break a bone due to osteoporosis. In the U.S., approximately 80,000 hip fractures each year occur in men. For more information on osteoporosis in men, see Chapter 11.

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Age-related osteoporosis

All individuals — women and men — lose bone with age. It's normal to lose a small percentage of bone mass each year up to age 80. This happens because as you get older, new bone formation slows while bone breakdown stays the same or increases. The internal structure of your bones also weakens, and the outer shell thins. These developments are all a common part of aging, which happens at a different rate for everyone. What's important is the degree of change.

Osteoporosis is most common in older women because their skeletons experience a double whammy. In addition to age-related bone loss, which affects both men and women, many older women have already experienced bone loss from menopause.

Secondary causes of osteoporosis

Sometimes osteoporosis may be related to certain conditions, procedures or medications that accelerate bone loss. Secondary causes are a factor in about 20% to 30% of postmenopausal women with osteoporosis and about 50% of women who are approaching menopause (perimenopausal). Among men with osteoporosis, about 50% have a secondary cause. Osteoporosis that's likely due to one of these causes is known as secondary osteoporosis.

In general, the younger you are when you receive a diagnosis of osteoporosis, the more likely it is that a secondary factor is contributing to the problem. The sidebar above lists some of the more common factors associated with secondary osteoporosis. Chapter 12 offers more information on many of the causes of secondary osteoporosis.

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Secondary causes of osteoporosis in adults

The following medications, conditions and surgical procedures can accelerate bone loss, increasing your risk of osteoporosis. Check with your doctor about other medications or conditions that may affect your bone loss as well.

Medications

- Steroids
- Anticonvulsants
- Excessive thyroid medication
- Certain diuretics, such as loop diuretics
- Certain blood thinners, such as heparin and warfarin
- Certain enzyme inhibitors, such as aromatase inhibitors
- Medications used to treat breast and prostate cancers

Medical conditions

- Endocrine disorders
    - Sex hormone deficiency (hypogonadism)
    - Excessive parathyroid hormone (hyperparathyroidism)
    - Cushing syndrome
    - Type 1 and type 2 diabetes
- Stomach, intestinal and liver disorders
    - Crohn’s disease
    - Celiac disease
    - Primary biliary cirrhosis
    - Lactose intolerance
- Rheumatoid arthritis
- Failure to menstruate (amenorrhea)
- Paralysis or prolonged bed rest due to a medical condition

Surgical procedures

- Organ transplant

- Gastric and upper intestinal surgeries

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A POSITIVE OUTLOOK

A bank account is a useful analogy to describe how your skeleton maintains itself and what happens to bones affected by osteoporosis. But while reduced bone density — a low bank account — puts you at increased risk of osteoporosis, it doesn't mean you're doomed to have a bone fracture in your future.

Low bone mass and low bone density are good indicators of osteoporosis. However, just as your financial health can't be judged solely by what you've saved in the bank, your bone health isn't based solely on bone density numbers. Your doctor will also take into consideration factors such as your bone structure, age, sex and lifestyle.

Chapter 2

The life cycle of bone

People generally think of bone as being solid and inflexible, rather than living tissue. But in fact, your skeleton has an active life of its own. Bones are constantly in a dynamic state of renewal and change, just like hair, skin and other tissues.

Within your body, existing bone is continuously being replaced with new bone in what's known as the bone remodeling cycle. At any given moment, millions of bone-removal and bone-building projects are taking place within your skeleton. This process occurs throughout your life, but the balance between how much bone is removed and how much bone is formed varies over time and with other medical conditions.

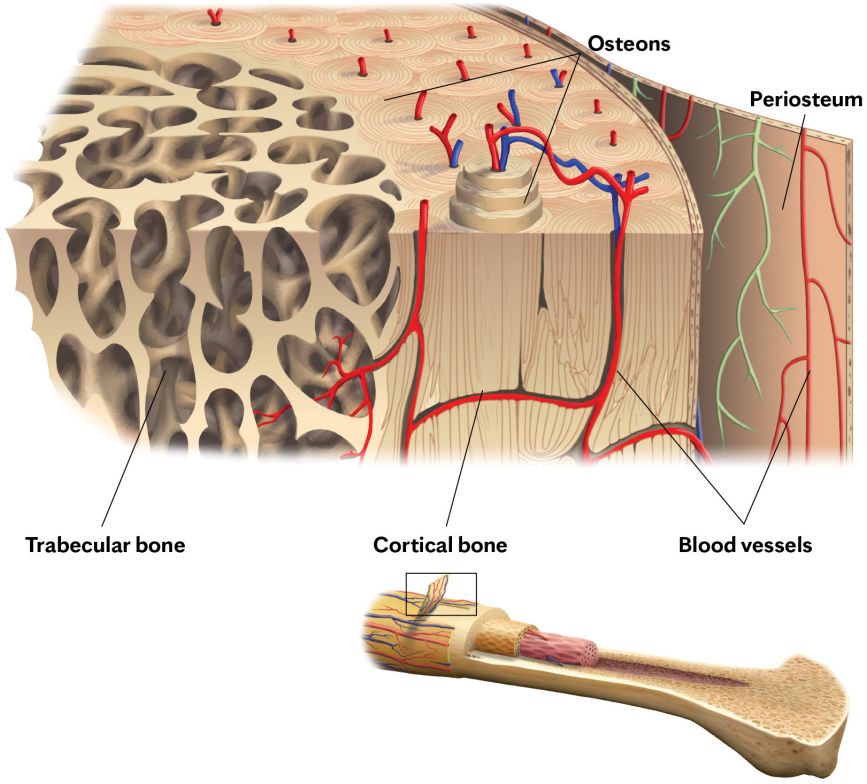
Each stage of your life influences your bone health — starting with fetal growth in the womb and continuing through childhood and adolescence. In your young adult years, your bones grow to their maximum potential in size and density. Bone mass is largely maintained for years after that. In the later years of adulthood, the process changes as you begin to lose bone more rapidly than you form it.

Having a basic understanding of the bone remodeling cycle is important because it can help you comprehend some of the changes that occur to your bone health and bone structure as you age. Keep in mind that the changes vary from person to person because many factors are involved in the remodeling process.

The main point to remember is that positive actions you take now — at any age, but the earlier the better — may help minimize some age-related changes.

BONE BASICS

Bone's basic structure, its inner framework, is a mesh of fibers composed primarily of the protein collagen. Within this framework are deposits of minerals such as calcium and phosphorus, with smaller amounts of sodium, magnesium and potassium. These minerals mix with water to form a hard, cementlike substance called hydroxyapatite that makes bone firm and gives it strength. Think of this like steel-reinforced concrete.



Most bone contains both cortical and trabecular tissue. Bone marrow, another type of tissue within bone, fills many of the holes and passageways in trabecular bone.

The outside surface of bone is covered by a thin membrane called the periosteum. This membrane contains blood vessels that supply nutrients to bone, as well as nerves that send pain messages to the brain in case of an injury or disease.

Underneath the membrane covering are two types of bone tissue, called cortical bone and trabecular bone, in addition to another type of tissue called bone marrow.

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Key bone builders

Like vitamins, minerals are substances that your body needs in certain amounts for normal growth and function. Because your body can't manufacture most minerals and vitamins, you must get them from the foods you eat or, in some cases, from supplements.

Minerals serve many important functions in your body, including the development and maintenance of bone. Bone serves as storage — or a bank — for certain minerals, including calcium, phosphorus and magnesium. When minerals such as these are lacking in your diet, they're extracted from the reserves in your bones. Heavy withdrawals from your bone bank could impair your skeleton's ability to function normally.

Calcium is the most important mineral for bone health. Ninety-nine percent of your body's total calcium is stored in your skeleton. Besides helping keep your bones and teeth strong, calcium is needed for your heart, muscles and nerves to function properly and for your blood to clot normally.

Additional minerals that contribute to bone health and maintenance are phosphorus and magnesium and trace amounts of a few others. Most people who eat a balanced diet or who take a standard multivitamin with minerals get sufficient amounts of these minerals.

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Cortical bone

Compact (cortical) bone forms the dense outer shell of bones. Its basic components are tightly packed, rod-shaped units called osteons, which look something like long green onions bundled together. Osteons are formed from layers of tissue, much like the layers of an onion. In each layer the collagen fibers face different directions, providing added strength.

Trabecular bone

Cortical bone surrounds a type of spongy tissue called trabecular bone, also referred to as cancellous bone.

In this type of tissue, millions of tiny interlacing strands, called trabeculae, form a complex latticework structure. Trabeculae are often arranged along the lines of greatest pressure or stress.

This combination of dense cortical tissue with a supple core of trabecular tissue is what makes bones both strong and light. Your skeleton is a tough but somewhat flexible structure that supports your body, protects your brain and other vital organs, and allows you to walk, run, jump, dance and move in many ways.

Most bone contains both cortical and trabecular tissue, but the proportion of each varies from bone to bone. The long bones of the arms, legs and ribs are mostly cortical bone, whereas irregularly shaped bones, such as the pelvis or the vertebrae of the spine, are mostly trabecular bone.

Bone marrow

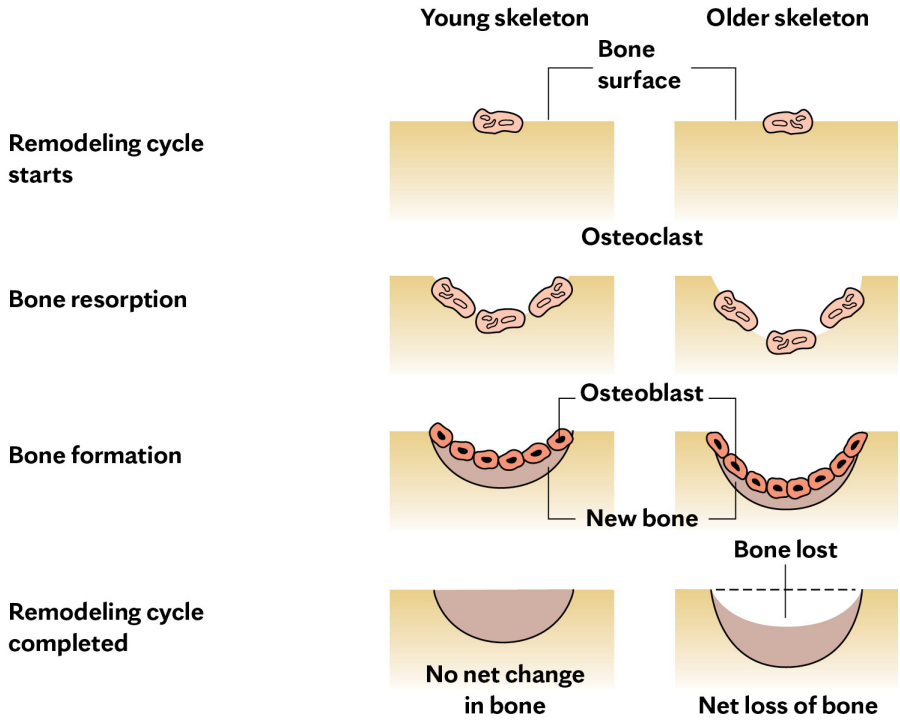
Bone marrow, another type of tissue within bone, is a soft substance that fills the holes and passageways in the interior portion of your bones. Bone marrow manufactures your vital oxygen-carrying red blood cells, germ-fighting white blood cells and clot-producing platelets. In long bones, such as the femur bone in the upper leg, bone marrow fills a canal running through the central shaft.

BONE REMODELING

Your skeleton is a never-ending home repair project. Throughout your lifetime, bone is continuously removed and replaced by new bone in a process called bone remodeling (sometimes referred to as bone turnover). On a regular basis, millions of tiny sections on the surface of your bones are simultaneously under reconstruction.

Bone remodeling occurs for several important reasons. One is simply to repair damage caused by wear and tear. Another is to ensure that enough

calcium and other minerals circulate in the bloodstream to carry out the many bodily functions that depend on these minerals. Finally, remodeling occurs in response to physical activity. Your skeleton adapts to heavier loads and greater stress by forming new bone.



The bone remodeling cycle: Illustrations in the left column show how the bone remodeling cycle in a younger person typically rebuilds as much new bone as was lost. In an older person, not as much new bone is formed after resorption, resulting in a loss of bone over time.

This skeletal regeneration occurs in two basic stages. The initial stage is bone breakdown (resorption), and the second is bone formation. Each stage is carried out by a team of specialized bone cells and is regulated by hormones and other substances in the body.

During resorption, cells called osteoclasts become active at locations on the bone surface. These cells attach themselves to the bone and, equipped with special enzymes, begin to break down the bone surface. As the osteoclasts digest the bone, proteins and minerals are released for circulation in the bloodstream, sometimes for use in other parts of the body. The activity of the osteoclasts results in microscopic cavities on the bone surface.

Bone resorption is followed by bone formation, a process carried out by a different group of specialized cells called osteoblasts. The osteoblasts migrate to excavated areas where they begin to fill in the cavities with collagen. Gradually, the meshwork hardens as minerals carried in the bloodstream are redeposited in the collagen. The cycle ends when the collagen is completely mineralized — bone that was removed during resorption is now completely replaced.

During remodeling, the bone cells release byproducts in the blood or urine (markers of bone turnover). Sometimes your doctor may measure these byproducts as a check on your bone remodeling process or on the effects of a bone treatment.

Other cells called osteocytes, which are osteoblasts that have become layered over and embedded within bone during previous remodeling cycles, also play an important role in remodeling. They coordinate the activities of both the osteoblasts and osteoclasts on the surface of bone during the remodeling process.

A full cycle of bone remodeling at one site — the excavation of a cavity and the replacement of collagen and minerals within that cavity — takes about three to six months in children and adolescents and six to 12 months in adults. In older adults, the process may take 18 months.

As tends to be true with most remodeling projects, the demolition phase generally goes faster than the reconstruction phase. In order to maintain your skeleton at any given moment, fewer sections are being broken down than are being rebuilt.

For individuals in their 30s, about 1% of the skeleton is undergoing bone breakdown while about 4% is undergoing bone formation. At this pace, your skeleton undergoes complete regeneration every 10 years.

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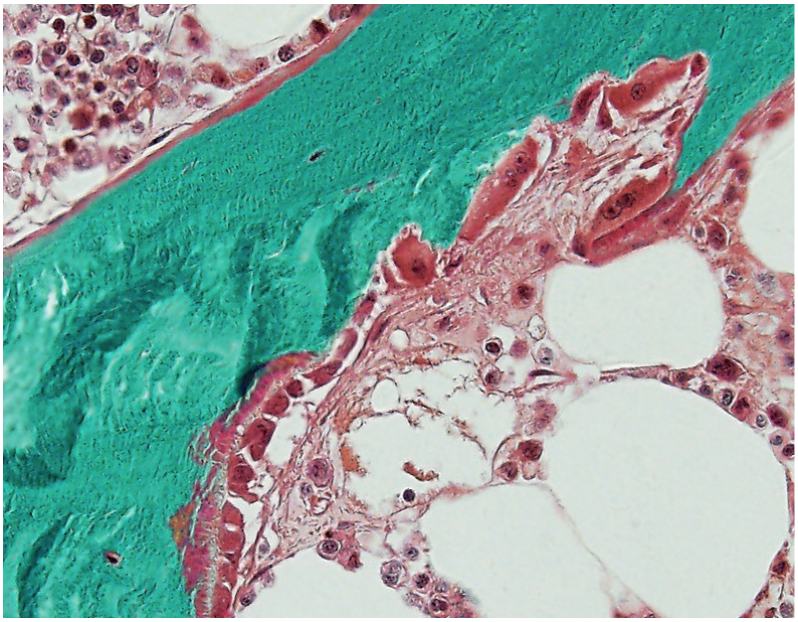
Bone under construction



This photomicrograph — a photo taken through a microscope — shows a high-powered (200x) view of the bone remodeling cycle. Older, mineralized bone is stained green. At upper right, osteoclasts carve out a section of bone. To the left, osteoblasts form new bone in a space left by resorption. The new bone (above the osteoblasts) appears pink, as it's not yet fully mineralized.

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HORMONES AND BONE FORMATION

The activities of osteoclasts, osteoblasts, and osteocytes in the bone remodeling cycle are controlled by hormones and other substances that allow these bone cells to communicate with one another. Hormones also affect how much calcium is extracted from your food and how much is eliminated from your body.

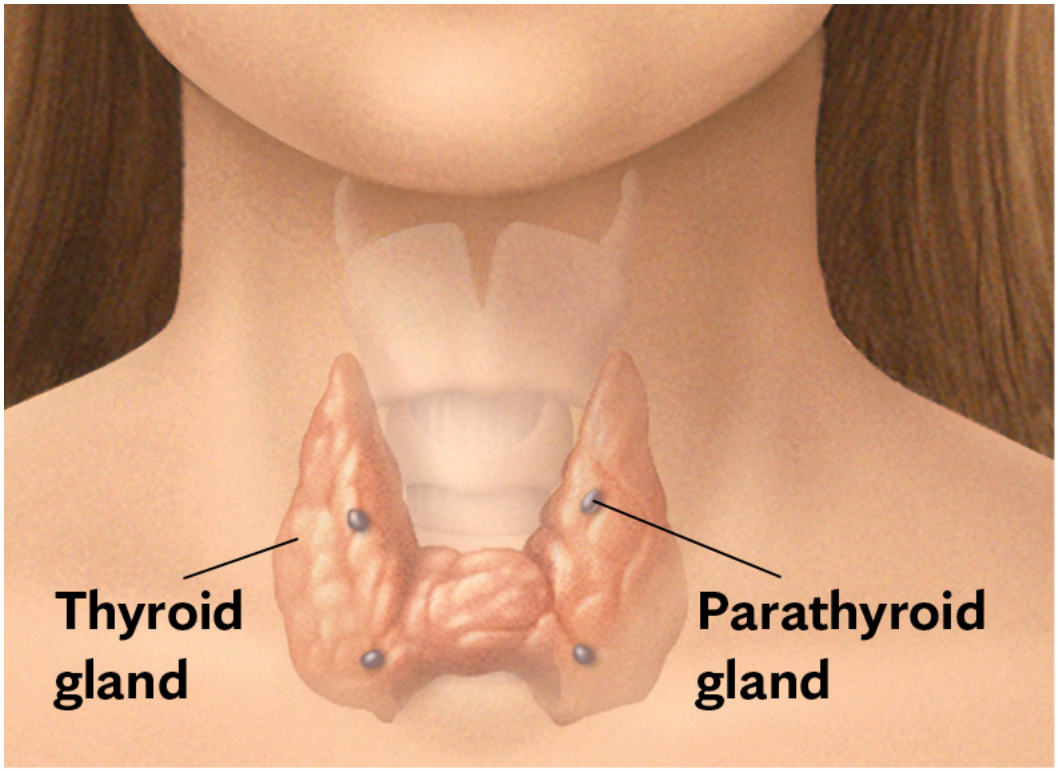
Hormones are chemical messengers that target specific parts of the body to help regulate many processes and functions. Hormones are part of the endocrine system, which is a system of specialized glands. The glands

produce and secrete hormones into the bloodstream as they're needed. Most people are familiar with the sex hormones estrogen and testosterone, which are involved in puberty and reproduction. These and other hormones are involved in the day-to-day regulation of bone tissue as well. Because the endocrine system is involved in bone remodeling, endocrinologists are among the specialists who treat osteoporosis.

The main hormone involved in bone remodeling is parathyroid hormone (PTH), which is produced by four small glands located at the base of your neck, adjacent to the thyroid gland. When the level of calcium in your bloodstream drops, the parathyroid glands secrete PTH. The hormone stimulates osteoclasts to break down bone and release more calcium into the bloodstream. Under special conditions, PTH can also stimulate bone formation.

PTH activates vitamin D, which increases the absorption of calcium in the gastrointestinal tract. PTH also directs the kidney to retain more calcium in the bloodstream rather than filter it into the urine. Besides PTH, other substances help regulate bone remodeling. These include calcitonin — a hormone produced by the thyroid gland — and the sex hormones estrogen and testosterone.

You maintain bone strength when the amount of bone that's removed during resorption is fully replaced by new bone. Many factors figure into this equation, including age, hormones, diet and exercise. There's great variation from one person to another and from one stage of life to another. Throughout childhood, adolescence and young adulthood — the prime years of physical growth — more bone is formed than is removed. Later in life, changes in your body shift the cycle from surplus bone formation or equilibrium to bone loss.



Parathyroid glands: Four parathyroid glands (indicated by the gray dots) lie behind the thyroid gland. The parathyroid glands produce parathyroid hormone (PTH), which is vital to your bone health.

PEAK BONE DENSITY

When you're young, your skeleton grows to keep pace with other developments of childhood, adolescence and young adulthood. Consequently, during this time your bones grow larger, denser and stronger, and your bone mass increases. At the end of the adolescent growth spurt, young people usually have obtained up to 60% of their total adult bone mass. By age 18, your height (longitudinal growth) is nearly complete.

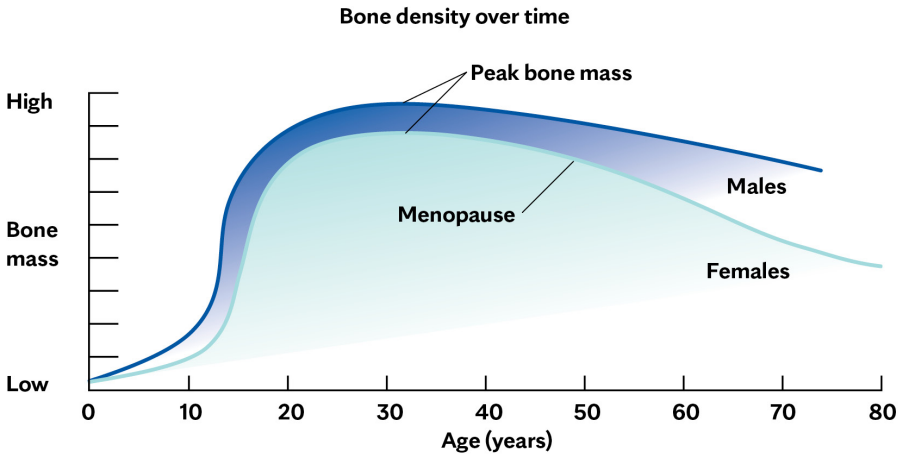
Your bone mass typically reaches its maximum — known as peak bone density — in your late 20s to early 30s. At this point, your bones are as fully developed as they'll ever be.

Peak bone density varies from one person to another. It's influenced by:

- **Heredity.** Genetic factors account for about three-fourths of the variation in peak bone density among individuals.

- **Sex.** Peak bone density is generally higher in men than it is in women because men's bones are larger.
- **Race and ethnicity.** White people and people of Asian descent generally have a lower bone density than do people who are Black, Hispanic or of Native American descent.
- **Diet.** People with adequate calcium and vitamin D in their diets generally reach a higher peak bone mass than do individuals who don't get enough calcium and vitamin D.
- **Physical activity.** Exercise and activity are positive skeletal influences because your bones respond to physical activity by becoming denser and stronger.
- **Hormone production.** Estrogen, testosterone and other hormones contribute to bone formation and the maintenance of your skeleton.
- **Medical conditions.** Some chronic medical disorders and certain severe illnesses, as well as medications used to treat those disorders or illnesses, may affect bone and reduce bone density.
- **Lifestyle.** Smoking and excessive alcohol use may have an adverse effect on bone density.

The higher your peak bone density, the better protected you'll be from osteoporosis, and the less likely you'll be to experience a fracture. That's because it takes longer for the effects of aging or illness to weaken strong bones to the point where they easily fracture. If you're young, a great way to protect yourself from osteoporosis is to develop habits and behaviors that build bone mass. If you're past the age of achieving peak bone mass, don't despair. Many of the same habits and behaviors are effective in slowing bone loss.



The rise and fall of bone density: Bone density, which varies by sex, race and ethnicity, peaks in your late 20s to early 30s and then slowly declines with age. Women experience a rapid decline in bone density beginning with the onset of menopause. In general, the higher your peak bone density, the lower your risk of having fractures due to osteoporosis later in life.

AGING AND YOUR BONES

Bone remodeling continues after you reach peak bone density, but the balance between formation and resorption shifts. With age, the rate of bone breakdown begins to overtake that of bone formation, and the number of resorption sites increases.

The bottom line is that because bone density is decreased, your bones become more porous and brittle.

The transition from bone gain to bone loss is slow. It's also universal, affecting both men and women, although at different stages in life. In a decade, you'll likely experience about 3% to 5% loss of bone. This change primarily affects trabecular bone, which is less dense than cortical bone.

The reasons behind the changes to the bone cycle are complex and not completely understood. As you get older, osteoblasts — the bone-forming cells — become less active and new bone is formed more slowly. Changes in your body's ability to absorb calcium, a lower activity level and decreases in certain hormones also play a role.

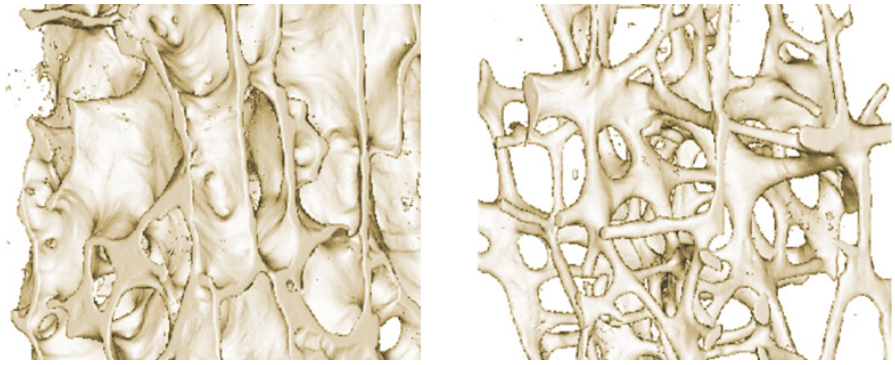
As people age, their intestines gradually absorb less calcium from the foods they eat, so less of this mineral reaches the bloodstream. The

kidneys also appear to lose some of their ability to conserve calcium, and as a result more calcium is lost in urine.

Some people also find that as they get older they're less tolerant of the sugar (lactose) in calcium-containing products, such as milk or yogurt. Because of this, they don't eat as many dairy products, resulting in less calcium intake. Some people also feel that dairy products contribute to constipation.

Vitamin D production also may decline as you age. The major source of vitamin D is sunlight, and many adults spend less time in the sun as they get older. With age your skin also becomes less efficient at synthesizing vitamin D from the sun's rays. The use of sunscreen also markedly limits the ability of the skin to synthesize vitamin D.

In addition, if you're consuming fewer dairy products, it's likely that you're also getting less vitamin D from your diet. Vitamin D is routinely added to cow's milk to fortify it. With less of the vitamin to help with calcium absorption, much of the calcium you consume may not be making it to your bloodstream.



Bone becomes brittle: 3D images of trabecular bone from a vertebra show healthy bone (left) and bone weakened by osteoporosis.

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Are you shrinking?

You probably reached your full adult height by about age 18 — and assumed you'd always remain that tall. Instead, as you enter middle age and beyond, you may find yourself getting shorter. How can that happen?

From day to day, no matter what your age, the disks that cushion and separate the vertebrae in your spine are being compressed during your waking hours. At night, while you rest, the disks have a chance to rehydrate and expand. You may actually be slightly taller in the morning than you are in the evening.

Over time, however, the disks within your vertebrae naturally shrink, causing everyone to lose a little height. This loss may range from about 1 to 3 inches. Osteoporosis can cause the vertebrae in your spine to compress or even collapse, leading to a greater loss of height than normal. Another cause of stooped posture is the weakening of your upper back muscles.

If you feel that you're shrinking, talk to your doctor. He or she may suggest you be screened for osteoporosis.

One of the possible long-term effects of osteoporosis is a series of compression fractures that can produce a stooped posture and the appearance of a hump on the upper back.

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The estrogen factor

After menopause, bone loss speeds up dramatically in women. This acceleration is primarily due to decreasing levels of the hormone estrogen. Women may lose around 10% or more of their bone mass in the five to seven years after going through menopause.

Men produce small amounts of estrogen, in addition to testosterone. Although men don't experience comparable bone loss at midlife, estrogen levels do affect men's bone density as well.

Around age 70 or 75, the accelerated pace at which women lose bone begins to slow, but it doesn't stop entirely. Bone loss continues with age, but at a slower rate. Ultimately, women may lose 35% to 50% of their peak bone mass. Men, in comparison, may lose 20% to 30%.

It's not surprising, then, that women are more likely to develop osteoporosis than are men, and are more likely to experience a bone fracture. Peak bone mass in women is generally lower to begin with, and women experience accelerated loss of bone after menopause. Men generally have larger skeletons and more bone mass, so bone loss due to aging is less detrimental.

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Going through menopause

Menopause, which normally starts around age 50, occurs when the ovaries begin making less estrogen. Menstrual periods become irregular and then stop altogether. This transition may take less than a year or more than two years to complete. Declining levels of estrogen and other reproductive hormones are responsible for many of the physical and emotional changes that women may experience during this time.

Estrogen plays a variety of roles in women's bodies. It's involved in reproduction and also has a protective effect on bone, promoting greater density and helping regulate bone remodeling. When the ovaries produce less estrogen, either due to natural aging (menopause) or surgical removal, bones lose the hormone's protective effect, and the rate of bone loss increases. Unless medical treatment is started, this bone loss is irreversible, putting postmenopausal women at higher risk of osteoporosis.

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MAXIMIZING PEAK BONE DENSITY, MINIMIZING BONE LOSS

Much about the bone remodeling cycle is determined by your genes, and a certain amount of bone loss can be expected as you age. The amount of calcium and other minerals deposited in your bone bank during peak bone formation is critical. A high peak bone mass can cushion the impact of bone loss in your later years and may reduce your risk of fracture.

There are many things you can do to influence the bone cycle:

- Eat a balanced diet that contains adequate calories, minerals and vitamins, especially calcium and vitamin D.
- Get regular weight-bearing exercise because physical activity contributes to higher bone mass.
- Limit alcohol and don't smoke. Alcohol may interfere with calcium absorption, and tobacco is known to contribute to weak bones.
- For teenagers going through puberty, avoid excessive dieting and other behaviors that can interfere with normal development.

Remember that it's never too late to begin making bone-saving lifestyle changes. Even if you're past the age of peak bone mass, what you eat and drink and how much you exercise can still help keep your bones strong and healthy. For more information on diet and exercise, see Chapters 8 and 9.

Chapter 3

Fractures and falls

A broken bone (fracture) occurs when a bone can't withstand the physical force that's exerted on it. A fracture is often the result of a fall, a sharp blow or another type of traumatic impact. Many people sustain one or more fractures during their lifetimes.

When you were a child, a broken bone may have been painful, but the incident — such as falling out of a tree and breaking your arm — likely made for a good story later on. For older adults, however, breaking a bone can be a serious event, resulting in complications that may severely reduce their independence or even prove fatal.

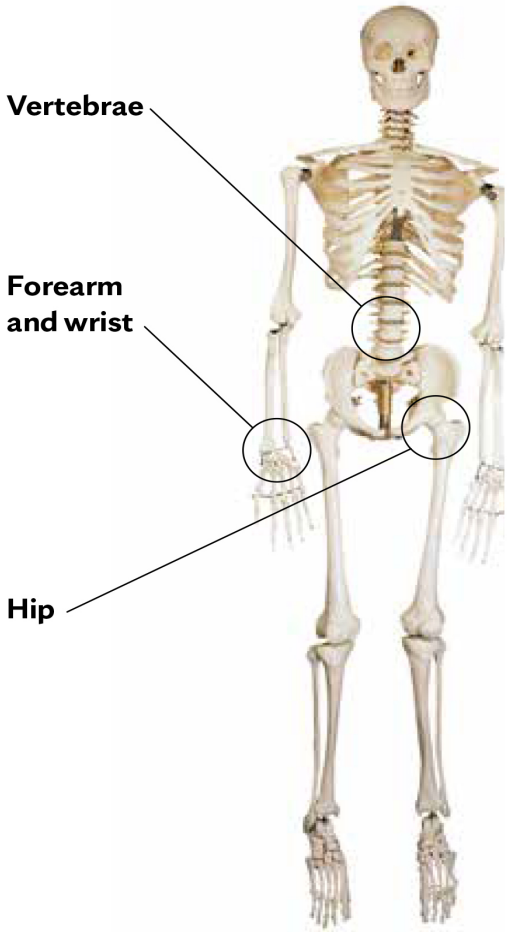
Worldwide, nearly one in three women and one in five men over age 50 will experience a fracture. So preventing fractures and falls in older adults is a major focus in health care.

A bone fracture is the clearest — and often the only — indication of osteoporosis. Each year, osteoporosis leads to nearly 9 million fractures worldwide, with more than 2 million fractures in the United States alone. Among Americans on Medicare, around 23% of these are spinal fractures, while approximately 17% are hip fractures.

When your bone density is reduced, your bones are weakened and they're less able to withstand the pressures and strains of everyday activities. Many times, a bone fracture isn't the result of a traumatic event but rather an event that you would normally consider routine, such as lifting a bag of groceries or a basket of laundry.

FRACTURES

As discussed in Chapter 2, the balance in the bone remodeling cycle between bone breakdown (resorption) and bone formation changes with age. Breakdown starts to occur at a faster rate than does formation. As a result, bone density decreases and open spaces within the bone structure widen. This contributes to a loss of bone mass and much lighter, weaker bones.



Common fractures: Breaks due to osteoporosis are most likely to occur in the circled locations.

Fractures may occur in any bone in your body, but the most common fractures from osteoporosis are of the vertebrae and the hip — bones that directly support your weight. Wrist (forearm) fractures also are common. Fractures may also occur in the pelvis and the long bones, such as the thighbone and the humerus (upper arm bone).

And you don’t always have to experience a fall or an injury for a fracture to occur. As the bones of your spine (vertebrae) weaken, they may collapse during normal activities of bending or twisting. Hip and wrist fractures, however, usually result from a fall. With proper rehabilitation, most people do well following surgical treatment for hip fractures. In some situations, fractures may lead to disability or death. This is usually due to a coexisting condition or disease.

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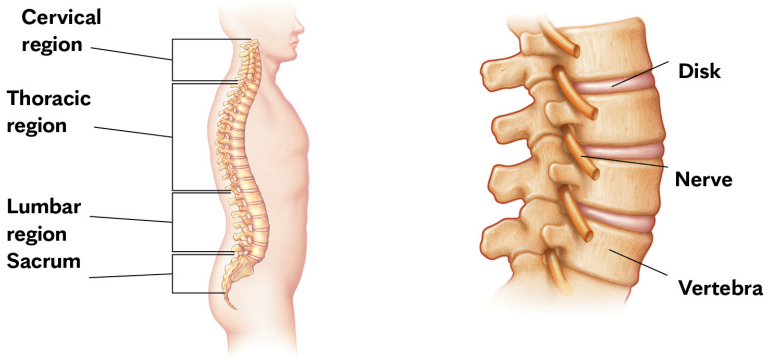
Your flexible spine

Your spine is made up of interlocking bones called vertebrae, which are stacked one on top of another in a column. Each vertebra consists of the barrel-shaped vertebral body and bony projections that form the vertebral arch, which protects the spinal cord. Separating the vertebrae are cartilage disks that act as shock absorbers, absorbing the bumps and jolts of everyday life. Your vertebrae form four curves that enhance your body’s flexibility and balance.

From top to bottom, the spine’s vertebrae become larger and thicker. The seven cervical vertebrae at the top are small and delicate. They support your head. The 12 thoracic vertebrae support your arms and trunk, and the five lumbar vertebrae — the biggest and strongest — support the weight of most of your body and give you a stable center of gravity. Below the lumbar vertebrae, five smaller vertebrae are fused together to form the sacrum.



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Spinal fractures

Your vertebrae support your body, allow you to stand upright and protect the nerves of your spinal cord.

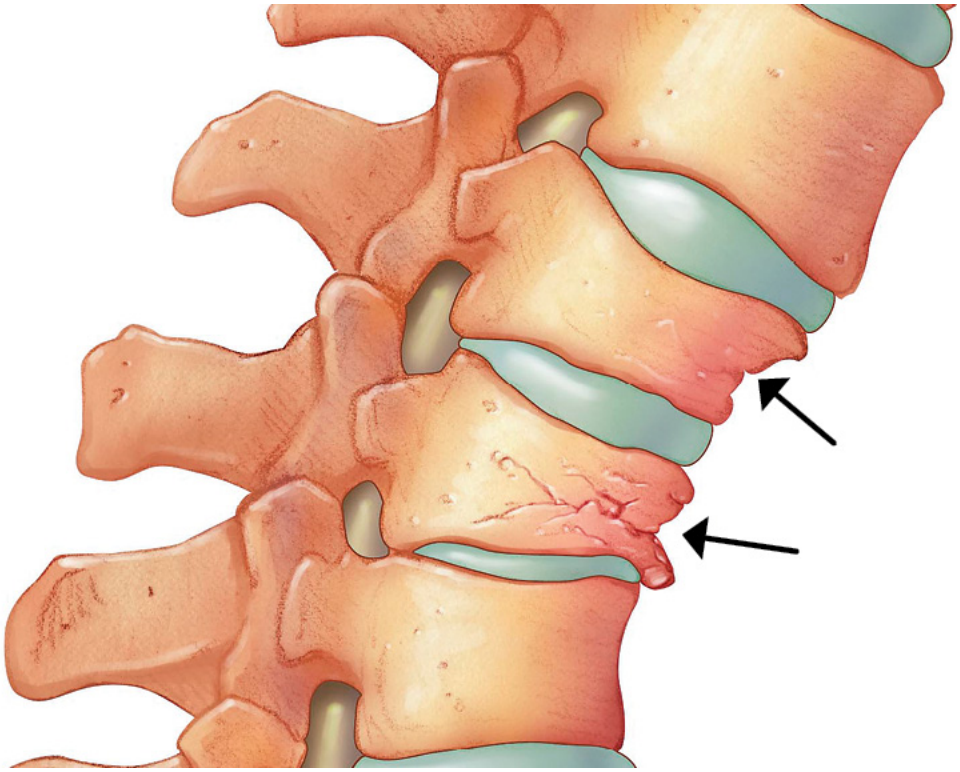
Compression fractures caused by osteoporosis occur when your vertebrae lose so much bone density that they collapse. The front part of the vertebral body literally caves in. These types of fractures usually happen in the middle (thoracic) and lower (lumbar) parts of the spine — most commonly, where these two areas meet. The lower thoracic and upper lumbar vertebrae are the most common sites for compression fractures because that is where the spine does most of its forward bending (flexion). This flexion puts force on the vertebrae. If they are weak due to osteoporosis, they can collapse.

Most compression fractures occur as a result of a routine activity, such as bending over, coughing, sneezing or lifting an object. Unlike hip fractures, most vertebral fractures aren't related to a fall. If the bone density within your vertebrae is very low, just one instance of an activity such as coughing or sneezing is enough to cause a fracture.

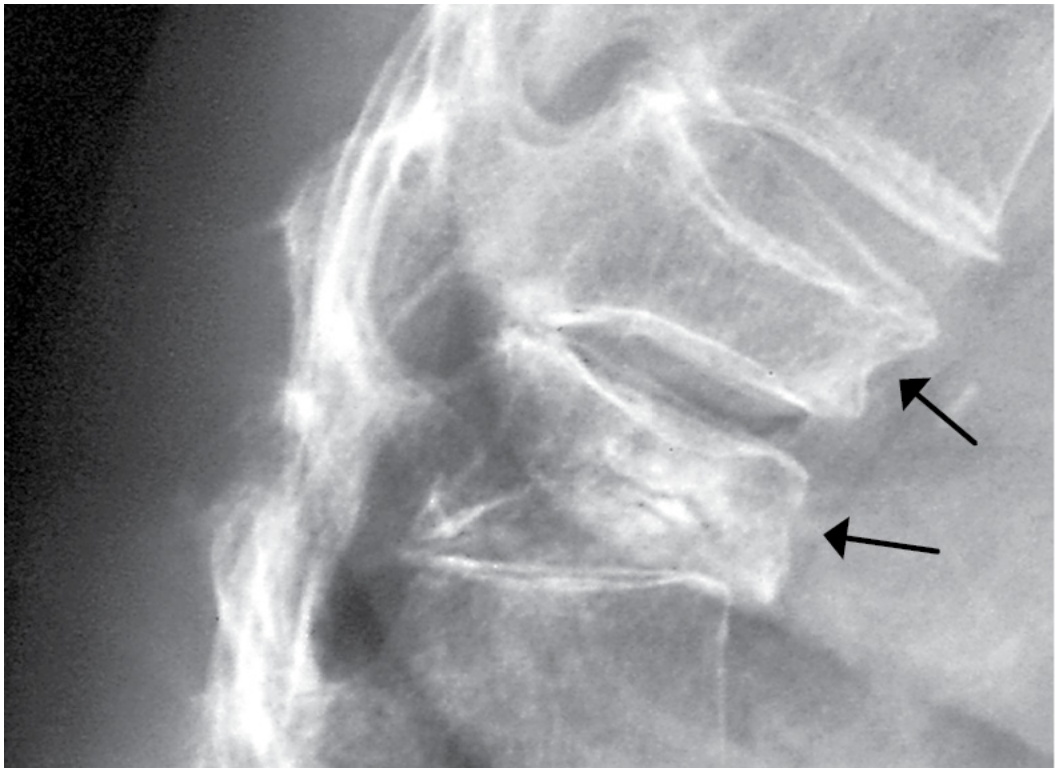
A compression fracture often goes undetected. Only about one-third of people with a spinal fracture seek medical attention for the fracture. However, sometimes a vertebral fracture can be very painful and can limit an individual's ability to walk and care for themselves. The pain may start out as a constant nagging or come on suddenly.

Signs of multiple compression fractures include loss of height and a forward curvature of the spine, an appearance of slouching or slumping over. In a condition known as kyphosis, the curvature of the spine is so exaggerated that someone may not be able to straighten the back to avoid looking hunched over.

Usually the pain from a vertebral fracture gradually improves over 6 to 8 weeks, so invasive treatment for the fracture itself may not be necessary. Occasionally pain persists and a doctor might suggest surgery or other interventions. (See Chapter 14.) However, it's important that the underlying osteoporosis be treated to prevent future fractures. After one vertebral fracture occurs, the risk of more vertebral fractures is very high.



Vertebral fractures: Osteoporosis may cause vertebrae to fracture and compress (see arrows) as a result of weakness in the bone structure.

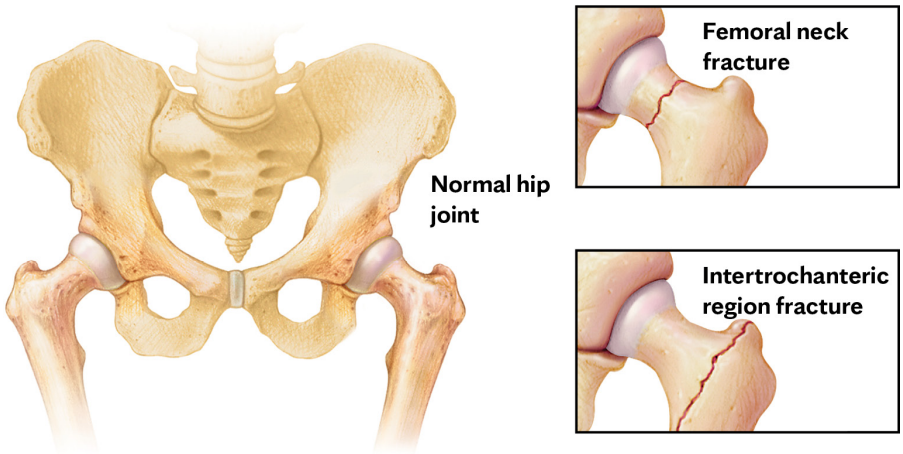


Collapsed vertebrae: In this X-ray image, collapsed (compressed) vertebrae appear wedge-shaped compared with the vertebrae above and below them.

Hip fractures

A hip fracture is the most serious outcome of osteoporosis. It's most often the result of a fall, especially when falling sideways or backward. Every year more than 300,000 Americans are hospitalized for a hip fracture. Doctors expect that number to grow as the U.S. population ages.

Because older women lose bone density at a faster rate than older men, they're two to three times as likely to experience a hip fracture. Men, however, have a higher death rate in the year following a hip fracture, mostly due to coexisting diseases and complications of fracturing. Statistically, around 1 in 5 individuals who experience a hip fracture dies within a year of the incident.



Types of hip fractures: Most hip fractures occur at the femoral neck or in the intertrochanteric region of the femur, near the hip joint — where the femur meets the pelvis.

The vast majority of all hip fractures occur at one of two locations along the femur, the long bone that extends from your pelvis to your knee (see diagram below):

- **The femoral neck.** This is a thin section of the upper femur located just below its rounded end that fits into the ball-and-socket joint of your hip.
- **The intertrochanteric region.** This is the part of your upper femur immediately below the femoral neck. It lies between two parts of the bone called the greater and lesser trochanters.

Your doctor can determine that you have a hip fracture based on your symptoms and an X-ray of the hip. An X-ray can confirm that a bone is broken and reveal exactly which part of the hip is fractured. The type of treatment that's recommended will depend on the type and location of the hip fracture. Most often, you'll need surgery to treat a hip fracture.

Although a hip fracture is usually treatable, complications from the fracture, such as a blood clot or pneumonia, can be life-threatening, particularly for older adults with other serious medical conditions such as heart disease or diabetes.

If you experience a hip fracture and are immobile for a long period, you risk developing blood clots. It's possible for a clot to become lodged in a blood vessel in the lung, blocking blood flow to the lung tissue and causing an obstruction (embolism). This can be fatal if not treated promptly. Other risks of immobility due to hip fracture include bedsores and urinary tract infection. Doctors typically encourage some activity as soon as possible.

Many older adults — including those over age 80 — do recover from a hip fracture, although the recuperation period can take up to a year, and recovery isn't always complete.

During recovery many people need assistance getting around their homes and doing daily tasks, such as bathing, dressing and cooking. A considerable number of people who break a hip enter a long-term care facility while recuperating because they need assistance that's not available at home. Generally, the better your health and mobility are before the fracture, the better your chances are for making a complete recovery and regaining the same level of independence.

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The mechanics of a fracture

Some osteoporosis research has used engineering principles to calculate the risk of fracture. The amount of force applied to the hip or the spine by certain activities or actions is compared with the maximum amount of pressure these bones can bear — similar to calculating the tonnage a bridge can bear. Researchers were able to identify several activities and actions that involve a high risk of fracture.

One of the most significant risk factors for a hip fracture is falling sideways — either while walking or standing. The impact often exceeds the capacity of an average older adult's hip to sustain the fall, resulting in a fracture. Other factors also influence the risk of fracture. For example, absorbing some of the energy of the fall with your leg muscles or using an outstretched hand to break the fall can reduce the impact on your hip. Skin and fat around the area of impact or padded clothing also can reduce damage caused by the fall.

The risk of a compression fracture in the spine also has been measured. By bending over at a 30-degree angle and lifting a weight of approximately 17 pounds — the equivalent of lifting a small child or a bag of groceries — you more than double your risk of a compression fracture if your bone density is low. See Chapter 13 for guidance on safer positioning while lifting objects.

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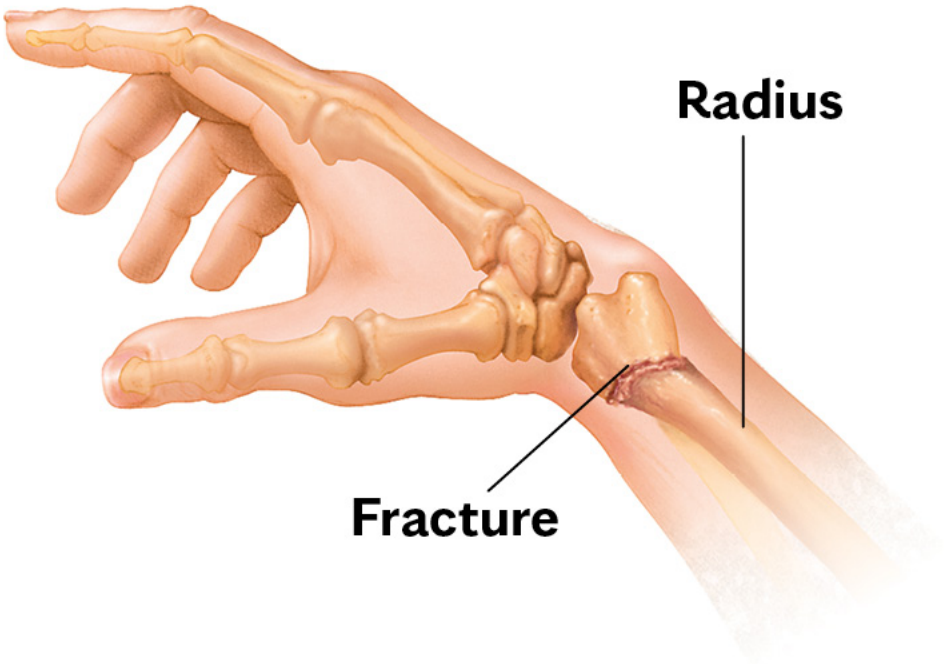
Wrist (forearm) fractures

When you feel yourself falling, your natural instinct is to extend your arms to help break the impact of the fall. If the force is great enough and the wrist bones are weak, the result is often a fracture.

The two main bones of your forearm are the radius and the ulna. The most common location for a wrist fracture among people with osteoporosis is at the end of the radius, just below the wrist. This type of break is called a Colles' fracture. Sometimes both the radius and the ulna are broken by a fall.



Colles' fracture: This type of wrist fracture occurs at the end of the radius, just below the wrist. A wrist fracture may cause a sharp pain, especially when you try to rotate your hand in a circular motion.

Common signs and symptoms of a Colles' fracture include swelling, tenderness or pain in the wrist area. Picking up or holding anything of moderate weight may also be difficult. Sometimes the wrist is deformed, inclined at an angle toward the palm of your hand. An X-ray can help your doctor determine the exact location and extent of the injury.

Many people recover from a Colles' fracture without problems, but older adults are at a higher risk of complications and don't always regain full mobility of the wrist joint.

Possible complications may include chronic pain resulting from ligament or joint damage or from arthritis in the wrist. Carpal tunnel syndrome may be another long-term complication if the median nerve, which runs between the radius and the ulna, has been injured and becomes inflamed.

Kids and fractures

A broken bone is often a normal part of an active childhood. About 1 in 3 children experiences a bone fracture. But recent studies have found that

broken bones may have implications for a child's long-term bone health.

One Mayo Clinic study found that children who experienced forearm fractures as a result of mild trauma often had lower bone strength than children with fractures from moderate or severe trauma. According to the researchers, fractures resulting from mild trauma may suggest an underlying skeletal deficit that could increase the risk of osteoporosis later in life.

Researchers have also found that children who've experienced one fracture are more likely to have future fractures than children who have not broken a bone.

Interventions at a young age to optimize bone strength — including a healthy diet and plenty of weight-bearing exercise — may help reduce this risk.

AVOIDING FUTURE FRACTURES

Most doctors regard fractures caused by routine activities — those that normally wouldn't be traumatic enough to break a bone — or from a simple fall, as strong evidence of osteoporosis. This kind of fracture is known as a low-trauma fracture, low-energy fracture or fragility fracture.

Compression fractures of the spine, which can occur simply from bending too far forward, all too frequently go unnoticed until osteoporosis is well developed.

Having a low-trauma fracture increases your risk of future fractures. That is to say, once you've experienced one fracture, your chances of another fracture are even greater. Research indicates that a prior fracture approximately doubles the risk of another. In some studies, the increase was even greater. The risk is highest in the first few years after the initial fracture.

Guidelines published by multiple medical professional groups all agree that the two most important risk factors for osteoporosis-related fractures are low bone density and a previous low-trauma fracture.

If you fracture a bone, is there something you can do to reduce your chances of a future fracture? The answer is yes. First, see a doctor and consider having a bone density test if you haven't already done so.

According to the World Health Organization, any woman experiencing a wrist fracture after menopause has sufficient cause to evaluate her bone density for osteoporosis. The National Osteoporosis Foundation recommends bone density testing for all postmenopausal women following a fracture. Some doctors may perform a less expensive screening test first and then schedule a more complete bone density test if additional testing is warranted.

Other testing may also be done. Your doctor may recommend blood tests, including calcium and phosphate levels, thyroid function, and liver function. Urine tests also may be performed.

If your bone density is low, you want to find out the cause — whether it's osteoporosis or some other condition that's leaching minerals from your bones. Once the cause is known, measures can be taken to increase bone density and help strengthen your bones and muscles. With proper treatment, your risk of a second fracture may eventually return to normal.

Regardless of the results, don't forget that measuring your bone density is important because it provides a benchmark for assessing changes in your bone health over time.

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Vitamin D, fractures and falls

Vitamin D has been promoted as having many possible health benefits, including lowering the risk of a fall or broken bone. While experts agree that Vitamin D is essential for helping the body absorb calcium, many studies have examined whether taking vitamin D supplements can actually prevent falls and fractures from falls. Results of this research have been mixed. Thus, current recommendations do not include taking vitamin D supplements to lower the risk of falls.

Vitamin D may still be recommended for older individuals at risk of deficiency, to help with calcium absorption. A comprehensive approach to fall prevention would include assessing the risk of vitamin D deficiency.

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FALLS

Every second of every day, an older adult falls. Falling is one of the major reasons why older adults break bones. Slips and falls can happen to anyone for any reason — a loose carpet, a slick surface, an unexpected change in the pathway, or dizziness caused by a disorder or medication. As you age, a fall becomes more common and can result in more-serious injuries. Because of this, it's important for older adults to talk to their primary care providers about ways that they can reduce their risk of falling.

Various changes associated with aging — such as problems with balance, loss of muscle mass and strength, and poor vision — can contribute to slower reaction times. Older adults also lose some of their fatty cushioning around the hip, which helps to break falls.

About a third of people over age 65 fall at least once each year. But just because falls are common, that doesn't mean that they're a normal part of aging. Nor does it mean that falls are inevitable. Many falls and fractures

can be prevented if you make small changes to your lifestyle. Read on for ways to minimize your risk factors.

Problems with balance

As you age, your sense of balance tends to decline and your reaction time slows. Both of these changes increase the likelihood of falling.

Under normal circumstances, balance is controlled by the signals sent to your brain from three sensory systems in your body:

- Inner ear. The slightest movement of your head activates sensors in your inner ear. These sensors send electrical signals to the brain, which is constantly monitoring the position of your head relative to the ground.
- Eyes. Visual signals help you determine where your body is within your surroundings.
- Sensory nerves. Nerves in your skin, muscles and joints send messages to your brain about the movement of your body.

Good balance depends on at least two of these systems working well. For instance, closing your eyes while washing your hair in the shower doesn't mean you'll lose your balance — signals from your inner ear and sensory nerves help keep you upright.

If your central nervous system is slow to process these signals, if the messages are contradictory or if your sensory systems aren't functioning properly, your balance may suffer. This may make it harder for you to avoid something in your path or adjust to a sudden change in the ground surface, leading to a fall. Some older adults have increased body sway while standing still, which also may increase their risk of falling.

How can I improve my sense of balance?

Talk to your doctor about your balance concerns. He or she may do a physical exam to assess your balance and may refer you to a physical therapist or a special class aimed at improving your balance. Balance exercises such as tai chi have been shown to reduce one's risk of falls.

See Chapter 9 for tips on staying active and strong so that you can react quickly and prevent falls.

Muscle weakness

As you get older, your muscles tend to lose some of their bulk and they begin to weaken. With time, your ligaments and tendons — the body's connective tissues — also lose their elasticity, which can cause your muscles and joints to stiffen. Lack of physical activity also can decrease muscle mass and strength.

When combined with changes in balance brought on by aging, muscle weakness can turn a stumble into a fall. When your brain receives a signal that you've lost your balance, it immediately triggers your muscles to try to compensate. But if your reaction is slowed and your muscles are weak, your body may not be able to maintain its upright position.

How can I improve my core and lower extremity strength?

Performing strength training exercises can reduce your risk of falling. Your health care provider may encourage you to participate in an evidence-based exercise or fall prevention program that focuses on your leg and core strength. Some exercises to get you started are featured in Chapter 9.

Vision problems

Much like the tissue of your ligaments and tendons, the tissue of the lenses of your eyes becomes less elastic with age. This reduced elasticity makes it more difficult to focus an image on your retina and to see close objects clearly. Vision problems or changes in your depth perception make it easier for you to trip or stumble off a step.

Many age-related vision problems can be corrected with the right glasses, and older adults may find it necessary to wear bifocals or trifocals to improve vision. However, shifting your eyes between different focal powers in a lens can momentarily disorient you, affecting your balance.

This can sometimes lead to a fall. Focusing straight ahead and lowering your head can help avoid this.

Eye conditions such as cataracts, glaucoma and macular degeneration also can affect your perception or make it difficult to see obstacles.

How can I improve my vision to reduce my risk of falling?

Your doctor and your eye care provider can help you make sure that you're seeing as well as possible. This may include discussing whether cataract surgery is needed or whether changing to multifocal lenses might help improve your depth perception. They can also check for signs of other eye conditions.

Postural Hypotension

As people age, they may have more difficulty maintaining a stable blood pressure when they move from lying down to sitting up or from a sitting to standing position. They sometimes experience a drop in blood pressure that can be especially pronounced if they stand up quickly, become dehydrated or consume a large meal.

This form of low blood pressure is called postural (orthostatic) hypotension. It can occur with changes due to aging in the cardiovascular and sensory-motor systems. However, more research is needed to fully understand it. Common symptoms of postural hypotension include feeling lightheaded, passing out, or having blurry vision when you sit up or stand up.

What can I do to reduce symptoms of postural hypotension?

First, talk to your doctor if you are having symptoms of low blood pressure. He or she might want to adjust your medications or prescribe compression stockings to help reduce your symptoms. There are also several steps you can take to reduce symptoms from low blood pressure. These include getting out of bed slowly and sitting on the side of the bed for a couple of minutes before standing. Exercise your muscles gently

before standing. Stay hydrated. And avoid taking very hot showers or baths, as hot conditions can also affect your blood pressure.

Chronic medical conditions

Chronic medical conditions, which tend to become more common with age, may increase your chances of falling. Conditions that affect your nervous system, such as stroke, Parkinson's disease and multiple sclerosis, may affect your balance and coordination. Disorders affecting your feet and legs, such as arthritis and peripheral nerve damage, may disrupt your ability to walk.

Other chronic conditions that make it difficult to get around — such as emphysema, congestive heart failure or severe obesity — can lead to physical inactivity and loss of muscle strength and balance. People with decreased mental alertness, such as that caused by dementia or depression, are at increased risk of falling. In addition, flu, low blood pressure or dehydration can cause dizziness.

How can I minimize the risk?

Work with your doctor to effectively treat any chronic conditions and reduce your risk of falling.

Reaction to medications

Many drugs can affect your balance and increase your risk of falling. These include certain blood pressure medications, sedatives, tranquilizers, antidepressants, cold and allergy medications (sedating antihistamines), pain relievers, and sleep medications. Other side effects from medications may include muscle weakness, low blood pressure, shakiness and blurred vision, any of which can lead to a fall.

How can I reduce my risk of medications causing a fall?

Review all your medications (both prescribed and over-the-counter) during visits with your doctor. He or she may help you optimize your medications by reducing a dose or discontinuing a high-risk medication.

Footwear and foot conditions

If you have pain or numbness (neuropathy) in your feet, or if your shoes are ill fitting, this may be increasing your risk of falls. Sometimes, finding shoes with a better fit or a different type of shoe traction can help to reduce your risk of slipping or tripping.

Minimize your risk:

It's a good idea to wear solid shoes with traction whenever you're walking on slippery surfaces such as tile or hardwood floors.

Environmental hazards

Factors that aren't related to your physical health also can cause a tumble. Although you may think that your home is a safe place to be, many falls and resulting fractures occur at home.

Some potential hazards within the house include loose rugs, cluttered floors, poor lighting, exposed electrical or telephone cords, and stairs with no handrails. Walking around the house in slippery socks or standing on something other than a sturdy step stool when reaching for an object also can spell trouble. Any of these hazards could cause you to fall, often onto furniture, increasing your chance of a fracture.

Reduce your risk:

Many home hazards can be avoided. For information and tips on making your home safer, see Chapter 15.

PREVENTING FALLS

Falls can happen to anyone. However, as discussed in this chapter, there are several ways that you can reduce your risk of a fall and fracture. Make sure to talk with your doctor if you have fallen or feel unsteady. He or she can help assess your personal risk of falls and work with you to create a plan to reduce your fall risk.

Use the checklist below to take a quick scan of strategies you can start using today.

- Have your vision and hearing checked regularly.
- Exercise regularly to maintain and improve your strength and balance.
- Talk with your doctor about any dizziness or other symptoms of low blood pressure.
- Work to keep chronic medical conditions under control.
- Frequently review and discuss any medications with your doctor.
- Have your doctor check your feet and ensure that your footwear fits well and provides helpful traction.
- Remove tripping hazards around your home (see Chapter 15), and wear footwear with traction any time you're walking on slippery floors.

Chapter 4

Can you reduce your risk of osteoporosis?

No one can say for sure whether you'll develop osteoporosis. The disease is too complex for that. But doctors do know what makes some people more likely than others to get it. So it's important to be aware of the risk factors for osteoporosis and understand what you can do to reduce some of them.

If you already have osteoporosis, bone loss has already weakened your skeleton. But if you never experience a fracture, you'll avoid the most serious consequence of the disease. Pain is normally not associated with osteoporosis unless you have a fracture. Even individuals with very low bone density can continue to lead active, independent lives and participate in activities they enjoy, as long as they don't break any bones.

Generally speaking, your risk of osteoporosis and a bone fracture depends on your bone health — the size and strength of your bones and the condition of your bone tissue. Bone health is a result of how well your skeleton developed during childhood and early adulthood and how much bone was present at the time you reached peak bone mass, which usually

occurs by your late 20s to early 30s. Bone health is also affected by how rapidly you lose bone mass as you get older.

Many unique factors about you put an individual stamp on your bone health. Those factors include your family history and the genes you inherited, as well as hormones, your diet, the amount of exercise you get, lifestyle behaviors and your overall state of health.

Factors that reduce your peak bone mass or accelerate bone loss increase your susceptibility to osteoporosis. They're called risk factors. However, by taking precautions, having realistic expectations of what you can or can't do, and doing all that you can to build or maintain bone mass, you can lower your risk of osteoporosis or a fracture.

UNDERSTANDING YOUR RISK

If you were to characterize the person most likely to get osteoporosis, you might describe a tall, thin, white woman past menopause who smokes, has several alcoholic drinks a day, eats poorly, doesn't exercise and takes medications such as corticosteroids. In addition, her mother would have experienced a stooped posture from multiple compression fractures of the spine or a broken hip.

But keep in mind, even if you share some of these characteristics, you're not necessarily destined to get osteoporosis. And if you do develop the disease, you're not necessarily going to break a bone. Conversely, some people with no known risk factors can develop osteoporosis and break a hip.

If some of the following risk factors apply to you, discuss them with your doctor. The two of you can develop a prevention strategy that's both practical and achievable. Women at increased risk of the disease should take action before they reach menopause. However, even if you're past menopause, you can still take positive steps to slow bone loss.

RISK FACTORS YOU CAN'T CHANGE

Some risk factors for osteoporosis you can't control. You were born with them, you inherited them from your parents, or they're simply an inherent part of living. But you can take steps to slow the disease's development, and you can monitor your bone health for early signs of abnormal bone loss. These are common risk factors for the disease.

Sex

Eighty percent of all Americans with osteoporosis are women. Peak bone mass in women is usually lower than in men because women's skeletons often are smaller. Women also tend to live longer. So, in effect, women have less bone to lose and more time in which to lose it. In addition, when menopause occurs, women experience a drop in their estrogen levels, which accelerates bone loss.

Young adult men generally have 25% more bone mass in their vertebrae than do females of a similar age. And not surprisingly, bone mass of the male hip tends to be greater than that of the female hip.

Women are about two to three times as likely as men are to break a bone due to osteoporosis, and fracturing generally starts at a younger age. With increasing age, however, the risk for men and women begins to even out. And notably, the mortality rate following a fracture tends to be higher among men.

For people who are transgender, the age at transition and use of hormone treatment may affect their risk of osteoporosis.

Age

The older you are — male or female — the more likely you are to develop osteoporosis and the more likely you are to break a bone because of it. In some populations, more than 50% of women over 80 may have the disease. For more information on how aging affects bones, see Chapter 1.

Heredity

Family history is a strong predictor of low bone mass, but it's not a very good predictor of your chances of experiencing a fracture because of osteoporosis. Studies show that genetic factors account for many differences in bone size, bone mass and bone density.

If your mother, sister, grandmother or aunt has osteoporosis, you're more likely to get it. Research also shows that if you're a woman whose mother broke her hip, you're twice as likely to break a hip, compared with the general population of women.

Several genes affect your risk of osteoporosis. These genes play a role in the density of your bones at peak bone mass, as well as how rapidly you lose bone mass later in life. You also have genes that determine at what age you go through menopause and genes that regulate hormones and growth factors, all of which influence bone formation and breakdown. Other genes affect how your body uses calcium and vitamin D or how it makes the protein collagen, an essential ingredient of bone.

But your genes don't necessarily determine your bone density. Just because your mother developed osteoporosis doesn't automatically mean that the same thing will happen to you. By taking specific steps to lower your risk, you may avoid a similar fate.

Race and ethnicity

You're at greatest risk of developing osteoporosis if you're white or of Asian descent. Black people have the lowest risk of osteoporosis. Hispanics and American Indians appear to have an intermediate risk.

The various levels of risk are based in part on differences in bone mass and bone density across groups. And some women of Asian descent, for example, tend to get less calcium from their diets. Fracture rates aren't always in line with these risk levels, however. White women past menopause experience the majority of hip fractures, while fractures are also more common among American Indian women.

Body size

Your build also affects your risk. Petite women with thin-boned frames are at greater risk of osteoporosis than are larger women with thick-boned frames. This is because women who are petite and thin boned often have less bone mass to begin with, causing them to reach a fracture-prone stage at an earlier age.

Hormones

The greater your exposure to the hormone estrogen over your lifetime, the lower your risk of osteoporosis.

This means women who begin menstruating later — after age 16 — don't have the bone-building effects of estrogen for as many years as women who start menstruating at an earlier age. Likewise, women who reach menopause early — either naturally in their late 40s or due to surgery before age 45 — lose the bone-building benefits of estrogen earlier than do women who experience menopause at a later age. In addition, having the ovaries removed at an early age greatly increases a person's risk of osteoporosis.

In men, a delayed onset of puberty — after age 16 — can shorten their lifetime exposure to the bone-building hormone testosterone and lower their peak bone mass. And after reaching their peak bone mass, a low testosterone level during the adult years can accelerate bone loss. Low estrogen levels in men (yes, men produce estrogen, too) also have been shown to be an important factor in bone loss among older men.

Men and women may also experience a reduction in testosterone and estrogen levels during certain cancer treatments.

Previous fractures

If you have already experienced a broken bone, keep in mind that having a prior fracture significantly increases the statistical risk of another fracture. Talk with your doctor about your history, what it might mean for your future risk of broken bones and whether a bone density test might be beneficial.

RISK FACTORS YOU CAN INFLUENCE

Your individual circumstances or lifestyle choices may modify your osteoporosis risk. In addition, many forms of secondary osteoporosis are treatable, or they may occur only for a certain period of time. Often, there are steps you can take to reduce your risk of the disease.

Childbearing

During pregnancy and breastfeeding, women may experience a reduction in bone density because they're sharing their calcium supply with baby. The intestinal tract and kidneys compensate for the extra demand by absorbing and conserving more calcium. Still, if you're pregnant, make sure you're getting sufficient calcium. Generally, the bone mass lost is recovered over time when you stop breastfeeding and your periods return.

Medications

Certain medications are known to accelerate bone loss and increase the risk of osteoporosis. These medicines may cause a form of secondary osteoporosis, or they may aggravate osteoporosis caused by aging or menopause. If you take these medications, talk to your doctor about what you can do to counteract their effects on your bones.

Corticosteroid medicines

Long-term use of corticosteroids such as prednisone, cortisone, prednisolone and dexamethasone is especially damaging to bone. These medications, also called glucocorticoids, are commonly used to treat asthma, rheumatoid arthritis and other inflammatory conditions. They lower bone mass by slowing bone formation and by decreasing your blood levels of estrogen and testosterone.

Any dosage of an oral or intravenous corticosteroid increases your risk of fracture. However, these drugs are prescribed because of their benefits. If your doctor has you taking one of these medications, he or she has good reasons for doing so. Don’t stop taking it, and don’t change your dose without first talking to your doctor. If you take the medicine for more than a few weeks, it’s likely that your doctor will monitor your bone density and recommend drugs that prevent bone loss.

Inhaled corticosteroids may cause a small amount of bone loss in the lumbar spine. Corticosteroids taken in nasal spray form haven’t been shown to result in bone loss. Certain osteoporosis medications can help reduce the effects of glucocorticoids on your bones. See Chapter 10 for more about these medications.

Anticonvulsants

Medications taken to control seizures include the drugs phenobarbital, phenytoin (Dilantin), carbamazepine (Carbatrol, Tegretol) and valproic acid. If this type of medication is used over a long period of time, your liver starts to metabolize vitamin D in a way that causes a deficiency of the vitamin. If you take one of these medications, your doctor may recommend vitamin D and calcium supplements.

Thyroid medicines

If used in excessive quantities, thyroid medications such as levothyroxine (Levoxyl, Synthroid, others) can cause hyperthyroidism, leading to accelerated bone loss. Because your requirements for thyroid hormone can change over time, a blood test for thyroid-stimulating hormone (TSH) should be done annually. The test determines if you're taking the right amount of medicine. The dose can be adjusted if necessary.

Diuretics

Diuretics are drugs that prevent fluid buildup in your body. In so doing, certain diuretics may cause your kidneys to excrete too much calcium. If you're not getting enough calcium and other bone-building minerals in your diet, you may experience bone loss.

Diuretics that may cause this problem include bumetanide (Bumex), furosemide (Lasix), ethacrynic acid (Edecrin) and torsemide. Other diuretics, called thiazides, may actually help your body retain calcium. Always talk to your doctor about any risks associated with your medications. You may be able to switch to a diuretic that doesn't cause calcium loss.

Blood thinners

Blood thinners are prescribed to prevent blood clots from developing in your veins and arteries. Low molecular weight heparin, which is widely used to prevent blood clots, isn't associated with bone loss. However, traditional heparin may cause bone loss if used over long periods of time. Also, some studies show long-term use of warfarin (Jantoven, and formerly available as Coumadin) may cause some bone loss, but the research has not been conclusive.

Newer blood thinners, such as the drugs dabigatran (Pradaxa), rivaroxaban (Xarelto) and apixaban (Eliquis), haven't been shown to cause bone loss.

Gonadotropin-releasing hormone agonists

This is a class of drugs used to suppress blood levels of estrogen and testosterone. It includes the medications leuprolide acetate (Lupron Depot) and nafarelin (Synarel). These drugs are effective in treating conditions such as endometriosis, severe premenstrual syndrome (PMS) and prostate cancer. However, reduced levels of estrogen and testosterone can result in rapid bone loss. Levels usually return to normal after the dosage is stopped.

Aromatase inhibitors

Aromatase inhibitors are used to treat breast cancer. They include the medications exemestane (Aromasin), letrozole (Femara) and anastrozole (Arimidex). Aromatase inhibitors speed up loss of bone mass, increasing your risk of a fracture.

Proton pump inhibitors (PPIs)

PPIs are medications used for gastric reflux disease to reduce acid in the stomach. This group includes lansoprazole (Prevacid), omeprazole (Prilosec), esomeprazole (Nexium) and others. These drugs lower the absorption of calcium carbonate-based supplements that depend on good acid in the stomach to be absorbed. Some studies show that long term use of PPIs may reduce bone density and increase the risk of fracture.

If you're taking these medications, you may avoid bone loss by getting your calcium through food sources. And when needed, supplement with calcium brands containing calcium citrate instead of calcium carbonate.

Antidepressants

Tricyclic antidepressants and selective serotonin reuptake inhibitors (SSRIs) have been associated with an increased risk of bone fracture in some studies. However, if your treatment includes these drugs, do not stop taking them unless your doctor prescribes a change. Instead, try to prevent falls, get enough calcium and vitamin D, and avoid smoking and drinking excessive alcohol.

Certain diabetes medications

The medications pioglitazone (Actos) and rosiglitazone (Avandia) are used to treat diabetes. These can also increase the risk of bone loss and fracture.

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Evaluating your risk

One way to get a better sense of your bone health is to take advantage of a free online fracture risk assessment tool. While a number of these tools exist, including the QFracture tool and the Garvan fracture risk calculator, many experts consider the Fracture Risk Assessment Tool (FRAX) to be the gold standard.

FRAX is a simple questionnaire that can estimate your risk of experiencing bone fractures in the next 10 years. It was developed using data from several large patient studies performed in diverse populations and in different parts of the world.

FRAX is intended for men and postmenopausal women between the ages of 40 and 90. Although it was created for people who are not taking medication for osteoporosis, research suggests that it may also help doctors monitor overall fracture risk in women currently undergoing treatment for the condition. One way to access the tool is by going to www.sheffield.ac.uk/FRAX. There you can select the Calculation Tool tab and choose your country of origin.

FRAX will ask about your:

- Age, sex, and race or ethnicity
- Weight and height
- Prior broken bones
- Family history of hip fracture
- Tobacco and alcohol use
- Steroid medication use
- Medical conditions known to affect bone health
- Bone density test results (optional)

Based on your answers, a computer-based algorithm will calculate your chances of having any major fracture due to osteoporosis as well as specific chances of a hip fracture in the next 10 years.

If you use the FRAX calculator, it's best to discuss the results with your doctor. FRAX results can help you and your doctor decide if diagnostic testing may be warranted and whether you might benefit from beginning or continuing preventive therapy. Keep in mind that FRAX isn't a perfect predictor, and it can't determine whether you have osteoporosis.

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Medical conditions

Certain medical conditions can increase your risk of osteoporosis by slowing bone formation or speeding up bone resorption. Some of these conditions may cause a form of secondary osteoporosis.

Endocrine disorders

Your endocrine system produces hormones that help regulate many body activities and functions. Problems with endocrine glands associated with bone growth and maintenance can disrupt your bone remodeling cycle.

Hypogonadism. This condition occurs from a lack of estrogen and testosterone, leading to abnormal bone loss. Many factors can affect hormone production, including certain medications, various diseases of the ovaries or testes, natural aging, and eating disorders that disrupt menstruation.

Hyperparathyroidism. This is the result of overactive glands supplying too much parathyroid hormone (PTH) to your bloodstream. Too much PTH may result in release of too much calcium from your bones and increase your risk of fracture.

Cushing syndrome. Cushing syndrome occurs when the adrenal glands produce too much cortisol, a corticosteroid that slows bone formation and can increase bone resorption.

Diabetes. Type 1 diabetes, which must be treated with insulin, is associated with bone loss, especially if the condition is poorly controlled. People with type 2 diabetes, the more common form, may also be at higher risk of bone fracture.

Gastrointestinal disorders

Some gastrointestinal diseases can affect the bone remodeling cycle and lead to bone loss. They do so by interfering with the way your intestines absorb calcium from the food you eat and by lowering your vitamin D level.

Intestinal disorders. Disorders of the small intestine that interfere with absorption of calcium and vitamin D, such as Crohn's disease and celiac disease, can result in reduced bone mass. Sometimes these conditions are treated with a corticosteroid medication, which further inhibits calcium absorption and vitamin D levels.

Liver disorders. Certain disorders of the liver are rare but notorious for causing osteoporosis. Primary biliary cirrhosis occurs when tiny bile ducts in the liver become inflamed and scarred. This disorder occurs most often among women between the ages of 35 and 60.

Lactose intolerance. This condition causes gas, stomach cramps and diarrhea when you consume dairy products containing milk sugar (lactose). If you're lactose intolerant or you don't consume dairy products for other reasons, it's important to take calcium supplements or eat plenty of nondairy foods high in calcium.

Rheumatoid arthritis

Rheumatoid arthritis is an inflammatory condition that causes painful aching and swelling in your joints. The disease appears to be triggered by an abnormal response from your body's immune system. Therefore, it's referred to as an autoimmune disease. The principal area of attack of rheumatoid arthritis is the lining of your joints, leading to the gradual destruction of cartilage, bone, tendons and ligaments in the joint. The condition can keep people from being physically active, increasing their risk of bone loss. It may also be treated with corticosteroids and other medications that can damage bone.

Amenorrhea

Absent or irregular menstrual cycles (amenorrhea) in women of childbearing age may be a sign of low estrogen levels. Amenorrhea may result from eating or malabsorption disorders, excessive exercise, or disorders of the ovaries or pituitary gland. If you have a history of abnormal menstrual cycles, your risk of osteoporosis is increased.

Surgical procedures

Organ transplants can result in bone loss because the immunosuppressant medications you generally have to take

afterward may interfere with bone formation. This includes corticosteroid medications.

Gastric surgery to remove part of your stomach can cause bone loss because you're less able to absorb calcium and vitamin D from your food. Intestinal bypass surgery and certain bariatric surgeries for weight loss also can result in osteoporosis. The part of the intestine where many minerals and vitamins are easily absorbed is bypassed, so the body doesn't absorb iron, calcium and other nutrients as efficiently, increasing your risk of osteoporosis.

Prolonged bed rest

If you're on prolonged bed rest or you are immobilized because of stroke, fracture, surgery or paralysis, consult your doctor regarding what you can do to prevent abnormal bone loss.

RISK FACTORS YOU CAN CHANGE

You can control some of the factors that put you at risk of osteoporosis. That means you may be able to eliminate them or at least greatly reduce their effects on your skeleton. Osteoporosis is easier to prevent than it is to treat. That's why it's important to understand which risk factors you can limit or change.

Weight and dieting

Eating disorders and obesity can affect your bone health and your risk of osteoporosis. Your goal is not to weigh too much or too little, but to maintain a healthy weight.

Obesity. Obesity was once thought to protect against bone loss, but researchers are no longer certain that is the case. Recent studies suggest that some people who are obese have fat inside their bone marrow. The fat is thought to take up space where cells responsible for new bone formation reside. With less new bone being formed, existing bone may be weakened and more prone to fracture. Low-grade systemic inflammation, which is common in obesity, may also affect bone health. In addition, excessive weight is associated with falls. More research is needed to fully explore the relationship between excess weight and osteoporosis.

Eating disorders. In a weight-obsessed society, you may try to stay thin by keeping food off your plate. But if you starve your body, you also starve your bones. Serious eating disorders such as anorexia nervosa and bulimia can damage your skeleton by depriving your body of essential nutrients needed for bone building and maintenance.

While these illnesses are more common in women, they affect men, too. Men at a low weight or with a long history of an eating disorder may particularly be at risk of osteoporosis or low bone mass.

Anorexia nervosa is an eating disorder triggered by an overwhelming fear of weight gain. It most often affects young people — lowering levels of estrogen, testosterone and other important growth hormones during an important time of skeletal development. Studies show that both women and men

with anorexia nervosa have a higher risk of low bone density. A person with anorexia nervosa may begin losing bone at an earlier age and lose bone more rapidly than normal.

Excessive dieting may also affect bone health. Your peak bone mass, which you achieve in your young adult years, is influenced by your weight. Thin women tend to produce less bone-building estrogen. People who lose significant weight through dieting also may lose bone mass, and bariatric surgery for weight loss can reduce bone density as well.

The best approach for your bones — and your overall health — is to keep your weight within a normal range for your age and your height. If you do make dietary changes, do it in a healthy manner, taking steps to preserve bone density.

Physical activity

Use your bones or lose your bones. Regular activity and exercise are keys to preventing osteoporosis and fractures. Children who are the most physically active often have a high bone density and reach a higher peak bone mass than do children who don’t get enough exercise.

Lack of physical activity also accelerates bone loss when you’re older. Studies show that adults who sit all day at a desk job and don’t exercise are more apt to lose bone mass and suffer fractures than are adults who fit some form of physical activity into their day.

Weight-bearing exercises such as walking or resistance training can increase or at least maintain your bone density at

any age. For more information on appropriate activities and exercises for bone health, see Chapter 9.

Smoking

If you smoke, you already have plenty of good reasons to stop. But here's another — smoking is bad to the bone. It interferes with production of estrogen and testosterone. Smoking also disrupts calcium absorption and the bone-formation part of the remodeling cycle. That may be a reason that smokers are more likely to experience osteoporosis and to have bone fractures.

Menopause, which accelerates bone loss, happens on an average of two years earlier in women who smoke than in nonsmokers. And postmenopausal smokers lose bone at a faster rate than do postmenopausal nonsmokers. Smokers also tend to drink more alcohol and not exercise or eat as healthy as nonsmokers. These behaviors increase your risk of osteoporosis. The good news is, if you stop smoking right now, you can slow your bone loss, even if you're older.

Alcohol use

Consuming too much alcohol over a long period of time can increase your risk of osteoporosis and fractures. Alcohol causes a double whammy: It's toxic to bone-building osteoblasts, and it stimulates bone-removing osteoclasts, increasing bone loss.

People who drink heavily on a regular basis also have lower levels of the hormones estrogen and testosterone. More than an ounce of alcohol a day for women and 2 ounces a day for

men can lead to these effects. Vertebral fractures are uncommon in people younger than age 50, but they're more likely to be seen in individuals who drink heavily, eat poorly and don't exercise. These individuals are also more likely to fall and break a bone because alcohol impairs their balance. People who stop drinking alcohol are often able to restore normal bone-building function and, if they're relatively young, they may even recover some lost bone mass.

WHAT'S NEXT?

Osteoporosis is a treatable disease, and bone fractures associated with it aren't inevitable. Taking steps to maintain strong bones and a healthy skeleton is important because your first fracture greatly increases your risk of future fractures.

Now that you've had a chance to review the factors that can increase or decrease your risk of osteoporosis and bone fractures, you may wish to discuss them with your doctor. Together you can determine whether you're at high, moderate or low risk. Generally, being at high risk means you have two or more risk factors.

Then you and your doctor can plan your strategy for lowering and even eliminating some of your risk factors. The earlier in life you do this, the better. But remember that it's never too late to start. You may wish to ask your doctor about a bone density test. You can learn all about this important test in the next chapter.

Chapter 5

Screening, diagnosis and monitoring

How do you know if you have osteoporosis or are at risk? This is a common question, and one you may want answered sooner rather than later. The sooner you can start taking action on prevention strategies, the better your chance of keeping your skeleton healthy. And if you already have osteoporosis, the earlier you treat it, the better your chance of slowing or even reversing bone loss.

It used to be that breaking a bone was the only way to detect osteoporosis. Things are different now. A bone mineral density (BMD) test, also known as bone densitometry, can determine if you have osteoporosis before any bones are broken. It can also detect if your bone density is lower than normal for a person of your age and sex. Decreased bone density that's likely to progress to osteoporosis without treatment or other preventive measures is known as low bone mass. Low bone mass is also called osteopenia.

In addition to having you undergo a bone density test, your doctor can learn much about your bone health from a thorough health history and physical exam. Other tests also may be

done. These evaluations can help identify secondary causes of osteoporosis.

SCREENING VS. DIAGNOSING

To help determine your bone health, you may have screening tests, diagnostic tests or both.

Screening tests are done on someone who has no apparent signs or symptoms of a disease. If the test result is abnormal, it may reveal the presence of a previously unsuspected problem. This gives a chance to prevent progression of a disease and avoid problems that may occur if the disease were diagnosed later.

Diagnostic tests are performed on someone who's suspected of having a disorder, such as osteoporosis, because of certain risk factors or the presence of signs or symptoms. Diagnostic tests are generally more precise than are screening tests, depending on the technology.

The test recommended for screening or diagnosis of osteoporosis is a BMD test (bone densitometry). This is most often measured with dual-energy X-ray absorptiometry (DXA or DEXA). But other tests or tools may be used for screening to help determine who needs further testing with DXA or when DXA isn't available.

Your doctor may suggest a screening test for osteoporosis if you have certain risk factors for the disease, even if you don't have any apparent signs or symptoms. For example, BMD testing is recommended for all women at age 65. Or it may be recommended for some middle-aged women who are past

menopause and have low body weight but haven't experienced broken bones, loss of height or sudden-onset back pain.

Some screening tests can be done without a referral from your doctor, at a community health fair or other similar setting. If the results suggest that your bones are weaker than they should be for someone of your age and sex, contact your doctor for more in-depth testing.

You may have diagnostic testing for osteoporosis if, say, you're age 50 or older and you break a bone in a fall from a standing height or lower. The primary diagnostic test is a DXA bone density test, arranged by your doctor, along with a medical history and physical examination.

The results of diagnostic tests can help:

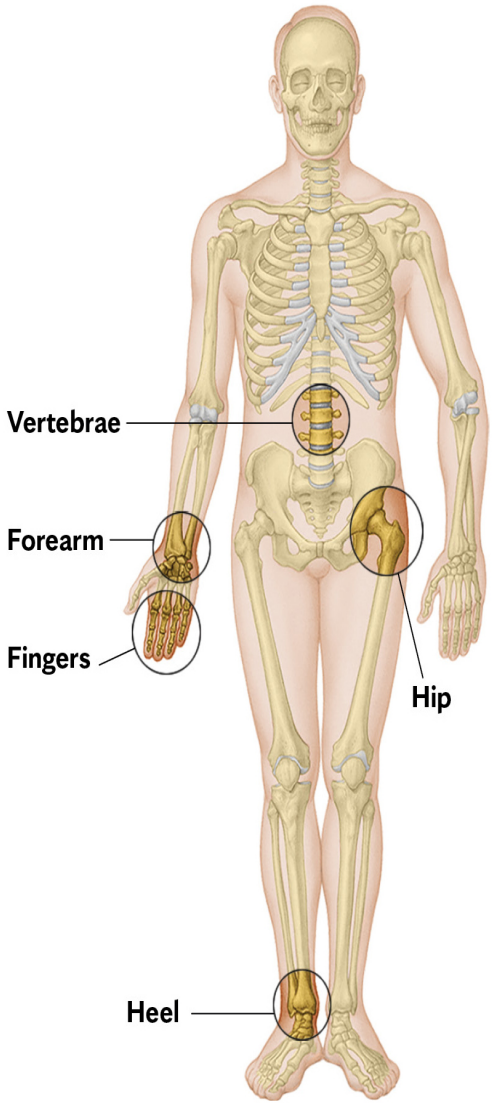
- Confirm that you have osteoporosis
- Determine its severity
- Establish a baseline bone density value

BONE DENSITY TESTING

A bone density test is one of the key factors predicting your risk of a break due to weak, brittle bones. From test results, your doctor can tell if you have osteoporosis and give you a good indication of how susceptible your bones are to fracture.

The test is simple, fast and painless. The most common tests use X-rays to measure how much bone mineral (bone mineral content) is packed into a square centimeter of bone. Generally, the higher your bone mineral content, the denser your bones. And the denser your bones, the less likely they are to fracture.

Bone density tests are usually done on bones that commonly break in people who have osteoporosis or on bones that are easily accessible with portable devices. These sites include the lumbar vertebrae located in your lower spine, the neck of your femur bone near where the bone meets the pelvis, often simply referred to as the hip, and the bones of your forearm. Because large numbers of people have had these areas measured, there are established “normal” reference ranges for evaluating results.



Locations for bone density testing: Bone density tests are usually done on bones in the spine (vertebrae), hip and forearm. A screening test may also look at the heel, forearm or fingers with a smaller, portable device.

Who should be tested?

Adults at risk of osteoporosis should have their bone density measured. Early testing makes it possible to begin preventive measures and give them time to work. Testing is also the first step toward diagnosis and treatment.

A bone density test is recommended for the following people:

- All women age 65 and older.
- Postmenopausal women under 65 who have risk factors for osteoporosis (see "Risk factors considered for screening").
- Men age 70 and older at risk of osteoporosis.
- Anyone over 50 who breaks a bone in a low-energy injury — such as a fall from standing height or lower (also called a fragility fracture).
- Anyone taking glucocorticoids for six months or more.
- Anyone with low estrogen or testosterone levels (hypogonadism). Some medications used to treat breast and prostate cancers reduce these hormones and may put you at risk.
- Anyone at high risk of bone loss and fracture.

There's some disagreement among groups of experts about who to screen, so your doctor may recommend a bone density test in other situations as well.

For example, if you're going through menopause, you may have a bone density test sooner than age 65 to help your doctor decide whether estrogen replacement therapy is right for you. An earlier test is especially helpful if you're at high risk of

osteoporosis or if you've broken a bone or experienced a loss in height.

Bone density testing usually isn't a one-time event. Bone density tests taken at intervals over several years can reveal the rate at which you're losing bone. The rate of bone loss is a strong predictor of your fracture risk. If you're taking medication to treat osteoporosis, a follow-up test can show how your bone density is responding to treatment.

How frequently you should be retested is often determined by the results of your first test. Your doctor will also consider what the rate of change is likely to be. Certain medications or changes in your health can cause more-rapid bone loss, so the next test may be recommended sooner than would typically be needed to check bone loss from aging. Your doctor will also weigh other factors that may increase your risk and warrant earlier testing. Ultimately, retesting is only useful if the result might change your care plan — if taking medication would be considered or appropriate in your situation.

Only a small fraction of adults who have osteoporosis or are at risk are properly screened, diagnosed and treated. Part of the reason is that not enough people get bone density tests. One study of over a million women showed that only 26% of the women ages 65 to 79 had ever had a bone density test. This was in spite of the fact that all guidelines agree that this group should be screened.

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Risk factors considered for screening

Even for women younger than 65, doctors may suggest bone density screening if any of these risk factors are present. Your health care team may consider other risk factors as well.

- Low body weight
- History of a low-energy (fragility) fracture
- Use of certain medications such as glucocorticoids
- Loss of height of more than 1.5 inches
- Disease or condition associated with bone loss (see Chapter 12)

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How do you get tested?

Perhaps the best way to arrange a bone density test is through your primary care provider. If your doctor doesn't suggest a bone density test during your routine physical exam, it may be up to you to call it to his or her attention. Don't be shy about inquiring about a test, particularly if you've broken a bone after age 50, have a family history of osteoporosis, are entering menopause, or are age 65 or older and simply want to be screened.

Most tests take place in hospitals, usually in the radiology department. Some hospitals have special osteoporosis programs, often as part of a women's health center. Some larger cities even have osteoporosis centers unaffiliated with a

hospital. If you don’t have a personal physician, a hospital in your community can direct you to a doctor or a department to consult or help you find a screening test at a local drugstore or health fair.

Endocrinologists — doctors who specialize in the body’s hormonal system — are specially trained to screen, diagnose and treat osteoporosis. However, other types of medical specialists, such as rheumatologists and geriatricians, may have osteoporosis training as well. Many primary care doctors can diagnose and treat straightforward osteoporosis.

Keep in mind that bone density screenings that involve portable devices set up in smaller clinics, in drugstores or at community health fairs are generally less accurate than the testing done in medical centers. If your screening test result is abnormal or shows low bone mass in a certain area, you’ll need to have a DXA bone density test to confirm a diagnosis.

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Retesting?

If you have a bone density test at age 65 and you're not diagnosed with osteoporosis, when should you retest? The following guidelines apply if you have no other health changes that warrant a test sooner.

Results of first test at hip (femoral neck)	When to retest
T-score > -1.5	15 years
T-score -1.5 to -1.9	5 years
T-score -2.0 to -2.4	1 year

Source: *New England Journal of Medicine. 2012;366:225*.

In some situations, your doctor may suggest follow-up testing every two years or more. This may be recommended if you're taking certain medications or if your risk factors change.

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Who pays for testing?

Depending on where you get tested and what type of device is used, some health insurance plans pay for the test and others don't. Contact your health plan administrator to find out if testing is covered under your plan and how much of the cost is paid.

Private insurance plans often follow Medicare guidelines regarding payment (see "Medicare coverage for bone density testing" above). Coverage may also depend on whether the

procedure is done as a screening or a diagnostic test. If you have signs or symptoms, the test is usually considered diagnostic. If you don't, it's often considered a screening test.

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Medicare coverage for bone density testing

Medicare is the U.S. federal health insurance program for individuals age 65 and older. The program pays for bone density tests in certain circumstances. Medicare Part B covers this test once every 24 months for people age 65 and older at risk of osteoporosis who meet the following criteria:

- Women whose doctors determine that they're estrogen deficient and at risk of osteoporosis based on medical history and other findings
- People whose X-rays show possible osteoporosis, osteopenia or vertebral fractures
- People taking prednisone or steroid-type medications, or who will soon begin such treatment
- People who have been diagnosed with primary hyperparathyroidism
- People who are being monitored to see if osteoporosis treatment is working

As with any medical test, check your Medicare plan to see if you may have to pay some or all of the cost. For more information and updates on coverage, visit the Medicare website: www.medicare.gov.

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HOW TESTING IS DONE

Bone density testing uses a device called a densitometer. Most densitometers measure how much of a low-energy X-ray beam can pass through the body. Denser tissue such as bone absorbs more of the X-ray beam, letting less of it through to a radiation detector. The device measures the difference between how much radiation passes through the bone versus the soft tissues next to the bone. The machine's software then uses these measures to calculate bone mineral density.

Why not use regular X-rays for a bone density test? Regular X-rays are higher energy and are optimal for a wide variety of imaging. But the energy of regular X-rays isn't sensitive enough to detect low bone density until a bone has lost about 30% of its mineral content. By then osteoporosis may already be in an advanced stage.

Radiation exposure from X-ray beams used in bone density testing is very low — only a small fraction of the radiation used for a standard chest X-ray. You don't need to wear a protective apron, and the person testing you doesn't need to leave the room.

All bone density tests are quick, painless and noninvasive. The tests usually take about 10 to 30 minutes, depending on the type of densitometer being used. This doesn't include the time needed for filling out forms and other preparation work.

A radiologist, endocrinologist or other bone specialist will assess your test results. You may want to set up an appointment with your doctor to discuss the results and determine the next steps.

CENTRAL DENSITOMETERS

Densitometers come in several sizes and levels of accuracy. Some types work better on specific bones than others.

Central densitometers are relatively large — large enough for you to lie down on — and they're usually found in medical centers or hospitals. As the name suggests, these instruments are used to measure the density of the central, stabilizing parts of your skeleton, such as the spine and hip.

Central densitometers provide the most accurate bone density tests and are good predictors of your potential risk of fracture. They are used for osteoporosis screening as well as diagnosis. There are two types of central densitometry: dual-energy X-ray absorptiometry and quantitative computerized tomography.

Dual-energy X-ray absorptiometry (DXA)

A DXA test is the most accurate central device, using the least radiation, to measure your bone density. That's why doctors typically rely on this test to screen for and diagnose osteoporosis. A DXA machine uses two different (dual-energy) X-ray beams, which increases the accuracy and precision of the measurement. A DXA test can detect as little as a 3% to 5% change in bone density between successive scans.

To begin the test, you lie down on a padded platform. Once you're in position, mechanical arms that contain an X-ray source (located under the table) and an X-ray detector (located above your body) are aligned. The amount of X-ray energy absorbed by the bone is measured to determine your bone

density. The healthier your bone is, the less X-ray energy that passes through it. With the latest equipment, a DXA test takes only a few minutes.

DXA is most often performed on the narrow neck of your femur bone, just below the hip joint, as well as on the lumbar vertebrae, which form the lower portion of your spine. These areas are preferred in part because the hip and spine are prone to fracture, causing more-serious complications and longer recovery than a break in another area might. A DXA test of these sites can predict the fracture risk of other bones as well.

Because of its accuracy, safety and lower cost compared with other central tests, DXA is the preferred test for a baseline bone density measurement for anyone starting medication to treat osteoporosis.

Dual-energy X-ray absorptiometry (DXA): For a DXA scan of the spine, you lie on your back with the arm of the device positioned over you. The arm measures your bone density by detecting energy from an X-ray source located under the table. The information is then transmitted to a computer.

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Additional tests on a dxa machine

When you have bone density testing on a DXA machine, your doctor may also use two other methods to get a more complete picture of your bone strength.

Trabecular bone score (TBS)

Using software installed on a DXA machine, TBS analyzes the structure (microarchitecture), rather than the density, of your bones on a DXA image. This analysis can take place during a bone density test and doesn't require additional scan time or radiation exposure. Your doctor could also use this analysis on an image from a previous DXA test.

TBS is performed on a section of your lower (lumbar) vertebrae. The technique allows your doctor to examine your bone texture and the structure of the porous, inner part of your bone (trabecular bone). Together with a bone density measurement, TBS can provide a fuller understanding of your overall bone quality and fracture risk. In fact, TBS analysis may alert your doctor to bone weakness that isn't apparent from a DXA test.

Doctors may recommend TBS analysis for postmenopausal women, particularly those who also have type 2 diabetes, or for men over age 50 with a risk of developing a fracture. This test may not be available in all medical centers.

Vertebral fracture assessment (VFA)

VFA is a screening technique for detecting spinal fractures. Because these fractures may be painless, they often go undetected.

VFA is usually done together with a DXA test for bone density. The DXA machine takes an image of your vertebrae, much like a conventional X-ray image, which your doctor examines for signs of moderate to severe fractures. While conventional X-rays also can show these fractures, VFA uses less radiation. It's also less expensive and faster than taking X-rays when it's simply added to a DXA scan. Sometimes, X-rays are needed to follow up after this test.

Your doctor may suggest VFA if you have osteoporosis or low bone mass and you fall into one or more of these categories:

- You're a woman age 70 or older or a man age 80 or older.
- You've lost more than 1.5 inches in height over your lifetime.
- You believe you may have had a previous spinal fracture.
- You've been taking glucocorticoids daily for at least three months.

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Quantitative computerized tomography (QCT)

This procedure measures the bone density in your spine or hip using computerized tomography (CT). Similar to having a CT scan, for this test you lie on a movable padded table that slides into a large ring where the measurements are made. X-ray images are obtained from all angles. The test usually takes less than 30 minutes.

A QCT test is more expensive than other densitometry tests and exposes you to more radiation. However, it can be useful in situations where DXA may be inaccurate. These may include when osteoarthritis, prior surgeries or changes in the spinal bones behind the vertebrae (facet joints) result in calcium deposits in the joints, or if you have surgical hardware such as screws in the spine. These materials absorb the X-rays in a DXA scan. That can make the test's bone density measurement read too high (falsely increased). In contrast, the QCT test passes radiation through the vertebrae from all angles and can "see" them without other materials getting in the way.

If you need a CT scan of the abdomen or pelvis for other reasons, those images may be used to look at the bone density in your lumbar spine or hip as well. QCT bone density results may be converted and reported as T-scores, comparable to DXA results. That way, you and your doctor can discuss your risk level and your care plan using an approach that's familiar and available.

PERIPHERAL DENSITOMETERS

Peripheral densitometers are smaller and less expensive than central densitometers. They're used to measure bone density on the periphery of your skeleton, such as in your wrist, finger and heel bones. You might find these devices at smaller clinics or as part of a community health fair offering bone density screening. Peripheral densitometers aren't as accurate as the central devices in predicting your risk of hip fracture, but

they’re accurate enough to screen anyone at risk of osteoporosis.

If the results of a peripheral test show that you have low bone density, you’ll want to follow up with a central densitometer test. It provides a more accurate result to help you and your doctor determine the best plan to prevent or treat osteoporosis. Even if the peripheral densitometry test results include T-scores and Z-scores, these are not equivalent to the scores resulting from a central densitometer test.

Quantitative ultrasound (QUS)

This procedure is often called a heel ultrasound, because most often it measures bone density in the heel. Instead of X-ray radiation, QUS sends high-frequency sound waves through your heel while you rest your bare foot on the instrument. And rather than measure X-ray absorption, this type of densitometer measures the reflection of sound waves. The denser your bone, the sooner sound waves are reflected back to the device.

This type of densitometer is portable, low cost and widely available. It measures your bone density in less than a minute. QUS is an easy way to be screened if you think you’re at risk of osteoporosis. However, it’s not accurate enough to positively diagnose osteoporosis or low bone mass, which may progress and require some type of intervention.

Heel ultrasound may be about as accurate as DXA at certain measures, such as predicting your risk of breaking a hip or another bone. But it can’t measure changes in your central

skeleton over time or show how your bones are responding to medication.

Peripheral DXA (pDXA)

This test uses a compact, portable DXA scanner. With the use of X-rays, pDXA measures bone density in your forearm, finger or heel. The test takes about three minutes and is accurate enough to screen for osteoporosis. However, results can't be compared with those from other DXA devices. Because pDXA is more expensive than a QUS test and the device is less portable, it isn't used as often as QUS.

WHICH TEST IS RIGHT FOR YOU?

The type of bone density test that's best for you depends on your age and on why you're being tested. Perhaps you're worried because you have risk factors that make you susceptible to osteoporosis. Maybe you have no risk factors but are simply a woman of the right age.

Here's some information about how your doctor may determine which test is right for you.

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Bone density test? Bone scan? Bone biopsy?

Bone density tests aren't the same as bone scans or bone biopsies. Bone scans often are used to diagnose cancer or occasionally a rare bone disease. A small amount of radioactive fluid is injected into your bloodstream and then collects in your bones. This allows a radiologist to see problem hot spots. As with a bone density test, your body's exposure to radiation is very small.

A bone biopsy is a procedure that uses a hollow needle to remove a small sample of bone tissue from your hip. This sample is tested to see if you have other bone diseases, such as osteomalacia, which is a softening of bone caused by a variety of conditions. A bone biopsy can also be useful in determining bone disease associated with kidney failure.

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You have no risk factors

If you don't have any risk factors for osteoporosis and you haven't broken a bone, a less expensive peripheral screening test, such as pDXA or QUS, may be sufficient. If the results indicate low bone density, you and your doctor will likely want to follow up with tests from a central densitometer, such as DXA.

You have multiple risk factors or a broken bone

If you suspect that you may have osteoporosis, talk with your doctor. He or she can arrange for a DXA test — even if the result of an earlier peripheral test was normal.

DXA gives a more accurate measure of your bone density, and it's the best test to follow over time.

You suspect secondary osteoporosis

A disease, surgical procedure or certain medications can result in secondary osteoporosis — bone loss that's triggered by another medical condition.

If, for example, you have hyperparathyroidism, you may be losing mostly cortical bone. In this case, a DXA of your forearm in addition to the spine and hip is important because your forearm is made mostly of cortical bone.

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Summary of bone densitometry types

Technique	Abbreviation	Common testing location
Central		
Dual-energy X-ray absorptiometry	DXA	Spine, hip, forearm and total body
Quantitative computerized tomography	QCT	Spine and hip
Peripheral		
Quantitative ultrasound	QUS	Heel
Peripheral dual-energy X-ray absorptiometry	pDXA	Forearm, finger or heel

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You have osteoporosis

If you have osteoporosis, your doctor may schedule periodic DXA tests of the primary fracture sites — your hip, spine, forearm or a combination of these. When repeat testing is performed, it's recommended that the same machine (densitometer) be used each time, as well as the same technician if possible. That's because while different brands and models of densitometers are all accurate, they use slightly different technologies, software and quality controls. This may lead to slightly different results, similar to the variation you might see when weighing yourself on two different scales. Testing with the same machine and tech each time will help you get the most precise results. It also helps ensure that a

change in your results reflects a true change in your bone density, rather than variation between machines.

Densitometry experts are working on a way to compare test results from different densitometers.

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What's on the horizon in bone density testing?

While DXA is the current gold standard in testing bone density, new technologies may improve on its limitations. For example, DXA can't distinguish between the different layers of bone, and DXA alone doesn't assess the bone's structure (microarchitecture). For now, these newer tests are primarily used in research, not in routine screening and diagnosing.

High-resolution peripheral QCT (HRpQCT)

Using 3D imaging, HRpQCT measures bone strength and quality in the forearm and lower leg. This sophisticated technology assesses bone microarchitecture in addition to bone density, while exposing subjects to minimal radiation. The test, which is still being evaluated in research settings, is thought to provide better insight into bone health than devices more commonly used today.

High-resolution magnetic resonance imaging (micro-MRI)

Another investigational technology, this device is used at peripheral sites, such as the wrist, ankle and heel. Think of it as a micro-MRI machine. It can assess bone microstructure and strength with the use of stronger magnetic fields and new types of technology. Like HRpQCT, the device is undergoing study and isn't commonly used.

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You’re monitoring your treatment

If you’re taking medication for osteoporosis, central densitometry of your spine is often the best test to repeat over time. The trabecular bone in your spine best shows the effects of most medications. However, the spine can also be affected by osteoarthritis and other degenerative changes, which can “trick” DXA measurements. Improvement in spine density over time can be mistaken for treatment effect when in fact it is due to these other factors. The hip bone density is not affected by these common issues, so it may be measured in addition to the spine. In general, central DXA is used for monitoring treatment.

The prolonged use of certain types of osteoporosis drugs has been associated with a rare but serious type of fracture in the upper thighbone (femur), known as an atypical femur fracture (AFF). While the risk of AFF is very low, your doctor may choose to monitor this bone by performing extended femur scans.

This technique, also called full-length femur imaging (FFI), takes place during a DXA bone density test. Extended femur scans are not yet widely used, but this technology may show early warning signs of AFF. In this situation, your doctor will likely order additional imaging tests of both femurs to confirm your results. He or she may also recommend stopping your current treatment.

If you’ve been taking certain osteoporosis drugs for three or more years and you’re also experiencing pain in your thigh, hip or groin, your doctor may order diagnostic X-rays.

HISTORY AND PHYSICAL EXAM

Many people mistakenly believe that a bone density test is all that's needed to diagnose osteoporosis. It's true the test can confirm that you have low bone density, but it can't tell you why. Is something about your general health or lifestyle damaging your bones? To answer this question, you'll need a complete medical evaluation, including a medical history and physical exam.

To get a medical history, your doctor will ask you questions about your personal health history and the medical history of your close relatives. You may also be asked about medications you're taking, what you eat, how much you exercise, and how much tobacco and alcohol you use. Be honest with your answers. Your doctor isn't there to judge you but to determine your risk of osteoporosis and to identify other conditions that may cause the symptoms.

At your exam, your health care team may measure your height, check your posture and balance, and look at tissues related to bones, such as eyes, teeth and joints. You may also have blood and urine tests to look for secondary causes of osteoporosis.

Secondary osteoporosis occurs as a result of certain diseases, surgical procedures or drugs that can accelerate bone loss and increase your chances of a fracture. Other medical conditions that can affect osteoporosis risk include excess production of thyroid hormones (hyperthyroidism), excess production of parathyroid hormones (hyperparathyroidism), type 1 and type 2 diabetes, and liver disease. Long-term use of certain medications also may play a role.

When your doctor is determining your fracture risk, he or she will take these medical conditions and medications into account. For more information on secondary causes of osteoporosis, see Chapter 12.

Combined with your medical history, a physical evaluation helps your doctor interpret the results of your bone density test.

BONE MARKER TESTS

Bone marker tests measure bone turnover, that is, the rate at which bones are remodeling, repairing or renewing. The bone remodeling cycle releases chemical byproducts into your bloodstream and urine. These include bone-building materials, hormones and enzymes. A bone marker test can detect these remnants in a blood or urine sample and indicate the rate at which bone breakdown (resorption) and formation are occurring.

However, this test result doesn't conclusively show the balance of the remodeling cycle — whether you're losing more bone or gaining more. So bone density tests are used in diagnosis and treatment of osteoporosis. A bone marker test is done only in some situations to give more information about the bone cell activity.

Bone marker tests are useful in monitoring treatment for osteoporosis, most commonly in addition to DXA. Bone marker tests can indicate if drug therapy is producing the expected action in as little as three to six months. These tests may be helpful in unusual situations where the response to

treatment is uncertain or in doubt. Bone marker tests are not used to diagnose osteoporosis.

TAKING STEPS TOWARD A DIAGNOSIS

Of the tools your doctor has for diagnosing osteoporosis, a bone density test combined with a medical history and a physical exam is the most important.

A DXA scan of the spine or the hip is usually the best tool to calculate your fracture risk. Meanwhile, a medical history and physical exam may help your doctor detect a possible disorder that could cause osteoporosis.

After your bone density test, you'll probably have a follow-up visit with your doctor to discuss the test results. You'll get more out of that discussion if you understand what the numbers, tables and graphs on your results mean. You can learn more about this in the next chapter.

Chapter 6

Making sense of test results

You just had a bone density test on a dual-energy X-ray absorptiometry (DXA or DEXA) machine, and you get the results. What do all those lines and numbers mean? What's a T-score or Z-score?

A bone mineral density test measures the amount of minerals, such as calcium and phosphate, that are packed into a segment of bone. Those results provide insight into the strength of your skeleton.

Bone density isn't the only factor that determines bone strength, but it's an important factor that can be easily measured. Any location on your skeleton with very low bone density, sometimes called low bone mass, is at a high risk of fracture. And it's not the only part of your body in jeopardy. For example, if a bone density test of your hip indicates low bone mass, not only do you have an increased chance of breaking your hip, you also have an increased chance of fracturing a vertebra.

Well-defined criteria have been developed for interpreting bone density measurements. Two numbers from the test results, your T-score and your Z-score, can help your doctor diagnose osteoporosis before a fracture occurs or assess the severity of osteoporosis if a fracture does occur.

WHAT'S INCLUDED

The results of a DXA bone density test usually include at least three elements:

- An image (black and white or color)
- A summary table of one density values
- A graph

The image shows the part of your skeleton being measured. It's what a technician sees on the computer screen while performing your bone density test. In the sample test result shown here, the image shows that this test was performed on the spine. Blue rectangles with the labels L1, L2 and L3 indicate that, for this test, bone density was measured on the first three vertebrae in the lumbar region of the spine. The label (L4) indicates that the measurement of the L4 vertebra was not reliable.

The summary table that accompanies this image is shown at upper right in the sample report. In the first column are the L1, L2, L3 and (L4) labels. In the second column you'll find the bone density values for each vertebra. Other columns indicate the T-score and the Z-score. These scores are explained later in

the chapter. The bottom row or rows give the average of the reliably measured vertebrae.

The colored graph that accompanies the summary table shows how your bone density compares with others'. The black square on the graph represents the average density of L1 through L3 for the individual tested. Its position indicates where it falls among bone density values for people of the same age, sex and ethnicity. The lighter area crossing the graph represents the average range, which varies by age. The line through the middle of the light area shows the average bone density value across different ages.

On this graph, the black square indicates that the person being tested is about 66 years old with a bone density of around 0.9. (The table shows the value as exactly 0.878.) This person has somewhat low bone density in the lumbar region for an individual around this age. While it's still within the average range among this person's peers, it falls into the red region across the bottom of the graph. This individual would likely be diagnosed with osteoporosis.

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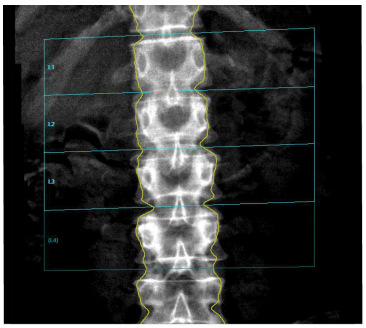
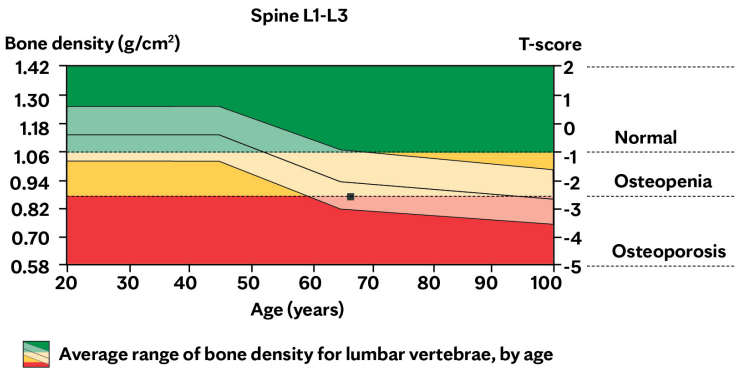
DXA Bone density test results: Spine

Results of a DXA bone density test include an image, a summary table and a graph. On this image, blue lines mark the bounds of the vertebrae measured.



Region	Bone density (g/cm^2)	Young adult T-score	Age-matched Z-score
L1	0.821	-2.6	-0.7
L2	0.903	-2.5	-0.6
L3	0.905	-2.5	-0.6
(L4)	0.985	-1.8	0.1
L1-L3	0.878	-2.5	-0.5



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If you've had any bone density tests done before at the same facility, the current bone density measurement can be compared to those results. On the results report, a second graph may show the amount of change from test to test, either as a percentage or using the actual values from multiple bone density tests over time.

Bone density test results from other parts of the skeleton will include similar images, tables and graphs. Here you'll find an

example of results from a bone density test performed on both hips. The black squares on the graph — one for each hip score — indicate that, again, the person who had the test was about 66 years old. He or she has fairly low bone density of the hip for his or her age, with values falling within the range of osteopenia (the yellow bar).

Yellow and blue lines on the accompanying image indicate the region where hip bone density was measured. The summary table lists the bone density at the femoral neck — just below the ball part of the ball-and-socket hip joint. It also gives an average score (total) of the region.

What hasn't been explained so far from the examples presented are the T-score and the Z-score that appear in test results. Both scores provide important information to your doctor to help determine the best diagnosis and care plan. Read on to find out what the scores mean and how each one is used.

UNDERSTANDING T-SCORES

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Using the same scale

As mentioned in Chapter 5, there is some variation across the machines used to measure bone density (densitometers). Because of this, having bone density tests at different medical facilities can make it challenging for your doctor to assess changes in your bone density over time.

That's why it's a good idea to have any follow-up testing done at the same health center where you were first tested, on the same machine. It's like weighing yourself on the same scale so you can most accurately track your weight over time.

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Your T-score represents how your bone density compares with the average bone density of a healthy young adult. The number is a measure of how much above or below that average your bone density is.

The T-score uses units of measurement called standard deviations. If your T-score is 0.0, your bone density is right at the average for young adults. (Congratulations!) If your T-score is -1.0, your bone density is lower than average by one standard deviation. Having a negative T-score when you are older is typical, as everyone loses bone density with age. The important question is how far below the young adult average your score is.

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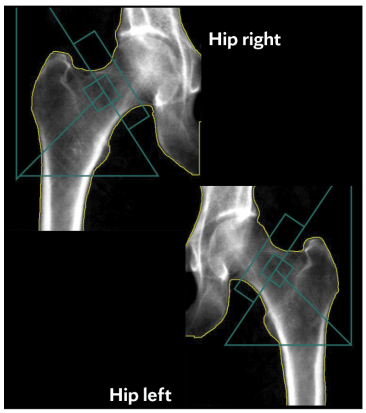
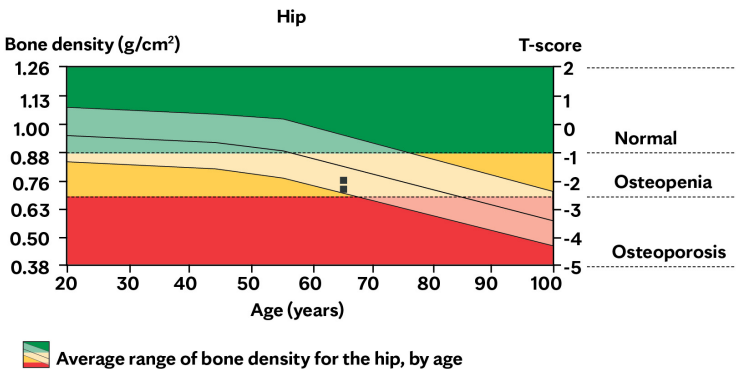
DXA Bone density test results: Hip (femur)

Results from a DXA test of the hip have the same elements as spinal DXA test results: an image, a summary table and a graph. The blue lines mark the areas of bone that were measured. In this test, both hips were measured.



Region	Bone density (g/cm²)	Young adult T-score	Age-matched Z-score
Neck left	0.722	-2.3	-0.5
Neck right	0.711	-2.4	-0.6
Total mean	0.720	-2.3	-0.8



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You may wonder why your bone density is compared to an average value for people considerably younger than you. After all, no one expects women who are in their 60s to have the same T-scores as women who are in their 30s. However, there's a good reason for doing it this way. It helps doctors to

diagnosis osteoporosis in older women and men before a fracture occurs.

If you are menopausal or over age 50, your doctor will likely follow the official guidelines of the World Health Organization to determine if you have low bone mass (osteopenia) or osteoporosis. According to these guidelines:

- If your T-score is within one standard deviation of the young adult average, that is, between +1.0 and -1.0, you have normal bone density.
- If your T-score is -1.0 to -2.49, you have low bone mass (also called osteopenia).
- If your T-score is -2.5 or lower, you have osteoporosis.
- If your T-score is -2.5 or lower and you've had a bone break in a low-energy fracture (fragility fracture), you have severe osteoporosis.

T-scores from different bones in your skeleton can't be compared. Generally, when more than one bone is tested, doctors use the lowest T-score to diagnose osteoporosis. For example, if you have a T-score of -2.7 in your spine and -2.0 in your hip, the spine T-score would be used to indicate osteoporosis. In the spine, the average T-score of two or more vertebrae provide the most accurate diagnosis. If the machine can't get an accurate measurement of two vertebrae, other areas such as the hip or forearm are used for diagnosis instead.

Bone density test results may be a good indicator of osteoporosis, but they're not a complete diagnosis. Your doctor will consider the possibility of other diseases or conditions, hereditary or acquired, that result in low bone mass as well. See Chapter 12 for more information on these

secondary causes. Looking at your family history, calcium and vitamin D levels, and other test results can help your doctor rule these out.

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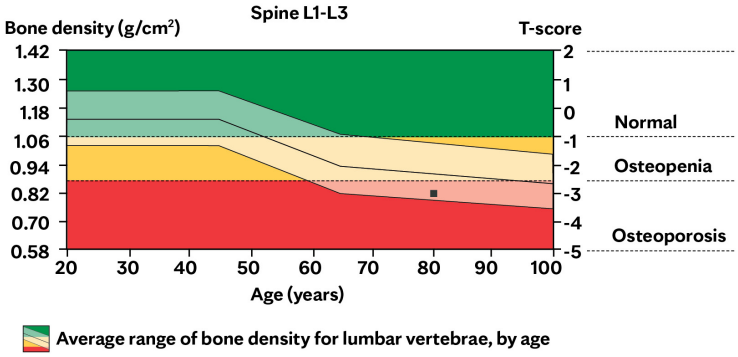
Diagnosed with osteoporosis?

This graph shows the results of a bone density test of the spine in someone around 80 years old. This person would be diagnosed as having osteoporosis.



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Being told that you have low bone mass — a T-score in the range of -1.0 to -2.4 without a history of low-energy fractures — doesn't guarantee that you'll develop osteoporosis. But it does mean that you want to avoid losing more bone mass. If your T-score is close to the range for osteoporosis, your doctor may recommend retesting in as little as two years. If your T-score is much better, your chance of developing osteoporosis may depend on how long you live and how your health changes as you age. Retesting may be appropriate in a later decade.

UNDERSTANDING Z-SCORES

While the T-score compares your bone density to a young adult's, the Z-score compares it with your peers'. Your Z-score is the number of standard deviations your bone density is above or below the average for someone of your age, sex and ethnicity.

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Interpreting the scores

The third and fourth columns on this table indicate T-scores and Z-scores for three vertebrae measured in a DXA test. The bottom T-score — the average score of all three vertebrae — is the one a doctor should use for a diagnosis of osteoporosis.

Region	Bone density (g/cm2)	Young adult T-score	Age-matched Z-score
L2	1.270	-1.0	-1.0
L3	1.243	-1.5	-0.9
L4	1.301	-2.0	-0.5
L2-L4	1.272	-2.4	-0.3

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The Z-score is a good indicator of how normal or abnormal your bone density is for your age, but it's not used to determine if you have osteoporosis. In both younger and older groups, a low Z-score can be useful because it can raise the question of whether a secondary cause of osteoporosis — something other than aging or menopause — may be

contributing to bone loss. For example, it may be used for a child experiencing low-energy fractures.

A Z-score lower than -2.0 is considered lower than expected for a given age. Fewer than 3% of adults have a Z-score that low. If the Z-score is below -2.0, and especially if someone is younger or has a family pattern of fractures, a doctor may do more testing to look for a secondary cause of bone loss — certain diseases, conditions, surgical procedures or drugs that can increase your chance of a fracture. If a secondary cause can be identified, the disease or condition can often be treated and bone loss slowed or stopped.

It's possible to have a normal Z-score and a low T-score. In fact, this is quite common among older adults. That's because most everyone experiences a decline in bone density with age. By the time many people reach their 80s, their bone density may be typical for people their age according to their Z-scores, but they may have low bone mass or osteoporosis according to their T-scores.

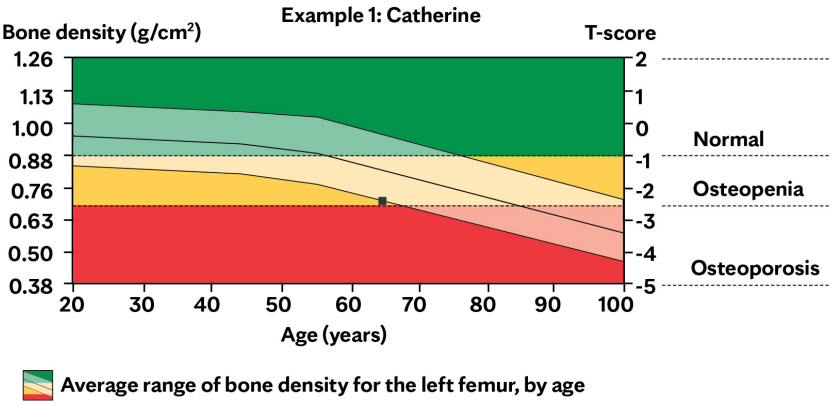
If you're confused by these two scores, don't worry. Your doctor or a member of your care team will help explain the numbers and answer your questions.

HOW ARE THE NUMBERS USED?

T-scores and Z-scores are important pieces of information when determining if you have, or may be at risk of, osteoporosis. Let's look at two imaginary examples that illustrate how the numbers are used to assess bone health and diagnose osteoporosis.

Example 1

Catherine is a 65-year-old white woman. She doesn't smoke and doesn't drink alcohol in excess. She doesn't take corticosteroids and she's never broken a bone. No one in her family has osteoporosis. Catherine's doctor recommends a bone density test based on her age and sex. For Catherine it's a screening test, just as a colonoscopy is recommended for people at a certain age even without other risk factors for colon cancer.



Following the test, Catherine studies the printout of her test results (see the graph below). She notices how bone density for the left femur gradually declines with age, and the decline becomes more pronounced around age 50. A black square on the graph indicates that Catherine's T-score is -2.3. That means that her bone density is 2.3 standard deviations below the average value for healthy young women.

Although she doesn't have osteoporosis — which generally is diagnosed with a T-score of -2.5 or low-energy (fragility) fractures after age 50 — Catherine is told that she has low bone mass. She learns that she's at risk of osteoporosis if she experiences more bone loss in the future.

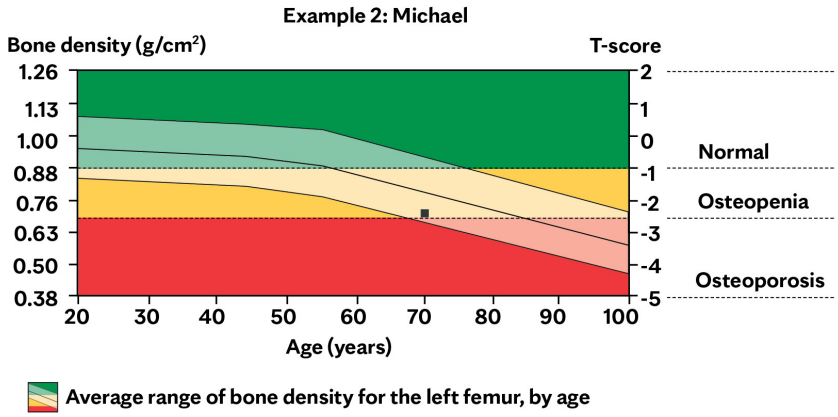
Catherine's Z-score, meanwhile, is -0.7, seven-tenths of a standard deviation below the average for a woman of her age and ethnicity. Her Z-score isn't low enough to suggest that her bone loss is due to a secondary cause, such as an underlying disease or disorder or a particular medication.

There's no way to know for sure, but Catherine's peak bone density when she was a young adult may have been below her peer average. In that case, being below average at this age would be not be unexpected but rather due to typical bone loss with aging.

Catherine and her doctor discuss steps she can take to minimize further bone loss and avoid fractures.

Example 2

Michael is a white male who is 70 years old. He is a smoker and has COPD as a result. He had a vertebral compression fracture one month ago when he lifted a bag of rocks to put in his garden. After his fracture, his doctor recommended that he have a bone density test.



Michael's T-score is the same as Catherine's: -2.3 (see the graph above). But Michael has had a fracture, which means his risk of more fractures is high even though his bone density isn't very low. Therefore, Michael is at greater risk of experiencing fractures.

These two examples illustrate how similar bone density scores can have a different meaning for different people. You may have the same T-score as your neighbor, but one of you may develop osteoporosis and the other may not. Your fracture risks also may be different.

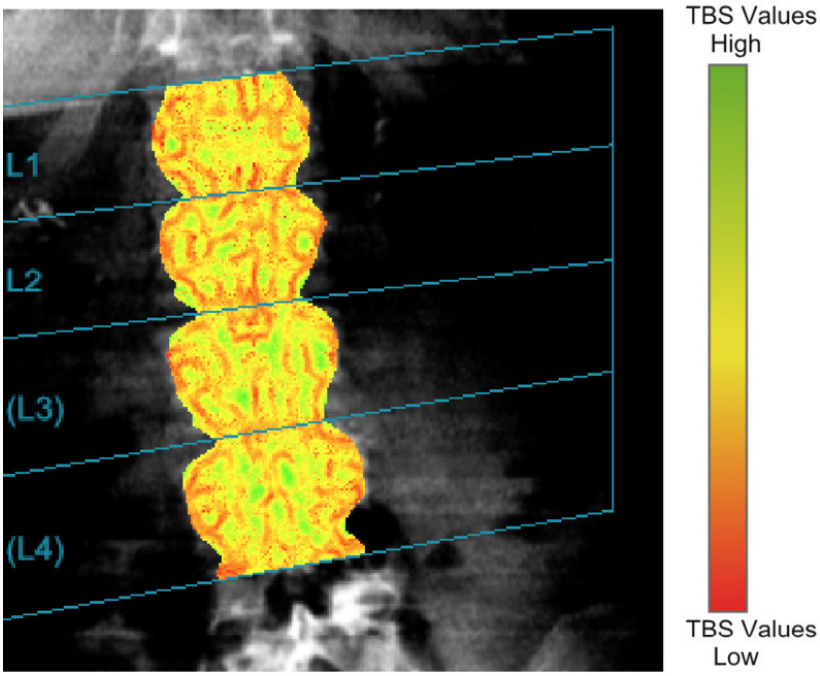
OTHER TESTS PERFORMED ON A CENTRAL DXA BONE DENSITY MACHINE

To determine your bone health and fracture risk, your doctor may perform one or more additional evaluations in conjunction with your bone density test. Neither of these is a substitute for a bone density test, nor are they diagnostic or screening tests for osteoporosis. But the results from these evaluations can provide a more precise picture of your bone health.

Trabecular bone score (TBS)

TBS is generated from computer analysis of spinal images from a DXA machine to assess the structure (microarchitecture) within your spine bones. A high TBS value means that your bone structure is strong and well

connected. A lower TBS value means the structure of your bones is less robust or degraded.



Trabecular bone score: The colored sections show the TBS values for four vertebrae in this image. Red highlights the areas with the poorest or weakest structure in the trabecular bone.

Bone structure declines naturally with age. A healthy 30-year-old woman may have a TBS value of 1.4 or higher, whereas by age 65, her TBS value might be closer to 1.3. Normal TBS results can vary depending on age, sex and ethnicity. A score that is below normal may suggest a greater fracture risk.

TBS and a DXA bone density test measure different things about your bones. A bone density test tells your doctor how much bone is present, and TBS tells how well it is organized or structured. Think of a brick wall — the strength depends on how many bricks there are but also on how they're arranged. Considered in combination with the results of your DXA bone density test, your TBS results can help your doctor determine whether treatment for osteoporosis is warranted.

Vertebral fracture assessment (VFA)

If your doctor orders VFA as part of your bone density test, the central DXA machine will take additional images of your spine from a side (lateral) view. These images look similar to conventional X-rays but use much less radiation. Software analyzes them to detect fractures of your upper (thoracic) and lower (lumbar) spine.

Your doctor will inspect the images to confirm any findings. If he or she discovers one or more fractures, you may be at increased risk of future fractures in your vertebrae, hip or other bones.

VFA can detect moderate to severe spinal fractures, which may help in determining a diagnosis and treatment plan. Sometimes additional X-rays are needed to get a more detailed look. If you've had a spine X-ray recently, VFA generally is not needed.

Vertebral fracture assessment: These VFA images were taken several years apart. The image on the right shows deterioration and more-severe wedge shapes in several bones in the thoracic spine — a sign of compression fractures.

OTHER RISK FACTORS FOR FRACTURE

T-scores and Z-scores are both statistical numbers based on groups of people with similar characteristics. However, you are a unique individual with a specific genetic makeup and lifestyle, which also affect risk. At your DXA test, you may be asked questions about your additional risk factors for a

fracture. When your doctor considers your risk of bone fracture, he or she takes into account these additional factors.

Age

The older you are, the more likely you are to get osteoporosis and break a bone because of it. Daily wear and tear over time causes your bones to become more fragile and less able to absorb shock.

Your sex

Approximately 80% of people in the U.S. with osteoporosis are women. Women are three times as likely as men to break a bone due to osteoporosis.

Ethnicity

The geographical area in which you grew up or are descended from is considered in assessing your fracture risk. Fracture probability varies among different regions of the world. Countries with the highest risk include Norway, Iceland, Sweden, Denmark and the United States. The exact reason for the differences in risk isn’t known, but it may include genetic differences and lifestyle factors such as diet and exercise.

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Results from other bone density tests

While a DXA machine is the most common tool for measuring bone density, other methods also can help your doctor assess your bone health. Here are two common types of test results you may receive.

Quantitative ultrasound (QUS)

To screen for osteoporosis, your doctor may recommend a quantitative ultrasound of your heel bone, also called a heel scan. The scan measures the density of your heel bone, and this measurement is usually converted to a T-score. Alternatively you may receive a positive or negative result, indicating that you're more or less likely to have developed osteoporosis.

In general, T-scores from heel scans are higher than DXA T-scores. For example, if you receive a T-score of -1.3 from a heel scan, you may receive a T-score of -2.5 or lower from a follow-up DXA bone density test, meaning that you have osteoporosis.

Because bone density can vary from one location in your body to another, a measurement taken at your heel usually isn't as accurate a predictor of fracture risk as a DXA test. If you receive a low T-score or a positive result, your doctor might recommend a follow-up DXA test to confirm or rule out a diagnosis of osteoporosis.

Quantitative computerized tomography (QCT)

Another method for measuring bone density is a CT scan of the hip, spine or both. Your doctor will likely convert the density measurement from this scan to a bone density T-score, similar to what you'd receive after a DXA test.

Research suggests that T-scores from QCTs of the spine are often lower than T-scores from DXA tests. One reason is that DXA machines do not distinguish between vertebral bone calcium and other calcium deposits, which are common in arthritis of the spine. This may falsely elevate some DXA bone density results. In certain situations, a T-score from a QCT may more accurately predict your risk of spinal fractures.

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Height and weight

Men and women who have small body frames — especially those with low weight for their height — generally have a higher risk of developing osteoporosis and bone fractures. This is because they tend to have less bone mass to draw from as they age. For larger women and men with thick-boned frames, the risk is typically lower.

Previous fracture

If you've broken a bone as an adult, you're at an increased risk of breaking another one, even if you don't have osteoporosis. This is true for both women and men. Even fractures that you were not aware of, such as vertebral fractures discovered on VFA, increase your risk and count as fractures for fracture risk assessment tools.

Family history of hip fracture

If either your mother or your father experienced a fractured hip, your risk of hip fracture is increased. Some of this risk

reflects the influence of your parents' genes on your bone mass and structure.

Smoking

Individuals who smoke are more likely to experience osteoporosis and bone fractures. Smoking interferes with the production of the hormones estrogen and testosterone. Smoking also disrupts calcium absorption and the bone formation part of the remodeling cycle. There may be additional ways that smoking is harmful to your bones, as its exact role isn't clear.

Alcohol

Excessive use of alcohol over a long period of time is damaging to bone because alcohol is toxic to bone-building osteoblasts. Chronic heavy drinking also lowers levels of the hormones estrogen and testosterone. People who drink tend to fall more often as well.

Use of glucocorticoids

These medications are especially hard on your bones. They lower bone mass by slowing bone formation, they temporarily speed bone resorption, and they decrease levels of estrogen and testosterone. Risk of osteoporosis and subsequent fracture is greatest in individuals who take oral or intravenous glucocorticoids for more than six months. Risk is minimal with inhaled glucocorticoids.

Rheumatoid arthritis

Studies suggest that having rheumatoid arthritis increases your risk of osteoporosis and fracture. Joint damage and limited mobility that accompany rheumatoid arthritis increase fracture risk. Some medications used to treat the disease also can damage bone and put you at a higher risk of osteoporosis.

PUTTING IT ALL TOGETHER

After you've completed a bone mineral density test, your doctor will combine the results with additional information gathered during your health history and physical exam to get a better picture of your fracture risk. If one of the bone areas measured has a T-score of -2.5 or lower and no other conditions are found to explain it, you'll be diagnosed with osteoporosis. Your doctor will then discuss strategies to improve your bone density and lower the risk of broken bones.

If your results show low bone mass (osteopenia), your test results — mainly your T-score at the femoral neck — and the information about your other risk factors are typically entered into a fracture risk assessment tool called FRAX. If available, the trabecular bone score also can be entered into the assessment tool. FRAX is used in considering treatment for people who have low bone mass but not osteoporosis. The tool analyzes the information provided to estimate your chance of experiencing a major fracture within the next 10 years. For more information on FRAX, see "Evaluating your risk."

FRAX was developed to help doctors better identify and treat people at high risk of debilitating fractures. With this tool,

doctors can identify individuals who might be overlooked when considering only the T-score but whose characteristics indicate they may benefit from treatment.

While FRAX is helpful for predicting fractures, it cannot indicate which treatment will work best to reduce your fracture risk. And it's not used to monitor your risk of fractures when you are getting treatment. Your doctor will consider a variety of factors in devising and monitoring your treatment plan.

IN SUMMARY

Bone density tests are important, but keep in mind that they aren't the be-all and end-all to determining your bone health. There's more to diagnosing osteoporosis and estimating fracture risk than a number from a densitometer. Before jumping to conclusions, discuss your bone density test results with a doctor. It's important that he or she connect all of the dots to create a complete picture of your bone health.

PART 2 PREVENTION AND TREATMENT

Chapter 7

Developing an Action Plan

It’s never too early to fight back against osteoporosis or too late to stop the condition in its tracks. Whether you’re trying to prevent osteoporosis or you need to treat it, the goal is the same: You want to maintain your bone health to ensure a low risk of fracture. The steps you’ll take to protect your bones are the same, too.

Understanding your role in the prevention or treatment of osteoporosis is vital for success. That’s because many of the steps require your active participation. Working together, you and your doctor will want to develop an action plan that includes key strategies related to diet, exercise and medications. Think of your action plan as your “how-to” for keeping your bones healthy.

Even if you don’t have osteoporosis, an action plan is still important. A good plan can greatly reduce your risk of getting the disease. Ideally, prevention begins in childhood and it continues throughout life. The more you build up your bones early on, the less likely you are to develop osteoporosis in your later years.

STRONG BONES FOR A LIFETIME

A successful action plan involves several elements that contribute to overall bone health. These elements include good nutrition — including an adequate intake of calcium and vitamin D — regular physical activity, healthy habits and behaviors, good posture, and careful use of medications.

When combined, these elements support and strengthen one another to help you prevent or manage osteoporosis, keep you healthy, and maintain your overall quality of life. Each element is discussed in this chapter to show why it is essential to your action plan and how it works together with other elements of your plan. Chapters 8 through 12 discuss specific elements in more detail, providing additional information and demonstrating how different strategies can be put to practical use.

In establishing an action plan, consider these objectives:

- Maximize the development of your skeleton. As a child or young adult, the focus is on attaining a high peak bone mass. As an older adult, the goal is to stabilize existing bone mass.
- Prevent fractures. Bones weakened by the depletion of calcium and other minerals are more likely to break.
- Relieve the symptoms of fractures, stooped posture and chronic pain, should they occur.
- Improve your balance and the ability to move and be active.

Success in meeting these objectives depends in part on your commitment to your action plan. It’s up to you to stick with

daily routines and be willing to change some of your behaviors.

At the same time, you don’t have to do it alone. As with any chronic disease, it’s important to maintain good relationships with professionals, as well as with family and friends. Several kinds of doctors and specialists can help treat or prevent osteoporosis, including endocrinologists, rheumatologists, general practitioners, internists, gynecologists, rehabilitation specialists and orthopedists.

Often your own doctor is the best person to work with because he or she knows you personally, including your medical history. In dealing with certain parts of your action plan, you may also find it useful to consult a dietitian or a physical or occupational therapist.

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Starting young

The secret to preventing osteoporosis is to make your skeleton as strong as it can be when you're young. This means doing everything you can to help it reach its peak bone mass. (For more discussion of peak bone mass, see Chapter 2.) By eating healthy foods and staying physically active during the years when bone mass is increasing — from childhood to early adulthood — you can lessen the impact of bone loss that occurs naturally in your later years.

Parents and grandparents can help children develop habits that will benefit their bones for the rest of their lives. Start by making sure children get enough calcium. Young people often have diets that are deficient in calcium. Good overall nutrition also is important. Some young people diet excessively in a quest to be thin and deprive themselves of valuable nutrients. Low body weight puts bones at risk. Conversely, experts know that getting enough calcium during the years of growth and development helps bones reach their highest possible peak density.

Many children love soft drinks, which have no calcium content. Parents can do their kids a favor by skipping the soda and offering milk or calcium-fortified juice to boost their calcium instead. But even fortified juice should be given in limited amounts, due to its high sugar content.

Parents and grandparents can also encourage physical activity as part of the family routine, whether it's an evening walk after dinner, swimming, bowling, a canoe trip, or a game of basketball or tennis. Regular physical activity is essential for building strong muscles and bones.

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DIET AND NUTRITION

Good bone health starts with good nutrition. To keep your bones healthy, you need a balanced diet that includes enough calcium, vitamin D and other nutrients that your body requires to perform its daily functions. Calcium and vitamin D are essential nutrients for maximizing and preserving bone mass.

Getting adequate calcium and vitamin D is the first step in promoting bone health. Protein and other nutrients, such as the minerals phosphorus, sodium and magnesium, also play important roles in keeping your bones strong.

Calcium: The foundation

Calcium is found in every cell in your body, although about 99% of it lies in your bones and teeth. Because calcium is a major component of bone, you need adequate amounts of the mineral throughout your life to achieve and maintain peak bone mass.

Calcium is also needed for your heart, muscles and nerves to function well and for your blood to clot normally. It’s important that your bloodstream always contain an adequate supply of calcium. Fortunately, the body has built-in safeguards to regulate the calcium in your blood — allowing for neither too little nor too much.

Each day, your body loses some calcium. It's lost through urine and feces and, to a lesser extent, sweat. This continual removal of calcium means that your body requires constant replenishment.

If you don't consume enough of the mineral in your diet, your parathyroid glands will release parathyroid hormone (see this illustration), which in turn stimulates your bones to release calcium. Your bones give up calcium in order to keep the calcium level in your blood normal. If this action occurs repeatedly over a long period of time, your bones continue to lose calcium and your bone density level decreases.

Calcium requirements

Calcium is essential during childhood and adolescence, when your skeleton is growing rapidly. And contrary to popular belief, your need for dietary calcium increases — not decreases — with age.

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Recommended daily calcium

Age	Adequate intake (milligrams/day)	Upper limit (milligrams/day)
Children and adolescents		
1-3 years	700	2,500
4-8 years	1,000	2,500
9-13 years	1,300	3,000
14-18 years	1,300	3,000
Men		
19-50 years	1,000	2,500
51-70 years	1,000	2,000
71+ years	1,200	2,000
Women		
19-50 years	1,000	2,500
51+ years	1,200	2,000

Aim to get an adequate intake of calcium each day. If you exceed the upper limit, you may increase your risk of health problems related to excessive calcium.

Source: Institute of Medicine, 2010

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This is because as you get older, your body becomes less efficient at absorbing calcium and vitamin D from the foods you eat and at retaining calcium in your kidneys. For women, a drop in estrogen levels at menopause further reduces calcium absorption. In addition, older adults are more likely to have chronic medical problems and use medications that may interfere with calcium absorption. All these changes put greater pressure on your body to maintain sufficient calcium levels in your bloodstream.

Unfortunately, many people don't get the calcium they need. It's recommended that adults get 1,000 to 1,200 milligrams (mg) of calcium a day to keep their bones strong. The typical American diet provides around 1,000 mg for men but just 800 to 900 mg for women — enough for some, but below recommended levels for many older adults.

Groups most likely to consume too little calcium are children and adolescents — especially girls — ages 9 to 18, women between the ages of 51 and 70, and both men and women older than age 70.

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During pregnancy and lactation

During pregnancy, the body needs extra calcium for a developing baby. To provide that additional calcium, the ability to absorb the mineral from the intestines is increased — a nifty trick of nature. During lactation, the kidneys conserve calcium, making more of the mineral available for moms and babies.

Because of these changes in the body, the recommended calcium intake for women during pregnancy and lactation is the same as that for all women of the same age. Nevertheless, if you're pregnant, talk to your doctor about meeting calcium requirements.

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Researchers cite several possible reasons for the inadequate calcium intake. Foremost is the fact that people are eating fewer dairy products. People often drink soda, bottled water and sports drinks in place of milk, which is high in calcium. Some people also avoid milk because of intolerance to the sugar in milk (lactose). Or they think that dairy products lead to weight gain or acne. Some may be advised to follow a diet that avoids naturally calcium-rich foods. In addition, people don't typically eat enough fruits and vegetables, which also contain vitamins and minerals important to bone health.

One way to increase the calcium in your diet is to know which foods are rich in calcium and include them in your meals. An easy way to get adequate calcium is to have a glass of milk — either dairy milk or a plant-based milk that's calcium fortified

— with every meal. Another way is to take a calcium supplement.

These topics, as well as an overview of good nutrition, are discussed in Chapter 8.

Don't overdo calcium supplements

While it's important that you have adequate calcium in your diet, it also matters how you get that calcium — and that you don't get far too much. Some studies have suggested that people who take calcium supplements may be at increased risk of heart attacks compared with those who don't take supplements. However, research results are mixed.

Meanwhile, plenty of healthy foods offer calcium naturally. While any possible risks of calcium supplements continue to be debated, experts agree that getting enough calcium from your diet is safe and preferred.

As with any health issue, it's important to talk to your doctor to determine what's best in your particular situation.

Vitamin D: Unlocking the door for calcium

The amount of calcium you consume is not the sole answer to building strong bones. Your body must maintain a balance between how much calcium is absorbed from the food you eat and how much is eliminated from your body.

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How your body makes vitamin D

When your bare skin is exposed to sunlight, the sun's ultraviolet rays change cholesterol in your skin to an inactive form of vitamin D. Inactive vitamin D is also contained in some foods. Your liver and kidneys then make two more chemical changes to vitamin D that activate the nutrient. In its active form, vitamin D helps your body absorb calcium for maintaining healthy bones.

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Calcium absorption takes place as your intestines extract the mineral from the food you eat and move it into your bloodstream. Calcium loss (excretion) occurs primarily through urine, feces and sweat. Poor absorption and increased excretion can upset the calcium balance and weaken your bones.

Enter vitamin D. Vitamin D is as critical to your bone health as is calcium. It plays an important role in maintaining the absorption-excretion balance by increasing calcium absorption in the small intestine. Think of vitamin D as the key that unlocks a door, allowing calcium to leave the intestines and enter the bloodstream. If you routinely don't get enough vitamin D, the level of calcium circulating in your bloodstream drops.

When calcium levels in your blood become too low, your parathyroid hormone signals your bones to release more calcium into circulation. This reduces the amount of calcium

in your bones. Continually robbing your bones of calcium like this can cause them to weaken. That's why it's important to get enough vitamin D in addition to enough calcium.

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Recommended daily intake of vitamin D

Age	Recommended intake (international units/day)	Upper limit (international units/day)
1-3 years	600	2,500
4-8 years	600	3,000
9-70 years	600	4,000
71+ years	800	4,000

Source: Institute of Medicine, 2010

Note that the upper limit represents the safe boundary — not your daily goal.

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Sources of vitamin D

Sunlight is a significant source of vitamin D for most people. Ultraviolet (UV) radiation from the sun stimulates your skin to synthesize vitamin D.

How much vitamin D you convert from sunlight depends on many factors, including the season, how far you live from the equator, and the amount of sunshine and air pollution in your

region. The age and color of your skin, the health of your liver and kidneys, your outdoor activity, and the type of clothing you wear also affect your vitamin D production.

Using sunscreen and spending long periods of time indoors, especially in the winter months in northern climates and in summer in parts of the world where avoiding heat is a factor, prevent some people from getting adequate vitamin D. In addition, in some northern latitudes, solar radiation isn't strong enough in the winter to produce adequate vitamin D in skin. Skin pigment also is a factor, as UV light's effects on lighter skin tones produce more vitamin D compared with darker skin tones. And compared with younger skin, older skin is less efficient in producing vitamin D from the sun.

When the body doesn't get enough vitamin D from the sun, it depends on its stored supply of the vitamin or dietary sources of vitamin D. Only a few foods are naturally rich in vitamin D. They include fatty fish, fish liver oils (including cod liver oil), liver and egg yolks. The milk you buy at the grocery store is usually fortified with vitamin D.

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Body weight and osteoporosis

Most people have heard about the dangers of being overweight. Among other things, obesity can put you at increased risk of a heart attack and stroke. But being too thin isn't healthy either, especially when it comes to your bones. Your diet should include enough calories to maintain a healthy body weight. Weight has a powerful effect on bone mass. It increases the load on your skeleton, and your bones compensate by growing stronger.

Women who are very lean run the risk of having low bone mass and excessive bone loss at menopause, and they may have an increased risk of a fracture. If you're underweight, you want to reach a normal weight. If you're having trouble with your weight or your diet, talk to your doctor or a dietitian.

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Vitamin D requirements

Getting enough vitamin D is necessary at any age. Most infants and children in the United States get enough vitamin D because it's added to milk. Although consumption of milk often decreases during adolescence, vitamin D deficiency is unusual in this age group. It's more common in older adults, and there are a number of reasons why.

- Older adults don't always consume enough foods and beverages fortified with vitamin D, such as milk.
- The ability to absorb vitamin D from what you eat and drink tends to diminish with age.

- Many older adults spend less time in the sun, in northern latitudes during the winter months and in southern latitudes in the summer.
- With age, skin becomes less able to synthesize vitamin D, and organs such as the kidneys and liver may become less efficient at processing it.

To help ensure an adequate amount of vitamin D from sunlight, some experts recommend getting five to 30 minutes of midday sun exposure on your face, arms and hands at least twice a week. This recommendation is dependent on individual skin sensitivities.

When you're exposed to the sun's rays, remember many factors can reduce the effectiveness of sunlight for producing vitamin D. These include sunscreen, air pollution, the weakness of solar radiation in winter and skin pigmentation. Light filtered through a window inside also doesn't provide the same UV benefits. If you're affected by any of these factors, you may need vitamin D supplements. People who take steroid medications such as prednisone or hydrocortisone may require additional vitamin D.

Other nutrients and your bones

Nutrients other than calcium and vitamin D can also influence your bone health both positively and negatively.

Phosphorus

Phosphorus is important for normal development and maintenance of your bones and tissues. It's present in most foods, including meat, poultry, fish, eggs, dairy products, nuts,

legumes, cereals and grains. Phosphate salts are used extensively in processed foods.

Phosphorus consumption in the American diet has risen in recent decades, due primarily to increased use of food additives and consumption of carbonated beverages. Most people get plenty of the nutrient, without exceeding the recommended upper limit. There's speculation that an excess of phosphorus may have adverse effects on your skeleton, possibly increasing the risk of low bone density.

Sodium

Sodium chloride, the main component in table salt, increases calcium excretion through urine. Although uncommon, a diet that's high in sodium may adversely affect the calcium balance in your bloodstream. Most American adults consume more than the recommended limit of 2,300 milligrams of sodium daily.

Protein

Protein is one of the building blocks of bone, and it's essential to build and repair tissue. It also aids in fracture healing and is necessary for the body's immune system to function properly. Most Americans consume more than the recommended amount of daily protein, which is 0.8 grams (g) of protein per kilogram of body weight. For example, a person who weighs 75 kilograms — that's 165 pounds — should consume 60 grams of protein a day. For reference, 2 cups of milk have about 16 grams of protein, and 3 ounces of chicken breast (roughly the size of a deck of cards) contains about 27 grams of protein.

For years, experts thought that a high-protein diet may increase calcium loss. But more-recent systematic reviews of research have shown that eating more protein has no negative effects on bone health. In fact, getting more than the recommended daily amount may actually improve bone loss and fracture risk. A low-protein diet, meanwhile, may interfere with calcium absorption in the intestines.

The bottom line? It's best to eat a balanced diet that provides your body with a variety of nutrients for your bones and your overall health. See Chapter 8 for more information about nutrition.

PHYSICAL ACTIVITY

Getting frequent physical activity is another key component of any action plan to prevent or treat osteoporosis. Studies show that regular exercise early in life helps you achieve a higher peak bone mass. During your adult years, exercise can help slow bone loss, maintain your posture and strengthen your cardiovascular health.

In addition, exercise improves your muscle strength, balance and coordination, all of which reduce the risk of falling and breaking a bone. Evidence indicates that physical activity also improves muscle function, separately from strength.

Activity builds bone

Bone is living tissue that can strengthen — or weaken — in relation to how much it's used. The greater the demands you place on your bones, the stronger and denser they become.

When you perform an action such as hitting a tennis ball or landing on your feet after a jump, chemical messengers instruct your arm bones or leg bones to be ready to handle that impact again. Repeating the action over time reinforces the preparedness of your bones.

For example, if you looked closely at X-rays of the arms of a tennis player, you'd probably see that the bones of the dominant arm — the one that holds the racket — are larger and denser than the bones of the other arm. Conversely, people who are put on bed rest or otherwise immobilized lose bone strength quickly due to lack of activity.

Every bit of activity helps. Being active includes all of the motions of daily living. Moving around throughout the day is good for you. Getting more-structured activity is even better. This may include taking a walk or playing a round of golf. Your bones also benefit from resistance exercises, which may involve the use of weights, resistance bands or just your own body weight.

If you have osteoporosis or may be at risk, talk with your doctor about what types of activities are appropriate for you before starting an exercise program. You may need to avoid or limit certain exercises. Physical activity is discussed in more detail in Chapter 9.

Perfecting your posture

In addition to activities that strengthen your bones, you also want to include those that help strengthen your back muscles and improve your posture. Good posture is crucial to preventing falls and avoiding an excessively curved back.

Posture refers to the positions of different body parts in relation to one another — whether you're standing, sitting, lying down or moving. Good posture allows your back to follow the mild S-shaped curve of the spine, and it places only minimal strain on your muscles and joints. Knowing how to sit, stand and move properly can help you avoid fractures and limit the exaggerated curvature of the spine that results from compression fractures. For more on good posture and proper ways to move, see Chapter 13.

MEDICATIONS

In addition to diet and exercise, medications are often prescribed for people at high risk of developing osteoporosis and those who've been diagnosed with the disease. The main goal of medications is to preserve or increase bone density and prevent fractures.

Most prescription medications for osteoporosis are known as anti-resorptive agents. The term refers to the action of slowing or stopping the breakdown of bone tissue (resorption). By putting the brakes on bone removal, anti-resorptives help bone formation keep pace. This often allows bone density to increase over time.

Medications that promote the formation of new bone tissue may also be prescribed. They're most commonly used to treat women and men with severe forms of osteoporosis, including those at a high risk of fracture and who haven't responded well to other forms of treatment. For more-detailed information

about available medication options and how they work, see Chapter 10.

HEALTHY BEHAVIORS

Along with a balanced diet, physical activity and medications, you may need to direct your attention to other aspects of your life that are harming your bones. For example, stopping smoking and avoiding excessive use of alcohol are important steps in treating or preventing osteoporosis.

Avoid smoking

Studies show that smoking increases the rate of bone loss. Women who smoke have lower estrogen levels than women who don't smoke. Women smokers also tend to undergo menopause earlier, and cigarette smokers tend to be thinner. (For more details, see this discussion.) All of these factors increase the risk of osteoporosis and possible fractures.

Avoid excessive alcohol use

Studies indicate that consuming more than a moderate amount of alcohol can hasten bone loss and reduce your body's ability to absorb calcium. If you choose to drink alcohol, do so in moderation. For healthy adults, that means up to one drink a day for women and up to two drinks a day for men.

Alcohol can affect hormones that regulate calcium levels and reduce the formation of new bone. People who drink heavily

also are more prone to fractures because they have an increased risk of falling.

MEETING THE CHALLENGE

All of the elements described in this chapter, including diet, physical activity, correct posture, medications and healthy behaviors, can help you maintain bone strength and avoid fractures. Each element helps address a vital aspect of your health. However, no individual element is sufficient in itself to prevent or treat osteoporosis — each component works best in combination with the others.

The chapters that follow provide practical suggestions for implementing your action plan. By being proactive and involved in your health, you can enjoy a more active, fulfilling life.

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Integrative medicine treatments

To date, no specific integrative health treatments — sometimes called complementary or alternative treatments — have been proved effective specifically for treating osteoporosis. Getting adequate calcium and vitamin D is the cornerstone of osteoporosis prevention and treatment. Calcium and vitamin D are the only two supplements that have been shown to decrease fracture rates, with a modest effect. Dietary sources of these nutrients are preferable, but many people may need a calcium and vitamin D supplement, especially if they don't get sufficient high-calcium foods and exposure to the sun.

Other supplements may claim to offer benefits for bone health and osteoporosis but haven't yet been proved safe or effective. For more information about these supplements, turn to chapter 10.

Another integrative health practice that may be beneficial is tai chi. Research suggests it may be a safe alternative to conventional exercise among postmenopausal women for maintaining bone mineral density. Tai chi is a mind-body practice that originated in China as a martial art. It consists of slow and gentle body moves, while breathing deeply and meditating. Tai chi is sometimes called "moving meditation." The benefits of tai chi appear similar to those of conventional exercise. However, tai chi may also improve balance to help reduce the risk of falls.

For people with osteoporosis who have experienced one or more osteoporotic fractures of the spine, treatments such as biofeedback, meditation and relaxation techniques may be useful in treating chronic pain, which can accompany such fractures. Various methods for managing chronic pain are discussed in Chapter 14.

If you have osteoporosis, be cautious about two forms of integrative medicine that could worsen your condition — chiropractic treatment and massage. These therapies aren't recommended because they can cause or aggravate spinal fractures. Before trying any form of spinal manipulation, it's best to talk with your doctor.

If you're considering any integrative therapy, gather as much information about the treatment as you can. Bring the information with you to your next appointment and seek out your doctor's advice.

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Chapter 8

Eating for healthy bones

Like any living tissue, bones need nutrients so that they can grow and maintain themselves. Most nutrients aren't produced by the body; they must be provided by food. A lack of nutrients in your diet can lead to stunted growth, weaker bones and other medical conditions. In other words, the better your diet, the better your health. And the stronger your bones, the less chance you have of developing osteoporosis.

Calcium and vitamin D have received the most attention for their roles in preventing and treating osteoporosis. But other nutrients also play a supporting role in ensuring bone health. They include the minerals magnesium, potassium and fluoride; vitamins C, K and A; and disease-fighting plant compounds called phytochemicals. There's also evidence that maintaining a healthy weight may prevent or reduce your risk of osteoporosis.

The previous chapter talked about diet in the context of how to develop an action plan for preventing or treating osteoporosis. This chapter discusses the basics of good nutrition as well as practical ways to ensure that your diet maximizes bone health.

GOOD NUTRITION IN A NUTSHELL

Variety isn't just the spice of life — it's the basis for a healthy diet. No single food provides all of the nutrients your body needs. Eating a variety of foods helps get the nutrients you need to achieve a healthy weight, enjoy good health and maintain strong bones.

A simple approach for achieving and maintaining a healthy diet is to follow basic nutrition guidelines. Nutrition guidelines promote variety, balance and moderation in your food choices. Key recommendations for a healthy diet are often summarized as follows:

- Eat more vegetables, fruits and whole grains.
- Aim for adequate protein and healthy fats.
- Choose foods that are good sources of calcium.
- Limit sugar, salt and phosphate additives.
- Limit consumption of alcohol and caffeine.

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Nutrients and bone health

Nutrient	Role in bone health	Food sources include
Calcium	Major mineral found in bone.	See "Food sources of calcium."
Vitamin D	Essential for absorbing calcium from food and supplements.	Fortified milk and cereals; trout and salmon; mushrooms exposed to UV light.
Potassium	Adequate amount helps prevent loss of calcium in urine.	Vegetables, fruits, legumes and milk.
Vitamin K	Involved in bone maintenance.	Dark green leafy vegetables, fruits and some vegetable oils.
Vitamin C	Inadequate consumption associated with low bone density.	Citrus fruit and juices, peppers, broccoli, tomatoes, and green leafy vegetables.
Vitamin A	Essential for bone remodeling (natural "recycling" of bone).	Darkly colored (orange or red) fruits and vegetables.
Magnesium	Adequate intake is associated with higher bone density.	Seeds, nuts, vegetables, legumes, fish, dairy, bananas and grains.
Phosphorus	Balance needed; consuming too much phosphorus and too little calcium may stimulate the body to reduce bone mass.	Limit foods with phosphate additives such as cola drinks, processed meats such as hot dogs and deli meats, pizza, processed cheese or cheese sauce, macaroni and cheese, and sauces.

Nutrient	Role in bone health	Food sources include
Sodium	Causes loss of calcium in urine; more calcium needed to offset loss.	Processed foods such as cured meats, pickled items, canned salted soups, canned vegetables, restaurant and fast foods, chips, and more.

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Eat more vegetables, fruits and whole grains

Studies show that eating more vegetables and fruits — and less protein from meat sources — leads to improved bone health. Choose a variety of vegetables, fruits and whole grains for your daily meals. These foods are generally lower in calories and fat, so you don’t have to worry as much about the amount of food you eat. Fruits and vegetables are also high in fiber, essential vitamins and minerals, and phytochemicals, substances that may help protect against a variety of diseases, including osteoporosis.

Aim to eat four or more servings of vegetables and three or more servings of fruit each day. Fresh fruits and vegetables are good choices but are not the only healthy options. Frozen and canned fruits and vegetables without added sugar, salt, sauces or syrups are convenient and economical. Because different fruits and vegetables provide different nutrients, variety is vital. Fruits and vegetables are excellent sources of magnesium, potassium, and vitamins C, K and A. All play a role in maintaining bone health.

Also eat 5 to 10 ounces of grains — cereal, bread, rice and pasta — daily. The range depends in part on your body size, age and activity level. Older people who have a small to average build and a low activity level likely need just 5 to 7 ounces. A 1-ounce serving is typically a small handful of crackers, one slice of bread, 1 cup of cereal, or ½ cup of rice or pasta. Choose whole grains for at least half of your daily total. They contain more nutrients, especially magnesium and fiber, than do refined grains. You may be eating some whole grains without realizing it, such as oatmeal and popcorn.

Aim for adequate protein and healthy fats

For bone health — and good health in general — it's important to eat lean types of protein. The best choices include plant proteins, such as beans, lentils, soy and nuts, as well as fish, skinless poultry and lean cuts of meat. Plant proteins are rich in vitamins, minerals and estrogen-like plant compounds that help preserve bone.

Aim for a total amount of 5 to 7 ounces of protein-rich foods daily. A diet too low in protein is associated with bone loss, and in recent years, higher protein intake has been tied to improved bone density and fracture risk. Just be sure to leave enough room on your plate for healthy fruits, vegetables and whole grains.

As for fat, you need some of it in your diet in order for your body to function properly. But too much fat, especially of the wrong kind, can have a negative impact on your health. Of all nutrients, fat contains the most calories. This is why health experts recommend limiting added fats and choosing lean

meats and lower fat dairy to maintain a healthy weight. While people with a higher body weight tend to have greater bone density than people at a lower weight due to the work of supporting the body, there are many other reasons for maintaining a healthy weight.

Try to choose foods with unsaturated fats (mono- and polyunsaturated fats), which are the best types of fat for keeping your heart and cholesterol levels healthy. Good sources include fatty fish, nuts, seeds, and oils such as canola and olive and spreads and dressings made from them. Even these fats, however, should be eaten in limited amounts.

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How much calcium are you getting?

Nondairy calcium-rich foods (not those that are calcium fortified) generally provide about 200 to 300 mg of calcium a day. To calculate your daily calcium intake, assume you get about 250 mg from these nondairy sources. Add 300 mg for each serving of dairy that you consume. A serving is generally about 1 cup of milk, 6 ounces of plain yogurt or calcium-fortified juice, or 1 ½ ounces of hard cheese. Then add the amount of calcium contained in any supplements you take.

Below is an example of a woman whose only dairy serving each day is milk that she has with cereal in the morning. However, because she also takes a calcium supplement, she meets the recommended daily intake for women ages 19 to 50:

- Nondairy sources: 250 mg
- Dairy servings (1 cup milk): 300 mg
- One calcium supplement: 500 mg
- Total calcium: 1,050 mg

Keep in mind that women over age 50 and men over 70 need 1,200 mg of calcium in a day. If you're already taking a supplement but falling short of the recommended amount, look for ways to add more foods that are rich in calcium to your diet.

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Choose good sources of calcium

You know that calcium is a nutrition superstar when it comes to bone health. And yet many people still don't get enough.

Adults in the United States tend to get around 800 to 1,000 milligrams (mg) of calcium each day. Women and older men in particular often don't meet the recommended daily intake, which ranges from 1,000 to 1,200 mg. (See Chapter 7 for specific calcium requirements.)

The obvious way to increase your calcium intake is to eat more foods that are high in calcium. Milk and other dairy products, such as yogurt and cheese, are the richest food sources of calcium, but some foods that are fortified with calcium are good sources, too. You can choose fat-free and low-fat varieties that contain the same amount of calcium as higher fat products. Milk is also fortified with vitamin D, as are many types of nondairy milk. One cup typically contains more than 100 international units of vitamin D.

Dairy products aren't the only foods rich in calcium. Other sources are listed this chart. However, it's easier to meet calcium requirements with dairy products than with other foods. For example, 1 cup of milk contains the same amount of calcium as at least 4 cups of broccoli. If you can't or you choose not to eat dairy products, you may have to work a little harder to make sure you get enough calcium.

If you have difficulty digesting milk or prefer nondairy milk, you can meet your calcium needs by consuming lactose-free milk products or calcium-fortified plant-based milk and yogurt. You may also want to seek out calcium-fortified foods or take a supplement. (See "If you avoid dairy.")

Many foods have calcium added to them — such as breakfast cereals, breads, pasta, rice, pancake and waffle mixes, juices,

and soy and almond beverages. Check the labels to determine the nutritional content of these foods.

Studies suggest that calcium-rich foods are better for you than calcium supplements because foods containing calcium generally include other important nutrients as well. For example, milk also provides protein, vitamins A, D and B-12, magnesium, riboflavin, potassium, and zinc. Dietary calcium may reduce the risk of high blood pressure and kidney stones, but supplements don't have this effect.

BONE-HEALTHY MEALS

Here are three sample menus developed by Mayo Clinic dietitians that provide the recommended amount of daily calcium.

The menus emphasize whole grains, vegetables, fruits and low-fat dairy products. This variety helps provide plentiful amounts of calcium and other nutrients.

Each day's menu is based on a diet of 2,000 calories, with no more than 30% of the calories coming from fat. (Keep in mind that you may need more calories or less.) Sodium is also limited to 2,300 mg a day or less.

Menu 1

Breakfast

- 1 cup whole-wheat flakes cereal, topped with a peach
- 1 cup skim milk

2 slices whole-grain toast

2 teaspoons honey

1 tablespoon almond butter (no salt added)

Lunch

Turkey sandwich a la Mediterranean: 1 ounce turkey, 1 ounce part-skim mozzarella cheese, ½ sliced tomato and 1 tablespoon pesto sauce on 2 slices whole-wheat bread

1 fresh apple

1 cup fresh vegetables: raw baby carrots, celery sticks and broccoli florets

¼ cup fat-free cottage cheese (dip)

8 ounces cranberry juice (unsweetened)

Dinner

4 ounces grilled salmon steak

½ cup (3 small) roasted new potatoes

Spinach with feta cheese and almonds (see recipe here)

1 whole-wheat roll with margarine

1 cup skim milk

Snack (anytime)

3 cups air-popped popcorn

Menu 1 nutritional analysis

Calories: 1,800

Protein, in grams (g): 99

Carbohydrates (g): 276

Fat (g): 43

Saturated fat (g): 10

Sodium (mg): 2,175

Calcium (mg): 1,140

Menu 2

Breakfast

Omelet: 1 egg, 2 egg whites, 1 ½ ounces low-fat cheddar cheese, ¼ cup chopped onion and 1 ¼ cup chopped tomato; cooked in 1 teaspoon corn oil

1 small cornmeal muffin

2 teaspoons fruit spread

6 ounces calcium-fortified orange juice

Decaffeinated coffee with low-fat milk

Lunch

Vegetarian chili with tofu (see recipe here)

6 wheat crackers

1 cup chopped cauliflower and cucumber

¾ cup blueberries

1 cup vanilla fat-free yogurt

Herbal tea or other calorie-free beverage

Dinner

Grilled chicken and vegetable kebabs: Marinate 3 ounces chicken in pineapple juice. Skewer and grill chicken pieces, bell peppers, cherry tomatoes and ½ cup pineapple chunks.

2/3 cup brown rice, tossed with parsley

2 cups spring greens with ½ cup orange segments and light vinaigrette

Water or other calorie-free beverage

Snack (anytime)

2 ounces (½ cup) unsalted pretzel twists

½ cup plain Greek yogurt with dill (dip)

Menu 2 nutritional analysis

Calories: 1,900

Protein (g): 109

Carbohydrates (g): 271

Fat (g): 47

Saturated fat (g): 14

Sodium (mg): 2,275

Calcium (mg): 1,422

Menu 3 (vegan)

Breakfast

1 cup calcium-fortified soy milk

5 ounces vanilla soy yogurt with 2 tablespoons ground flaxseed and 1 cup blueberries

1 banana

Lunch

Vegetable, lentil and chickpea stew (see recipe here)

1 whole-wheat pita with ½ cup hummus

1 cup sliced red bell pepper

Water or other calorie-free beverage

Dinner

Tofu with bok choy (see recipe here)

1 cup cooked quinoa

¼ cup sunflower seeds (dry-roasted, salted)

1 cup strawberries

1 cup calcium-fortified soy milk

Snack (anytime)

1 apple with 1 tablespoon almond butter (no salt added)

Menu 3 nutritional analysis

Calories: 2,100

Protein (g): 87

Carbohydrates (g): 300

Fat (g): 74

Saturated fat (g): 9

Sodium (mg): 1,900

Calcium (mg): 1,500

INCREASING YOUR CALCIUM INTAKE

Now that you know which foods are high in calcium, work on finding ways to make these foods part of your daily diet. Try to eat at least one serving of a calcium-rich food at each meal. Three servings a day can provide as much as 900 mg of calcium toward your daily goal of 1,000 to 1,200 mg. Consider the following tips:

- Add 1 ounce — a slice or two thin slices — of Swiss cheese to your sandwich for an extra 200 mg of calcium.
- Prepare instant oatmeal with low-fat milk instead of water — ½ cup of low-fat milk added to a packet of oatmeal provides about 150 mg of calcium. Fortified instant oats provide another 100 mg.
- Think soy. Many soy foods are high in calcium. These include edamame (fresh soybeans), commonly found with other frozen vegetables. One cup has about 100 mg of calcium. Firm tofu can be used in place of meat, poultry or fish in a stir-fry, with around 250 mg or more of calcium per ½ cup. Or snack on soy nuts (dried soybeans). One-third cup has about 45 mg of calcium.
- Instead of sour cream, which has little calcium and lots of fat, use fat-free plain or Greek yogurt as a dip for vegetables and fruit. One cup of plain yogurt typically has at least 400 mg of calcium.
- Like Southern-style foods? One cup of each of the following has about 100 to 250 mg of calcium: cooked greens (turnip, collard, kale, beet or spinach), okra, black-eyed peas and white beans.

- When making a smoothie, substitute ½ cup of low-fat milk, fortified nondairy milk or yogurt for water. Using ½ cup of calcium-fortified orange juice instead of plain juice also will boost the calcium content. You may also mix in a tablespoon of malt powder (50 mg of calcium) or dark molasses (41 mg of calcium).
- Use low-fat milk in place of water in soups. A 2-cup portion of soup may provide about 300 mg of calcium.
- Gourmet treatment can add calcium. Serve eggs or fish on a 1-cup bed of cooked spinach for about 250 mg of calcium. Or add 65 mg of calcium when you garnish vegetables or fish with 3 tablespoons of slivered almonds.

When cooking, remember not to add milk to boiling ingredients or a scalding-hot pan because milk scorches easily. Instead, add hot ingredients gradually to the milk, and then bring the whole mixture up to temperature. Most recipes containing milk can also be cooked without scorching in the microwave or in a double boiler. When using ingredients that are high in acid, prevent curdling by adding them to the milk gradually rather than vice versa.

CALCIUM SUPPLEMENTS

If you aren’t getting enough calcium in your diet, you may need to take a calcium supplement. A supplement is often recommended for postmenopausal women to help reduce the rate of bone loss.

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If you avoid dairy

For many people, getting daily calcium from a range of milk and dairy products isn't an easy option. You may follow a vegan diet, avoiding animal products, or you may have lactose intolerance — the inability to fully digest the sugar in milk (lactose). Your food choices may also depend on other special diets, cultural traditions or preferences.

In addition, some individuals avoid milk and other dairy products because they have heard health and safety concerns. Common misconceptions about milk include that it makes you fat, it's full of antibiotics and hormones, and it causes allergies. If you avoid dairy for any of these reasons, consider the following:

- The association between milk and body fat is controversial; however, eating low-fat versions of milk, yogurt and cheese can be part of a weight-loss diet.
- The Food and Drug Administration has approved the use of antibiotics in dairy cattle, as well as the use of bovine somatotropin (bST) to promote milk production. This hormone occurs naturally in milk and is biologically inactive in humans. Even so, you can buy organic milk, which comes from cows not given bST or antibiotics. Some conventional milk is now produced this way, too, so check the packaging.
- Milk allergies are usually a reaction to certain components in milk, such as the protein casein, and are uncommon. About 1% to 3% of children

experience allergies to cow's milk, which they usually outgrow by age 3. In adults, milk allergies are even more rare.

Lactose intolerance, on the other hand, is fairly common. Signs and symptoms may include bloating, cramping, gas, diarrhea and nausea. Discomfort usually begins 30 minutes to two hours after ingesting foods that contain lactose. But you probably don't need to forgo dairy products completely. Many people with lactose intolerance can comfortably digest hard cheeses, yogurt or even a small glass of milk with a meal. You can also find lactose-reduced milk and tablets or drops that can be chewed or added to milk to help you digest lactose.

If you choose not to consume dairy products regularly for any reason, you still need calcium. Look at the table here to find other foods that can boost your daily intake. Try calcium-fortified nondairy alternatives to find a version you like, add leafy greens such as kale or chard to meals, or choose tofu that's processed with calcium. Supplements also can help meet your daily calcium needs.

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Types

Different kinds of calcium compounds are used in calcium supplements. Each compound contains varying amounts of the mineral calcium — referred to as elemental calcium.

Common calcium compounds in supplements include:

- Calcium carbonate (40% elemental calcium)

- Calcium citrate (21% elemental calcium)
- Calcium gluconate (9% elemental calcium)
- Calcium lactate (13% elemental calcium)

The two main forms of calcium supplements are calcium carbonate and calcium citrate. Calcium carbonate is the cheapest form and therefore often a good first choice.

In addition, some calcium supplements are combined with vitamins and other minerals. For instance, some calcium supplements may also contain vitamin D or magnesium. Check the ingredient list to see which form of calcium your calcium supplement is and what other nutrients it may contain. This information is important if you have any health or dietary concerns.

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Reading a supplement label

Read the package label to learn a supplement's calcium content and serving size. Some supplements contain between 200 and 600 mg or more of calcium in a serving. For best absorption and minimal side effects, it is best to take no more than 600 mg of calcium at a time. Check the ingredients for any allergy concerns as well.

Example of a calcium Supplement Facts label:

Supplement Facts	
Serving size 1 tablet	
Amount per tablet	% Daily Value
Vitamin D-3 (as cholecalciferol) 400 IU	50%
Calcium (as calcium carbonate) 600 mg	46%

Other ingredients: Cellulose gel, maltodextrin, croscarmellose sodium, hypromellose, magnesium stearate, polyethylene glycol, gelatin, corn starch

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Choosing a supplement

To determine which calcium supplement may be best for you, consider these factors.

Amount of calcium

Elemental calcium is key because it's the actual amount of calcium in the supplement. It's what your body absorbs for bone growth and other health benefits. The Supplement Facts label on calcium supplements states how much elemental

calcium is in one serving. For example, calcium carbonate is 40% elemental calcium, so a serving that provides 500 mg of elemental calcium will actually contain 1,250 mg of calcium carbonate. Be sure to note the serving size on the supplement label.

Tolerability

Calcium supplements cause few, if any, side effects. But side effects can sometimes occur, including gas, constipation and bloating. In general, calcium carbonate is the most constipating form. You may need to try a few different brands or types of calcium supplements to find one that you tolerate the best.

Interactions with prescriptions

Calcium supplements can interact with many different prescription medications, including certain blood pressure medications, synthetic thyroid hormones, bisphosphonates, antibiotics and calcium channel blockers. Ask your doctor or pharmacist about possible interactions and which type of calcium supplement would work for you.

You may also want to ask about the best timing for taking any medications and a calcium supplement. It may be recommended to space them by at least one to two hours.

Quality and cost

Manufacturers are responsible for ensuring that supplements are safe and claims are truthful. Some companies may have their products independently tested by the U.S. Pharmacopeia (USP), ConsumerLab.com (CL) or NSF International.

Supplements that bear the USP, CL or NSF abbreviation meet voluntary industry standards for quality, purity, potency, and tablet disintegration or dissolution. Different types of calcium supplements have different costs.

Supplement form

Calcium supplements are available in a variety of forms, including tablets, capsules, chews, liquids and powders. If you have trouble swallowing pills, you may want a chewable or liquid form.

Absorbability

Your body must be able to absorb the calcium for it to be effective. All varieties of calcium supplements are better absorbed in small doses (600 mg or less) and are generally best absorbed when taken at mealtimes. However, calcium citrate is absorbed equally well when taken with or without food. This form is recommended for people with low stomach acid (more common in individuals over 50 or those taking stomach acid blockers), inflammatory bowel disease or absorption disorders.

Supplement risks

Calcium supplements aren’t for everyone. For instance, if you have a health condition that causes excess calcium in your bloodstream (hypercalcemia), you should avoid calcium supplements. If you aren’t sure if a calcium supplement is appropriate for you, talk to your doctor.

Some studies have suggested a possible link between calcium supplements and heart disease, but it’s still under

investigation. Research results have been mixed, including studies of calcium alone as well as calcium with vitamin D. More research is needed before doctors know any effect calcium supplements may have on heart attack risk.

There's similar controversy about calcium and prostate cancer. Some studies have shown that high calcium intake may increase the risk of advanced and metastatic prostate cancer, while others have shown no link or even a decreased risk of prostate cancer. But research has generally looked at diets high in calcium from dairy, not supplements. Again, more research is needed to understand this possible risk.

As with any health issue, talk to your doctor to determine what's right for you.

Too much calcium

Dietary calcium is generally safe, but more isn't necessarily better, and taking excess calcium doesn't provide extra bone protection. In fact, if the calcium in your diet and from supplements exceeds the tolerable upper limit, you could increase your risk of health problems such as kidney stones, prostate cancer and constipation. Too much calcium can also lead to calcium buildup in your blood vessels and impaired absorption of iron and zinc.

If you take calcium supplements and eat calcium-fortified foods, you may be getting more calcium than you realize. Check food and supplement labels to determine about how much calcium you're getting each day. You want to achieve daily recommended amounts but not exceed the recommended upper limit.

FOODS TO AVOID

In addition to learning what types of foods and food ingredients are good for your bones, researchers are also discovering food ingredients that can harm your bones. There are some foods and beverages you will want to avoid or consume only sparingly.

Limit sugar, salt and phosphate additives

Foods containing sugars that are added during processing generally provide a lot of calories, additives and preservatives but few vitamins, minerals and other nutrients. For these reasons, dietary guidelines often recommend that you limit processed foods and beverages.

In the United States, the No. 1 source of added sugar in the diet is sugar-sweetened drinks. Carbonated soft drinks are among the most consumed beverages but typically provide little to no nutrition beyond sugar. What's more, they may take the place of other drinks that could provide calcium or protein to your diet. And sweetened tea and coffee drinks can add excess calories, potentially affecting your weight.

The Nutrition Facts label on most packaged foods and beverages now includes added sugars. Look for this number to find out how much of the total sugar is naturally occurring, such as lactose in milk, versus added sugars contributing empty calories.

Most Americans also consume too much salt. The recommended daily amount is 2,300 mg, which is equivalent to about 1 teaspoon of salt. Most of this salt is found in

processed foods. Studies show that high levels of sodium are associated with high blood pressure. In addition, too much salt increases the amount of calcium you excrete from your body when you urinate.

Phosphorus, in the form of phosphates, is used as an additive in many processed foods such as hot dogs, chicken nuggets, chips, processed cheeses and spreads, instant gravies, sauces, fillings and puddings, frozen products that are breaded, and cola beverages. Too much phosphorus in your diet can interfere with how much calcium is absorbed through your small intestine. To limit your intake of sugar, salt and phosphate additives, check the labels on processed foods you buy at the grocery store. When preparing meals, use herbs, spices and fruits to flavor food.

Limit alcohol and caffeine

Alcohol supplies calories but few nutrients. It can be harmful for many reasons when consumed in excess, and some people shouldn’t drink at all. Having more than one to two alcoholic drinks a day can contribute to bone loss and reduce your body’s ability to absorb calcium. If you choose to drink, do it in moderation. Drinking alcohol with meals also slows its absorption.

Caffeine can slightly increase loss of calcium during urination, but much of the potentially harmful effect is due to caffeinated beverages too often being substituted for healthier drinks, such as milk. Moderate caffeine consumption — about 2 to 3 cups of coffee a day — won’t harm you as long as your diet contains adequate calcium. You can help offset calcium loss to

coffee drinking by adding a tablespoon or two of milk to each cup.

STEP ONE IN YOUR ACTION PLAN

Diet is one part of a healthy lifestyle. Calcium, vitamin D, protein and other nutrients are particularly essential for maintaining healthy muscles and bones to help you avoid fractures. When your goal is slowing bone loss, feeding your body a variety of nutrients is one way you can take action every single day.

Eating nutrient-rich foods and limiting less healthy choices in your diet can also help keep your energy up so that you can stay active and in control of other steps in your plan. In the next chapters, we'll discuss activity, medications, and other components of preventing or treating osteoporosis.

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Food sources of calcium

Food	Amount	Calories	Calcium (milligrams)
Dairy			
Yogurt, plain, low-fat	1 cup	155	450
Yogurt, with fruit, low-fat	1 cup	245	340
Greek yogurt, plain, fat-free	¾ cup	90	190
Milk, skim	1 cup	80-100	300
Milk, 2%	1 cup	120	295
Milk, fat-free, dry powder (1⁄3 cup dry milk makes 1 cup fluid milk)	1⁄3 cup	80	285
Milk, whole	1 cup	150	275
Frozen yogurt, low-fat	1 cup	220	175
Chocolate pudding, from dry mix	1 cup	290	270
Cottage cheese from whole milk	1 cup	205	175
Cottage cheese, low-fat, from 1% milk	1 cup	165	140
Ice cream	1 cup	275	170
Calcium-fortified nondairy milk			
Soy milk	1 cup	105	300
Almond milk, unsweetened	1 cup	37	449
Oat milk	1 cup	120	350
Cheese			
Ricotta, from part-skim milk	½ cup	170	340
American, processed	1 slice	60	80
Swiss	1 ounce	110	250
Cheddar	1 ounce	115	205
Mozzarella, from part-skim milk	1 ounce	85	195

Food sources of calcium (continued)

Food	Amount	Calories	Calcium (milligrams)
Fish			
Sardines, canned, with bones	3 ounces	180	325
Salmon, canned, with bones	3 ounces	120	240
Shrimp	3 ounces	85	60
Herring, pickled	3 ounces	225	65
Fruit			
Orange juice, calcium-fortified	1 cup	120	350
Orange	1 medium	65	60
Papaya	1 cup	62	29
Vegetables			
Rhubarb, sweetened (cooked)	1 cup	280	350
Collards (cooked)	1 cup	45	325
Spinach (fresh, cooked)	1 cup	40	240
Black-eyed peas	1 cup	200	40
Turnip greens (fresh, cooked)	1 cup	30	200
Bok choy (cooked)	1 cup	25	185
Okra (fresh, cooked)	1 cup	35	125
Beans, Great Northern (cooked)	1 cup	210	120
Edamame, shelled (cooked)	1 cup	200	100
Swiss chard (frozen, cooked)	1 cup	40	100
Kale (fresh, cooked)	1 cup	40	175
Broccoli (fresh, cooked)	1 cup	55	75
Carrots (raw)	1 cup	50	40
Broccoli (raw)	1 cup	30	45
Other foods			
Tofu (firm), processed with calcium	½ cup	100-185	250-860
Tomato soup, with milk	1 cup	140	175

Food	Amount	Calories	Calcium (milligrams)
Blackstrap molasses	1 tablespoon	60	100
Pizza with cheese	3-ounce slice	220	145
Macaroni and cheese, boxed	1 cup	310	160
Hummus	2 ounces	155	65
Sunflower seeds	1 ounce	165	20
Peanuts, roasted	1 ounce	165	15
Cashews, oil-roasted	1 ounce	165	15
Cereal, calcium-fortified	Check label on cereal box		

Sources: USDA Nutrient Database for Standard Reference, Legacy, and USDA FoodData Central 2019-2021.

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Recipes

Spinach with feta cheese and almonds

Serves 6 (generous ½-cup portions)

¼ cup slivered almonds

1 teaspoon extra-virgin olive oil

1 large garlic clove, chopped

4 scallions (green garden onions with tops), chopped

1 ½ pounds spinach, stems removed and well washed in several changes of cold water

A small amount of water

Freshly ground black pepper

4 ounces crumbled, reduced-fat feta cheese, at room temperature

Lemon wedges

Toast slivered almonds in a sauté pan over medium heat until slightly browned and fragrant. Put asidwe to cool. In the same pan, heat oil, add garlic and scallions, and cook gently for 15 to 20 seconds, being careful not to let the garlic brown. Add spinach and a bit of water. Cover and cook for about 1 minute. The spinach will wilt rapidly. Remove from heat and top with black pepper, feta cheese crumbles and toasted almonds. Garnish with lemon wedges and serve immediately.

Nutrient content per serving:

Calories: 140

Fat (g): 9

Saturated fat (g): 2

Cholesterol (mg): 15

Sodium (mg): 300

Calcium (mg): 190

Vegetarian chili with tofu

Serves 4

1 tablespoon olive oil

1 small yellow onion, chopped (approximately 1/2 cup)

12 ounces extra-firm tofu, cut into small pieces

2 cans (14 ounces each) diced tomatoes with no salt added

1 can (14 ounces) kidney beans with no salt added, rinsed and drained

1 can (14 ounces) black beans with no salt added, rinsed and drained

3 tablespoons chili powder

1 tablespoon oregano

1 tablespoon chopped fresh cilantro (fresh coriander)

In a soup pot, heat the olive oil over medium heat. Add the onion and sauté until soft and translucent, about 6 minutes. Add the tofu, tomatoes, beans, chili powder and oregano. Bring to a boil. Reduce heat and simmer for at least 30 minutes. Remove from the heat and stir in cilantro. Ladle into individual bowls and serve immediately.

Nutrient content per serving:

Calories: 288

Protein (g): 20

Carbohydrates (g): 45

Fat (g): 5

Saturated fat (g): 0.7

Sodium (mg): 326

Calcium (mg): 195

Vegetable, lentil and chickpea stew

Serves 8

3 cups butternut squash (approximately 1 ½ to 2 pounds), peeled, seeded and cut into 1-inch cubes

3 large carrots, peeled and cut into ½-inch pieces

2 large onions, chopped

3 garlic cloves, minced

4 cups low-sodium vegetable stock

1 cup red lentils

2 tablespoons no-added-salt tomato paste

2 tablespoons peeled and minced fresh ginger

2 teaspoons ground cumin

1 teaspoon turmeric

¼ teaspoon saffron

1 teaspoon freshly ground pepper

¼ cup lemon juice

1 can (14 ounces) chickpeas (garbanzo beans), drained and rinsed

½ cup chopped roasted unsalted peanuts

½ cup chopped fresh cilantro

In a Dutch oven, slowly sweat vegetables (squash, carrots, onions and garlic) over low to medium heat until onions just start to brown. Stir in vegetable stock and scrape up the browned bits of vegetables on the bottom of the pan. Add lentils, tomato paste and seasonings. Cover and continue to cook over medium-low heat until lentils and squash are soft (about 1 to 1 ½ hours). Stir occasionally. (Or at this step

transfer ingredients to slow cooker and cook for 4 to 6 hours on low setting.) Stir in lemon juice and garbanzo beans. Serve warm and top with chopped peanuts and cilantro.

Nutrient content per serving:

Calories: 291

Protein (g): 14

Carbohydrates (g): 43

Fat (g): 9

Saturated fat (g): 1.2

Sodium (mg): 182

Calcium (mg): 101

Tofu with bok choy

Serves 4

1 pound firm tofu, drained

2 tablespoons hoisin sauce

2 tablespoons rice vinegar

1 tablespoon firmly packed brown sugar

1 tablespoon low-sodium soy sauce

1 teaspoon Dijon mustard

½ teaspoon chili garlic sauce

1 clove garlic, minced

4 heads baby bok choy, halved

1 teaspoon sesame oil

Heat the oven to 450 F. Cut the tofu lengthwise into 4 slices. Cut each slice into 2 triangles. Place the tofu triangles on a plate and cover with plastic wrap. Top with a second plate and a heavy weight and let stand for 10 minutes to drain.

In a small bowl, whisk together the hoisin sauce, vinegar, brown sugar, soy sauce, mustard, chili garlic sauce and garlic. Spread 1⁄3 of the mixture in an oblong baking dish. Drain the tofu, arrange the triangles in the dish and top with the remaining hoisin mixture. Bake until heated through, 10 to 15 minutes.

While the tofu is baking, bring 1 inch water to a boil in a large pot fitted with a steamer basket. Add the bok choy, cover and steam until tender, 6 to 8 minutes. Transfer to a plate. Sprinkle with the sesame oil. Serve 2 bok choy halves and 2 tofu triangles on each individual plate.

Nutrient content per serving:

Calories: 150

Protein (g): 13

Carbohydrates (g): 13

Fat (g): 6

Saturated fat (g): 1.1

Sodium (mg): 438

Calcium (mg): 382

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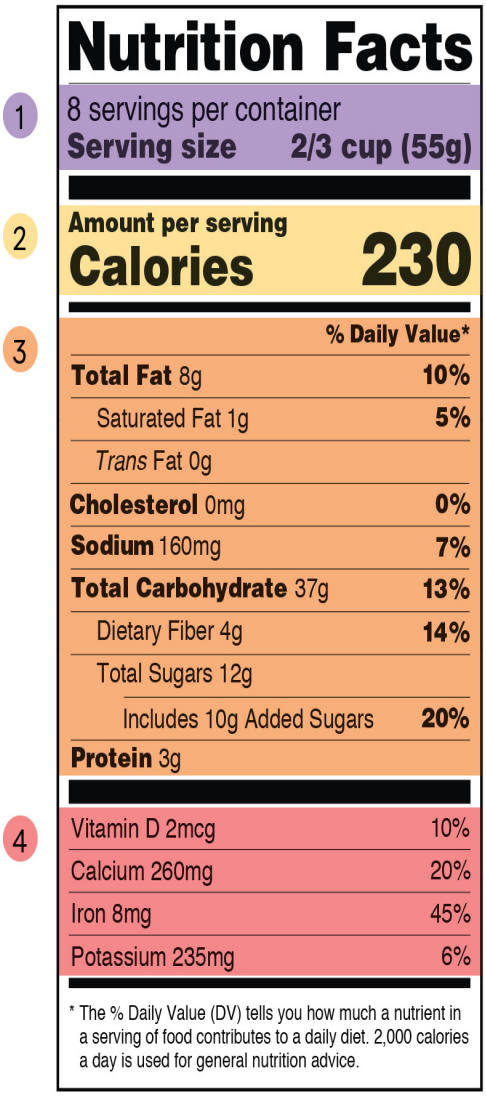
Reading the nutrition facts label

Look for this key information on the Nutrition Facts label that appears on most packaged foods and drinks in the U.S.



Source: U.S. Food and Drug Administration, 2019.

1. *Serving size:* The size of a single serving is listed in standard measurements, such as cups or pieces. Be sure to check the serving size against how much you actually eat.
2. *Calories:* This number shows the amount of calories in one serving.
3. *Nutrients and Daily Value:* The label lists the amount of fat, cholesterol, sodium, carbohydrate, fiber, sugar,

protein, vitamin D, calcium, iron and potassium in one serving. The Daily Value tells you the percentage of the recommended daily amount (or limit) one serving provides, based on a 2,000-calorie-a-day diet.

4. *Vitamins and minerals:* Vitamin D, calcium, iron and potassium are listed on the label to encourage people to get more of these important nutrients. Other vitamins and minerals in the food are listed here as well.

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Chapter 9

Staying active

Like the rest of your body, your bones thrive on movement. That's why activity and exercise are good for bone health. During childhood, regular physical activity increases bone mass. It helps you maintain bone density as a young adult. And it can help offset bone loss as you age. Physical activity also helps improve your posture and balance, which in turn reduces your risk of falls.

Beyond its benefits for bones, physical activity keeps you healthy and strong, and it can give you more energy.

This chapter guides you on the path to a more active lifestyle. The exercises described on the following pages are designed to strengthen your bones while minimizing your risk of fractures. No matter what your age or condition, regular physical activity can be an enjoyable part of your day.

PUTTING THOUGHTS INTO ACTION

You may know that exercise is good for you, but in the past you didn't have the time, the energy or the right equipment to exercise. Maybe you found exercise boring, or you were afraid of getting injured. The fact is, most adults don't get enough exercise. Only about 20% to 25% of adults meet recommended guidelines for aerobic and muscle-strengthening activities.

If you're at risk of osteoporosis or you already have it, it's even more important to find ways to fit physical activity into your life. You may be

reluctant to exercise because of concerns about injury or pain. But avoiding physical activity only allows bone loss to continue unchecked and puts your skeleton in greater jeopardy. Making physical activity a routine part of your day is one of the best things you can do to care for your bones.

Physical activity doesn't have to be a tedious chore requiring hours at the gym, fancy workout clothes or specialized equipment. Routine tasks can be just as important as formal exercise.

Exercise is generally viewed as a structured, planned approach that's often measured or timed, such as doing 15 stretches or walking briskly for 30 minutes. Activity, meanwhile, refers to almost every motion of your body as you go about performing daily tasks and living your life. Spending a part of each day straightening up the house, shopping, mowing the lawn, walking the dog or gardening can contribute to bone strength when the activities are done on a regular basis.

Although the activities of daily living are vital to any action plan for osteoporosis, the needs and capabilities of one person are quite different from those of another. You and your doctor can discuss which types of exercise and daily activity are the best fit for your situation.

The information that follows focuses on a simple exercise program to supplement the regular activities in your day. With a few general rules and tips, this program will allow almost anyone, regardless of his or her specific circumstance, to establish a safe exercise routine. Several of the exercises described in this chapter may appeal to you and be included in your routine, but many other exercises would be suitable choices, too.

GETTING STARTED

If you're trying to prevent or treat osteoporosis, the types of activities and exercises you choose to do will be based on your goals, overall health status, degree of bone loss and what you enjoy doing. You may want to avoid some exercises and movements that could cause more damage to your bones. What's appropriate for one individual may not help another.

Your doctor can help you determine what exercises will do you the most good and how intensely to do them.

The important thing is to participate safely in some activity in a regular and sustained manner. Any safe exercise is better than no exercise. Your best bet is to choose exercises that you enjoy. That way you're more likely to stay active for the long haul. Often a combination of different exercises is recommended to help prevent or treat osteoporosis. These include weight-bearing, resistance and back-strengthening exercises.

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Warning signs during exercise

No matter what exercise you're doing, stop and seek immediate care if you experience any of these warning signs:

- Tightness in your chest
- Severe shortness of breath
- Chest pain or pain in your arms or jaw, especially on the left side
- Heart palpitations
- Dizziness, faintness or feeling sick to your stomach

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Consult your doctor

If you have osteoporosis, talk to your doctor before starting an exercise program. For one thing, a doctor can assess your overall health status and family medical history, such as whether you or anyone in your family has or had cardiovascular disease or high blood pressure. Be aware that some medications, especially sedatives such as diazepam (Valium) or alprazolam (Xanax) and those that help you sleep, can affect the way your body reacts to exercise. Ask your doctor about how your medications may affect your exercise plan.

Talking with your primary care doctor is a good starting point. In addition, a physical therapist or an exercise specialist may be able to give helpful input about appropriate exercise routines, including how best to warm up and cool down. A physical therapist can demonstrate proper body mechanics, safe methods for stretching and strengthening muscles, and proper use of the equipment you use as well. Some hospitals and fitness centers offer special exercise classes for people with osteoporosis.

Assess your fitness level

Although osteoporosis and other conditions may prevent you from doing certain activities, almost everyone can participate in some form of exercise. It's helpful to have a realistic appraisal of your fitness level as you plan your routine.

If you can easily do all of your normal daily activities at a reasonable pace without feeling breathless or dizzy, breaking a sweat, or having chest pain, you're probably fit enough for a simple exercise program. Flexibility and muscle strength also are important components of your fitness level to consider.

Signs of not being fit (deconditioning) include feeling tired most of the time, being unable to keep up with the pace of others your age, avoiding activities because you know you'll tire quickly, and becoming short of breath or fatigued after walking a short distance.

If you've been inactive or in a weakened condition or you have low bone density, don't expect to be able to run 3 miles and lift heavy weights. And you don't need to work out two hours a day, seven days a week to make great strides in your fitness. Begin with short amounts of physical exercise — perhaps no more than five to 10 minutes. If all goes well, begin to gradually increase your activity. Try to keep physical exertion at a level you can safely and comfortably perform.

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Yoga do’s and don’ts

Living with osteoporosis means using a little extra caution with certain activities. While some yoga postures aren’t recommended, practicing yoga can still be a gentle, safe activity that’s great for improving your balance, flexibility and strength. The suggestions on this list apply to many people with weakened bones, but talk with your doctor about which postures are safe for you.

Do

- Standing postures — if any twisting or side bending is involved, do so with spinal elongation
- Fish
- Locust
- Downward-facing boat
- Sphinx
- Cobra
- Upward-facing dog
- Plank
- Tadasana
- Urdhva hastasana in tadasana
- All warriors — with good body alignment
- Extended puppy pose

Don’t do

- Abdominal crunches
- Situps
- Knee to chest
- Toe touches — seated or standing — or rag doll
- Straight leg raising and leg circles
- Supine spinal twist
- Forward bends
- Traditional child’s pose
- Spinal rocking

- Plow pose
- Cat pose (with rounded back) of cat-cow stretch
- Pigeon pose

Use caution

- All seated postures — avoiding compression.
- Spinal twists — do with elongated spine and begin from positions of least to most compression: lying faceup, lying on your side, lying facedown, positioned on hands and knees, kneeling, standing to sitting.
- Extended child's pose.
- Bridge — only do if you can lift your thoracic spine and are not having compression in that area; check your cervical spine alignment.
- Downward-facing dog — it's important to lengthen the back.
- Side-lying leg raises — make sure you can keep neutral hip alignment when raising your leg.

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Set your goals

Setting goals is a good way to get motivated and stick with your exercise program. Try to make your goals specific, measurable and achievable. It's always encouraging to see or feel some results as you exercise. Setting your goals too high, rather than smaller short-term goals, can lead to frustration and failure.

Your physical activity goals may center around:

- Increasing your ability to carry out daily tasks and activities, such as walking comfortably for a certain length of time or distance
- Maintaining or improving your posture and balance
- Relieving or lessening pain
- Preventing falls and fractures

- Increasing your sense of well-being

If you have chronic pain, your goals also may include exercises to help lessen your pain and increase mobility. After consulting with your doctor or physical therapist, you may come up with a list of several gentle stretches to try. Perhaps your initial goal will be to do a certain number of stretches each day for a week. At the end of the week, note whether your pain has lessened and whether you're able to move a bit more easily. If so, consider increasing your activity — adding a short walk to your day or increasing the number of stretching exercises you do. If you're not feeling better, talk to your doctor about other possible exercises.

If your overall goal is to improve your posture, perhaps start with a few balance and posture exercises every other day. Or maybe your goal is to walk briskly for 30 minutes, four days a week. Start with 10 to 15 minutes daily and build from there.

It's important to monitor your activity and adapt what you do so that it serves you best. You might want to keep an exercise diary to chart your progress.

Avoid risky movements

If you have low bone density or already have osteoporosis, a few precautions may be necessary when you exercise or perform physical activities. Certain movements may be dangerous because of the stress they put on the spine. This includes some positions used in yoga. Yoga positions that involve severe flexing or twisting of the spine may lead to compression fractures. This list features a number of yoga postures that are relatively safe or that are best to avoid if you have osteoporosis.

Certain Pilates exercises may also be of concern. Talk with your doctor about which positions might be risky for your individual situation.

You may not be able to avoid all movements that can potentially be dangerous. Practicing good posture and body mechanics and paying attention to how you move will help.

Forward bending

Avoid activities and exercises that involve bending forward because they increase the risk of compression fractures of your vertebrae. Try not to round your back as you make the bed, tie your shoes, pull weeds, reach down to pick up something from the floor and so on.

Instead, keep your back straight as you bend at the knees to lower your body. Forward rounding of the torso is especially dangerous if you're carrying anything, such as when you take a heavy pan out of the oven or set a bag of groceries on the floor.

Heavy lifting

Avoid heavy lifting, which may include lifting loads of laundry, grocery bags or exercise weights. These motions increase the stress on your vertebrae. If you must lift a heavy object, carry it close to your body. Be careful when opening windows or manually opening a garage door.

Twisting

Twisting movements can place unusual force on the spine. When you're driving, use your rearview and side mirrors or backup camera for backing up and parking so that you avoid twisting to look behind you. Golfing and bowling are both risky because of the twisting movements they involve. Talk to your doctor or physical therapist about whether you can safely participate in these activities.

Reaching overhead

For people with severely stooped posture, reaching above the shoulders — as when you reach for something on a high shelf — isn't recommended. This position can make balancing difficult.

High-impact activities

Activities that involve jarring movements, sudden stops and starts, and abrupt weight shifts put too much stress on the spine and can lead to falls and knee injuries in older adults. These include jogging, running, soccer, racket sports, volleyball and basketball. If you're unsure about the impact level of an activity you enjoy, talk with your doctor or physical therapist.

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Low-impact weight-bearing activities

Any of the following activities would generally be a safe, invigorating choice for someone with osteoporosis:

- Walking
- Treadmill walking
- Using an elliptical machine
- Using a stair-step machine
- Low-impact aerobics
- Tai chi
- Dancing
- Light gardening
- Deep-water walking
- Water aerobics

Water activities don't provide the impact your bones need to slow mineral loss, but they can be beneficial for people with severe osteoporosis.

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Do it!

When it comes to exercise, finding the motivation to stick with an exercise program can be a challenge. To be successful, you need to make a commitment to being active. This doesn't mean that you won't have setbacks or occasionally need to take breaks. The key is to keep going. Try not to let a small setback or break turn into a mental roadblock. Consider these tips:

- **Start slowly.** Don't jump into an intense exercise program right away if you haven't been physically active in awhile. Focus on doing small amounts of activity more frequently. Then you can gradually work up to longer periods and more strenuous forms of exercise.

- **Schedule exercise into your day.** Schedule your activity, just as you would an important errand or a social event. But don't be rigid about sticking to your schedule if you don't feel up to it. If you're very tired or you're not feeling well, take a day or two off.
- **Pace yourself.** If you're unable to talk while you're exercising, you're probably working too hard. Slow your pace.
- **Listen to your body.** You may feel some muscle soreness and discomfort as you begin exercising, but you shouldn't feel pain. And soreness shouldn't last more than 24 to 48 hours. If the discomfort persists, you may be working too hard. Try easing up.

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Walking: An ideal exercise

Walking is considered a safe, simple and cost-free exercise that causes minimal jarring to your bones. It requires no special equipment, lessons, other participants or membership fees. For many older adults and those with osteoporosis, walking is a mainstay activity.

A walking program shouldn't be too easy or too hard. When you start, walk a short distance at a comfortable speed. Then gradually increase your distance but not the pace. As you feel yourself becoming better conditioned, you can begin a more formal program of fitness walking, aiming for a speed of around 3 to 5 miles per hour. A walking program should be done at least every other day to build both flexibility and endurance.

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EXERCISES FOR OSTEOPOROSIS

Three types of exercise are often recommended for people with osteoporosis: weight-bearing exercise, resistance exercise and back-strengthening exercises with extension. Doing a little of each in a structured program can help you keep your bones strong and maintain

good posture. Remember that exercise doesn't have to be strenuous to be effective.

Warming up and cooling down

It's important to allow time for warming up before any physical exercise and cooling down afterward. Warming up gradually increases your heart rate, and it loosens up your muscles, which reduces your risk of injury.

To warm up, walk slowly, then increase your pace gradually. Or begin an activity, such as bicycling or swimming, at a relaxed pace until you feel loose.

End each exercise session by walking slowly or continuing the activity at a slower pace. It's also a good time to stretch the muscles you used during your exercise.

Weight-bearing exercise

Weight-bearing exercises have nothing to do with weightlifting equipment. They're done on your feet with the bones of your lower body supporting your weight. These activities help slow mineral loss in the bones of your legs, hips and lower spine.

Many young adults build bone mass through their participation in high-impact activities, which places greater loads on their bones. High-impact activities include jogging, soccer, basketball, volleyball, racket sports, gymnastics, dance and figure skating.

Older adults or people with low bone density should take precautions against too much impact and avoid activities that involve a high risk of falling. Low-impact activities such as walking place less stress on fragile bones.

If slower paced activity sounds more your speed, tai chi may be a good choice. This ancient Chinese martial art is now practiced as a graceful form of exercise. It involves a series of movements performed in a slow, focused manner with deep breathing. Tai chi may help improve your strength and balance through gentle weight-bearing exercise and

stretching. Still, if you have severe osteoporosis, talk with your doctor before trying it.

Someone in a frail condition may opt for weight-supported exercises — as opposed to weight-bearing exercises. Weight-supported exercises include swimming, floor exercises or cycling on a stationary bike.

Remember that weight bearing is all about being on your feet. The most important thing is to choose exercises that you enjoy. Walking not only improves your balance and coordination, it's one of the best exercises for reducing your risk of falls.

Take a brisk walk around the block with a neighbor or walk on a treadmill while watching television. If you don't use walking as a form of regular exercise, fit in short walks whenever possible. Make your walks more fun by bringing a friend or your spouse. On poor-weather days, consider indoor walking at a mall or a health club. Remember to include warm-up and cool-down periods.

Aerobic benefits

Weight-bearing exercises also provide aerobic benefits. Aerobic activities increase your breathing and heart rate, which improve the health of your heart, lungs and circulatory system. This gives you more stamina, which makes it easier to do whatever you need to do, whether it's cleaning the house or climbing stairs.

Even if your doctor advises you to avoid weight-bearing exercises, you can still gain aerobic benefits from low- or no-impact exercises, such as swimming, water exercises and indoor cycling.

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Stretching and flexibility

Stretching exercises help increase your flexibility, another key component of overall fitness. Flexibility is the capacity to move a body part, such as a leg or an arm, in different directions around a joint, such as a knee or an elbow. Having a maximum range of motion around a joint helps prevent muscle injury.

The specific exercises you perform may depend on your physical condition and the exercise goals you've set for yourself. For example, for people with low bone density, the back-strengthening exercises described in this chapter may be useful.

Stretching exercises can be done every day, often in conjunction with weight-bearing exercise. The ideal time to stretch is when your muscles are loose — after you've exercised for eight to 10 minutes. Stretching your muscles without a warmup increases the risk of strains.

Stretches should be gentle and slow. Stretch only until you feel a slight tension in the muscle. Relax and breathe deeply while you stretch. Hold your stretches for at least 30 seconds. It takes time to safely lengthen muscles.

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Resistance exercises

Whereas weight-bearing exercise uses gravity to strengthen the bones in your lower body, resistance exercise applies weight — or resistance — to specific muscles to strengthen them. Strong muscles allow you to stand up straight and move with confidence, and they help keep you from falling. Activities that build muscle strength also work directly on bone to slow mineral loss.

To create resistance, your muscles have to push or pull against an opposing force. A common way to do resistance exercise is to lift weights, either with free weights or with weight machines. For this reason, resistance exercise is sometimes called weightlifting, weight training or strength training. But conditions such as osteoporosis can

make it difficult and unsafe to hoist heavy weights. Other, more-gentle methods of resistance training include isometric exercises, resistance bands and water workouts.

Why do you need resistance exercise? As you grow older, your muscle fibers shrink in number and size. Sometime after age 30, your muscle mass begins to diminish by as much as 1% each year. The quality of muscle fibers changes too. That means you could have 40% less muscle at age 70 than you did at age 30. Losing muscle mass not only saps your strength but also affects your balance and coordination.

If you have osteoporosis, you'll need assistance in designing a resistance training program that includes proper lifting techniques and that's appropriate for your degree of bone loss. Consult your doctor, a rehabilitation specialist (physiatrist), a registered physical therapist or a certified athletic trainer to determine the type of resistance exercise that's best for you.

Weight training

With proper supervision, many older adults, including those with osteoporosis, can participate in weightlifting. But you'll need to check with your doctor first. He or she can prescribe exercises based on your bone density and fitness level. The weights should be light. And you'll need to pay strict attention to proper technique to avoid placing too much stress on the spine.

Exercising with free weights is a great way to build muscle mass because it can simulate motions you make in real life, such as carrying boxes or lifting a bag of groceries. Start with weights of 1 or 2 pounds — and not more than 5 pounds. You should be able to lift the weights comfortably at least eight times. One set of 10 lifts, repeated a few times a week, can build muscle.

Free weights and weight machines can be found at most gyms and health clubs and in some schools. You can make your own weights by filling old socks with beans or pennies or by partially filling a half-gallon jug with water or sand. Or you may be able to purchase used weights at some

athletic equipment stores. Make sure you receive instruction on how to use them.

Isometric exercise

These exercises involve tensing your muscles while holding them in stationary positions. When you push your arm against a wall, for example, there's a buildup of tension in the muscles even though your arm isn't moving. Your own body creates the resistance.

Isometric exercises are especially useful for people recovering from injuries that limit range of motion. You should avoid isometric exercises if you have high blood pressure or heart disease because your blood pressure can rise significantly during the muscle contractions.

Resistance bands

Large elastic or latex bands — they look just like large rubber bands — provide resistance when you pull on them. These exercise bands are made with different degrees of resistance to match your fitness level. Consult your doctor or an exercise specialist to select an appropriate resistance level. Someone with osteoporosis should start exercising with low-resistance bands. Resistance bands can easily be used at home or packed in a suitcase when you travel. Some bands have handles or an anchor so that they can be attached to a door.

Water workouts

Water offers resistance as you push against it. Simply walking in water using correct posture will strengthen your abdominal muscles. You can also perform upper and lower body moves such as curls and squats in the water. For a more intense workout, use barbells and weighted boots, which add to water's natural resistance.

Many organizations, including YMCAs, YWCAs, health clubs and hospitals, offer water exercise classes. Be sure to inform your instructor if you have any health conditions such as osteoporosis that might affect your workout.

Whole-body vibration

With whole-body vibration, you stand, sit or lie on a machine with a vibrating platform. As the machine vibrates, it transmits energy to your body.

The low-intensity vibrations generated by the machine are said to mimic the effects of weight-bearing exercises. They make muscles work against gravity, thereby stressing bones enough to cause them to rebuild themselves and, theoretically, increase their density.

Whole-body vibration may offer some fitness and health benefits in the short term, but it's not clear if this type of activity is as good for you as regular exercise. Some research shows whole-body vibration can reduce bone loss as well as improve balance and decrease back pain, but long-term comprehensive studies are lacking, and the effect on other organs is not clear yet.

The device can also be dangerous. The vibration makes some people dizzy and faint, and some have fallen off the platform and been injured.

Because whole-body vibration can be harmful in some situations, check with your doctor before using it. You may find a whole-body vibration machine at a local gym, or you can buy one for home use.

HOW MUCH EXERCISE?

At this point, you may have a number of questions. How often should you exercise (frequency)? How hard a pace should you exercise at (intensity)? How long should you exercise (duration)? Your doctor or a physical therapist can help you answer all of these.

Remember that it's best to start out at a comfortable level and, when you're ready, gradually increase your exertion. If you take more than a few days off, start back gradually — do less than you were last doing. Here are some other tips.

Frequency

The more often you exercise, the better. To receive the maximum health benefits of exercise, try to do weight-bearing and back-strengthening exercises most days of the week. Include resistance exercise two to three times a week.

Intensity

For weight-bearing exercise, start at a pace you can continue for five to 10 minutes without feeling fatigued. As a rule of thumb, if you can't carry on a conversation while exercising, you're probably working too hard.

For most people, resistance exercise should be done at about 80% of their maximum muscle strength. This usually means lifting the same weight eight to 10 times. In general, to improve bone density and promote bone strength, the intensity of your activities — how hard you work — should increase over time. But the increase in intensity should be gradual.

Duration

To begin with, try to accumulate at least 30 minutes of weight-bearing exercise each day. This doesn't have to be done all at one time. Rather, it's the total amount of activity you undertake in a day, including routine tasks.

After about six months of gradually becoming more fit and increasing your activity level, your daily routine might include:

- A five-minute warmup
- 30 minutes of weight-bearing exercises
- A five- to 10-minute cool-down period
- 10 to 15 minutes of back-strengthening exercises

Two or three times a week, include 10 to 20 minutes of resistance exercise as well.

All of this activity can be broken into smaller sessions and spread throughout the day.

STAYING IN THE GAME

For someone who is at risk of osteoporosis or already has it, activity and exercise play an important part in preventing or managing the condition. No matter what exercises you undertake, the important thing is to get moving and make physical activity a regular habit.

Your attitude is key. If you can't seem to stick with an exercise program, you're probably missing a crucial ingredient — fun. If exercise isn't enjoyable and rewarding, you won't do it for long. Make exercise part of everyday activities and hobbies that you enjoy. Be active with family members, or choose an activity you've always wanted to try.

Here are other ways to stay motivated:

- **If you're a beginner, develop a six-month exercise plan.** People who stick with a new behavior for six months generally have long-term success — exercise becomes a habit.
- **Choose exercises that fit your personality, physical health and lifestyle.** Do you like to exercise alone or with a buddy? Do you like being outside or indoors?
- **Add variety to your exercise routine to prevent boredom.** For example, alternate walking and bicycling with swimming or a low-impact aerobics class. On nice-weather days, do your back-strengthening exercises outside.
- **Join a class with people of a similar age and fitness level.** Peer support can keep you going.
- **Find an exercise buddy.** Exercising with a companion will help you stay motivated. Encourage your friends and family to be active with you.
- **Be flexible.** If you're traveling or especially busy a certain day, it's OK to skip or shorten your exercise program to accommodate your schedule.
- **Track your progress.** Keeping a log helps you work toward your goals and reminds you of how far you've already progressed.
- **Reward yourself at milestones in your exercise plan.** Schedule something special that you've always wanted to do. Visit a special

hiking spot, invest in exciting new gear, or plan a special meal to celebrate.

- **Forgive lapses.** Everyone falls off the exercise wagon at some point. That's no excuse to quit. Remind yourself that it's just a temporary setback, and get moving again.

Keeping physically active on a regular basis is one of the most valuable gifts you can give yourself. Exercise can be as simple as walking around the block or doing a few stretches while you listen to music. Being more active is one way you can take charge of your health and help manage a number of health conditions, including osteoporosis.

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Resistance exercises

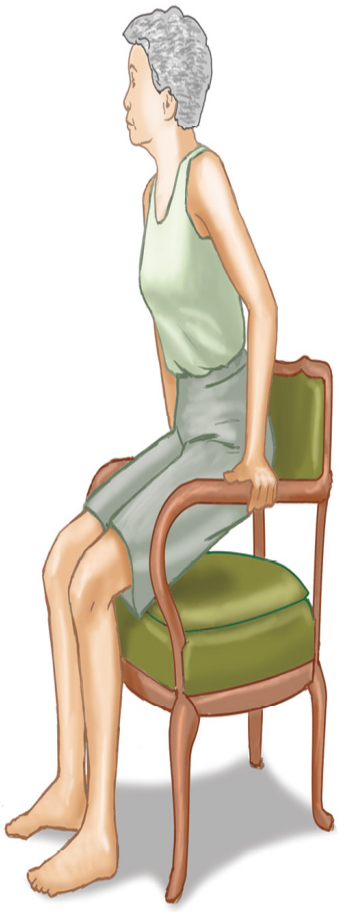
Following are some simple resistance exercises that you can try. Move slowly and smoothly as you perform each of these exercises. Inhale before you lift or exert, and exhale as you lift.

To begin with, do three to 10 repetitions of each exercise. Take it easy, and don't overdo it. Gradually add new exercises or more repetitions if the original set of exercises becomes easy after doing it for at least three days.

These exercises shouldn't hurt in any way while you're doing them or cause soreness for more than a day afterward. If they do, stop the exercises and consult your doctor or a physical therapist.

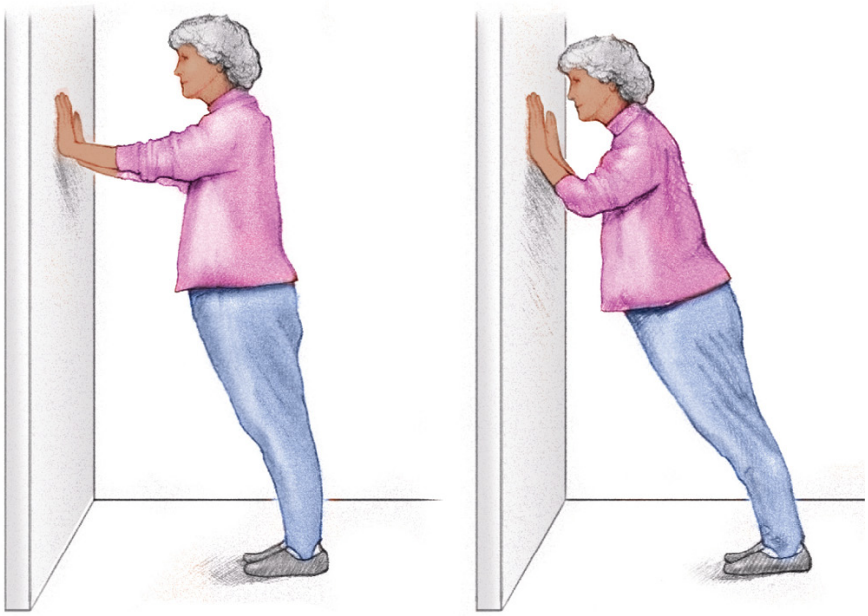
Resistance exercises are an important part of your exercise program because they can slow or even reverse age-related decline in muscle mass and bone density. They can also help improve compression fractures and stooped posture and reduce your risk of falls.

A doctor or physical therapist can provide instruction on additional exercises you can perform at home or at the gym to help build bone mass.



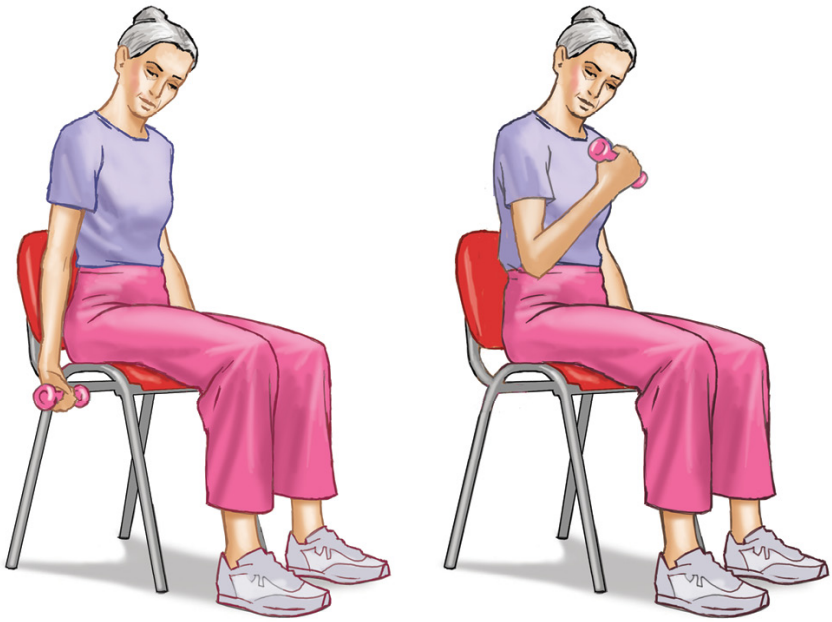
Chair situps

Sit in a chair that has arms. Push your body up from the chair using only your arms. Hold this position for 10 seconds. Relax and repeat.



Wall pushups

Face the wall, standing far enough away so that you can place your palms on the wall with your elbows slightly bent. Keeping your heels flat on the floor, slowly bend your elbows and lean toward the wall, supporting your weight with your arms. Try to keep your back straight. Straighten your arms and return to an upright position.



Biceps curls

Sit in a chair and have 1- or 2-pound weights in each hand. Start with your arms at your sides. Bend one arm at the elbow, lifting a weight to your shoulder without moving your shoulder or upper arm. Lower it slowly. Repeat with the other arm.

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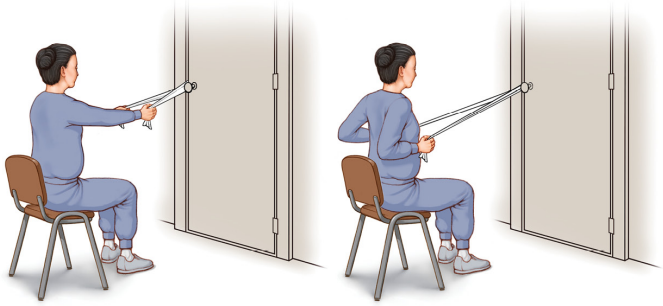
Back-strengthening exercises

Strengthening your back muscles can help treat osteoporosis by improving posture and reducing your risk of vertebral fractures. A few back-strengthening exercises are shown here. To begin with, try to do at least three repetitions of each exercise but not more than 10. Add more repetitions when the exercises become easy. Remember to avoid exercises that round your back and increase pressure on your spine.

Talk to your doctor or a physical therapist about other exercises that help strengthen the back. Exercises that use specially designed, weighted backpacks may be beneficial in improving back strength and reducing compression fractures.

Lower back extensions

Starting from a hands-and-knees position, raise one leg at the hip, keeping your knee bent. Keep your trunk straight. Maintain this position for five seconds. Repeat the exercise with the other leg.



Upper back extensions

Sit upright in a chair with a resistance band tied to a doorknob in front of you. Grab the band in each hand and squeeze your shoulder blades together to gently stretch the band, with arms bent at 90 degrees. Hold the position for five seconds. Relax and repeat.

Back flattened against the floor

Relaxed

Pelvic tilts

Lie on the floor on your back with your knees bent and your feet resting flat on the floor. Tighten your abdominal muscles as you roll your pelvis down, flattening the small of your back against the floor surface. Avoid using your leg and buttock muscles.

Chapter 10

Taking medications

Getting enough calcium and vitamin D in your diet and being physically active are key components of any plan for preventing and treating osteoporosis. But these measures alone can't completely offset bone loss due to aging and, in women, the onset of menopause. Diet and exercise also aren't sufficient to treat osteoporosis once your bones are already weakened. Medications are often prescribed to help slow or reverse bone loss and reduce your risk of fractures.

Your doctor may prescribe medication to prevent or treat osteoporosis if:

- You've been diagnosed with osteoporosis based on a fragility fracture or bone density measurement
- You have low bone density, are postmenopausal or otherwise have an increased risk of fractures
- You have a condition or are using medications that increase your risk of fracture or rapid bone loss
- You experience continued bone loss or a fracture, even though you're physically active and get adequate dietary intake of calcium and vitamin D or are taking supplements

The medication your doctor recommends will be based on a variety of factors. All medications discussed in this chapter are approved for use in postmenopausal women, while some are approved for use in men and some for use in specific situations. The choice of medication is often based upon effectiveness, safety, cost, convenience and other factors.

There are two main categories of osteoporosis medications, based on how the drugs work. Anti-resorptive medications slow the breakdown of bone in the remodeling process. These are also known as bone-stabilizing drugs. Anabolic medications are bone-building therapies, helping to promote bone formation. Both classes of medications can change the net effect of the bone remodeling cycle, slowing or even reversing the loss of bone.

ANTI-RESORPTIVE MEDICATIONS

Anti-resorptive drugs include bisphosphonates — the most common type of osteoporosis medication — and several others. These therapies work in various ways to prevent bone breakdown, preserve bone mass and reduce the risk of fracture. When you take these medications, the rate at which you lose bone mass slows. Your bone density typically increases as a result.

BISPHOSPHONATES

For both women and men, the most widely prescribed osteoporosis medications are bisphosphonates.

Bisphosphonates are often preferred because of their effectiveness and relatively low cost and the availability of long-term safety data.

Bisphosphonates alter the actions of osteoclasts, the bone-excavating cells, and halt their functions. (Turn to Chapter 2 for more on osteoclasts' role in bone remodeling.) By doing so, bisphosphonates slow bone loss and increase the mineral content of bones.

This can effectively preserve bone mass and even increase bone density in your spine and hip, thereby reducing your risk of fractures.

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Taking bisphosphonates

Oral bisphosphonates may be taken in pill form or dissolved in water once a day, once a week or once a month, depending on the medication. The less often the medication is taken, the larger the dose. Taking the proper medication once a week or once a month is just as effective as taking it daily and is more convenient for most people. For some people, oral bisphosphonates are hard on their digestive systems. However, the side effects are about the same whether you take a daily dose, weekly dose or monthly dose.

Bisphosphonates need to be taken with plain water on an empty stomach, at least 30 to 60 minutes before eating, drinking other beverages, or taking other medications or supplements. If not taken on their own, the drugs can bind to compounds in food, beverages or medication and leave the digestive tract without being absorbed.

To minimize any side effects, your doctor will recommend that you take your medication first thing in the morning with a full glass (8 ounces) of water. After taking the medication, remain upright — sitting, standing or walking — for 30 to 60 minutes to allow the drug to move through your esophagus and stomach and into your small intestine.

Bisphosphonate medications administered by IV don’t cause stomach upset. The medications can be given anytime of the day. However, the infusion can result in a flu-like reaction in the first few days afterward, especially with the initial infusion. Taking acetaminophen (Tylenol, others) after the infusion and for two more days can help reduce the risk of this side effect.

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Oral vs. IV

Bisphosphonates may be taken by mouth (orally) — in pill form or dissolved in water, depending on the drug — or they may be given through an IV. Oral bisphosphonates include the medications:

- Alendronate (Binosto, Fosamax)
- Risedronate (Actonel, Atelvia)
- Ibandronate (Boniva)

These oral medications may be taken daily, weekly or monthly, and they generally increase bone density of the lumbar spine by approximately 5% to 10%. They also reduce the risk of new spinal fractures by 40% to 70%, and some can reduce the risk of hip fractures by about 30% to 40%.

Oral alendronate and risedronate are often the first line of treatment for postmenopausal women and men with osteoporosis. These medications are also approved for the prevention and treatment of osteoporosis due to glucocorticoid use. Ibandronate is approved for use only in postmenopausal women, however.

The most common side effects of oral bisphosphonates are heartburn and abdominal pain caused by irritation to the esophagus or stomach. Taking the medications once a week or once a month doesn’t appear to cause fewer stomach problems than does taking them daily.

Two bisphosphonates are available as IV medications — drugs that are given directly into a vein.

- Zoledronic acid (Reclast) is administered as an infusion once a year.
- Ibandronate is given by injection once every three months.

The injected form of ibandronate, like the oral route, is approved for postmenopausal women. Zoledronic acid is approved for use in postmenopausal women, men and those with glucocorticoid-induced osteoporosis.

These medications are typically administered in a hospital or at an outpatient infusion therapy center. Because they don't cause gastrointestinal upset, intravenous medications offer an excellent alternative for postmenopausal women who may not be able to take oral bisphosphonates. Zoledronic acid may also have advantages over oral bisphosphonates in some people. This includes individuals with certain types of breast cancer who are taking aromatase inhibitor therapy and people who've had a heart transplant in the past year.

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Anti-resorptive medications

Bisphosphonates	
Alendronate (Binosto, Fosamax)	Oral
Risedronate (Actonel, Atelvia)	Oral
Ibandronate (Boniva)	Oral
Ibandronate	IV
Zoledronic acid (Reclast)	IV
Denosumab	
Denosumab (Prolia)	Injection
Selective estrogen receptor modulators (SERMs)	
Raloxifene (Evista)	Oral
Conjugated estrogens-bazedoxifene (Duavee)	Oral
Calcitonin	
Calcitonin (Miacalcin)	Injection
Calcitonin	Nasal

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Which is better?

Both forms — oral and IV — are effective. The type you receive generally depends on your preferences and your insurance. There are some advantages to IV bisphosphonates. Researchers have found that many women taking an oral bisphosphonate stop treatment or take less than prescribed after one year of use. This reduces the effectiveness. A yearly or quarterly IV dose ensures that you're fully protected until the next treatment.

Some people take several pills daily to manage other health problems and don't want to take yet another pill. And some

individuals experience stomach upset from oral bisphosphonates. These people may prefer an IV medication.

Safety

Bisphosphonates have been studied for decades, and have a low risk of serious side effects. The drugs may not be recommended if you have severe uncontrolled heartburn or gastroesophageal reflux disease (GERD) or severely reduced kidney function. Your doctor will likely evaluate the safety and effectiveness of your medications on a yearly basis.

Bisphosphonates are also used to treat other bone diseases, such as Paget’s disease of bone, and bone affected by cancer that has spread from other organs. Typically, these treatments are given intravenously and more frequently.

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How long should you take bisphosphonates?

Bisphosphonates are considered safe and effective osteoporosis medications. But there's no consensus on how long people with osteoporosis or low bone density (osteopenia) need to take these drugs.

Up to five years of treatment with bisphosphonates is safe and effective. Many good studies of all the bisphosphonate medications prove their safety and show their effectiveness at preventing fractures of the hip and spine for up to three to five years.

Beyond five years of treatment, there's less certainty. For treating postmenopausal women, some research indicates that alendronate (Binosto, Fosamax) — the most commonly prescribed oral bisphosphonate — improves bone density and reduces fracture risk for up to 10 years and is well tolerated. Risedronate (Actonel, Atelvia) has been shown to be effective and well tolerated for up to seven years of continuous use in postmenopausal women. Zoledronic acid (Reclast) is considered safe and effective for up to six years of continuous use in this group.

One thing that is known, though, is that even if you stop taking the medication, its positive effects can persist. After taking a bisphosphonate for a period of time, you build up the medicine in your bones. Because of this lingering effect, some experts believe it's reasonable for people who are doing well on treatment — those who have not broken any bones and are maintaining bone density — to consider taking a break from their bisphosphonate after taking it for five years. But if you're at high risk of fractures or you have very low bone density, taking a break from your osteoporosis medication may not be a good idea.

So, what does this mean for you? Discuss your risk level and your options with your doctor to determine how long you should take bisphosphonates. Don't stop taking the medication without consulting your doctor.

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In case of a fracture

Osteoporosis medications lower the chance of fracture, but they don't eliminate all risk of breaking a bone. If you have a fracture while taking bisphosphonates, your doctor will reassess you. He or she may look into whether other health problems might have contributed to the broken bone.

Depending on the outcome of that assessment, you may be a candidate to switch to a more potent bone-building therapy. This might include parathyroid hormone (PTH), manufactured as teriparatide (Bonsity, Forteo) and abaloparatide (Tymlos), or sclerostin antibody therapy in the drug romosozumab (Evenity). Romosozumab both reduces bone resorption and increases bone formation by inhibiting sclerostin, a major regulator of bone activity that's produced by osteocytes.

These treatments are typically reserved for women who are at very high risk of a fracture — those with very low bone density or who have had fractures. Teriparatide may also be used in certain men. All of these therapies have the potential to rebuild bone and actually reverse osteoporosis, at least somewhat.

Another option might be to switch to the drug denosumab (Prolia). Denosumab produces similar or better results,

compared with bisphosphonates, but works in a different way. It's delivered via a shot under the skin every six months.

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Risks of long-term use of anti-resorptive therapy

Long-term therapy with bisphosphonates and other anti-resorptive drugs has been linked to a rare problem in which the upper thighbone (femur) fractures. This injury, known as atypical femoral fracture, can cause pain in the lateral thigh or groin that begins subtly and may gradually worsen. It can sometimes develop in both legs at once. This side effect is very rare, but the risk is higher in people who have taken anti-resorptives for more than five years, in women of Asian descent, and in people taking glucocorticoids for one year or longer.

If such fractures show up on X-ray or another scan, therapy should be stopped. The risk rapidly decreases after stopping bisphosphonates, and importantly, the risk of atypical femur fractures is very low compared with the reduction in risk of fractures with treatment.

Bisphosphonates also have the potential to affect the jawbone. Osteonecrosis of the jaw is a rare condition in which a section of jawbone dies and deteriorates. This can result in an open wound, generally after invasive oral surgery such as a tooth extraction. The risk is higher in people who take frequent doses of the medication by vein (intravenously) — much more frequent than typically used for osteoporosis — to treat cancer in their bones. The risk of osteonecrosis of the jaw with regular use of bisphosphonates for osteoporosis is very small.

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DENOSUMAB

Denosumab (Prolia) is used to treat osteoporosis in postmenopausal women who are at an increased risk of fractures. It may also be an option for women who cannot take or did not respond to other osteoporosis medications.

Denosumab is a monoclonal antibody — a laboratory-produced substance that inactivates the body's bone breakdown mechanism. It was the first "biological therapy" to be approved for the treatment of osteoporosis. It works by blocking osteoclast bone resorption. In other words, it slows the bone-breakdown process. But like all anti-resorptives, it also slows the entire remodeling process.

In one study, denosumab was given to women every six months for three years. The women taking the medication were compared with women who received an inactive substance (placebo). Those on denosumab had a significantly reduced risk of breaking a bone, such as a spinal bone or hipbone, compared with the women who received the placebo.

This medicine is also used in men to treat osteoporosis. It may be prescribed for men who cannot take other medications for osteoporosis or after other drugs haven't worked well. Denosumab is also used to treat bone loss in men and women who are receiving treatments for prostate and breast cancers and is approved for people taking glucocorticoids.

Taking denosumab

The medication is delivered by injection every six months. This is typically done at a hospital or an outpatient infusion

therapy center. The shot may be administered in the upper arm or the abdomen but is usually given in the thigh.

Side effects

Common side effects of denosumab include skin irritation, back pain, and other bone, muscle or joint pain. Other side effects include an increased risk of osteonecrosis of the jaw and atypical femur fractures, similar to that seen in people on bisphosphonates. There have also been some cases of serious allergic reactions to the medication. There is also a higher risk of skin infections, and other infections may be increased in people with compromised immune systems.

Because denosumab lowers calcium levels, it’s not recommended for people with very low blood calcium (hypocalcemia). Signs and symptoms of low blood calcium include spasms, twitches or cramps in the muscles, or numbness and tingling in the fingers, toes or around the mouth. However, most people with low blood calcium don’t experience symptoms. Individuals receiving denosumab should also take calcium and vitamin D supplements.

Stopping denosumab

One of the biggest concerns with denosumab therapy is discontinuation of this medication. Unlike with bisphosphonates, which continue preventing bone breakdown after they’re stopped, delaying or stopping denosumab appears to speed up bone breakdown. This more-rapid bone loss persists for two years and may lead to an increased risk of spine fractures. Switching to a bisphosphonate such as

alendronate after denosumab has been shown to potentially prevent this bone loss. Intravenous bisphosphonates may be another option, although research results are mixed. Giving PTH treatments after denosumab increases bone loss, so this sequence of medications is not recommended.

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Menopausal hormone therapy and osteoporosis

The hormone estrogen can help maintain bone density and prevent fractures. However, the use of female hormones to treat osteoporosis — once a common practice — changed in the early 2000s when the results of a study organized by the National Institutes of Health, called the Women's Health Initiative, were released. The study was stopped early because it found that long-term use of the hormones estrogen and progesterone increased the risk of breast cancer, heart attacks, strokes and blood clots in postmenopausal women. Another part of the study was stopped early when it showed that long-term use of estrogen alone also increased the risk of strokes. Estrogen increases the risk of blood clots, as well, but not the risk of breast cancer or heart attacks.

More-recent research analysis has confirmed these findings. It has also shown that the risks of hormone therapy appear to be lower for younger women than for those age 60 or older. That's good news for women seeking relief from hot flashes or other changes of menopause, such as mood swings or sleep disturbances, in their 40s and 50s. Today, hormone therapy is usually prescribed on a short-term basis, in the lowest dose possible, to reduce severe menopausal symptoms. An estrogen skin patch or gel is an option for relief that has certain lower risks than does the estrogen pill.

Menopausal hormone therapy isn't recommended solely to prevent osteoporosis, because other medications with fewer risks are equally effective. For women who have menopausal symptoms and are at risk of osteoporosis, a short course of hormone therapy may be considered.

Estrogen-related therapy

Medications called selective estrogen receptor modulators (SERMs) work in a similar manner to estrogen and are sometimes prescribed to treat osteoporosis. Raloxifene (Evista) mimics the hormone's beneficial effects on bone density in postmenopausal women, without some of the risks associated with estrogen use. The drug may also reduce the risk of some types of breast cancer. However, hot flashes are a common side effect. Raloxifene may also increase your risk of blood clots.

A newer medication (Duavee) combines estrogens and bazedoxifene, a SERM. It provides the benefits of both — menopausal symptom relief and prevention of bone loss from estrogen, along with some protective effects on the endometrium and breast tissue from the SERM.

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RALOXIFENE AND CONJUGATED ESTROGENS-BAZEDOXIFENE

Raloxifene (Evista) belongs to a class of drugs called selective estrogen receptor modulators (SERMs). SERMs are sometimes referred to as designer estrogens because their chemical structure has been manipulated, or designed, in a laboratory. These synthetic compounds mimic some of estrogen's beneficial effects while avoiding some, but not all, of its adverse effects.

SERMs work by activating or inhibiting estrogen receptors in certain tissues, such as bone and breast tissue. Sometimes the drugs act just like estrogen, and other times they block the effects of estrogen. For example, raloxifene binds to estrogen

receptors in bone cells, which may cause an increase in bone density in much the same way estrogen does. But when raloxifene interacts with estrogen receptors in breast tissue, the drug blocks the action of estrogen. This lessens breast cancer risk in women who are at high risk. However, the drug hasn't been thoroughly studied in women who've already had breast cancer.

Raloxifene improves bone density and prevents spinal fractures. Studies have shown that daily treatment with raloxifene can reduce the risk of vertebral fractures by around 40%. However, it's not as effective as other osteoporosis medications for preventing other fractures, such as a broken hip or wrist. Treatment has not proved to significantly reduce these fractures.

Conjugated estrogens-bazedoxifene (Duavee) is a newer medication that pairs a SERM (bazedoxifene) with a type of estrogen (conjugated estrogens). For postmenopausal women who haven't had the uterus removed, this combination may offer the benefits of each drug without some of the risks of hormone therapy alone. Estrogens provide relief from hot flashes as well as bone-preserving effects. But estrogen alone can cause thickening of the uterine lining (endometrium), which may lead to cancer. Bazedoxifene helps prevent this thickening. It also blocks the action of estrogen in breast tissue.

The combined SERM helps maintain bone density, and it reduces the risk of fractures, too. While this medication isn't used to treat osteoporosis, it can help prevent the disease from developing.

Taking raloxifene and conjugated estrogens-bazedoxifene

Raloxifene and conjugated estrogens-bazedoxifene are available as tablets taken by mouth. You take one tablet each day, preferably at the same time of day. These medications can be taken with or without food.

Side effects

Because of raloxifene's anti-estrogen effects, the most common side effects with it are hot flashes. Conversely, because of its estrogen-like effects, raloxifene increases the risk of blood clots, including deep vein thrombosis (DVT) and blood clots in the lung (pulmonary embolism). Other possible problems include leg swelling due mainly to blood clots, bone pain and a flu-like syndrome. If these side effects are going to occur, they generally do so within the first few months of use. If you have a history of blood clots or are at risk of developing them, your doctor may recommend that you avoid this medication.

The combination of conjugated estrogens and bazedoxifene carries some of the increased risks of taking estrogens, including strokes and DVT. (See this discussion for more details.) Common side effects include muscle cramps, nausea, diarrhea, indigestion, abdominal pain, mouth and throat pain, dizziness, and neck pain.

CALCITONIN

Calcitonin is a hormone produced in the thyroid gland. A synthetic form of calcitonin is approved by the U.S. Food and Drug Administration (FDA) to treat, but not prevent, postmenopausal osteoporosis. Like the bisphosphonates and SERMs, calcitonin works by slowing bone breakdown. It may slow bone loss and modestly increase bone density.

Calcitonin is less effective than other medications for treating osteoporosis. In addition, there is evidence that it may increase the risk of various cancers. For those reasons, it's considered one of the last treatment options and is no longer widely used.

Calcitonin may still be prescribed to treat women with osteoporosis who cannot take other medications. It may also relieve bone pain in people with osteoporotic spinal fractures, especially in the first days to weeks after a fracture.

Taking calcitonin

Calcitonin comes in two forms, an injectable version (Miacalcin) and a nasal spray. The nasal spray is administered by spraying one puff in alternating nostrils each day. The injectable form also is taken daily. The method is similar to injecting insulin for diabetes. Both the nasal spray and the injectable form should be refrigerated until opened.

Side effects

An increased risk of cancer is linked to long-term treatment with calcitonin. With the injectable form of calcitonin, common side effects include nausea, irritation at the injection site, increased urination, and flushing of the face and hands.

Serious side effects of the nasal spray may include nasal irritation and headache, which occur in a small percentage of people.

ANABOLIC MEDICATIONS

Whereas anti-resorptive medications work to prevent bone loss, another group of drugs tips the balance of bone health in another way. Bone-building (anabolic) therapies work by boosting bone formation. That can help new bone growth outpace bone loss, increasing bone mass and density.

TERIPARATIDE AND ABALOPARATIDE

The medication teriparatide is a chemical modification of the body's parathyroid hormone (PTH). This hormone is produced by the parathyroid glands, which are located behind the thyroid gland at the base of your neck. The drug abaloparatide contains a cellular component that has similar actions to PTH in bones and in the kidneys (parathyroid hormone-related peptide, or PTHrP). Both drugs can treat osteoporosis by promoting bone growth.

PTH plays a critical role in the bone remodeling cycle and in maintaining the calcium balance in your bloodstream. The hormone normally raises the calcium level in your blood in several ways. It releases stored calcium in your bones. It also increases calcium absorption by your intestines by stimulating production of vitamin D in your kidneys, and it reduces the

amount of calcium your kidneys lose to urine. Although sustained increases in PTH can cause bone loss, intermittent increases of the hormone given by daily injection can strengthen bones.

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Anabolic medications

Teriparatide (Bonsity, Forteo)	Injection
Abaloparatide (Tymlos)	Injection
Romosozumab (Evenity)	Injection

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Teriparatide (Bonsity, Forteo) and abaloparatide (Tymlos) work by stimulating osteoblast cells and, by so doing, increase new bone formation. Abaloparatide may result in a slightly greater increase in bone density compared with teriparatide, although it has not been shown to be superior in reducing fractures.

Researchers studying postmenopausal women with osteoporosis and a history of spinal fractures have found that daily injections of these medications, along with calcium and vitamin D supplementation, increased bone density of the spine and hipbone.

Teriparatide is approved to treat women and men with severe forms of osteoporosis, including those who are at high risk of fractures or who haven’t responded well to anti-resorptive drugs or other treatment. It may also be prescribed for people

taking glucocorticoids. Abaloparatide is approved for use in postmenopausal women with severe forms of osteoporosis.

Teriparatide and abaloparatide are quite expensive compared with other medications for treating osteoporosis. This limits the number of people for whom the drugs are a viable option. Health insurance plans may require prior authorization in order to cover these medications, so check with your plan administrator.

Taking teriparatide and abaloparatide

These medications are administered by a daily injection — which you perform yourself — in your thigh, hip or abdomen. Your supply comes in a disposable device that looks like a fat ballpoint pen. The device contains enough doses to last about one month before it needs to be replaced.

Side effects

A warning that accompanies abaloparatide states that laboratory rats developed a small increased risk of cancerous (malignant) bone tumors called osteosarcomas after being given high doses of the drug. However, it’s not yet known whether this medication increases the risk of osteosarcoma in people.

Teriparatide and abaloparatide have a risk of reducing blood pressure, especially upon standing after sitting or lying down (orthostatic hypotension).

The optimal length of treatment with these medications hasn’t yet been established. Because the long-term effectiveness and

safety aren’t known, the FDA advises that treatment with abaloparatide should not continue for longer than two years. Longer treatment with teriparatide may be considered for people who remain at high risk of a fracture.

After stopping these medications, an anti-resorptive treatment is typically prescribed to help maintain the improvement in bone mass.

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Supplements not yet ready for prime time

You may have heard claims that certain supplements can offer benefits for bone health. None of these substances are approved as medical treatment in the U.S., but their safety and effectiveness as health supplements is still under investigation.

Soy isoflavones are compounds found in soybeans. Some research suggests that, in combination with adequate calcium and vitamin D, soy isoflavones and ipriflavone, a compound made from an isoflavone, may help increase bone mineral density. However, studies of these compounds are inconsistent in their design, scope and results. More-rigorous research over a longer period is needed to confirm whether these supplements can improve bone health.

Vitamin K is known for its importance in blood clotting. But it's also needed for the function of osteocalcin, a protein made by bone-forming osteoblasts. In particular, vitamin K-2 is thought to be involved in regulating bone metabolism. A recent review of studies showed that taking a vitamin K supplement is linked to a lower fracture rate in postmenopausal women and people who have osteoporosis. The effects on bone density haven't been clear, though. More evidence is still needed to determine if this vitamin can help treat weakening bones.

The mineral strontium is similar to calcium in its chemical properties. One form, strontium ranelate, has been used in osteoporosis medications available in Europe. However, its use has been restricted in recent years due to limited benefits and increased risks of heart attacks and other serious side effects. Strontium ranelate may also make bone density test results less accurate. Other forms of strontium that are available in the U.S. as

health supplements have not been tested for safety or effectiveness and aren't recommended.

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ROMOSOZUMAB

Until recently, osteoporosis therapies worked by either promoting bone formation or slowing bone resorption. Romosozumab (Evenity) is the first drug to do both. It's made using an antibody to sclerostin, a naturally occurring protein produced in certain bone cells. Sclerostin plays a critical role in controlling bone mass by inhibiting the activity of bone-forming osteoblasts. In a way, it's a braking system to keep bone building in balance. Romosozumab works by binding to sclerostin, thereby blocking its inhibiting property. Think of it like taking your foot off the brake pedal in your car. At the same time, the medication slows the rate at which your body breaks down bone.

Romosozumab can be taken for up to one year. Because the bone-building effects of the drug disappear quickly once you stop taking it, your doctor will then prescribe an anti-resorptive therapy to protect the bone that's been built up.

Large research studies in postmenopausal women have confirmed romosozumab's effectiveness. Women received the medication for a year and then received an anti-resorptive medication. Romosozumab improved bone density and reduced the risk of fractures in the vertebrae, hip and other bones.

Your doctor may recommend romosozumab if you're postmenopausal with a high risk of fracture. This includes having severe osteoporosis or multiple fractures in your vertebrae. Romosozumab may also be an option for postmenopausal women who haven't responded well to other osteoporosis treatments.

Taking romosozumab

The medication is delivered by injection once a month for up to one year. A nurse or other health professional at your doctor's office or your hospital clinic administers the injection in your stomach, thigh or upper arm.

Side effects

Romosozumab is a newer drug and less is known about its long-term side effects. The most common short-term side effects include fast heartbeat, fever, and pain, stiffness or swelling of the joints. As with any medication, a severe allergic reaction is another possible but rare side effect.

This drug may raise the risk of heart attack or stroke. Romosozumab is not recommended for anyone who is at very high risk of these conditions, including women who have had a heart attack or stroke in the past year. More research is needed to determine the effects of romosozumab on cardiovascular health.

Romosozumab can also lower the calcium levels in your blood and shouldn't be taken if you have hypocalcemia. To protect against developing this condition, you'll receive calcium and

vitamin D supplements while taking romosozumab. Additional rare side effects include an increased risk of osteonecrosis of the jaw and atypical femur fractures. These risks are similar to those of anti-resorptive medications.

GETTING THE MOST FROM TREATMENT

In recent decades, new medications for osteoporosis have helped to transform what was an insidious and unpredictable disorder into a treatable condition. The new medications hold promise not only in stopping the breakdown of bone but also in promoting bone growth, turning bone loss into bone gain. You and your doctor now have a variety of options from which to choose the most effective drug to fit your individual needs.

When discussing a treatment strategy with your doctor, one important consideration is how to best sequence these medications. For example, teriparatide, abaloparatide and romosozumab all work better in someone who has never taken bisphosphonates than in someone switching from a bisphosphonate to one of these medications. In addition, taking an anabolic treatment after stopping denosumab can be associated with limited improvements in bone density (romosozumab) or even bone loss (teriparatide and abaloparatide).

No matter what drug you're prescribed, the key is that you take your medication as recommended. When you take an osteoporosis drug, you won't feel your bones getting stronger.

For some people, this can make it difficult to stay on a treatment plan.

But it's important that you take your medicine as prescribed if you want it to work. Taking an osteoporosis medicine half the time or less is the same as if you don't take it at all. Administer the drug — whether by pill, injection or spray — just as your doctor prescribed. To get the most from your medication it's also important that you exercise regularly and get enough calcium and vitamin D.

If you decide that a particular treatment isn't right for you, express your concerns with your doctor. Don't just stop taking the medicine. It's important to see your doctor regularly and review your medicines at each visit. This will help to identify any side effects of the medicine and ensure that you're responding to treatment as you should.

MONITORING AND ADJUSTING YOUR PLAN

To find out if and how well your treatment is working, your doctor may repeat your bone density test in a year or two. In some cases, doctors may also use special lab tests called bone marker tests, or biochemical marker tests, to monitor the effects of treatment. Bone marker tests often can indicate if therapy is producing positive results in as little as three to six months. Meanwhile, it can take one to two years of treatment before a bone density test measures significant changes.

Your doctor may also repeat a bone density test one or two years after stopping bisphosphonates or switching to a

different osteoporosis medication. Once you and your doctor know how well your skeleton is maintaining previous gains or responding to a new drug, you can continue to chart and modify the path forward.

Unfortunately, osteoporosis can’t be cured. But with advanced medications as part of your action plan, the condition can be well managed throughout your life.

Chapter 11

Osteoporosis in men

While osteoporosis is more common in women, it can and does affect men. About 2 million men in the United States have osteoporosis, and approximately 12 million more are believed to have low bone mass, putting them at increased risk of bone fracture.

Each year, about 80,000 men break a hip. And it's not only older people. Men at age 50 have about a 13% to 25% chance of having an osteoporosis-related fracture in their future. For men, the lifetime risk of an osteoporosis-related fracture is greater than the risk of prostate cancer.

What's more, men have a substantially higher disability and mortality rate after a hip fracture than do women. This is particularly true in the year immediately after the fracture.

When men experience low-trauma fractures, they may be diagnosed with osteoporosis regardless of bone density measurement. Without a low-trauma fracture, men are diagnosed by bone density testing just as women are.

The number of men affected by osteoporosis is expected to increase in the coming years. In light of this, doctors and scientists are working to improve awareness of osteoporosis in

men, and to provide an accurate diagnosis and effective therapy.

BONE DENSITY IN MEN VS. WOMEN

Women make up about 80% of people who have osteoporosis. Why is the disease so much less common in men? Several factors may account for the difference.

Higher peak bone mass

During puberty, bone mineral density increases substantially due to rapid increases in sex hormone production. Accumulation of bone mass peaks by a person's late 20s and early 30s for both men and women, but men typically achieve between 8% and 10% more bone mass than do women. This results in greater bone mass due to bigger bones.

Bone density measured by volume is about the same in men and women in their 20s and 30s. But bones with a larger diameter give men an advantage when it comes to bone strength. There's more distribution area when forces are applied to bone, making it less fragile.

Lack of menopause

Like women, men experience loss of bone density as they age. But men don't normally experience a phase of rapid decline in hormone production, as women do during menopause. As a result, bone loss in men usually proceeds more slowly. Certain diseases or disorders can cause lowered hormone production,

though. For example, this occurs with some types of prostate cancer therapy or hormone disorders.

Quality of bone loss

Bone loss in men and women that occurs as a result of normal aging mainly affects the spongy-looking inner core of the skeleton, called trabecular bone. In men, bone loss is characterized mainly by a thinning of trabecular bone tissue structure. In women, trabecular bone tissue structure becomes eroded and lost. In other words, trabecular bone structure in men remains stronger because it remains more intact than it does in women, even though the bone may be thinner than it once used to be.

HOW DO MEN GET OSTEOPOROSIS?

Everyone loses some bone density with age. After attaining peak bone mass, men start to lose bone density at a rate of up to about 1% a year. Beginning around age 65 or 70, men and women lose bone mass at roughly the same rate. This is because women have completed their rapid phase of bone loss by this age. During their lifetimes, men lose about 30% of their bone density. If you're older than age 70 and you are diagnosed with osteoporosis, it's likely that your age is a significant factor.

In about 50% of men with osteoporosis, the origin of the disease isn't due to an identifiable cause (idiopathic osteoporosis). Scientists suspect that men with idiopathic

osteoporosis who are younger than age 70 have a genetic cause for their low bone density, and multiple genetic variations are likely involved.

In the other 50% of men, the disease is associated with one or more underlying conditions known to contribute to bone loss (secondary causes of osteoporosis). Most of these conditions also increase the risk of bone loss in women. To find out more about secondary causes of osteoporosis, see Chapter 12.

Medications

Loss of bone mass is a common side effect of taking corticosteroid medications (glucocorticoids) used to treat conditions such as asthma or rheumatoid arthritis. Glucocorticoids appear to directly suppress new bone formation, but they may also disrupt vital hormonal processes. Other medications that may cause bone loss include drugs used to prevent seizures (anticonvulsants), chemotherapy drugs, hormone treatment for prostate cancer and excessive use of supplemental thyroid hormone medications.

Chronic illness

A variety of chronic illnesses can adversely affect your body's rate of bone remodeling, leading to bone loss.

Hormone disorders

Certain hormones play an important role in both bone resorption and formation. As a result, disruption of hormone production is a major risk factor for osteoporosis. This is why

menopause affects the risk of osteoporosis in women — their estrogen levels decline rapidly at this point.

In men, low levels of testosterone (hypogonadism), as well as estrogen, can increase the risk of osteoporosis. In fact, low levels of estrogen seem to be more strongly correlated with bone loss in men than are low levels of testosterone. Hypogonadism in men can result from several factors, including old age or certain hormone treatments for prostate cancer. Excessive production of parathyroid hormone (hyperparathyroidism) or thyroid hormone (hyperthyroidism) also can increase men's risk of osteoporosis.

Digestive disorders

Digestive disorders, such as inflammatory bowel disease, celiac disease and other malabsorption syndromes, can inhibit your body's absorption of calcium and vitamin D. These nutrients are essential to bone density and strength.

Other disorders

A number of other conditions can increase your risk of osteoporosis. These include a disorder that causes too much calcium to be excreted from your body through your urine (hypercalciuria), chronic obstructive pulmonary disease (COPD), rheumatoid arthritis and certain cancers.

Lifestyle habits

Alcohol overuse may be associated with low bone mass or osteoporosis-related bone fractures, especially if someone isn't eating well and isn't getting adequate nutrition. Alcohol causes

multiple effects on bone cells and is thought to mainly interfere with bone formation.

Smoking is another important risk factor. The specific cause and effect isn't clearly understood, but studies show that men who smoke have less bone mineral density than do men who never smoked. Other personal habits known to increase the risk of osteoporosis in men include a sedentary lifestyle and low intake of calcium, vitamin D or both.

Genetics

Having a parent with osteoporosis — either your mother or father — is a major risk factor for osteoporosis in both men and women. Around 60% to 80% of what determines your bone mass is due to genetic factors. Not all of these factors are well understood yet, however.

SCREENING IN MEN

Doctors continue to debate what groups of men would benefit from routine screening for low bone density — getting tested before any signs or symptoms are evident.

Some guidelines advocate for routine screening at age 70, even if a fracture hasn't yet occurred. Others say the evidence isn't strong enough to recommend routine screening without signs or symptoms of weakened bones. Most osteoporosis experts agree that men younger than age 70 also should be screened in certain situations. These include:

- Signs or symptoms that suggest osteoporosis, such as a low-trauma fracture, sudden back pain, loss of height of more than 1.5 inches or a hunched posture
- Having an illness or taking medication that increases the risk of low bone mass
- X-ray results that incidentally show low bone mass or an unsuspected fracture

In men who aren't routinely screened for low bone density, the signs and symptoms mentioned above may be the first indication of osteoporosis. See your doctor if you notice any of these. The sooner low bone density is detected, the sooner treatment can start and the more effective it may be.

Getting evaluated

An evaluation for osteoporosis usually begins with a review of your medical history and a physical examination. In fact, if you have osteoporosis, your medical history and physical examination may provide an explanation for why the condition developed.

Bone density testing confirms the presence of low bone density. Your doctor also may order blood or urine tests to determine whether an underlying condition may be causing your bones to weaken (secondary osteoporosis). In a bone density test, an instrument called a bone densitometer measures the mineral content in a small section of your bones. The higher your mineral content, the denser your bones are.

A bone density test is usually done on the lower spine, hip or wrist. The most common and accurate way to determine bone

density is with a dual-energy X-ray absorptiometry (DXA) test. The test is usually done on your hips and lower spine. For more information on bone density testing, see Chapter 5.

Interpreting the results

To interpret the results of a bone density test in men older than 50, a doctor generally looks at an individual's T-score, a number that indicates how much that person deviates from the norm. The norm is the average bone density at a particular site — hip, spine or wrist — in a group of young healthy men at peak bone density.

For example, a T-score of 0.0 means your bone density is exactly average compared with a healthy young adult at peak bone density. A T-score of -1.0 means you're one standard deviation lower than average; a T-score of +1.0 means you're one standard deviation higher than average.

In both men and women, osteoporosis is diagnosed when the T-score is -2.5 or lower, and low bone density (osteopenia) when the T-score is between -1.0 and -2.5. See Chapter 6 for more explanation of test results.

For men younger than 50, a doctor generally looks at the individual's Z-score. This number indicates how much the person deviates from the norm within a group of healthy men of the same age. For example, a Z-score of 0.0 means the person's bone density is exactly average for men in the same age group. A Z-score of -1.0 means the person is one standard deviation lower than average, and a Z-score of +1.0 means one standard deviation higher than average. Low bone density is diagnosed when the Z-score is less than -2.0.

TREATMENT

In many ways, treatment for osteoporosis in men is similar to treatment that's recommended for women. It generally consists of getting adequate calcium and vitamin D, regular exercise, and appropriate medications. If an underlying condition is contributing to your bone loss, your doctor will want to treat it.

Calcium and vitamin D

Getting enough calcium and vitamin D is a standard part of any treatment plan for osteoporosis, both for men and women. Calcium is one of the main components of bone. The amount of calcium you need to stay healthy changes over your lifetime. Your body's demand for calcium is greatest during childhood and adolescence, when your skeleton is growing rapidly. But older men also need to consume more calcium. As you age, your body becomes less efficient at absorbing calcium, and you're more likely to take medications that interfere with calcium absorption.

Experts recommend that men age 70 and younger get 1,000 milligrams (mg) of calcium daily. For men age 71 and older, the recommended amount is 1,200 mg. A daily intake of 1,200 mg may also be recommended for men age 70 and younger who have low bone density or osteoporosis.

Getting enough vitamin D is just as important as getting enough calcium. Vitamin D improves bone health by aiding calcium absorption. For adults up to age 70, the recommended daily intake is 600 international units of vitamin D. Adults 71 and older should aim for 800 international units a day.

Both calcium and vitamin D are found in vitamin D-fortified milk. Other dairy products, such as yogurt and cheese, are excellent sources of calcium. Foods rich in calcium include broccoli, spinach, and calcium-fortified juices, nondairy milks or cereals. (See Chapter 8 for more ideas of how to get these key nutrients.) Sunlight is a major source of vitamin D. For many people, five to 30 minutes of sun exposure on your face, arms, hands and legs — without sunscreen — twice a week may be enough to maintain optimum levels of vitamin D. Supplemental vitamin D may be needed, depending on various factors such as the season and day length, air pollution, and a person's skin color (melanin).

If you're not sure that you get the recommended amounts of calcium and vitamin D in your diet or from sun exposure, ask your doctor if calcium and vitamin D supplements are appropriate for you.

Regular exercise

Regular exercise can help maintain, and perhaps even increase, the density of your bones, making them stronger and less prone to fracture. Exercise also strengthens your muscles. Together, strong bones and muscles will improve your posture and balance, which can reduce your risk of falls.

A Swedish study set out to examine the influence that leisure physical activity might have on men's risk of osteoporotic fracture. It included more than 2,000 men, who at the beginning of the study were between the ages of 49 and 51. Over a follow-up period of 35 years, the researchers found that

the more active the men were, the less risk they had of fracturing a bone. Specifically, hip fracture occurred in:

- 20% of men with sedentary lifestyles
- 13% of those whose activities included some walking and cycling
- 8% of men who participated in sports at least three hours a week

Even if you haven't been physically active, it's not too late to start. The researchers also found that men who increased their activity levels tended to lower their risk of fractures, whereas men who decreased their activity levels increased their risks.

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Not all exercise is the same

For anyone with osteoporosis, experts recommend weight-bearing aerobic activities. These involve doing aerobic exercises on your feet, with your bones supporting your weight. Walking is a good example. Strength training exercises, especially extension exercises for your back, also can be helpful. Depending on the degree of your osteoporosis, your doctor may ask you to moderate or avoid high-impact sports, such as running or playing basketball, and exercises with twisting motions, such as golfing, yoga or bowling. For more information on exercising with osteoporosis, see Chapter 9.

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Bisphosphonate therapy

Bisphosphonates — a group of drugs commonly used to treat osteoporosis — are effective in men as well as in women. Bisphosphonates work to inhibit bone breakdown, preserve bone mass and reduce the risk of fracture. They're a type of treatment known as anti-resorptive therapy. Once you start taking a bisphosphonate, the rate at which you lose bone mass slows more than the rate at which new bone is formed. As a result, your bone density most often increases over time.

The Food and Drug Administration has approved three bisphosphonate drugs for treating osteoporosis in men: alendronate (Fosamax, Binosto), risedronate (Actonel) and zoledronic acid (Reclast). These drugs are also effective for treating osteoporosis resulting from other conditions, such as long-term glucocorticoid use or hypogonadism. Alendronate is taken as a daily or weekly tablet or a liquid taken by mouth. Risedronate comes in the form of tablets. Zoledronic acid is given by infusion once a year.

Typically, you take bisphosphonates for up to five years. If you respond well to the therapy — meaning your bone density remains stable or improves and you experience no fractures — after five years your doctor may consider discontinuing the drug. There's evidence that the fracture reduction benefits of bisphosphonates persist for several years after therapy is ended.

Denosumab

The medication denosumab (Prolia) also works to slow the bone-breakdown process. It blocks bone resorption by

specialized cells (osteoclasts). However, it also slows the entire bone-remodeling process.

This drug is used to treat osteoporosis in postmenopausal women as well as in men. It may be given when other medications cannot be used or after other medications did not work well. It can also treat osteoporosis in people who have used steroid medications for six months or longer. Denosumab is given through injection by a member of your health care team. A shot in your thigh, upper arm or stomach is given every six months.

Denosumab lowers your calcium levels, so your doctor may recommend calcium and vitamin D supplements. Potential side effects include back pain, irritated skin, and other muscle or joint pain. Other more serious side effects are less common. In addition, it's important to note that stopping or delaying denosumab can lead to rapid bone loss, so talk to your doctor if you need to disrupt the schedule of getting injections.

Teriparatide

Teriparatide (Bonsity, Forteo) is a shortened form of human parathyroid hormone that belongs to a group of drugs called anabolic therapies. Whereas anti-resorptive medications mainly prevent bone loss, anabolic therapies promote bone formation. Anabolic therapies also increase bone mineral density substantially in the spine, and to a lesser degree in the hip bones.

Teriparatide is approved for men and women at high risk of fractures, including people with a previous osteoporotic fracture or very low bone density, or those who haven't

responded to other treatment. The drug is taken as a daily injection.

Generally, it is taken for a lifetime maximum of two years. There's not enough evidence yet to know the benefits and risks of additional courses of teriparatide. After ending this therapy, your doctor will likely recommend a bisphosphonate or denosumab to maintain or enhance the bone density gained with teriparatide.

Other anabolic agents that stimulate bone formation, such as abaloparatide (Tymlos) and romosozumab (Evenity), are not yet approved for men. For more information on osteoporosis medications, see Chapter 10.

Testosterone replacement

For men who have osteoporosis due to low levels of testosterone, which occurs with hypogonadism, a doctor may recommend testosterone replacement therapy, alone or in combination with a bisphosphonate or other osteoporosis medication.

Testosterone replacement is shown to increase bone mineral density in men with low testosterone, but not in men with normal levels of testosterone. It may be given through a gel, liquid or patch applied to the skin, or by injection. However, testosterone therapy isn't recommended if you have prostate cancer or are at high risk of it.

Self-care

In addition to proper medication, calcium and vitamin D supplementation, and exercise, you can also help reduce your risk of weak bones and fracture — and improve your overall health — with two other important steps. Quit smoking if you smoke, and limit your consumption of alcohol to a moderate amount. These lifestyle behaviors are also important to bone health.

TAKE ACTION

The idea that men aren't affected by osteoporosis is false. Even though osteoporosis is less common in men than it is in women, it can be disabling and deadly if a major fracture occurs.

If you experience signs or symptoms of osteoporosis — a fracture from a low-trauma accident or fall, loss of height, or sudden back pain — don't ignore them. Talk to your doctor.

Even if you don't have any signs or symptoms, if you're older than age 70, you may want to consider having a bone density test as a preventive measure. In the long run, treating osteoporosis is a much better option than letting it go and suffering the potential consequence of it — a serious and disabling fracture.

Chapter 12

Associated disorders

Most people are aware that osteoporosis is more prevalent with advancing age. In particular, women are at a higher risk after the onset of menopause. The risk for men increases with age as well. Age and menopause are the two most common risk factors for the disease.

However, many health issues can increase the risk of osteoporosis: an underlying condition, a nutritional deficiency or a particular medication can lead to secondary osteoporosis. These factors frequently play a role when significantly weakened bones are discovered before age 50. Often, osteoporosis results from a combination of factors.

In turn, having osteoporosis can increase your risk of developing a related disorder such as kyphosis. This rounding of the spine is caused by back weakening or fractures of the vertebrae.

This chapter looks at the associated disorders that may increase your risk of developing osteoporosis or result from having osteoporosis.

ENDOCRINE DISORDERS

The body's endocrine glands include the pituitary, thyroid, parathyroid and adrenal glands. The pancreas, ovaries and testes also act as endocrine glands. The endocrine system controls cell activities by releasing chemical messengers in the form of hormones into the bloodstream.

A healthy balance of hormones is necessary to reach peak bone density and maintain bone health. During puberty, there is a rise in the reproductive hormones — estrogen in girls and testosterone in boys.

These hormones are responsible for the building of bone. The main bone-building phase is throughout the teenage years and the early 20s, when most people reach their peak bone mass. Bones are then more or less maintained until the reproductive hormones decline with advanced age. This age-related loss of estrogen in women, leading to menopause, or loss of testosterone in men increases the rate of bone breakdown and bone loss.

In women and men, too little of the reproductive hormones can affect bone density in two ways. It can limit gains in bone density during growth and development, or it can increase the rate of bone breakdown and bone loss after the skeleton is mature. Too much or too little of other hormones also can affect bone health.

Following are some endocrine and hormonal disorders that can increase an individual's risk of osteoporosis.

- Hypogonadism, caused by decreased production of reproductive hormones, estrogen by the ovaries or testosterone by the testes
- Amenorrhea, a form of hypogonadism in which menstrual cycles are absent during a time in life when they should be present
- Cushing syndrome, a condition in which the body abnormally produces too much of the hormone cortisol
- Hyperthyroidism, caused by excess production of thyroid hormone
- Hyperparathyroidism, caused by excess production of parathyroid hormone
- Type 1 and type 2 diabetes, in which the body doesn't produce enough of the hormone insulin to regulate the blood sugar

GASTROINTESTINAL DISORDERS

Studies have found an increased risk of bone loss and bone fractures in people with certain gastrointestinal diseases or conditions.

Inflammatory disorders

Inflammation from disorders such as inflammatory bowel disease (Crohn's disease and ulcerative colitis) produces natural chemicals in the body. These chemicals, in turn, are known to increase bone breakdown. In addition, certain medications used to treat some inflammatory gastrointestinal disorders, such as steroid medications, also increase bone loss.

Malabsorption disorders

People with malabsorption disorders, such as celiac disease, are unable to properly absorb nutrients such as vitamin D and calcium. They may experience bone loss as a result.

Bone loss may also occur as a result of weight-loss (bariatric) surgery in which part of the stomach and intestine is "bypassed" during digestion. The surgery can help an individual lose weight, but it can also reduce the body's ability to properly absorb bone-building nutrients such as calcium and vitamin D in food. Other surgeries that remove a significant amount of the small intestine also can result in a reduced nutrient absorption and negatively affect the bones.

RHEUMATIC DISORDERS

Rheumatic disorders include diseases such as rheumatoid arthritis, systemic lupus erythematosus and ankylosing spondylitis. Rheumatic disorders usually result from autoimmune inflammatory diseases. An autoimmune disease is a condition in which the body releases antibodies that attack its own healthy tissues.

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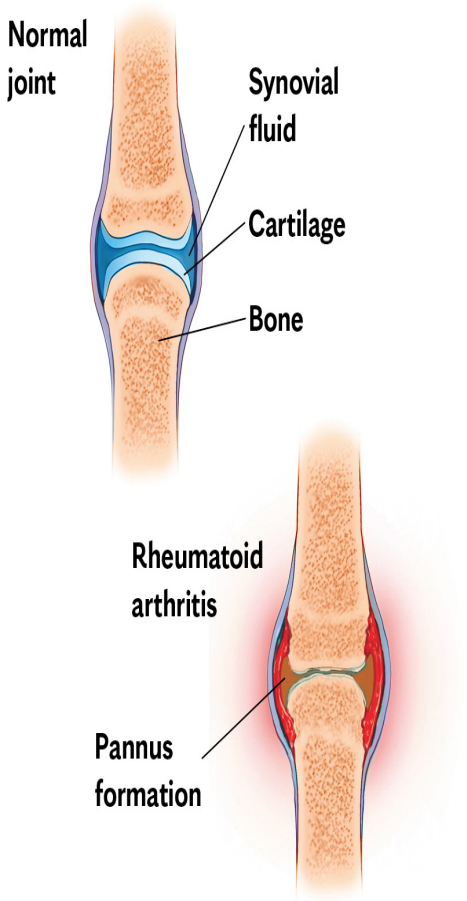
Joint changes in rheumatoid arthritis



In a normal joint (top), synovial fluid lubricates the joint. With rheumatoid arthritis (bottom), inflammation causes the synovial fluid to thicken, forming a layer called the pannus. Cells in the pannus release enzymes that destroy cartilage and bone. Space narrows between the bones of the joint as cartilage is eroded. Moving the joint becomes very painful.

While joint inflammation causes this local damage, chronic inflammation from rheumatoid arthritis can lead to bone loss throughout your skeleton, as well.

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With rheumatoid arthritis, for example, inflammation in a joint may result in the release of enzymes that can destroy the lining of the joint. Joints most affected are those in the hands, wrists, knees, feet and ankles. In addition to joint damage, people with rheumatic disorders usually have lower bone mass than people without these conditions.

The reason why isn't clear, but it may be that certain inflammatory chemicals or chemicals produced by the diseased joints may also affect bone and lead to bone breakdown. In addition, certain medications used to treat rheumatic conditions, such as steroid medications, are known to increase the risk of developing osteoporosis.

GLUCOCORTICOID-RELATED DISEASE

Glucocorticoid-induced osteoporosis results from taking steroid (glucocorticoid) medications such as prednisone, prednisolone, dexamethasone or cortisone. These medications may be taken to help control asthma, emphysema, inflammatory bowel disease or a rheumatic disease, such as rheumatoid arthritis or systemic lupus erythematosus.

Glucocorticoid medications affect bone tissue in a multitude of ways. The medications have a direct negative effect on bone cells, slowing the rate of bone formation for as long as the medication is taken. They also temporarily speed up bone breakdown for several months after the medication is started. And they decrease the levels of the hormones estrogen and testosterone, which normally protect against bone loss. In addition, glucocorticoid medications affect how the body handles the mineral calcium — decreasing calcium absorption in the intestines and increasing calcium loss in urine.

Anyone who takes a significant dose of an oral glucocorticoid medication, or receives lower doses of an intravenous glucocorticoid medication, for more than three to six months is at risk of developing osteoporosis. Bone loss tends to occur most rapidly in the first six months after starting an oral steroid. After about a year of use, the rate of bone loss slows. Still, the risk of osteoporosis remains higher.

Inhaled steroids, used to treat lung conditions, may cause only mild bone loss and are less damaging to bones than steroid pills are. Nasal sprays containing steroids may cause bone loss, but the extent is not well understood.

Several medications can effectively prevent or treat bone loss related to steroids. These include bisphosphonates, teriparatide and denosumab. One study showed that teriparatide may prevent fractures more effectively than the bisphosphonate alendronate does in people taking oral glucocorticoids. Romosozumab, a newer medication, may be useful but needs to be studied further.

Other medications

In addition to glucocorticoids, a number of medications may increase your risk of osteoporosis either by reducing peak bone mass (when the medication is taken during childhood or young adulthood) or by increasing bone loss later in life. If you need to take a medication associated with bone loss (see the list on pages 180-181), talk to your doctor about steps you can take to help protect your bones.

LIVER DISORDERS

Osteoporosis is common among people with serious, chronic liver disorders. Liver disorders are thought to increase the risk of osteoporosis partly by decreasing vitamin D production, leading to lower calcium absorption. But it's likely that a number of other factors also are involved.

Individuals awaiting a liver transplant may take glucocorticoid medications prior to transplant surgery. This can lead to osteoporosis by affecting bone formation and resorption. In addition, liver disorders are associated with certain chemical changes and with a loss of muscle mass. It's likely that these changes affect bone resorption, as well.

Chronic liver disease also can reduce the production of male or female reproductive hormones, a condition called hypogonadism. Low estrogen and testosterone levels are known risk factors for osteoporosis. Excessive

alcohol consumption associated with some forms of liver disease is another risk factor.

KIDNEY DISORDERS

Osteoporosis is common among individuals with late-stage chronic kidney disease. As kidneys begin to fail, the body begins to make increasing amounts of parathyroid hormone, which causes increased bone loss. The worse kidney function becomes, the worse hyperparathyroidism gets in turn.

Failing kidneys are unable to make enough of the biologically active form of vitamin D, which limits the ability of the intestine to absorb calcium. This aggravates the existing hyperparathyroidism. Chronic kidney disease may also cause decreased production of male and female hormones, leading to hypogonadism. And because the kidneys normally clear toxins from the bloodstream, toxins may build up and cause bone loss by various means.

ORGAN TRANSPLANT

Many people who undergo an organ transplant take medications before and after surgery to help the body prepare for and accept the transplanted organ. These medications, which include steroid medications, certain diuretics, some blood-thinning medications and immunosuppressive drugs, can increase bone loss.

Often, people undergoing an organ transplant experience end-stage organ failure before the transplant, which may cause bone loss. In addition, if they have fatigue associated with end-stage organ failure, decreased physical activity may contribute to bone loss.

CANCER

Men and women with certain types of cancer are at increased risk of osteoporosis as well. This may be due to the effects of some cancers on the skeleton or to the medications and therapies required to treat the cancer. Treatments such as chemotherapy or therapy to reduce reproductive hormone levels may decrease bone density.

Aromatase inhibitors are an important component of treatment for postmenopausal women with estrogen receptor positive breast cancer. The medications inhibit an enzyme responsible for converting androgens to the hormone estrogen. Therefore, they can cause rapid bone loss due to estrogen deficiency.

Women receiving aromatase inhibitors to treat breast cancer should adopt lifestyle changes that promote bone health, including getting regular physical activity and plenty of calcium and vitamin D. Medication may be given to help offset a loss in bone density.

Osteoporosis also is a side effect of certain therapies used to treat prostate cancer. Some men develop osteoporosis as a result of therapy to reduce testosterone, known as androgen deprivation therapy. Bone mineral density screenings may be a good idea for men receiving this type of therapy. Exercise and adequate daily calcium and vitamin D can help decrease the risk of osteoporosis for these men. Medication to offset the bone-thinning effects also may be prescribed.

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Diseases, disorders and drugs associated with low bone density

Endocrine disorders

- Primary hyperparathyroidism
- Hyperthyroidism
- Diabetes
- Hyperprolactinemia
- Early menopause
- Cushing syndrome
- Addison’s disease
- Growth hormone deficiency
- Klinefelter’s syndrome
- Turner’s syndrome
- Acromegaly

Gastrointestinal disorders

- Celiac disease
- Crohn’s disease
- Pernicious anemia
- Malabsorption of any cause

Rheumatic disorders

- Rheumatoid arthritis
- Systemic lupus erythematosus
- Ankylosing spondylitis

Liver disorders

- Primary biliary cirrhosis
- Primary sclerosing cholangitis

Kidney disorders

- Chronic kidney disease of any cause

Medications

- Glucocorticoids
- Certain anticonvulsants
- Levothyroxine (more than needed)
- Selective serotonin reuptake inhibitor (SSRI) antidepressants
- Cyclosporine
- Injections of Depo-Provera or steroids
- Diuretics causing hypercalciuria
- Long-term heparin therapy
- Lithium
- Methotrexate or other antimetabolites
- Antipsychotic medications (phenothiazine derivatives)
- Aluminum-containing phosphate binders
- Tetracycline (extended use)
- Gonadotropin-releasing hormone (GnRH) agonists
- Proton pump inhibitors

Cancer

- Multiple myeloma
- Systemic mastocytosis
- Leukemia

Genetic diseases

- Osteogenesis imperfecta
- Ehlers-Danlos syndrome
- Gaucher disease and other glycogen storage diseases
- Homocystinuria
- Hypophosphatasia
- Marfan syndrome
- Menkes’ syndrome
- Mitochondrial myopathies

- Familial dysautonomia
- Sickle cell anemia
- Thalassemia
- Congenital porphyria

Immobility

- Prolonged bed rest from any cause
- Spinal cord syndromes

Miscellaneous causes

- Vitamin D deficiency of any cause
- Low calcium intake or absorption
- Alcohol overuse
- Idiopathic scoliosis
- Lactose intolerance
- Anorexia nervosa
- Chronic obstructive pulmonary disease
- Endometriosis
- Hemochromatosis
- Amyloidosis
- Epidermolysis bullosa
- Hemophilia
- Movement disorders (Parkinson's disease)
- Multiple sclerosis
- Prolonged parenteral nutrition
- Sarcoidosis

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GENETIC DISEASES

A number of rare genetic diseases have been associated with the development of osteoporosis. If you have one of the diseases listed on the

chart above, know that your risk of osteoporosis is increased.

IMMOBILITY

Any disease or disability that limits your ability to be active is likely to cause bone loss. This includes if you use a wheelchair, you aren't able to walk or stand for a period of time, or you have difficulty getting around. If you can't take part in weight-bearing activities frequently enough to get the related bone benefits, you're likely to experience a loss in bone density. Weight-bearing activities include any physical activity in which your feet and legs are supporting your weight.

An extreme example of what happens to bones without weight-bearing activity is observed in astronauts in space. When there's no gravitational stress affecting the bones, astronauts lose bone mass even though they may exercise to try to prevent bone loss.

While immobility can contribute to bone loss, it may also be a result of osteoporosis if you're recovering from fractures or falls. That's why staying as active as possible is so important. Whatever your age, fitness or mobility, working to strengthen your muscles and bones can help limit the risk of falls that may result in fractures or other injuries, immobility, and more bone loss.

KYPHOSIS

One condition that can result from osteoporosis — rather than contribute to its development — is an exaggerated, forward rounding of the upper back called kyphosis. A certain amount of rounding is normal, but with kyphosis the rounding is more severe. While kyphosis can occur at any age, it's most common in older women. Over time you might have heard this condition called other names, including humpback, hunchback or dowager's hump.

Age-related kyphosis often occurs after osteoporosis weakens spinal bones to the point that they crack and compress. Other types of kyphosis

are more common in children or adolescents.

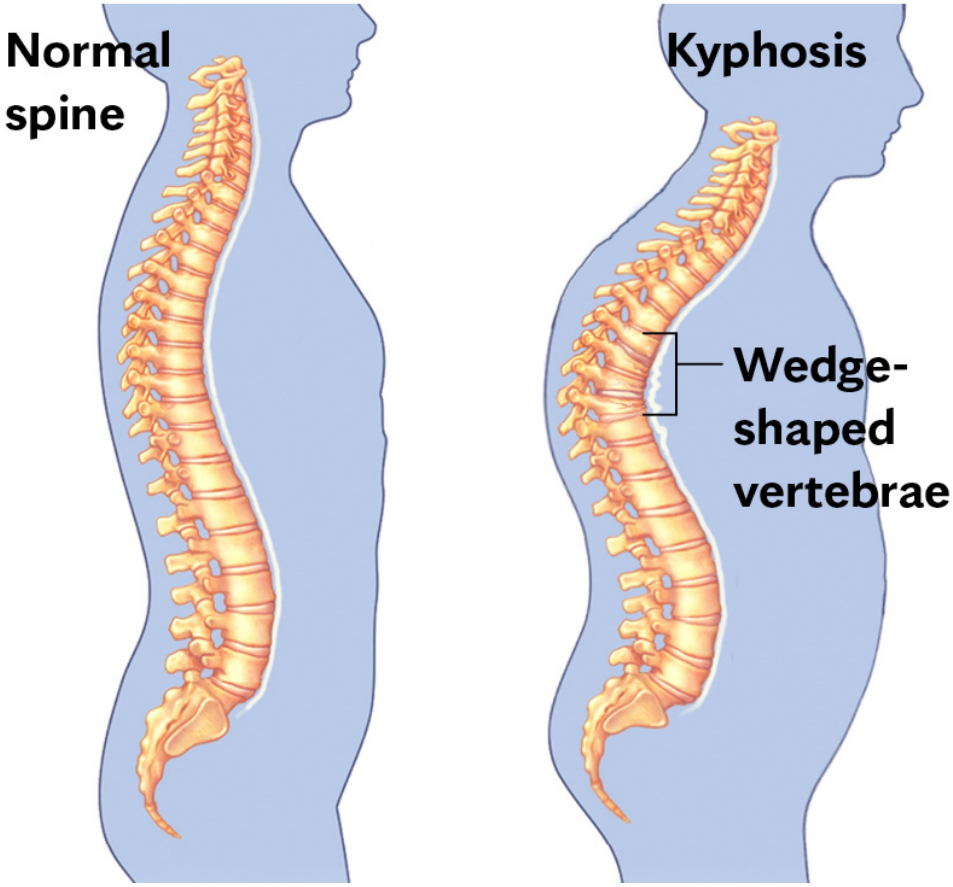
Mild cases of kyphosis may produce no noticeable signs or symptoms. However, severe kyphosis can affect your breathing by reducing your lungs' space to expand. It may also compress the digestive tract, leading to digestive problems, acid reflux and difficulty swallowing. You may have back pain and stiffness as well, limiting your physical functions and activities. In addition to an abnormally curved spine, kyphosis can cause back pain and stiffness in some people.

Older adults with osteoporosis are at greater risk of spinal fractures that can contribute to kyphosis. In addition, certain other groups of people are also at higher risk of kyphosis.

- Adolescents with poor posture are at greater risk of postural kyphosis, a slouched posture due to the muscles and ligaments around the spine stretching as they become accustomed to that position. Exercises to retrain the muscles can typically resolve this.
- Adolescent boys are at greater risk of Scheuermann's kyphosis, a structural issue in the spine due to three or more vertebrae in a row with a significantly wedged shape.
- People who have connective tissue disorders, such as Marfan syndrome, also are at greater risk of kyphosis.

Treatment of the condition depends on the cause and the signs and symptoms that are present. Your doctor may suggest use of pain relievers. If over-the-counter products aren't enough, stronger pain medications are available by prescription. In addition, bone-strengthening drugs used to treat osteoporosis may help prevent additional spinal fractures that can cause kyphosis to worsen.

Other treatments for kyphosis include stretching exercises to improve spinal flexibility and exercises that strengthen the abdominal muscles to improve posture. Children who have Scheuermann's kyphosis may be able to stop the progression of the disease by wearing a body brace while their bones are still growing.



Kyphosis: Wedge-shaped vertebrae (right) in some forms of kyphosis can significantly affect the curvature of the back and cause other signs or symptoms.

If the kyphosis curve is severe, particularly if the curve is pinching the spinal cord or nerve roots, your doctor might suggest surgery to reduce the degree of curvature. The most common procedure, called spinal fusion, connects two or more of the affected vertebrae permanently. A surgeon inserts bits of bone between the vertebrae. Then the vertebrae are fastened together with metal wires, plates and screws to give that section of the spine stability.

LIFE BEYOND TREATMENT

Thanks to decades of research and medical discoveries, the understanding, diagnosis and treatment of osteoporosis is more advanced than ever before. Secondary causes and other conditions associated with low bone mass can be identified and addressed to stop or even reverse the

cycle of bone loss. But medical treatment is just one aspect of life with osteoporosis.

The following chapters in Part 3 address aspects of daily life with this condition. Learn which steps you can take in your routine and around your home to maximize your health and safety and lead a fulfilling life with osteoporosis.

PART 3 LIVING WITH OSTEOPOROSIS

Chapter 13

Healthy living strategies

Osteoporosis is a bone disease, but its impact extends well beyond your skeleton. Many people with osteoporosis learn how to live with the condition as they go about their daily activities. But for others, especially those who have fractured a bone, osteoporosis can take a tremendous physical, emotional and social toll.

If you have osteoporosis, work and household tasks may become more difficult and you may require assistance from others. You may experience pain and fatigue, as well as stress, anxiety and depression. Your social relationships may be more difficult to maintain, and you may not be as independent and active as you once were.

Coping with any chronic illness requires patience and perseverance. But you don’t have to avoid your normal routines or let it rule your mindset. You can still maintain your quality of life.

This chapter presents strategies to help you cope with some of the physical, emotional and social aspects of having osteoporosis. Coping may require a team effort involving family and your health care team. Above all, it requires your commitment.

PRACTICE GOOD POSTURE

People who have osteoporosis live with greater risk of injury from movements that involve twisting, lifting, carrying or bending. But needing to be a little more cautious doesn’t mean that you should stop being active.

You can take steps to increase your safety and protect yourself from fractures and falls. Learning to sit, stand and move using good posture and body

mechanics makes it easier to function in your daily routine.

Poor posture increases strain on your muscles and bones, causes fatigue, and makes you more prone to injury. Throughout the day, including when you exercise, try to maintain good posture and make sure that you’re moving safely.

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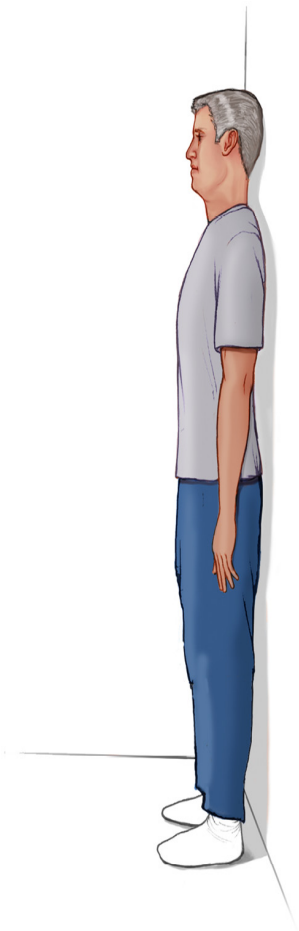
Good posture



Good standing posture: Head is erect with chin tucked in, chest held high, shoulders relaxed, hips level, knees straight but not locked, feet parallel with comfortable space to the wall, if needed.

Good sitting posture: Spine and head are erect, back and legs at a 90-degree angle, natural curves of the back maintained.

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Move safely

For people with osteoporosis, even mild strains and pressure can cause a fracture, so it's important to know what movements to avoid. Try to avoid rounding your back forward, especially during activities that involve lifting or reaching. Also avoid excessive twisting of the spine. Here are some tips that can help you improve your posture:

- Think tall when you stand. Keep your stomach muscles tight.
- Stand with your weight on both of your feet.
- Wear comfortable shoes with low or flat heels.
- When standing in one place, put one foot up on a stool or chair rung and periodically switch to the other foot.
- Carry a small shoulder bag rather than a large one so that you can't make it very heavy. Or use a bag with wheels if you need to carry heavier things with you.
- Sit in a straight-back chair with your back supported.
- When you're in a seated position, the chair seat should be high enough so that your thighs rest horizontally on the seat and your feet are flat on the floor.
- When sitting for long periods, occasionally elevate your legs by placing your feet on a footstool or a chair rung. Also change positions to shift your weight. If possible, get up and move around every half-hour or so.
- When seated in bucket seats or soft chairs, use a thick rolled-up towel or pillow to support your lower back.

Coughing and sneezing

The force of a cough or sneeze can cause you to jerk forward suddenly. If your bones are weak, this could result in a spinal compression fracture.

To avoid this type of injury, get in the habit of placing one hand on the front of your chest or on your thigh for support when you start to sneeze or cough.

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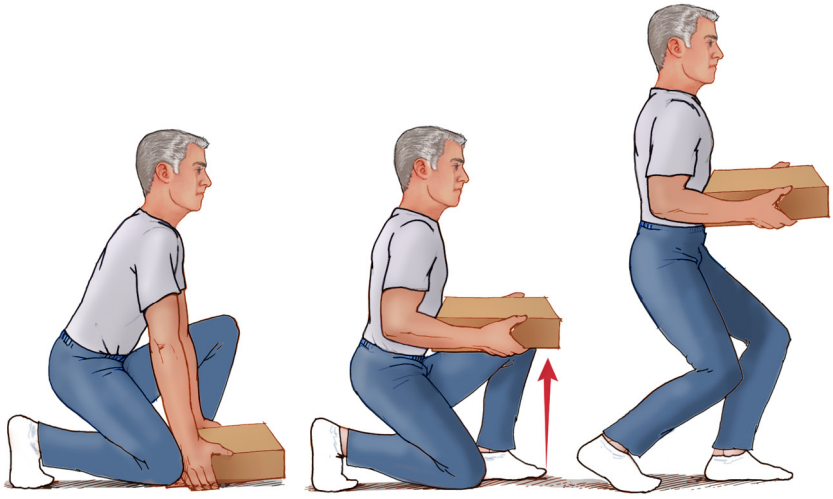
Coughing and Sneezing

A hand on the thigh helps support your body from the force of a sneeze or cough.

Lifting



Lifting objects, even those that are lightweight, can put stress on your spine. To lift properly:

- Keep your feet about shoulder-width apart and maintain the normal curve of your spine. Place one foot forward, and lower your body down to one knee by bending at the hips and knees, keeping your body weight on the balls of your feet.
- Kneel close to the object you're about to lift. If the object is heavy, lift it first to your bent knee.
- Grasping the object, rise from the floor by using your leg muscles. Gently breathe in while straightening up. Don't hold your breath.
- Carry the object close to your body at about waist level. If possible, place your forearms under the object. Turn by pivoting your feet. Don't twist at your waist.

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Working and lifting

Try to use good posture and body mechanics as you go about your daily activities. Ask yourself if there are more-efficient or safer ways to perform common activities. Even if bending over to grab something off the floor has never caused problems, using a safer lifting technique as you age is smart.

As much as possible, avoid movements such as reaching, bending, twisting or using short, choppy motions, which can be dangerous for someone with osteoporosis. If you have to lift or push or pull something, use proper technique. In the illustrations above, note the neutral back and bent legs to minimize stress on the spine.

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Pushing and pulling

When moving objects, you want to minimize the strain that you put on your back. Whenever possible, push rather than pull.

- Bend your knees so that your arms are level with the object. Don't bend forward at the waist.
- Maintain the normal curve of your spine and walk forward or backward, using your body weight to push or pull the object.

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Sleeping

How you sleep is important, too. When you're lying down, you want to maintain your spine's normal curvature and avoid positions that can aggravate your back. Turn to the next page to see examples of sleep positions that can help prevent a fracture.

If you sleep on your back, pay attention to how you sit up in bed or get out of bed. Try not to lift your head and upper back, which rounds the spine. Make a habit of rolling to your side first and then using your arms to help you sit up.

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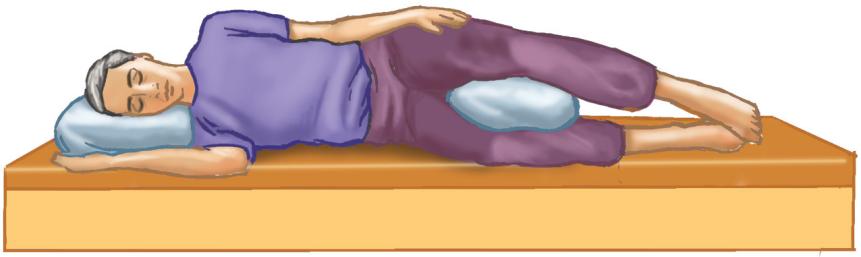
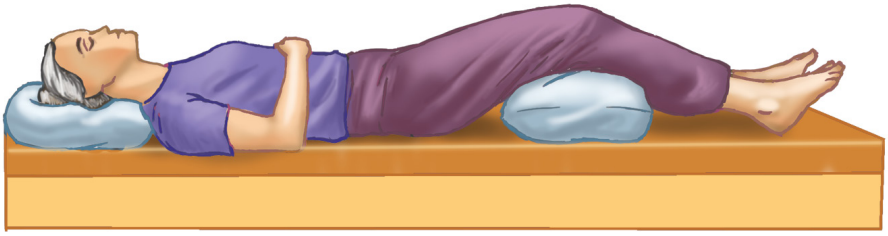
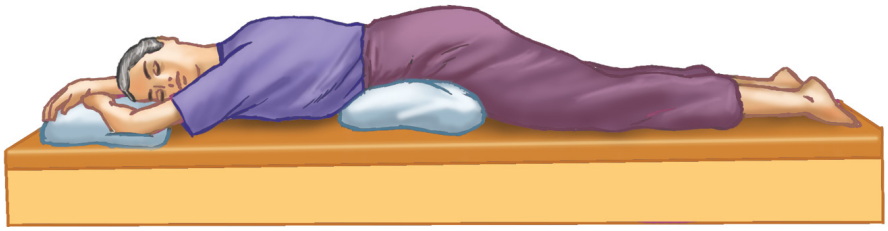
Sleeping



Sleep on your side with your thighs somewhat drawn up toward your chest. Place a pillow between your legs.



If you sleep on your back, support your knees and neck with pillows.



Sleep on your stomach only if a pillow cushions your abdomen.

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Using long-handled objects

The movements of raking, sweeping, mopping and vacuuming can put stress on your spine. To reduce this stress:

- Stand with one foot forward. Use a rocking motion to shift your body weight to your forward foot. To pull back, shift your weight to your back foot.
- Use arm and leg movements instead of back movements.
- Avoid overreaching, twisting and choppy motions. Use long, smooth strokes.

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BOOST YOUR EMOTIONAL HEALTH

Having osteoporosis may produce a range of emotions. And the more severe your condition, the more intense your emotions are likely to be. When you learn that you have the disease, you may feel shock, disbelief or anger. If you've fractured a bone, you may feel helpless. Anxiety and depression also are common responses.

Negative emotions are a natural and understandable reaction to a chronic illness, but such emotions don't have to get the best of you. For many people, acknowledging their negative feelings is a helpful step. This can be tough in a culture that so frequently praises the optimist and criticizes the complainer.

Fear and anxiety

"What happens if I fracture a bone?" This is one of the most common fears among people with osteoporosis. You may worry that a fracture could lead to the loss of your independence. You may feel anxious if you can't live up to your own or others' expectations. This may be especially true if your condition limits your ability to cook, clean or care for yourself.

Fear of fracture often leads a person to limit his or her activities. Unfortunately, this can set off a harmful cycle: A more sedentary lifestyle leads to decreased physical conditioning, making you more susceptible to falls, which in turn makes you all the more reluctant to be active. Lack of activity can also lead to apathy, isolation and depression.

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Safety tips for common daily tasks

As you perform daily chores, keep these suggestions in mind:

- If you're sweeping, use a long-handled dustpan.
- Use casters under furniture that you frequently move.
- Use an upright, self-propelled vacuum to avoid stooping or straining.
- For mopping, fill the pail half full and lower it to the floor using both hands. Finish filling the pail with a smaller container. After mopping, empty the pail halfway using the smaller container, then lift the bucket and dump the water down the drain.
- When changing bedding, avoid using fitted sheets unless you have a single bed or a lightweight mattress. You can tuck in the corners of a flat sheet using an open hand. If you must lift the mattress, get help.
- Avoid filling a laundry basket more than half full for carrying, or use a basket on wheels. Be sure that you can see the floor when you're walking with the basket, especially when you're on the stairs.
- Use an ironing board that's at the correct height for you. Have a clothes rack nearby to hang your ironed clothes on. And when you sort clothing, do so at a table or counter that doesn't require you to hunch forward while working.
- Drive up to the parcel pickup for your groceries or have your groceries delivered to avoid carrying them yourself.

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Depression

Depression is two to three times more common in individuals with a chronic illness compared with the general population. If your osteoporosis is keeping you from performing your typical daily tasks or is causing you pain because of a fracture, you could be at risk of depression. Anxiety, reduced activity

and changes in your physical appearance also may result from osteoporosis and may contribute to depression.

Depression can manifest itself in a variety of ways that you may not always recognize:

- Sleep problems
- Changes in appetite
- Loss of interest or pleasure in most activities
- Irritability and mood swings
- Restlessness
- Feelings of hopelessness, worthlessness or guilt
- Extreme fatigue or loss of energy
- Decreased concentration, attention and memory

If you think you might be depressed, talk to your doctor or another medical professional. It's important to get treatment because untreated depression can increase your risk of other health problems. With treatment, most people who have depression show improvement, often in a matter of weeks. Treatment may include medication, psychotherapy or both.

Anger

It's natural to become angry when you're confronting a chronic illness, pain or disability. But it's unhealthy to stay angry, bottle up your feelings or express them through explosive outbursts.

Mismanaged anger, whether it's short term and intense or lingering and subdued, can lead to headaches, backaches, high blood pressure and other health problems. Anger also increases muscle tension, making it difficult to relax.

Your goal is not to avoid ever feeling anger but to find healthier ways of dealing with it.

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Looking good

Feeling good about how you look is closely tied to self-esteem. But finding nice-looking clothes that fit well can be challenging for some people with osteoporosis. Compression fractures of your vertebrae may cause you to lose height and develop a curved back or a protruding belly. Blouses and shirts may feel too tight, skirts and pants may ride too high, and dresses may fit differently than they used to.

If you can sew, try tailoring store-bought clothes or modifying clothing patterns to fit better. Otherwise, consider the following suggestions when buying clothing:

- Think loose. Look for blouses or shirts with loose-fitting sleeves — for example, dolman or raglan sleeves. Or try buying clothes a size larger if you feel like your usual size is accentuating bumps and bulges.
- Try a boxy, unstructured look with straight-sided jackets, blazers, shirts and dresses. Alternatively, fit and flare tops or dresses for women may give a flattering look.
- Keep your wardrobe simple for ease of getting your clothes on and off, and use accessories such as scarves or hats to jazz up your look.
- For women, experiment with different types of bras, such as front-closure bras, sports bras or those with crisscross straps, to find one that fits well and is comfortable.

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Self-esteem

Osteoporosis can deliver a blow to your self-esteem. If multiple fractures prevent you from doing your job at work, pursuing a hobby or doing household chores, you might feel less competent. This can send your self-esteem spiraling downward.

You may also be bothered by physical changes, such as a stooped posture, loss of height or your belly sticking out more than it used to. You may see

yourself as somehow deformed.

The physical changes that occur with osteoporosis can be especially challenging in a society that values youthful beauty and vigor. These ideals are hard enough to fulfill throughout a healthy adult life. With fractures from osteoporosis, meeting expectations becomes even more difficult.

Coping strategies

Research shows that people diagnosed with osteoporosis can improve their emotional well-being by becoming actively involved in their health management. The following strategies can help you reduce stress, anxiety and depression and boost your self-esteem.

Educate yourself

The more you know about osteoporosis, the less abstract and threatening it will seem. Fear of the unknown can cause anxiety. Understanding can calm fear. If you're afraid of falling, for example, you can minimize the risks by learning how to move safely. You'll also know that avoiding activity only makes you less fit and more prone to falls.

Exercise

Research shows that getting regular exercise reduces the symptoms of anxiety and plays a role in treating mild to moderate depression. Exercise also promotes a better self-image and raises self-esteem. For more information about physical activity and osteoporosis, see Chapter 9.

Controlling stress

No one is immune from stress, but a chronic condition such as osteoporosis can increase your stress level. Sometimes simply becoming aware of the causes can make stress easier to deal with.

Aim for a healthy balance of activities in your day — time for work, physical activity, socializing, relaxation and rest. These tactics also may help you keep your stress level lower:

- Organize your day. An organized day can help you feel more in control of your life. If your morning is always rushed, you might start by

getting out of bed 15 minutes earlier. Keep a written schedule of your daily activities so that you can minimize conflicts or last-minute panics.

- Plan before you act. Before you begin a task, gather all of the items you need. For example, keep cleaning supplies in one bucket to avoid multiple trips up and down the stairs. Or list the items you need before shopping, to avoid a second trip.
- Keep commonly used items accessible. Organize your living space and work space so that the items you use frequently are close at hand. For example, keep your wrenches and screwdrivers on a pegboard above the workbench. Keep frequently used files at hand on your desk.
- Break apart lengthy tasks. Avoid spending intensive time on one activity. Instead of taking all day to plant your garden, spend one or two hours a day in the garden over three or four days.
- Work at a moderate pace. Instead of rushing to complete a task, take your time and work at a comfortable speed.

Learn to relax

Relaxation helps to counteract stress. Relaxation can also help you cope with daily demands and remain energetic and productive. Many techniques promote relaxation, including deep breathing, progressive muscle relaxation, meditation, biofeedback, hypnosis and guided imagery. It may help to learn about different relaxation techniques from a physical therapist so that you can try them at home.

Practice positive thinking

A coping technique that many people find effective is positive self-talk. Self-talk is the endless stream of thoughts that automatically run through your head every day. These thoughts may be positive or negative.

With practice you can learn to recognize negative thoughts and replace them with positive ones. For example, if your negative thought is, “I can’t do things the way I used to — I’m useless,” try to reframe it in a way that helps to build your self-esteem.

Replace that thought with a positive one such as, “I can do many of the things I want to do. As long as I don’t overdo it, I can still be active.” Over time, positive self-talk will become more automatic.

Manage your anger

Learn to identify what triggers your anger and recognize the warning signs. When you find yourself becoming angry, take a short timeout. Remember that you have a choice in how to respond to situations. Look for ways to release strong emotions, such as writing, listening to music, gardening or painting.

Many of these coping strategies will have a positive effect on your self-esteem. Here are other ideas for building a strong sense of self-worth:

- Structure your day with goals that you can achieve. When the day is done, you'll feel a sense of accomplishment.
- Seek emotional support. Reach out to family and friends. Confer with a counselor, religious adviser or a mental health professional.
- Help someone else. It reminds you that your life makes a difference.
- Treat yourself to something that you enjoy, such as music, a book, a movie or going out with a friend.

MAINTAIN SOCIAL CONNECTIONS

For many people a satisfying social life is the key to feeling good mentally and physically. Social ties give you a sense of purpose in life. And staying connected is good for your health.

Studies show that people with strong social support recover from illness better than do people who face illness alone. Family and friends help you recover from any injury, including a fracture. Social contact also motivates you to be more involved in living.

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Strengthen your social network

Does your social network need a boost? Consider these tips:

- Make it a point to answer all phone calls, text messages, emails, and letters from family and friends.
- Accept invitations to social events. Strategize how you can take part safely.
- Take the initiative and invite someone to join in an activity.
- Become more involved in community organizations, neighborhood events and family get-togethers.
- At local events, strike up a conversation when the opportunity arises.
- Join a group exercise class that's safe for someone with osteoporosis. Your doctor can advise what's appropriate.

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Social consequences of osteoporosis

Osteoporosis can affect your relationships with family and friends in a number of ways.

Most of us define ourselves to some extent by the social positions we hold, such as parent, spouse, colleague or manager. Even mild osteoporosis can change these relationships. You may become more dependent on your spouse or adult children. You may lose a sense of shared effort and contribution within the family or at work. You may not be able to reciprocate friends' good will and intentions.

Depending on the severity of your condition or your risk of fracture, you may have to let go of some or all of your job and household responsibilities. People with severe osteoporosis may withdraw socially because of chronic pain or fear of fractures. If you experience chronic pain, riding in a car, sitting in a hard chair, standing or walking can quickly become uncomfortable.

To avoid the pain, you may stop taking part in some of your customary activities, such as attending religious services, playing cards, going to movies and traveling.

Fear of falling down also can result in social isolation. You may avoid going out in public — especially to crowded places — because you worry about being pushed or stumbling. You may find it difficult to shop at grocery stores or make visits to the mall because lifting and carrying bags can be difficult.

Intimacy

Sexuality is a natural, healthy part of living, and part of your identity. But if you have osteoporosis, you may be concerned about what that means for the safety of sexual intercourse. If you have pain or an injury from the disease, you may be worried that your partner finds you less attractive because of it. Or you may have simply lost interest in sex as a result of the symptoms.

It doesn't have to be this way. You can have a healthy and satisfying sexual relationship, no matter your bone density. The key is honest communication. It also helps to be creative and willing to change. Try these strategies:

- Communicate openly. Talk with your partner about how you feel, what you want or need from the relationship, and how to be intimate in a way that works for both of you. If you have unspoken fears regarding sexual contact, tell your partner about them. Talking openly together can ease your concerns.
- Rekindle your romance. Go on a date, plan a picnic, send flowers or just spend extra time together. Set the stage for sexual intimacy with dinner by candlelight or holding hands during an evening stroll.
- Expand your definition of intimacy. If the act of intercourse causes problems, consider intimate alternatives that might be more comfortable and fulfilling.
- Experiment to make intercourse more comfortable. Instead of a conventional posture that may be painful, try a different position, for example, lying side by side, kneeling or sitting.

If you continue to have sexual problems, talk with your doctor. Pain and fatigue can reduce your libido, but many medications, including glucocorticoids and antidepressants, also can reduce your sex drive. Your

doctor may be able to change your medication, change the dosage or recommend other strategies to enhance your sex life.

In all partnerships, it takes effort to maintain what is good and to correct what isn't. Be willing to make that effort. A healthy sexual relationship can positively affect all aspects of your life, including your physical health, self-esteem and productivity.

Reaching out

Many adults are used to being quite independent. So it may seem embarrassing to ask others for help, especially with tasks you've done all of your life. But this is a time to put your safety above your independence.

Although relying on others might seem unnatural at first, this increased reliance can actually help you manage your physical health and stay independent. For example, by asking someone to help you with day-to-day tasks such as shopping and housework that require lifting, you reduce the risk of fracture. It's not a sign of weakness to ask for assistance when you need it.

It's true that relationships can sometimes be as much a source of stress as support. Your loved ones may not understand everything that you're going through emotionally, but they're likely eager to help you adjust. Family and friends can provide encouragement, offer gentle but helpful feedback and lend a hand when you need it.

Remember, good relationships require patience, compromise and acceptance. Your family and friends will need to accept your needs just as you must learn to accept theirs.

Joining a support group

It can be discouraging if you feel that no one else understands exactly what you're going through. But there are people who understand, primarily because they're going through it themselves. Support groups, or self-help groups, bring together people who share common concerns. Even if your family is sympathetic, sometimes it's helpful and reassuring to talk with others in a similar situation.

A support group can give you a sense of belonging. It can provide you with an outlet to express your feelings and fears and to exchange experiences. It also offers an opportunity to meet new friends.

Support groups may vary in format and size, but they're all based on peer support. Many groups are sponsored by a hospital or a clinic or led by a health professional. The National Osteoporosis Foundation has developed a national network of affiliated support groups. To find an osteoporosis support group in your area, ask your doctor or contact the National Osteoporosis Foundation (see this discussion).

A NEW NORMAL

If you have an increased risk of a bone fracture, staying independent and injury-free may take some adjustments to all aspects of your routine. You may need more support than you're used to — particularly if you're recovering from a fracture. But staying active and engaged is not only possible, it's key to staying strong and healthy in the long term. Help your family and friends understand the risks of osteoporosis. Talk through your frustrations. Asking for support or accommodations can be difficult, but staying connected and spreading awareness empowers you to take charge of your health.

Chapter 14

Recovering from a fracture

You didn't plan on spending the next six months recovering from hip surgery. Then again, you didn't plan on slipping in the shower and breaking your hip, either. And now here you are, using a walker to move around the house. You need help doing tasks such as the laundry and making dinner. You can't get out like you used to. You feel like you'll never be your old self again.

It's true that recuperating from a broken bone, particularly an osteoporotic fracture, can be painful and frustrating. It may take longer than you'd like it to. But many people do regain their former abilities and a semblance of their former lives. In general, the healthier you are and the more positive your attitude, the better equipped you are for recovery from a fracture.

In this chapter you'll learn how bone heals and restores itself after breaking. The chapter also covers forms of treatment for the most common osteoporotic fractures — those of the spine, hip and wrist. In addition, you'll read about ways to manage chronic pain, which can accompany a fracture. Learning about the fracture you may have and the treatment that's available can help you recover faster and get active again.

YOUR RECOVERY

How well you recover from a broken bone depends in part on the location and severity of the fracture. In many instances, prompt medical attention combined with the body's natural healing process will lead to fracture repair within several months. For example, a wrist fracture will usually heal if you wear a cast and an arm sling until your wrist is stable enough to bear weight again.

But it's not always quite that simple. Additional support may be needed for severe breaks, such as hip fractures, which generally require surgery. Other fractures, such as vertebral fractures, can cause chronic pain after the bone is healed and may require a different therapeutic approach.

You'll find that each fracture requires its own course of treatment. In addition to taking steps to heal your broken bone, you may also begin receiving treatment for osteoporosis, if you haven't already done so.

But the recovery process doesn't necessarily end once the bone is healed. You may need ongoing therapy to regain most of your former strength and mobility. In addition, you may need to take steps to prevent other fractures. This often involves diet, exercise and other lifestyle changes, in addition to the use of medication.

Let's start with a look at the process of bone healing.

HOW BONE HEALS

As discussed in Chapter 2, your bones are continuously renewing themselves in a process called remodeling. Cells called osteoclasts tear down old or damaged bone (resorption), while cells called osteoblasts build new bone (formation). This continual cycle is the basis of fracture healing. In fact, bone is the only solid tissue in your body that can rebuild and replace itself. Other tissue injuries, such as a skin wound, heal with the formation of a different, fibrous tissue that leaves a scar.

Self-repair of a bone fracture can be described in phases:

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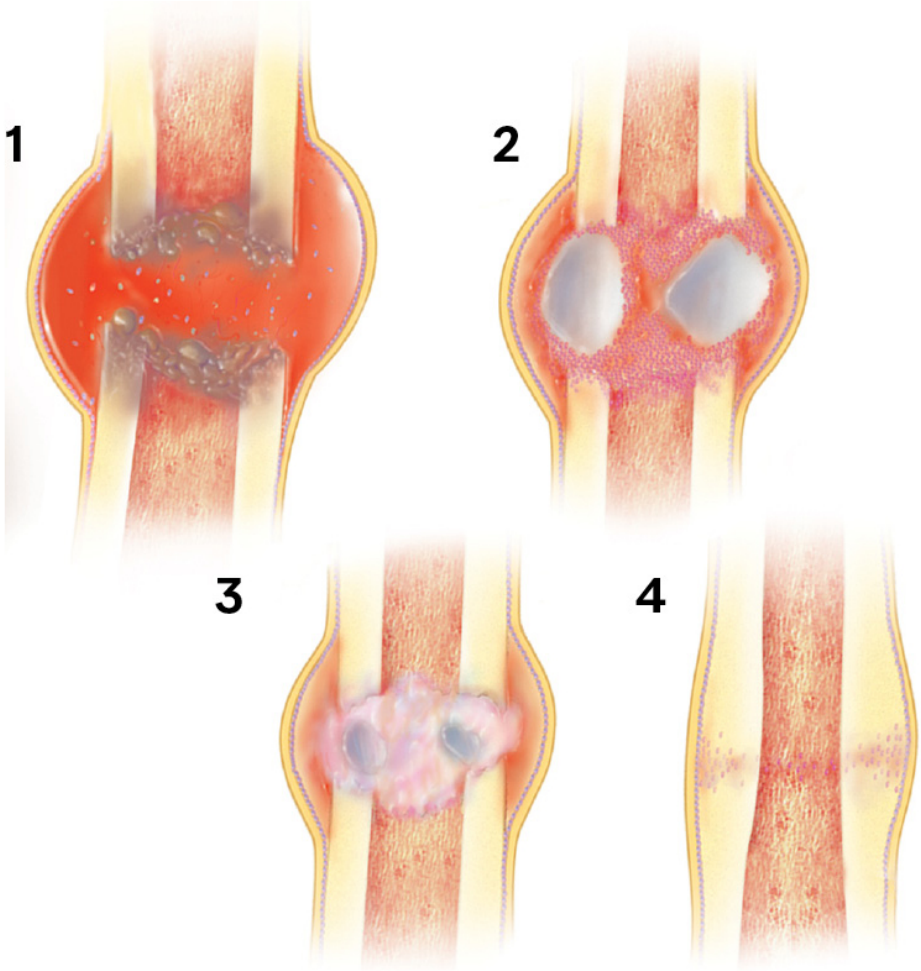
How a broken bone heals



After a break, a blood clot forms, sealing off damaged blood vessels between the ends of the broken bones (figure 1). A soft callus develops as the bone begins to regenerate (figure 2). Osteoblasts help build a mesh of spongy bone, creating an internal splint that links the fractured bone ends (figure 3). With the deposit of calcium and other minerals, this mesh develops into denser bone (figure 4).

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Phase 1. When a bone breaks, it bleeds like any other tissue in the body. A blood clot forms that seals off damaged blood vessels near the break. Molecules in the blood clot are thought to signal specialized cells to help with the repair process. Meanwhile, osteoclasts begin removing damaged bone and tissue. Phase 1 generally takes about two weeks.

Phase 2. Over the next four weeks or so, the bone begins to regenerate with the help of osteoblasts. A soft callus that's made of collagen, the structural framework of bone, forms at the site of the break.

Phase 3. The work of the osteoblasts continues as a mesh of spongy bone develops. This creates an internal splint linking the fractured bone ends.

Phase 4. Within about six to 12 weeks, denser, harder bone replaces spongy bone. Newly deposited minerals in the collagen bind together and harden, resulting in greater bone strength. At this point, the fracture may be considered healed, although remodeling continues to strengthen the bone.

Throughout this process, the fractured bone must be correctly aligned to allow for proper healing. Problems usually arise when the ends of the fractured bone aren't aligned or they can't be immobilized. In such instances, surgery or another medical procedure may be necessary to reposition the bone ends and stabilize the fracture so that the bone will heal properly.

VERTEBRAL FRACTURES

When the mineral density of your bones decreases, the vertebrae that make up your spinal column begin to weaken. Eventually, some vertebrae can lose most of their mineral content, leaving them unstable. The impact to bone that occurs from falling down — or even from twisting your torso improperly — can result in a compression fracture. So can lifting a load that's too heavy for your vertebrae to bear. The bone literally collapses and falls in on itself.

While some compression fractures produce no symptoms, others can cause a sudden, sharp pain or pain that's chronic and persistent.

Typically, vertebral fractures are treated with pain relievers, bed rest, braces worn around the midsection and physical therapy. Compression fractures usually heal within two to four months, and acute pain gradually improves during this period.

Sometimes, however, the pain may persist and isn't relieved by conventional methods. In these instances, surgical procedures may be considered for treatment of fractures that cause chronic, unrelieved pain.

Pain relievers

Nonprescription pain medications often help minimize your discomfort, particularly at the start of the recovery period. Commonly used nonprescription pain relievers include aspirin, acetaminophen (Tylenol, others), ibuprofen (Advil, Motrin IB, others) and naproxen sodium (Aleve, others).

Long-term use of these medications typically isn't recommended because of the distressing side effects they can cause, such as gastrointestinal bleeding, stomach upset, dizziness, bloating and abdominal pain. Kidney problems also can occur if this type of medication is taken regularly for a long time.

Stronger prescription medications, such as those that contain codeine, are available for severe pain. However, prescription medications may cause constipation, which can be particularly distressing, along with other side effects. Long-term use can also lead to tolerance for the medications. When this happens, larger dosages are required to alleviate the pain. Read important information about these medications here.

Bed rest

Acute pain from a compression fracture will usually diminish after a couple of days of bed rest. A firm mattress provides better support for your spine than does a soft one. Although rest is essential to alleviate the initial pain, staying in bed for more than a few days generally isn't good. Doing so may weaken your back and aggravate bone loss.

Therefore, it's important to start moving as soon as you can, alternating periods of rest with activity. Physical activity can strengthen the muscles in your back and abdomen and improve support for your spine.

Bracing

If the pain persists following several days of bed rest, your doctor may recommend that you use a brace to help support your back. Back braces are generally worn for short periods of time, such as when doing an activity that may strain the back. Wearing a brace for too long can actually be counterproductive. With a brace, your back doesn't work to support itself, causing your back muscles and abdominal muscles to weaken.

Back braces are generally available at pharmacies and medical supply stores. There are many styles to choose from. Your doctor or a physical therapist can advise you on the best choice.

Exercise

Exercise can strengthen your back muscles, help you maintain good posture, slow bone loss and improve your overall fitness, all of which can help prevent fractures. Your doctor or a physical therapist can help you design a safe exercise routine that provides you with these benefits while minimizing the risk of fractures during exercise. An exercise program usually includes the following:

Weight-bearing exercises. These are activities you do on your feet with your bones supporting your weight, such as walking.

Resistance exercises. These are activities that apply force on specific muscles and bones: for example, by using weights.

Back-strengthening exercises. These activities help you maintain or improve your posture, which helps avoid more fractures. Always be sure to consult your doctor or physical therapist before beginning an exercise program, as some activities or movements can increase the pain from compression fractures or even cause more fractures.

Vertebroplasty

Vertebroplasty is a surgical procedure to help alleviate pain. Under X-ray guidance, a needle is placed into a fractured and collapsed vertebra, and acrylic bone cement is injected. The cement hardens over a few hours, sealing and stabilizing the fractures and relieving pain. The procedure generally takes from one to two hours.

Vertebroplasty may be used in individuals with unstable vertebral fractures or severe pain, but there are concerns as to its effectiveness. Studies over time have shown mixed results. A 2018 report looked at numerous studies of vertebroplasty from around the world. High-quality evidence did not show an advantage among people who received vertebroplasty compared with those who underwent a fake procedure (placebo group). Still, another recent study found that vertebroplasty did provide better relief for certain people —

those with recent fractures and persistent, severe pain. Further research is still needed for more-definitive results.

Complications of the procedure are relatively few. During the hardening process, the cement generates heat that threatens nerve endings within the spine. This may cause temporary discomfort, but may also provide some pain relief.

One of the main concerns surrounding vertebroplasty is leakage of the cement into surrounding tissues as it's being injected. During test studies, the leakage generally had no side effects, although in a few incidents it led to compressed nerves and increased pain.

Kyphoplasty

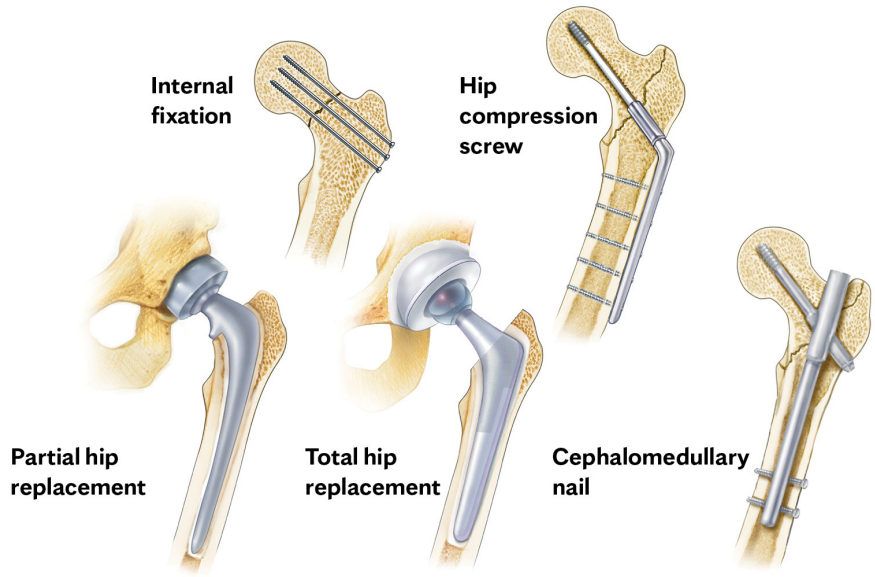
Kyphoplasty is a surgical procedure similar to vertebroplasty that involves the use of a balloon-tipped needle. After the needle is inserted into the vertebra, the balloon is inflated to create a space for the cement to be injected. In most cases, this action not only strengthens the vertebra but also may expand the collapsed vertebral body.

Kyphoplasty is reported to provide pain relief, and serious complications are uncommon. But, again, health experts caution that more research is necessary to determine all of the procedure's risks and benefits, as well as its effectiveness.

HIP FRACTURES

A hip fracture is a serious injury, particularly if you're older, and its complications can be life-threatening. Most hip fractures occur in people older than 65, with the risk increasing as you age.

A hip fracture almost always requires surgical repair or replacement, followed by physical therapy. Doctors may turn to nonsurgical alternatives, such as traction, only if you have a serious illness that makes surgery too risky. The type of surgery you have generally depends on where the bone is broken, the severity of the fracture and your age.



Treatment options for a hip fracture: For a fracture in the femoral neck, internal fixation, partial hip replacement or a total hip replacement may be used. A hip compression screw or a cephalomedullary nail may be used for a fracture in the intertrochanteric region.

Femoral neck fractures

The long bone of your thigh (femur) is connected to the pelvis at your hip, which is a ball-and-socket joint. A narrow section of the femur just below the joint, known as the femoral neck, is a common location for a hip fracture (see this illustration). Doctors repair the fracture by one of three methods:

Internal fixation

Surgeons may insert metal screws into the bone to hold it together while the fracture heals. In some cases, screws are attached to a metal plate that runs down alongside the femur.

Partial hip replacement

If the ends of the broken bone aren't properly aligned or they've been damaged, your doctor may remove the head and neck of the femur and install a metal replacement (prosthesis).

Total hip replacement

A total hip replacement involves replacing both your upper femur and the socket in your pelvic bone with prostheses. Total hip replacement may be a

good option if arthritis or a prior injury has damaged your joint, affecting its function even before the fracture.

Intertrochanteric region fractures

The intertrochanteric region is the part of a femur adjacent to the femoral neck. To repair a fracture in this area, a surgeon usually inserts a long metal screw, known as a hip compression screw, through the fracture to rejoin the broken bone. The screw is attached to a plate that runs partially down the length of the femur. The plate is attached to the femur with smaller screws to keep the bone stable. As the bone heals, the compression screw allows the edges to grow together.

Many hip fractures are now treated with a cephalomedullary nail, also called an intramedullary nail. This device is a metal rod that is placed inside the bone to stabilize the fracture. It's very similar to the compression hip screw, but it can be placed through three or four small incisions, instead of a single, larger incision. This intramedullary rod comes in different lengths, and it can be placed inside the bone to a point just above the knee. This provides protection of the whole femur.

General concerns

When you have hip surgery, you'll either undergo general anesthesia or local anesthesia. If all or part of the joint is removed, the prosthesis is often secured with bone cement — the same type that's used in vertebroplasty and kyphoplasty. It takes only a few minutes for the cement to harden and the hip prosthesis to be firmly in place.

Sometimes a different type of prosthesis is used that allows the bone itself to grow into the device and keep it in place. This usually requires a longer recovery period because the bone needs time to grow. A hybrid prosthesis involves cementing part of the device (usually the femoral neck) and leaving the other part uncemented (usually the socket).

Artificial hip joints generally can function well for 20 years or more, but eventually the prosthesis may loosen, requiring another operation. Older adults are more likely to receive a partial or total hip replacement because they tend to put less strain on an artificial joint than younger people do.

Among younger individuals, use of internal fixation to repair a fractured hip is more common. The procedure can be used to repair fractures in people of any age so long as the broken bones are well aligned.

If the hip is infected or there's a skin disorder around the hip, a surgeon will likely wait until the condition improves before doing the operation. Before surgery you'll probably go through an extensive evaluation to check your medical history, the extent of damage to your hip and your current health. Your doctor likely will also discuss the potential risks and benefits of having hip surgery in your specific case.

At the hospital

Hip surgery usually requires a few days to a week in the hospital, depending on how well you recover from the operation. Hospital staff will try to get you up and moving as soon as possible.

A serious complication of hip surgery is the formation of blood clots in the veins of your thighs and calves. A blood clot may break free and travel to your lungs, causing a pulmonary embolism that can be fatal in a matter of hours. Hospital staff will closely monitor your condition to prevent this from happening.

It's important to begin gentle activity immediately after surgery. This may include slowly moving your foot up and down or rotating your ankle as you lie in bed. A physical therapist can show you how to do specific exercises. Although these activities might feel uncomfortable at first, they can lessen pain, prevent blood clot formation and improve hip movement.

You'll likely continue these exercises after you go home. In addition, your doctor may prescribe blood-thinning medications for several weeks or months after the procedure to prevent clot formation. Some older adults, particularly those who live alone, may enter a rehabilitation center for a period of time after surgery to receive physical therapy and assistance during their recovery.

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When treatment doesn’t prevent a fracture

A person with osteoporosis who is taking medication to prevent fractures might still experience a fracture. In most cases, this occurs because osteoporosis medications — at best — prevent only about 70% of fractures. In addition, some osteoporosis medications are more effective in preventing fractures than are others. And while all osteoporosis medications help prevent spinal fractures, not all medications help prevent hip, wrist or other fractures. Your doctor will select the right type of medication for you, based on your initial bone density test report and your risk of future fractures.

So, what do you do if you experience a fracture while receiving treatment for osteoporosis? It’s likely that your doctor will review your situation to make sure that you’re taking the medication correctly. Because some individuals don’t absorb the medication properly, your doctor may also order tests to rule this out as a possible cause for your fracture. Depending on when you had your last bone density test, your doctor may have you take another test to see if your bone density has improved, remained stable or decreased. If you’re receiving treatment, your bone density should remain stable or improve. If your bone density decreases, this could be a sign that your medication isn’t working.

Your bone loss may also be due to a condition neither you nor your doctor are aware of. This condition may produce a stronger negative effect on your bones than the positive effect your medication provides. For example, your vitamin D level might be too low, such that you can’t absorb calcium adequately. Your bone density may decrease because of this, despite taking your medication. To rule out an unrecognized cause, you may be asked to undergo several blood or urine tests, or both.

Even after checking for a variety of conditions, some people have no identifiable cause for their fractures. In this type of circumstance, it’s likely that your doctor will continue to use the same kind of medication, and it may be that no further fractures will occur. If another fracture does occur, you may be switched to a different, more powerful drug.

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At home

Before you go home, or even before you enter the hospital for surgery, it may be a good idea to have your home rearranged to be more conducive to recovery. This involves clearing pathways so that you can freely use a walker and making sure that you have a firm, high-seated chair available to use.

In addition, set up a personal recovery area with everything you need at your fingertips, such as eyeglasses, reading material, medications, a phone, a remote control, a computer or tablet, a wastebasket, and water to drink.

You contribute much to your own rehabilitation. Your participation in the recovery process often determines the procedure's success. Here are a number of factors to keep in mind:

- Keep the incision clean and dry. Stitches are generally removed two to three weeks after surgery. Until then take sponge baths instead of showers.
- Swelling is a normal reaction during the first few months after surgery. To counteract the swelling, elevate your leg and place an ice pack on your hip for several minutes at a time. Avoid placing ice directly on your skin by wrapping the pack in a washcloth or dish towel.
- Contact your doctor immediately if you think you're developing a blood clot or infection. Signs and symptoms of a blood clot include pain, redness or tenderness in your calf, and new swelling in your leg or foot. Signs and symptoms of an infection include redness or swelling around the incision, wound drainage, persistent high fever, chills, and increasing hip pain.
- Care must be taken not to dislocate the prosthesis. Don't cross your legs, whether sitting, standing or lying down. Keep your knees below the level of your hips. Sit on a cushion to keep your hips higher than your knees. Avoid bending at the waist. When sleeping, place a pillow between your knees to keep your hip properly aligned.
- Bacteria can enter your bloodstream during dental procedures, so it's important to let your dentist know that you've had a hip replacement. Your dentist may recommend that you take antibiotics before dental work to help prevent bacteria buildup and an infection.
- It's important to stay active. Get up and move around at least once an hour during the day. Most people can usually put some weight on their

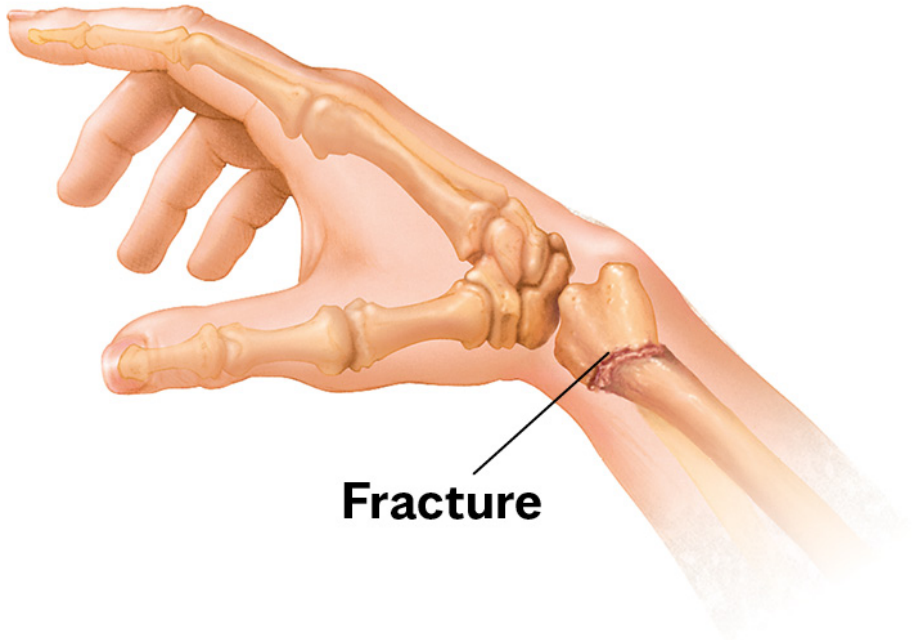
leg right away after hip fracture surgery, but you'll need to use a walker for a while to allow the joint to heal properly. If you have a cementless prosthesis, your surgeon will probably ask you not to put any weight on the leg for the first six weeks, to give your bones time to grow into the prosthesis.

- Don't overdo your activities. The key is to be active and exercise at a level that's comfortable for you. Walking is usually safe, and swimming, an exercise that's easy on your joints, is recommended after your incision has healed.
- A healthy diet is important. If you were watching your weight before surgery, continue doing so because excess weight can place unnecessary stress on your hip joint.

Most people return to their normal activities, but it generally doesn't happen immediately. A healthy recovery requires not only a willingness to do what your doctor or physical therapist prescribes, but also consistency in actually doing it, such as performing prescribed exercises each day.

WRIST FRACTURES

Compared with vertebral and hip fractures, wrist fractures are usually simpler to treat. Most osteoporotic wrist fractures are clean breaks of the radial bone in the forearm just above the wrist joint. This break is known as a Colles' fracture. These types of fractures typically heal well, resulting in full use of the hand and wrist.



Wrist fractures: A basic fracture is often treated with a cast. For more-severe fractures, metal pins may be used to help hold the bones in place while the fracture heals.

Some wrist fractures, however, can be complex. If the broken ends of bone shift apart by less than a tenth of an inch, the fracture is considered displaced. Before the bone is allowed to heal, the bone must be realigned. If a bone splinters into numerous pieces, the break is referred to as a comminuted fracture.

In either case, surgery may be required to reposition the pieces, and various devices may be used to hold the pieces in place as the bone heals. If the broken bone breaks the skin — what's known as an open fracture — emergency treatment is required to prevent infection.

Several methods are used to treat a fractured wrist:

Cast or splint

A cast is often the preferred method for older adults who have a simple wrist fracture with minimal displacement.

A short arm cast is usually applied from below the elbow to the hand. It immobilizes the wrist bone, is less invasive than is surgery and usually has good results.

After a fracture, swelling is often a problem. If so, a splint may be used for the first few days and then replaced with a cast after the swelling has gone

down. Elevating your arm and icing your hand also help reduce the swelling.

In other cases, a long arm cast, which extends from your upper arm to your hand, is used to immobilize the whole arm and thumb. This cast is later replaced with a short arm cast to allow free motion of the elbow. After the cast is removed, your doctor may have you use a removable splint at night and between exercise sessions during the day for added support.

Internal fixation

Some complex fractures, particularly those that extend into the joint, may require internal fixation. This involves surgery in which a surgeon places metal pins, rods, plates, screws, or bone grafts inside or along the fracture to hold the bone in position as it heals.

External fixation

If a fracture is severely displaced or comminuted, it may heal best with metal pins inserted through the skin into the bone on each side of the fracture. The pins are attached externally to a frame that helps hold the fracture in place. Your arm is held in a sling to help protect it and to keep the wrist elevated.

An external device is usually worn for 6 to 12 weeks. During this time, your doctor may adjust the pins periodically to ensure the precise alignment of the bone.

Injectable bone cement

For some fractures, a bone-replacement material is used that acts as a filler, helping to restore stability to the broken bone. Bone cement used to be more commonly used for wrist and hand fractures, but the results were often unsatisfactory. It is now mainly reserved for unique cases.

Physical therapy

A frequent complication of a wrist fracture is subsequent stiffness of the wrist. To counteract this effect, your doctor or physical therapist likely will work with you to get your fingers and adjoining elbow and shoulder moving as soon as possible after the fracture has stabilized.

A common exercise is to close your fingers into a fist and then slowly fully extend them. You may be asked to do this several times an hour during the

day. After the cast or fixation device is removed, you'll be given additional exercises, including resistance exercises to build bone mass. You may also receive balance and gait training to prevent further falls.

As with any form of rehabilitation, you play a vital role. Your goal is to regain function of your hand. You may accomplish this by following your doctor's instructions carefully and by consistently performing the prescribed exercises.

MANAGING CHRONIC PAIN

Although proper treatment may relieve the initial pain of an osteoporotic fracture, the recovery period following treatment also can be painful. Sometimes pain may persist after the bone has healed.

Dealing with chronic pain can be frustrating when there seems to be no immediate relief in sight. The pain can cause feelings of irritability, depression and anxiety, which only make the pain seem worse. Although no quick fixes are available, you can learn to manage your pain. Keep these two points in mind:

- **You play a central role in pain management.** If you want your life to improve, you'll need to take steps to make it happen. Only you can control your future.
- **Managing chronic pain isn't about making pain disappear.** It's about learning to keep pain at a level you can tolerate.

In dealing with chronic pain, people often turn to pain medications. These are certainly appropriate for coping with acute pain, and they can be very effective when used properly. But for many chronic pain disorders, medication often isn't the answer.

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About opioid medications

Opioid medications, also called “narcotics” or “pain killers,” work by dulling the brain’s sense of pain. These powerful pain medications may be given after surgery or for short-term (acute) pain relief. Examples of opioids prescribed in pill form include oxycodone (OxyContin, Roxicodone, others) and oxycodone with acetaminophen (Percocet, others).

Opioids may be habit-forming and can have significant side effects, including nausea, vomiting, constipation, urinary retention, drowsiness, impaired thinking skills and poor respiratory function. They may also have other serious complications, including death.

If your health care provider has included opioids in your pain care plan, you should discuss steps that you can take to reduce the risks of using them. These may include:

- Take medication only as directed, using the smallest effective dose for the shortest possible time.
- Talk to your doctor when your pain is not under control.
- Do not use alcohol while taking opioids.
- Follow your doctor’s instructions about other drugs not to take while using opioids.
- Store drugs safely.
- Dispose of any unused pills when you’re done taking them, ideally through a pharmacy take-back program.
- Do not share your medication with other people.

Important!

Before you take opioids, be sure to tell your health care provider about:

- All medications or substances you take, including herbal products or dietary supplements.
- Whether you or a family member has had a substance-use disorder or a mood or anxiety disorder in the past or currently. These conditions greatly increase your risk of addiction to opioids.

- Whether you have any other medical conditions, especially ones related to your heart and lungs, as opioids may not be safe to use if you have these conditions.

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Some people take medication because they feel they need to, not because it helps. The drugs become a crutch or distraction from more-effective, safer long-term solutions. People are often surprised to find that stopping their medications isn't as difficult as anticipated. They often also find that not using medications gives them a greater sense of control over the pain and their lives.

For long-term pain, pain medications may not be effective. Many medications can also be habit-forming. In particular, opioids — strong medications that may be used to reduce severe pain for a short time — carry the risk of addiction. They can also have serious side effects and complications (see "About opioid medications"). Talk with your doctor right away if you find that your medication dose has become less effective or if you're experiencing side effects.

Alternative methods for relieving pain

When medication isn't effective or it isn't recommended due to unwanted side effects, other methods can be used to help relieve chronic pain.

Exercise

Although rest is important for recovery and pain relief, exercise is equally vital to reducing pain, especially in the long term. Exercise causes your body to release chemicals called endorphins, which prevent pain signals from reaching your brain. The more endorphins you produce on your own, the less you'll need to rely on other forms of pain management, such as medication.

Because certain exercises shouldn't be done when you have osteoporosis, it's important to consult your doctor before beginning an exercise program. That way you'll be sure you're performing the activities that are best for you.

Ice and heat

Applying an ice pack can reduce swelling and inflammation and act as a local anesthetic. Treatment in the form of a hot water bottle, hot bath or heat lamp relaxes your muscles and helps relieve chronic pain. Remember not to directly expose your skin to extreme temperatures. Keep the ice pack or hot water bottle wrapped in a towel. Limit applications to 20 minutes at a time.

Relaxation techniques

Your physical therapist can show you certain relaxation techniques that help take your mind off pain, relax your muscles and relieve unnecessary stress. These techniques might include visualization, progressive muscle relaxation and deep breathing.

Biofeedback

The goal of biofeedback is to teach you how to control certain body responses. During a biofeedback session, a trained therapist applies electrodes and other sensors to various parts of your body. The electrodes are attached to devices that monitor your responses and give you visual or auditory feedback of your muscle tension, heart rate, blood pressure, breathing rate and skin temperature.

With this feedback you can learn to produce positive changes in body functions, such as lowering your blood pressure or raising your skin temperature. These are signs of relaxation — and the more relaxed you are, the less focused you are on your pain. The therapist may use relaxation techniques to further calm you.

Music therapy

Practitioners of music therapy claim that it can lower stress, reduce symptoms of depression and promote pain relief. With this treatment, a trained music therapist uses music and all of its facets — physical, emotional, mental, social and spiritual — to help people improve or maintain their health. Performing or listening to music, with guidance from a music therapist, can help relieve muscle tension and slow your breathing.

Electrical stimulation

Transcutaneous electrical nerve stimulation (TENS) may help stop pain by blocking nerve signals to your brain. A physical therapist places electrodes

on your skin near the area of your pain. TENS may relieve pain in your leg due to inflammation or compression of nerves in your back, but it may provide little relief for chronic back pain.

A word of caution

Certain methods of pain relief may spell trouble if you have osteoporosis. Massage, chiropractic treatment and other spinal manipulation can cause or aggravate vertebral fractures, so talk to your doctor before trying any of these.

SETTING UP FOR A SUCCESSFUL RECOVERY

After a fracture, getting back to your old routines may take several weeks of inconvenience — say, with your wrist in a cast — or several months or more of intensive care and recovery. For older adults, serious injuries such as a hip fracture might even mean a permanent adjustment in lifestyle. But you can take steps at any age to improve your chance of a faster, full recovery. Keep your bones and your muscles as strong as possible, stay socially connected, and stay in tune with your mental health so that you can keep a positive attitude.

You can also reduce your risk of a fall and fracture by making adjustments in your home. The next chapter offers practical tips to help you minimize safety hazards in your daily routine.

Chapter 15

Home safety

Falls are a serious hazard for older adults, especially those with osteoporosis. According to the Centers for Disease Control and Prevention, 1 out of every 3 people in the United States age 65 years and older will fall each year. And of those who fall, 20% to 30% will suffer moderate to severe injuries that reduce their mobility and independence. At least 95% of all hip fractures result from a fall.

Among people age 65 and older, half of all falls occur at home. Therefore, an action plan for osteoporosis involves minimizing your risk of falling. You can do this by organizing your home environment and workspace in a way that allows you to move about comfortably and safely.

You may also have occasion to use what is known as an assistive device. These devices are items that enable you to perform routine tasks and activities safely and with minimum stress on your skeleton. Canes and walkers can provide support and keep you balanced as you move about. Other assistive devices eliminate dangerous movements that can lead to fractures, such as reaching above your head for something on a high shelf or bending forward to pick up something from the floor.

As you age, you'll likely want to remain as independent as you can. Often, this means being able to live at home, keep your own schedule and organize your time as freely as anyone else. Taking preventive action can help you continue to do this for as long as reasonably possible. This chapter focuses on practical measures you can take to help avoid fractures, stay active and maintain the lifestyle you want.

STAYING SAFE INDOORS

It’s ironic that the home — your private refuge — statistically ranks as one of the most dangerous places you can be. The average residence puts you in regular contact with electricity, heat sources, water, slick surfaces, stairs and many other physical dangers. And many people, particularly older adults, spend a major portion of each 24-hour day within the walls of their homes.

For these reasons, it’s important to carefully examine your home and look for features that could cause you to lose your balance or footing: stairs, rugs, electrical cords, step stools and areas where there may be wet surfaces. The kitchen and bathroom are often among the most dangerous places in the home. Also identify high-traffic areas that combine multiple threats. Keep in mind these commonsense general principles when inspecting your home for safety.

- Keep pathways clear
- Use proper lighting
- Ensure safe seating options
- Organize work areas

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Making your home as safe as possible

Here are some simple changes you can make in your home to help prevent falls:

- Keep rooms free of clutter, especially floors and stairs.
- Keep electrical cords and oxygen tubing neatly organized and tucked out of the way.
- Avoid walking in socks, stockings or plush slippers. Choose comfortable, low-heeled shoes with nonskid soles.
- Be sure your carpets and rugs have skid-proof backing or are tacked to the floor. Get rid of throw rugs that can't be held securely in place.
- Place a phone and flashlight within reach of your bed.
- Make sure stairs are well lit and have handrails on both sides. Cover the steps with tightly woven carpet or nonslip treads.
- Avoid storing items at the bottom or top of the stairs.
- Paint the top edges of the steps a contrasting color so that you can see the stairs better.
- Install grab bars on bathroom walls near the tub, shower and toilet. Use a rubber mat or a chair in the tub and shower.
- Use a night light in your bathroom.
- Add ceiling light fixtures so that you don't have to walk into a dark room to turn on a lamp.

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Keep pathways clear

Clearly, it's smart to watch your footing everywhere you go in your home. But pay close attention to the primary pathways within rooms, between rooms and in hallways. Keep these areas picked up and remove unnecessary clutter.

Also be alert to tight spaces and blind corners that might cause you to bump into furniture or collide with someone. Avoid loose rugs and carpeting, buckled or torn linoleum or tile, and raised thresholds — the crosspiece at the bottom of a door frame — that could catch your heel and cause a fall. While it's best to avoid throw rugs, if you do want to use a rug or mat, secure it to the floor with double-sided tape or a nonslip backing.

Cords, wires and oxygen tubing also can pose a significant hazard in walkways. Consider coiling or taping cords and wires so that you cannot trip over them. Or consider battery operated alternatives.

Use proper lighting

Good vision is one of the best tools you have to prevent falls. The easiest, most practical way to improve vision safety in your home is to add lighting. Be prepared to add more than just an extra lamp or two. Start by increasing the wattage in the lamps you currently use. Be careful to stay within the manufacturer's recommended range for each fixture, which is marked on the device. Be aware, also, that too much light used in the wrong way can produce a blinding glare.

Areas of your home that may need the greatest lighting improvement are stairways, hallways, storage closets, storage sheds, the laundry room, the garage and areas with a change in floor height: for example, a sunken living room. Check to see that you have the highest wattage bulbs allowed in overhead lights. Installing lighting under kitchen cabinets helps brighten work areas.

Because your balance may not be as good in the dark as it is in daylight, place night lights in key pathways of your house. They're great for illuminating midnight trips to the bathroom and kitchen. Also make sure there is a lamp or light switch within easy reach of your bedside.

Ask an electrician about adding three- or four-way wall switches to your heavily used rooms. These allow you to control lights from more than one location, saving you a trip across a dark room. Remote control switches

and switches connected to your home Wi-Fi network also may be helpful options.

Ensure safe seating options

Keep furniture, especially chairs, sofas and other forms of seating, in good repair. Chairs should be well supported and not prone to tipping. Be cautious with anything on rollers or rockers. To help prevent dizziness that contributes to falls, take time to sit on the edge of the bed or chair before rising.

It's important that you are able to sit down or stand up easily and without unnecessary strain. Particularly after hip replacement, you'll need to keep your hips higher than your knees to prevent dislocating the new joint. Chairs or sofas that sit high with firm cushioning are generally easier to get in and out of than low, soft-cushioned seating. You may be able to adapt existing furniture with an extra foam cushion or two placed on the chair or under the sofa cushioning.

Organize work areas

Keep frequently used items within easy reach and avoid stretching for items on high shelves. If you need to retrieve something up high, use a sturdy step stool with wide steps and handrails or an assistive device known as a reacher. In the kitchen you can limit strain on your back by using front burners on your stove whenever possible and sliding, not lifting, pots in and out of the oven. Exposure to tap water that's too hot can cause you to pull back suddenly and possibly slip and fall, especially in the bathtub. To prevent scalding from hot water, be sure the water heater thermostat isn't set too high. Clean up any spills on the floor immediately.

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Fearing a fall

Falls can be a serious source of stress. Falling or experiencing a fracture may affect your confidence and make you hesitant to stay as active as you'd like. It's understandable — after recovering from a broken hip, going through it all again may be the last thing you want to do.

Unfortunately, a fear of falling may lead some people to limit physical activities and exercise that are actually beneficial to their overall health. This vicious cycle of inactivity can lead to deconditioning and actually increase the risk of falls.

After a fall, there are many ways to build up your confidence and begin to exercise again. Regular exercise can help you feel more confident and is a powerful, proven tool to help prevent falling in the future. Balance-based exercises such as tai chi have been shown to decrease one's risk of falls as well as reduce one's fear of falling. Another important step you can take is making simple changes within your own home to make it safer. This chapter is full of home safety tips you can put to use right away.

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ASSISTIVE DEVICES

Everyone has heard the phrase "Work smarter, not harder." Now swap the word live for work, and that's the idea behind assistive devices. These tools for living smarter can help you with everyday tasks. Some are simple handle extensions that provide more leverage, and others are sophisticated, ergonomically designed devices.

As you consider assistive devices for around the home, think about how many of them we already rely on to make our lives easier and more enjoyable. Do you get in a car or on a bus for a short trip to the grocery store? A car is an assistive device. The vehicle helps you get from one point to another with greater speed and comfort than you would have by walking. What about the remote that allows you to control the TV while

seated in a comfortable chair across the room? A remote control is also an assistive device.

Assistive devices generally have a well-defined function and are easy to use, sometimes with a little practice. Whether it's something you do every day, such as putting on your shoes, or something you do once in a while, such as moving a heavy object, these devices help you achieve your goals with minimum risk to your bones. Gait aids, such as a cane or walker, allow you to put more energy into mobility and less into stability — so you can walk farther, faster and more safely.

Medical supply stores, websites, catalogs, your hospital's physical therapy department and even the local hardware store are full of specifically designed items and materials that can help you with daily tasks. By using these tools, you can move more comfortably, increase your safety, bolster your confidence and sustain your independence.

Devices for daily needs

Assistive devices are often used to accomplish simple daily tasks. Using the right tool can facilitate almost everything you need to do or want to do at home, and most of these devices are available at pharmacies, hardware stores or online.

One of the most common and practical tools is what's known as a reacher. It's a lightweight pole with a trigger at one end that manipulates a single grasping claw at the other end. A reacher can help you retrieve lightweight items such as a newspaper from the floor or a remote control from the coffee table without having to bend forward. The device is easily carried and can be used just about anywhere in the house.

Many helpful devices are available for use in the bathroom. These include grab bars and folding shower seats to prevent slipping, and elevated toilets that permit easier seating. You can buy long-handled hairbrushes, combs, and sponges to clean and groom yourself without having to twist or bend your torso.

Preventing falls: The bathroom is a common place for falls because wet surfaces may be slippery. A number of devices, such as a shower chair, can make using the bathroom less risky.

In the kitchen, chances are you're already using some small electric appliances. You can expand their usefulness by finding new ways to adapt them to your chores. Manufacturers of appliances sometimes include tips for alternative uses. Buy a jar opener that can be mounted under a kitchen cabinet or countertop. A reacher with a squeeze handle grasper is perfect for easy access to items on higher or lower shelves.

Devices for movement and mobility

If you've had hip surgery, you may need support as you move around the house, at least during the first few months of recovery. Multiple compression fractures of the spine that cause you to hunch forward also may require you to use a cane or walker.

According to the Department of Health and Human Services, millions of Americans use assistive devices to accommodate impairments with walking. Although they may initially seem awkward and annoying, walking aids help you get around on your own.

Walking aids include canes and walkers. Each type comes in a variety of sizes, weights and designs, so it's not always easy to select and properly use the one that's right for you.

It may be best to have your doctor or physical therapist recommend a walking aid that would be most appropriate for you. Get assistance in determining the proper size and fit, as well as learning the best way to use it and adapt it to your needs. It's a common mistake to choose a cane that's too long. The extra length pushes up one arm and shoulder, causing strain on certain back muscles.

Awkwardness with any new device is natural. Remember the first time you tried riding a bike or casting a fishing rod? Ease will come with practice. The following section gives some pointers to help you become more informed about your options.

Canes

Canes aren't intended to carry the full weight of your body. Rather, they provide some relief and stability by allowing you to put a third point of contact on the ground — besides your two feet.

A single-point cane is the most common type of cane. This type is very helpful for people with mild balance problems who don't need to put a lot of weight on the cane.

Quadripod canes, which have a four-pronged base, offer a wider base of support than do canes with a single tip. They can also stand upright on their own. However, they can be heavier and more cumbersome to use.

A lightweight aluminum cane is often less of a burden than is a heavier wooden one. In addition, you can try different handle and grip styles to choose the most comfortable one.

Finding the correct fit and height of the cane is essential. To see if your cane is the right fit, stand erect with your shoes on, letting your arms hang at your sides. The top of the cane's handle should align with the crease of your wrist. When you hold the cane while standing still, your elbow should be flexed at a 15- to 20-degree angle. Wooden canes must be cut to the correct height. Adjustable canes can be lengthened or shortened to fit.

Is the height right? Finding a proper fit for your cane is important. Canes that are too short or too long can cause falls as well as arm and back pain.

It's best to hold your cane in the hand opposite the side that needs support, regardless of which hand is your dominant or preferred hand.

The cane and the affected leg should swing forward and touch the ground at the same time.

On stairs, step up with your good leg, then bring your affected leg and cane up. This way, your good leg lifts your body. Coming down the stairs, lead with your affected leg and cane, then bring your good leg down. This allows your good leg to lower your body.

Walkers

Walkers are self-standing units that provide more stability than a cane does. Some are maneuvered by lifting, and others are equipped with wheels. Some walkers are equipped with a basket or a carrying case. Walkers function best in single-level homes, and they shouldn't be used on stairs or in crowded, cluttered areas.

If you're at risk of falling, or you're recovering from a broken bone, a walker may help you get around. Ask your health care team about options, which include types with no wheels, two wheels, three wheels, four wheels and a knee scooter. In general, walkers with wheels are easier to manage than walkers that you lift, unless you have thick carpet or are on rough ground. Wheeled walkers are especially important if you have balance problems. If you'll be doing any traveling, consider a walker that folds.

Grips and tips

With any walking aid, a handle that's contoured to your grip is usually easier to hold for extended periods than is a rounded handle. Wrap foam around a handle that feels too small.

The tips of walking devices come in different diameters and styles. What's important is the traction they provide with the ground. Rubber is a commonly used material because it's nonskid and easily replaced when worn out. Flat, soft tips hold the ground more securely than rounded ones do.

Never glue on the tips. You'll need to replace them as they wear out. Most pharmacies and some hardware stores carry replacement tips.

Take your time

If you're going to be using a walking aid for a while, invest some time in choosing the right style and fit for you. You can find walking aids at medical supply stores and some pharmacies. You can also order them from specialty catalogs or online.

As for cost, more-expensive models aren’t necessarily better at providing support than less expensive ones are. Medicare or your private insurance company may cover part or all of the cost of your walking aid if you have a written prescription from your doctor.

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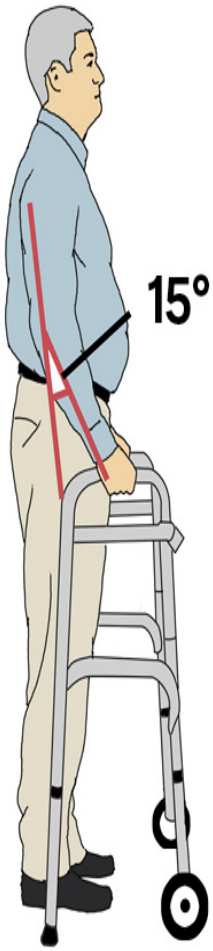
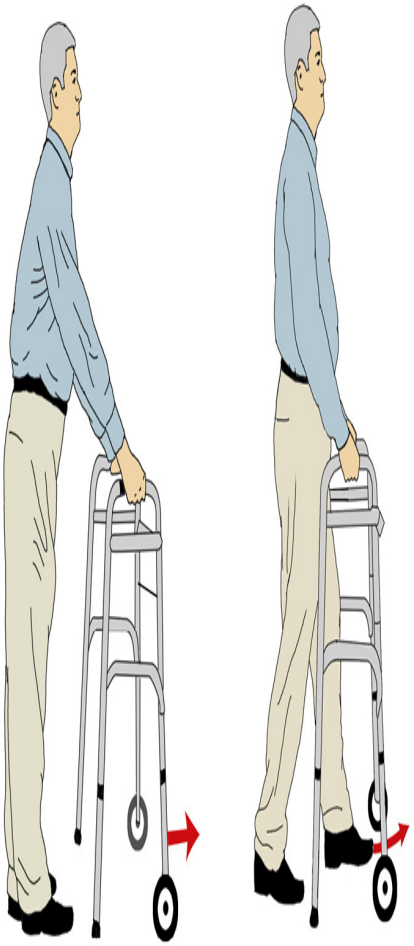
Using a walker

A walker disrupts your normal walking gait, so you'll need a little practice. First of all, as with a cane, your walker needs to be adjusted to the correct height. When your arms are relaxed at your sides, the top of the walker should align with the crease in your wrist. If your walker is adjusted correctly, you should be able to stand up straight when using it.





To walk, move the walker a comfortable arm’s length from you. Don’t move it too far in front, or you might fall. Then step into the walker, leading with your weak or injured leg. Don’t attempt to climb stairs with a walker unless you’ve had training.

When standing up with a walker, slide toward the edge of your chair before trying to get up.

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Wearable technology

If you do fall, it can be difficult to get up afterward — particularly when no one else is around to help. If you're on the floor for an hour or more after falling (a "long lie"), you have an increased risk of negative outcomes such as pressure sores, pneumonia and dehydration. One

helpful strategy to reduce the risk is to wear a personal emergency response system device or a smartwatch.

Personal emergency response systems can work in a variety of ways. One type of older technology is worn around the neck or on the wrist. The small device has a button you would press after a fall to contact a central call center, neighbor or family member. Newer systems can detect a fall automatically. If you choose these devices, make sure you understand how to use them in an emergency.

Some smartwatches allow you to make calls or send messages. If you wear one, consider how you'd use it in case of a fall. Carrying a mobile phone where you can always reach it or give voice commands can serve the same purpose as wearable tech.

An open mind

Assistive devices can't do all things for all people. You can't expect a single implement to free you from issues associated with having osteoporosis or allow you to be totally independent. But assistive devices can still have a tremendous impact. It's common for people to marvel over how much easier life can be with that extra little bit of assistance, once they start using them.

To maintain your independence, keep an open mind about your physical limitations — what you can and can't do, realistically — and the tools that can help you overcome or minimize these limitations.

Whether you should use assistive devices depends on you, your health care provider, or an occupational or physical therapist. Some of the tools described in this chapter may or may not be right for you. For a more customized evaluation, contact your health care team to help you decide on the most effective and safest device.

Occupational and physical therapists specialize in helping people deal with the effects of illness, injury or aging in their daily lives. A therapist typically can meet with you on an individual basis and make recommendations based on your specific needs. Assistive devices can be obtained from a hospital's physical therapy department, medical supply

stores, specialized catalogs or internet sites, and even local hardware stores.

THE IMPORTANCE OF ATTITUDE

All this talk about prevention, assistive devices and safe movements may leave you wondering what happened to the days when you moved around however you pleased without giving it a second thought. The old saying still rings true: One of the constant things in life is change. How you cope with change can have a big impact on your quality of life.

Your attitude about having osteoporosis and the lifestyle adjustments you may have to make has a tremendous influence on how independent or dependent you eventually become.

For example, if you look at a cane as a sign of weakness and deterioration, you might avoid using it and end up falling and breaking a hip. But if you view a cane as a symbol of freedom and opportunity, you'll make it work for you. You'll benefit from the support and stability it provides, and you'll value the ability to move around without the aid of others.

TAKING CONTROL

It's never too late to work on maintaining or improving bone health. This book discusses many ways to approach this goal. A well-organized action plan suited to your needs and abilities allows you to benefit from diet, exercise, medications, good posture, and a safe environment at home or work.

Just as important to success is the support you receive from your doctor, other health care professionals, and your family and friends. All of these factors in combination can provide you with the means to prevent or treat osteoporosis and maintain a full and active life.

Additional Resources

WHERE TO GET MORE INFORMATION YOU CAN TRUST

You can find a lot of health information on the internet and social media. The online environment has a way of making all health information appear of equal quality, but don't believe everything that you find. The key is making sure to get information from trusted sources.

Carefully read reports and check if the information comes from respected publications, organizations or medical professionals. If something you find seems questionable or conflicts with conventional wisdom, you have the right to be skeptical.

Also beware of supplements and products promising a quick fix. At worst, the products may actually be dangerous. Even vitamins can be harmful if they're taken in large doses. Watch out for glowing testimonials or medical treatments described as secret, miracle, foreign, breakthrough and overnight.

You can depend on the resources listed here to provide quality information on osteoporosis and guidance on keeping your skeleton and your body healthy, no matter your bone density.

Your medical care team may be able to point you to other resources too.

EatRight.org — Academy of Nutrition and Dietetics

www.eatright.org

This organization's website offers a wealth of information on food, health and fitness, including articles tailored to seniors, women and other groups. You'll also find articles addressing nutrition specifically for diseases such as osteoporosis.

Choose PT

www.choosept.com

The American Physical Therapy Association offers information on how physical therapy may help you recover from injuries and train and strengthen your body to move safely through daily activities.

Food and Drug Administration (FDA)

www.fda.gov

The FDA's website contains a wide variety of information on food, drugs and medical devices used in the U.S. You can find medication guides for FDA-approved drugs, advice for reading and understanding updated food nutrition labels and supplement labels, and more.

International Osteoporosis Foundation

www.osteoporosis.foundation

This organization aims to promote bone health worldwide. Its website offers snapshots of the impact of osteoporosis around the globe, as well as a variety of educational materials on causes, prevention and treatment of osteoporosis.

Mayo Clinic

www.MayoClinic.org

Visit Mayo Clinic's website for a vast collection of additional information on health conditions, medications and other treatments.

National Center for Injury Prevention and Control

www.cdc.gov/injury/

Find helpful information and tips for avoiding falls at any age, staying safe on the road, and preventing injuries and violence in a range of settings, including recognizing and preventing elder abuse.

National Institute on Aging

www.nia.nih.gov

This organization is part of the National Institutes of Health. Its website covers a variety of topics geared toward older adults to help them maximize their health, both physically and mentally, as they age.

National Osteoporosis Foundation

www.nof.org

The National Osteoporosis Foundation offers a wealth of information about osteoporosis, including recent U.S. statistics. The website also covers treatment and prevention, including exercise, medications and nutrition.

National Safety Council

www.nsc.org/home-safety

Find more tips and strategies to help you avoid injuries at home and in your activities — especially important when your bones are weakened. You can even sign up for a monthly newsletter of practical and seasonal safety precautions, updates on safety-related legislation, and more.

NIH Osteoporosis and Related Bone Diseases — National Resource Center

www.bones.nih.gov

Another service of the National Institutes of Health, this website offers information on bone health, osteoporosis and related conditions. It also features pages tailored to different racial and ethnic groups. You'll find reliable information on who's at risk, what a diagnosis may involve and what types of treatment are available.

Office on Women's Health

800-994-9662

www.womenshealth.gov/a-z-topics/osteoporosis

The Office on Women's Health provides easy-to-read information about osteoporosis and its prevention and treatment. It includes a printable and shareable fact sheet that answers some common questions, and a help line is available to point you toward answers or resources over the phone.

Your local library

Your public library may offer helpful books related to osteoporosis, as well as online access to information from around the world. Ask a librarian about the best way to search for the information you need — for example, the latest updates

on clinical trials or product reviews before you purchase equipment.

Glossary

B

bisphosphonates A family of drugs used to prevent and treat osteoporosis.

bone An organ composed of living tissue that provides structural support to the body. It is made mostly of collagen and calcium.

bone density The amount of calcium and minerals packed into a given site in the skeleton, divided by the area of bone at that site and measured in grams per square centimeter.

bone mass The total amount of bone in your skeleton; sometimes used interchangeably with bone density to refer to the amount of bone in a given area.

bone mineral density test Also called bone densitometry; it measures bone density to see if a person has low bone density or osteoporosis.

C

calcitonin A hormone produced by the thyroid gland; it's also available as a medication to treat osteoporosis.

calcium A mineral found in many foods that's used by the body to strengthen bone and teeth.

cancellous bone Also called trabecular bone; this is the inner spongy part of bone that resembles a honeycomb.

collagen An insoluble protein fiber that's the primary component in bone and connective tissues, such as skin and tendons.

compression fracture A type of injury to the spine in which one or more vertebrae collapse.

cortical bone The outer, hard layer of bone that surrounds the inner cancellous (trabecular) bone.

D

dual-energy X-ray absorptiometry (DXA or DEXA) The most common and reliable technique used to measure bone mineral density.

E

elemental calcium The amount of usable calcium contained in a calcium supplement, which may differ from the source amount.

endocrine system The body system composed of glands that secrete hormones into blood.

estrogen The major female sex hormone responsible for reproduction and development of secondary female sex characteristics.

ethnicity A person's culture and heritage; does not directly describe physical characteristics such as skin color.

F

femoral neck The part of the hipbone that connects the ball of the hip to the long shaft of the thighbone (femur).

fragility fractures *See* low-energy fractures.

G

glucocorticoid A type of steroid medication used to treat asthma, rheumatoid arthritis and many other inflammatory diseases that can damage bone.

H

hyperparathyroidism Excessive activity of the parathyroid glands.

hyperthyroidism Excessive activity of the thyroid gland.

hypogonadism Decreased activity of the male or female sex organs resulting in decreased testosterone or estrogen production.

K

kyphosis Sometimes called kyphotic curve, “humpback” or dowager’s hump, the curve is often a telltale sign of advanced osteoporosis caused by the collapse of vertebrae.

L

low bone mass A condition in which there’s a decrease in bone density but not to the point of osteoporosis. Osteopenia is another term for low bone mass.

low-energy fractures Fractures to bones that occur with minimal or no trauma, such as from a fall from standing height. These are also called fragility fractures.

M

menopause The time in a woman’s life when the ovaries shut down and stop producing the female hormones estrogen and progesterone.

O

ossification The natural process of adding mineral to bone during formation.

osteoblast The type of cell that forms bone.

osteoclast The type of cell that breaks down bone.

osteopenia *See* low bone mass.

osteoporosis A condition in which there's a significant decrease in bone mass and bone density and an increased risk of fracture due to weakness in the bone.

P

parathyroid hormone A hormone secreted by the parathyroid glands that increases blood calcium and may cause bone loss.

peak bone mass The maximum amount of bone mass a person achieves during skeletal growth and development.

phosphorus A mineral found in bone and many tissues that is also present in many foods.

postmenopausal After menopause; this describes women whose periods have ended, whose ovaries have stopped producing eggs and whose hormone levels have decreased.

R

remodeling The process of replacing old bone with new bone through the action of osteoclasts and osteoblasts.

resistance exercises Exercises in which the muscle is acting against some form of resistance, as in lifting weights.

resorption The breakdown and absorption of bone through the action of osteoclasts.

risk factors. Factors that influence an individual's risk of developing a condition or disease.

S

secondary osteoporosis Bone loss caused by medications or other diseases or conditions; it's not related to normal aging.

spinal column Also called the vertebral column; it extends from the skull to the pelvis and is made up of 33 individual bones called vertebrae.

standard deviation A consistent unit of measure above or below the average of a comparison group.

T

testosterone The major male sex hormone responsible for reproduction and development of secondary male sex characteristics.

trabecular bone *See* cancellous bone.

trabecular bone score (TBS) A measure of the structure (microarchitecture) within the bones of your spine; generated from computer analysis of spinal bone density images from a DXA machine, as an additional assessment of bone strength.

T-score A measure of how a person's bone density compares with young, healthy individuals of the same sex and ethnicity; measured in standard deviations.

V

vertebra Any one of the 33 bony segments of the spinal column.

vertebral fracture assessment (VFA) Additional images of your spine taken by a central DXA machine to detect moderate to severe spinal fractures of your upper (thoracic) and lower (lumbar) back. VFA involves much lower radiation levels than traditional X-rays.

W

weight-bearing exercises Exercises in which a person supports his or her own body weight. Most any activity done on your feet is weight-bearing exercise.

Z

Z-score A measure of how a person's bone density compares with individuals of the same age, sex and ethnicity; measured in standard deviations.