written by
Harvard Medical School

Osteoporosis

The "Thin Bone" Disease

PROMED
Patient Education Center
www.patientedu.org

Healthy bones are amazingly strong; ounce for ounce, they can support as much weight as reinforced concrete. But your bones have to be smart as well as strong. Unlike concrete, they have to grow and to repair themselves after injuries. With good care and feeding, your bones will be up to the job. And even if you get started late, treatment can help you rebuild your bones.

For more information about osteoporosis from Harvard Health Publications go to www.patientedu.org.

Busy Bones

Your body's 206 bones are living tissues. Even after you've stopped growing, your bones are constantly restructuring themselves by breaking down old bone and forming new tissue. At any one time, about 7% of your body's bone is being remodeled.

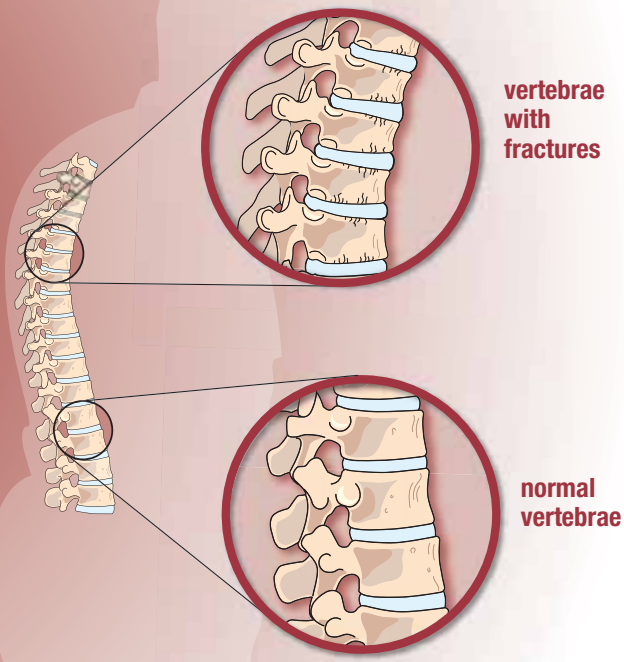
During the first 20 years of life, new bone is being built more quickly than old bone is broken down. By age 30, your bones are at their strongest, containing about $2^{1}/_{2}$ pounds of calcium on average. In women, bone calcium remains level until menopause, when bone is lost rapidly. In the 5 to 7 years after menopause, women can lose up to one-fifth of their bone calcium. Bone loss usually begins later for men and it progresses more slowly. But between ages 65 and 70, men and women lose bone at the same rate.

What is Osteoporosis?

Osteoporosis develops when bones have lost so much calcium that they become thin and brittle. People with osteoporosis can suffer fractures of the hip, wrist, spine, and other bones after minor trauma. Even without trauma, they may lose height as the backbones narrow, producing the "dowager's hump" deformity (see below).

More than 10 million Americans have osteoporosis. Another 34 million have *osteopenia*, a milder lack of bone calcium that often leads to osteoporosis and its painful complications.

Dowager's Hump



Normal vertebrae are upright, but if several vertebrae collapse, a curvature of the spinal column known as dowager's hump may develop. This condition can make it difficult to walk without a cane or walker and can interfere with proper breathing and digestion.

Who Gets Osteoporosis?

Anyone can. But some people are at higher risk because of these factors:

Hereditary factors	
Family history of osteoporosis	Thin body type
Advancing age	Caucasian or Asian background

Lifestyle factors	
Lack of exercise	Excessive alcohol use—more than two drinks a day for men, one for women
Smoking	
Extreme weight loss	

Dietary factors	
Lack of calcium	Excessive caffeine (more than three cups of coffee a day)
Lack of vitamin D	Excessive protein intake, especially animal protein
Excessive vitamin A intake (more than 5,000 IU a day)	

Medical factors	
In women, menopause, especially before age 45	Certain medications (prednisone, antiseizure drugs, chemotherapy)
In men, low testosterone	Chronic intestinal disorders
Overactive thyroid, parathyroid, or adrenal glands	Certain cancers

Diagnosis

Simple tests can diagnose osteoporosis and osteopenia early, so preventive treatment can head off trouble.

Dual energy x-ray absorptiometry (DXA) is the standard test. It is quick, safe, and painless, taking only 10 minutes. While you lie on a table, a machine beams photons through your bones, usually at the spine, hip, or wrist. DXA can compute the bone density in any region of your body, and it exposes you to only one-tenth as much radiation as a chest x-ray.

Ultrasound uses sound waves to measure bone mineral density at the hip, shin, heel, or finger. This test is not as accurate as DXA, but it can give an estimate of bone density painlessly in less than a minute.

The National Osteoporosis Foundation recommends testing for all women ages 65 and older and for all postmenopausal women younger than age 65 who have one or more of the risk factors listed on page 5. Men over 70 should also be tested, as should younger men with osteoporosis risk factors or a history of broken bones. Anyone taking bone-building medication should be tested periodically to measure his or her progress.

…preventive treatment can head off trouble.

Know Your Score

Osteoporosis is defined in terms of standard deviations from the average peak bone density, also called a *T-score*. Standard deviation is a statistical term used to express the amount of variation away from the mean, or average. The lower your T-score, the lower your bone density, and the higher your risk of a fracture. The World Health Organization has established the following classification system:

If your T-scores is greater than –1:
Your bone density is considered normal.
If your T-score is –1 to –2.5:
You have osteopenia (low bone mass).
If your T-score is –2.5 or less:
You have osteoporosis.

Building Better Bones

The foundation for building bone density is simple: get enough calcium and vitamin D, engage in weight-bearing exercise regularly, and take appropriate medications when necessary. You can also protect your bones by avoiding bone-depleting habits such as smoking and excessive alcohol use.

Calcium. If you don't supply your body with the calcium it needs, it will respond by taking calcium from your bones and weakening them. The National Academy of Sciences has established the following recommended calcium intakes:

The calcium you need:

Age	Calcium Intake
Birth–6 mos.	210 mg/day
7 mos.–1 year	270 mg/day
1–3 years	500 mg/day
4–8 years	800 mg/day
9–18 years	1,300 mg/day
19–50 years	1,000 mg/day
51 years or older	1,200 mg/day
Pregnant or lactating, 14–18 years	1,300 mg/day
Pregnant or lactating, 19–50 years	1,000 mg/day

Source: The National Academy of Sciences.

Because excessive amounts of calcium can be harmful, it's wise to keep your intake below 2,500 mg a day (the upper limit set by the National Academy of Sciences). And since high intake of calcium may increase the risk of prostate cancer, men should limit themselves to 1,200 mg a day.

Many adults don't get enough calcium. If your diet falls short, consider calcium supplements. Calcium citrate and calcium carbonate are best.

Here is a list of some calcium-rich foods:

	Food	Serving Size	Calcium Content
Dairy products	Milk	1 cup	292 mg
	Yogurt	1 cup	415 mg
	Cottage cheese	1 cup	138 mg
	American cheese	1 ounce	174 mg
Vegetables	Spinach *(cooked)*	1 cup	245 mg
	Broccoli *(cooked)*	1 cup	205 mg
Fish	Sardines *(canned)*	3½ ounces	240 mg
	Salmon *(canned)*	3½ ounces	237 mg
Tofu	Firm	1 cup	516 mg
	Regular	1 cup	260 mg

Vitamin D. All the calcium in the world won't do you any good unless you have enough vitamin D to absorb calcium from your intestines. Recommendations are 200 IU a day for people ages 1 to 50, 400 IU a day for people ages 51 to 70, and 600 IU for people ages 71 and older. But many experts suggest 800 IU a day for adults. The only substantial dietary source of vitamin D is fortified milk, but it has only 100 IU per 8 ounces. Fortunately, supplements are widely available; vitamin D_3 (*cholecalciferol*) is best.

Exercise. Weight bearing and resistance exercises help increase your bone calcium. Any exercise that involves working against gravity, such as running, walking, weightlifting, or stair climbing, can help build bone. Generally, high-impact exercises and weightlifting have greater benefit than low-impact exercises. Aim to get at least 30 minutes of weight-bearing and resistance exercises a day.

Medications

A variety of medications can curb bone loss and help prevent fractures in people with osteoporosis. Some of them can also prevent osteoporosis in people who have osteopenia or are at high risk.

Bisphosphonates. This is the major family of drugs used to prevent or treat osteoporosis in postmenopausal women and to treat men in certain cases. Biphosphonates reduce the breakdown of bone. In cooperation with calcium and vitamin D, they slow bone loss and produce modest increases in bone density. The oral bisphosphonates are *alendronate*, *risedronate*, and *ibandronate*.

Irritation of the *esophagus* ("food pipe") and stomach is the major side effect. If your doctor prescribes a biphosphonate, be sure to take it on an empty stomach with a full glass of water, then stay upright (sitting, standing, or walking) without eating anything for 30 to 60 minutes. Treatment is much easier now that one pill a week and one pill a month doses are available.

These medications are often the first choice of doctors and patients alike because they reduce hip, wrist, and spinal fractures and have few side effects. However, studies show a slight risk of *osteonecrosis*, the death of bone tissue, in the jaw among patients taking bisphosphonates. A recent analysis of these studies found that 85% of the people who developed osteonecrosis while taking bisphosphonates were cancer patients taking high doses of the drug intravenously, and 60% occurred after dental surgery to treat infections. If you know you'll need bisphosphonate therapy, consider getting invasive dental procedures done beforehand. Be sure to tell your dentist if you're taking the drugs.

…medications can curb bone loss and help prevent fractures…

Raloxifene. This medicine is known as a *selective estrogen receptor modulator* (SERM). It mimics some of estrogen's positive effects without some of the side effects (see "Hormone therapy" on page 13). Like estrogen, raloxifene slows bone loss. Unlike estrogen, though, it does not increase the risk for uterine cancer and it actually reduces the risk for breast cancer. Raloxifene can be prescribed to prevent or treat osteoporosis in postmenopausal women.

Hormone therapy. Estrogen replacement therapy has fallen out of favor as harmful effects have come to light. For men with osteoporosis, testosterone therapy is sometimes prescribed when natural testosterone levels are low.

Calcitonin. This hormone, which is produced by the thyroid gland, helps reduce the breakdown of bone. It is approved only for the treatment, not prevention, of osteoporosis in postmenopausal women; it hasn't been studied in men. Calcitonin is considered to be less effective than other osteoporosis medications because it doesn't build bone as well. It is available in an injectable form and as a nasal spray.

Parathyroid hormone. *Teriparatide*, a synthetic version of parathyroid hormone, is approved for the treatment, but not prevention, of osteoporosis in men and postmenopausal women. It promotes calcium absorption in the intestines and slows its excretion by the kidneys. Parathyroid hormone therapy helps build new bone and may increase bone mass dramatically.

Safeguarding Your Bones

The earlier you start taking good care of your bones, the stronger they will be throughout your life. Get enough calcium and vitamin D. Exercise on most days, making sure to include weight-bearing exercises such as walking or jogging along with resistance exercises such as weightlifting. If you are at high risk of osteoporosis, talk with your doctor about having a bone mineral density test and, if needed, take medicine to prevent fractures. It's never too late to start—and it's never too early to start your family on the road to healthy bones.

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For more information on Osteoporosis, visit:

National Osteoporosis Foundation

www.nof.org/

1-800-231-4222

National Institute of Arthritis and Musculoskeletal and Skin Diseases

www.niams.nih.gov

877-22-NIAMS
(877-226-4267)

To learn more about osteoporosis, visit the **Pri-Med Patient Education Center** at **www.patientedu.org/osteoporosis**.

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