

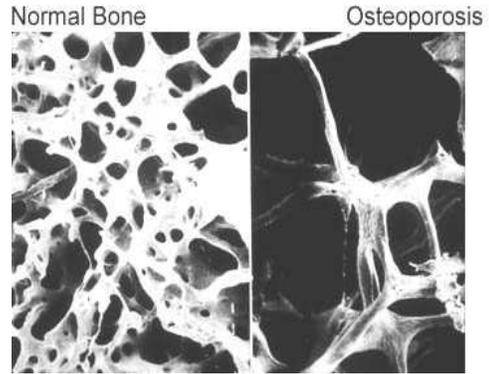
# InfoSheet – Osteoporosis

David M. Klein, M.D. – Kennedy-White Orthopaedic Center

---

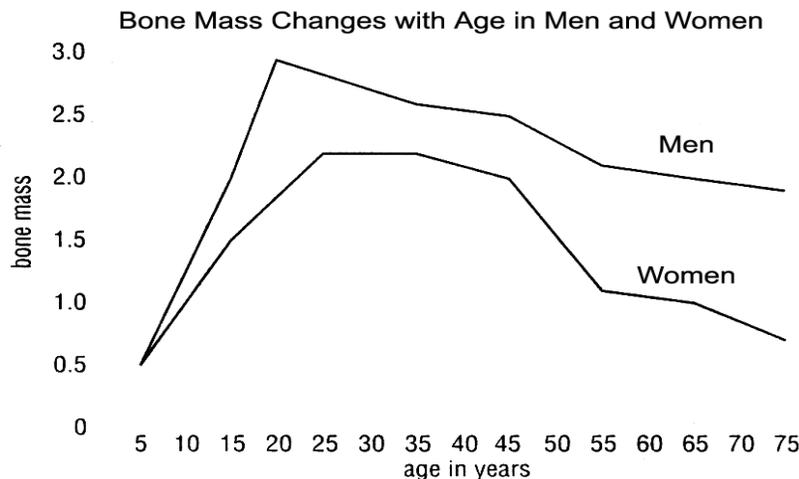
## INTRODUCTION TO BONE

The bone that forms your skeleton is living tissue, comprised of protein that provides the foundation for the structure of bone. The protein is calcified, producing the bone(s) that you see on x-rays. Healthy bone is continuously remodeled, with small amounts of old bone being absorbed and then replaced by new bone. Prior to age 30 or 35, the amount of new bone laid down will exactly match the amount of old bone absorbed. After the age of 30 or 35, the amount of new bone laid down decreases, becoming less than that of the old bone absorbed. Gradual bone loss after the age of 35 is normal and expected (as depicted in the graph below), for both women and men. Unfortunately, this loss can become a problem if an individual never develops sufficient bone stock during their youth, or if the rate of bone loss becomes too high.



Electron micrographs of normal (L) and osteoporotic (R) bone (about 20x life size)

---



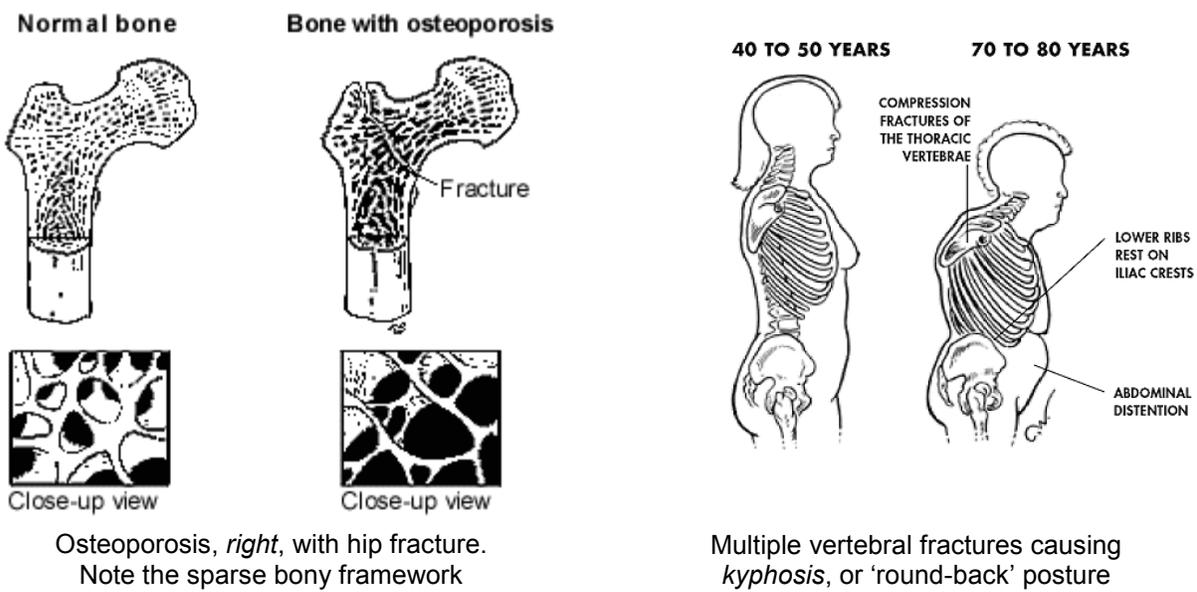
Relationship between bone density and age. Note normal peak at age 25-30.

---

## WHAT IS OSTEOPOROSIS?

Osteoporosis means “porous bone.” In this scenario, there is too much empty space, and not enough new bone. One analogy for this would be a dock made with wooden planks. Every month, you find that there are **five** bad planks that need to be replaced, but your budget only allows you to replace **three** planks. After several months, you will have a dock comprised of some good quality wood. The dock will also have numerous spaces from the removal of bad planks. As a result, it will be far weaker than the original dock.

Osteoporosis is a ‘silent’ disease -- it generally does not cause pain or any symptoms unless a fracture occurs (and even many spontaneous spine fractures will not cause pain). Fractures with relatively low energy trauma are referred to as ‘fragility fractures.’ Fractures of the spine (vertebral bodies) may occur with something as ‘simple’ as coughing, sneezing, or twisting the ‘wrong’ way. Other vulnerable spots include the hips, the wrists, and the feet.



## WHAT ARE SOME OF THE CAUSES OF OSTEOPOROSIS?

There are several factors that can contribute to the development of osteoporosis. Some of these include normal aging, reduced physical activity, changes in estrogen level and other hormones, heredity and genetics, medicines containing cortisone and other steroids, thyroid medications, smoking, caffeine, poor diet, and excessive consumption of alcohol.

Prevention of osteoporosis is absolutely crucial. Making sure that children and teenagers are engaged in regular physical activity, and that they receive adequate calcium consumption daily is

very important. Building good bones by the time you are a mature adult will then provide you with more bone stock to carry into your later adult years. Poor diets with low quantities of calcium, high quantities of caffeine-containing sodas, nutritional/medical issues such as eating disorders (anorexia/bulimia in girls and boys), lack of menstruation in girls (amenorrhea), low body weight, and excessive exercise can all seriously impair bone development. Once a person is in her or his late teens and early 20s, increasing bone mass becomes more difficult.

The greater the bone mass you have built up during your teenage years, the more protection you will have against loss of bone density later in life. Women lose bone much more rapidly following menopause (either naturally occurring or surgically-induced by removal of the ovaries during a complete hysterectomy). Men lose bone mass at a lower rate as they get older, but they can still become very osteoporotic, especially if they have risk factors.

### **RISK FACTORS AND WARNING SIGNS OF OSTEOPOROSIS SUGGESTED BY THE AMERICAN ACADEMY OF ORTHOPEDIC SURGEONS:**

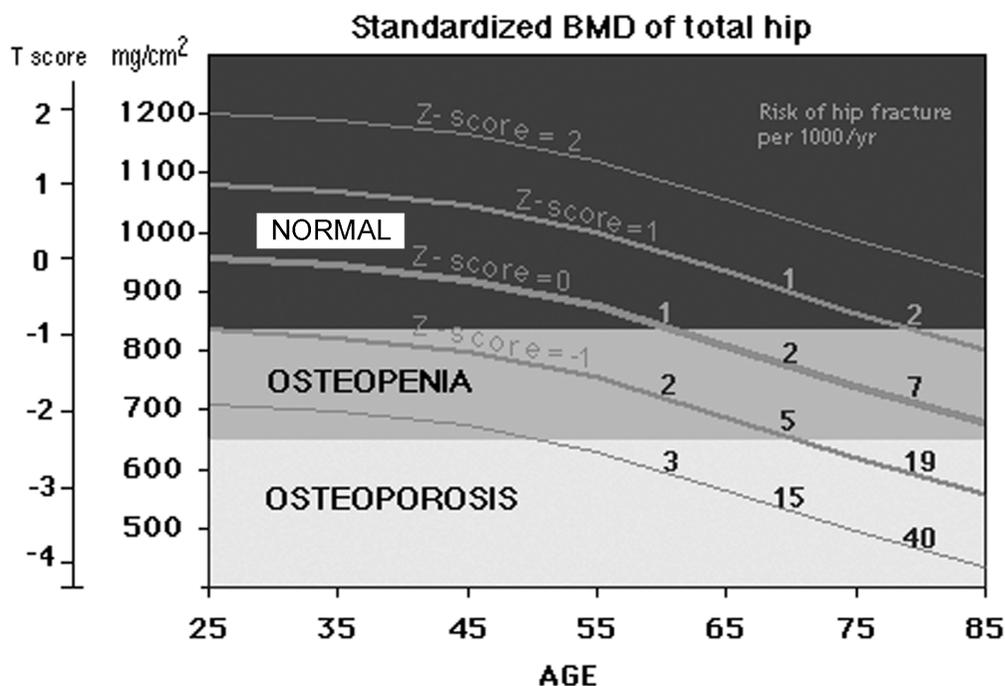
1. Breaking a bone as an adult with a relatively low impact accident
2. Family history of osteoporosis or family history of hip or spontaneous spinal fractures
3. Low calcium intake, dietary or supplemental, throughout your life
4. Cigarette smoking (smoking doubles your risk of an osteoporotic fracture) or excessive consumption of alcoholic beverages
5. Low body weight
6. Caucasian females with small-framed build
7. Chronic medical problems (including asthma, thyroid disease, diabetes, hyperparathyroid disease, or rheumatoid arthritis), especially those requiring steroid medications (inhaled or by mouth) for treatment
8. Persistent back pain, especially in the upper back rather than the lower back
9. Loss of more than one inch of height or “rounding off” of the back in the late adult years

### **HOW IS BONE DENSITY DETERMINED?**

There are several ways to determine bone density. The poorest method of these is simply by looking at a regular x-ray. A fair screening method is ultrasound, such as of the heel. The best accepted method is a DEXA scan (dual energy x-ray



absorptiometry). A DEXA scan is a study similar to taking an x-ray using a machine that measures bone density. This gives the most reproducible and accurate measurement of a person's current bone density. Bone density is usually checked in the lower back and in the hip. This sampling then predicts bone density throughout the body. You should take note that in people who have arthritis in their spine, the spinal reading may be artificially elevated. In the case, the spinal readings are best disregarded, and the readings from the hip are more accurate.



Graph of bone density vs. age – Average for age is along central line, where Z-score=0.  
Three rows of numbers at right give relative risks for hip fractures.

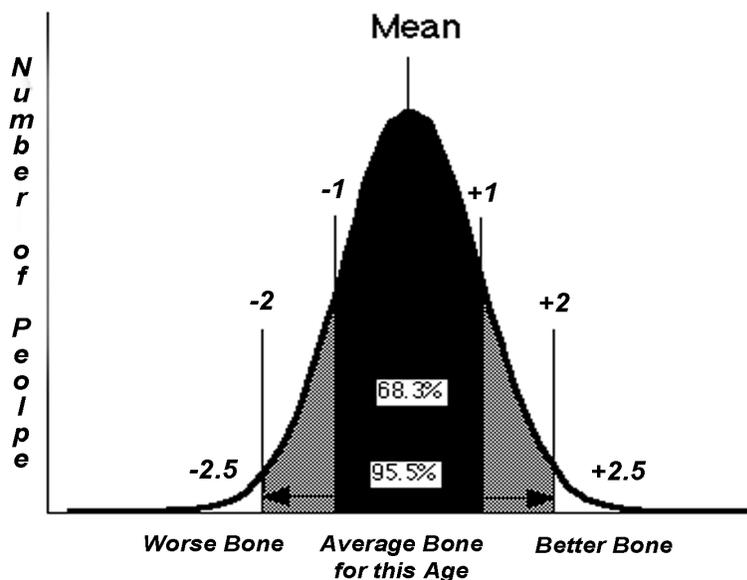
### IF YOUR BONE DENSITY IS NORMAL FOR YOUR AGE, DOES THAT MEAN THAT YOU DO NOT HAVE OSTEOPOROSIS?

As defined by the World Health Organization (W.H.O.), *osteoporosis* is a loss of bone mass as compared to that of a healthy young adult (the “*T-score*”), averaging 35 years of age. It is theorized that by this age, we have developed the maximum amount of bone possible. **Normal aging** will produce a significant amount of bone loss. Therefore, having **normal** bone density **for your age** (the “*Z-score*”) does **not** mean that you do **not** have a significant amount of osteoporosis. The bone of the average 70 year-old Caucasian woman will meet the criteria for osteoporosis as defined by the W.H.O. Therefore it is much more accurate to compare your particular bone density to a number that represents the maximum amount of bone density you could have had present early in your adult life. Even if you do not meet the criteria for

osteoporosis, you may still have osteopenia, which is defined by the W.H.O. as significantly less than normal bone density, but not severe enough to meet the criteria for osteoporosis.

**World Health Organization criteria for “T” score** (comparison to young adults):

<u>“T” Score</u>	
0 to -1	<b>Normal</b>
-1 to -2.5	<b>Osteopenia</b>
Less than -2.5	<b>Osteoporosis</b>
Less than -2.5 <u>and</u> prior fracture	<b>Severe Osteoporosis</b>



**Bone Density Distribution for a young age range – the “T-score”**

The graph is essentially a ‘slice’ of bone density distribution for a sample of 30-year olds as shown on the graph on the previous page. Note how it follows a bell-shaped curve. About 95% of people fall within 2 standard deviations of the mean (also noted as the topmost and bottommost lines on the prior graph). The same comparison can be made at your own age (then called the “Z-score”), where the graph would be a ‘vertical slice’ of your age point on the prior page’s graph.

## HOW IS OSTEOPOROSIS TREATED?

Osteoporosis is best treated with a multifaceted approach. This includes:

- **Nutritional supplementation** (including *calcium* with *vitamin D*), in addition to adequate dietary intake
- **Weight-bearing exercise** (such as running or walking, and lifting weights)
- **Reduce smoking and alcohol use**
- **Adjunctive medications**
- **Fall prevention practices**

## **CALCIUM and VITAMIN D**

Calcium and vitamin D are the most important nutritional elements to allow building and maintaining bone mass in both women and men. Calcium deficiencies during life will certainly help contribute to the development of osteoporosis. *Unfortunately, these agents alone, even if taken in excess, may not prevent osteoporosis.*

Even in Florida, we tend not to get enough sun for our bodies to produce adequate amounts of vitamin D, so we have to supplement our diets. Vitamin D is required at a minimum of 400 IU (International Units) per day, and 800 IU is probably a better goal, as many people have dietary problems that decrease its absorption.

## **WHAT TYPE OF CALCIUM AND VITAMIN SUPPLEMENTS SHOULD I TAKE?**

While either calcium citrate or calcium carbonate (the two most commonly used forms) will work for you, here are a few key points to consider when choosing calcium supplements.

Calcium *carbonate* is best absorbed when ingested along *with* food. Calcium *citrate* is best absorbed when taken *without* food, and seems to potentially cause less GI distress (less constipation, less gastritis). In healthy individuals, absorption of the two forms of calcium appears to be similar.

As a general rule, individuals should know that citrus products can interfere with absorption of calcium. Additionally, calcium can interfere with absorption of iron supplementation. Other dietary and vitamin supplementation, as well as prescription medications may alter calcium absorption as well. There are too many to discuss here, making a “home library” nutrition book a good investment.

The calcium supplement you choose should be able to readily dissolve within your gastrointestinal tract. You can test this by dropping the tablet into two ounces of vinegar, a very weak acid. The tablet should be two-thirds dissolved within thirty minutes’ time. If it is not, it will not dissolve adequately within the acid in your stomach.

Calcium is absorbed better when taken with magnesium. Select a calcium supplement that contains twice as much calcium as magnesium. If you can get vitamin D within the same tablet, then you are saving yourself another pill.

Oyster shell calcium is considered a ‘natural’ form of calcium carbonate. Because of reports of poor manufacturing processes with this particular type of calcium, we do not recommend its use. If you do choose to use it, ask your pharmacist regarding manufacturer’s reputations.

**DAILY DOSING RECOMMENDATIONS  
FOR CALCIUM AND VITAMIN D SUPPLEMENTATION:**

	<b>AMOUNT PER DAY</b>
<b>Children and teenagers</b>	<b>1200 mg calcium, 400 IU vitamin D</b>
<b>Adults under 50 years of age</b> (male or female), including premenopausal women	<b>1000 mg calcium, 400 IU vitamin D</b>
<b>Adults over 50 years of age</b> (male or female) <b>without osteoporosis</b>	<b>1200 mg calcium, 400 IU vitamin D</b>
Any individual who is on <b>chronic steroid treatment</b>	<b>1200 mg calcium, 400 IU vitamin D</b>
Any woman that has experienced <b>early menopause</b> (either natural or surgically induced)	<b>1200 mg calcium, 800 IU vitamin D</b>
<b>Pregnant women and lactating women</b>	<b>1500 mg calcium, 800 IU vitamin D</b>
<b>Any adult formally diagnosed with osteoporosis</b>	<b>1500 mg calcium, 800 IU vitamin D</b>

Note that these are *supplementation recommendations* and that they do not replace good dietary calcium intake. Rather, they should be additive in order to appropriately meet the needs of the particular individual.

With respect to the **dosing of the calcium**, the *body will only absorb 500 to 600 mg of calcium at one time*. Divide the daily calcium dose requirement into 500 or 600 mg interval doses (twice daily for 1200 mg, or three times daily for 1500 mg). Often the vitamin D is included with the calcium, and will not have to be taken separately.

**FOODS:**

As an example of dietary calcium, one cup of skim milk has 300 mg of calcium, one ounce of cheddar cheese has 200 mg, and many nondairy foods such as sardines, almonds, broccoli, and green leafy vegetables have a significant amount of calcium. Again, a good nutrition book can be quite an asset to the “home library”. Also, the listing of “nutritional facts” on product labels has made it a lot easier to know the amount of calcium that different food items contain.

**ADJUNCTIVE MEDICATIONS:**

Prescription medications recommended may include Fosamax, or Actonel, (both of which are bisphosphonates and help prevent further deterioration of bone mass), hormone replacement (e.g. Premarin, Prempro) or synthetic variants of hormone replacement (such as Evista), and/or calcitonin (brand name Miacalcin). Parathyroid hormone (Forteo) is available by injection for severe osteoporosis. Other medications are currently under research and development.

Bisphosphonates (such as Fosamax and Actonel as well as the intravenous drug Aredia) are the most effective oral prescription medicines currently available for treating osteoporosis. Miacalcin should be used if no other medications are tolerated, as we now know that it is the least helpful in treatment or prevention of osteoporosis.

Prescription hormone replacement therapy (e.g. Premarin, Prempro, and the synthetic Evista), during perimenopause and then after menopause, can be helpful in slowing the loss of bone mass in women. There are several medical issues related to taking hormone replacement therapy and patients should always discuss this with their internist and/or gynecologist.

Studies show that it is better to be on more than one of these medications at one time in order to prevent further bone loss and rebuild bone density. A *bisphosphonate* coupled with *estrogen or Evista* is a commonly chosen combination. None of these medications replace the need to take calcium. No matter which medication(s) is chosen, taking daily calcium and vitamin D supplements is still imperative.

**FALL PREVENTION:**

While osteoporosis itself does not ‘cause’ fractures (with the exception of some spontaneous vertebral body fractures), it does increase the risk of fractures. The **most common cause of fractures** is *falls* to the ground. In addition to treating osteoporosis to lower the *risk* of fractures, ‘*fall-prevention*’ is a very important goal. Here are some easy things to do around your home in order to limit the risk of falls:

- **Eliminate throw-rugs on the floors**
- **Re-route electrical cords so they do not cross ‘walk-ways’**
- **Have proper lighting, including ample ‘nightlights’ to guide your path at night, especially to the bathrooms and kitchen**
- **Enroll in an exercise class that centers on Tai Chi, or other similar activities, in order to help increase balance and muscular support**

**SUMMARY:**

As with any medical condition, good prevention is always key. But, even if the time of prevention is past, and the diagnosis of osteoporosis is given, good intervention and a degree of reversal can still be achieved. Be sure to talk to your physician about your medical history and possible risk factors. If you do not know your status with respect to osteoporosis, get tested (preferably with a DEXA scan), and find out for sure whether or not there is a problem.

***BE PROACTIVE!***