

Nutrition Aspects of Osteoporosis Care and Treatment

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Objectives

- To understand bone growth and development across the lifespan.
- To develop a better understanding of osteoporosis.
 - The pathophysiology of osteoporosis.
 - How osteoporosis is diagnosed.
 - The prevalence of osteoporosis in the United States and in WV.
 - Nutritional concerns.

Types of Bone

- Cortical bone (80% of the skeleton)
 - Makes up the shaft of the long bones and makes up the outer shell of all bones.
- Cancellous (trabecular) bone (20% of the skeleton)
 - “shock absorbing bone” found in the vertebrae of the spine and at the end of long bones.

Bone Growth and Development

- Bone is a living tissue that is continuously being both built up and torn down (remodeling cycle).
- Every ten years, most of the skeleton has been remodeled.



Bone Growth and Development

- Involvement of two types of bone cells in the remodeling process:
 - Osteoclasts-remove old bone.
 - Osteoblasts-build bone.



Peak Bone Mass

- More bone is built up than destroyed for most individuals until their early 20's.
- At this point, peak bone mass is reached or the strongest the bones will be.



Influences on Peak Bone Mass

- Hereditary Influences (70-80%)
 - Gender
 - Race
- Lifestyle Influences (20-30%)
 - Smoking
 - Excess intake of ETOH
 - Exercise
 - Fall prevention behaviors
 - Nutritional (calcium and vitamin D)

Changes in Bone Over Time

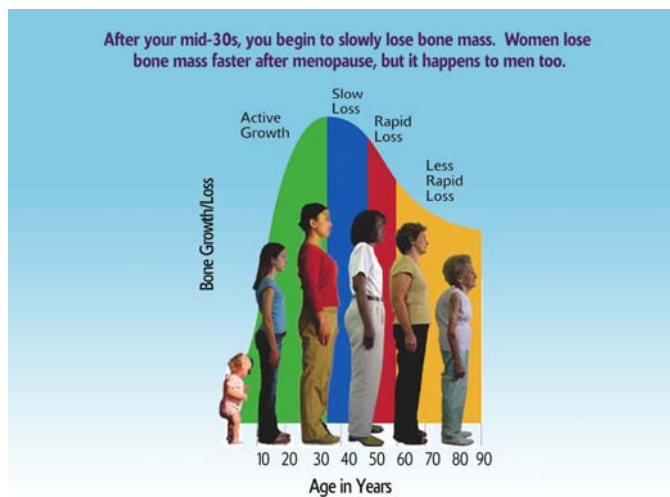
- Bone is significantly built up during the teenage years.
- Bone mass remains essentially the same until the 30's to 40's.
 - Bone loss starts to occur as more bone is broken down than is built up.

Changes in Bone Over Time

- With the onset of menopause, bone loss is accelerated.
 - This acceleration can last 5-10 years.
 - Some women can lose as much bone during the 5 years after menopause as they gained during their adolescence.



Effect of Age on Bone Mass



U. S. Department of Health and Human Services. (2004). *Bone health and osteoporosis: A report of the Surgeon General*. U. S. Department of Health and Human Services: Office of the Surgeon General.

What is Osteoporosis?

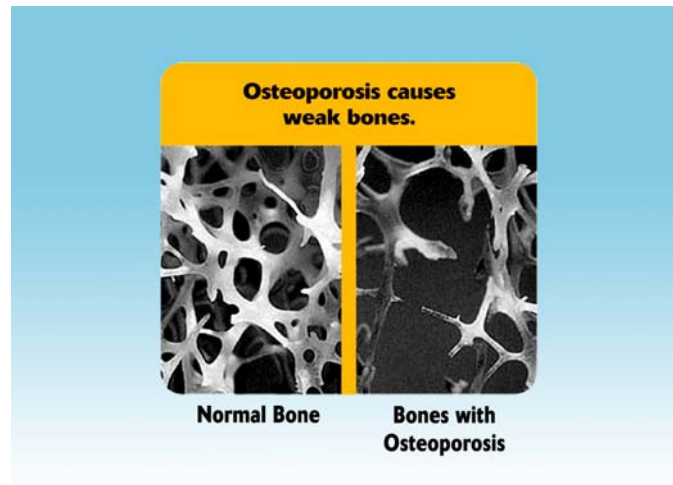


Osteoporosis

- “Osteoporosis is a skeletal disorder characterized by compromised bone strength predisposing to an increased risk of fracture. Bone strength reflects the integration of two main features: bone density and bone quality.”

U. S. Department of Health and Human Services. (2000). NIH consensus statement: Osteoporosis prevention , diagnosis, and therapy. Bethesda, MD: Author.

Normal Bone Versus Osteoporosis



U. S. Department of Health and Human Services. (2004). *Bone health and osteoporosis: A report of the Surgeon General*. U. S. Department of Health and Human Services: Office of the Surgeon General.

Diagnosing Osteoporosis

- Use of the World Health Organization Classification.

OR

- Having a fragility fracture (low trauma).
 - A fracture that occurs in a situation where a fracture normally wouldn't have occurred or from a fall from standing height or less.

Evaluation of Bone Density

- Multiple tests available:
 - Peripheral quantitative computed tomography – primarily used in research.
 - Quantitative computed tomography-greater radiation exposure and requires concurrent use of a phantom scan with patient's scan.
 - Quantitative ultrasound-formula required to calculate T-score equivalent.

Types of Bone Density Tests

- Radiographic absorptiometry-x-ray technique of hand which requires specialized equipment.
- Radiogrammetry-x-ray technique of the hand.
- Single x-ray absorptiometry-peripheral site measurement requiring the heel or forearm to be immersed in water.
- Peripheral energy dual x-ray absorptiometry (pDXA)-focused on forearm or heel.

The Gold Standard



- Dual energy x-ray absorptiometry (DXA):
 - Measures the axial skeleton (spine and hip(s)).
 - Can also measure aspects of the peripheral skeleton (forearm).
 - Can perform a total body assessment.
 - Able to perform a vertebral fracture assessment.

Acceptance of DXA:

- Low radiation levels.
- DXA (axial) measures areas of bone where the impact of bone loss will be seen more quickly.
- Shown to be effective in predicting fracture risk.
- Only method approved by Medicare for follow-up testing.

T-score

- Obtained through DXA testing.
- The T-score compares an individual's bone mineral density to the mean of a young normal reference group. The difference is expressed as a standard deviation score.

Kanis, J., Melton, L., Christiansen, C., Johnston, C., & Khaltaev, N. (1994). The diagnosis of osteoporosis. *Journal of Bone Mineral Research*, 9 (8), 1137-1141.

WHO Classification for Postmenopausal Osteoporosis

- Normal: T-score ≥ -1.0 and above.
- Low bone mass (osteopenia): T-score of -1.1 to -2.4 .
- Osteoporosis: T-score ≤ -2.5 and below.
- Severe or established osteoporosis: ≤ -2.5 and below with fragility fractures.

Kanis, J., Melton, L., Christiansen, C., Johnston, C., & Khaltaev, N. (1994). The diagnosis of osteoporosis. *Journal of Bone Mineral Research*, 9 (8), 1137-1141.

Acceptance of WHO Classification Guidelines

- Osteoporosis Society of Canada
- International Society for Clinical Densitometry
- National Osteoporosis Foundation (United States of America)
- U. S. Preventative Services Task Force
- *Bone Health and Osteoporosis: A Report of the Surgeon General (2004)*

Fracture Risk:

- Osteopenia increases the risk of a fracture two-fold while osteoporosis increases fracture risk four- to five-fold.



Osteoporosis Society of Canada. (1996). Clinical practice guidelines for the diagnosis and management of osteoporosis. *Canadian Medical Association Journal*, 155, 1113-1133.

The Most Common Osteoporotic-Fracture Sites

Third Most Common

wrist

Most Common

spine

Second Most Common

hip

U. S. Department of Health and Human Services. (2004). *Bone health and osteoporosis: A report of the Surgeon General*. U. S. Department of Health and Human Services: Office of the Surgeon General.

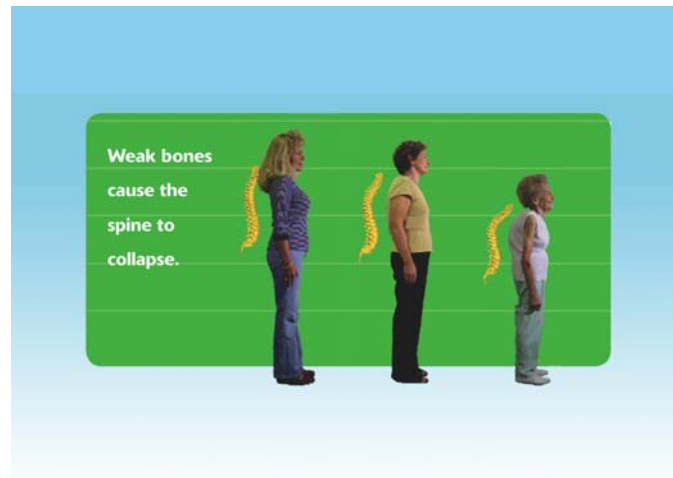
T6
T7
T8 Severe Biconcavity
T9 Severe Biconcavity
T10
T11 Severe Biconcavity
T12 Severe Biconcavity
L1 Severe Wedge
L2
L3 Moderate Biconcavity
L4

Normal VFA

Osteoporotic fractures seen on VFA

GE Healthcare

Development of Kyphosis

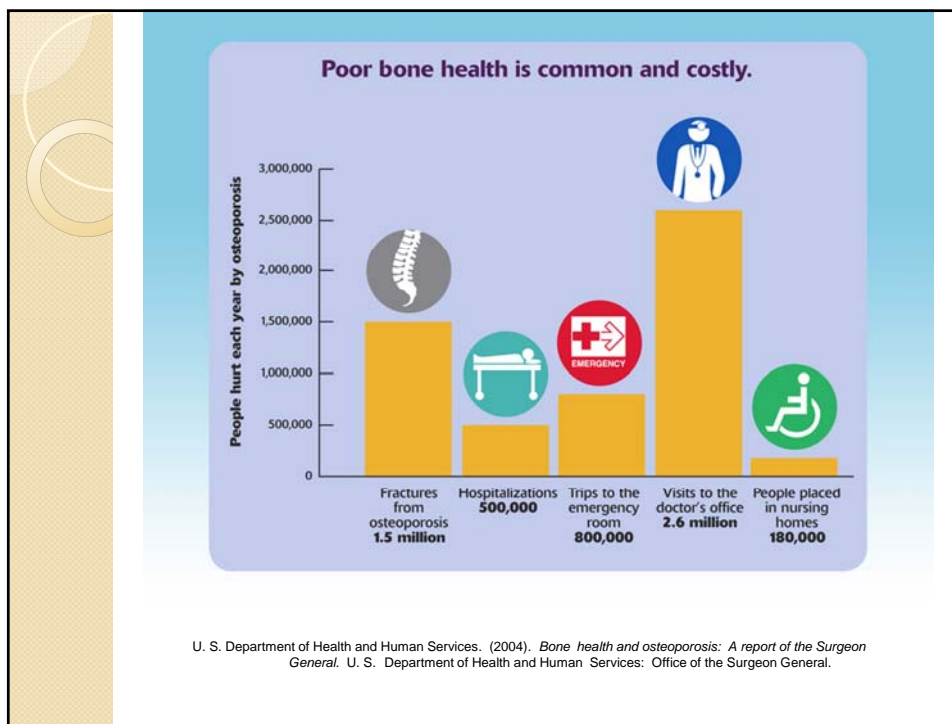


U. S. Department of Health and Human Services. (2004). *Bone health and osteoporosis: A report of the Surgeon General*. U. S. Department of Health and Human Services: Office of the Surgeon General.

Fracture Estimates

- After age 50, **one** in **two** women and **one** in **four** men will have a fracture due to osteoporosis.





Fracture Consequences

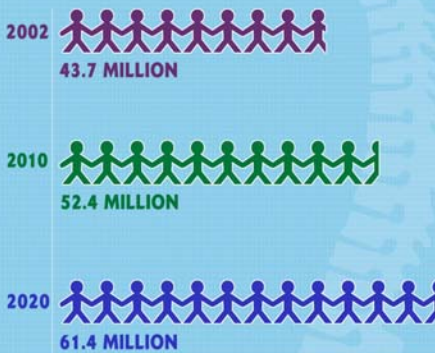
- 20% of patients with a hip fracture die within a year of the fracture.
- One year after the fracture, 40% of patients have trouble walking without help.
- 60% have trouble doing necessary ADLs.
- 80% have trouble with some type of activity (IE: driving).

Prevalence of Osteoporosis

- Nationally, ten million people have osteoporosis.
- Thirty four million have osteopenia.



Projected Growth in U.S. of Osteoporosis and Low Bone Mass

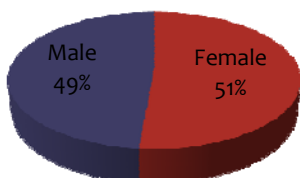


To learn more about bone health call toll free 1-866-718-BONE to order a free publication from the Surgeon General or visit www.surgeongeneral.gov.

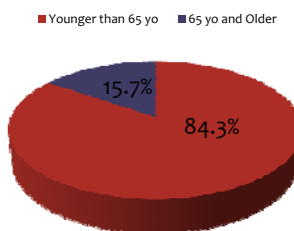
Source: Bone Health and Osteoporosis: A Report of the Surgeon General. U.S. Department of Health and Human Services, Office of the Surgeon General, 2004.

WV Statistics

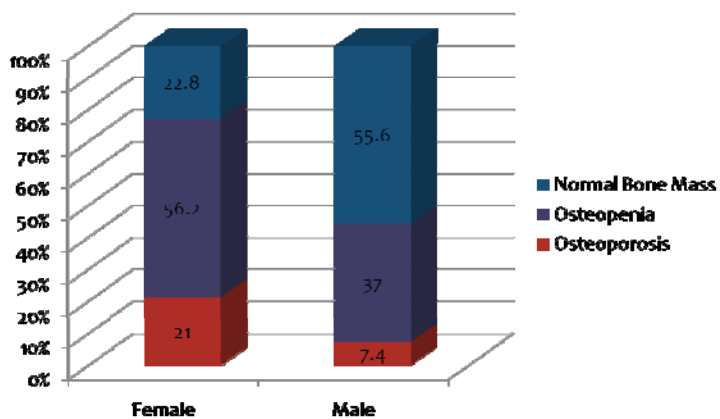
Gender by Percentage for WV in 200



Population of WV by age in 2008

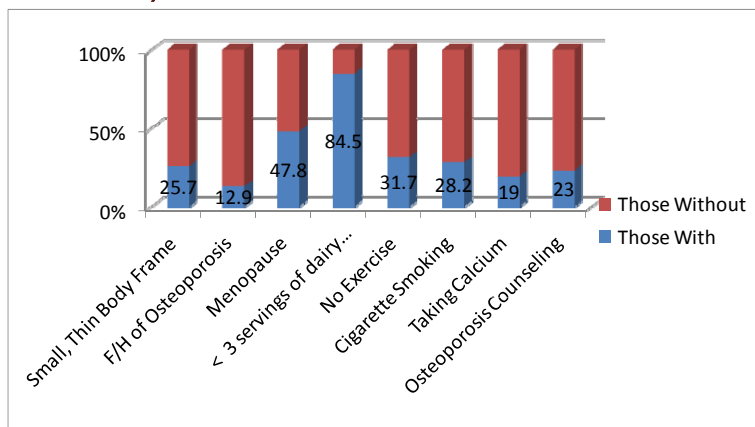


Prevalence of Bone Loss in WV



West Virginia Osteoporosis Prevention Education Program (2004). *The Burden of Osteoporosis in West Virginia*. West Virginia Department of Health and Human Resources.

Select Osteoporosis Risk Factors for WV residents (Male and Female), 1999



West Virginia Osteoporosis Prevention Education Program (2004). *The Burden of Osteoporosis in West Virginia*. West Virginia Department of Health and Human Resources.

Nutritional Influences

- Crucial Role of:
 - Calcium
 - Vitamin D
 - Other Micronutrients



How Patients Really Get Dietary Calcium



"The doctor said I need more calcium in my diet, so I'm switching from dark chocolate to milk chocolate."

Recommended Daily Intake of Calcium

Your body needs calcium.	
<i>If this is your age,</i>	<i>then you need this much calcium each day (mg).</i>
0 to 6 months	210
6 to 12 months	270
1 to 3 years	500
4 to 8 years	800
9 to 18 years	1,300
18 to 50 years	1,000
Over 50 years	1,200

(A cup of milk or fortified orange juice has about 300 mg of calcium.)

U. S. Department of Health and Human Services. (2004). *Bone health and osteoporosis: A report of the Surgeon General*. U. S. Department of Health and Human Services: Office of the Surgeon General.

Calcium Rich Foods

Food	Calcium (mg)	% of Daily Value (1000 mg/day)
1 ½ ounce cheddar cheese	306	31%
8 ounces of nonfat milk	302	30%
8 ounces whole milk	291	29%
2 cups of cottage cheese (1% milk fat)	276	28%
6 ounces of calcium fortified orange juice	200-260	20-26%
½ cup vanilla ice cream	85	8.5%
½ cup raw brocolli	21	2%

For Pregnancy/Lactation

- During pregnancy and lactation,
 - For those 18 yo and younger: 1300 mg/day
 - For those 19-30 yo: 1000 mg/day
 - For those 31-50 yo: 1000 mg/day



Calcium

- Don't want to exceed 2000-2500 mg of calcium a day.
- If supplementation needed, the body absorbs about 500-600 mg at a time.
- If on an acid suppressing medication, calcium citrate supplementation a better choice.

Interferences to Calcium Absorption

- Oxalate: Found in foods such as beet greens, spinach, and rhubarb.
- Phytate Sodium: Legumes, 100% wheat bran.
- Excess Protein Intake
- Excess Caffeine Intake
- Excess Phosphorus Intake
- Excess Sodium Intake

Vitamin D

- Ways to obtain:
 - Food
 - Sunlight
 - Supplements/medication



Foods High in Vitamin D

Food	Vitamin D (IU)
3 oz of baked herring	1775
1 cup orange juice fortified with calcium and vitamin D	259
1 cup nonfat milk	100-241
3 oz of baked salmon	238

Foods and Vitamin D

- Some cereals and soymilk are fortified with Vitamin D.
- Cheese, ice cream, butter, and most yogurts are not fortified with Vitamin D.



Vitamin D Recommendations

- Adults under age 50: 400-800 IU QD.
- Adults aged 50 and older: 800-1000 IU QD.
- Among experts, the safe upper limit of Vitamin D is debatable. Currently, 2000 IU/day of Vitamin D is thought to be safe.

Vitamin D toxicity

- Other than by taking a prescription dose of Vitamin D, it is felt to be difficult to get too much Vitamin D if the previous recommendations are followed.
- Vitamin D levels can be measured with a 25-hydroxyvitamin D blood test.

Other Nutrients

- Fluoride stimulates bone growth
- Iron, Copper, Vitamin C, Vitamin K, Zinc, and Manganese seem to help in the formation of the bone matrix.
- Magnesium may help in building bone and with calcium processing.

Helpful Internet Resources

- National Institute of Health Osteoporosis and Related Bone Diseases-National Resource Center

www.niams.nih.gov/bone

- Best Bones Forever

<http://www.bestbonesforever.gov/>

Helpful Internet Resources

- National Osteoporosis Foundation

www.nof.org

- West Virginia Osteoporosis and Arthritis Program

<http://www.wvbonenjoint.org/>

Any Questions?



References

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