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)

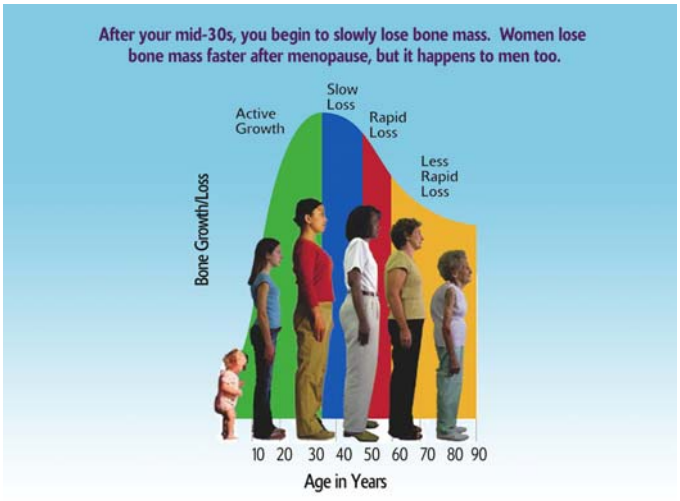
Changes in Bone Over Time

- 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.

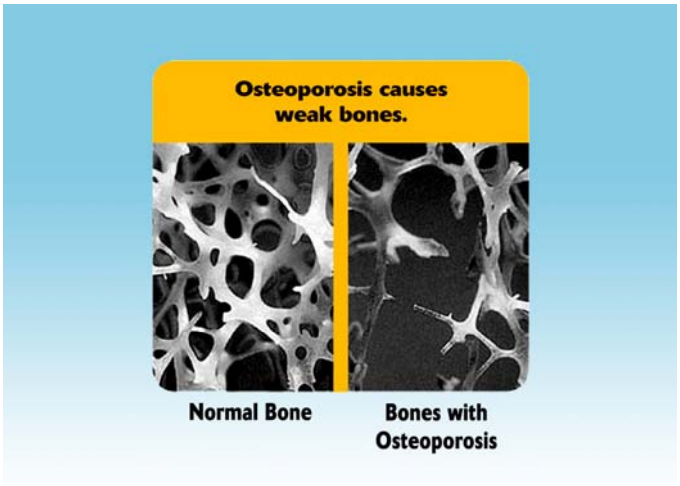
What is Osteoporosis?

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



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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.

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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

Most Common

Second Most Common

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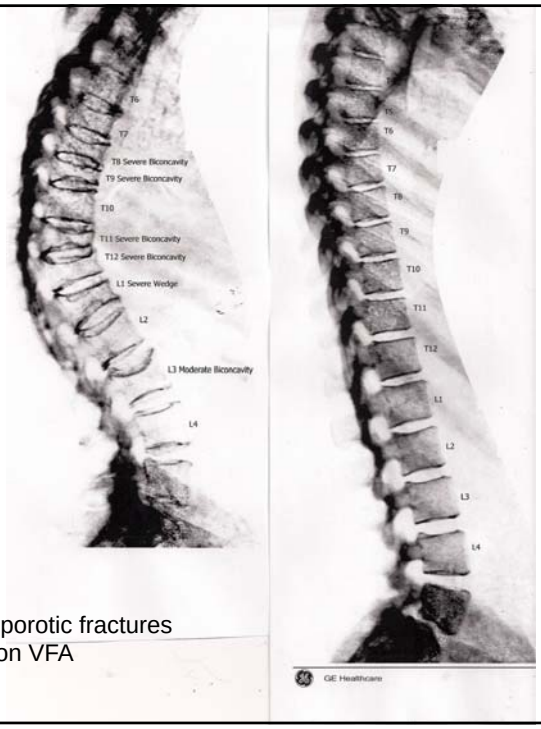
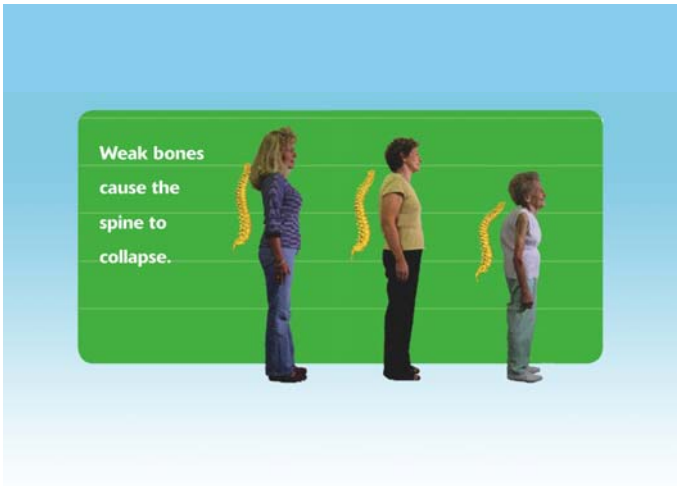


Osteoporotic fractures seen on VFA

Normal VFA

Development of Kyphosis



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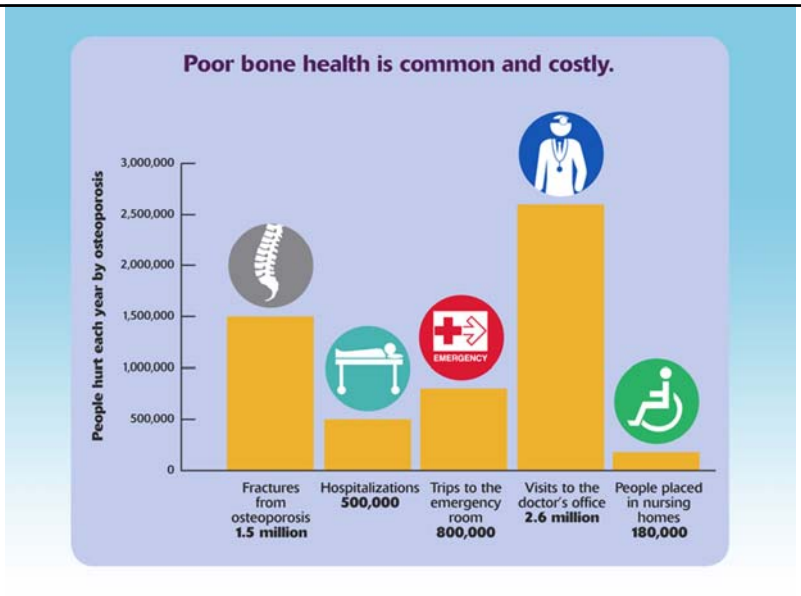
Fracture Estimates

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



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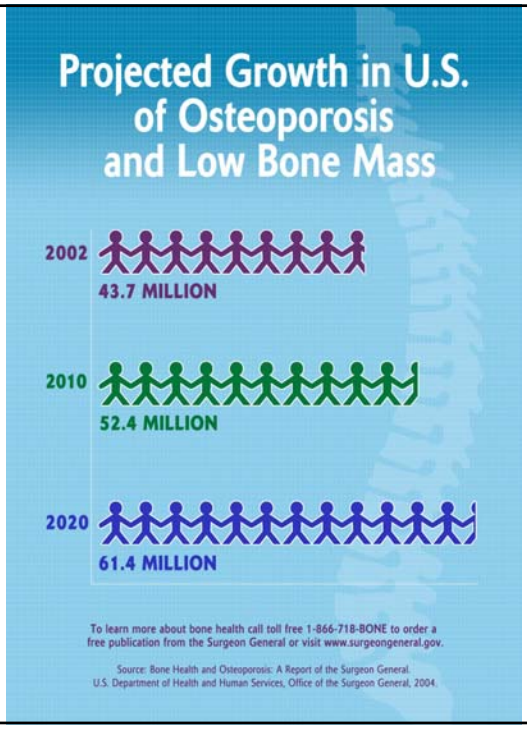
Fracture Consequences

- 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).

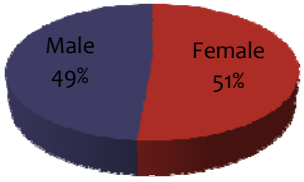
Prevalence of Osteoporosis

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

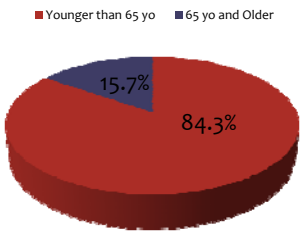


WV Statistics

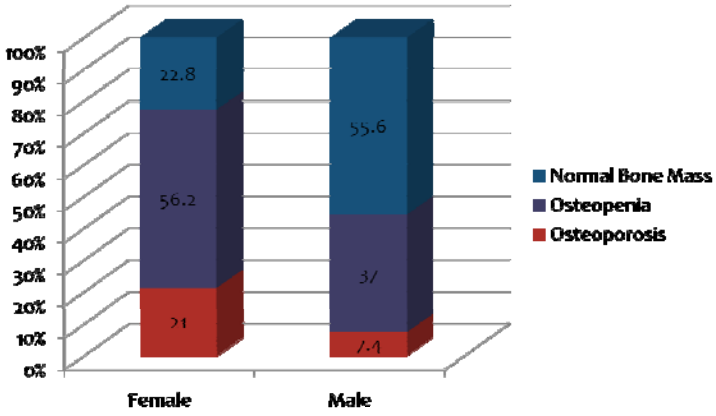
Gender by Percentage for WV in 200



Population of WV by age in 2008



Prevalence of Bone Loss in WV



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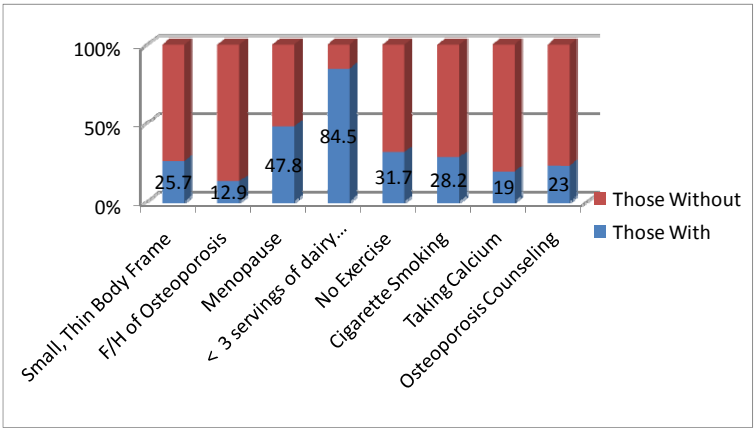
Select Osteoporosis Risk Factors for WV residents(Male and Female), 1999



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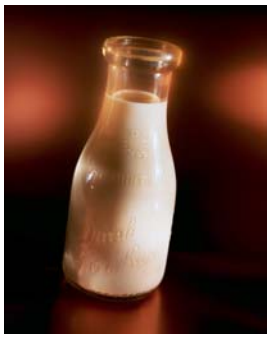
Nutritional Influences

- 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.	
If this is your age,	*then you need this much calcium each day (mg).*
0 to 6 months	210
6 to 12 months	270
1 to 3 years	500
4 to 8 years	800
9 to18 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.)	

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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, Cooper, 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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