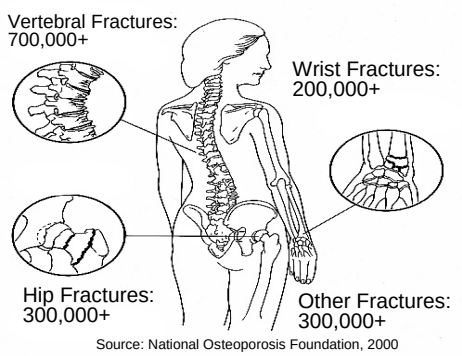
Geriatric Fragility Fractures

Laura Phieffer, MD

Director of Orthopaedic Trauma
Clinical Co-Director of
The Fragility Fracture Program at
The Ohio State University Medical Center

1.5 Million Fragility Fractures Annually



Source: National Osteoporosis Foundation, 2000

Fragility Fracture

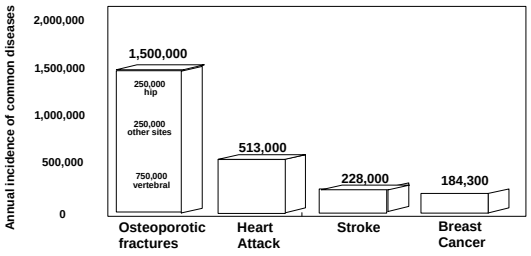
- **Fractures that are a result of minimal trauma (i.e. from a fall from a standing height)**

Fragility Fractures Due to Osteoporosis are Common

- 1 in 2 women and 1 in 5 men over age 50 will suffer a fracture in their remaining life time[1]
- 55% of persons over age 50 are at increased risk of fracture due to low bone mass
- At age 50, a woman**'s lifetime risk of fracture exceeds** combined risk of breast, ovarian & uterine cancer
- At age 50, a man**'s lifetime risk of fracture exceeds** risk of prostate cancer

1. Johnell et al. Osteoporos Int. 2005; 16: S3-7

Osteoporosis-fracture Occurrences vs Other Diseases

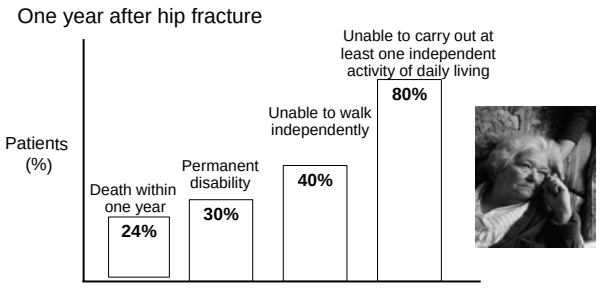


Source: National Osteoporosis Foundation

Morbidity and Mortality of Fractures in Men

- **Men account for 30% of hip fractures**

Consequences of Hip Fracture



Cooper. Am J Med 1997; 103(2A):12s-19s.

Morbidity and Mortality of Fractures in Men

- **Men account for 30% of hip fractures**
- **Annual number of fractures in men should increase as U.S. population ages**

Morbidity and Mortality of Fractures in Men

- Men account for 30% of hip fractures
- Annual number of fractures in men should increase as U.S. population ages
- Mortality is higher for men following hip and vertebral fractures

Osteoporosis Underdiagnosed

- Fewer than 5% of patients with fractures are referred for evaluation and treatment
- Most older women with hip, wrist, or vertebral fracture received no drug treatment within 1 year

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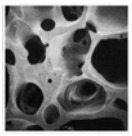
Definition of Osteoporosis

A skeletal disorder characterized by…

- **Excessive osteoclast-mediated bone resorption**
- **Compromised bone strength**
- **Increased risk of fracture at all skeletal sites**

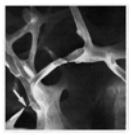
Normal



"Osteoporosis is one of the most common and debilitating chronic diseases, and a global healthcare problem."

International Osteoporosis Foundation

Osteoporosis

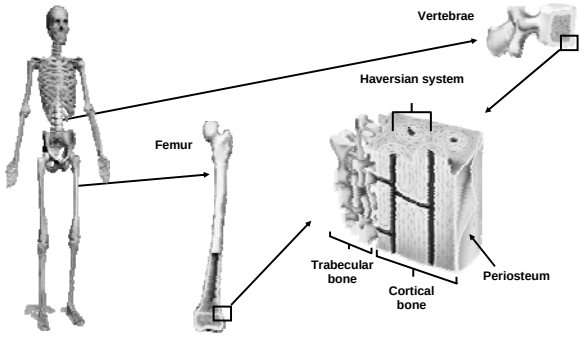


"Osteoporosis has financial, physical, and psychosocial consequences, all of which significantly affect the individual, the family, and the community."

NIH Consensus Statement

Boyle WJ, et al. *Nature*. 2003;423:337-342.
NIH Consensus Development Panel. *JAMA*. 2001;285:785-795.
Images are of a paired iliac crest biopsy and courtesy of Yebin Jiang MD, PhD. Osteoporosis & Arthritis Lab, University of Michigan.

Skeletal Form and Function



Adapted from: Dempster DW. *Primer on the Metabolic Bone Diseases and Disorders of Mineral Metabolism*. 6th ed. 2006:7-11.

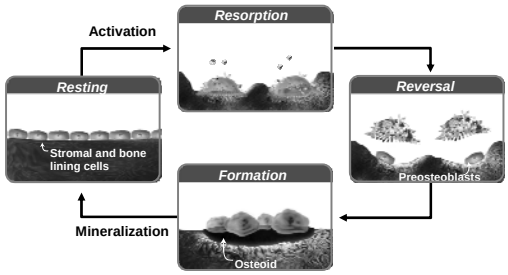
Skeletal Form and Function

- **The skeleton is a dynamic organ comprised of over 200 discrete bones with mechanical, protective, and metabolic functions**
- **Composed of two types of bone:**
  - Cortical bone**: Outer dense shell**
  - Trabecular bone**: Network of connecting plates inside the cortical shell**
  - **Bone remodeling (formation and resorption "bone turnover") occurs throughout life**

Adapted from: Dempster DW. *Primer on the Metabolic Bone Diseases and Disorders of Mineral Metabolism*. 6th ed. 2006:7-11

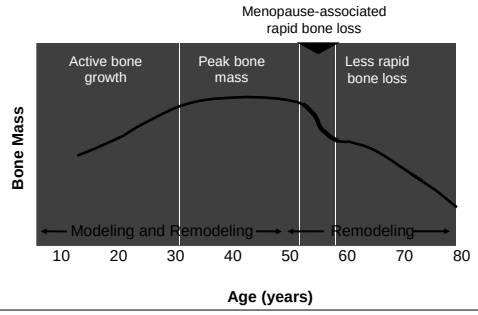
The Life Cycle of Bone

- **When bone turnover is increased, bone loss dominates**



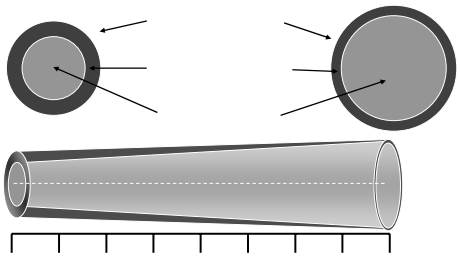
Adapted from: Baron R. *Primer on the Metabolic Bone Diseases and Disorders of Mineral Metabolism*. 5th ed. 2003:1-8.
Raisz LG. *J Clin Invest*. 2005;115:3318-3325.

Bone Mass Is Lost in Age-Related Remodeling



Graph adapted from: Finkelstein JS. *Cecil Textbook of Medicine*. 21st ed. 1999:1366-1373.

Cortical Bone Geometry Changes With Age

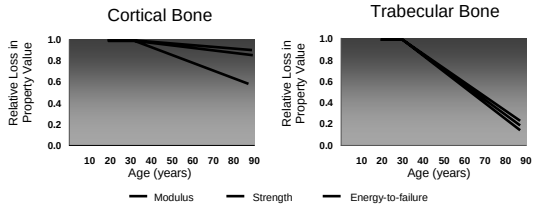


Adapted from: Orwell ES, et al. *Atlas of Osteoporosis*. 2003:167.

Pathophysiology: Bone Strength

- **Factors that influence bone strength**
  - **Bone mass (measured by BMD)**
  - **Remodeling frequency (bone turnover)**
  - **Bone size**
  - **Bone area**
  - **Microarchitecture**
  - **Degree of bone mineralization**

Biomechanical Strength of Bone Decreases With Age



Property	Loss/Decade, %	Loss from 20–80, %
Modulus	**–1.5**	**–7.5**
Strength	**–2.1**	**–11.0**
Energy-to-failure	**–6.8**	**–34.0**

Property	Loss/Decade, %	Loss from 20–80, %
Modulus	**–12.8**	**–64.0**
Strength	**–13.5**	**–67.5**
Energy-to-failure	**–14.0**	**–70.0**

Adapted from: Orwell ES, et al. *Atlas of Osteoporosis*. 2003:168.

Who Has Osteoporosis and Low Bone Mass?

- More than 44 million Americans

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- 1 in 4 men over 50 years old

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  - $15 billion for care of fractures

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- **More than 44 million Americans**
- **<u>1 in 2 women</u> over 50 years old**
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- **Associated Costs**
  - **$15 billion for care of fractures**
- **62 million in U.S. by 2020**

2000–2010: National Bone and Joint Decade

- **Goals**
  - **Raise awareness of the growing burden of musculoskeletal disorders on society**
  - **Empower patients to participate in decisions on their care**
  - **Promote cost-effective prevention and treatment**
  - **Advance understanding of musculoskeletal disorders through research to improve prevention and treatment**

"The musculoskeletal system gives us support and the power to move. When things go wrong, people are in pain and their lives become limited. The goal of the Bone and Joint Decade…is to keep people moving, to enjoy fuller lives."

Stuart L. Weinstein, MD; Bone and Joint Decade

Delmas PD, Anderson M. *Osteoporos Int.* 2000;11:95-97.

U.S. Surgeon General 2004

"According to the Surgeon General, an estimated 10 million Americans over the age of 50 have osteoporosis while another 34 million have osteopenia or low-bone mass. This problem affects men and women of all ethnicities. Due to the aging of baby boomers, we will have many more people at risk over the next two decades.

It is vital that Americans know how to prevent and treat bone disease and take action that can lead to better bone health."

The Fragility Fracture Program

- Improve processes and outcomes for older adults undergoing surgery for fragility fractures

"Multi-disciplinary approach with standardized protocols"

Fragility Fracture Program

↙ ↘

Hospital In-patient | **Clinic Out-patient**

Benefits of Inpatient Program

- Streamlined admission process
- Standardized protocols decrease variability/delays to surgery
- Optimal fracture surgery within 24 hours of admission
- Daily evaluation to ensure earlier mobility and faster recovery
- Co-management with frequent communication to avoid errors and reduce adverse events

Potential Impact

- Decreased time to surgical intervention =>
  - Decreased patient morbidity[1,2]
  - Decreased patient mortality[1,2]
  - Shorter length of stay[1,2]
  - Increased likelihood to return to pre-injury status

1 Friedman SM et al. J Am Geriatr Soc 2008
2 Fisher AA J Orthop Trauma 2006

Benefits of Inpatient Program

- Improved communication with patients, family and entire team
- Initiation of research and education
- Earlier initiation of rehabilitation and more effective use of discharge planning resources
- Screening for osteoporosis and plan management

Potential Impact

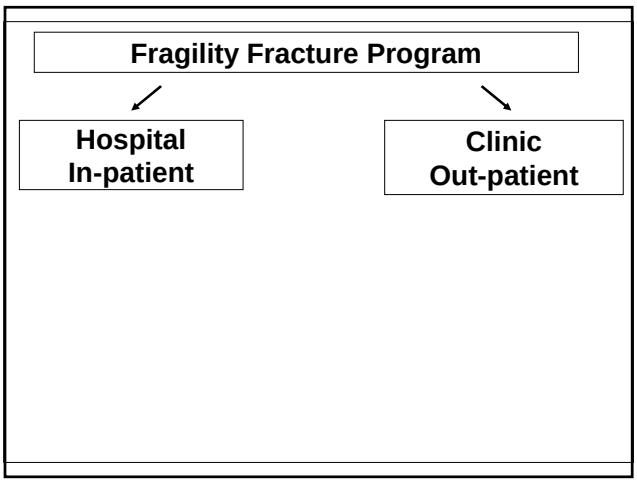
- Cost savings[1]
  - Estimate savings of $3879 /case
  - Assuming 350,000 hip fxs per year in the US => 1.36 billion dollars cost savings per year

1 Friedman SM et al. J Am Geriatr Soc 2008
2 Fisher AA J Orthop Trauma 2006

Increase awareness and treatment of osteoporosis

- **Fewer than 5% of patients with fractures *receive evaluation and treatment of osteoporosis, the underlying cause of most fragility fractures*[1,2]**
- **A prior fracture increases the risk of a new fracture 2- to 5-fold**
- **At hospital discharge, 4.5% of men with hip fracture and 27% of women with hip fracture had treatment for osteoporosis**

1. Eastell et al. QJM 2001; 94:575-59
2. Bouxsein et al. J Am Acad Ortho Surg. 2004; 12:385-95



Increase awareness and treatment of osteoporosis

- **Awareness and knowledge about osteoporosis is low among fracture patients**
- **Our response to a fragility fracture must include a determined attempt to prevent another one**
  - **Needs a system that achieves this automatically**

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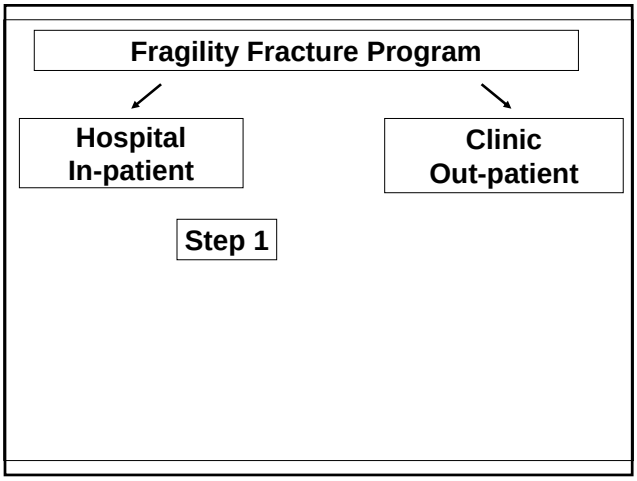


Fragility Fracture Program

Hospital In-patient	**Clinic Out-patient**
Step 1	Identify at-risk individuals who require further evaluation

Fragility Fracture Program

Hospital In-patient	**Clinic Out-patient**
Step 1	Identify at-risk individuals who require further evaluation
Step 2	Measure BMD for individuals at risk for osteoporosis

Fragility Fracture Program

Hospital In-patient	**Clinic Out-patient**
Step 1	Identify at-risk individuals who require further evaluation
Step 2	

Risk Factors - Osteoporsis

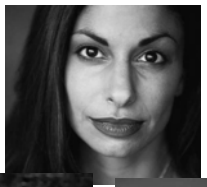
- **Female sex**
- **Thin or small frame**
- **Low body weight**
- **Hispanic or Caucasian race**
- **Low calcium intake**
- **Alcoholism (> 2 drinks/day)**

Risk Factors - Osteoporsis

- Sedentary life style
- History of smoking
- Estrogen deficiency at an early age (< 45 years)
- Family history or personal history of fractures or osteoporosis
- Use of medications associated with accelerated bone loss (oral corticosteroids > 3 mo)

Ethnicity & Osteoporosis

- Hispanic women at highest risk
- Hispanic women tend to consume less calcium than the RDA
- Caucasian & Asian-American women also high risk

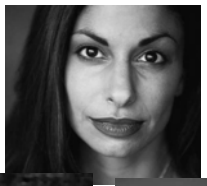
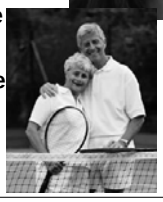


Osteoporosis in Men

- Gradual bone loss begins in men in their 30's
- Unlike women, no universal reduction in hormone levels resulting in accelerated bone loss
- Men with hypogonadism may experience rapid bone loss

Ethnicity & Osteoporosis

- The average calcium intake among Asian-American women is about half that of their Caucasian counterparts
- While Asian-American women generally have lower incidence of hip fractures than Caucasian women, the prevalence of vertebral fractures is about equal between the two populations.


Ethnicity & Osteoporosis

- **African-American women generally have higher bone density and are at somewhat lower risk than their Asian-American and Caucasian counterparts, this should not be taken to mean that there is no cause for concern among this population.**

BMD Screening Recommendations for Postmenopausal Women

- **National Osteoporosis Foundation[1]**

1. Physician's Guide to Prevention and Treatment of Osteoporosis. 2nd ed. Washington, DC: National Osteoporosis Foundation; 2003.
2. Screening for osteoporosis in postmenopausal women: recommendations and rationale. *Ann Intern Med*. 2002;137:526-528.

Ethnicity & Osteoporosis

- **10% of African-American women over 50 have Osteoporosis**
- **80-95% of all fractures sustained by African-Americans 64+ are osteoporotic**
- **African-American women more likely to die from hip fractures than White women**

BMD Screening Recommendations for Postmenopausal Women

- **National Osteoporosis Foundation[1]**
  - **All women aged 65 and older regardless of risk factors**

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  - Younger postmenopausal women with 1 or more risk factors, other than being white, postmenopausal, and female

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Patients Eligible for Medicare Coverage of BMD Testing

- Estrogen-deficient women at clinical risk for osteoporosis
- Individuals with vertebral abnormalities
- Individuals receiving, or planning to receive, long-term glucocorticoid therapy
- Individuals with primary hyperparathyroidism
- Individuals being monitored to assess the response or efficacy of osteoporosis therapy

Medicare and Medicaid Program Instructions. Centers for Medicare & Medicaid Services [Web site]. http://www.cms.hhs.gov/manuals

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  - Younger postmenopausal women with 1 or more risk factors, other than being white, postmenopausal, and female
  - Postmenopausal women who present with fractures

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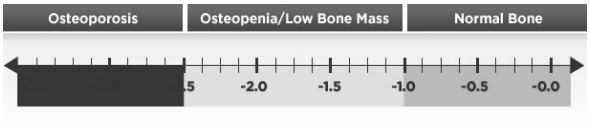
WHO Definition of Low Bone Density and Osteoporosis Based on BMD



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Normal

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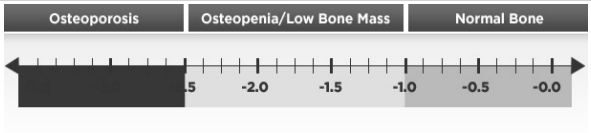

Normal BMD value within 1 S.D. of young-adult mean (T-score at or above -1)

Osteopenia

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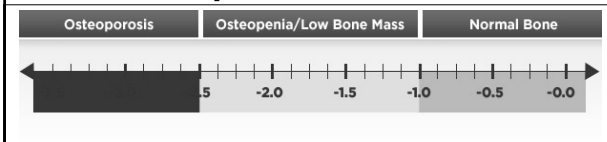

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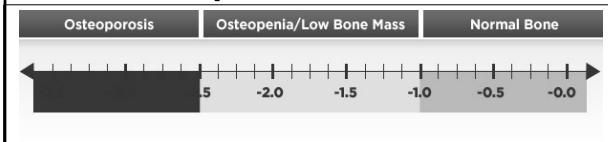

Normal BMD value within 1 S.D. of young-adult mean (T-score at or above -1)

Osteopenia BMD value between -1 S.D. and -2.5 S.D. below young-adult mean (T-score between -1 and -2.5)

WHO Definition of Low Bone Density and Osteoporosis Based on BMD

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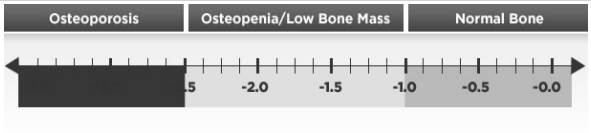
Osteoporosis	

WHO Definition of Low Bone Density and Osteoporosis Based on BMD



Normal	BMD value within 1 S.D. of young-adult mean (T-score at or above -1)
Osteopenia	BMD value between -1 S.D. and -2.5 S.D. below young-adult mean (T-score between -1 and -2.5)
Osteoporosis	BMD value at least -2.5 S.D. below young adult mean (T-score at or below -2.5)
Severe Osteoporosis	

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Osteopenia	BMD value between -1 S.D. and -2.5 S.D. below young-adult mean (T-score between -1 and -2.5)
Osteoporosis	BMD value at least -2.5 S.D. below young adult mean (T-score at or below -2.5)

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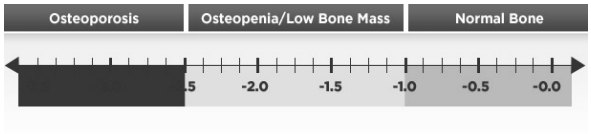

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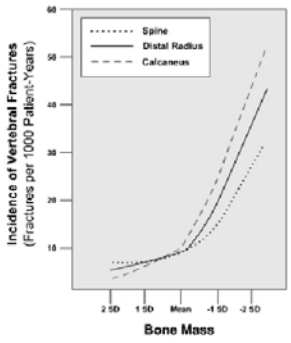
Osteopenia	BMD value between -1 S.D. and -2.5 S.D. below young-adult mean (T-score between -1 and -2.5)
Osteoporosis	BMD value at least -2.5 S.D. below young adult mean (T-score at or below -2.5)
Severe Osteoporosis	BMD value at least -2.5 S.D. below young adult mean and presence of fracture

Relationship Between BMD and Fracture Risk



Reproduced with permission from Miller PD, Bonnick SL, Rosen CJ, et al. *Semin Arth Rheum*. 1996;25:361-372.

Fragility Fracture Clinic

Fragility Fracture Program

Hospital
In-patient

Clinic
Out-patient

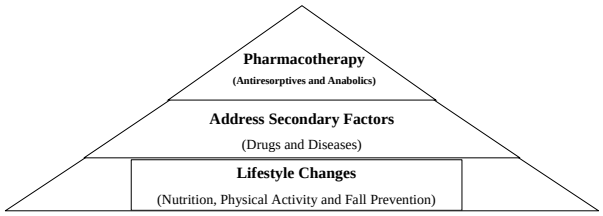
Geriatric Fragility Fractures

Suzanne Stanek, CNP
Clinical Co-Director of
The Fragility Fracture Program at
The Ohio State University Medical Center

Fragility Fracture Clinic Objectives

- **To identify patients at increased risk of fragility fracture**
- **To offer appropriate information to patients regarding osteoporosis management and fall prevention**
- **To provide advice to PCPs on suitable interventions**
- **To provide interventions to reduce risk of fragility fracture**

Prevention & Treatment of Osteoporosis

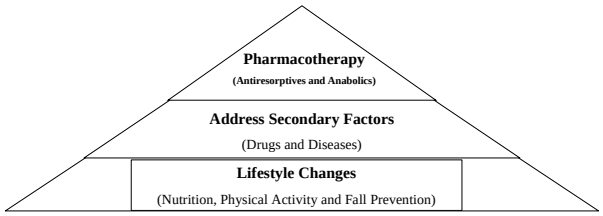


Bone health and osteoporosis: A report of the Surgeon General. Rockville, MD: U.S. Department of Health and Human Services; 2004.

Secondary Causes of Osteoporosis

Genetic Disorders		
Cystic fibrosis Ehlers-Danlos Glycogen storage diseases Gaucher's disease Riley-Day syndrome	Hemochromatosis Homocystinuria Hypophosphastasia Idiopathic hypercalciuria	Marfan's syndrome Menke's steely hair syndrome Osteogenesis imperfecta Porphyria
Hypogonadal States		
Androgen insensitivity Anorexia nervosa Premature ovarian failure	Hyperprolactinemia Panhypopituitarism Athletic amenorrhea	Turner's and Klinefelter's syndrome
Endocrine Disorders		
Acromegaly Adrenal insufficiency	Cushing's syndrome Diabetes mellitus (Type 1)	Hyperparathyroidism Thyrotoxicosis
Gastrointestinal Diseases		
Gastrectomy Inflammatory bowel disease	Malabsorption Celiac disease	Primary biliary cirrhosis

Secondary Causes of Osteoporosis



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Additional Secondary Causes

Hematologic Disorders		
Hemophilia Leukemias and lymphomas	Multiple myeloma Sickle cell disease	Systemic mastocytosis Thalassemia
Rheumatic and Auto-Immune Diseases		
Ankylosing spondylitis	Lupus	Rheumatoid arthritis
Miscellaneous		
Alcoholism Amyloidosis Chronic metaboilic acidosis Congestive heart failure Depression	Emphysema End stage renal disease Epilepsy Gastric restrictive surgeries for obesity Idiopathic scoliosis	Immobilization Multiple sclerosis Muscular dystrophy Post-transplant bone disease Sarcoidosis
Medications		
Anticoagulants (heparin) Aluminum Anticonvulsants Cytotoxic drugs Glucorticoids and adrenocorticotropin	Gonadotropin-releasing hormone agonists Immunosuppressants Lithium Methotrexate Progesterone (parenteral, long-acting)	Thyroxine Tamoxifen Total parenteral nutrition

AACE-Recommended Laboratory Tests

Complete Blood Count and Sed Rate

Serum Chemistry Studies

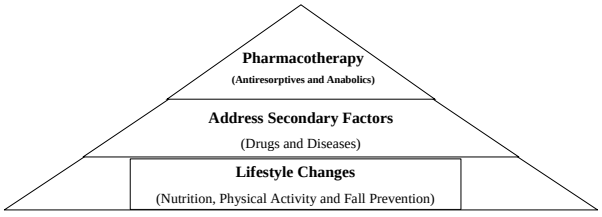
Calcium	**Creatinine**
Phosphorus	**25-hydroxyvitamin D**
Pre-albumin	**Parathyroid hormone (PTH-I)**
Alkaline phosphatase	**TSH**
Liver enzymes	**Urinary calcium excretion**

Modifiable Risk Factors for Osteoporosis

- **Inadequate calcium and vitamin D intake**
- **Physical inactivity**
- **Excessive alcohol**
- **Cigarette smoking**
- **Low body weight (127 lbs)**

NOF….

Lifestyle Changes



Bone health and osteoporosis: A report of the Surgeon General. Rockville, MD: U.S. Department of Health and Human Services; 2004.

How Much Calcium?

Adult Women and Men 50+ years

1200-1500 mg

In 2 divided doses

Maximum 2,000 – 2,500 mg/day

Calcium: Food Sources

Dairy products

- Skim milk, 1 glass 300 mg
- Yogurt, 6 oz fruit 200 mg
- Cheese, 1 slice 204 mg
- Cottage cheese, 1 cup 150 mg

Fortified foods

- Fortified cereal (Total ¾ c) 1,000mg
- Fortified orange juice, 1 c 300 mg

Calcium Carbonate

- Requires acid for absorption
  - Take with meals
  - Don't use if taking medication to reduce stomach acid
  - Aging?
- Low cost

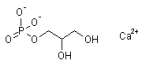
- Constipation or upset ?
- Tums, Oscal, Viactive Chews

Calcium Supplements

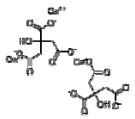
USP approved

2 Choices

- Calcium <u>carbonate</u>



- Calcium <u>citrate</u>



Calcium Citrate

- Acid not required for absorption
  - Can take any time of day
  - Ok with medication to reduce stomach acid
- Costs more
- No constipation or upset
- <u>2</u> tablets twice a day

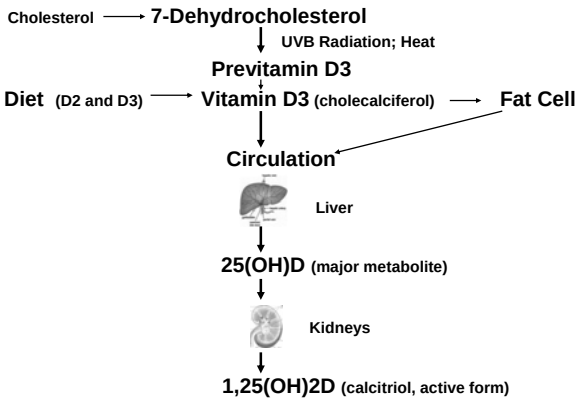
Risks of Calcium?

- Calcium Stones
  - **Evaluate risk**
  - **Prevention strategies**
    - **Diet; hydration; thiazides**
    - **Calcium rich food sources**
- Cardiovascular
  - **Evaluate risk**
  - **Prevention strategies**
    - **Vitamin D supplements**
    - **Calcium rich food sources**

Role of Vitamin D

- **Regulate mineral metabolism**
  - **Calcium and phosphorous homeostasis**
- **Bone metabolism**
- **Muscle strength; fall reduction**
- **Parathyroid regulation**
- **Inhibit cell proliferation (psoriasis); promote cell differentiation**
- **Insulin secretion**
- **Possible reduction of risk for some chronic diseases**

Synthesis and Metabolism of Vitamin D



Vitamin D Protection

- **Fall reduction**
  - Nursing home residents taking 800 IU vitamin D/day plus calcium had 26% reduction in risk of falls compared with placebo group
- **Anti-fracture efficacy**
  - Women consistent in taking calcium and 700-800 IU D3 had 29% reduction in hip fx (Women's Health Initiative)
- **Optimal protection**
  - only in trials providing 700-800 IU D3 / day or when serum 25(OH)D rose to 40ng/mL

Holick, Michael. N Engl J Med 357:3; 266-281

Dietary Sources of Vitamin D[1]

Food	Amount (IU)
Cod liver oil, 1 Tbsp	1360
Salmon, 3 ½ oz cooked	360
Mackerel, 3 ½ oz cooked	345
Tuna fish, canned in oil, 3 oz	200
Sardines, canned in oil, drained, 1¾ oz	250
Nonfat, reduced fat, and whole milk, vitamin D fortified, 1 cup	98
Margarine, fortified, 1 Tbsp	60
Pudding, prepared from mix and made with vitamin D fortified milk, ½ cup	60
Ready-to-eat cereals fortified with 10% of the DV for vitamin D (servings vary according to the brand)	40
Egg, 1 whole (vitamin D is found in egg yolk)	20
Liver, beef, cooked, 3½ oz	15
Cheese, Swiss, 1 oz	12

NIH Office of Dietary Supplements

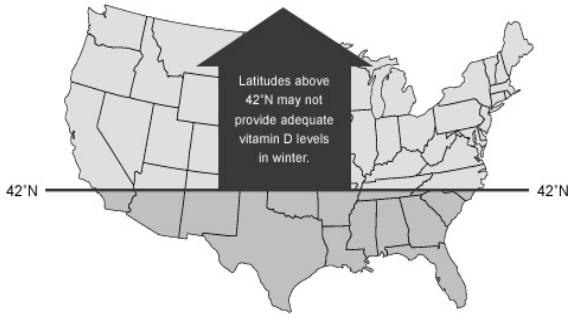
Who May Be D-Deficient?

Screen:

- Adults > 50 years
- Homebound; institutionalized
- Limited sun exposure; sunscreen, protective clothing
- Darkly pigmented skin
- Live north of the Carolinas
- Inadequate intake of vitamin D; malabsorption
- Chronic liver & kidney disease
- Drugs: anticonvulsants, glucocorticoids; antirejection meds

Source:NHANES III

Who May Be D-Deficient?



Source:NHANES III

Reference Range for Serum 25(OH)D

Hypovitaminosis D	
- **Severe deficiency**	**< 10 ng/ml**
- **Mild to moderate deficiency**	**10-20 ng/ml**
- **Insufficiency**	**21-29 ng/ml**
Sufficient	**30-80 ng/ml**
Possible toxicity	**> 80 ng/ml**

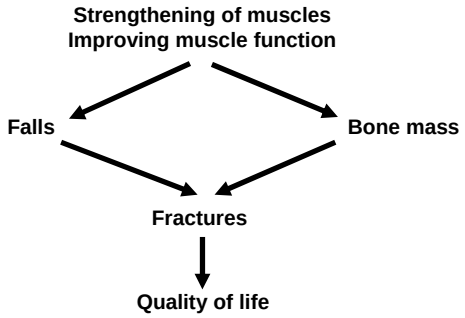
N Engl J Med 357:3, 2007

Vitamin D Recommendations

- **Deficiency (<20ng/mL):**
  - Vitamin D2 (ergocalciferol): 50,000 IU once a week for up to 2 - 3 months, or 3x/week for one month. Re-check levels; adjust dose for individual requirements.
- **Maintenance or Insufficiency:**
  - Vitamin D3 (cholecalciferol): 800 – 2,000 IU/day for older adults, or individuals who are chronically ill, housebound, or institutionalized.
- May take any time of the day. May continue smart sun exposure.

National Osteoporosis Foundation

Exercise: 20 Minutes A Day



Exercise





Exercise


Best to do
Weight-bearing exercises
AND
Strength-training-exercises
AND
Balance-exercises

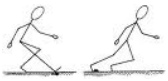
Tai-chi Reduces Fall Risk

Quin et al. Arch Phys Med Rehabil. 2002; 83:1355-9
Wolff et al. J Am Geriatr Soc. 1996; 44:489-97

Fall Prevention
The "F" Word

##* does happen…

We <u>can prevent</u> most falls!!!



Basic Balance Training

<u>One foot…5 seconds</u>

Stand facing a counter or table top.
Hold on with both hands, stand on one leg.
Hold for 5 seconds.
Repeat with the other foot.

Repeat sequence holding on with one hand.
Repeat holding on with fingertip.
Repeat sequence without holding on.
Repeat from beginning but close eyes when balancing on the one leg.

Risk Factors for Falling:
Intrinsic Factors

- **Frailty and associated deconditioning**
- **Problems with gait, balance and mobility**
- **Cognitive impairment or depression**
- **Poor visual acuity: depth perception & contrast**
- **Impaired hearing**
- **Low vitamin D levels**
- **Previous falls**
- **"Blackouts"**

Woolf et al. BMJ 2003; 327:89-95

Risk Factors for Falling:
Extrinsic Factors

Personal Hazards

- *Use of sedatives; SSRI*
- Inappropriate footwear and clothing
- Not using personal assistive devices

Hazards outdoors

- Uneven pavement, streets and paths
- Lack of safety equipment

Hazards indoors

- Snow and icy conditions
- Traffic and public transportation
- Dim lighting
- Steep stairs; lack of handrails
- Slippery floors; loose rugs
- Pets; grandchildren's toys
- Cords for telephone and electrical appliances

Timed Get Up and Go Test (TUG)

87% sensitive and 87% specific in predicting falls in community dwelling older adults

Performed with patient wearing regular footwear, using usual walking aid if needed, and sitting back in a chair with arm rest.

Observe patient for postural stability, steppage, stride length and sway.

Instruct the patient to:
•Rise from chair
•Stand still momentarily
•Walk short distance (~ 10 feet)
•Turn around
•Walk back to chair
•Sit down

J of Ger Phys Therapy, 33:4; 2010

Fall Risk Assessment

- **History of circumstances of the fall**
- **Medical: drugs; acute or chronic medical problems**
- **Cognitive: mental status**
- **Cardiovascular: heart rate and rhythm; postural hypotension**
- **Vision: depth perception and contrast sensitivity**
- **Mobility, gait and balance**
- **Neurological: leg strength, reflexes, proprioception, foot sensitivity; tests of cortical, cerebellar and extrapyramidal function**

Woolf et al. BMJ 2003; 327:89-95

Get Up and Go Test: Interpretation

Low scores correlate with good functional independence; high scores correlate with poor functional independence and higher risk of falls.

Completes task in:

< 10 seconds:	**Normal**
< 20 seconds:	**Adequate for independent transfers and mobility; > 13.5 fall risk**
> 20 seconds:	**Abnormal**
> 30 seconds:	**Higher dependence and risk of falls**

Posiadio (1991) J Am Geriatr Soc 39:142-8 and *Arch Phys Med Rehabil* (1986)67: 387 - 38

AACE Recommendations for Fall Prevention

PCP

- **Gait and balance training**
- **Adjust dosage of drugs with sedative effects**

Home

- **Avoid loose rugs**
- **Remove clutter**
- **Keep loose wires behind furniture**
- **Use nonskid mats**
- **Install handrails in bathrooms, halls, and stairs**
- **Light hallways, stairs, and entrances**
- **Wear sturdy, low-heeled shoes**

Hodgson SF, Watts NB, Bilezikian JP, et al. Endocr Pract. 2003;9:544-564.

FRAX Score: Osteopenia

- **WHO computer-based algorithm**
- **Identifies osteopenic patients who may benefit from treatment**
- **10 year fracture risk based on specific risk factors and BMD**
- **Country and race specific**

- **Suggest treatment if:**
  - **10 yr probability of hip fx >= 3%**
  - **10 yr probability of major osteoporosis-related fx >= 20%**

Treatment Guidelines (NOF)

Postmenopausal women and men >= age 50 who present with

- Hip or vertebral fragility fracture
- T-score <= -2.5 after exclude secondary causes
- Osteopenia and positive FRAX

⇩

- Consultation (general recommendations)
- Basic treatment (calcium + vitamin D)
- Fall evaluation and prevention
- Special pharmacotherapy

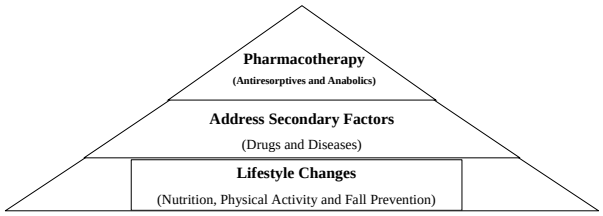
.

Clinician's Guide to Prevention and Treatment of Osteoporosis. Washington, DC: National Osteoporosis Foundation; 2008

Monitoring Therapy Postmenopausal Women

- **Serial BMD**
  - BMD changes slowly
  - Assessment is required every 2 years to measure change
  - Look for maintenance or improvement in BMD
  - Should be performed on the same machine if possible
- **Bone turnover markers**
  - Evolving method of clinical assessment
  - Large changes in biochemical markers associated with fracture reduction

Pharmacotherapy



Bone health and osteoporosis: A report of the Surgeon General. Rockville, MD: U.S. Department of Health and Human Services; 2004.

Pharmacotherapy: Bisphosphonates

Bisphosphonate	Labeled Indications	
	Prevention	Treatment
Alendronate	Postmenopausal osteoporosis	Postmenopausal osteoporosis Men with osteoporosis Glucocorticoid-induced osteoporosis
Ibandronate	Postmenopausal osteoporosis	Postmenopausal osteoporosis
Risedronate	Postmenopausal osteoporosis Glucocorticoid-induced osteoporosis	Postmenopausal osteoporosis Glucocorticoid-induced osteoporosis Men with osteoporosis
Zoledronic acid (IV)		Postmenopausal osteoporosis

Pharmacotherapy

1. **Antiresorptive agents**
   - **Bisphosphonates**
   - **SERMs** (Selective estrogen receptor modulators)
   - **Hormones: Estrogen; Androgen**
   - **Calcitonin**
2. **Anabolic agents**
   - r-PTH
3. **RANKL inhibitor (new)**

Efficacy of Bisphosphonates
30-50% Risk Reduction v.s. Placebo

Bisphosphonate	Risk Reduction	
	Hip	Spine
Alendronate	51-56%	44-48%
Ibandronate	34% (post hoc analysis)	48-49%
Risedronate	30%	41-49%
Zoledronic acid (IV)	41%	46-77%

Osteoporosis Int 2010; 21:1793-1802

Bisphosphonates

- **Contraindicated for poor renal function, hypocalcemia and pregnancy**
- **Caution in patients with abnormalities of the esophagus, reflux or stomach ulcers**
- **Use PPI if taking ASA**
- **Caution for oral surgery & poor dental hygiene**
- **Strict dosing instructions**
- **Consider drug holiday after 5 years therapy**
- **IV Reclast: pretreat with acetomenophen**

Osteoporosis Int (2010) 21: 1793-1802

Pharmacotherapy: HRT Clinical Studies

- **WHI confirmed the effects of hormone therapy on fracture reduction**
  - **Hip and vertebral fractures decreased by one-third**
  - **Total fractures decreased by 24% to 30%**
- **WHI found HT provides no cardioprotective benefits and increases breast cancer risk**
- **Other adverse effects (increased risk of stroke, cognitive impairment, deep vein thrombosis)**
- **May be 1st line therapy for women < 60 years with menopausal symptoms at low dose; women should discuss benefits and risks with their health care provider (FDA)**

AACE Position Statement on HRT and Cardiovascular risk, 2008

Pharmacotherapy: SERMS

Serms	Labeled Indications	
	Prevention	Treatment
Raloxifene	Postmenopausal osteoporosis Decrease risk of invasive breast cancer	Postmenopausal osteoporosis

Pharmacotherapy: Testosterone Clinical Studies

Testosterone

- Hypogonadism: testosterone replacement increases BMD; fracture prevention is unknown
- BMD did not increase in men with normal pretreatment levels
- May not be appropriate in elderly men, because of potential for undiagnosed prostate cancer

Pharmacotherapy: Calcitonin

Calcitonin	Labeled Indications	
	Prevention	Treatment
Calcitonin		Postmenopausal osteoporosis of spine Analgesia for vertebral fractures

Pharmacotherapy: RANKL Inhibitor

RANKL Inhibitor	Labeled Indications	
	Prevention	Treatment
Denosumab		Severe postmenopausal osteoporosis

Anabolic Agents Pharmacotherapy: rPTH

rPTH	Labeled Indications	
	Prevention	Treatment
Teraparatide		Postmenopausal osteoporosis Men with osteoporosis Glucocorticoid-induced osteoporosis May increase rate of healing fractures

Combining Therapies

Combining Antiresorptive Therapies

- Clinical studies have not shown combinations of HT or Raloxifene with bisphosphonates to increase BMD or reduce fracture risk more than each agent alone

Combining Antiresorptive & AnabolicTherapies

- PTH followed by Alendronate: vertebral BMD increased substantially
- PTH followed by Raloxifene: effective
- Alendronate and PTH used together---less effective
- Alendronate followed by PTH: reduced response
- Raloxifene followed by PTH: complete response to PTH
- Zolendronic acid and PTH: BMD increased

Multiple Factors May Mitigate Fracture Risk

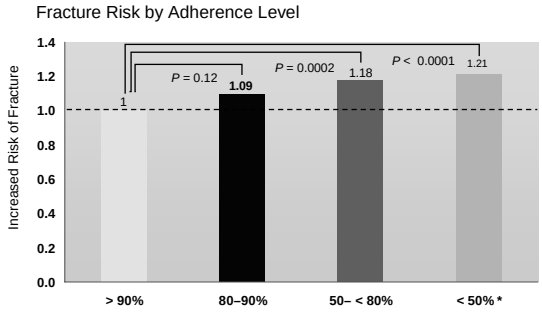
Lifestyle Modifications
Minimizing factors that contribute to falls
Modification of risk factors (diet, exercise)

Decrease Fracture Risk

Therapeutic Interventions
Slowing/stopping bone loss
Maintaining or increasing bone density and strength
Maintaining or improving bone microarchitecture
Improving medication adherence

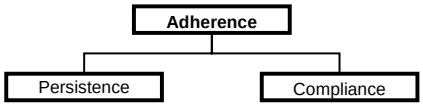
NAMS Position Statement. *Menopause*. 2006;13:340-367.
Heaney, RP. *Bone*. 2003;33:457-465.
Siris ES, et al. *Mayo Clin Proc*. 2006;81:1013-1022.

Poor Adherence Is Associated With Increased Fracture Risk



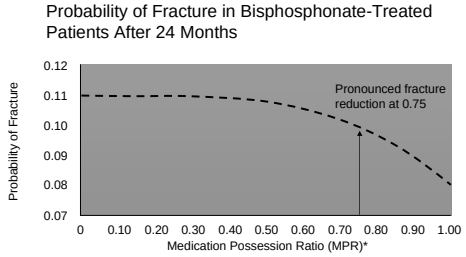
*Data on 38,000 women in a managed care database.
Huybrechts KF, et al. *Bone*. 2006;38:922-928.

Adherence Encompasses Both Persistence and Compliance



- **Adherence**
  Reflects a combination of behaviors determining the extent to which patients take medications as prescribed
- **Persistence**
  The length of time on therapy
- **Compliance**
  The consistency and accuracy with which a prescribed regimen is followed

Improving Adherence Has Been Associated With Decreased Fracture Rates in Postmenopausal Osteoporosis

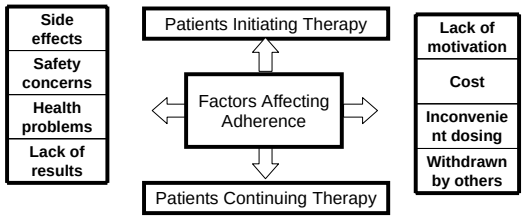


- **100% compliance is associated with a fracture rate of ~ 8%**

Data on 35,537 patients from 2 claims databases.
***Medication Possession Ratio (MPR)** is a measure of refill compliance using the percentage of time a medication was available to the patient.
Siris ES, et al. *Mayo Clin Proc*. 2006;81:1013-1022.

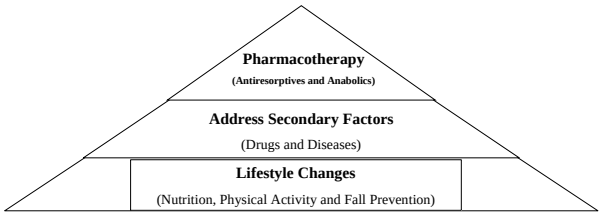
Osteoporosis Therapy and Patient Adherence

Less than 25% of patients adhere to their therapy for more than 1 year



Rossini M, et al. *Osteoporos Int*. 2006;17:914-921.
Payer J, et al. *Biomed Pharmacother*. 2007;61:191-193.
McCombs JS, et al. *Maturitas*. 2004;48:271-287.

Prevention & Treatment of Osteoporosis



Bone health and osteoporosis: A report of the Surgeon General. Rockville, MD: U.S. Department of Health and Human Services; 2004.

Fragility Fracture Clinic Prevention and Treatment

- **Assessment**
  - Lab work: calcium, vitamin D, secondary causes
  - Tests: DEXA, FRAX
  - Cognitive & mood assessment
  - Nutritional assessment
  - Risk assessment
  - Medication review
- Fall Prevention
  - Exam: orthostatic hypotension, vision, feet,
  - Gait assessment
  - Balance assessment
  - Home assessment for environmental risks
- Evidence based interventions
- Letter to Primary Care Provider
- Follow-up

Thank You!