Building Bone Density - Research Issues
Helping to Regain Bone Density
QUESTION 1
What are the symptoms of Osteoporosis?

Who is at risk?
Symptoms

- **Bone Fractures**
  - Osteoporosis
    - 1,500,000 fractures a year
    - Kyphosis
      - Loss of height – stooped position
  - 300,000 HIP Fractures
OVERVIEW

- Definition and Risks
  - Disease – Fragile Bones
  - Osteoporosis
    - Porous bone
  - No symptoms
    - Fracture
- Women 4 times Men
- 24,000,000 women
OVERVIEW

- Bone Anatomy and Physiology
  - Muscle support
  - Protection of Organ
  - Mineral Storage
- Cortical Bone – Trabecular Bone
- Bone Remodeling
Question 2
What are the key age factors?
OVERVIEW

- Key Age Factors
  - Teens to 30
  - 30 to 50
  - Older than 50
    - Post menopause
OVERVIEW

- Key Age Factors
  - Teens to 30
    - Building
  - 30 to 50
    - Slow loss
  - Older than 50
    - Post menopause
OVERVIEW

- Key Age Factors
  - Teens to 30
    - Weight bearing Exercise
    - Calcium intake
    - NO smoking
OVERVIEW

- Key Age Factors
  - Adults 30 – 50
    - Slow loss
    - Exercise
    - Non – smoking

- Idiopathic Osteoporosis
  - Osteoporosis Int. 2005
  - Some blood chemical levels lower
  - Women and men
Smoking
Smoking and fracture risk: a meta-analysis

Osteoporosis, Int, 2005 16 155-162
Smoking

- Study 59,232 men and women (74% w)
- Fracture 1.25 smokers to non-smokers
- Fracture 1.13 BMD considered
- Highest Risk Hip fracture (1.84)
- Higher risk for Men
Effect of age, weight & Lifestyle factors on calcaneal quantitative ultrasound in premenopausal women

Calif. Tissue Int. (2004) 74(4) 317-21
Effect of age, weight & Lifestyle factors

- Bone Stiffness Positive
  - Outdoor activity

- Bone Stiffness Negative
  - # of pregnancies
  - Chronic use of drugs
    - Smoking
    - Subjective Health Status
OVERVIEW

- Post menopause
  - Bone density screening
  - Exercise
  - Medications
Factors that effect Osteoporosis Potential

- Uncontrollable Factors
  - Family History
  - Age
  - Race
  - Gender

- Controllable Factors
  - Activity
  - Diet
  - Medication
Lifestyle Choices

- Exercise
  - Weight bearing
- Body Weight
  - “Extreme” weight loss at 50 (>10%)
- Smoking
Diet

- Calcium & Vitamin D
  - 1500 mg/day
  - 8-ounce milk 300 mg
  - 5 – 15 minutes sunlight

- Soy

- Others
  - Protein
  - Sodium
  - Coffee
Do medications help?
Drugs – Choice?
MEDICATIONS

- Alendronate (Fosamax)
- Raloxifene (Evista)
- Risedronate Sodium (Actinel)
- Hormone Therapy
MEDICATION

Alendronate (Fosamax)

- Class of drugs – bisphosphonates
- Action – Bone cells
- Taking Fosamax
  - First thing in morning
  - Full glass of water
    - Upright position Minimum 1/2 hour preferably one hour
    - Same time before first food, beverage, or medication of the day.
MEDICATION Side Effects
Alendronate (Fosamax)

- Side effects are uncommon
  - Abdominal or musculoskeletal pain,
  - Nausea,
  - Heartburn,
  - Irritation of the esophagus.
MEDICATION

Raloxifene (Evista)

- Standard use
MEDICATION
Risedronate Sodium (Actinel)

- Taking Medication:
  - First thing in morning
  - Full glass of water
  - ½ hour before food or beverage
  - Remain upright
MEDICATION
Hormone Therapy

- Higher Risk factors
DETECTION

- Individual Fractures
- BMD
- Duel energy x-ray absorption DEXA
- Location Effects
Research

Can detection be done effectively?
BMD: The Problem
Osteoporosis Int. 2005 16: 1013-1015

- Considered the “wrong” measure
  - 3-D to a 2-D (average Bone mineral/area of bone shadow)

- Bone Mineral Content (BMC) better

- Desire for STRENGTH
Research

Can detection be cheaper?
Identifying postmenopausal women with osteoporosis by calcaneal ultrasound, metacarpal digital x-ray radiogrammetry and phalangeal radiographic absorptiometry: a comparative study
Osteoporosis Detection

- Quantitative Ultrasound (QUS)
  - 67.5% sensitivity
- Digital X-ray radiogrammetry
  - 76.9% sensitivity
- Phalangeal Radiographic absorptimetry (RA)
  - 82.9% sensitivity
How else may we work against Osteoporosis? (And get a kick out of it)
Exercise
EXERCISE I

- Effects when young
- Effects for Middle age
- Effects for post-menopausal
Recent Research
Can exercise help children’s bone density?

Osteoporosis International (2005)
16:1225-1232
Diet and exercise during growth have site-specific skeletal effects: a co-twin control study

- Effects on peri-pubertal and post-pubertal NOT pre-pubertal
- Hour/week differences in exercise
  - 1.2% total body Bone Mineral Content (BMC)
  - 1.4% leg BMC
  - 0.5% spine BMC
  - 0.1% cortical Thickness
- Protein intake (1 gram) 0.4% in arm BMC
Recent Research
Can exercise help the bone density for premenopausal women?
Effects of high-impact exercise on bone mineral density: a randomized controlled trial in premenopausal women

Osteoporosis, Inc. (2005) 16 191-197
Effects of Impact exercise

- Femoral neck and Trochanter
  - No loss of BMD exercise
  - -1.1% Control group
- MEAN trochanter BMC
  - No loss of BMD exercise
  - -7.7% control group
- Fall with fractures
  - 6 Exercise Group
  - 16 Control Group
Recent Research
Can exercise help elderly woman?
Effects of impact exercise on bone mineral density in elderly women with low BMD: a population-based randomized controlled 30-month intervention

Osteoporosis Int. 2006 17: 109-118
Effects of high-impact exercise on bone mineral density

- Femoral neck BMD
  - 1.1% versus -0.4%

- Intertrochanteric BMD
  - 0.8% versus -0.2%

- Total femoral BMD
  - 0.1% versus -0.3%
Effects of high-impact exercise on bone mineral density

- L1 vertebra
  - 2.2% versus -0.4%

- Lumbar vertebra L2 – L4
  - No exercise effects
Resent Research
Can exercise help the spine of a postmenopausal women over a 3 – year period?

The bones are just not the same
Exercise maintains bone density at spine and hip
EFOPSS: a 3-year longitudinal study in early postmenopausal women

Osteoporosis Int. 2006 17: 133-142
Spine
Exercise maintains bone density at spine and hip – 38 months

- **DXA lumbar spine**
  - 0.8% versus -3.3%

- **QCT trabecular bone**
  - 1.1% versus -7.7%

- **QCT cortical bone**
  - 5.3% versus -2.6%
Exercise maintains bone density at spine and hip – 38 months

- **DXA total hip**
  - -0.2% versus -1.9%

- **DXA distal forearm**
  - -2.8% versus -3.8%

- **QCT cortical bone**
  - 5.3% versus -2.6%
Exercise maintains bone density at spine and hip – 38 months

- DXA lumbar spine – between group
  - 4.1%

- QCT trabecular bone – between group
  - 8.8%

- QCT cortical bone – between group
  - 7.9%
Exercise maintains bone density at spine and hip – 38 months

- DXA total hip – between group
  - 2.1%

- DXA distal forearm – between group
  - 1%
Exercise maintains bone density at spine and hip – 38 months

- Spine
  - Pain frequency and intensity reduced
Resent Research
Can we just exercise at home and solve our bone mass problems?
Predictors of compliance with a home-based exercise program added to usual medical care in preventing postmenopausal osteoporosis: an 18-month prospective study

Osteoporosis Int. (2005) 16: 325-331
Hone-based exercise programs

- 18 month compliance rate
  - 17.8%

- Factors
  - Contraindication for hormone replacement
  - General physical function
What happens when the problems are not solved?
Bone Problems

- Kyphosis
  - Spinal Hump
- Wrist Fractures
- Spinal Fractures
- Hip Fractures
Don’t fall – No fractures
Fall Prevention

- Be careful!
  - Time
  - Surfaces
  - Contact Surfaces
- Exercise