# Better Bones: Osteoporosis and Implications for Exercise

Carla Hill, MPT
University of North Carolina-Chapel Hill

# Why Better Bones?

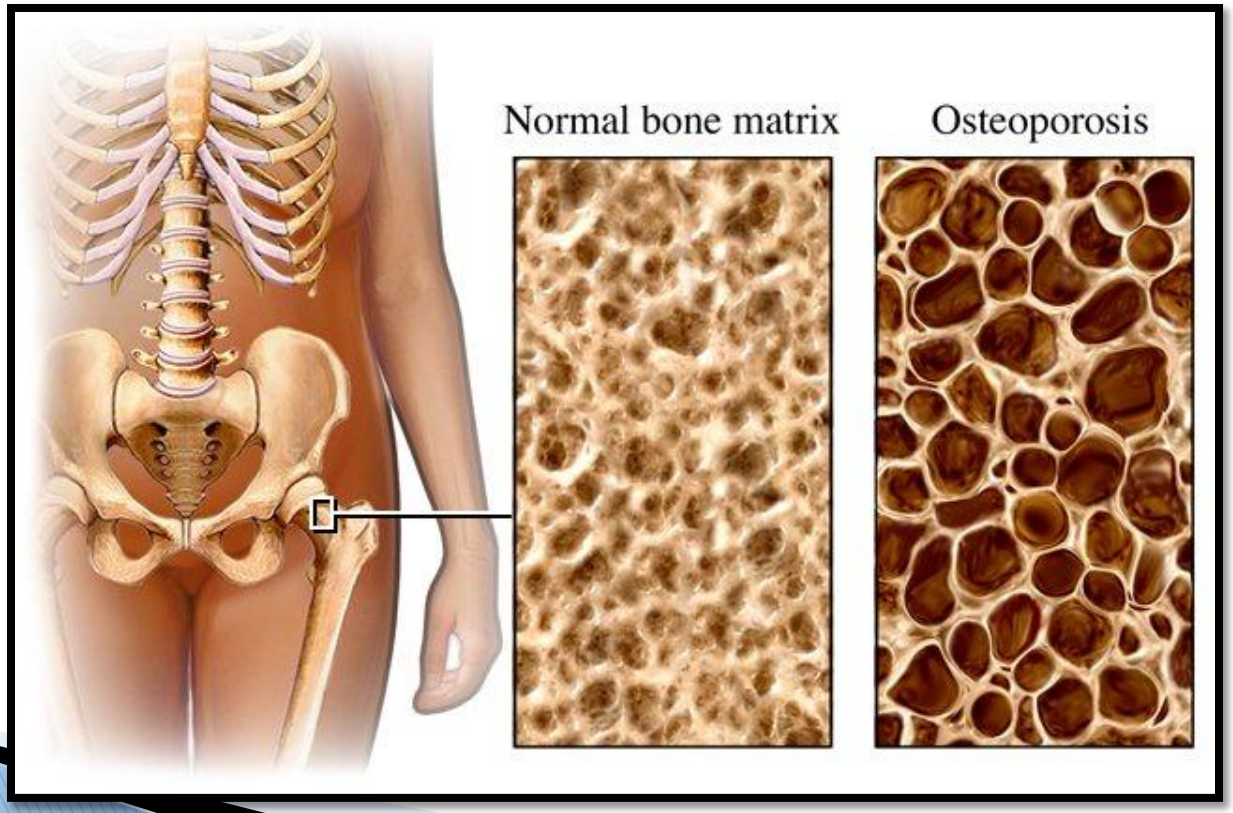
- Osteoporosis is the most common bone disease and is a major health issue!
- Prevention and management can improve health outcomes
- The right exercises can prevent fractures but the wrong ones can cause a fracture

# Overview

- Osteoporosis basics and diagnosis
- Risk factors
- Management interventions
- Exercise Recommendations
  - To ensure “bone safe” movement
  - To prevent falls and fractures
  - To improve bone density
- Body mechanics
- Team approach

# Osteoporosis

- A significant loss of bone density
- Weakens infrastructure of bone
- Makes bone susceptible to fracture



# By the numbers

- 10 million Americans have osteoporosis
- 34 million Americans have osteopenia

  A low bone mass condition that is a precursor to osteoporosis

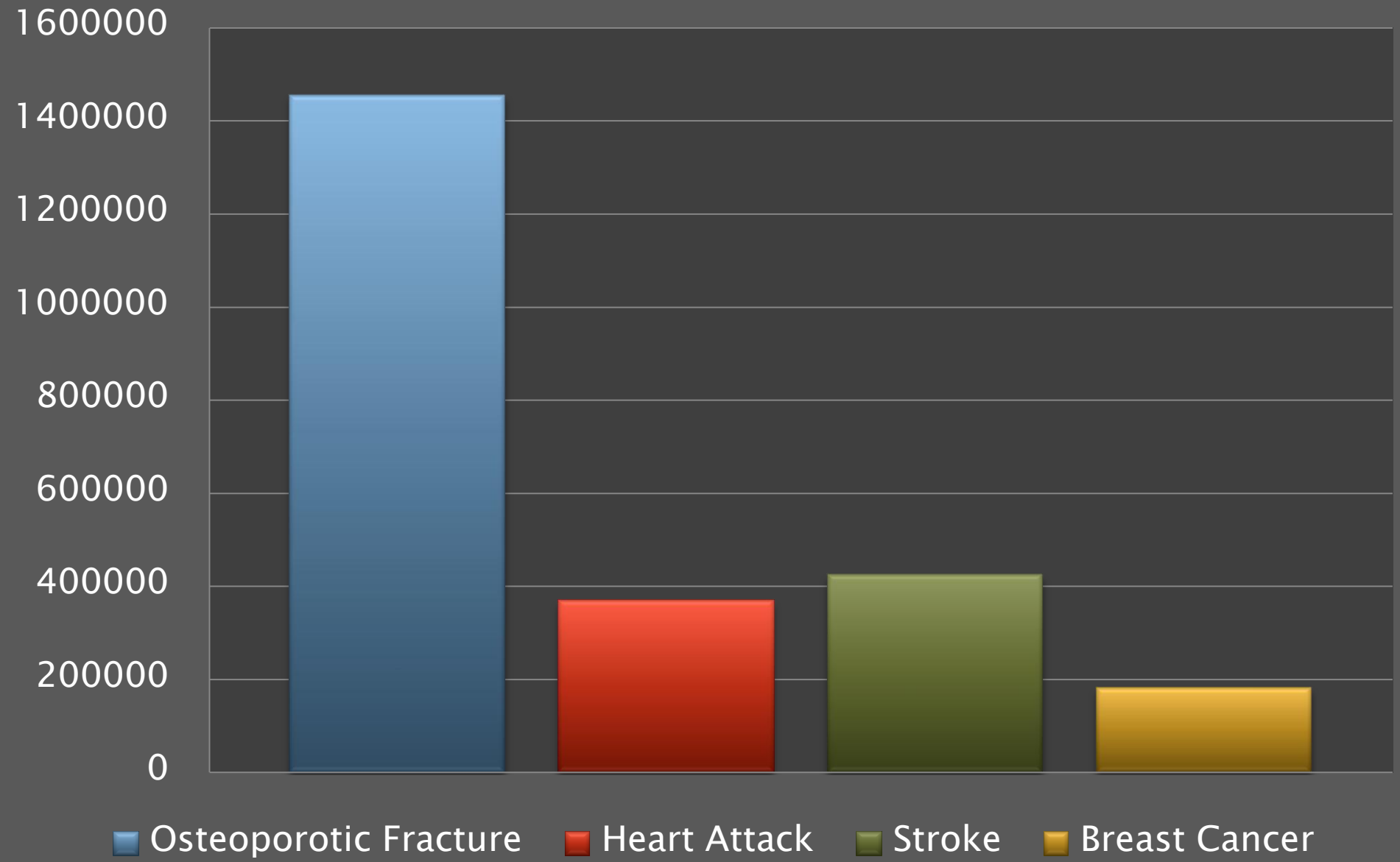
- 1.5 million osteoporosis fractures each year

  1 in 2 women and 1 in 5 men will experience an osteoporosis-related fracture during their lifetime

- $17 billion in annual healthcare costs

National Osteoporosis Foundation, 2010

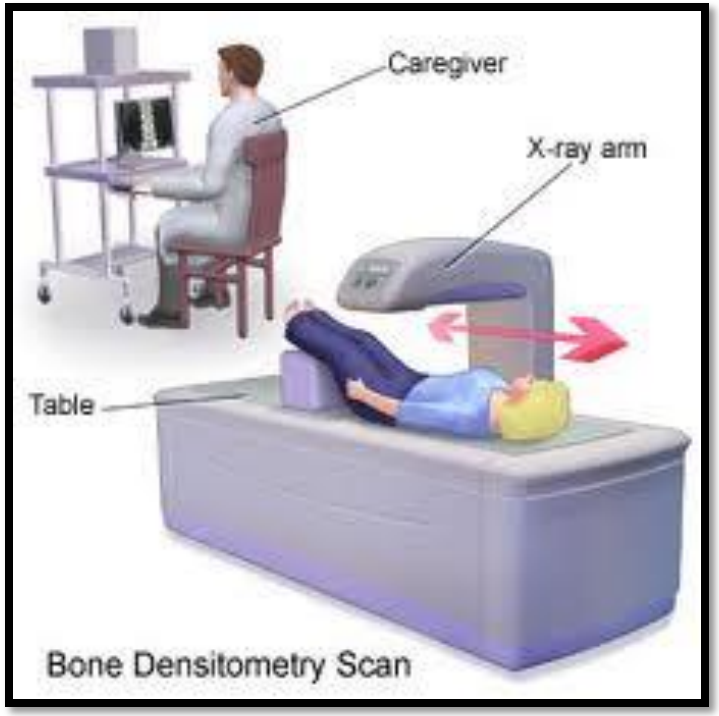
# Annual Incidence of Common Diseases In Women



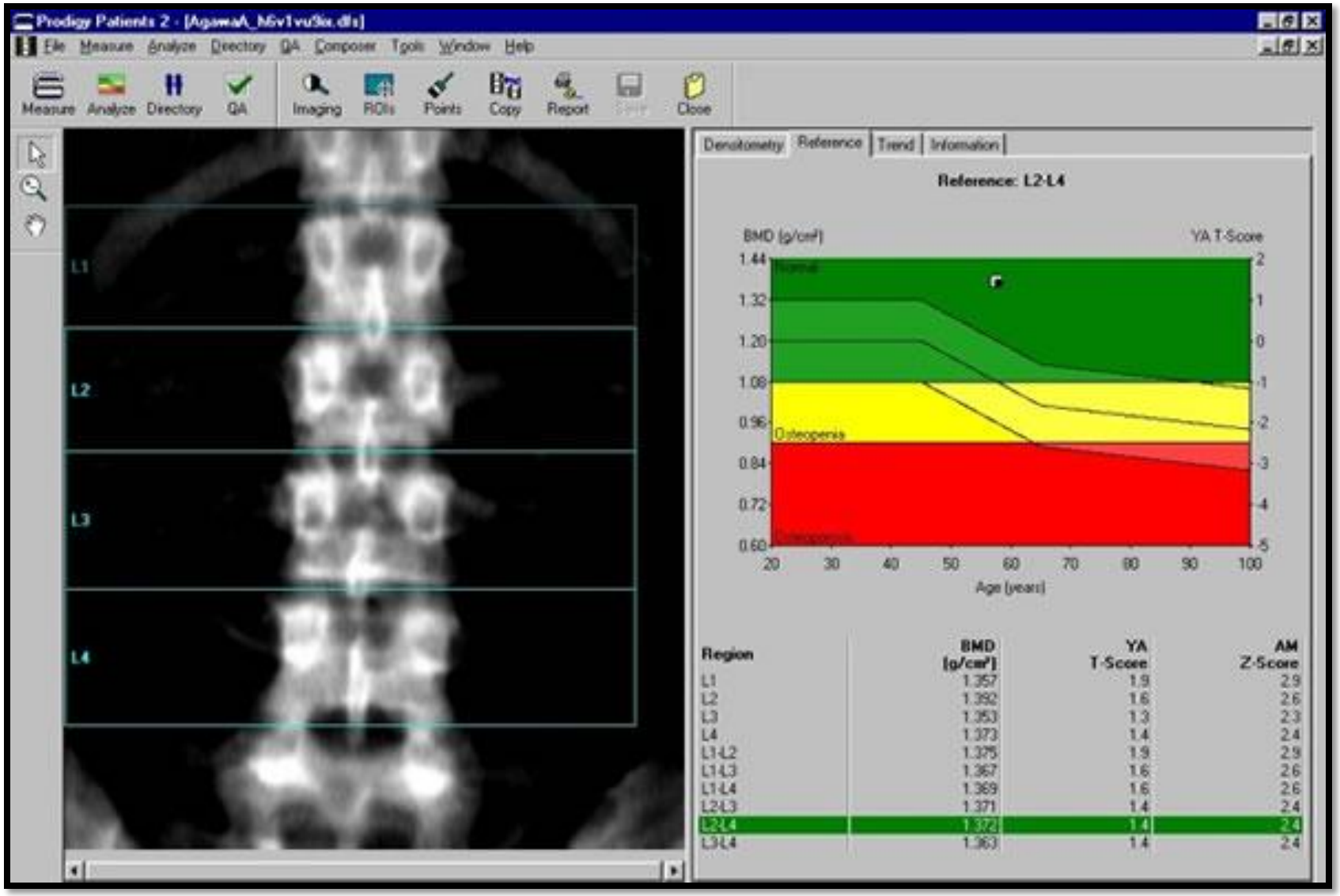

National Osteoporosis Foundation, 2010

# Diagnosis

- A “silent” disease because there are often no symptoms before a fracture
- Bone mineral density (BMD) evaluated by dual-energy x-ray absorptiometry (DXA)
  - Lumbar spine and Hip
- Recommendations
  - Women 65+ or postmenopausal women with additional risk factors
  - Men 70+ or 50-69 with additional risk factors



# DXA example


Prodigy Patients 2 - [AgawaA_h6v1vu9x.dls]
File Measure Analyze Directory QA Composer Tools Window Help
Measure Analyze Directory QA Imaging ROIs Points Copy Report Close
L1
L2
L3
L4
Densitometry Reference Trend Information
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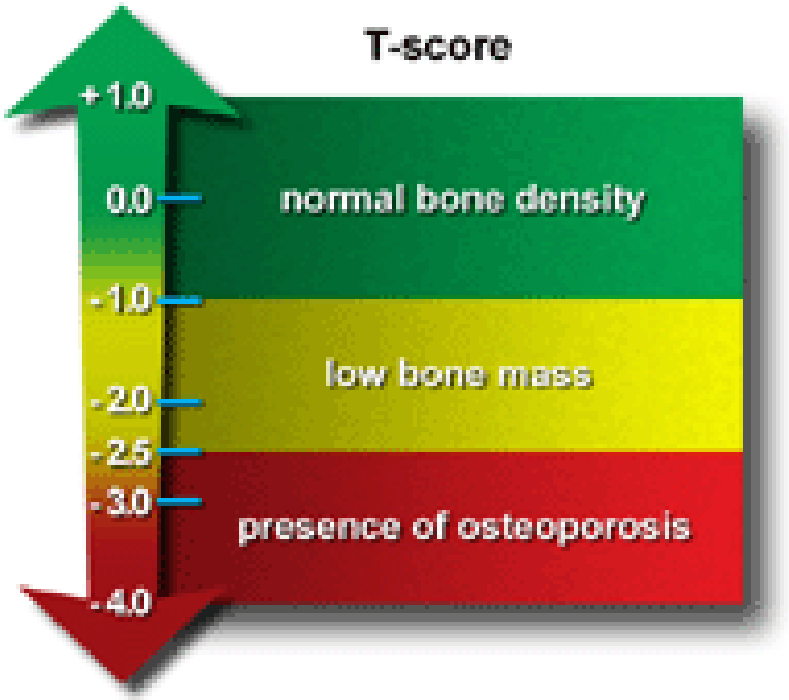
BMD (g/cm²)
YA T-Score
Normal
Osteopenia
Osteoporosis
1.44
1.32
1.20
1.08
0.96
0.84
0.72
0.60
2
1
0
-1
-2
-3
-4
-5
20 30 40 50 60 70 80 90 100
Age (years)
Region BMD [g/cm²] YA T-Score AM Z-Score
L1 1.357 1.9 2.9
L2 1.392 1.6 2.6
L3 1.353 1.3 2.3
L4 1.373 1.4 2.4
L1-L2 1.375 1.9 2.9
L1-L3 1.367 1.6 2.6
L1-L4 1.369 1.6 2.6
L2-L3 1.371 1.4 2.4
L2-L4 1.372 1.4 2.4
L3-L4 1.363 1.4 2.4

# T score interpretation

- Comparison to same-sex “young normal” adult to result in T score
- Osteoporosis: T score ≤ -2.5
- Osteopenia: T score between -1.0 and -2.5



# Potential First Signs

- Loss of height >1”
- Protruding abdomen
- Increasing kyphotic posture
- Loss of teeth (periodontal disease)
- Transparent skin (dorsum of hand)
- Persistent back pain

Sara Meeks, PT, GCS
“Patterns of Postural Change”

# Risk Factors

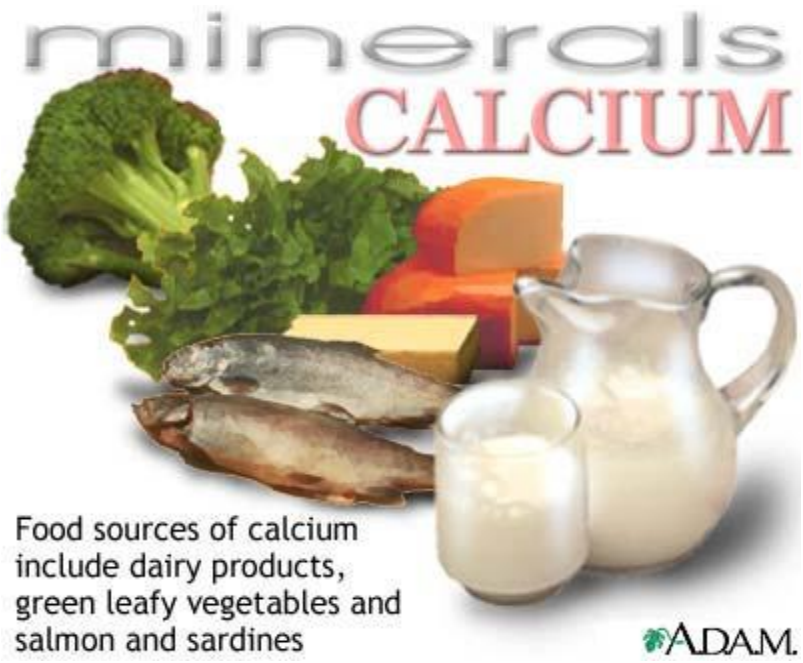
- Modifiable
  - Nutritional Intake
    - Calcium
    - Vitamin D
  - Inadequate physical activity
  - Tobacco use
  - Alcohol (≥3/day)
  - Caffeinated drinks and dark sodas (≥4/day)

- Non-modifiable
  - Age
  - Gender (F>M)
  - Race
    - Caucasian
    - Asian
  - Low BMI
  - Low hormone level
  - Certain diseases and medications

# Interventions

- Address modifiable risk factors
  - Improve nutritional intake
  - Increase “bone safe” physical activity
  - Stop tobacco use/smoking
  - Decrease alcohol intake
- Falls prevention
- Safe body mechanics
- Pharmaceutical management

# Nutritional Intake





1200-1500 mg/day

800-1000 IU/day

National Osteoporosis Foundation, 2010

# Pharmaceutical management

- Bisphosphonates
  - Alendronate (Fosamax)
  - Ibandronate (Boniva)
  - Risedronate (Actonel)
  - Zoledronic acid (Reclast)
- Calcitonin (Miacalcin, Fortical)
- Estrogen/Hormone Therapy
- Estrogen Agonist/Antagonist (Evista)
- Parathyroid Hormone (Forteo)

National Osteoporosis Foundation, 2010

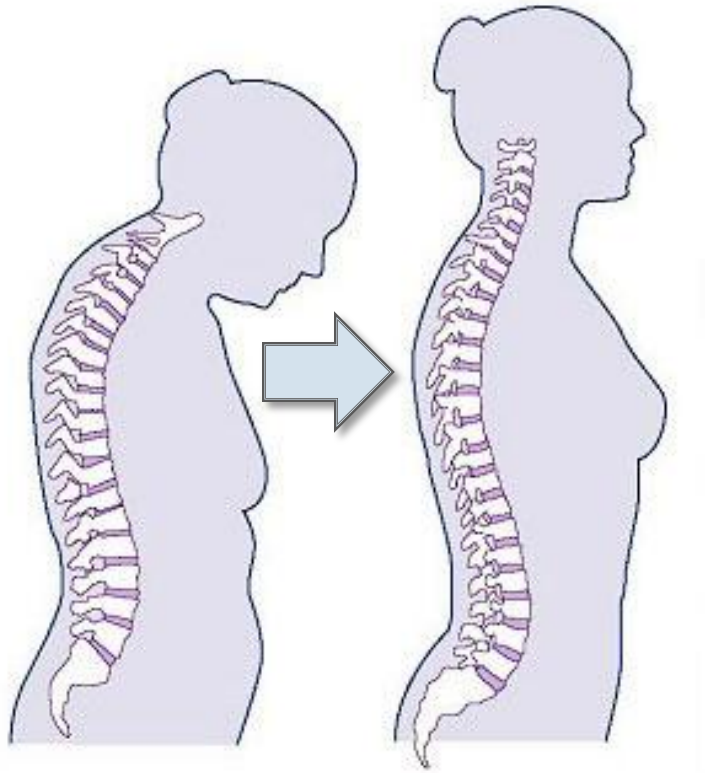
# Exercise Recommendations

- Bone safe movements
- Balance and strength training
  - Prevents falls and fractures
- Resistance training
  - Improves or maintains bone density

# Bone safe movements

- Encourage good posture and core stability with all exercise and activity
- Improve trunk extension strength
- Avoid trunk flexion (forward bending)
- Avoid loaded trunk rotation
- Attend to balance concerns

# Good posture



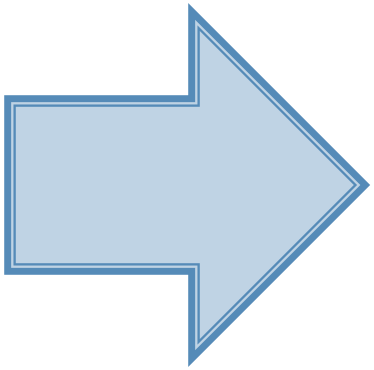
- Stand “Tall”
- Head/shoulder alignment
- Sternum lifted
- Thoracic spine extended
- Abdominals contracted
- Pelvis level

# Trunk flexion vs extension

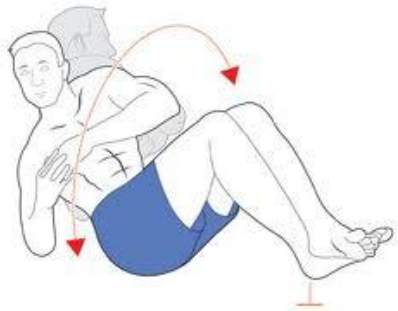
- Likelihood of new fracture in 1 year in women with a prior vertebral fracture:
  - Flexion (crunches)=89%
  - Extension (arches/lifts)=16%
  - Combined flexion and extension=53%
  - No exercise=67% (Sinaki and Mikkelson, 1984)

- Core strength is important
  - Perform in neutral
  - Perform safe range spinal extension for postural strengthening

# Unsafe exercises!




Compression Fracture



# Safe exercises!

Keep spine in neutral or extension.

Pilates and Yoga must be modified to avoid trunk flexion and rotation.

# Prevent falls, prevent fractures

- Exercise can improve static and dynamic balance to decrease risk of falling and fractures
  - Functional and balance training for 20 weeks (Hourigan et al, 2008)
  - Resistance, coordination, and balance exercise for 12 weeks (Swanenburg et al, 2007)

# Prevent falls, prevent fractures

- Balance training class for 12 months

  (Madureira et al, 2007)

- Agility training (balance and coordination) or resistance training for 25 weeks

  (Liu-Ambrose et al, 2004)

- Aerobic, balance, coordination, and strength exercise classes for 1 year

  (Lord et al, 1996)

# Balance training

- Narrowing base of support
  - Staggered ⟶ Tandem ⟶ Single leg
- Changing the standing surface
  - Foam mat ⟶ Air discs ⟶ Bosu
- Closing Eyes
- Weight shifting in all directions
- Turning head or swinging arms

# Exercise for bone density

- Exercise can improve, maintain or slow the loss of bone density associated with aging
  - Walking and strengthening for 12 months (Bergstrom et al, 2008)
  - High-intensity resistance training for 25 weeks (Liu-Ambrose et al, 2004)
  - Resistance training with load progression for 2 yr (Kerr et al, 2001)

# Exercise for bone density

- Resistance training, aerobics, and jumping over 12 years with intensity progression
  (Kemmler et al, 2011)
- Strength training and walking for 12 months
  (Bergstrom et al, 2008)
- Progressive strength training of high and low intensity for 40 weeks
  (Bemben et al, 2011)

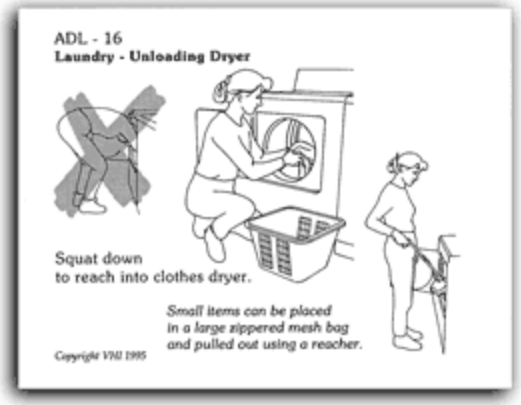
# Resistance training

- Utilize body weight
  - Squats
  - Step ups
  - Planks
- Resistance training with machines, free weights, and theraband or tube
- Must be progressed over time
- Don’t forget about posture!

# Musculoskeletal Imbalances

- Weaknesses
  - Gluteus maximus and medius
  - Rhomboids,middle and lower trapezius
  - Hamstrings
  - Abdominals, thoracic erector spinae
  - Ankle dorsiflexors
- Restrictions
  - Iliopsoas and rectus femoris
  - Pectoralis major and minor
  - Latissimus dorsi
  - Abdominals, lumbar erector spinae
  - TFL/ITB
  - Gastroc, soleus, hamstrings

# Safe Body Mechanics





- Spinal alignment is always important!
- During daily activities and household chores:
  - Maintain neutral position
  - Avoid flexion
  - Keep objects close to body

# Physical Therapy

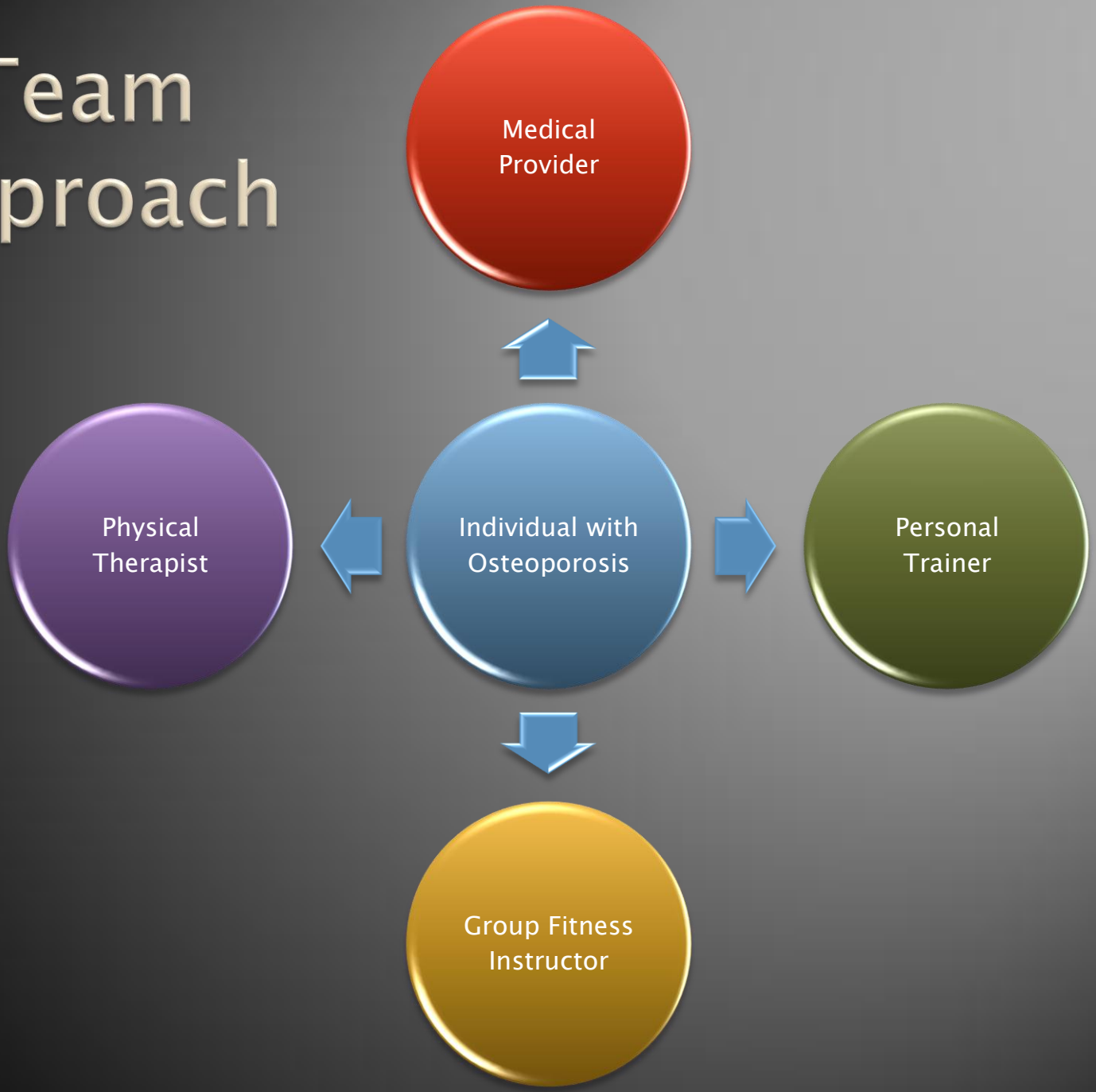
- Physical therapists are health care professionals who maintain, restore, and improve movement, activity, and health enabling individuals of all ages to have optimal functioning and quality of life, while ensuring patient safety and applying evidence to provide efficient and effective care.

American Physical Therapy Association, 2011

- Physical Therapist can:
  - Evaluate for impairments and functional limitations
    - Posture
    - Balance
    - Strength
    - Flexibility
    - Joint motion
  - Provide interventions to address issues
  - Set up and progress an exercise program
  - Educate the patient on their health condition and proper management

- Physical therapy intervention
  - Must be medically necessary
  - Addresses current impairments and functional limitations
  - Is progressive in nature and improves function over time (not a maintenance exercise program)
  - Includes recommendations for ongoing management and continuing an exercise program after discharge

# A Team Approach



# Summary: Interventions

- Educate individuals about the disease and risk factors
- Encourage healthy bone behaviors
  - Improve nutritional intake
  - Increase “bone safe” physical activity
  - Stop tobacco use/smoking
  - Decrease alcohol intake
- Prevent falls
- Medical provider follow up

# Summary: Exercise Guidelines

- Good posture with all exercises
- Promote spinal extension strength
- Avoid flexion and loaded rotation
- Progress balance and resistance training

# Questions?

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