Osteoporosis: update

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DISCLOSURES

CENTRE FOR BONE HEALTH—Received small unrestricted grants from Amgen, Novartis, Merck Frost –

used for Community Education

First Some Definitions

OSTEOPOROSIS

- Definition as outlined by a U.S. National Institutes of Health consensus conference:

"A skeletal disorder characterized by compromised bone strength, predisposing a person to an increased risk of fracture.

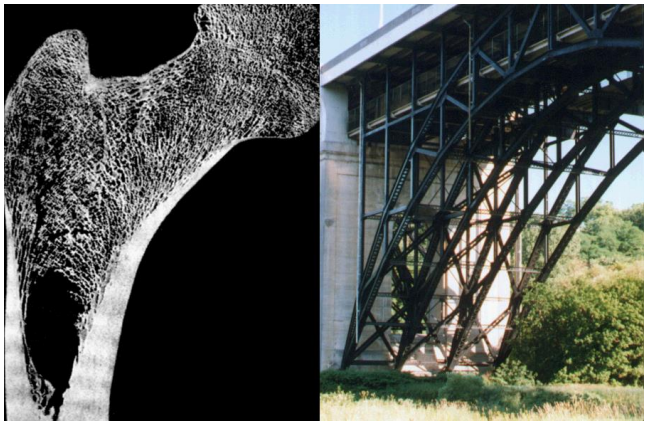
Bone strength reflects the integration of 2 main features: bone density and bone quality."

- That is to say:

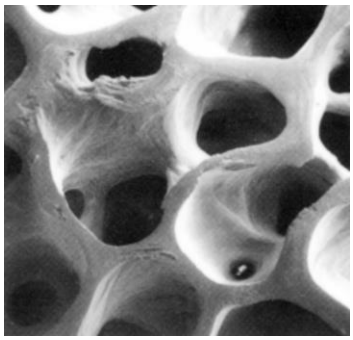
Bone is normal, but thin and not so strong, and therefore can break easily.

Strength = bone density + quality

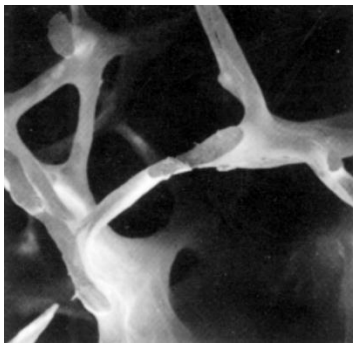
WHAT IS BONE?



What is Osteoporosis?



Normal Bone



Porous Bone

What is Osteoarthritis

Degeneration of joint—cartilage and bone, causing pain and stiffness

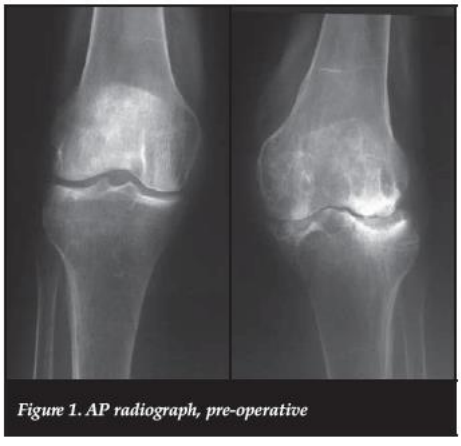


Figure 1. AP radiograph, pre-operative

What is Osteomalacia

Softening of the bones, typically through deficiency of Vitamin D or Calcium

FRAGILITY FRACTURE of bone

- A break caused by injury that would be insufficient to break a normal bone.
- A break occurring spontaneously or following minor trauma such as a fall from standing height (three steps or less)
- NOT INCLUDING head and neck, hands, feet, ankles

- That is to say:

Bone is normal, but thin and not so strong, and therefore can break easily.

Strength = bone density + quality

Bone Strength =
Bone Density + Bone Quality

BONE MINERAL DENSITY (BMD)

WHY THE EMPHASIS ON BMD?

- 1994--WHO (World Health Organization) used BMD T scores as criteria **defining Osteoporosis**
- March 2008--**FRAX (Fracture Risk Assessment**) ONLINE Scoring Tool by WHO for over 20 countries-better risk estimation with BMD
- Fall 2010--**CAROC** (Canadian Association of Radiology and Osteoporosis Canada) nomogram utilizes BMD for **Fracture Risk Assessment**.

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Many people who have sustained a fragility fracture do NOT appreciate the link to osteoporosis

Bessette L, et al. Osteoporos Int 2008; 19:79-86

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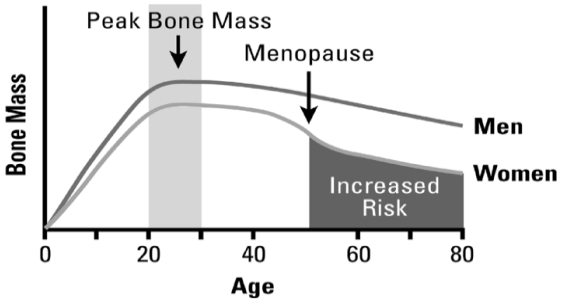
BONE MASS THROUGH THE LIFE SPAN



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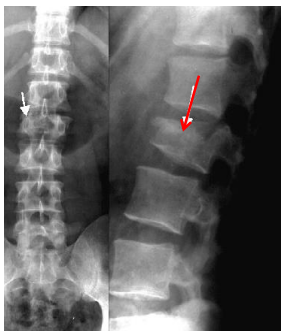
Common Sites for Fracture



Spine

Hip

Wrist

Burge J, et al. J Bone Miner Res 2007; 22:465-475

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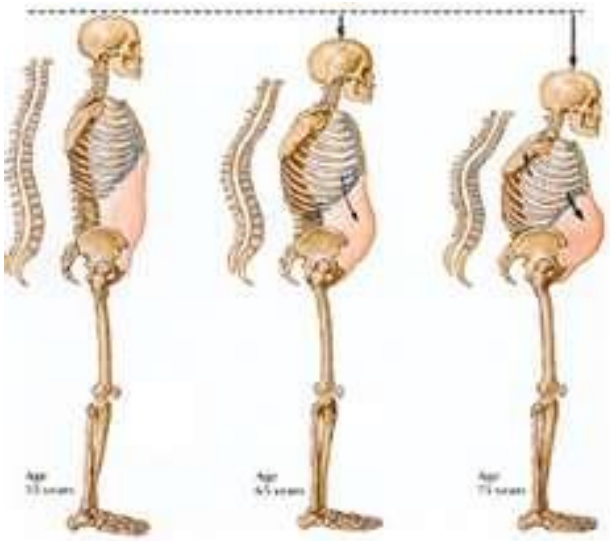
Why is the diagnosis and treatment of osteoporosis important?



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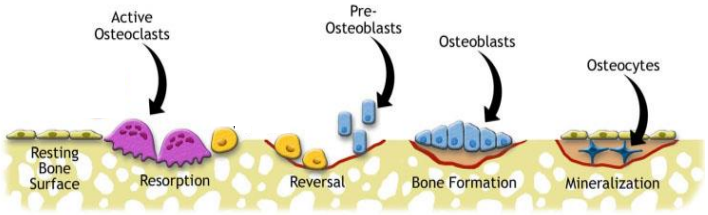
Bone Remodelling Cycle



Healthy Bone → **Resorption ≈ Formation**

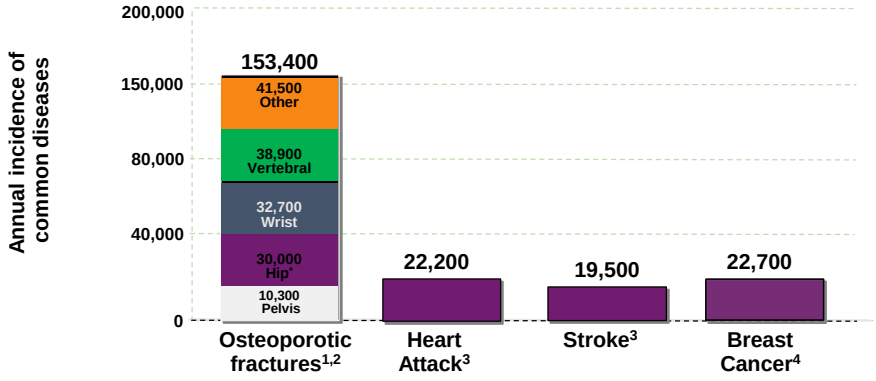
Menopause
Aging
Disease
Drugs

→ **Resorption > Formation**

Baron R. Primer on the Metabolic Bone Diseases and Disorders of Mineral Metabolism 6th ed .
Adapted from http://www.ns.umich.edu/Releases/2005/Feb05/img/bpme.jpg

Prevalence of Fractures in Canada

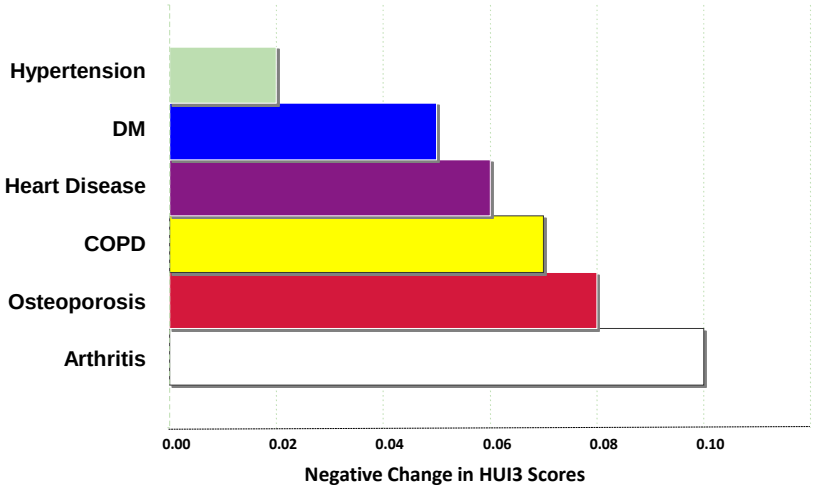
- Fractures from osteoporosis in Canadian women are more common than heart attack, stroke and breast cancer combined[1]



*Canadian hip fractures from (1); Non-hip fracture data extrapolated from (2).
†Other represents non-osteoporotic fractures sites (humerus, clavicle, hands/fingers, patella, tibia, fibula).[2]

1. Leslie WD, et al. *Osteoporos Int*. 2010; 21:1317-1322; 2. Burge J, et al. *J Bone Miner Res.* 2007;22:465-475;
3. Public Health Agency of Canada. 2009; 4. Canadian Cancer Society. 2009.

Impact of osteoporosis on Quality of Life between various disease states



Sawka AM, *et al*. *Osteoporos Int* . 2005;16:836-1840.

How do we make a diagnosis of osteoporosis?

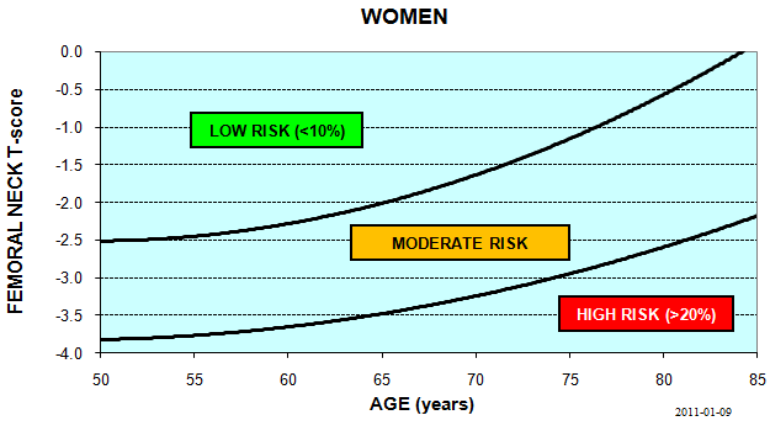
BONE MINERAL DENSITY (BMD)

Clinical Investigations

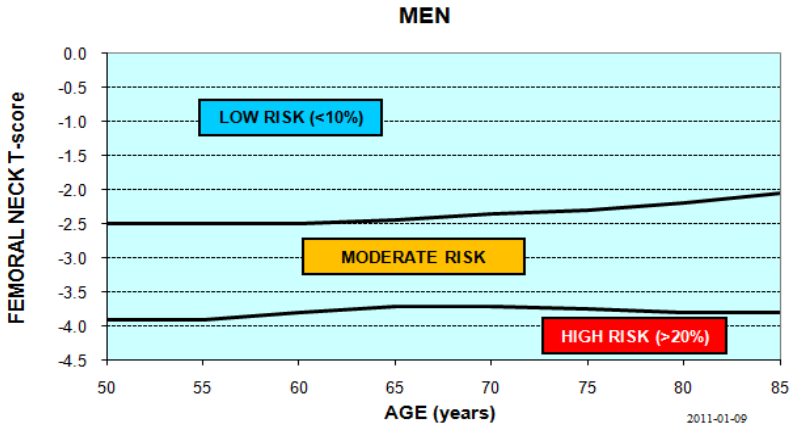
May also include:

- X-Ray of Thoracic Lumbar Spine
- Further blood work as required by physician

Assessment of Basal 10-year Fracture Risk: CAROC System



Assessment of Basal 10-year Fracture Risk: CAROC System



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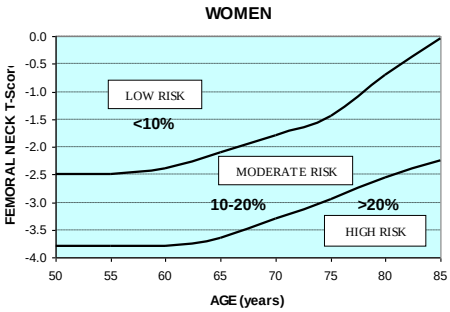
Fracture Risk Assessment

Canadian CAROC Tool



Increases to the next risk category

- Fragility fracture after age 40
- Prolonged corticosteroid therapy*

Hip / vertebral fracture → **High risk (> 20%)** ← **> 1 non-vertebral fragility fracture**

*** ≥ 3 months at prednisone-equivalent dose ≥7.5mg daily during preceding year**

Papaioannou A, et al. CMAJ 2010;182:1864-1873

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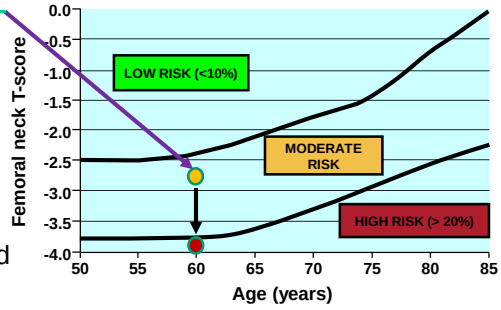
Example of Adjusting Basal Risk: Based on Additional Risk Factors

- 60-year-old woman
- Femoral neck T-score = -2.8
- Based on age and T-score alone = moderate risk
- History of fragility fracture or prolonged systemic glucocorticoid use would shift her to high risk



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Top 5 Reasons to Consider Treatment in the Moderate Risk Patient

1. Vertebral fracture (on lateral spine X-ray) or wrist fracture in patient > 65 years or BMD T-score < -2.5
2. Rapid bone loss or lumbar spine T-score much lower than femoral neck T-score
3. Falls (≥2 in the past year)
4. Concurrent high risk disorder or medications:
   - Glucocorticoids (long-term repeated use)
   - Aromatase inhibitor therapy
   - Hypogonadism/premature menopause
   - Primary hyperparathyroidism
   - Hyperthyroidism
   - Rheumatoid arthritis
5. Patient preference to be treated

Papaioannou A, et al. CMAJ 2010;182:1864-1873

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Fracture Risk Assessment

FRAX tool (by WHO)

- Computes 10-yr absolute risk for hip fracture or major osteoporotic fracture
  - Gender, Age
  - Bone density at femoral neck
  - Fragility fracture
  - Glucocorticoid use
  - Low weight (BMI)
  - Smoking, Excess Alcohol
  - Parental hip fracture
  - Rheumatoid arthritis or other secondary causes

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What can be done to prevent fractures?

- Start early and continue…..adequate nutrients for improving peak bone mass
- Improve balance, strength, posture
- Prevent falls----be PRESENT in your movements and be aware of your surroundings, use appropriate footwear, use gait aids as needed, review your medications taken with your physician, maintain your cognitive skills, check your vision
- Use medications as needed

EFFICACY
AT PREVENTING BONE FRACTURES

First Line Therapies with Evidence for Fracture Prevention in Postmenopausal Women*

Type of Fracture	Antiresorptive Therapy						Bone Formation Therapy
	Bisphosphonates			Denosumab	Raloxifene	Estrogen ** (Hormone Therapy)	Teriparatide
	Alendronate	Risedronate	Zoledronic Acid				
Vertebral	✓	✓	✓	✓	✓	✓	✓
Hip	✓	✓	✓	✓	–	✓	–
Non-Vertebral	✓	✓	✓	✓	–	✓	✓

In Clinical trials, non-vertebral fractures are a composite endpoint including hip, femur, pelvis, tibia, humerus, radius, and clavicle.
*For postmenopausal women, ✓ indicates first line therapies and Grade A recommendation.
**Hormone therapy (estrogen) can be used as first-line therapy in women with menopausal symptoms.

Papaioannou A, et al Canadian Osteoporosis Guidelines published October 12, CMAJ 2010. DOI:10.1503/cmaj.100771

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What are the BENEFITS of Medications?

- Reduction of fracture risk by approximately 50%
- Stabilize or improve bone density
- HIGH risk patients benefit the most

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What are the RISKS of Medications?

- No medication is absolutely safe
- All drugs have side effects
- Safe means that benefits of drug therapy outweigh the risks for a person
- Rare concerning risks:
  - Osteonecrosis of the Jaw (ONJ)
  - Atypical Femur Fracture (AFF)

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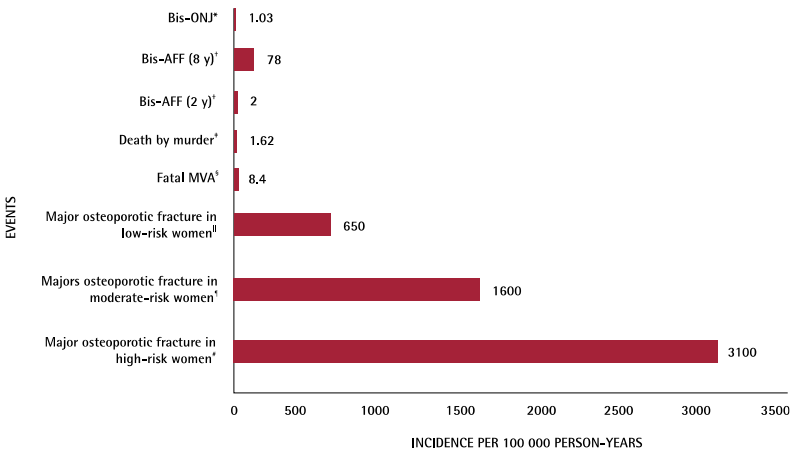
Figure 1. Risks of major osteoporotic fracture and other rare events



Brown JP, et al. CFP 2014; 60:324-333

Thank you for your attention.