

Bone Health Management



OTA – Core Curriculum

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I have no potential conflicts with this presentation

My disclosures –Editorial boards JOT, JBJS;
Reviewer JBJS, JOT, JAAOS, JBJS

Connector; Consultant for Zimmer, Lilly;
ABOS Part 2 Examiner; Steering Committee
Chair for Own the Bone; Research support
from Department of Defense, CIHR, NIH,
AONA, OTA

Department has received funds for
educational support from Smith & Nephew,
Zimmer, Synthes, Stryker

Objectives

- Scope of Osteoporosis
- DEXA scan (use and misuse)
- FRAX (risk factors and use)
- Labs
- Medications
- Atypical fractures
- Summary

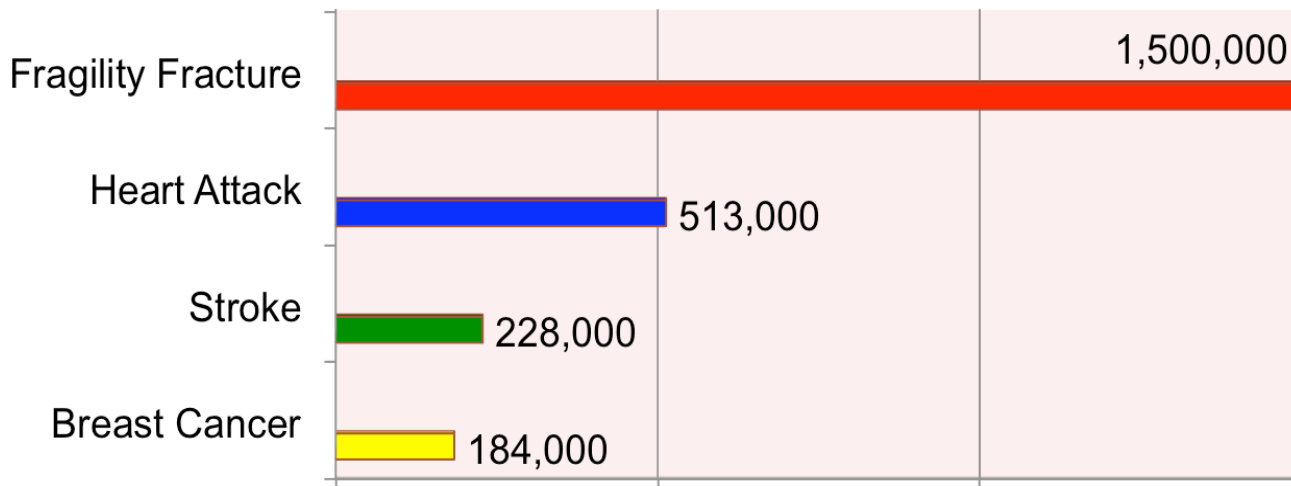
Does this patient have osteoporosis?

- **NIH Consensus Statement:**

Osteoporosis is a skeletal disorder characterized by compromised bone strength (low bone mass), predisposing to fracture



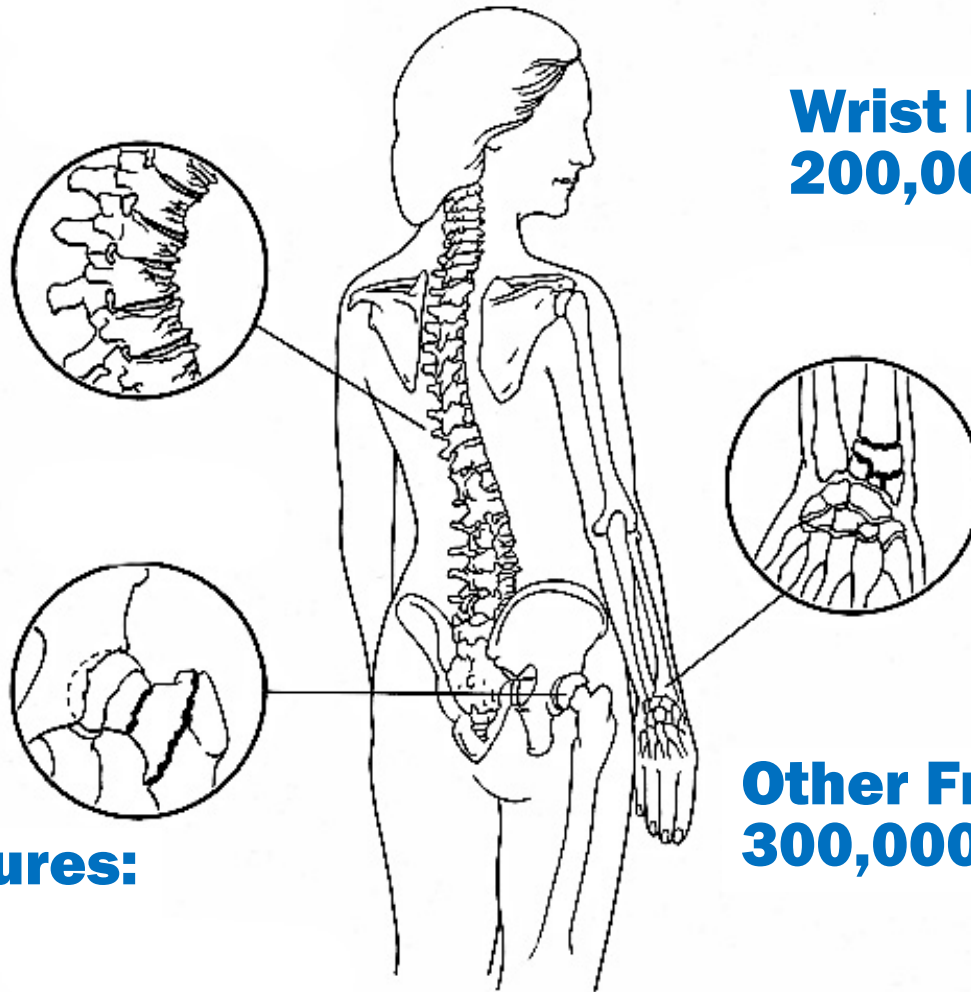
FRAGILITY FRACTURES: A HUGE PUBLIC HEALTH ISSUE



Over 2 Million Fractures Annually

**Vertebral Fractures:
700,000+**

**Wrist Fractures:
200,000+**



**Hip Fractures:
300,000+**

**Other Fractures:
300,000+**

WHAT SHOULD WE DO?

- Sentinel event
- Orthopaedists can help lead
 - We touch every patient with a fragility fracture
 - At the very least, we should be part of the solution!



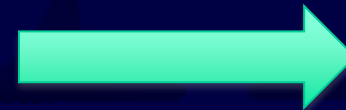
Treatment Works!



Kaiser Permanente – Southern CA Osteoporosis
Treatment & Fracture Prevention

= Savings of \$50 Million/5 years

Risk reduction for secondary fractures 3-7 fold
with treatment



DEXA - 1986



- Bone Mineral Densitometry became clinical tool for bone mass around 1986
- Safe, accurate, precise, normative population, databases, correlates with fracture risk

Why Have a DEXA?

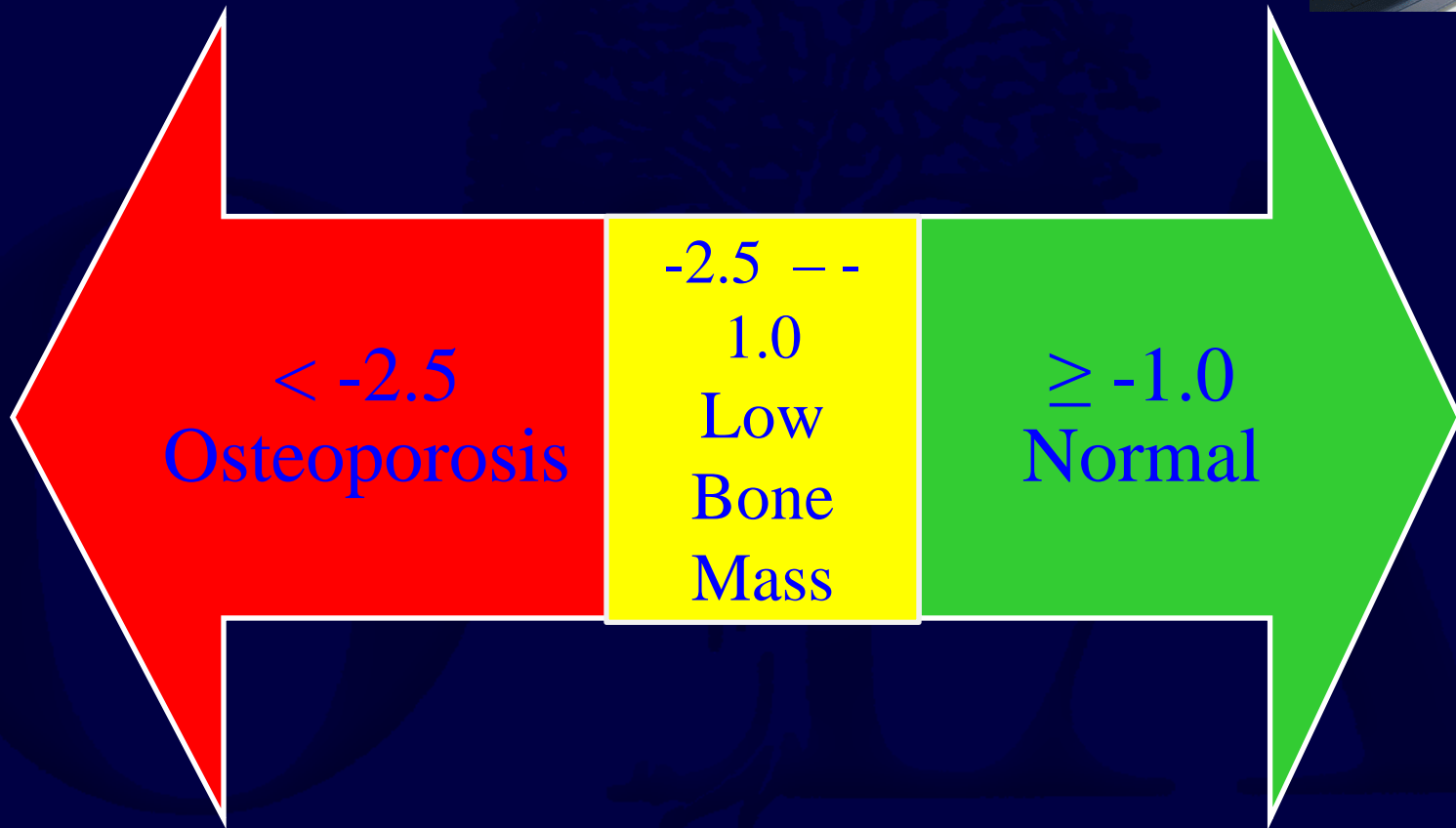
- $\frac{1}{2}$ of the osteoporotic fractures each year could be prevented with proper diagnosis and treatment
- $\frac{1}{2}$ of women and $\frac{1}{4}$ of men, over age 50, will break a bone due to low bone mass
- $\frac{1}{3}$ of people with a hip fracture had a prior fracture

Bone Densitometry (DEXA) –



- Diagnose osteopenia and osteoporosis - Detect a potential problem before fracture occurs
- Monitor disease progression/rate of bone loss
- Monitor treatment response

WHO Classification T-score



Based on average bone mass of 30 y/o adult

Defining Osteoporosis

A low energy fracture with a T-score ≤ -1.0 or less

A “low energy” hip fracture defines osteoporosis!
(A recent change!)

A T-score of ≤ -2.5 or less



DEXA – Screening Indications (NOF 2014 Position Statement)

- All women over 65 and men over 70
- Men 50-69 with clinical risk factors – How many?
- Women post-menopausal with clinical risk factors



When to Order DEXA if has Fragility Fracture?



- National Quality Forum will mandate ordering in patients with fragility fracture
- Fragility fracture over 40 years of age
- Current literature supports every 2-5 years

Every Time!!!!

DEXA Post Fracture Uses

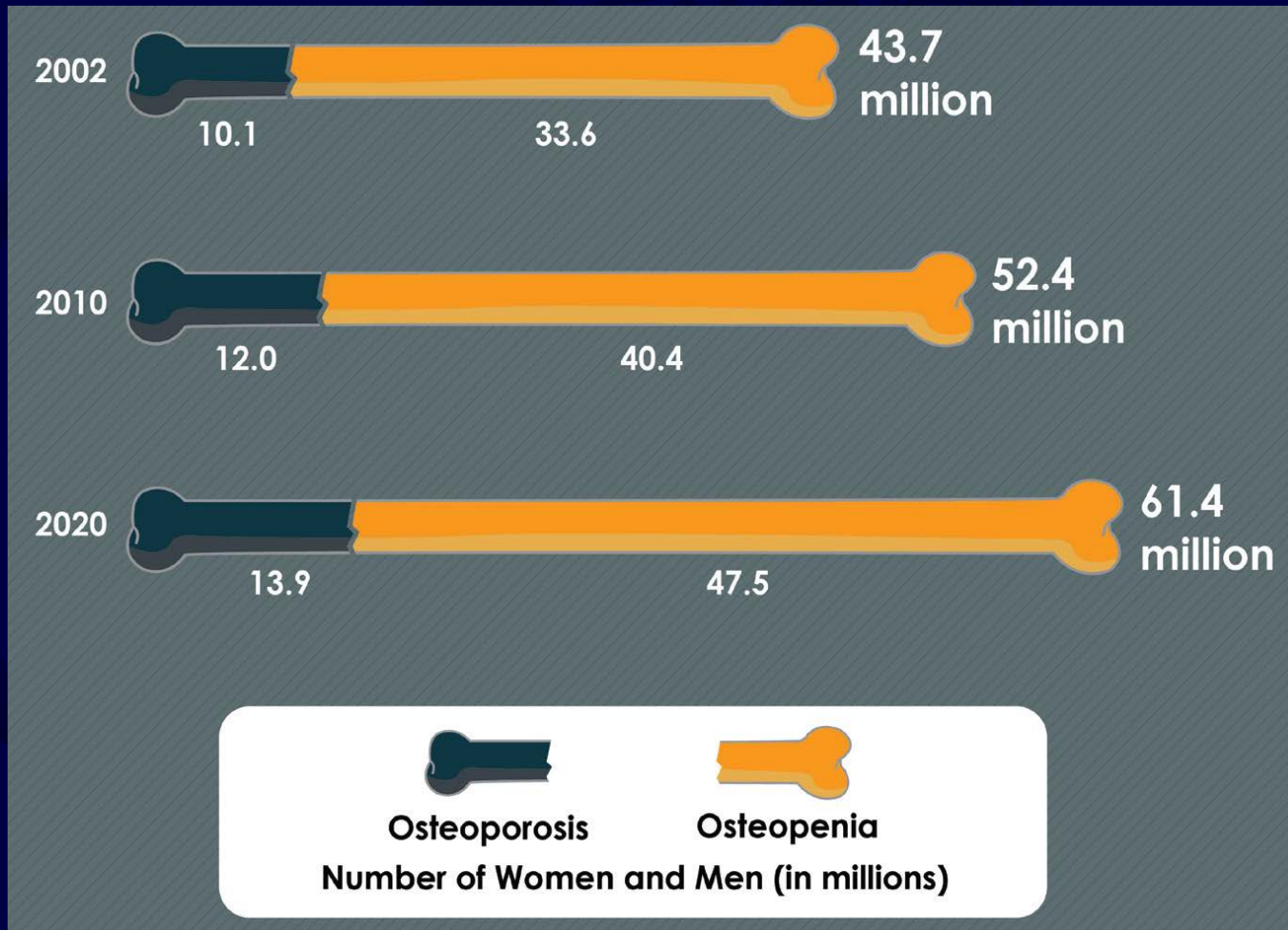
- T score – to help define osteoporosis (ICD-9 and in future ICD-10)
- May help with gauging success or failure of treatment



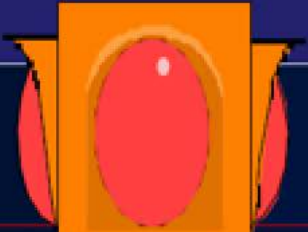
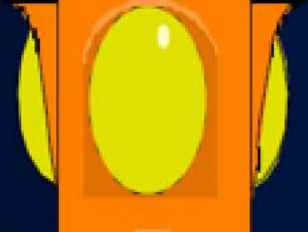

DEXA variability

- Densitometrists are a VERY important piece of the puzzle technique dependent
- Machines can differ
- Location important
- Upkeep of machine critical

Largest Growing Group



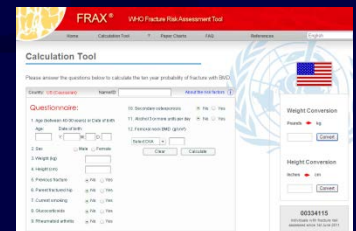
DEXA First?

T-score		Therapy decision
-2.5 or below		High risk Treat
-1.5 to -2.5		Intermediate risk FRAX
Above -1.5		Low risk General preventive measures

Fracture Risk Assessment Tool (FRAX)

- Based on Clinical Risk Factors (CRFs)
- Plus or minus BMD/DEXA
- Data from 11 validated prospective studies (excess of one million year patients)

- <http://www.sheffield.ac.uk/FRAX/>



<http://www.sheffield.ac.uk/FRAX/>

Free!

Country: **UK** Name/ID: [About the risk factors](#)

Questionnaire:

1. Age (between 40 and 90 years) or Date of Birth

Age: Date of Birth: Y: M: D:

2. Sex ☐ Male ☒ Female

3. Weight (kg)

4. Height (cm)

5. Previous Fracture ☒ No ☐ Yes

6. Parent Fractured Hip ☐ No ☒ Yes

7. Current Smoking ☒ No ☐ Yes

8. Glucocorticoids ☐ No ☒ Yes

9. Rheumatoid arthritis ☒ No ☐ Yes

10. Secondary osteoporosis ☒ No ☐ Yes

11. Alcohol 3 or more units/day ☐ No ☒ Yes

12. Femoral neck BMD (g/cm²)

Select BMD

BMI: 22.0

The ten year probability of fracture (%)

without BMD

Major osteoporotic	13
Hip Fracture	1.3

[View NOGG Guidance](#)

FRAX – What Does It Tell Us?

- 10 year probability of a hip fracture
- 10 year probability of a major osteoporotic fracture



BMI: 22.0

The ten year probability of fracture (%)

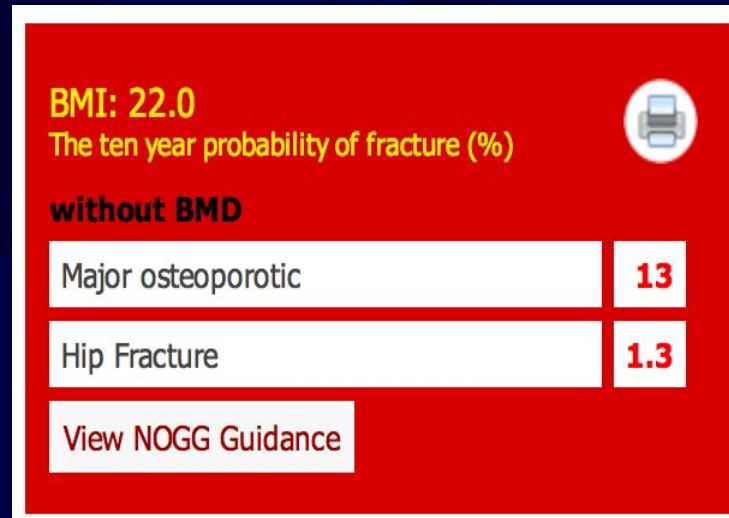
without BMD

Major osteoporotic	13
Hip Fracture	1.3

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FRAX – What Does It Tell Us?

- 10 year probability of a hip fracture (over 3%)
- 10 year probability of a major osteoporotic fracture (if over 9.3% need eval and treatment)



BMI: 22.0

The ten year probability of fracture (%)

without BMD

Major osteoporotic	13
Hip Fracture	1.3

[View NOGG Guidance](#)

The screenshot shows a red interface for the FRAX calculator. At the top, it displays 'BMI: 22.0' in yellow. Below this, the text 'The ten year probability of fracture (%)' is shown in yellow. Underneath, 'without BMD' is written in white. A table with two rows shows the probabilities: 'Major osteoporotic' with a value of '13' and 'Hip Fracture' with a value of '1.3'. Both values are in red. At the bottom, there is a white button with the text 'View NOGG Guidance'. A printer icon is visible in the top right corner of the red area.

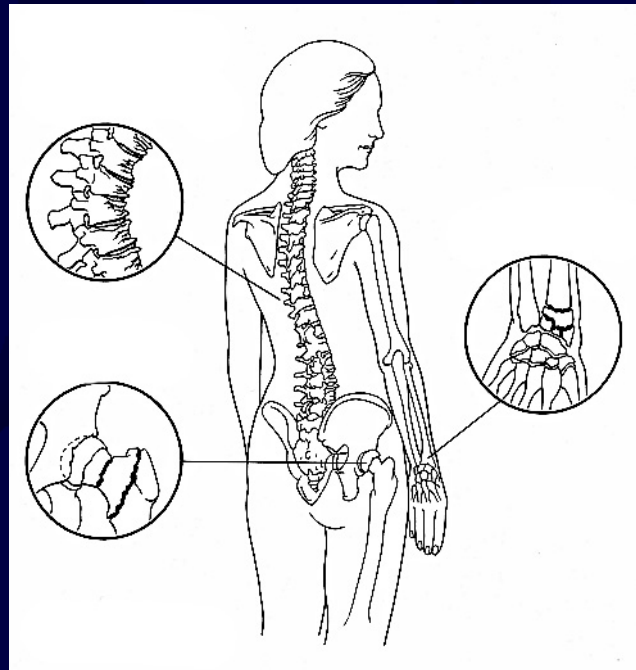
Risk Factors/Secondary Causes

- Too many to list all!
- Biggest is AGE!!!!!!!!!!!!



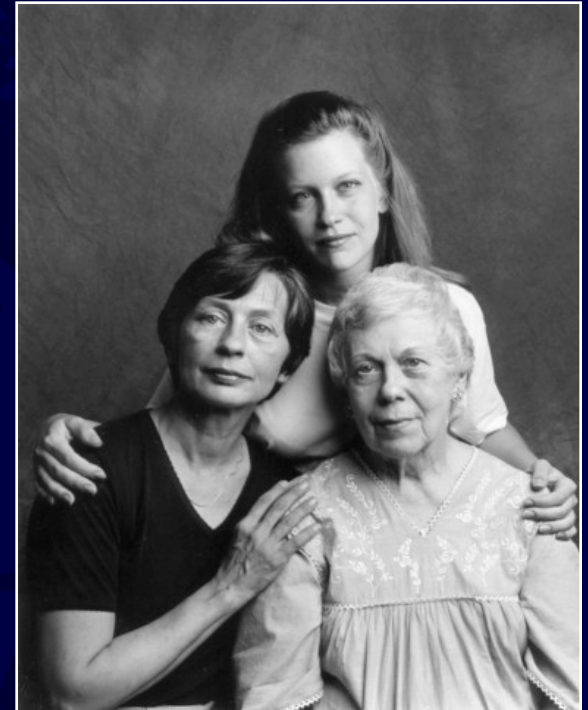
Risk Factors - History

- Previous “low energy” fracture
- Probably second most important (behind age)



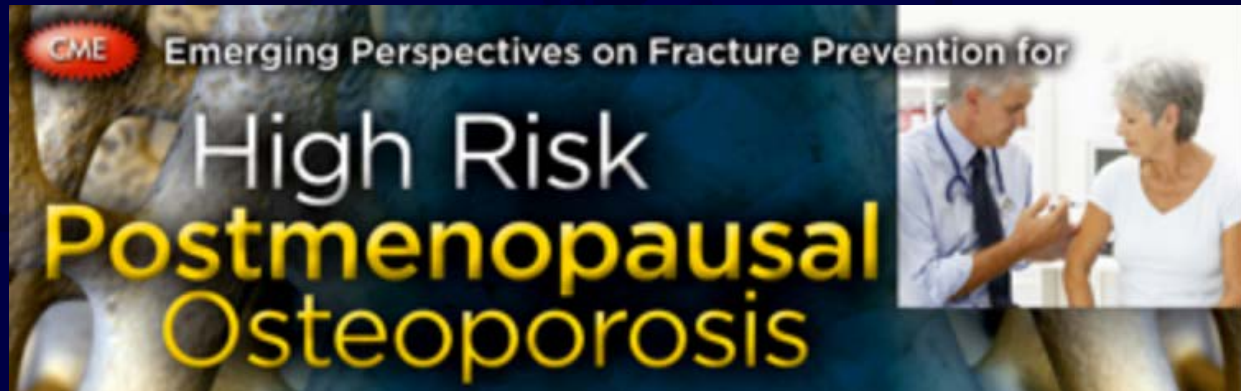
Risk Factors – Family History

- Parent with a HIP fracture



Risk Factors - Sex

- Post Menopausal
 - Hormonal imbalances can result in rapid bone loss
 - Women can lose up to 20% of their bone mass in 5-7 years



Men & Osteoporosis

Lifestyle
Age
Heredity
Meds
Disease
Testosterone

Underdiagnosed

Unrecognized

Underreported

Inadequately researched

Men & Osteoporosis

- 2 million American men suffer from Osteoporosis
- Millions more are at risk
- 80,000 hip fractures each year
- One-third die one year after fracture
- Low testosterone



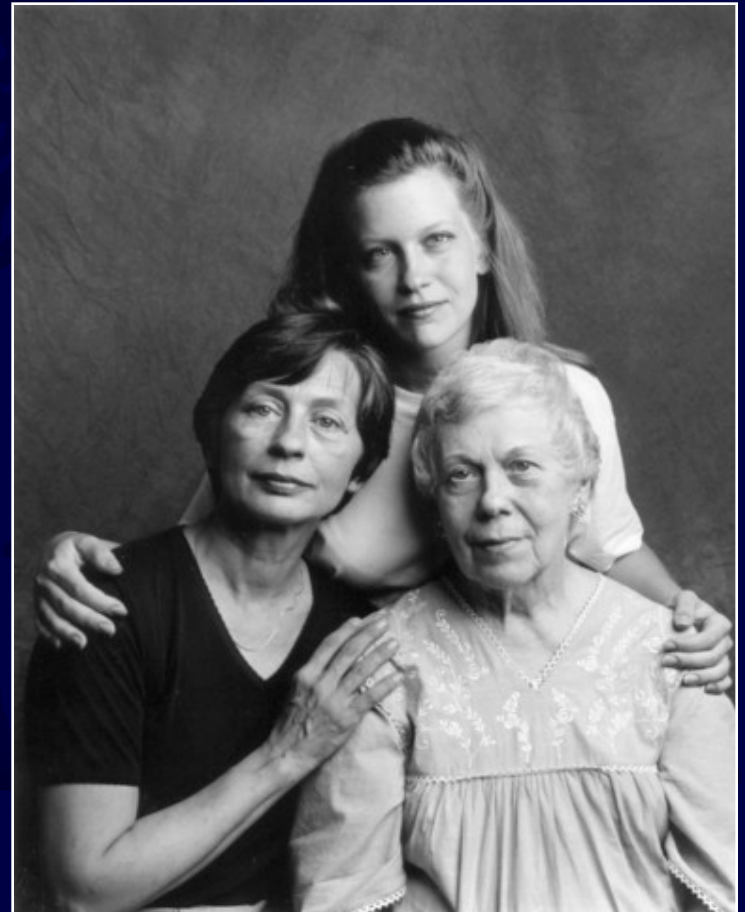
Risk Factors -

- Body size – low BMI
- Amenorrhea, anorexia, and bulimia



Risk Factors - Ethnicity

- Northern European
- Highest ethnic risk



Risk Factors: Ethnicity

- Osteoporosis undertreated in African-American women
- Risk doubles every 7 years
- African-American women more likely to die from hip fractures



Source: National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, Department of Health and Human Services

Risk Factors: Ethnicity

- 10% of Hispanic women over 50 have osteoporosis now
- 49% are estimated to have low bone mass, putting them at risk for the disease



Source: National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, Department of Health and Human Services

Risk Factors: Ethnicity

Native American
Very High Risk

Smokers, poorer
health/DM, lower
vitamin intake



*Source: National Institute of Arthritis and Musculoskeletal and Skin Diseases,
National Institutes of Health, Department of Health and Human Services*

Risk Factors: Ethnicity

Asian-American Women also at high risk



- 50% less Calcium intake
- But higher bone density
- than Caucasians
 - 50% less Hip Fractures
- Yet equal Spine Fractures

Source: National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, Department of Health and Human Services

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: **US (Caucasian)**

Name/ID:

[About the risk factors](#) 

Questionnaire:

1. Age (between 40-90 years) or Date of birth

Age:

Date of birth:

Y:

M:

D:

2. Sex

☐

Male

☐

Female

3. Weight (kg)

4. Height (cm)

5. Previous fracture

☒

No

☐

Yes

6. Parent fractured hip

☒

No

☐

Yes

7. Current smoking

☒

No

☐

Yes

8. Glucocorticoids

☒

No

☐

Yes

9. Rheumatoid arthritis

☒

No

☐

Yes

10. Secondary osteoporosis

☒

No

☐

Yes

11. Alcohol 3 or more units per day

☒

No

☐

Yes

12. Femoral neck BMD (g/cm²)

Select DXA



Clear

Calculate

CALCULATION TOOL

Argentina

Austria

Belgium

China

Finland

France

Germany

Hong Kong

Italy

Japan

Lebanon

New Zealand

Spain

Sweden

Switzerland

Turkey

UK

US (Caucasian)

US (Black)

US (Hispanic)

US (Asian)

Risk Factors (Secondary Causes)

- Rheumatoid arthritis – yes or no
- Glucocorticoid (steroid use greater than 3 continuous months) use



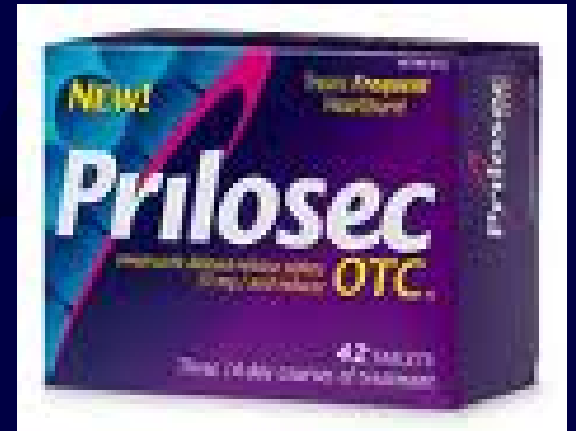
Other Risk Factors/Secondary Causes

- FRAX asks for a simple yes or no
- Too many to list! Keep in mind more common ones: renal disease, DM, Lupus, COPD, Asthma, thyroid and parathyroid problems, celiac disease, low T, drugs (see next slide)



Medications: Risk Factors

- Steroids/glucocorticoids
- Anticonvulsants
- Proton pump inhibitors
- Cyclosporin
- Methotrexate
- Heparin



Prevention: Identify Modifiable Risk Factors

- Smoking
- Sedentary lifestyle
- Excess alcohol
- Low BMI
- Diet



Country: **UK**

Name/ID:

[About the risk factors](#)

Questionnaire:

1. Age (between 40 and 90 years) or Date of Birth

Age:

Date of Birth:

Y:

M:

D:

2. Sex

☐ Male ☒ Female

3. Weight (kg)

4. Height (cm)

5. Previous Fracture

☒ No ☐ Yes

6. Parent Fractured Hip

☐ No ☒ Yes

7. Current Smoking

☒ No ☐ Yes

8. Glucocorticoids

☐ No ☒ Yes

9. Rheumatoid arthritis

☒ No ☐ Yes

10. Secondary osteoporosis

☒ No ☐ Yes

11. Alcohol 3 or more units/day

☐ No ☒ Yes

12. Femoral neck BMD (g/cm²)

Select BMD



Clear

Calculate

BMI: 22.0

The ten year probability of fracture (%)



without BMD

Major osteoporotic

13

Hip Fracture

1.3

[View NOGG Guidance](#)

The screenshot shows the FRAX (Fracture Risk Assessment) tool interface. At the top, it says 'FRAX® WHO Fracture Risk Assessment Tool'. Below this is a navigation bar with links: Home, Calculation Tool, Paper Charts, FAQ, References, and English. The main section is titled 'Calculation Tool'. It asks the user to 'Please answer the questions below to calculate the ten-year probability of fracture with BMD'. There are two tabs: 'US (Examples)' and 'International'. The 'US (Examples)' tab is selected. The questionnaire includes 12 questions: 1. Age between 40-69 years or Date of birth (with input fields for year, month, and day); 2. Sex (Male/Female radio buttons); 3. Weight (kg) (input field); 4. Height (cm) (input field); 5. Previous fracture (Yes/No radio buttons); 6. Parent fractured hip (Yes/No radio buttons); 7. Current smoking (Yes/No radio buttons); 8. Glucocorticoids (Yes/No radio buttons); 9. Rheumatoid arthritis (Yes/No radio buttons); 10. Secondary osteoporosis (Yes/No radio buttons); 11. Alcohol 3 or more drinks per day (Yes/No radio buttons); 12. Femoral neck BMD (g/cm²) (input field with a 'Select DEXA' dropdown). There are 'Clear' and 'Calculate' buttons. On the right, there are 'Weight Conversion' (Pounds to kg) and 'Height Conversion' (Inches to cm) sections, each with a 'Convert' button. At the bottom right, it says '00334115' and 'Information on FRAX tool assessment since 1st June 2011'.

FRAX and DEXA



- Has been validated with and without the reporting of BMD!
- Currently large trial looking at result of FRAX to guide the use of DEXA in women under 65 and men under 70

Labs - NQF Recommendations

- Serum 25-hydroxyvitamin D (normal is 30 ng/ml or 75 nmol/l)
- Complete blood count (CBC)
- Kidney function test
- Liver function test
- Serum Calcium



Labs - Others

- Serum TSH, TH and T4 if thyroid dysfunction suspected
- Serum and urine electrophoresis if MM suspected
- Antibodies for celiac disease
- Men testosterone

Testosterone Crisis in America

Researchers in Boston have found a natural way to boost testosterone. Try this weird trick and take your performance to the next level.

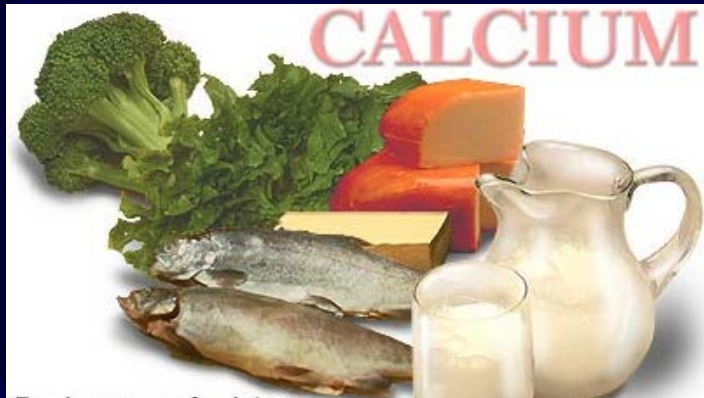
[Learn More »](#)

Drug Treatment

- **Vitamin D and Calcium**
- **Anti-resorptive bisphosphonates**
 - **Alendronate(Fosamax)**, Risendronate (Actonel), Etidronate (Didronel), Ibandronate (Boniva)
- **Nasal calcitonin and raloxifene – OUT!**
- **Teriparatide (Forteo)** –an anabolic agent
- **Prolia**
- **FDA has withdrawn support of HRT with estrogen except in selected post-menopausal women**

Problem - Treatment!

Less than 40% of our patients are getting pharmacology treatment beyond Vit D and Ca!



Vitamin D and Calcium Supplementation

- Permits accumulation of maximal peak bone mass
- Lose 350 mg from GI and kidneys
- Accumulates...
- Less than 50% adult population meets requirements for Vitamin D and calcium

Vitamin D



- 2000 IU day
- Once deficient...it takes longer to return to baseline
- Measure 25-hydroxyvitamin D
- Adequate sun exposure
- Think of grandma in a NH...
- Important to skeletal muscle function



415 mg

Calcium

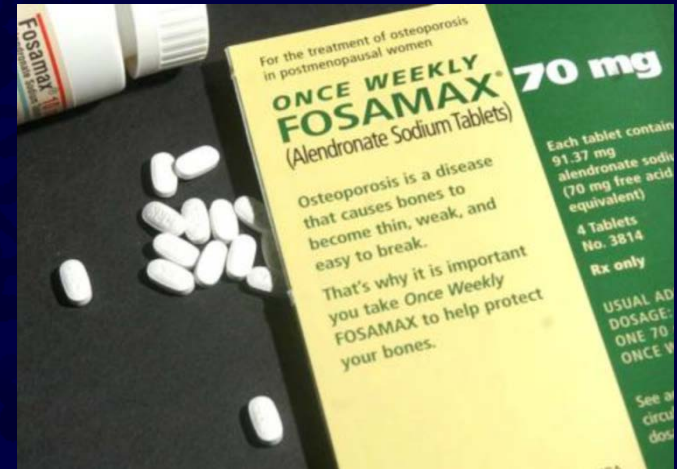


204 mg

- 1200-1500 mg elemental calcium
- Calcium carbonate is usually recommended
- Calcium citrate if cannot tolerate or decreased gastric acid
- *All patients treated for fracture reduction need calcium and vitamin D supplementation for other pharmacologic agents to be effective...*

Bisphosphonates

- First line of treatment
- Prevent bone loss
- Decrease rate of fragility fractures
- Mostly tolerated
- Optimum duration of therapy unclear...residual benefit for up to 5 years after cessation



Too Much of A Good Thing?



- Subtrochanteric region
- Cortical beaking anterolateral
- Transverse in nature
- Stress reaction
- Why?
 - **Suppresses bone turnover**



Who is at Risk?

- Bisphosphonate users greater than 3-5 years
- Younger age (50-70 as opposed to 70-90)
- Asian
- Female

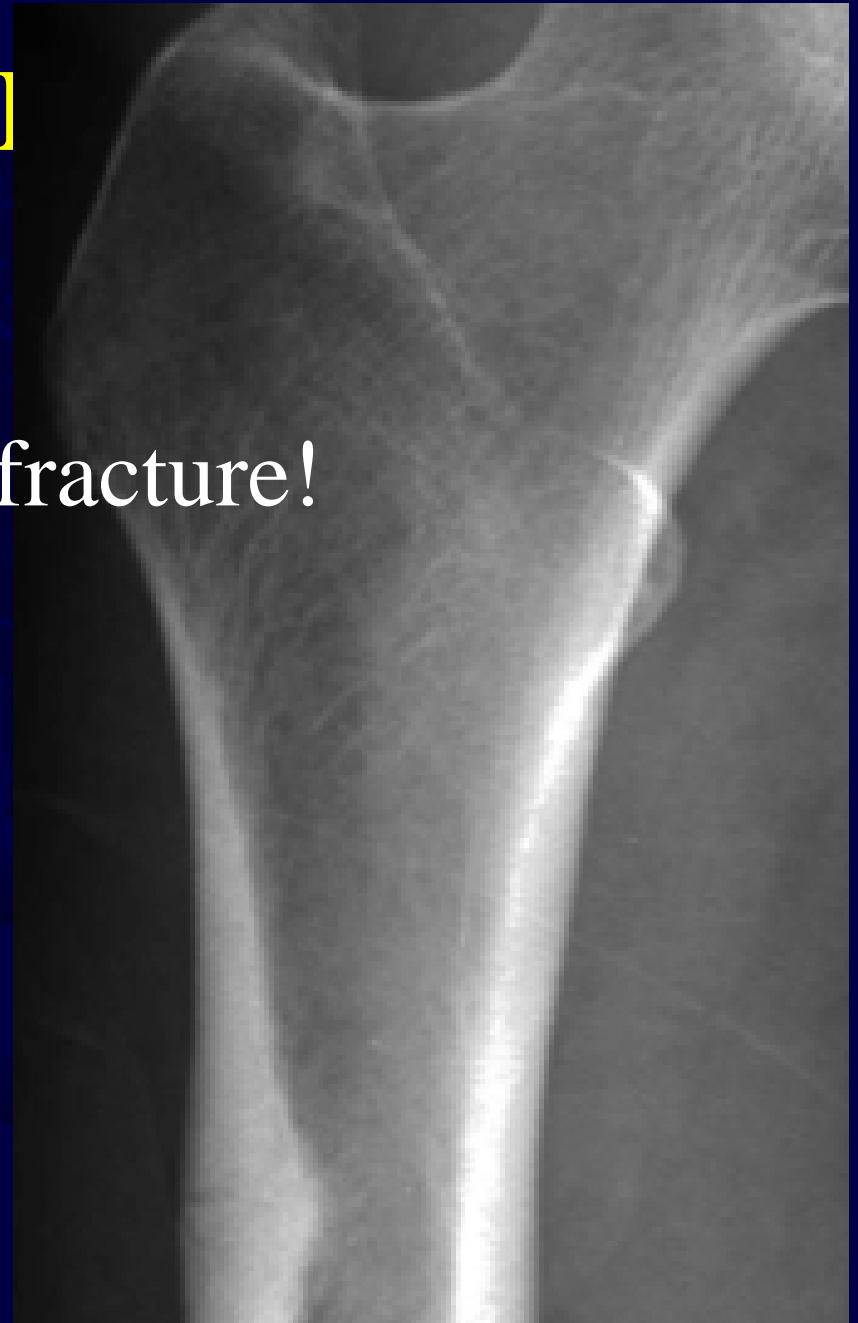
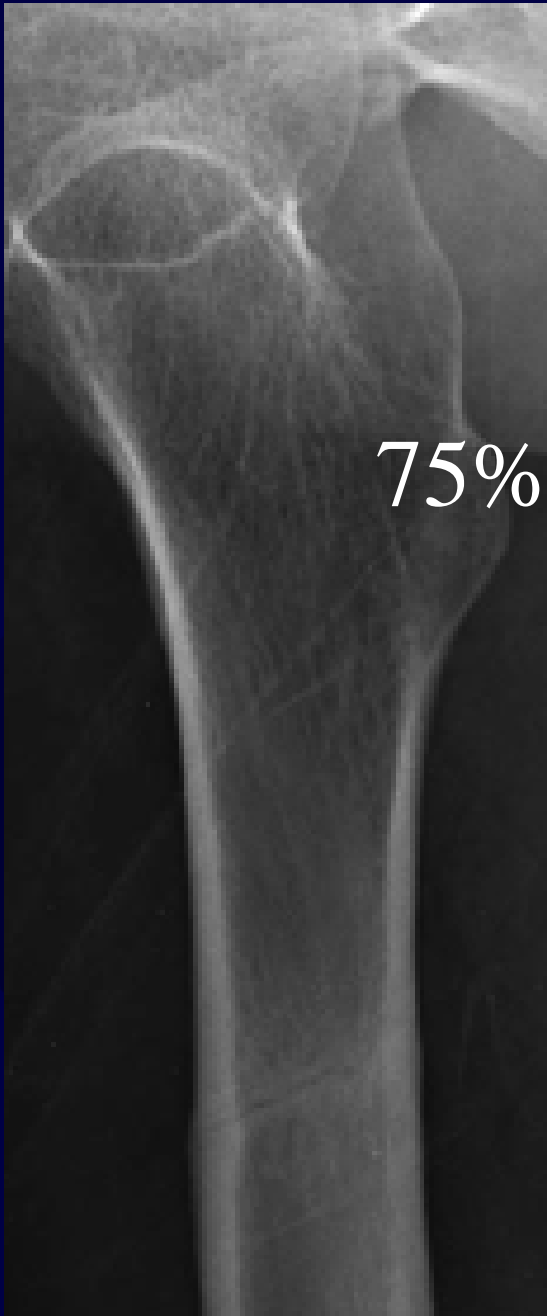


Recommendations – Weak!

- “While concrete, evidence-based recommendations could not be provided, strict surveillance, overall awareness of prodromal thigh pain, radiological findings, and bisphosphonate usage records were recommendations for prevention.”

DBI

75% risk of fracture!



Medical Recommendations

- Stop the bisphosphonates
- Recommend starting teriparatide therapy
- Make sure they are on Vit D and calcium

Long-term bisphosphonate usage and subtrochanteric insufficiency fractures JBJS
Br. 2011;93:1289-1295

TEN IMPORTANT MEASURES TO ACHIEVE SUCCESS

Nutrition Counseling*

1. Calcium supplementation
2. Vitamin D supplementation

Physical Activity Counseling*

3. Exercise, especially weight-bearing and muscle strengthening
4. Fall prevention education

Lifestyle Counseling*

5. Smoking cessation
6. Limiting excessive alcohol intake

Pharmacology*

7. Pharmacology for the treatment of osteoporosis

Testing*

8. DXA to test bone mineral density

Communication*

9. Physician referral letter
10. Follow-up note and educational materials provided to patient

*Unless contraindicated.



Measures listed here are consistent with recommendations from the National Osteoporosis Foundation, the Centers for Medicare & Medicaid Services, the Joint Commission, the World Health Organization, and the American Medical Association.

What is Our Role?

- At a minimum, recognize the problem and educate
- Need close communication between us and internist



Summary - What is Our Role?



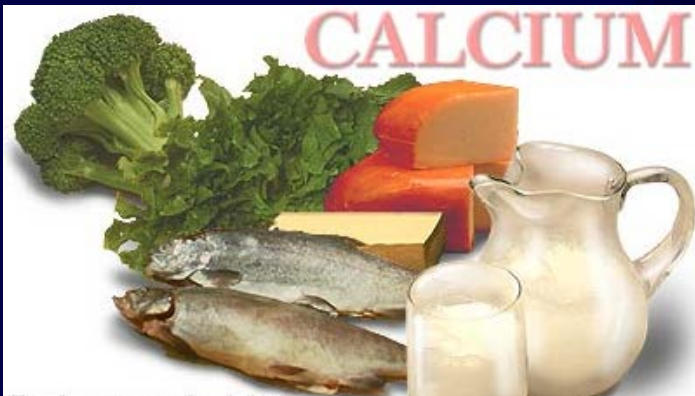
- Use FRAX to assess future fracture risk all over 40
- Screening DEXA for FM over 65 and M over 70 but with risk factors even earlier
- DEXA scan should be ordered after fragility fracture and can be helpful every 2-5 years


Summary

- At a minimum, start on calcium and vitamin D and referral
- Not only prevents further fractures, but potentially saves lives
- Remember our responsibility! Nobody else will do for us



Thank You





For questions or
comments, please
send to ota@ota.org