OSTEOPOROSIS

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Disclosures

- I have no financial disclosures.
- Any specific product name mentioned is purely for educational purposes and is not intended to promote that specific product.

A little about me

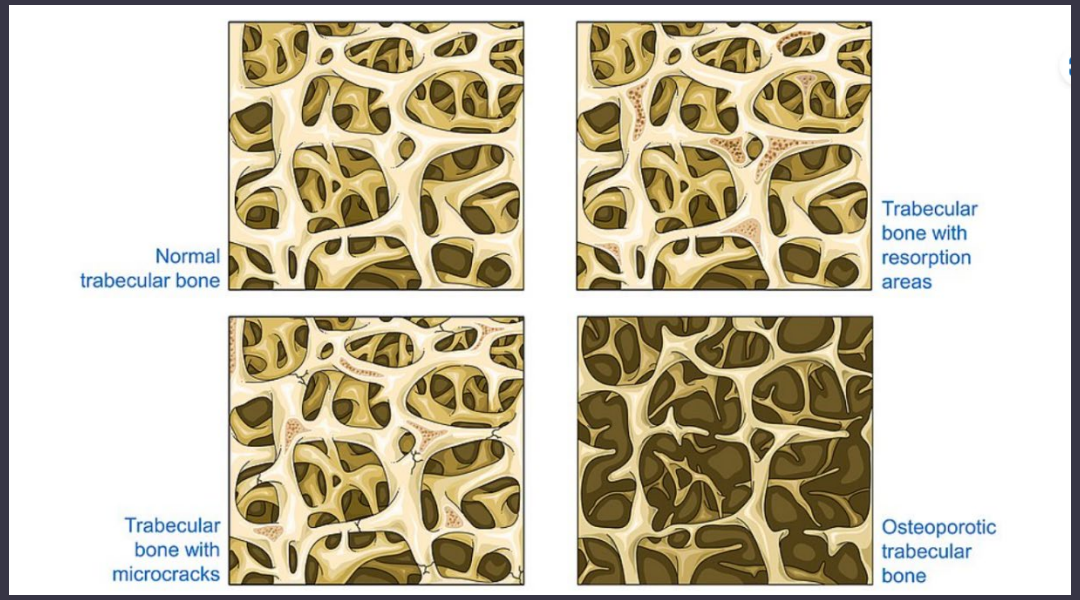
- LMU-DCOM Class of 2013
- Traditional rotating internship – Adena Health Systems, Chillicothe, OH
  - 2013-2014
- Ob/Gyn Residency - Central Michigan University/Covenant Healthcare, Saginaw, MI
  - 2014-2018
- Fellowship Minimally Invasive Gynecology - University of Washington/Northwest Hospital, Seattle WA
  - 2018-2019
- Private practice - Southern Ob/Gyn Associates
  - Sept 2019 – July 2024
- Hospital employed gynecology - MercyOne Genesis Health Systems
  - July 2024 – present

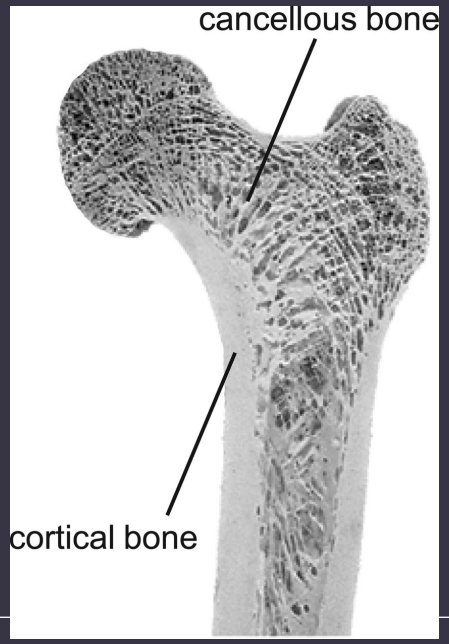
Educational goals

- To understand the physiology osteoporosis and osteopenia
- Rick factors
- General screening guidelines and early screening candidates
- Prevention
- First and second-line treatment
- Interval follow up
- When to refer to and who

Bone structure

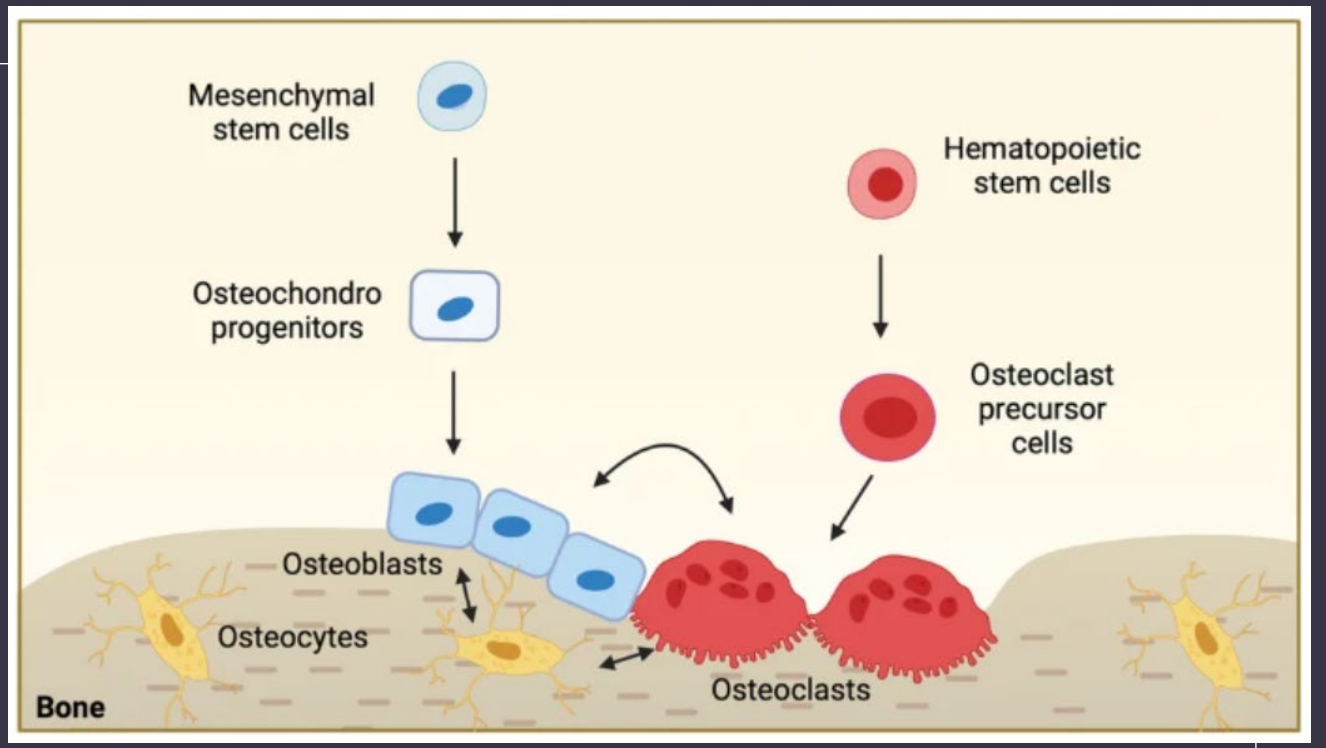
- 2 types of bone
  - **Cortical** = compact outer shell
    - 80% skeletal mass
    - Limited porosity
    - More brittle, stiffer
  - **Trabecular (cancellous)** = mesh inner network
    - 20% skeletal mass
    - Very porous
    - Very strong
    - Affected more dramatically by osteoporosis

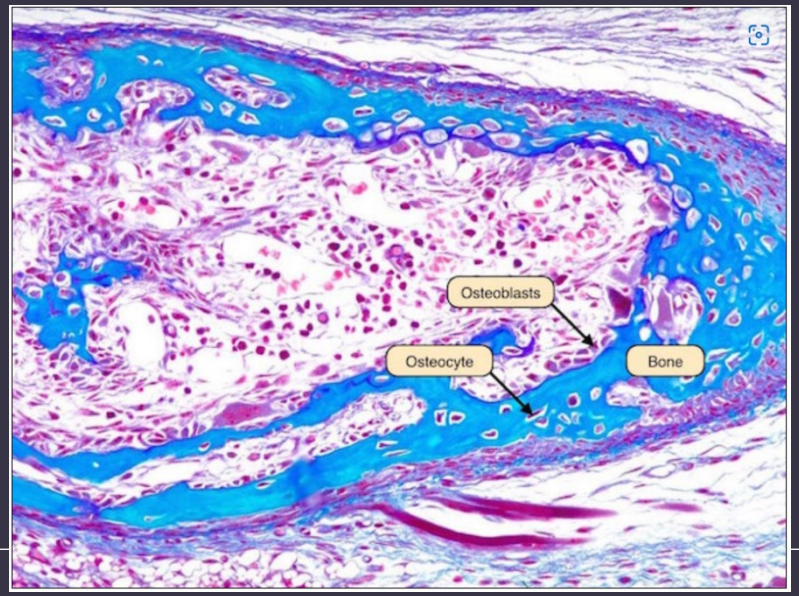


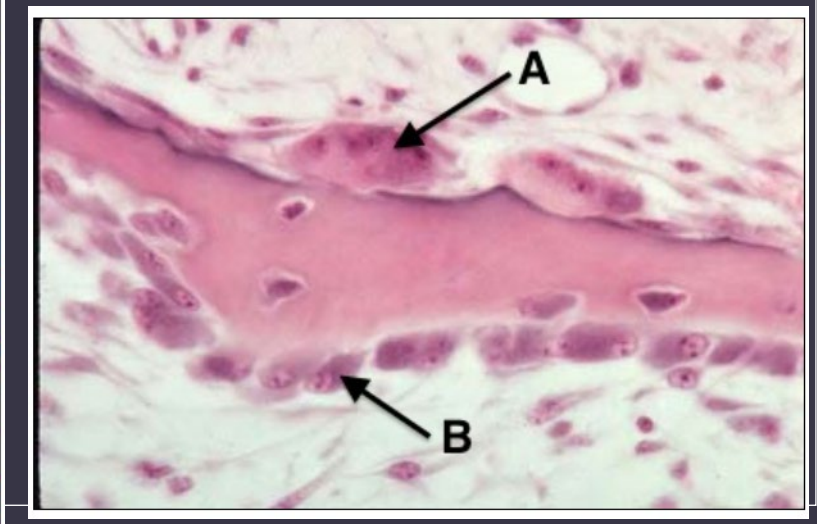


Types of bone cells

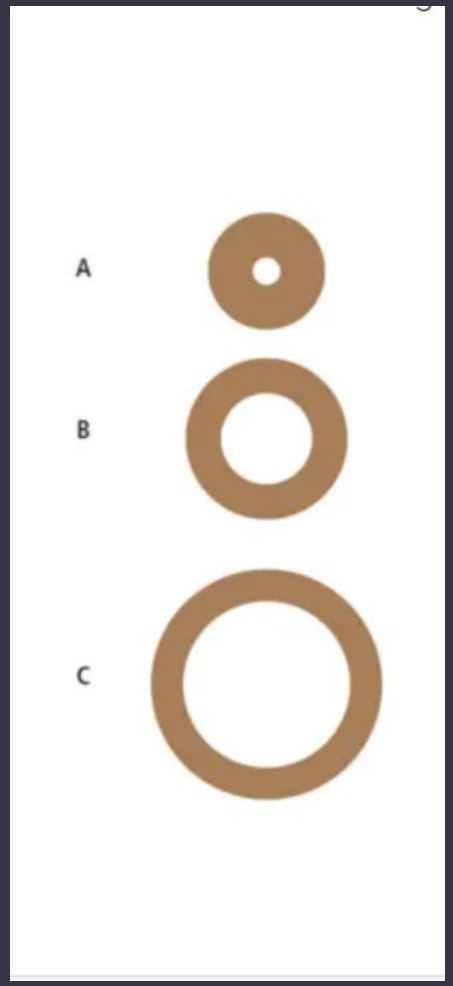
- Osteoblasts = build bone
- Osteoclasts = resorb bone
- Osteocytes = trapped osteoblasts in matrix





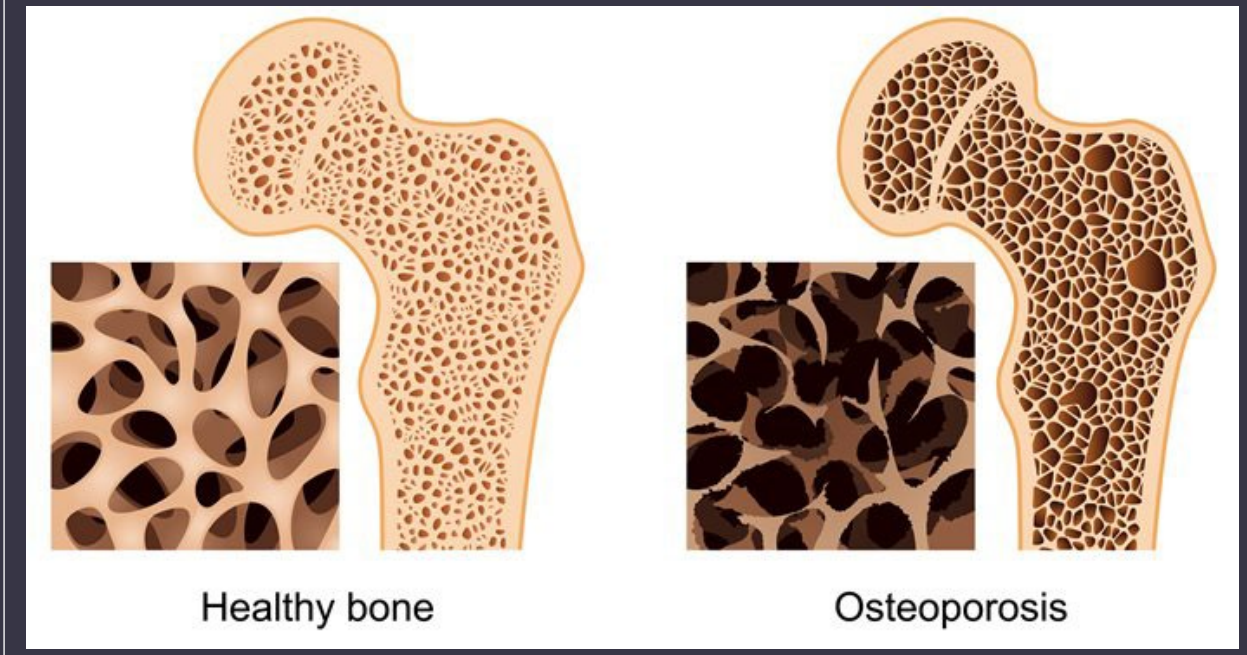


How does it happen?



- Bone remodeling allows us to grow and bones become more flexible
  - As we age this bone resorption surpasses bone growth = osteopenia/osteoporosis
- Osteoporosis is a metabolic bone disorder
  - Bone resorption surpasses bone formation
  - Resorption occurs in trabecular layer and on the inside of the cortical layer
  - Additional external cortical layers are created causing decreased flexibility
- Variety of contributing factors

Osteopenia & Osteoporosis



- Osteopenia = decrease in bone mineral density below normal
- T-score between -1 to -2.5

- Osteoporosis = bone mineral density decreased to T-score < -2.5
  - Or a fragility fracture without a bone mineral density (BMD)

As of 2010 Census

- 8.2 million women aged 50 years and older were diagnosed with osteoporosis
- 2 million men
- An additional **27.3 million women** had low bone mass

Lifetime morbidity & mortality associated with osteoporosis

- 1.5 million osteoporotic fractures in the United States each year
  - 180,000 individuals into nursing homes
  - 300,000 hip fracture hospitalizations each year
  - Most fractures occur in non-osteoporotic individuals

- Fractures often have significant downstream effects
  - Decline in physical independence and mental well-being
  - Hip fractures are associated with a significantly increased risk of death especially in the first year
    - 25% end up disabled
- Most fractures in postmenopausal women – 75%
    - Men have worse outcomes

What to watch out for

- Clinical symptoms
  - Usually none
  - Persistent pain, loss of height
- Fragility fracture
  - Fall from standing height or less without major trauma
  - Spine, hip, wrist, humerus, and pelvis
  - Warrants pharmacotherapy even without a BMD

Risk Factors

Osteoporosis Risk Factors

- Age
- Smoking
- Alcoholism
- Rheumatoid arthritis
- Chronic steroid exposure
- Family history
- Female
- Menopause
  - Early menopause < 40 yo
  - Oophorectomy <50 yo
- Ethnicity
  - Caucasians, Asians
- BMI < 20
- Long-term IM medroxyprogesterone
- Secondary medical conditions
  - Hyperparathyroidism, HIV, gastric bypass, anorexia, diabetes

Fracture Risk Factors

- Previous fracture
- Height loss
- Parental hip fracture

Prevention strategies

- Exercise!
  - Weight-bearing
- Diet
  - Vitamin D
  - Calcium
  - Protein
- Supplementation
- Risk reduction

- Fall prevention
  - Vision assessment/treatment
  - Balance
  - Environmental assessment

Case 1

Your patient is a 65 year old woman. She went through menopause at 50 and is not on hormone therapy. What is the appropriate dose of vitamin D for her to take daily?

a) 200 IU daily
b) 400 IU daily
c) 600 IU daily
d) 800 IU daily

Calcium and Vitamin D

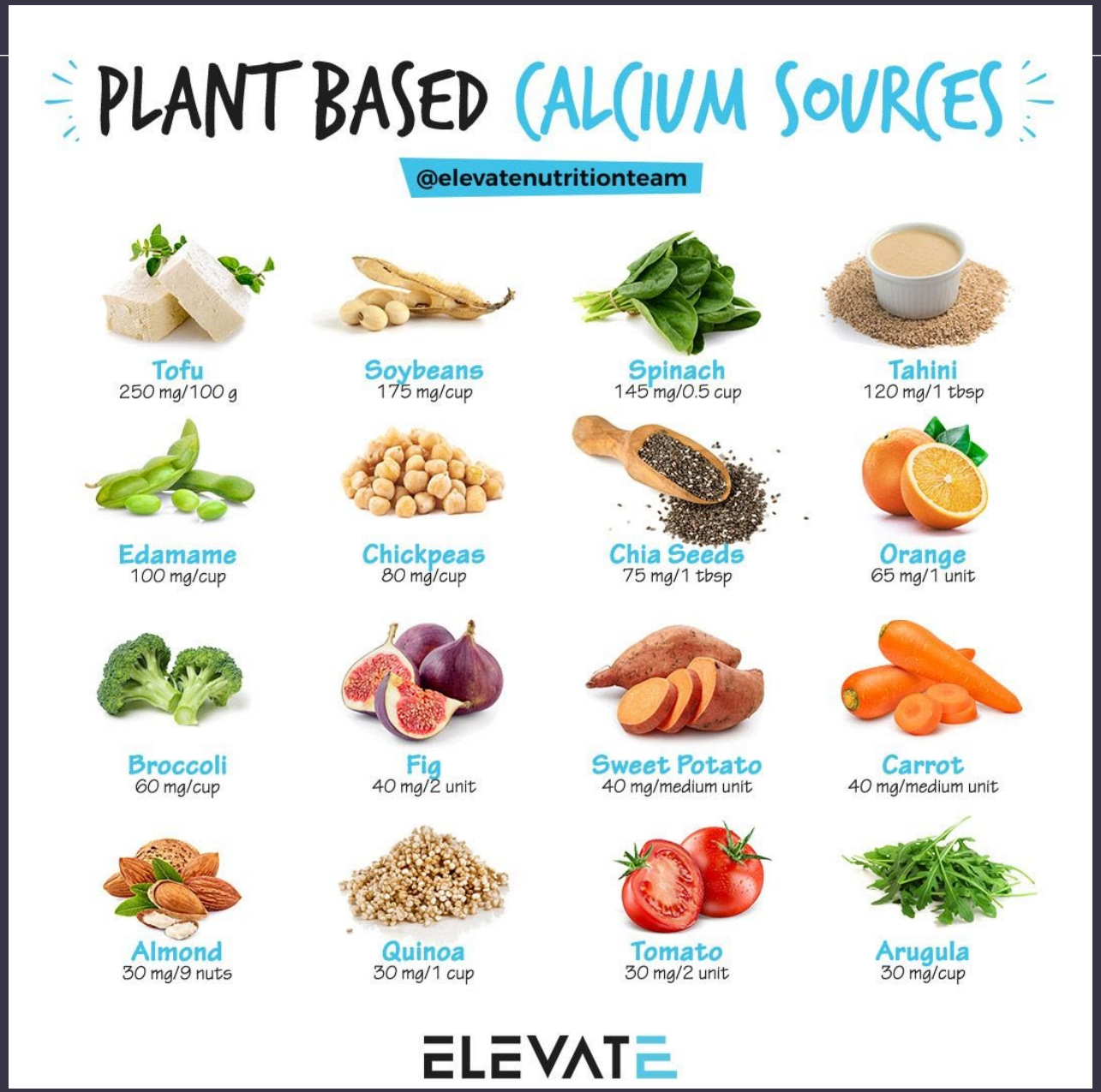
- 99% of our calcium in stored in bone
  - Inadequate levels sensed by receptors in parathyroid
    - ↑ PTH = ↑ osteoclast = ↑ increased intestinal absorption (vit D required) = ↑ renal reabsorption
- Vitamin D is required for calcium homeostasis
- Food sources are always best
  - Difficult to eat enough vitamin D or maintain consistent sun exposure
  - https://www.osteoporosis.foundation/educational-hub/topic/vitamin-d
  - https://www.osteoporosis.foundation/educational-hub/topic/calcium

Calcium

- Calcium carbonate – more elemental calcium, better absorbed with food, caution with H2 blockers, PPIs
  - Caltrate, Viactiv Calcium Chews, Os-Cal, and Tums
- Calcium citrate – ok with or without food, less elemental calcium
  - Citracal and GNC Calcimate Plus 800

Women	Calcium (mg/day)
19-50 years	1000
Post-menopause (51+ years)	1200
During pregnancy/lactation (14-18 years)	1300
During pregnancy/lactation (19-50 years)	1000

Men	Calcium (mg/day)
19-70 years	1000
70+ years	1200



Calcium 1c 2% milk = 305mg

Vitamin D
5µg = 200 IU

Summary of the RNIs for vitamin D by age group

Table 21

RNIs for vitamin D according to age groups

Age group	RNI µg/day
Infants	
0–6 months	5
7–12 months	5
1–3 years	5
4–6 years	5
7–9 years	5
Adolescents, 10–18 years	5
Adults	
19–50 years	5
Older adults, 51–65 years	10
Elderly adults, 65+ years	15
Pregnant women	5
Lactating women	5

[a]Units: for vitamin D, 1 IU = 25 ng, 40 IU = 1 µg, 200 IU = 5 µg, 400 IU = 10 µg, 600 IU = 15 µg, 800 IU = 20 µg; for 25-OH-D, 1 ng/ml = 2.5 nmol/l, 10 ng/ml = 25 nmol/l, 11 ng/ml = 28.5 nmol/l (low limit), 30 ng/ml = 75 nmol/l (normal), 60 ng/ml = 150 nmol/l (upper limit).

Vitamin D recommendations depending on age

Age group in years	Public Intake Recommendations for Vitamin D (National Academy of Medicine - NAM)	Public Intake Recommendations for Vitamin D (IOF)
0-1	*	Not assessed
1-59	600 IU/day	Not assessed
60-70	600 IU/day	800 - 1000 IU/day
71+	800 IU/day	800 - 1000 IU/day
Target 25(OH)D level	50 nmol/l for bone health at all ages	50 nmol/l for bone health at all ages

* adequate intake is 400 IU/day

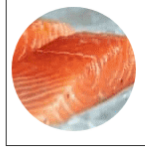
IOF includes all individuals with osteoporosis, independent of age and states that higher intakes may be needed in some individuals to reach a serum blood level of 50 nmol/l 25(OH)D.

MYFOODDATA

Top 10 High Vitamin D Foods

20µg of Vitamin D = 100% of the Daily Value (%DV)

1 Fish (Salmon)



142% DV (28.4µg)
per 6oz fillet

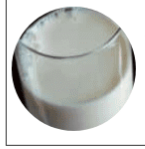
265 calories

2 Crimini (Chestnut) Mushrooms (Exposed to UV Light)

139% DV (27.8µg)
per cup

19 calories

3 Fortified Milk



32% DV (6.3µg)
per 16oz glass

298 calories

4 Fortified Milk Substitutes (Soy Milk)

29% DV (5.8µg)
per 16oz glass

160 calories

5 Fortified Tofu

28% DV (5.7µg)
per cup

208 calories

6 Fortified Yogurt

16% DV (3.2µg)
per cup

250 calories

7 Fortified Breakfast Cereal

12% DV (2.5µg)
per 3/4 cup

96 calories

8 Fortified Orange Juice

12% DV (2.5µg)
per cup

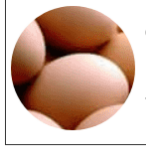
117 calories

9 Pork Chops

10% DV (2.1µg)
in 1 pork chop

525 calories

10 Eggs



6% DV (1.1µg)
in 1 large egg

78 calories

Vitamin D Top Food Categories

fish per 3 oz. (85 grams)

rainbow trout
16mg

sockeye salmon
14mg

canned sardines
1.8mg

drinks per cup

fortified orange juice
142 IU

fortified soy milk
100 IU

vitamin d milk
98 IU

meats per 3 oz. (85 grams)

beef liver
14 IU

ground beef
6 IU

chicken breast
4 IU

Clearvue Health

Quick note about vitamin levels

- If osteopenia or osteoporosis diagnosed – get calcium and vitamin D levels
  - Plasma 25-OH-D levels needs to be at least 27 nmol/l to ensure normal bone health
  - Additional supplementation may be required if deficient

  - Also helps rule out secondary medical conditions

Case 2

- Your patient is a 50 year old woman who's just completed menopause in the last year. Her mother had osteoporosis in her mid-70's and she asks about when she should start bone density screening. You advise her that she should get a bone mineral density or DEXA scan:

a) Now
b) 5 years earlier than her mother was diagnosed
c) At age 65
d) Whenever she feels like it

Who gets screened?

- Women at 65
- Early screening parameters – risk factors

- Low bone density is a risk for fracture

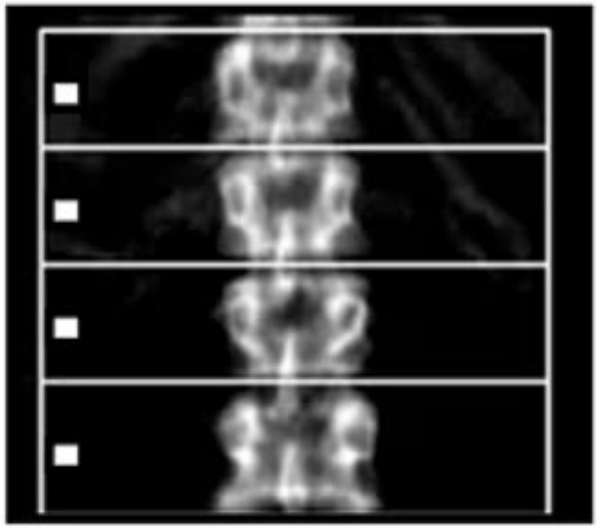
Recommendation Summary

Population	Recommendation	Grade
Women 65 years and older	The USPSTF recommends screening for osteoporosis with bone measurement testing to prevent osteoporotic fractures in women 65 years and older.	B
Postmenopausal women younger than 65 years at increased risk of osteoporosis	The USPSTF recommends screening for osteoporosis with bone measurement testing to prevent osteoporotic fractures in postmenopausal women younger than 65 years who are at increased risk of osteoporosis, as determined by a formal clinical risk assessment tool. See the Clinical Considerations section for information on risk assessment.	B
Men	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for osteoporosis to prevent osteoporotic fractures in men. See the Clinical Considerations section for suggestions for practice regarding the I statement.	I

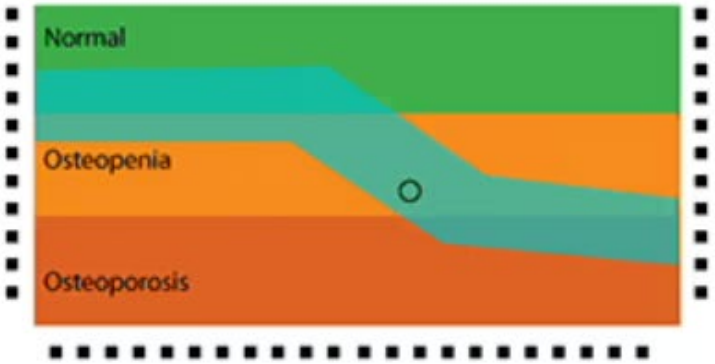
What is a DEXA?

- Dual-energy X-ray absorptiometry
- Radiation risk
  - Minimal, similar to a plain film x-ray
- How to prepare your patient for the exam
  - No calcium supplements for 24 hours prior
  - Loose fitting clothing
  - No zippers, jewelry

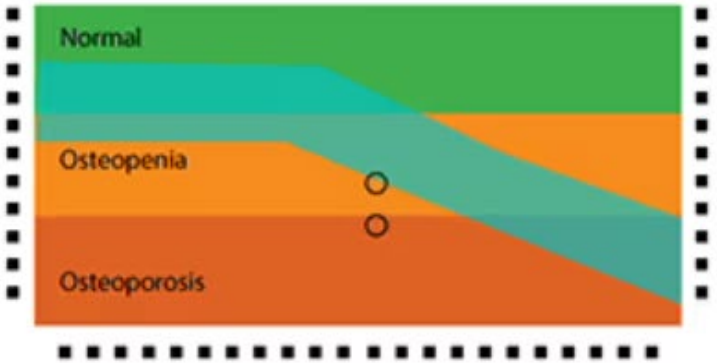
- Femoral neck
- Lumbar spine



ReferenceL Spine L1-L4



ReferenceL Dual Femur Total



- Bone density testing is use for diagnosis and risk assessment
- DEXA only measures **one** of the determinants of bone strength – bone mineral density
  - The other components of bone health must be considered
  - DEXA has still been shown to identify patients at increased risk of fracture

T-score….what is that?

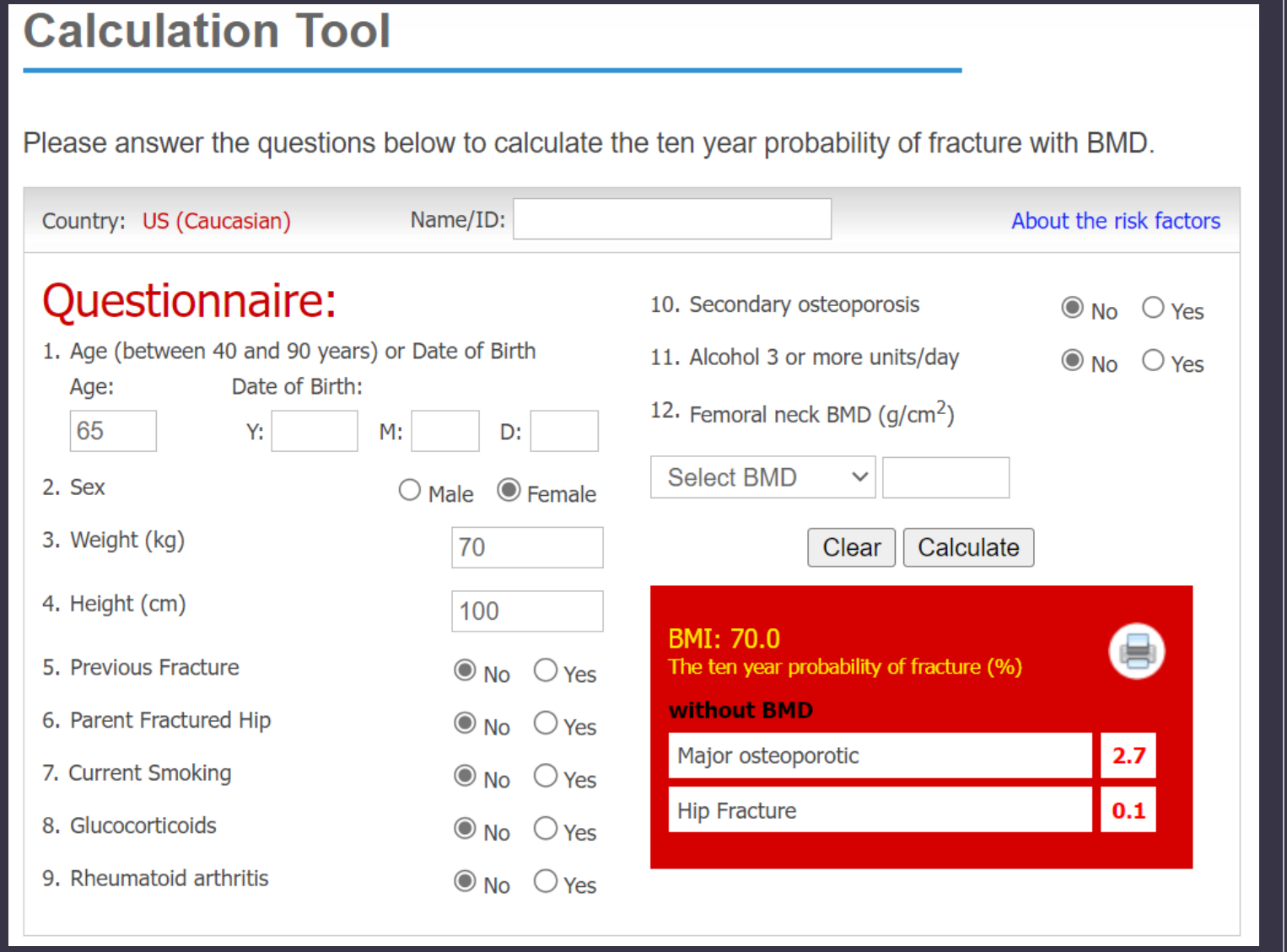
Diagnostic criteria	
Status	**Femoral neck BMD T-score (SD)**
Normal	-1 and above
Osteopenia	Between -1 and -2.5
Osteoporosis	-2.5 or lower
Severe Osteoporosis	-2.5 or lower and presence of at least one fragility fracture

And now a Z-score?

- Reflects bone mineral density adjusted for age, sex and ethnicity
- Used to assess children and adolescents
- For premenopausal individuals, a Z-score of −2.0 or lower is considered "below the expected range for age"

FRAX tool

- https://frax.shef.ac.uk/FRAX/



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 and 90 years) or Date of Birth
   Age: 65 Date of Birth: Y: M: D:
2. Sex — Male / Female
3. Weight (kg) 70
4. Height (cm) 100
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/cm^2) Select BMD

Clear Calculate

BMI: 70.0
The ten year probability of fracture (%)

without BMD

Major osteoporotic	2.7
Hip Fracture	0.1

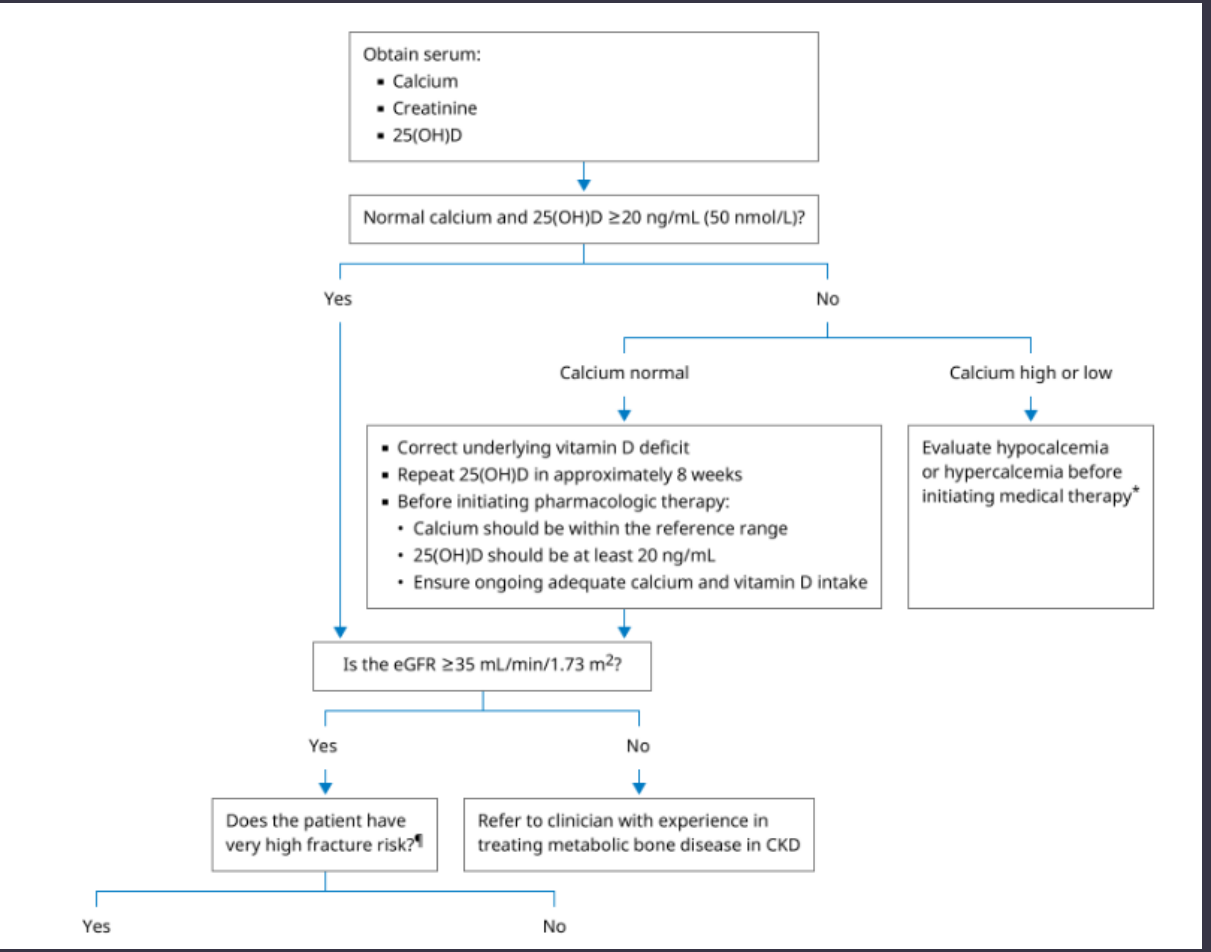
Case 3

- Your patient is a 65 year old woman who just had her first bone mineral density test. Her T-score is -2.5. She has never had a fracture. What is your next step in management?

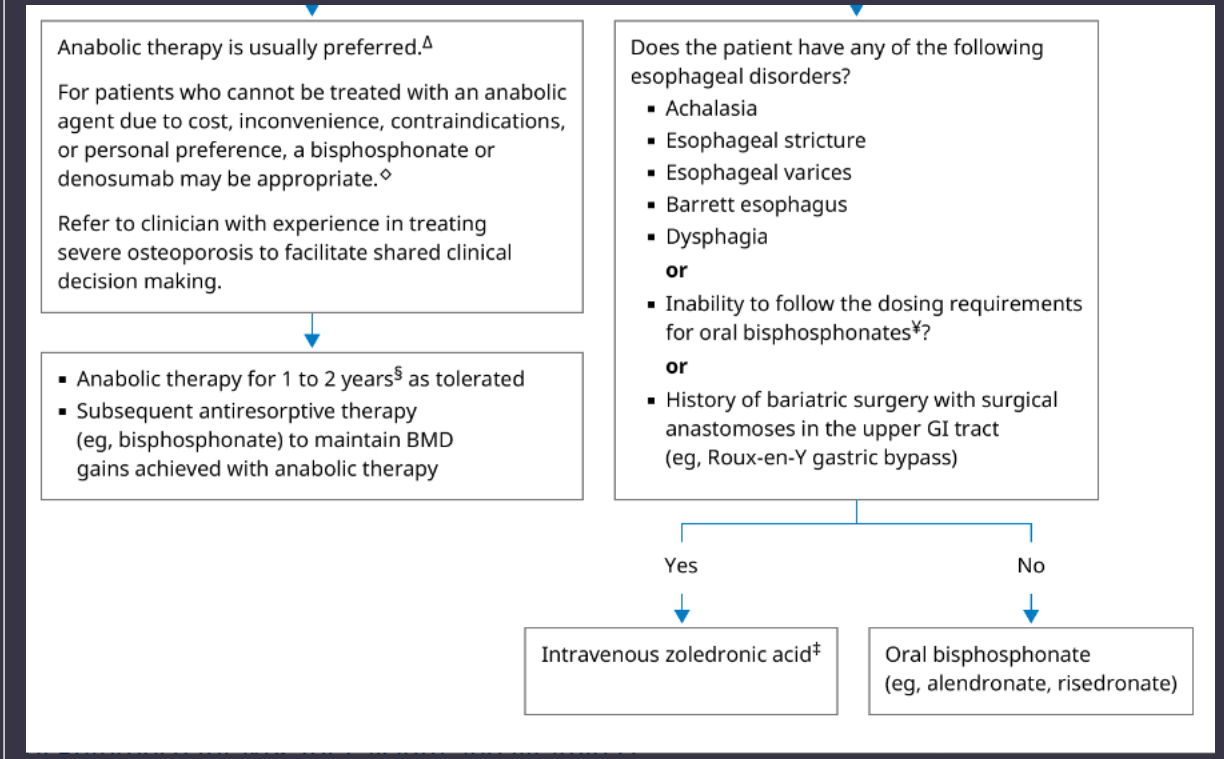
a) Optimize her intake of calcium, vitamin D and protein
b) Encourage weight-bearing exercise
c) Start an oral bisphosphonate
d) Perform a FRAX score with her

Who qualifies for treatment

- Fragility fracture
- T-score indicating osteoporosis



Treatments



- PREVENTION!
- Check calcium, vitamin D and creatinine levels
- Bisphosphonates = inhibit osteoclasts
  - Can be started 2 weeks after a fracture as long as patient can sit upright
  - Oral **alendronate** (Binosto, Fosamax Plus D, Fosamax), **risendronate** (Actonel, Atelvia)
  - IV **zoledronic acid** (Reclast)

First line anabolic therapy/Second line therapies

- Very high fracture risk – consider anabolic therapy
  - T-score of ≤-3.0 even in the absence of fractures
  - T-score of ≤-2.5 plus a fragility fracture
  - Severe or multiple fragility fractures

- **teriparatide (Forteo**) – recombinant PTH, stimulates osteoblasts, increases GI and renal absorption
  - 2 years
- **abaloparatide (Tymlos**) – PTH hormone related peptide analog stimulates osteoblasts
  - 2 years
- **romosozumab (Evenity**) *black box warning* – inhibits certain regulatory factors in bone growth prevention
  - 1 year, failed other treatments

- **denosumab (Prolia, Xgeva**) - *black box warning* – prevents osteoclast formation, transition to another drug required
- **raloxifene (Evista)** - *black box warning* – SERM, estrogen agonist in bone
  - Best for history of breast cancer

Table 1. Medications for Postmenopausal Osteoporosis

Category	Examples (Mode of Administration)	Indication	Demonstrated Fracture Risk Reduction
Antiresorptive agents			
Bisphosphonate*†‡	Alendronate (PO) Risedronate (PO) Zoledronic acid (IV)	Prevention and treatment	Vertebral Nonvertebral Hip
	Ibandronate (PO)	Prevention and treatment	Vertebral
	Ibandronate (IV)	Treatment	
Targeted monoclonal-antibody RANK-ligand inhibitor*‡§	Denosumab (SQ)	Prevention‖ and treatment	Vertebral Nonvertebral Hip
Selective estrogen receptor modulator*‡§	Raloxifene (PO)	Prevention and treatment for patients at increased risk of breast cancer	Vertebral
Hormone therapy*¶#	Estrogen with or without progestogen (multiple regimens)	Prevention	Vertebral Nonvertebral Hip
	Conjugated estrogen plus bazedoxifene (PO)	Prevention	N/A
Calcitonin**	Salmon calcitonin (intranasally or SQ)	Treatment	Vertebral††
Anabolic agents			
Parathyroid hormone analog*§	Abaloparatide (SQ) Teriparatide (SQ)	Treatment for patients at very high risk of fracture	Vertebral Nonvertebral
Sclerostin-binding inhibitor*‡‡	Romosozumab (SQ)		Vertebral Nonvertebral Hip

Abbreviations: PO, orally; IV, intravenously; RANK, receptor activator of nuclear factor kappa beta; SQ, subcutaneously; N/A, data not available.

Estrogen therapy

- Estrogen + progesterone if patients have a uterus
  - Progesterone required for endometrial protection
  - Not recommended beyond 60 yo
    - Increased the risk of coronary artery disease
    - Slightly increased risk of breast cancer, stroke, VTE, cognitive impairment, invasive breast cancer

- Estrogen alone if no uterus
  - < 60 years or within 10 years of menopause
  - Low risk of venous thromboembolism, breast cancer, and cardiovascular disease
  - Bothersome menopausal symptoms
  - Not candidate for bisphosphonates or denosumab

- Oral conjugated equine estrogen (0.625 mg daily)
- Oral estradiol (100-mg patch or 2 mg daily oral)
- Oral progesterone 200mg daily
  - Or can do cyclically 10-20 days of the month

Drug Holidays

- Concern over atypical fractures and osteonecrosis of the jaw
- Stable, low-to-moderate risk after **5 years of treatment** with oral bisphosphonates
  - Continue treatment for 10 years in high risk patients
- After **3 years of treatment** with intravenous zoledronic acid
  - Continue treatment for 6 years in high risk patients

Monitoring

- Rescreening interval
  - 1-3 years when on treatment
  - 10 years surveillance

Drug discontinuation effects

- All non-bisphosphonate therapies (denosumab, abaloparatide, teriparatide, selective estrogen response modulator, HT, tibolone, and calcitonin) disappear when stopped
- Therapy gains are lost rapidly
- Discontinuation of denosumab is associated with BMD decrease and can result in increased vertebral fractures

- Bisphophonates remain in the body for years after treatment
  - Bind to bone and are released again with bone turnover

Dental procedures

- Medication related osteonecrosis of the jaw (MRONJ)
  - Rare but debilitating 0.7-18%
  - Associated with bisphosphonates, denosumab and other non-osteoporosis related medications
    - Underlying mechanism not well understood

  - Drug holiday for dental work controversial
    - Dentoalveolar surgery = extractions, resecting mandible, resection of major gum disease, removing bone around teeth
    - Oral bisphosphonate use < 4 years low risk, no change in management
    - Oral bisphosphonate therapy > 4 years plus antiangiogenic medication or corticosteroids increases risk
      - Discontinue bisphosphonate/denosumab 2 months prior if allowable and restart once full bone and mucosal healing occur
  - Encouraging regular dental care and hygiene are preventative!

When to refer and to whom

- Varies by comfort level and resources
- Consider referral if moving to second-line therapy
- Endocrinology
- Continue other management

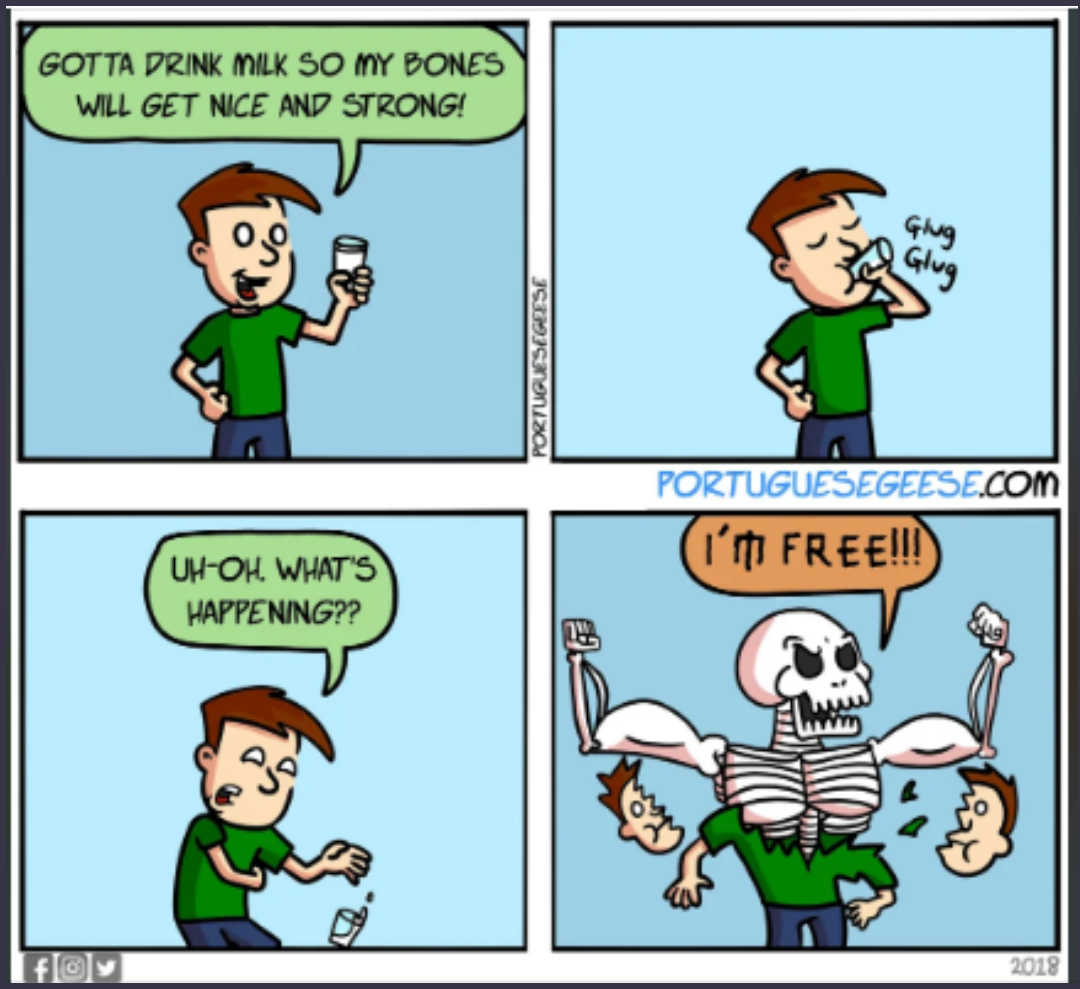
When can we stop screening?

- No guidelines
- Some recommend 85
- Shared decision making

- https://www.bonehealthandosteoporosis.org/

- https://www.bonesource.org/radically-simple-tool
- https://link.springer.com/article/10.1007/s00198-021-05900-y
  - Great summary article of guidelines and treatments

Thank you!


GOTTA DRINK MILK SO MY BONES WILL GET NICE AND STRONG!
Glug Glug
PORTUGUESEGEESE.COM
UH-OH. WHAT'S HAPPENING??
I'M FREE!!!
2018

Resources

- Listed in the comments of each slide