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Boning Up on Bone Health

Prepared: November, 2020

Ontario

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Boning Up on Bone Health

- Bone Health – The Basics
  - Micheline Jackson, Nurse Practitioner, Summerville Family Health Team
- Nutrition & Bone Health
  - Joanne Bak, Registered Dietitian, Summerville Family Health Team
- Exercise & Osteoporosis
  - Lindsay Bickerstaffe, Registered Kinesiologist, Metabolic Syndrome Canada

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Group Privacy Statement

- This session is reserved for the sharing of less sensitive information, mainly, educational materials relating to nutrition, exercise and stress management
- Virtual sessions do have some inherent privacy and security risks that there is a chance your personal log-in information may be intercepted or unintentionally disclosed
- It is possible that there could be a problem with the technology and your session could be cut short and/or interrupted
- We will not be recording the session, and ask that you not record the session, either

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Group Protocol

- Keep your microphone muted unless you would like to share
- Speak up when invited, to ask a question verbally
- Your participation is encouraged!
- Interactive Opportunities
  - Polls and questions – click and submit!
  - Chatbox – type in your question and choose to send to “everyone” or direct it to the facilitator

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Bone Health – The Basics

- Why does bone health matter?
- What is osteoporosis?
- What are current treatments for osteoporosis?
- How to prevent bone loss?
- How to prevent falls?

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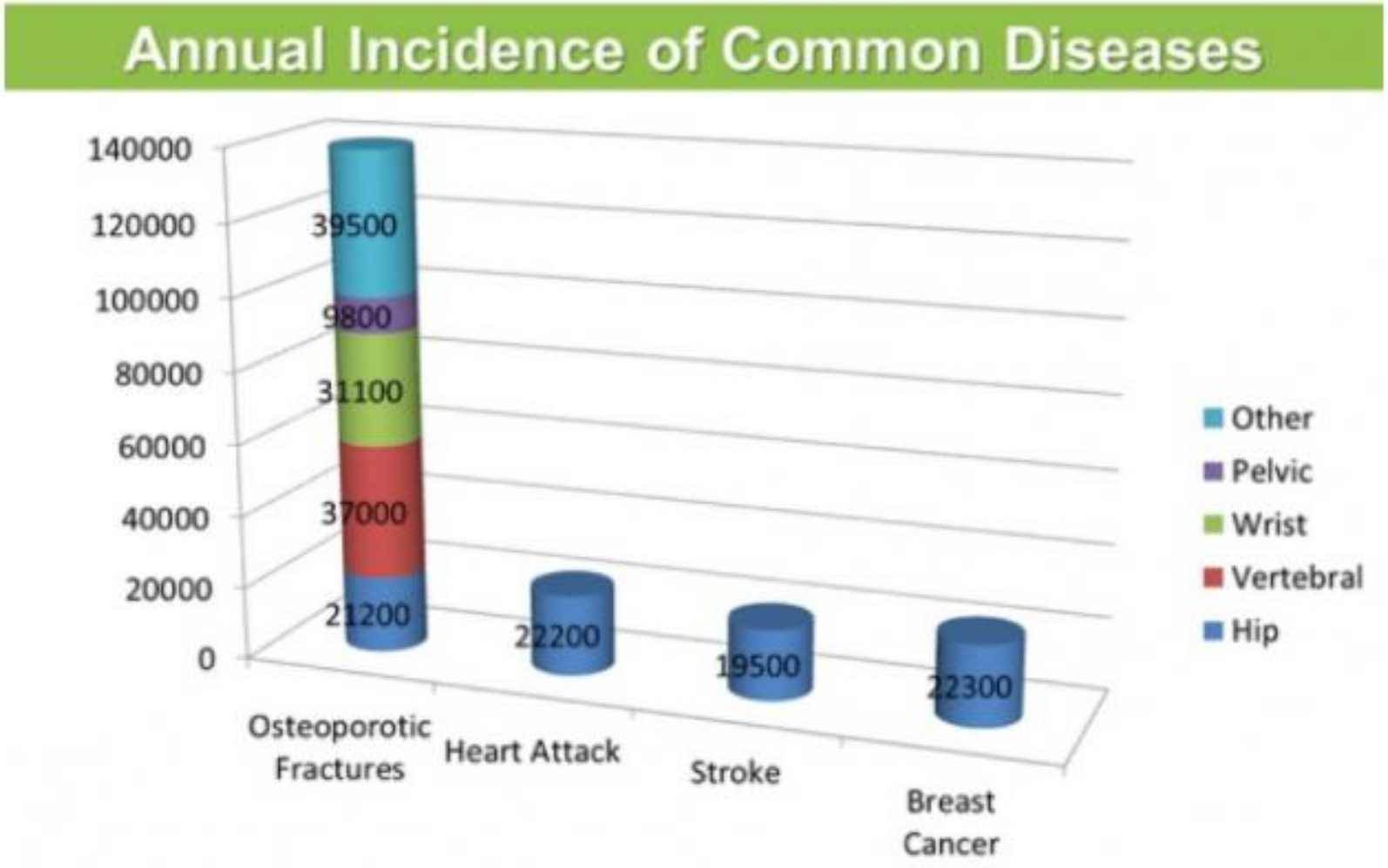
Why does bone health matter?

- 2 million Canadians are affected by osteoporosis
- At least 1/3 women and 1/5 men will break a bone due to osteoporosis in their lifetime
- Fragility fractures represent 80% of all fractures in menopausal women over the age of 50

(Osteoporosis Canada, 2020)



(Osteoporosis Canada, 2020)

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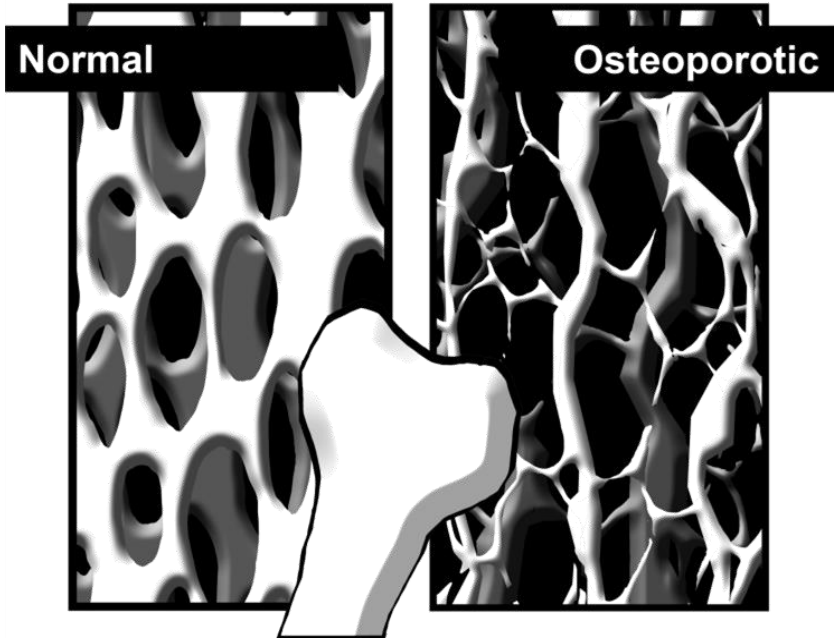
What is osteoporosis?

- Systemic skeletal disease characterized by low bone mass and deterioration of bone tissue, which can lead to increased risk for fractures.



(Osteoporosis Canada, 2020)

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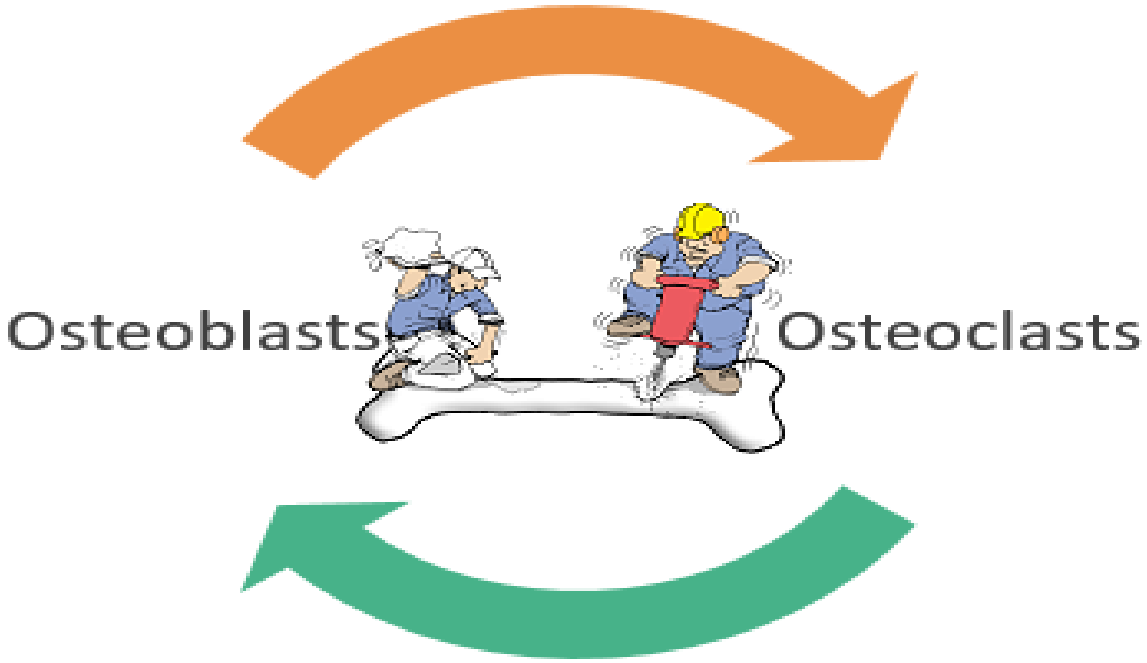
Bone growth, development and remodeling



Osteoblasts- build new bone

Osteoclasts- remove old or damaged bone

(Manolagas, 2020)

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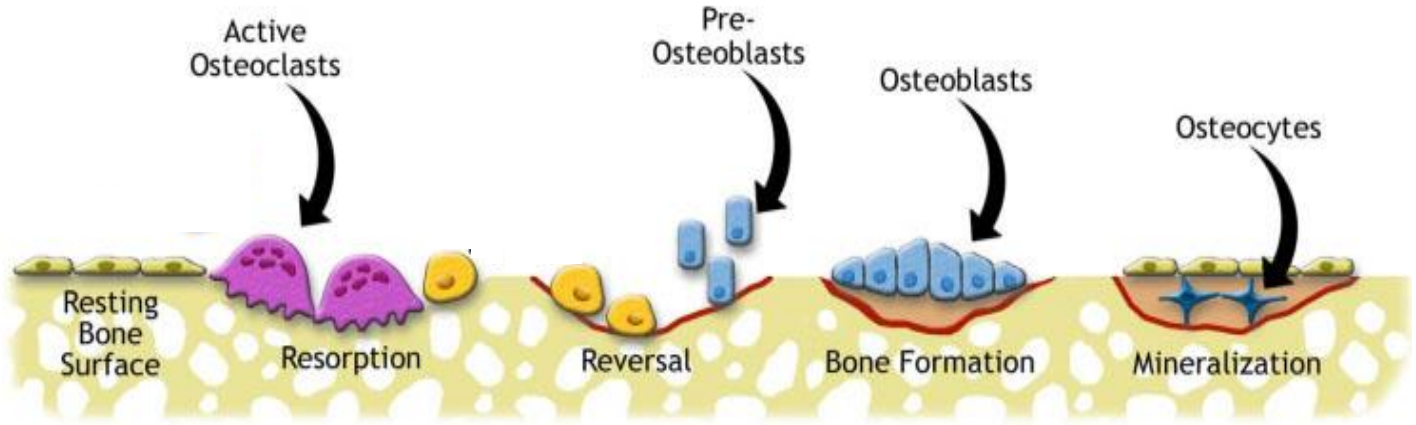
Bone remodeling cycle



Healthy Bone → **Resorption ≈ Formation**

Menopause
Aging
Disease
Drugs

→ **Resorption > Formation**

(Manolagas, 2020)

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Risk factors: non-modifiable

- Age
- Sex
- Low body weight
- Low bone mineral density
- Past fragility fracture (spine, hip, wrist)
- Having a parent who had a hip fracture
- A past history of fall(s)

(Osteoporosis Canada, 2020)

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Risk factors: modifiable

- Calcium, Vitamin D and protein consumption
- Smoking cessation
- Alcohol consumption
- Physical activity/Exercise
- Body weight

(Osteoporosis Canada, 2020)

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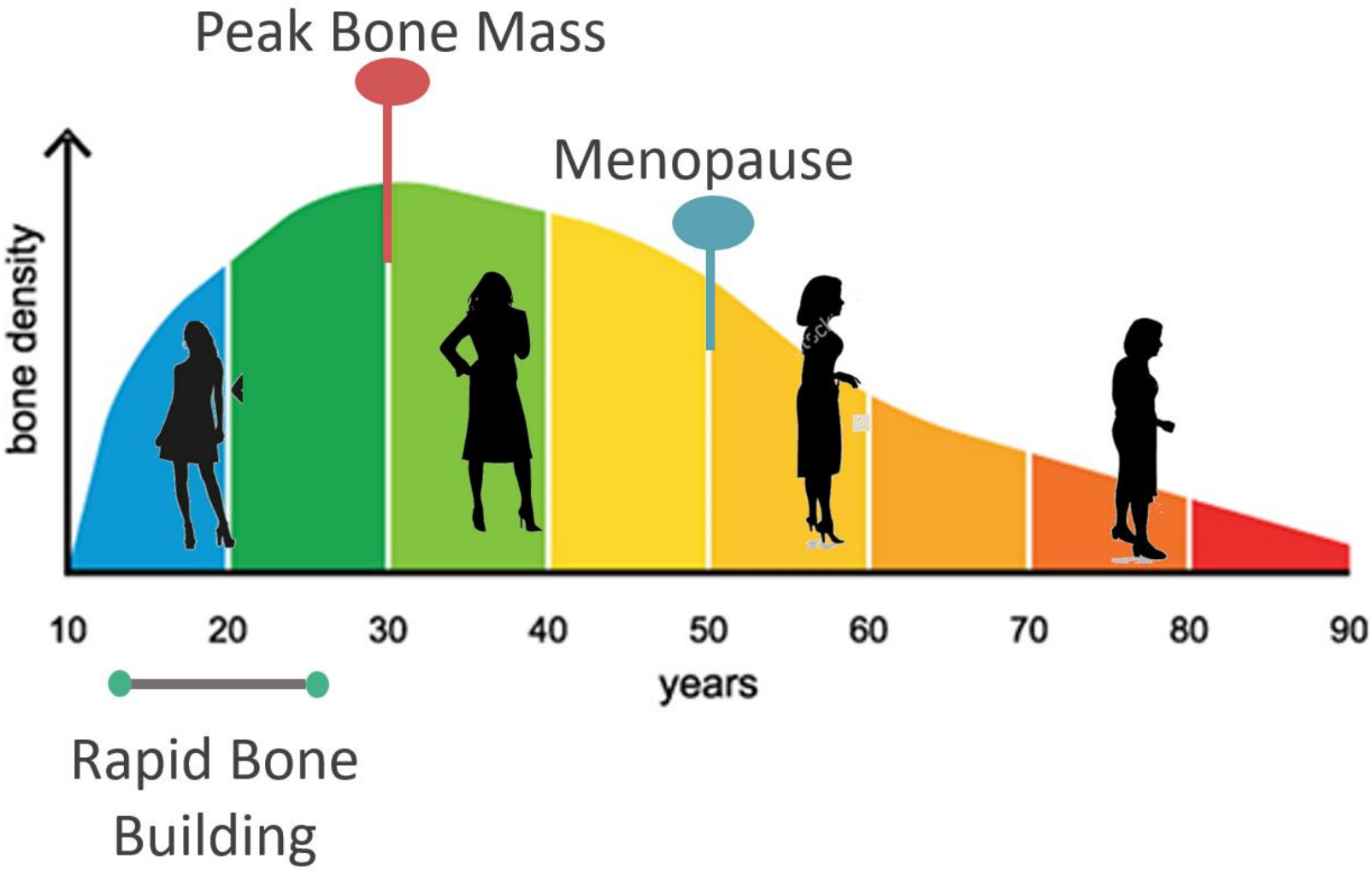
Bone changes over the lifespan



(Osteoporosis Canada, 2020)

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Canadian screening guidelines

- All women and men 65 years or older
- Postmenopausal women and men 50-64 with risk factors*
- Younger men and women <50 with a disease or condition associated with low bone mass or bone loss**

(Osteoporosis Canada, 2020)

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Medications that increase risk osteoporosis or falls

- Synthetic glucocorticoids
- Breast cancer drugs
- Prostate cancer drugs
- Heartburn drugs
- Depo-Provera
- Excessive thyroid hormone replacement
- Antiseizure and mood altering drugs
- Blood pressure medications
- Diuretics
- Prostate drugs

(Osteoporosis Canada, 2020)

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Diabetes and bone health

- Increased risk for fractures due to:
  - Decreased bone formation
  - Increased bone resorption
  - Decreased bone quality
  - Increased propensity to fall
    - Peripheral neuropathy, autonomic neuropathy, hypoglycemia, poor vision, stroke

(Osteoporosis Canada, 2020)

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Bone mineral density testing

- Assessed by DXA (Dual X-ray Absorptiometry)
- Results measured using T score – (-1 to -2.5 indicates low bone mass, less than -2.5 indicates osteoporosis
- Needs to be incorporated into a fracture risk calculator (CAROC/FRAX)
- WHO Classification of Osteoporosis based on bone density is a T-score ≤ -2.5

(Osteoporosis Canada, 2020)

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BMD reporting criteria

Age	Category	Criteria*
< 50 years	Below expected range for age	Z-score ≤ -2.0
	Within expected range for age	Z-score > -2.0
≥ 50 years	Severe (established) osteoporosis	T-score ≤ -2.5 with fragility fracture
	Osteoporosis	T-score ≤ -2.5
	Low bone mass	T-score -1.1 to -2.4
	Normal	T-score ≥ -1.0

(Osteoporosis Canada, 2020)

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Current medications

Anti-Resorptive (Inhibits Bone Loss)	**Anabolic Agent** (Bone Forming)

• **Bisphosphonates**
  • **Alendronate (Fosamax)**
  • **Risedronate (Actonel)**
  • **Zoledronic Acid (Aclasta)**
• **Denosumab (Prolia)**
• **Raloxifene (Evista)**
• **Hormone Therapy (Estrogen)**
	• **Teriparatide (FORTEO)**

(Osteoporosis Canada, 2020)

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Preventing bone loss

- Calcium
- Vitamin D
- Physical Activity
- Too Fit to Fracture program, Bone fit program
- Smoking cessation

(Osteoporosis Canada, 2020)

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Preventing falls

- Avoid multi-tasking
- Install hand rails and grab bars
- Improve lighting
- Remove trip hazards
- Routine eye exams
- Non slip shoes and mats
- Medication reconciliation

(Health Harvard, 2018)

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References

- Osteoporosis Canada (2020). Retrieved from https://osteoporosis.ca
- Health Harvard (2018). Retrieved from https://www.health.harcard.edu/staying-healthy/preventing-falls-infographic
- Manolagas, S. (2020). Normal skeletal development and regulation of bone formation and resorption. Retrieved from https://www.uptodate.com/contents/normal-skeletal-development-and-regulation-of-bone-formation-and-resorption?search=bone%20formation%20and%20resoprtion&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1

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Nutrition & Bone Health

1. Key nutrients: Protein, Calcium, Vitamin D
   - Food Sources
   - Factors affecting absorption of Calcium & Vitamin D
2. Diet habits that are NOT healthy for our bones
3. Do I need supplements?

Osteoporosis Canada's position on nutrition for healthy bones focuses on calcium & vitamin D while stressing a well-balanced diet which includes fiber & whole grains, vitamins & minerals and protein.

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Protein & Bone Health

- Gives bones strength & flexibility
- Big component of muscles – crucial for mobility & preventing falls
- Enjoy a variety of protein rich foods - emphasize choices from the Mediterranean diet
- Include protein rich foods at all meals and snacks
- How much do I need each day?
  - 0.8-1.2 g/kg body weight; higher end if >65 yrs of age
  - Example: 70 kg person: 56-84 g/d

"Diets that include recommended amounts of protein are associated with greater bone mass and fewer fractures when calcium intake is adequate.

Adults with limited protein intake are at high risk for bone loss and fractures".

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What foods contain protein?

- Mostly protein
  - beef, pork, poultry, fish, eggs, tofu
- Some protein
  - Legumes, nuts, nut butters, seeds, seed butters, milk, cheese, cottage cheese, soy beverages, yogurt
    - Milk products – added advantage of being good sources of calcium
- Little protein
  - Whole grain breads, rice, pasta, quinoa, barley, nut milks, veg, fruit

Food Group	Protein (grams)	Portion Size
Meats	21	3 oz = 75 g
Eggs	12	2
Tofu (firm)	12	¾ cup
Milk / Soy milk	8	1 cup
Yogurt / Greek yogurt	7-14	¾ cup
Beans & lentils	12	¾ cup
Nuts & seeds	5-17	¼ cup
Cooked grains: quinoa, pasta, rice, cereal or bread	2-4	½ cup or 1 slice
Vegetables	2	1/2 c
Fruit	1	1 med or ½ cup
Nut milks (e.g. almond, cashew, hemp, coconut)	1	1 cup
Fats & Oils	0	

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Calcium – Role in our Body

1. Calcium is found in our cells, blood, bones & teeth
   - > 99% of calcium is stored in bones and teeth
2. Proper functioning of many organs & tissues:
   - Muscle contraction
   - Heart action
   - Nervous system maintenance
   - Normal blood clotting
3. Our body does not produce calcium – we absorb it from the food we eat

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Calcium Status

- Getting your blood checked for calcium is a good way to know if you are getting enough calcium in your diet.
- **POLL #1: True or False?**

FALSE! Our body tightly controls calcium in the blood.

If your body is not getting enough calcium through diet, it will take it from your bones to serve all the other functions it is needed for.

When this happens bones become more fragile.

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Calcium – How much do I need each day?

Adults	Recommended Amount	Tolerable Upper Intake
19-50 years women 19-70 years men	1000 mg	2500 mg
> 50 years women > 70 years men	1200 mg	2000 mg

- **Calcium from food:** mild suppressive effect on bone turnover
  - benefit for BMD (bone mineral density)
- **Calcium from supplements:**
  - Possible adverse effects of *excess amounts from supplements*:
    - Kidney stones, CV events in women, prostate cancer in older men

% of Canadians with INADEQUATE Calcium Intake:

Adult men: 27- 80%*

Adult women: 48-87%*

*depending on age group (CCHS 2004)

Bottom Line: best and safest to get your calcium through food if at all possible

Health Canada; Osteoporosis Canada

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Calcium Rich Foods – are you getting enough?

Food	Serving Size	Calcium Content (mg)	Estimated Absorption
Milk products	1 c milk ¾ c yogurt 1.5 oz cheese	~ 300	30%
Soy beverage or fortified nut milks (shake well)	1 cup	300	24%
Tofu (prepared with calcium sulphate)	4 oz (112 g)	350	30%
Bok choy, kale broccoli	½ cup	33-84	40-60%
Spinach	½ cup	129	5%
Almonds	¼ cup	97	20%
Legumes	½ cup	25-85	25%

1. Quick Check
   - 300 mg because you eat various foods
   - 300 mg for each milk/fortified soy serving

     At 3 milk servings/d = 1200 mg calcium
2. Labels
   - % DV based on 1000 mg per serving
3. Calcium Calculator - online

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Poll #2

- Which of the following can REDUCE your absorption of calcium:
  A. Caffeine
  B. Alcohol
  C. High salt diet
  D. Smoking
  E. Low stomach acid
  F. Tea
  G. Poor Vitamin D status
  H. All of the above

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Calcium Absorption from foods:

- What helps?
  - Vitamin D – key that unlocks the door and lets calcium into the body
- What hinders?
  - Excessive caffeine, alcohol, salt
  - Controversy: phosphorus in soft drinks & high animal protein
  - Smoking
  - Low stomach acid – declines with age; some medications
  - Some medical conditions: celiac disease, IBD
  - Diets high oxalates & phytates*
    - Spinach, chard, chocolate, tea
    - High fibre foods

If calcium intake is adequate, generally don't need to worry about the inhibitory effects from healthy foods* as they provide protective factors:

- improve cholesterol, blood sugars
- anti-cancer

Low BMD or osteoporosis?

- Tea between meals
- Ca supplement 2 hours after bowl of bran cereal

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Calcium Supplements – who might benefit?

- Follow a vegan diet
- Limit dairy products – lactose intolerance, milk allergy, preference
- Are on corticosteroids long-term
- IBD or celiac disease – digestive system diseases that reduce ability to absorb calcium

** Talk to your doctor, NP or dietitian to determine if you need to supplement your diet with calcium

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Calcium Supplements – which one should I choose?

	Pros	Cons
Calcium Carbonate	Least expensive	Needs stomach acid for absorption: must take with food
	Fewer pills needed to meet needs	Not appropriate if low stomach acid or on medications such as PPI's that cause low acid (ie) Nexium, Prevacid, Dexilant, Pantaloc
		May be constipating
		Competes for absorption with iron * If anemic/low in iron, use a different type
Calcium Citrate	Absorbed well on empty stomach	More expensive than carbonate form – may need more since there is less elemental calcium per tablet
	No gastrointestinal side effects	

*look for **elemental** calcium on the label to determine the dosage; no more than 500 mg at one time

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Vitamin D: Role in our Bodies

- Vitamin D: regulates cell growth, neuromuscular and immune function, reduces inflammation

1. Bone health: builds stronger bones by increasing absorption of calcium
2. Improves function of muscles – improves balance – reduces risk of falling and suffering a fracture
3. Other research shows roles in:

- cancer prevention – colon, breast, prostate
- cognitive health – dementia, depression
- Multiple Sclerosis
- Psoriasis

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Poll #3

- Most adults need a supplement to meet their Vitamin D needs.

True or False?

True!

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Vitamin D – how much do I need?

Age	Recommended Amount	Tolerable Upper Intake	Supplement Recommendations – Osteoporosis Canada
19-50 years	600 IU/d	4000 IU/d	400 – 1000 IU/d
51-70 years	600 IU/d	4000 IU/d	800 - 2000 IU/d
70 years or younger adults at risk	800 IU/d	4000 IU/d	800 – 2000 IU/d

Did you know … Vitamin D was discovered in the 1920's as a cure for rickets

Natural sources: fish, egg yolks, sun

Food Fortification: started 1930's

Mandatory today: milk and margarine
Permitted: orange/apple juice, cheese, yogurt - check labels

* difficult to obtain adequate amounts from food or sunshine

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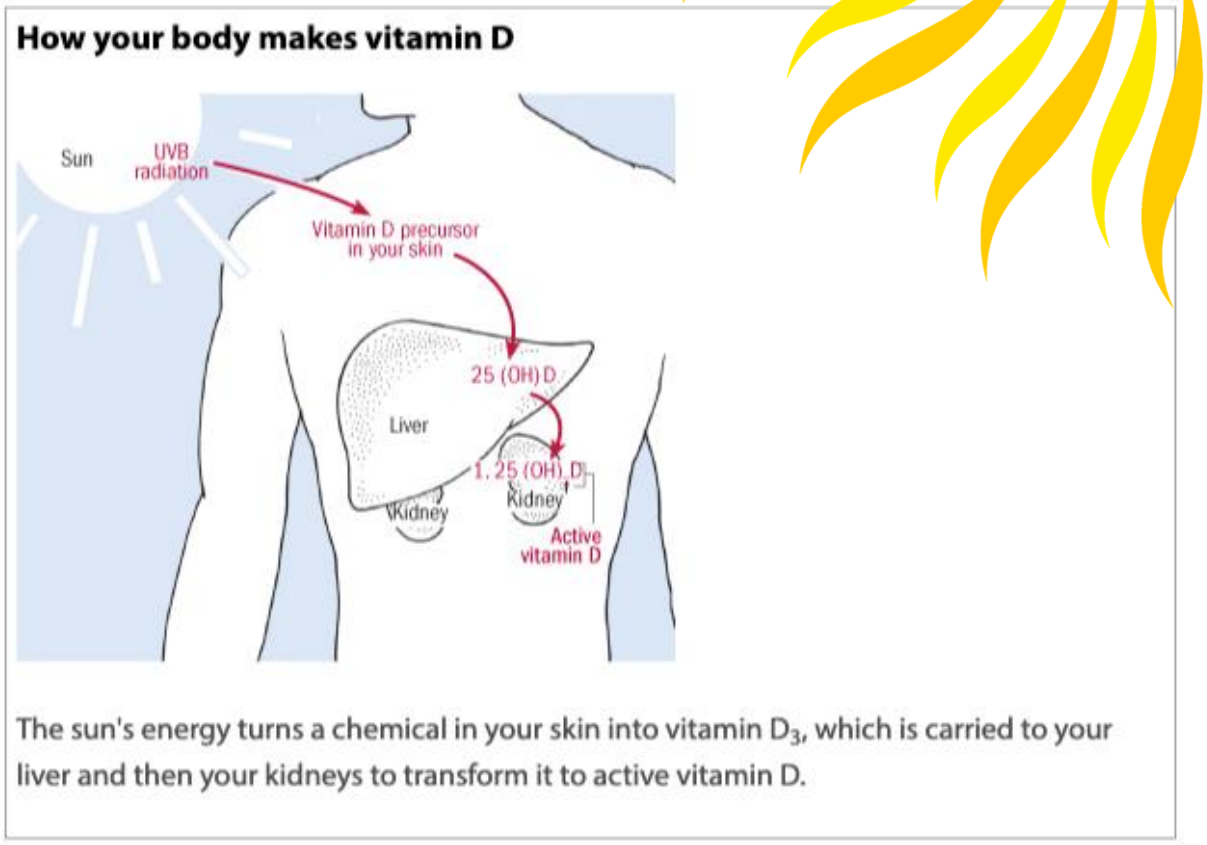
Vitamin D: Why summer sunshine ISN'T enough

1. Limited exposure to sunlight
   - northern latitude > 37 degrees from equator
   - sunscreen blocks harmful UVB rays
   - indoor work

2. Pigmentation – darker skin at higher risk

3. Advancing age – our skin's ability to make Vitamin D decreases



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Vitamin D – food sources

Food	Serving Size	IU's per Serving
Swordfish, Baked or Broiled	75 g	761
Salmon, pink, Canned, Drained with solids and bones	75 g	435
* Cod Liver Oil	5 mL/1 tsp	426
Salmon (Sockeye), Baked or Broiled	75 g	394
Snapper, Baked or Broiled	75 g	392
Milk (all types)	1 c/250 mL	103-105
Soy Beverage, Enriched	1 c/250 mL	86
Yogurt, Plain, Vitamin D Added	175 g	82-113
Egg Yolk, cooked	2 Large	64
Tuna, canned in water, drained unsalted	75 g	60
Orange Juice, Fortified	1/2 c/125 mL	50
Margarine, fortified	5 mL/1 tsp	25-36
Mushrooms, white	125 mL/ 1/2 c	4

Osteoporosis Canada

* Cod liver oil is not recommended due to possible excess Vitamin A which can weaken bones as well as contaminants like PCB's

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Vitamin D: Optimal Levels

- To most consistently improve clinical outcomes such as fracture risk, an optimal serum level of 25-hydroxy vitamin D is probably > 75 nmol/L
  - *For most Canadians, supplementation is needed to achieve this level*

Curious? Lab test fee $30-60

Experts recommend that all Canadian adults take a vitamin D supplement (specifically, vitamin D3 or cholecalciferol) year-round

Osteoporosis Canada.

Hanley DA, et al. *CMAJ* 2010; 182:E610-E618.

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Vitamin D Supplements – fun facts

- Drop form – take anytime, absorbed well
- Tablet form – take with food, biggest meal of the day since fat is needed for Vitamin D to be absorbed
  - Vit D3 – animal source, better utilized by humans
  - Vit D2 – fungus/yeast source, option for vegetarians/vegans

Ddrops

- **What if I forget?**
- It is ok to double up & take additional Vit D if you miss a day or two …. Just keep it to no more than 4000 IU at one time, the upper limit for safety

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Tips to keep my bones strong:

- ✓ Calcium rich foods
- ✓ Enough Vitamin D
- ✓ Adequate protein
- ✓ Balanced diet with plenty of:
  - fruits, vegetables/greens, legumes, nuts, seeds, whole grains, fish, dairy
- ✓ Limit caffeine, alcohol & salt
- ✓ Don’t smoke
- ✓ Keep physically active

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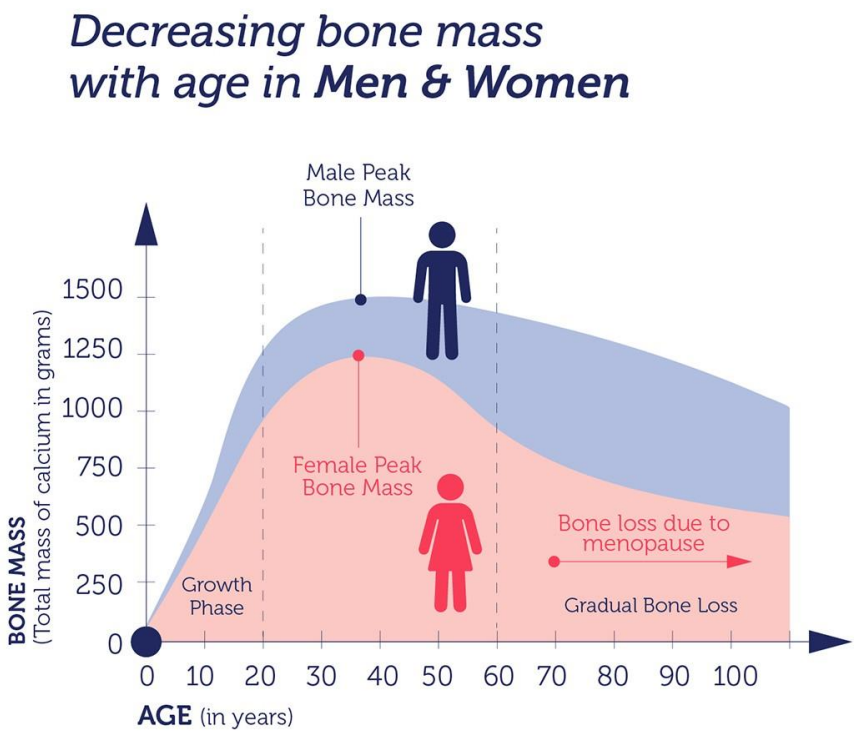
Nutrition & Bone Health – References / Websites

- Osteoporosis Canada
  - https://osteoporosis.ca/bone-health-osteoporosis/nutrition/
- Calcium Calculator
  - https://www.osteoporosis.foundation/educational-hub/topic/calcium-calculator
- Health Canada
- National Institutes of Health, Office of Dietary Supplements
- Mayo Clinic
- Unlock Food.ca – search for specific nutrients; recipes
- American Bone Health

Common Misconceptions: Exercise and Osteoporosis

- **All types of exercise helps prevent osteoporosis**
  - **Truth:** any exercise is beneficial for your WHOLE body. But specific types of exercise are BETTER than others for bone health
  - Weight bearing exercises (AKA bone-loading) and resistance exercises are most ideal for bone mineral density
- **If osteoporosis runs in your family, there's nothing you can do about it**
  - **Truth:** it can be managed with proper nutrition and exercise, but is a life-long endeavor
- **Exercise can compensate for low-calcium intake**
  - **Truth:** the best option is to consume enough calcium through nutrition, AND exercise regularly
- **You shouldn't exercise if you have osteoporosis**
  - **Truth:** Everyone should exercise! Exercise has a huge effect on strength, flexibility, and balance – all of which keep you upright and sturdy

Use it or lose it!



- Just like muscle, bone strengthens in response to exercise
- Exercise causes muscle contraction, which stresses the bone
- Weight-bearing exercise stresses the bone by using the force of gravity and muscle contraction
- Stressing bone through exercise encourages it to increase its calcium content and helps to maintain bone mass
- Bone naturally becomes weaker with age. This is why it is important for everyone to exercise, no matter what age you are

- Balance exercises are also important!

Why Balance Exercises?

- Helps to keep you stable
- Helps with coordination
- Can help prevent falls

- All of the above helps to lower the risk of a fracture from a fall

At least 1 in 3 women and 1 in 5 men will suffer an osteoporotic fracture in their lifetime

- Osteoporosis Canada

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Different types of exercise: Part One

- **Aerobic exercise:** 4-5 times per week (150 minutes each week)

  examples: brisk walking, swimming, pushing a lawn mower

- **Resistance exercise**: 2-3 times per week on non-consecutive days for rest and recovery

  examples: climbing stairs, digging in the garden, lifting weights, resistance band exercises

- **Flexibility exercise:** 2-3 times per week

  examples: yoga, tai chi, stretching

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Different types of exercise: Part Two

- **Balance Exercises:** Everyday

  examples: tai chi, dancing, walking on your toes or heels, standing on one foot

  Safety first: be sure to have a counter/chair/or something sturdy nearby to hold onto if needed

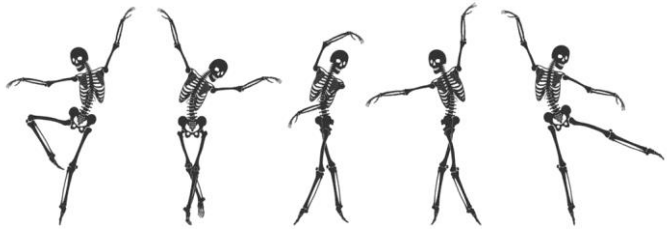
- **Posture exercises**: Everyday

  example: Tuck in your chin and lift your chest-bone upward

  Open your collarbones – think of them as wings spreading open

  Hold for 15-20 seconds, then release

  Repeat 2-3 times.



Workout Example

Squats

Wall Push-ups

Heel Raises

Bird Dog

Band Pull A-parts

Bent Over Rows

Bicep Curls

Hamstring Curls

Exercise and Intensity

RPE Scale	Rate of Perceived Exertion
10	**Max Effort Activity** Feels almost impossible to keep going. Completely out of breath, unable to talk. Cannot maintain for more than a very short time.
9	**Very Hard Activity** Very difficult to maintain exercise intensity. Can barely breath and speak only a few words
7-8	**Vigorous Activity** Borderline uncomfortable. Short of breath, can speak a sentence.
4-6	**Moderate Activity** Breathing heavily, can hold short conversation. Still somewhat comfortable, but becoming noticeably more challenging.
2-3	**Light Activity** Feels like you can maintain for hours. Easy to breathe and carry a conversation
1	**Very Light Activity** Hardly any exertion, but more than sleeping, watching TV, etc

Moderate to vigorous intensity, what does that mean?

- BERG rate of perceived exertion (0-10)
  0 is at rest
  10 is maximum effort

- Moderate intensity exercise: 5 or 6 (you can talk but cannot sing)
  50% max HR: 220-age

- Vigorous intensity exercise: 7 or 8 (you can’t say more than a few words without catching your breath)
  70% max HR

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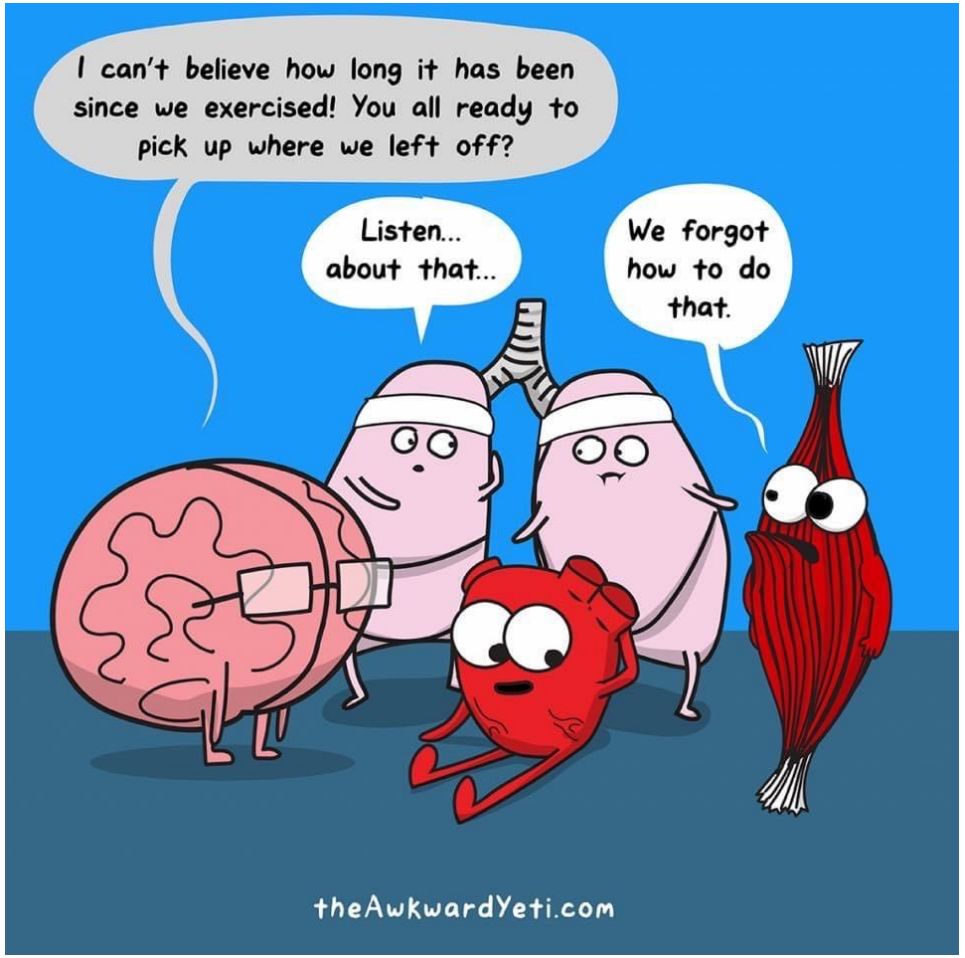
Exercise Summary

- Exercise is just as important as diet for bone health
- Start slow and build your routine over time
- Be sure to include weight-bearing exercises into your routine
- Aim to include aerobic exercise, resistance exercise, flexibility, balance, and posture exercises to reap the full benefits



Resources for Exercise and Bone Health

- **Osteoporosis Canada**
  - https://osteoporosis.ca/bone-health-osteoporosis/exercises-for-healthy-bones/
- **Harvard Health Publishing**
  - https://www.health.harvard.edu/pain/effective-exercises-for-osteoporosis
- **Exercise Right**
  - https://exerciseright.com.au/osteoporosis/

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Questions?

Thank you for attending today's session