

Strong Steps: A Seminar on Fracture and Fall Prevention

Presentation

<https://bit.ly/fall-seminar-slides-2025>

Video

<https://youtu.be/1LRdwYgwY4k>



STRONG STEPS: A SEMINAR ON FRACTURE AND FALL PREVENTION

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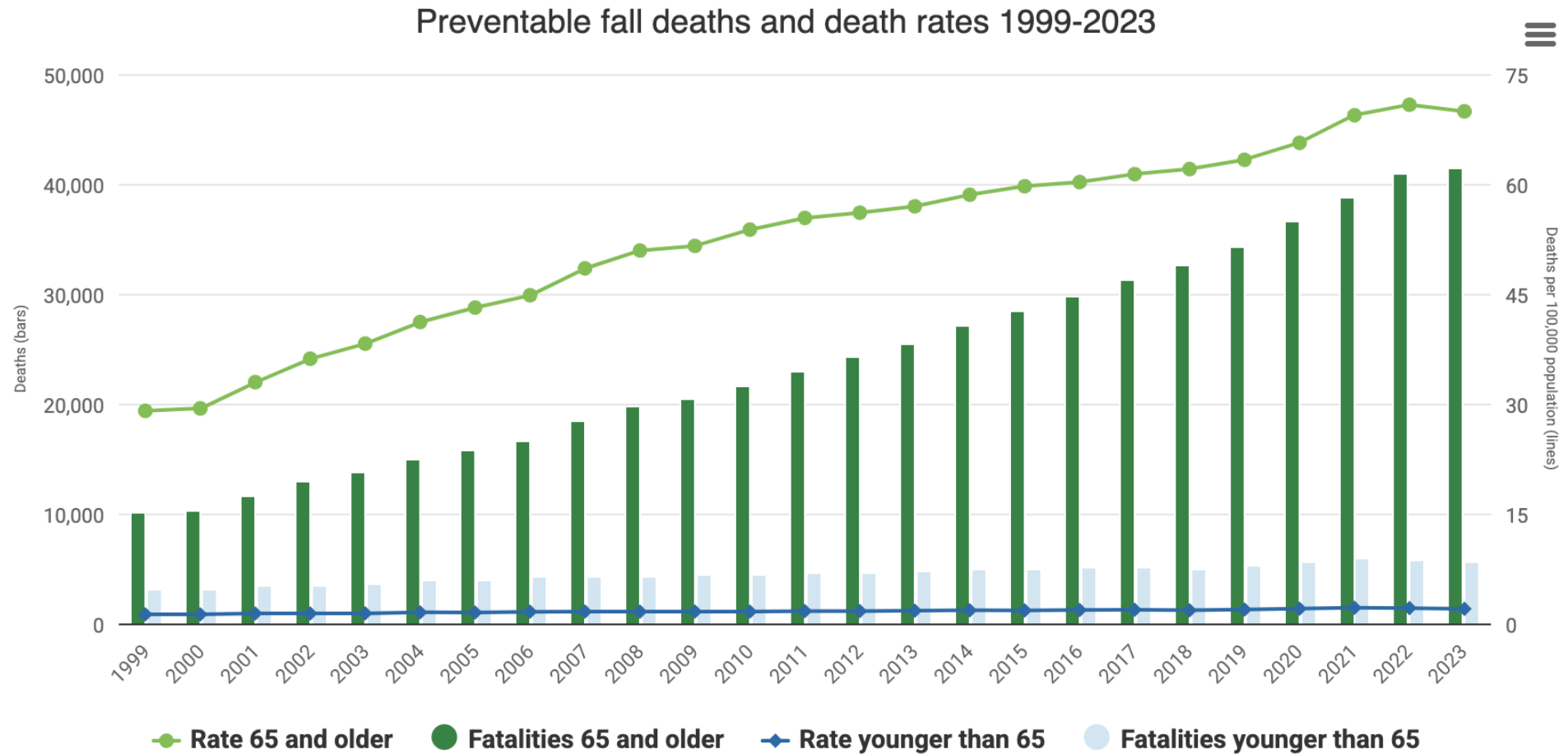
Disclosure:
Educational Talk, Not medical advice

WHY FALL PREVENTION MATTERS

- In the US about one in four adults over 65 will experience a fall each year
- Falls = Leading cause of both fatal and nonfatal injuries in seniors
- 2023 = 41,400 older Americans died from falls
- 2023 = 3.5 million older Americans treated in the ED for fall injuries



WHY FALL PREVENTION MATTERS



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Source: National Safety Council tabulations of National Center for Health Statistics data.

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WHY FALL PREVENTION MATTERS

Fall >
results in loss of independence >
results in fear of falling again >
results in less activity >
results in decreased mobility,
strength, and balance >
resulting in increased risk of fall

Falls account for 87% of all
fractures in elderly

20% of seniors who suffer a hip
fracture will die within a year due
to complications

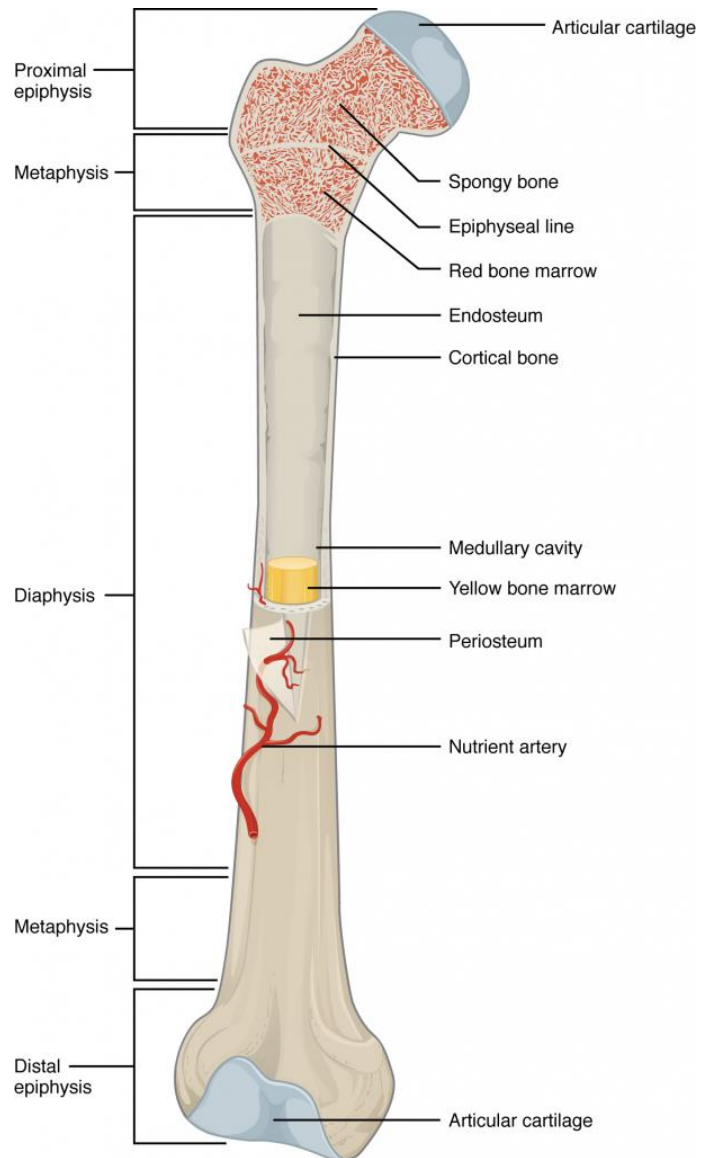
Peterborough average age
according to DataUSA.io:
2023 median age =
59.6 yrs old

Average age in US according to
CIA.gov 2022 estimate =
38.9 years old

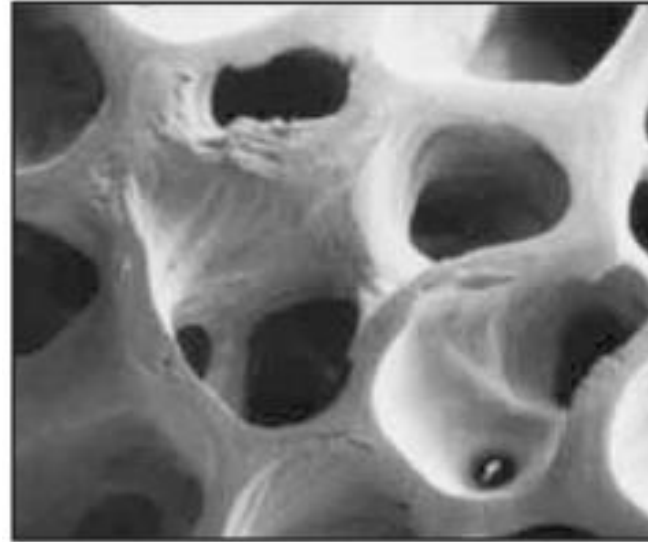
Goal by end of talk:
Find actionable ways for
community to try to improve their
health, safety and quality of life



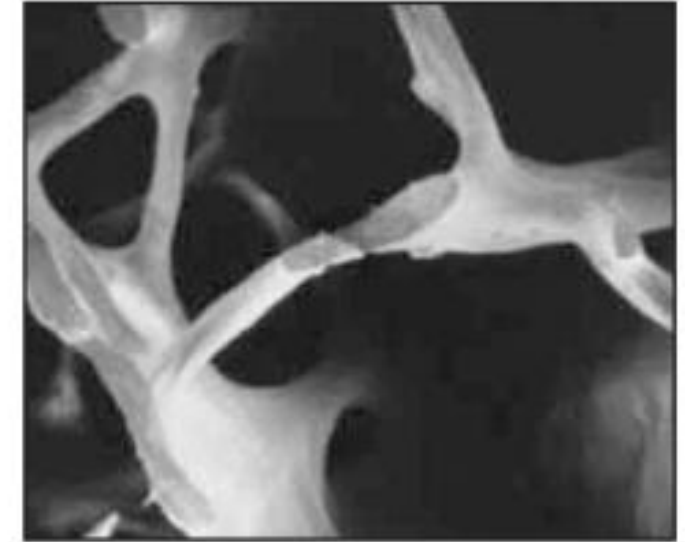
BONE BASICS



Normal Bone



Osteoporotic Bone

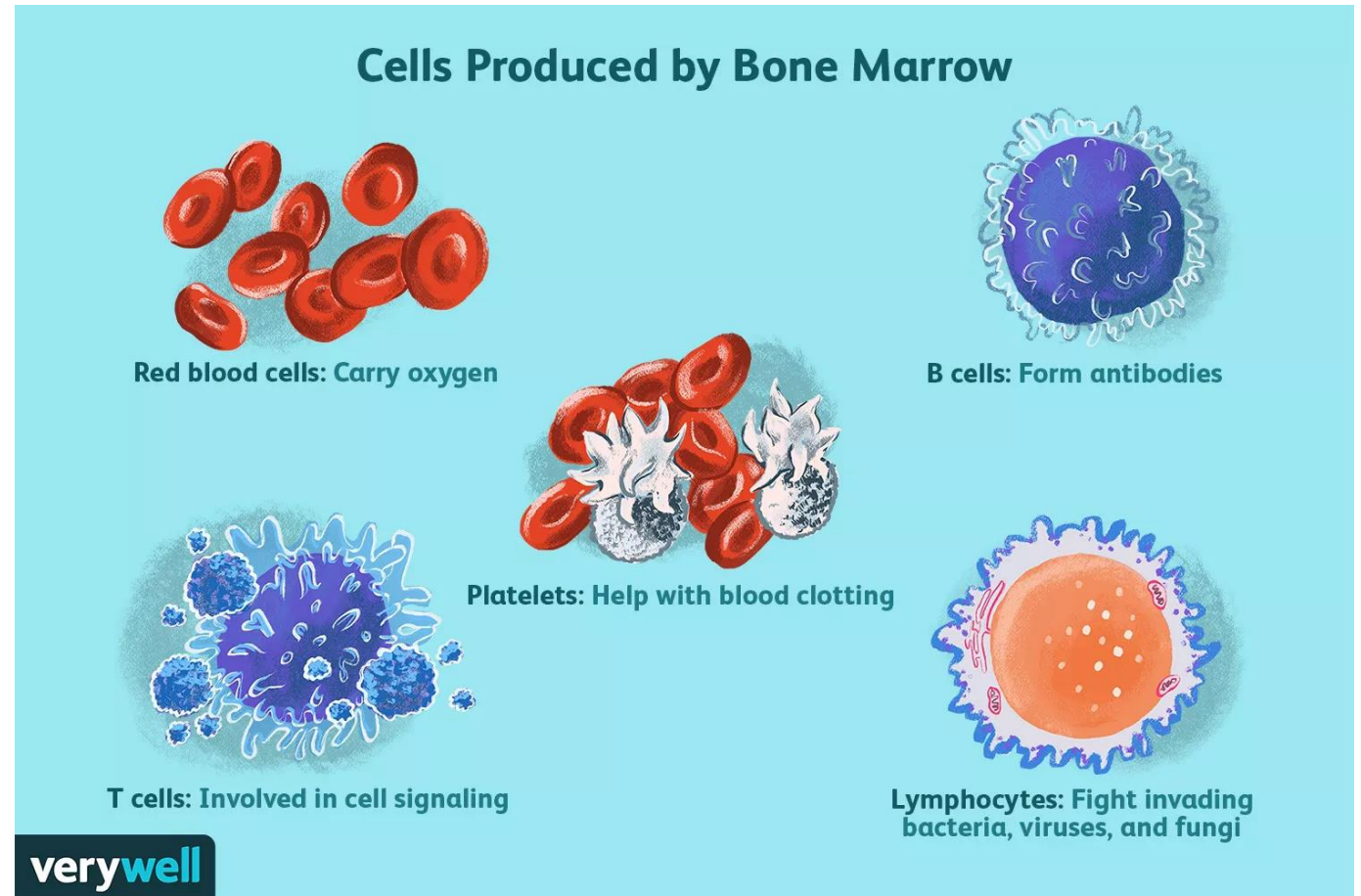


- Hard outer layer of cortical bone
- Spongy interior of trabecular bone
- Healthy bone: dense network
- Osteoporotic bone: gaps in trabecular bone leading to weakened struts



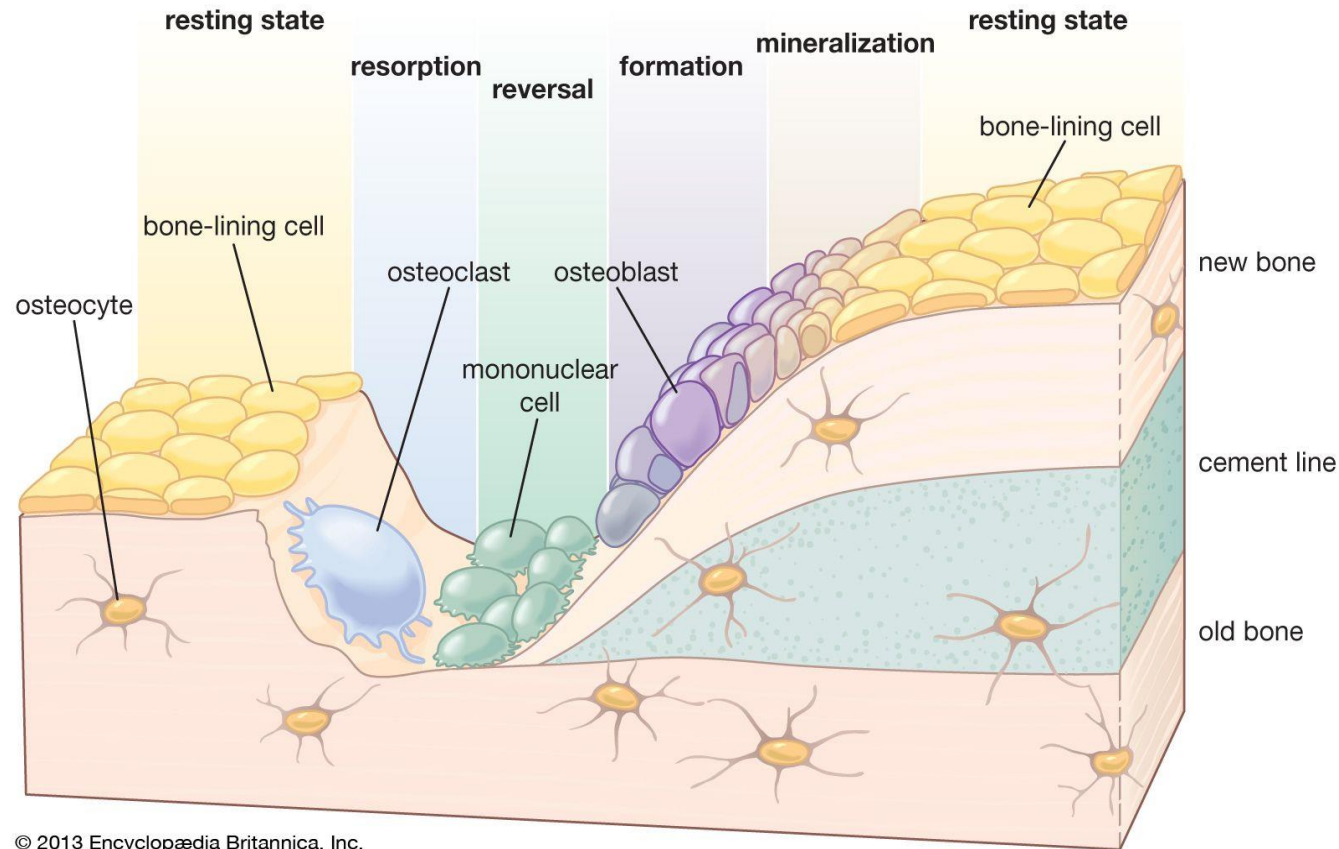
KEY FUNCTION OF BONE

- Structural support
- Protection of organs
- Movement
- Blood cell production = →
- Mineral storage:
 - Calcium phosphate
 - Carbonate
- Cations/Anions

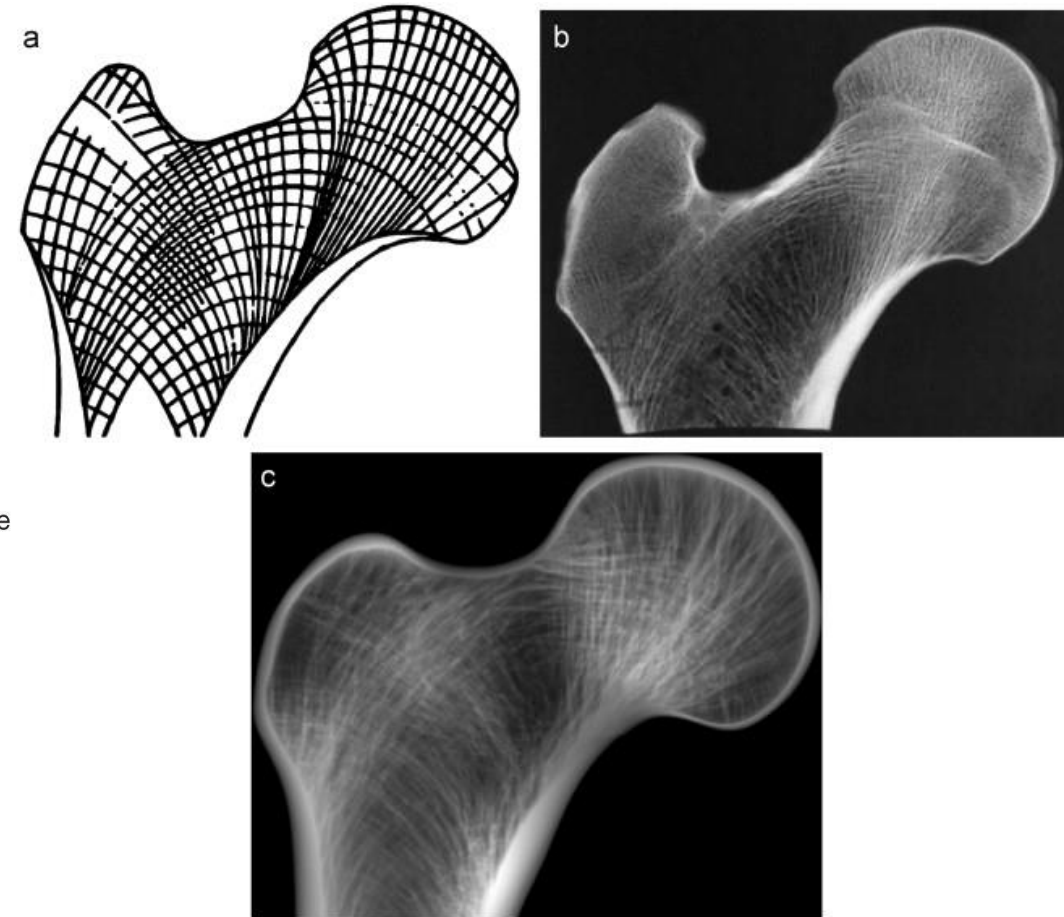


KEY FUNCTION OF BONE: REMODELING

Bone remodeling



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- Osteoclasts: remove old bone
- Osteoblasts: new bone is laid down
- Constant cycle allows bone to adapt to stress and heal from minor damage
- Wolffs Law: bone adapts to the degree of mechanical loading



BONE DENSITY ACROSS LIFESPAN

- About 90% of peak bone mass is acquired by age 18-20, with most reaching maximum bone density at age 30
- Bone nutrition: calcium, protein, vitamin D
- High impact activities: (Sports, jumping, running) can increase bone density by 1-6% in a span over just 6 months
- Higher bone mass by 30 = bigger bone bank (lowering risk of osteoporosis and fractures later in life)



MAINTAINING BONE DENSITY

Midlife and Older Age

- After Mid 30s we naturally start to lose a small amount of bone each year
- Women can lose bone rapidly in the first 5-10 yrs after menopause due to dropping estrogen level
- Hope is not lost: Lifestyle can slow or even partially reverse bone loss (nutrition and exercise)
- Bones remain responsive to exercise even later in life
- Regular strength training in post-menopausal women and older men has been shown to significantly increase BMD in the spine and hip over 6-12 months, effectively slowing or reversing age related bone loss
- Quick healthy habits: avoid smoking and excessive alcohol, maintain healthy weight, balanced hormones
- Even in our 70s and 80s it's never too late to adopt bone healthy habits to improve balance, strengthen bones to help prevent falls



IMPORTANCE OF NUTRITION FOR BONE HEALTH

Calcium:

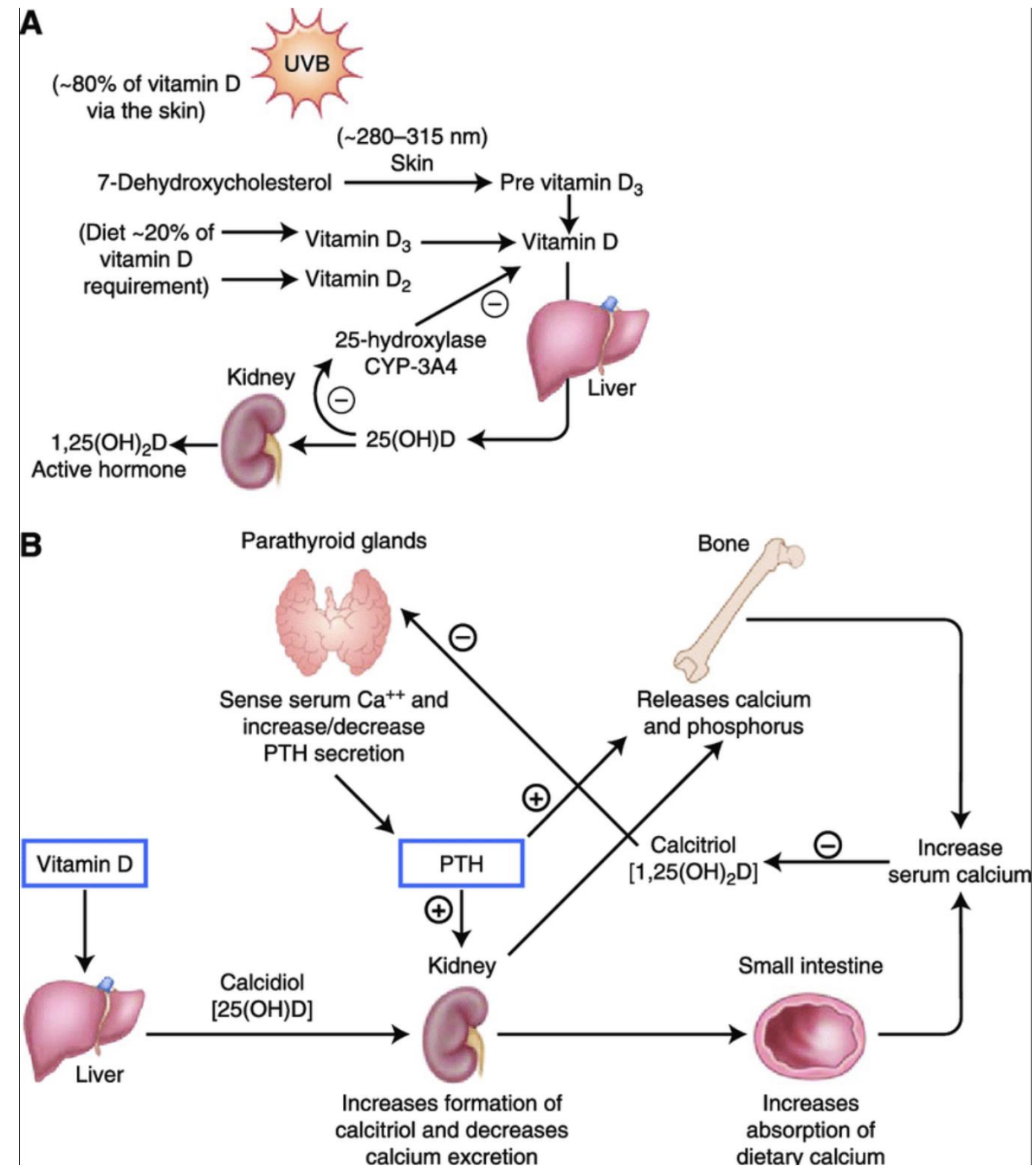
- Adults 19-50 need approx. 1,000mg of calcium per day
- Women over 50, Men over 70 need approx. 1,200mg of calcium per day
- Low calcium = calcium is being pulled from bone
- Dietary sources: dairy products, leafy green vegetables, sardines, salmon and fortified food



IMPORTANCE OF NUTRITION FOR BONE HEALTH

Vitamin D:

- Recommended intake is 600 IU/day for adults up to age 70
- Recommended intake is 800 IU/day for adults over 70
- Sunlight exposure allows you skin to produce vitamin D but older adults and New England residents often need dietary sources/supplementation to offset the limited sun exposure
- Adequate Vitamin D improves muscles function/balance = decreasing fall risk
- Vitamin D deficiency is linked to muscle weakness and falls



IMPORTANCE OF NUTRITION FOR BONE HEALTH

Protein:

- Adequate levels help preserve bone mass and muscle strength
- Low protein in diet can impair bone building and reduce insulin growth factor 1, which helps promote bone formation and calcium absorption
- Frail older adults with inadequate protein often have lower BMD and higher fracture rates
- Dietary Sources: Lean proteins such as poultry, fish, beans, nuts, dairy
- Protein intake + exercise = enhanced muscle and bone recovery in seniors



IMPORTANCE OF NUTRITION FOR BONE HEALTH

■ Fruits and Vegetables

Diet with <5 servings of fruit and vegetables per day are associated with lower bone density and higher fracture risk in older adults

Nutrients such as magnesium (greens, nuts, whole grains) and Vitamin K (leafy greens) are important for bone metabolism

■ Limit Alcohol:

>2 drinks per day linked to increased fracture risk chronic heavy drinking
>4 drinks per day can double risk of osteoporosis related fractures



■ Limit Caffeine

High caffeine intake (>4 cups of coffee) can cause calcium loss in urine and been linked to a slight increase in fracture risk



SURPRISING ROLE OF SLEEP

In Bone Health and Fall Prevention

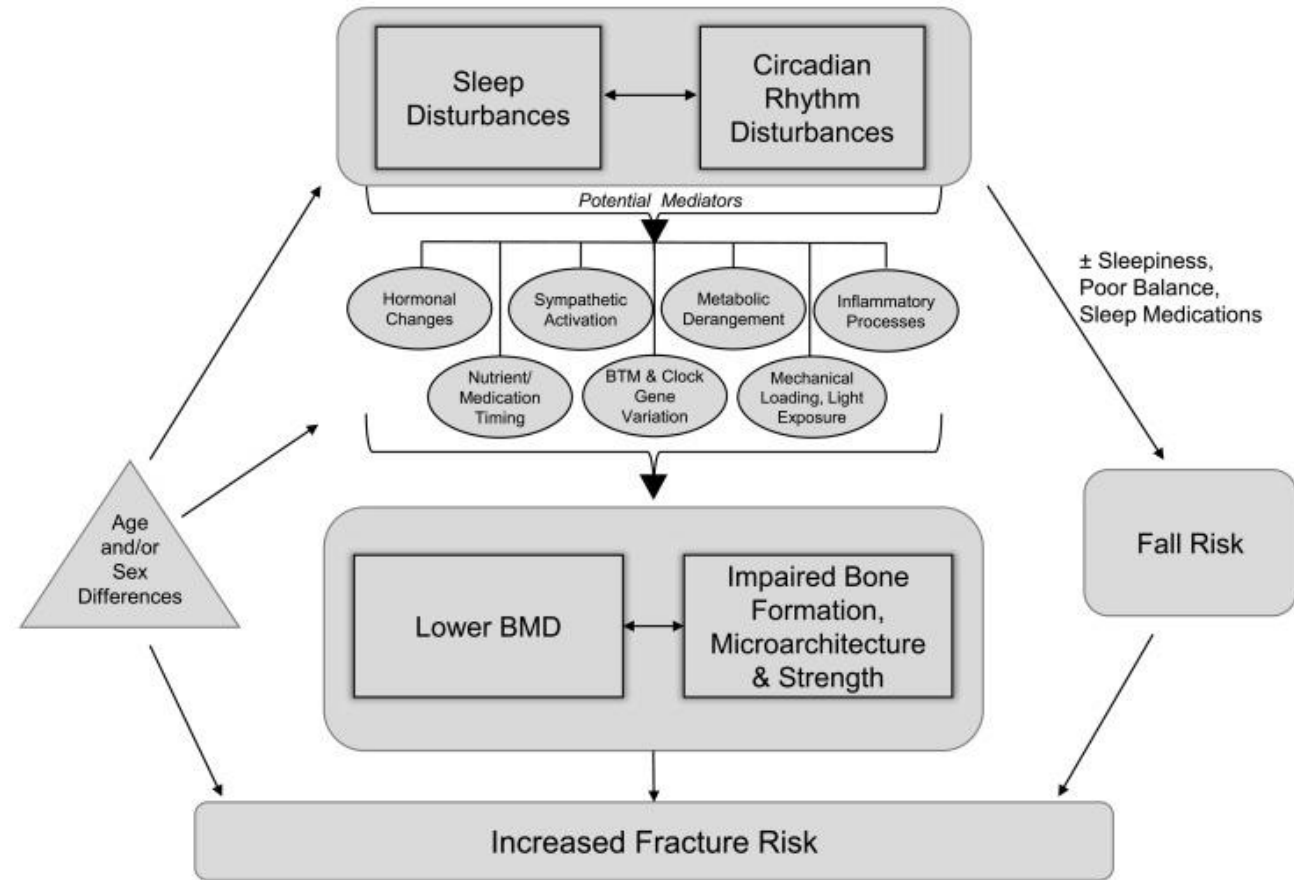
■ Sleep and Bone Density

Short sleep (<5hrs per night) linked to lower BMD and higher osteoporosis risk, as is very long sleep >10 hours

Chronic insomnia and poor sleep quality can elevate inflammatory markers that may accelerate bone loss

Cross Sectional Study: Women over 50, who slept less than 5 hours had significantly higher odds of low bone density

Explanation is likely hormonal and metabolic with sleep deprivations alter hormones such as GH and cortisol affecting bone remodeling



SURPRISING ROLE OF SLEEP

In Bone Health and Fall Prevention

Sleep and Falls

- Insufficient or disrupted sleep = increase fall risk
- Fatigue, grogginess (esp. if on sedating medications), impaired concentration from poor sleep can lead to missteps and balance issues
- Sleep apnea (leads to daytime dizziness) and sleep aid medications can further raise risk
- Study: 289k adults with healthy sleep (7-8 hrs, no frequent insomnia or excessive daytime sleepiness) had a 17% lower risk of falls, 28% lower risk of fractures over 12 years compared to those with poor sleep habits, independent of baseline BD



EXERCISE: STRENGTHENING MUSCLES AND BONES TO PREVENT FALLS

Regular exercise is one of the most effective strategies to prevent osteoporosis and falls

Exercise: increases bone/muscle strength and improves balance/coordination

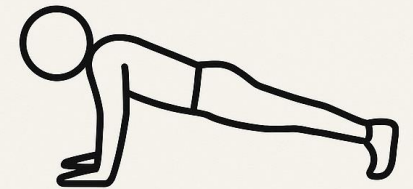
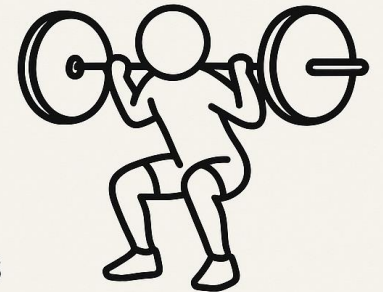
- Strength and resistance training:

Causes muscles to pull on bones, stimulating bone growth and strengthening muscle

Can significantly increase BMD in hip and spine (as shown in a 12 month weight training program in postmenopausal women)

Actionable Goal:

Aim for two days of strength training, with a focus on major muscle groups/compound exercises (if safely able to do with proper form) or start with bodyweight exercises.



- Stronger muscles = better support and shock absorption for joints



EXERCISE: STRENGTHENING MUSCLES AND BONES TO PREVENT FALLS

Weight Bearing Aerobic Activity

Ex: Hiking, dancing,
climbing, low impact jogging

Helps maintain bone density
by signaling bones to stay
strong as well as heart
health

**What could 150 minutes of moderate-intensity
physical activity look like each week?**



10 minutes
of vacuuming



20 minutes
of dancing



60 minutes
of gardening



60 minutes
of walking

Experts recommend older adults to get at least 150 minutes of moderate intensity aerobic exercise per week

Ex: 30 min brisk walk 5 days per week



EXERCISE: STRENGTHENING MUSCLES AND BONES TO PREVENT FALLS:

Balance and Flexibility training

Numerous studies show that balanced focused programs can reduce falls by 25-50% in community dwelling older individuals

Tai Chi: shown to reduce fall rates by around 45-50% in seniors who practice regularly

- Balance training:

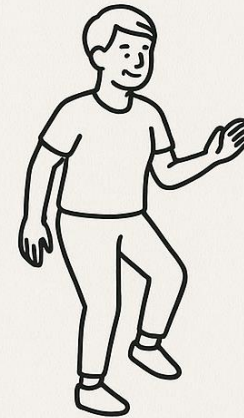
Strengthen core/hips. Increase reaction time

ex: heel to toe walking, single leg stands (use support if needed), guided balance classes



ACTIONABLE GOAL PER WEEK

**2 STRENGTH
SESSIONS**



**2 BALANCE
SESSIONS**

**AT LEAST 150
MINUTES OF
MODERATE-
INTENSITY
AEROBIC EXERCISE**



Should be appropriate for individual health status

Ensure safety and do a slow, gradual progressive overload

HOME SAFETY MODIFICATIONS:

Fall Proofing the Environment

National Institute on Aging Mod Recommendations:

Reduce clutter and trip hazards:
remove or secure loose throw rugs

Improve lighting:
especially at the top/bottom of stairs

Stair and bathroom safety:
install sturdy handrails on all stairways
and grab bars

Flooring:
ensure floors are not slippery, avoid
waxing/ high gloss tiles

Furniture Arrangement:
create clear walking paths, avoid items
with sharp corners, consider height of
chairs/bed

Assistive Devices

Medical alert systems:
pendants or watches that
can call for help

Footwear:
avoid walking in only socks
or smooth slippers on
tile/wood floors

By addressing these
environment factors, we
engineer out many
common causes of falls



MEDICATIONS AND INTERVENTIONS TO PROTECT BONE HEALTH:

Bisphosphates

Most common med class. ex Alendronate, Risedronate, Zoledronic acid

Work by slowing down bone resorption, over a few years they help stabilize or modestly increase BMD

Clinical trial show increase in spinal bone density by 5-7% over 3 years

Shown to reduce the risk of vertebral fractures by 60-70% within 1 year, lower hip fracture risk by about 40-50% in treated patients

Generally recommended for postmenopausal women or older men with a DXA bone density T score ≤ -2.5 or with history of fragility fractures



MEDICATIONS AND INTERVENTIONS TO PROTECT BONE HEALTH:

Denosumab (Prolia) and Anabolic (Bone Building) Agents

Denosumab

- Injected antibody (given every 6 months)
- Stops formation of osteoclasts
- Option for patients who can't take biphosphates or have reduced kidney function
- Increases bone density and reduces fractures in osteoporosis, however if discontinued bone loss can rebound quickly

Anabolic Agents (Bone Building) Agents

- Stimulate new bone formation
- Teriparatide (Forteo) and Abaloparatide (Tymlos): Daily injectables of PTH
- Romosozumab (Evenity): Newer medication, Monthly injection that both builds bone and slow resorption
- Can increase BMD (Often 10%+ at the spine 1-2 years) and reduce fractures
- Typically used for limited duration/ high risk cases due to cost and specific risk



MEDICATIONS AND INTERVENTIONS TO PROTECT BONE HEALTH:

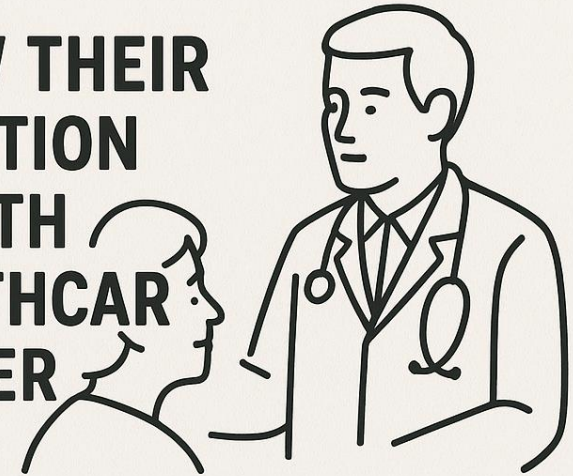
Fall Increasing Medications

- Some medications for other conditions can increase fall risk (by causing sedation, decrease in BP or dizziness)
- Common culprits: sleep aids, tranquilizers, some antidepressant, BP medications, diabetes medication



ACTIONABLE GOAL

REVIEW THEIR MEDICATION LIST WITH A HEALTHCARE PROVIDER



HAVE A CONVERSATION ABOUT FALL RISK

NEVER STOP MEDICATIONS ON YOUR OWN

IN SOME CASES, CHANGING MEDICATIONS CAN REDUCE DIZZINESS AND PREVENT FALLS

MEDICATIONS AND INTERVENTIONS TO PROTECT BONE HEALTH:

Bone Density Testing and Treatment Decisions

Bone Density Test (DXA):

- Identifies osteoporosis, osteopenia, bone fracture risk
- Measures strength and mineral content of bones
- Painless, quick, outpatient, usually 30 minutes
- Lay on X-ray table; hip and spine are scanned
- Bone density scanner uses two types of low-level radiation to interpret bone density.

Advised to get a bone density scan:

- Women over 65
- Men over 70
- People over 50 who have broken a bone in the past
- Biological parents/grandparents have osteoporosis
- People who've lost 1 ½ inches or more of height from tallest height

Advised **NOT** to get a bone density scan:

- Pregnant



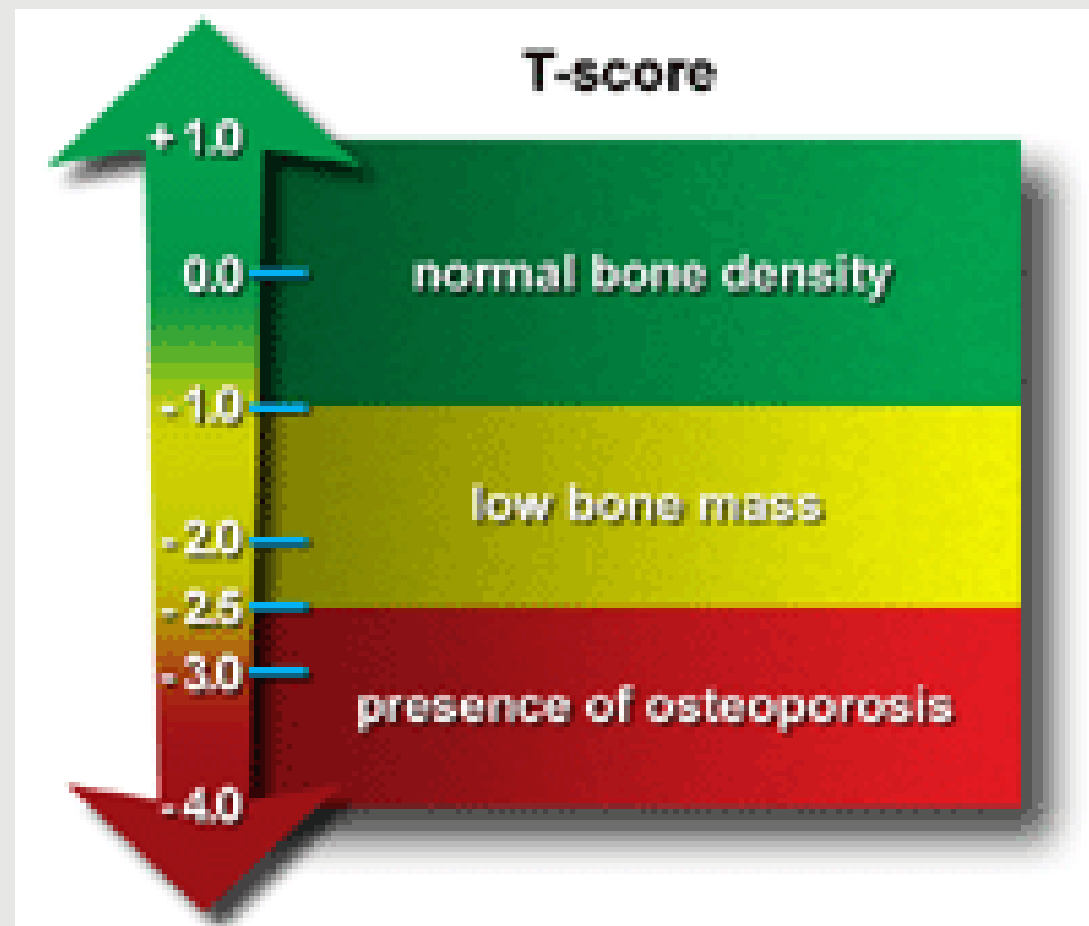
MEDICATIONS AND INTERVENTIONS TO PROTECT BONE HEALTH:

Bone Density Testing and Treatment Decisions

T Score: Compares bone density to that of a healthy 25-35 yr old of the same sex, ethnicity

World Health Organization:

- +1 to -1 SD: Normal BMD (bone mineral density)
- -1 to -2.5 SD: Osteopenia
- More than -2.5 SD: Osteoporosis



CONCLUSION: ACTIONABLE STEPS

Adequate calcium, vitamin D, protein, fruits, vegetables

2 days of strength training and resistance training

150 minutes of weight bearing aerobic activity

2 days of balance and flexibility sessions

Fall proof the home environment

Talk to your PCP to see if you could benefit from a DXA or adding/removing medications if needed



QUESTIONS?



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