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HOW COMMON IS OSTEOPOROSIS & OSTEOPENIA?

- We lose some bone density every decade from the age of 30 onwards (Benedetti et al., 2018).

- In 2022, approx. 6.2million Australians over 50 have osteoporosis, osteopenia, or poor bone health, which is 66% of all Australians over 50 (Osteoporosis Australia, 2022).

- Of these people, 22% have osteoporosis and 78% have osteopenia.

- Not just a women's issue: men account for approximately 30% of osteoporotic fractures recorded.

HOW DO I KNOW IF I HAVE IT?

- Osteoporosis is SILENT i.e. there are no symptoms

- Often people do not know they have it until a DEXA scan or a fracture from something unexpected (e.g. stepping hard off a curb)

- Osteoporosis is not osteoarthritis – osteoarthritis relates to joints & often has symptoms. They are not related.

- It is not a reflection on your health or lifestyle choices if you have osteoporosis/penia.
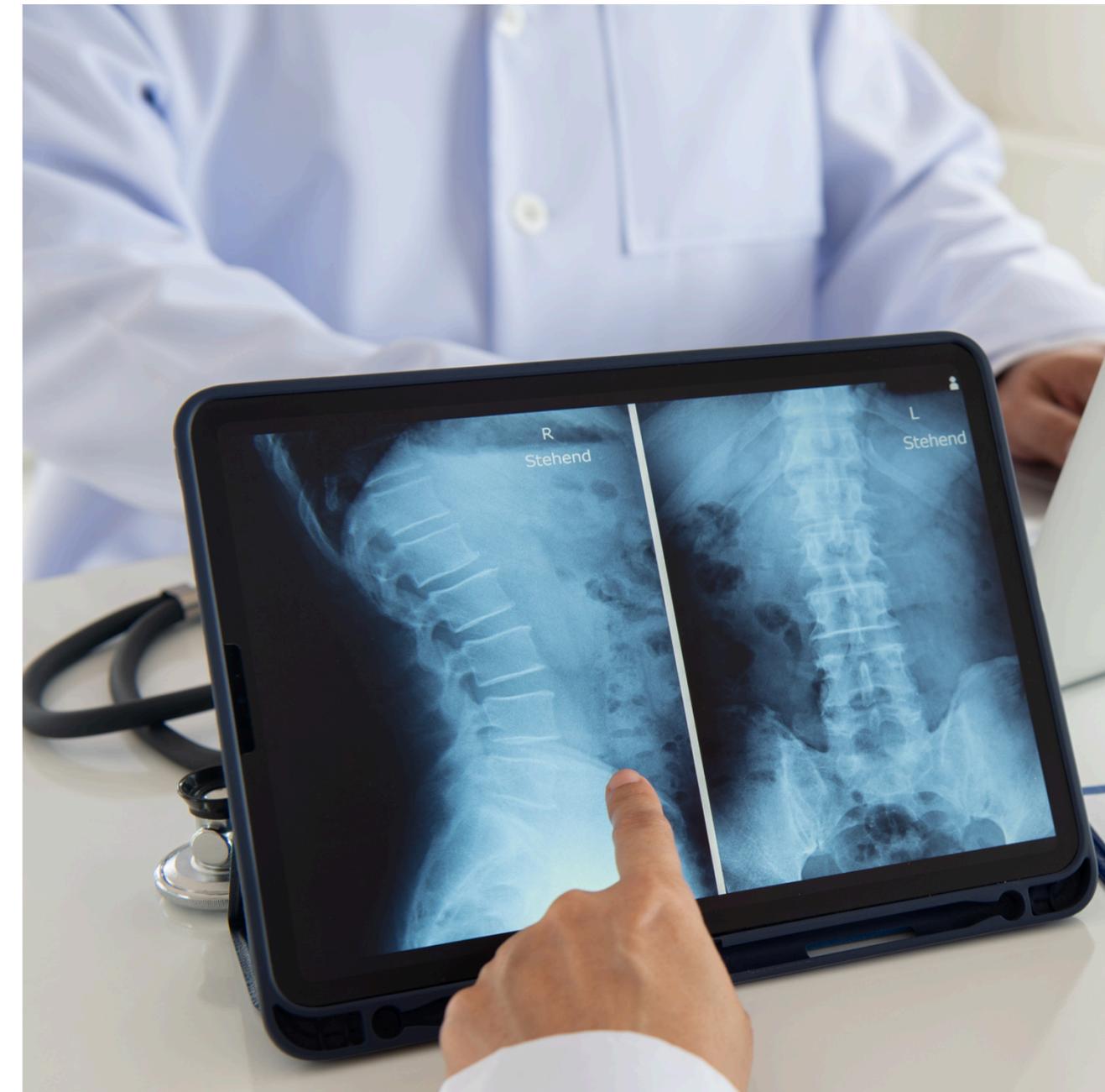
WHAT IS OSTEOPOROSIS OR OSTEOPENIA, EXACTLY?

- These are diagnoses based on your T score, which is found with a DEXA scan (Josh to discuss).
- Bone density represents about 60% of the total picture of your bone health (Osterhoff et al., 2016).
- The ability of your bones to resist fracture is also dependent on bony architecture.

THE MAKE-UP OF OUR BONES

- Outside of bone = hard shell = cortical bone

- Inside of bone = lattice type structure = trabecular bone

- Osteoporosis in earlier stages more primarily affects trabecular bone

- Higher % of trabecular bone in vertebrae, calcaneus (heel bone), end of radius (forearm bone)

Cartilage

Cortical bone

Periosteum

Endosteum

Bone marrow
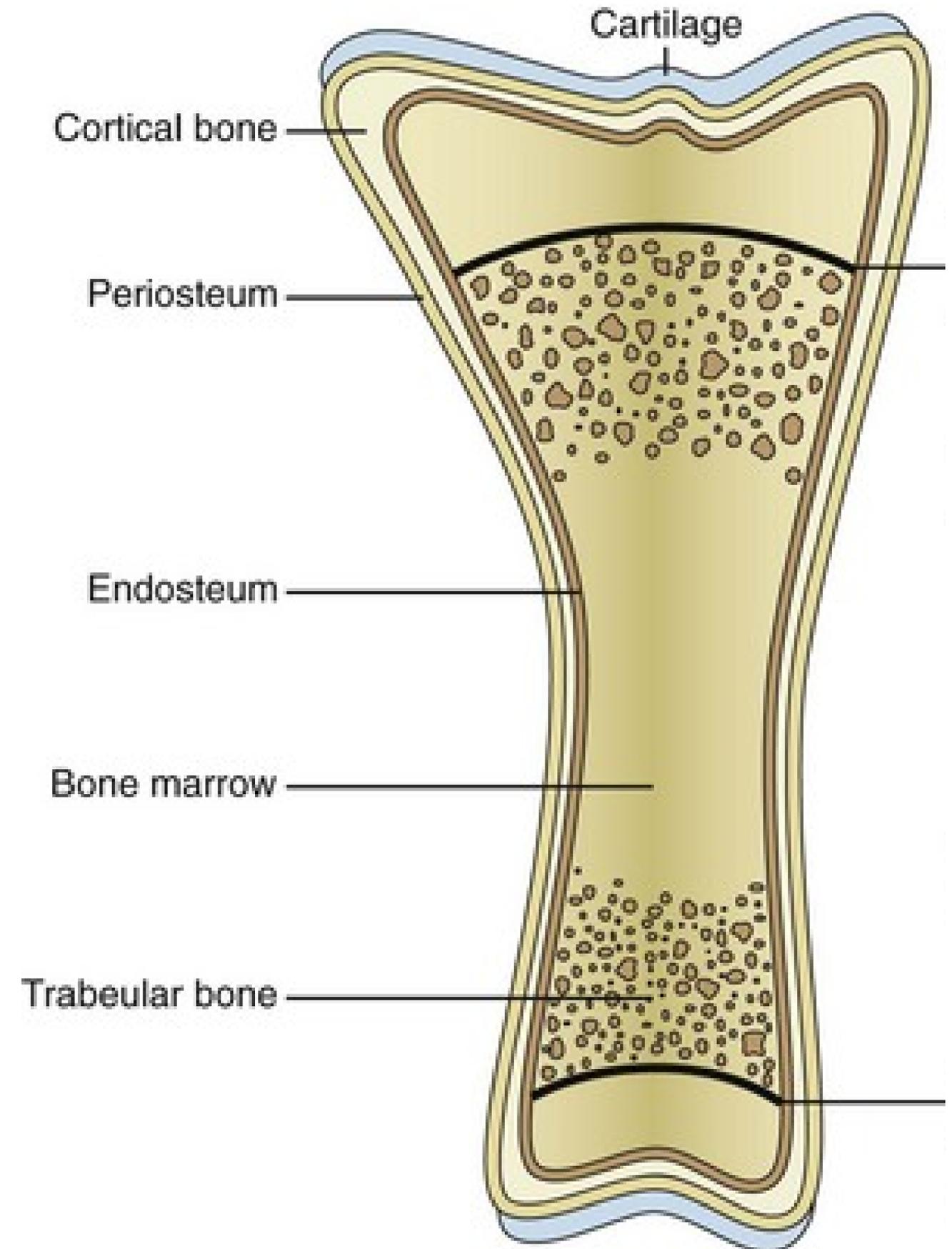
Trabeular bone

BONE LOSS OVER TIME

- Initially in earlier osteoporosis a higher percentage of trabecular bone is lost

- in later stages, a higher percentage of cortical bone is lost

- consequently, risk of vertebral fracture is higher younger and risk of hip fracture is higher later (Osterhoff et al., 2016)
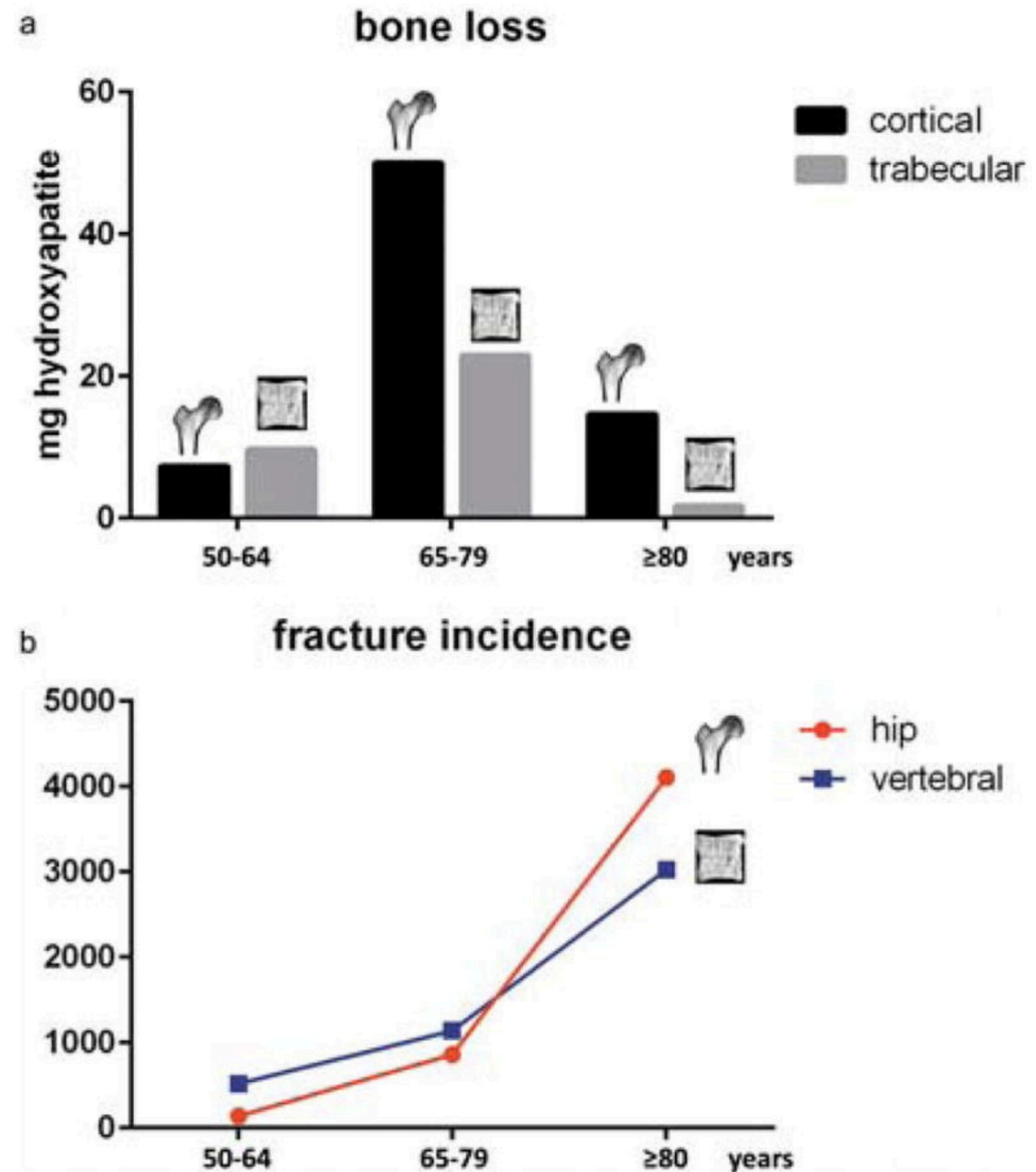
DIAGNOSTIC DEXAS

- Diagnositic DEXA scans for those at risk of having osteoporosis report **FRAX**: fracture risk assessment (likelihood of vertebrale fracture or major fracture in the next 10 years) and **TBS**: trabecular bone score

- TBS takes into account strength of bones, not just density

- Combination of BMD + TBS + other specific factors used to calculate FRAX (Australian and New Zealand Bone and Mineral Society (ANZBMS)).
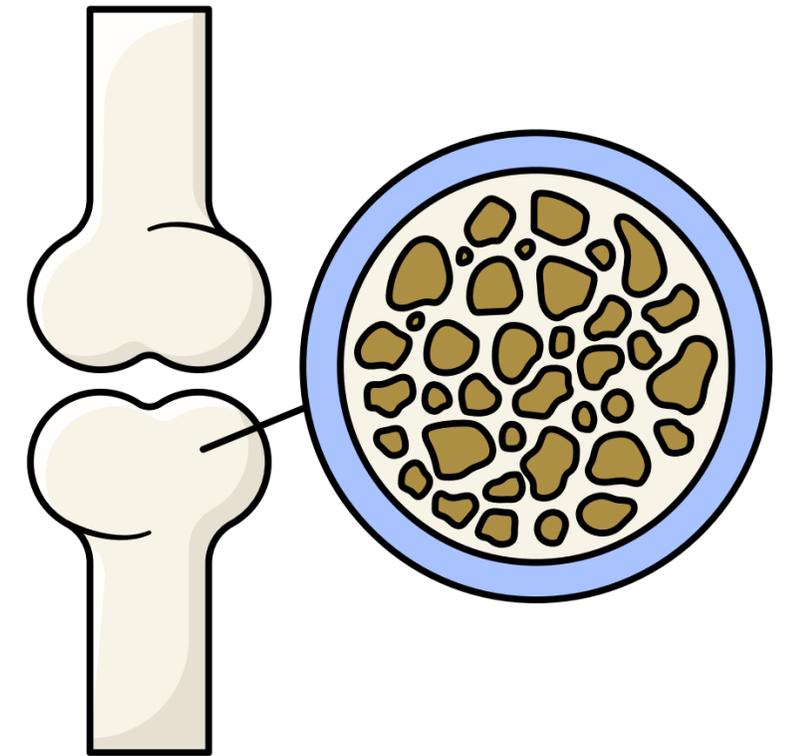
WHO IS AT RISK?

- We build most of our bone density by age 20. Peaks at 30, then starts to decline (Tu et al., 2018).
- Declines more quickly in women post menopause due to ↓ oestrogen.
- Women generally start with lower bone mass than men.
- Can lose 10% of bone mass in first 5 years post menopause (menopause.org.au).
- → post menopausal women have an inherently higher risk.

WHO IS AT RISK?
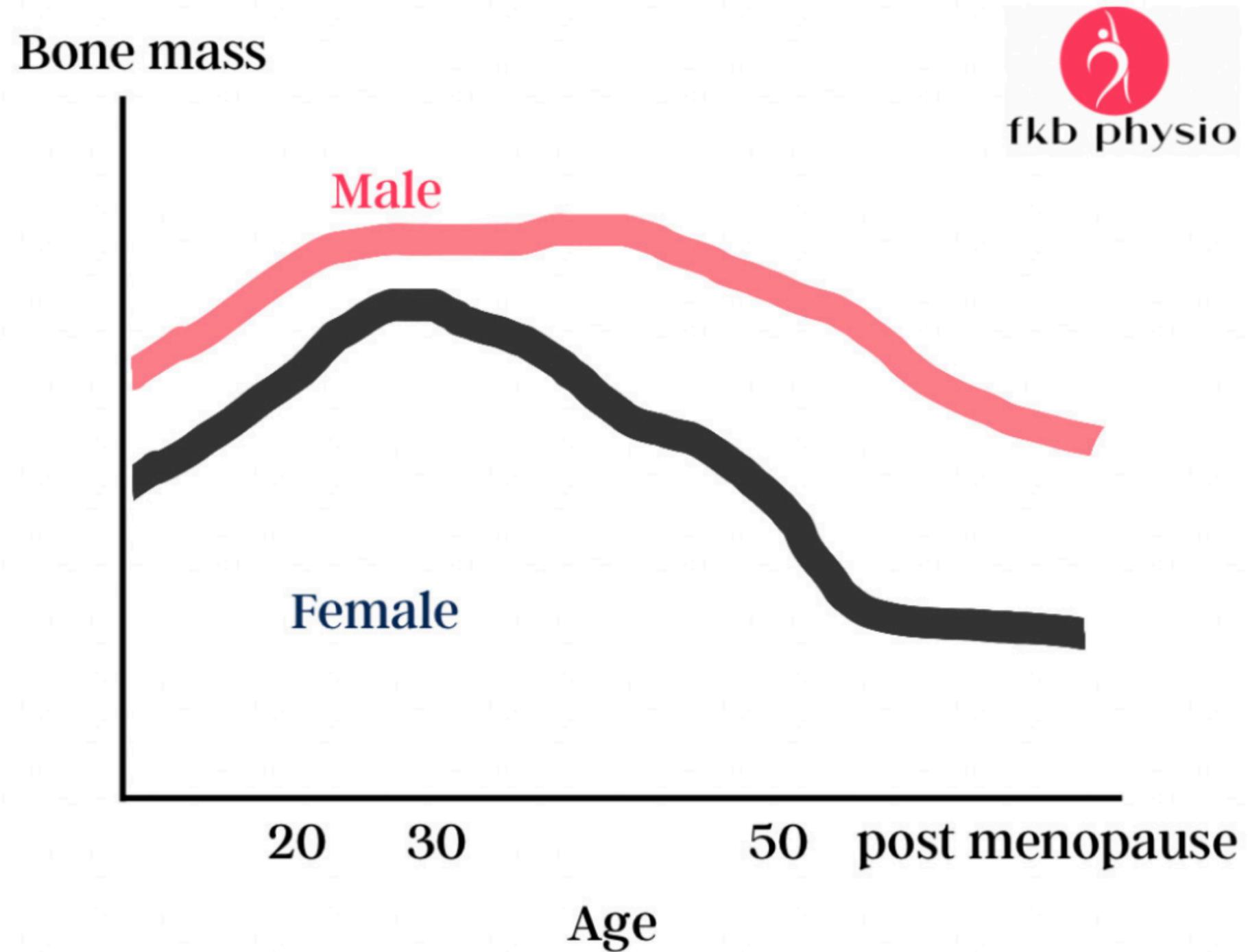
(Adapted from Santos et al., 2017)

POOR BONE HEALTH RISK FACTORS

fkb physio

·Early menopause
·Hypogonadism (low production of either testosterone or oestrogen)
·Low physical activity levels
·Low body weight
·Low muscle mass
·Low strength
·Poor balance
·Protein or calcium undernutrition
·Smoking
·Drinking >2 alcoholic drinks per day
·Vitamin D insufficiency

Taken from RCAGP Osteoporosis Flow Chart, racgp.org

POOR BONE HEALTH RISK FACTORS

fkb physio

Having one or more of these conditions:
-Rheumatoid arthritis, hyperthyroidism, Chronic kidney disease, chronic liver disease, coeliac disease, diabetes, myeloma, organ transplant, bone marrow transplant, HIV, depression

Use of one or more of these medications:
-Glucocorticoids (e.g. cortisone, prednisolone)
-Excess thyroid hormone replacement
-Aromatase inhibitors
-Anti-androgen therapy

Taken from RCAGP Osteoporosis Flow Chart, racgp.org

HOW & WHY DO OUR SKELETONS BECOME LESS STRONG

Calories

Mechanical load

Hormones

fkb physio
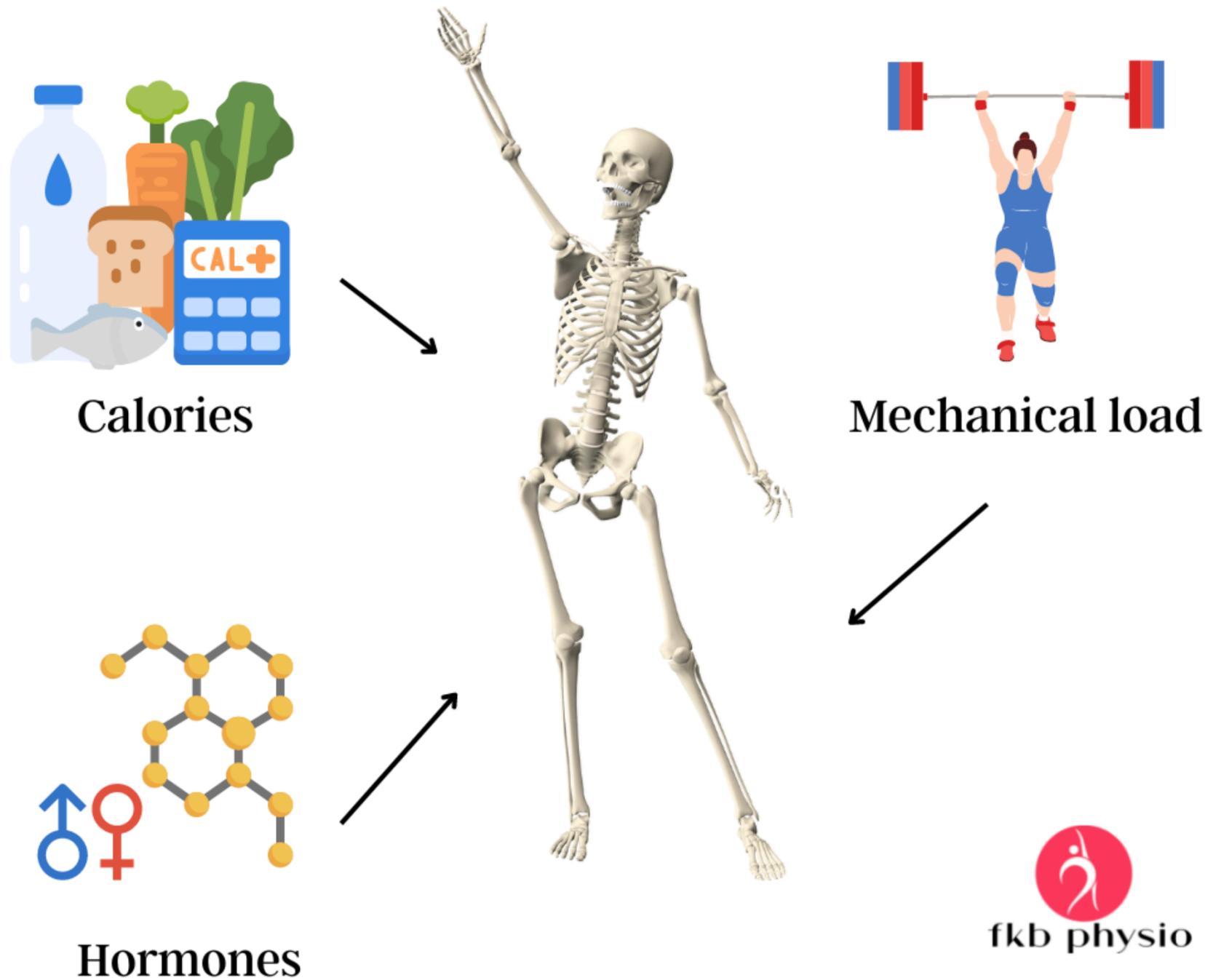
- Bones are living
- Constantly regenerating & adapting in response to mechanical load (Hadjidakis & Androulakis, 2006).
- Osteoclasts = clear away dead tissue
- Osteoblasts = lay down new tissue
- Ideally osteoblasts and osteoclasts operate at the same rate

HOW & WHY DO OUR SKELETONS BECOME LESS STRONG

- **Primary osteoporosis**: age related: decreased oestrogen, vitamin D3, calcium absorption

- **Secondary osteoporosis**: developed secondary to a health condition, medication, etc, outside of age/menopause related changes.

- → bone remodelling process becomes unbalanced; more clearing away, less new bone laid down → overall starts to reduce in density/strength.

WHAT CAN WE DO?

There are two clear goals when it comes to bone health:

1. Build as strong/ solid/ heavy/ dense skeleton as possible

2. Hold onto as much of that as you can over time, remembering: load on skeleton; enough food; calcium and vit D; minimising factors that reduce BMD (where possible)

NEW CONSIDERATIONS WITH GLP1 MEDICATIONS

- There appears to be a link between both types of diabetes and osteoporosis
- GLP1 (glucagon-like-peptide) medications like Ozempic and Wegovy, which are often prescribed for those with type 2 diabetes, may have positive impacts on bone health, theoretically (Zhao et al., 2017)
- GLP1 medications tend to result in significant weight loss which consists of both fat and muscle. Significant loss of muscle is associated with loss of BMD (Jensen et al., 2024)
- Resistance based exercise can mitigate this loss of BMD (Jensen et al., 2024)

WHAT IS A DEXA?

DEXA (Dual–Energy X-ray Absorptiometry)
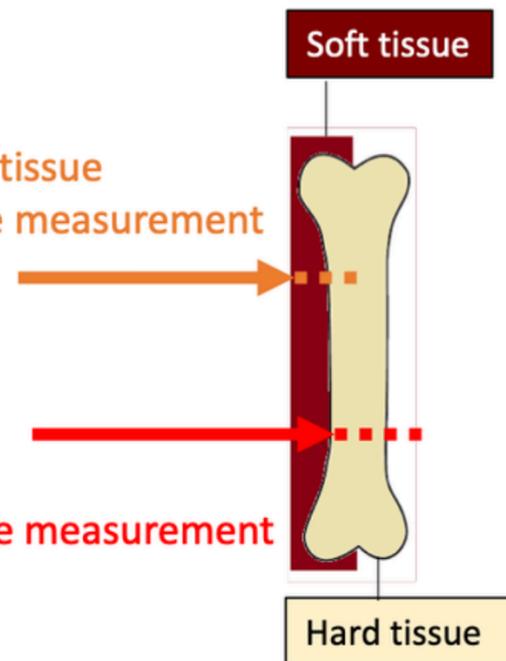
- Uses low-dose x-rays at two different energy levels to differentiate between bone tissue and soft tissue.
- ~4 minute duration.

Soft tissue

Low energy photons
- attenuated heavily by hard tissue
- more relevant to soft tissue measurement

High energy photons
- easily penetrate soft tissue
- more relevant to hard tissue measurement

Hard tissue

EXAMPLE RESULTS:

- Gold standard
- **T-Scores for Diagnosis**
  - –1.0 or above is considered normal.
  - Between –1.0 and –2.5 indicates osteopenia.
  - –2.5 or below indicates osteoporosis.
- **The Z-score** compares a person's bone density to what's expected in an individual of the same age, sex, and size.
- This is a 'Full Body Scan' example

DXA Results Summary:

Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T-score	Z-score
L Arm	161.48	122.45	0.758		
R Arm	162.28	124.02	0.764		
L Ribs	102.03	64.07	0.628		
R Ribs	117.69	73.50	0.624		
T Spine	124.52	92.60	0.744		
L Spine	60.25	62.90	1.044		
Pelvis	222.13	270.13	1.216		
L Leg	303.67	346.70	1.142		
R Leg	304.07	366.31	1.205		
Subtotal	1558.12	1522.69	0.977		
Head	228.16	465.75	2.041		
Total	**1786.28**	**1988.44**	**1.113**	**0.1**	**0.1**

Total BMD CV 1.0%

Total

Age
Fracture Risk

■ Not Increased □ Increased ■ High
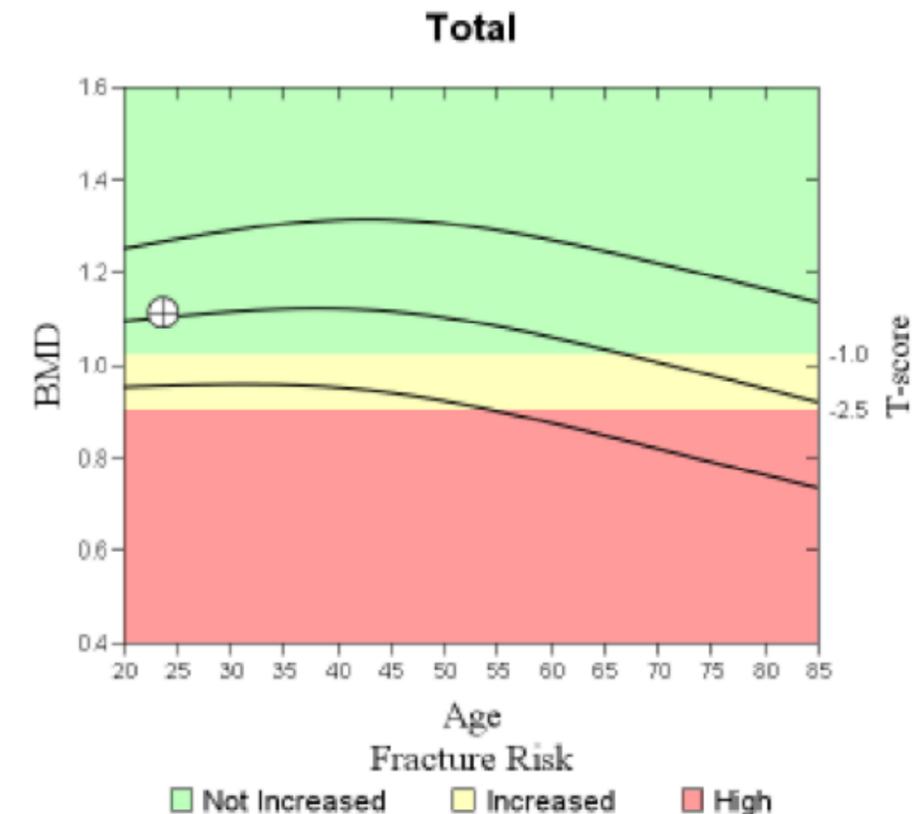
T SCORE EXPLAINED
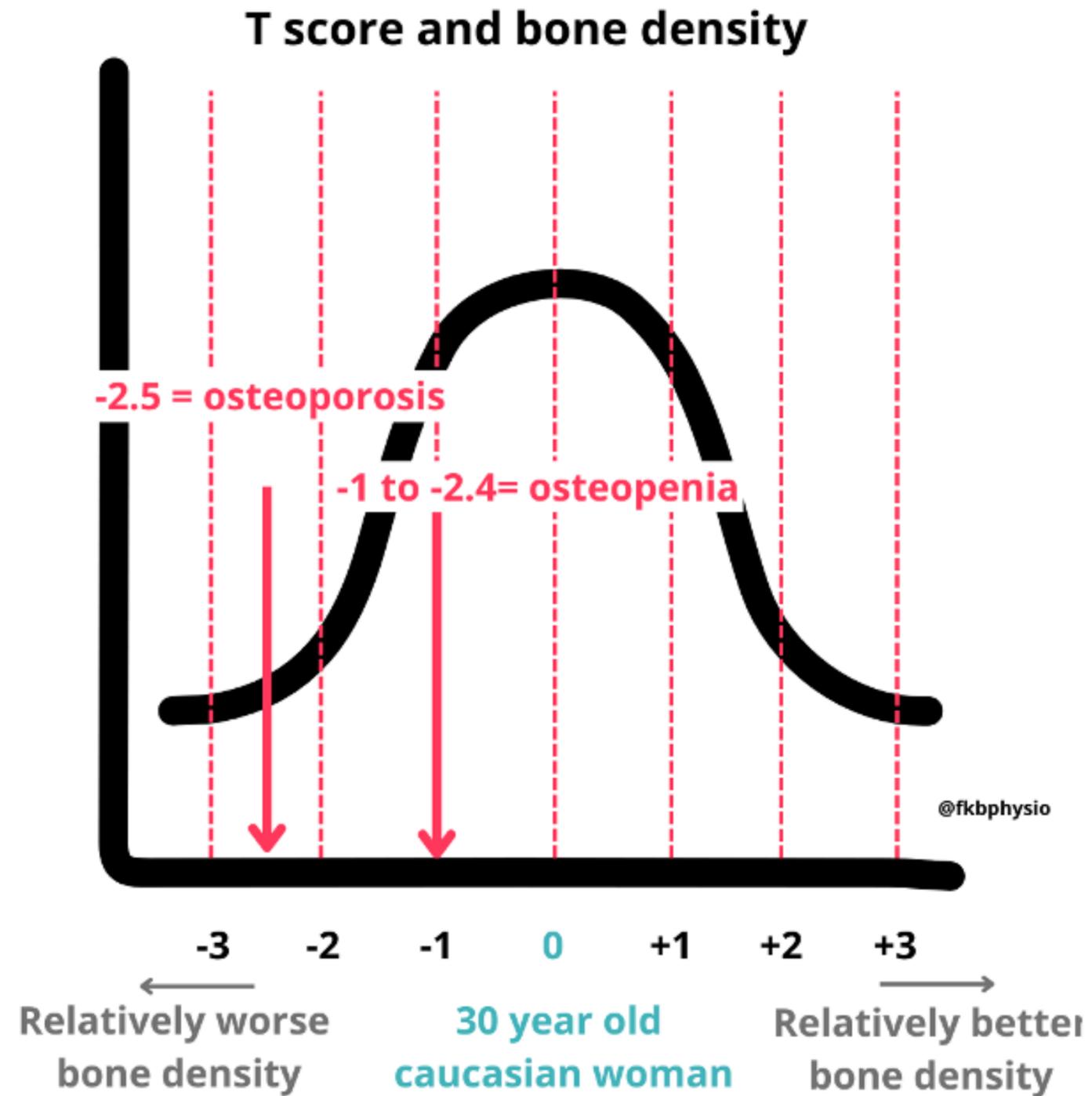
WHAT ELSE IT TESTS

- Body Fat %
- Lean Mass
- Fat Mass / Fat Mass Index
- Android/Gynoid Profile
- Visceral Fat
- Regional Breakdown

Total Body % Fat

Source: AIMSS reference values for body composition

World Health Organization Body Mass Index Classification
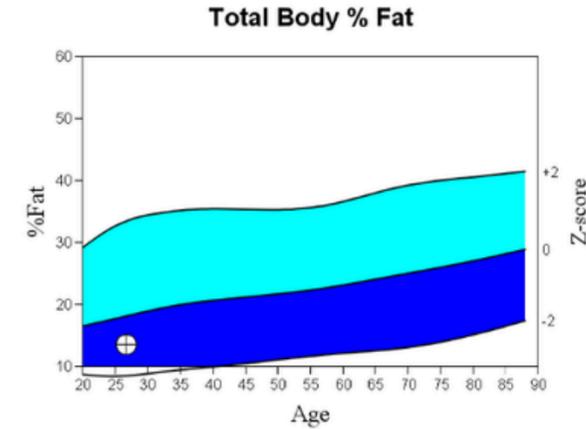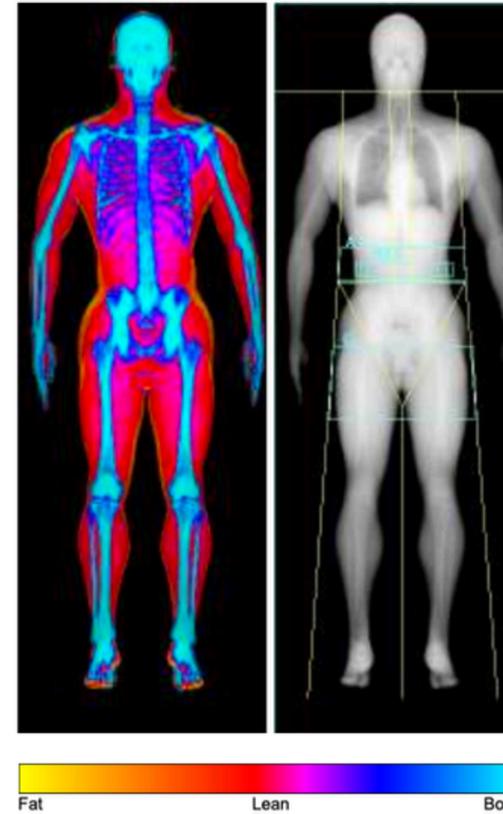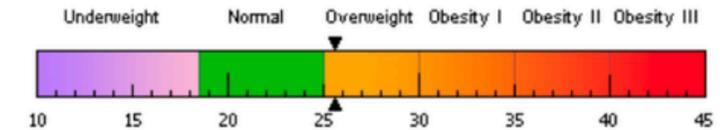BMI = 25.6 WHO Classification Overweight

Underweight Normal Overweight Obesity I Obesity II Obesity III

BMI has some limitations and an actual diagnosis of overweight or obesity should be made by a health professional. Obesity is associated with heart disease, certain types of cancer, type 2 diabetes, and other health risks. The higher a person's BMI is above 25, the greater their weight-related health risks.

Body Composition Results

Region	Fat Mass (g)	Lean + BMC (g)	Total Mass (g)	% Fat	%Fat Percentile YN	AM
L Arm	604	4265	4869	12.4	18	17
R Arm	629	4384	5013	12.6	17	15
Trunk	4632	30159	34790	13.3	17	15
L Leg	1498	10554	12052	12.4	6	6
R Leg	1576	10643	12218	12.9	6	6
Subtotal	8939	60004	68943	13.0	12	10
Head	1027	3688	4715	21.8		
Total	9966	63692	73658	13.5	23	21
Android (A)	712	4066	4778	14.9		
Gynoid (G)	1538	10323	11861	13.0		

Scan Date:	15 April 2024 ID: A04152403
Scan Type:	a Whole Body
Analysis:	15 April 2024 05:45 Version 13.6.1.3
	Auto Whole Body Fan Beam
Operator:	
Model:	Horizon A (S/N 307883M)
Comment:	

Adipose Indices

Measure	Result	Percentile YN	AM
Total Body % Fat	13.5	23	21
Fat Mass/Height² (kg/m²)	3.41	23	21
Android/Gynoid Ratio	1.15		
% Fat Trunk/% Fat Legs	1.05	77	73
Trunk/Limb Fat Mass Ratio	1.08	67	62
Est. VAT Mass (g)	269		
Est. VAT Volume (cm³)	290		
Est. VAT Area (cm²)	55.7		

Lean Indices

Measure	Result	Percentile YN	AM
Lean/Height² (kg/m²)	20.9	67	66
Appen. Lean/Height² (kg/m²)	9.75	58	58

Est. VAT = Estimated Visceral Adipose Tissue
YN = Young Normal
AM = Age Matched

SARCOPENIA & DEXA RESULTS

Lean Indices

Measure	Result	Percentile	
		YN	AM
Lean/Height² (kg/m²)	20.1	58	46
Appen. Lean/Height² (kg/m²)	9.07	54	49

Images not for diagnostic use

Fat — Lean — Bone

- Appendicular lean mass – **sarcopenia**
  - <7kg/m2 males, <5.5kg/m2 females + handgrip strength + gait speed
- Decreased muscle, strength & balance can increase risk of falls
- If this is low, one sign of less mechanical loading
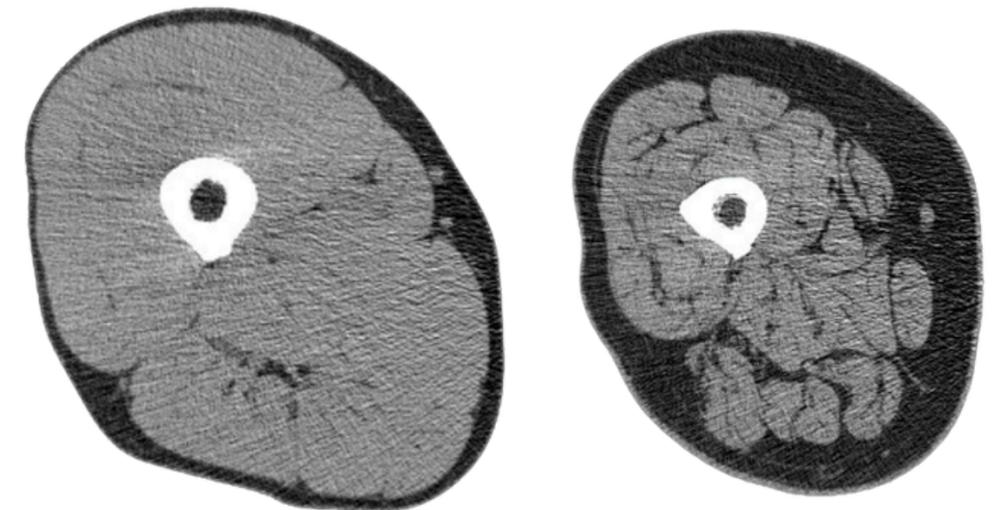
Healthy muscle · Sarcopenic muscle

TREATMENT FOR OSTEOPOROSIS: LIFESTYLE +/− MEDICATIONS

- Exercise should always be part of management plan for osteoporosis (healthyageing.org)

- It is not a matter of exercise OR medication as medications do not treat falls risk or treat sarcopenia

- ALL decisions are individual & must be made with own GP.

- Common medications =

  - Anabolic medications (eg, abaloparatide, teriparatide, and romosozumab (Evenity), which increase bone formation

  - Antiresorptive treatments (eg, alendronate (fosomax) or denosumab (prolea)), which reduce bone resorption
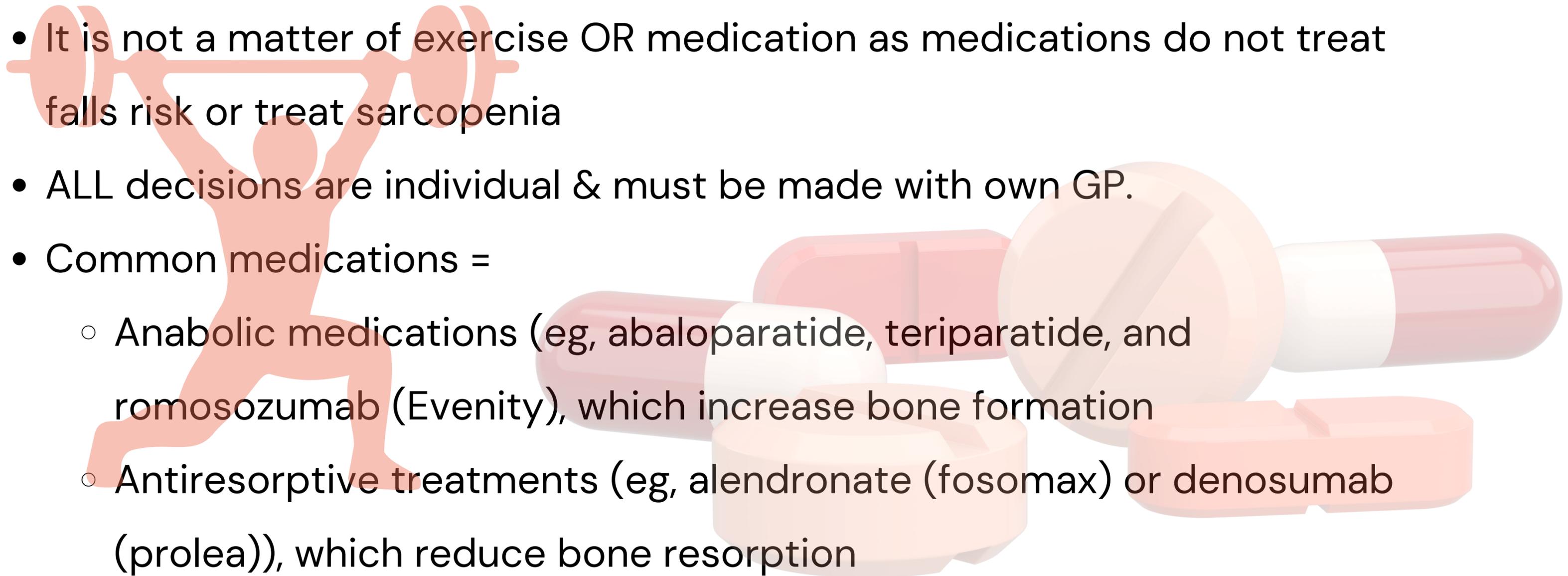
CANADIAN GUIDELINES FOR MEDICATION PRESCRIPTION

Postmenopausal females and males aged ≥ 50 years

- Recommend balance and muscle-strengthening exercises ≥ twice weekly
- Suggest eating foods rich in calcium and protein
- Suggest a minimum vitamin D supplement of 400 IU daily

Perform clinical assessment to identify risk factors
and signs of undiagnosed vertebral fracture*

Risk factors
- Previous fracture, after age 40 yr†
- Glucocorticoids (> 3 mo in the last year, prednisone dose > 5 mg daily)‡
- Falls, ≥ 2 in the last year
- Parent fractured hip
- Body mass index < 20 kg/m²
- Secondary osteoporosis‡
- Current smoking
- Alcohol ≥ 3 drinks/d

Signs of possible vertebral fracture*
- Prospective height loss > 2 cm or historical > 6 cm
- Rib-to-pelvis distance ≤ 2 finger-breadths in midaxillary line
- Occiput-to-wall distance > 5 cm

Age < 70 yr and no risk factors

Age 50–64 yr with previous fracture†
or ≥ 2 risk factors
Age 65–69 yr with 1 risk factor
Age ≥ 70 yr with no risk factors

Previous hip or spine fracture*
OR
≥ 2 fracture events†

Obtain BMD and calculate 10-yr
fracture risk with BMD using FRAX
(preferred) or CAROC tool

10-yr fracture risk < 15%
OR
T-score > –2.5

10-yr fracture risk 15%–19.9%*
OR
T-score ≤ –2.5 and age < 70 yr*

10-yr fracture risk ≥ 20%*
OR
T-score ≤ –2.5 and age ≥ 70 yr*

**DO NOT RECOMMEND
PHARMACOTHERAPY**

SUGGEST PHARMACOTHERAPY
Intermediate benefit

RECOMMEND PHARMACOTHERAPY
Largest benefit

Reassess BMD and fracture risk
If initiated pharmacotherapy:§
- Reassess in 3 yr
If not a candidate for or chose not to take pharmacotherapy:§
- If 10-yr fracture risk < 10% , reassess in 5–10 yr
- If 10-yr fracture risk 10%–15%, reassess in 5 yr
- If 10-yr fracture risk ≥ 15%, reassess in 3 yr

TREATMENT FOR OSTEOPOROSIS: LIFESTYLE CHANGES SUMMARY

- Adequate dietary intake of Vitamin D, calcium, protein and overall calories (details to follow)

- Adequate exercise (details to follow)

- Avoid excess alcohol (< 2 drinks/day) and avoid smoking all together
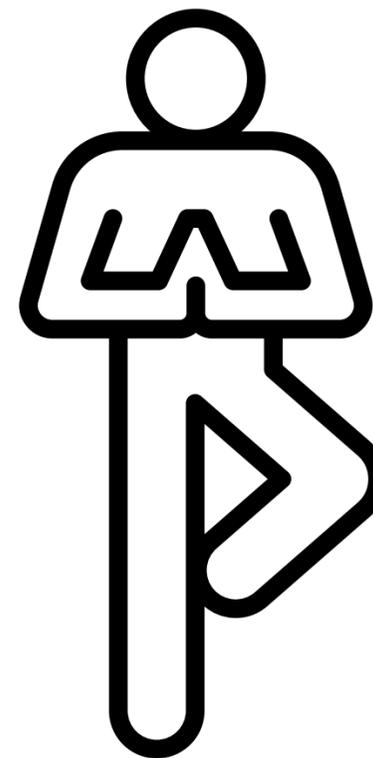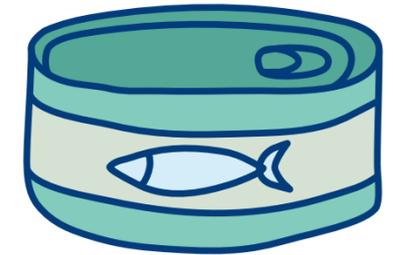
EXERCISE GUIDELINES FOR BONE HEALTH

- **Meet minimum exercise guidelines**: > 150 minutes, ideally 300+ minutes of exercise per week. 75-150 minutes of this moderate to vigorous intensity.
  - Continue exercise you enjoy, even if not inherently bone building.
- **Perform strength baesd exercises** that target the entire skeleton that are progressively made more challenging **2-3x per week**
- **Impact loading should be completed on most days.**
  - if safe up to 50 moderate → high impact loading per day (i.e. jumps, hops)
  - For those not safe to do so, aim to perform regular low impact exercise such as walking on most days.

EXERCISE GUIDELINES FOR BONE HEALTH (REFERENCES)

Made from combining recommendations from Australian, UK & Canadian guidelines...

Australian Guidelines

Healthy Bones Australia (2024), Exercise Prescription to Support the Management of Osteoporosis For Physiotherapists and Exercise Physiologists February 2024, https://healthybonesaustralia.org.au/wp-content/uploads/2024/02/hba-ex-presc-final-compressed.pdf

UK Guidelines

Brooke-Wavell K et al.,. Strong, steady and straight: UK consensus statement on physical activity and exercise for osteoporosis. Br J Sports Med. 2022 May 16;56(15):837-46. doi: 10.1136/bjsports-2021-104634. Epub ahead of print. PMID: 35577538; PMCID: PMC9304091.

Canadian Guidelines

Morin SN et al., Osteoporosis Canada 2023 Guideline Update Group. Clinical practice guideline for management of osteoporosis and fracture prevention in Canada: 2023 update. CMAJ. 2023 Oct 10;195(39):E1333-E1348. doi: 10.1503/cmaj.221647. PMID: 37816527; PMCID: PMC10610956.
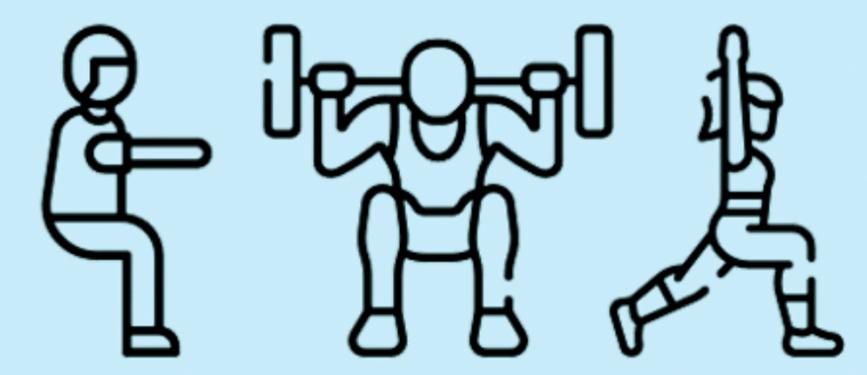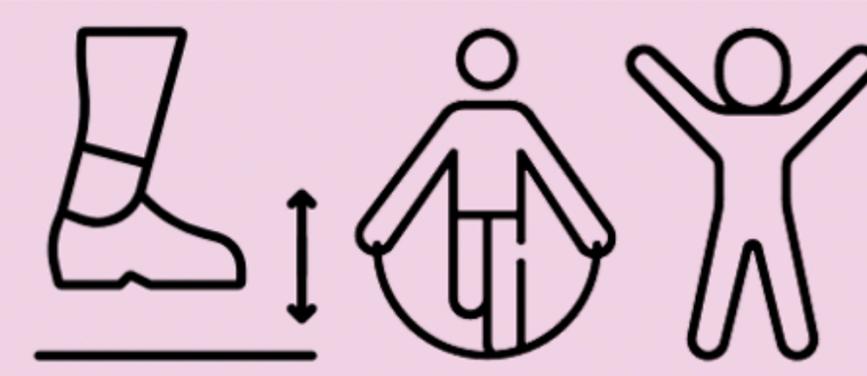
As well as a number of recent systematic reviews Alnasser et al. 2025, Kitagawa et al. 2022 , Souza et al. 2020, Xiaoya et al., 2025

EXERCISE GUIDELINES FOR BONE HEALTH

- **A combination of interventions is likely to be more beneficial than a sole intervention** (i.e. strength training + impact training + cardio exercise).

- **Balance training should be incorporated to reduce falls risk.**

- For people who are higher level, a lot of the exercises done for strength or impact will double as balance exercises (e.g. lunges, single leg deadlifts, jumping, hopping). For people at lower functional levels, specific balance exercises may need to be prescribed, e.g. standing on one leg, calf raises, walking heel to toe.
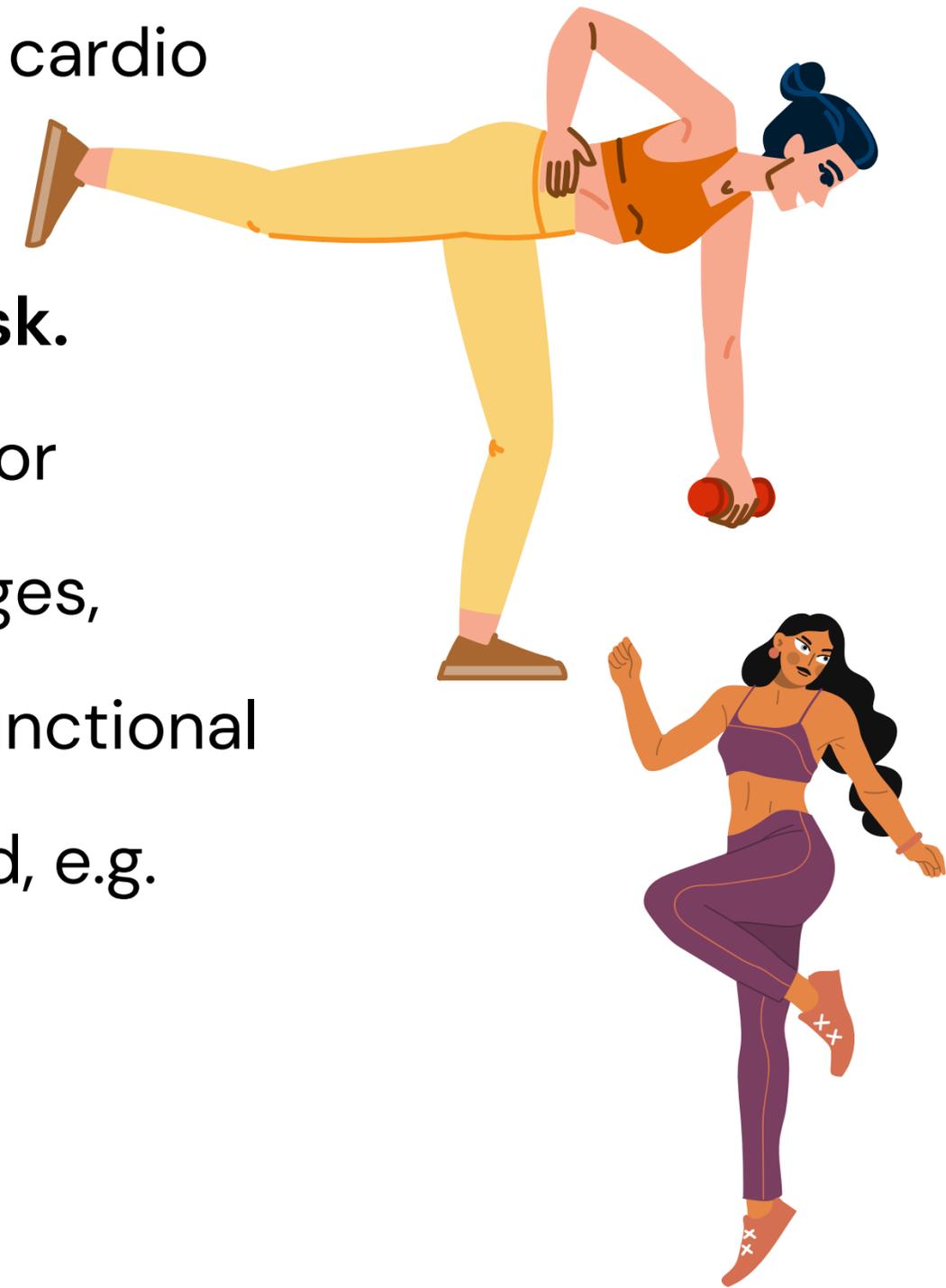
Three individual exercise sessions per week containing the following components of each exercise type

Type	Dose	Intensity	Exercise Examples	Visual Examples
Progressive resistance training	2-3 sets 5-8 repetitions.	Progress to 75-85% of 1RM or 5 to 8 on Borg 0-10 RPE scale. Higher intensity and fracture risk requires supervision.	Weighted squats, lunges, deadlift, hip exercises, back extension etc.	
Progressive impact training	~50 impacts per session. Best divided into brief bouts.	Gradual progression up to moderate impact *(>2-4 x body weight)* as tolerated.	**Low level:** foot stomping **Moderate level:** low jumps, skipping	
Progressive balance activities	3 hours – can be divided into brief bouts and include PRT and impact training time.	Moderate to high balance challenge.	Heel-to-toe walks, single leg stance, circle and pivot turns, Tai Chi, stepping	
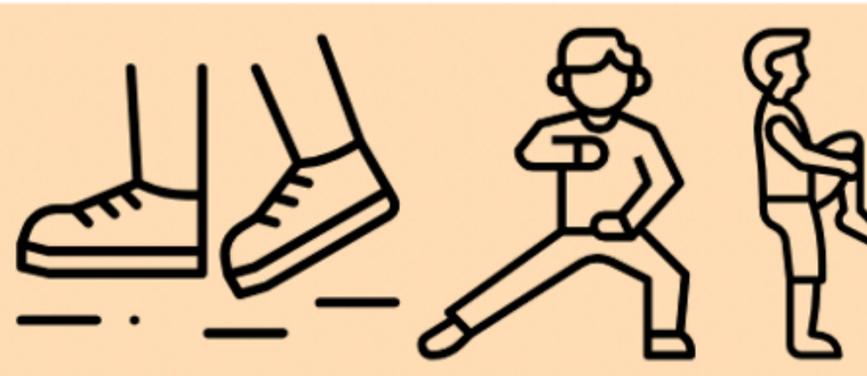
WHY IS RESISTANCE TRAINING PROMOTED OVER SWIMMING, WALKING, PILATES, YOGA ETC?

• Osteogenic loading = loading that stimulates bone growth

• Forces pulling on skeleton + ground reaction forces = strain

on bone leads to new bone growth (Warden et al., 2021)

• Need strain to be high magnitude & high velocity i.e. some

fast, some heavy (Healthy bones Australia, 2024)

• Needs to be more than habitual (day to day)

loading

WHY IS RESISTANCE TRAINING PROMOTED OVER SWIMMING, WALKING, PILATES, YOGA ETC?

- Exercises that do not create large muscle forces are not as helpful at building bone
- Yoga and pilates are resistance training, but difficult to progressively overload them enough to build bone (Fernández–Rodríguez, 2020).
- **Still useful as part of your overall health routine & to meet exercise guidelines**
- Everyone is different: what is adequate bony stimulus for one person may not be for another

Best exercise for bone health
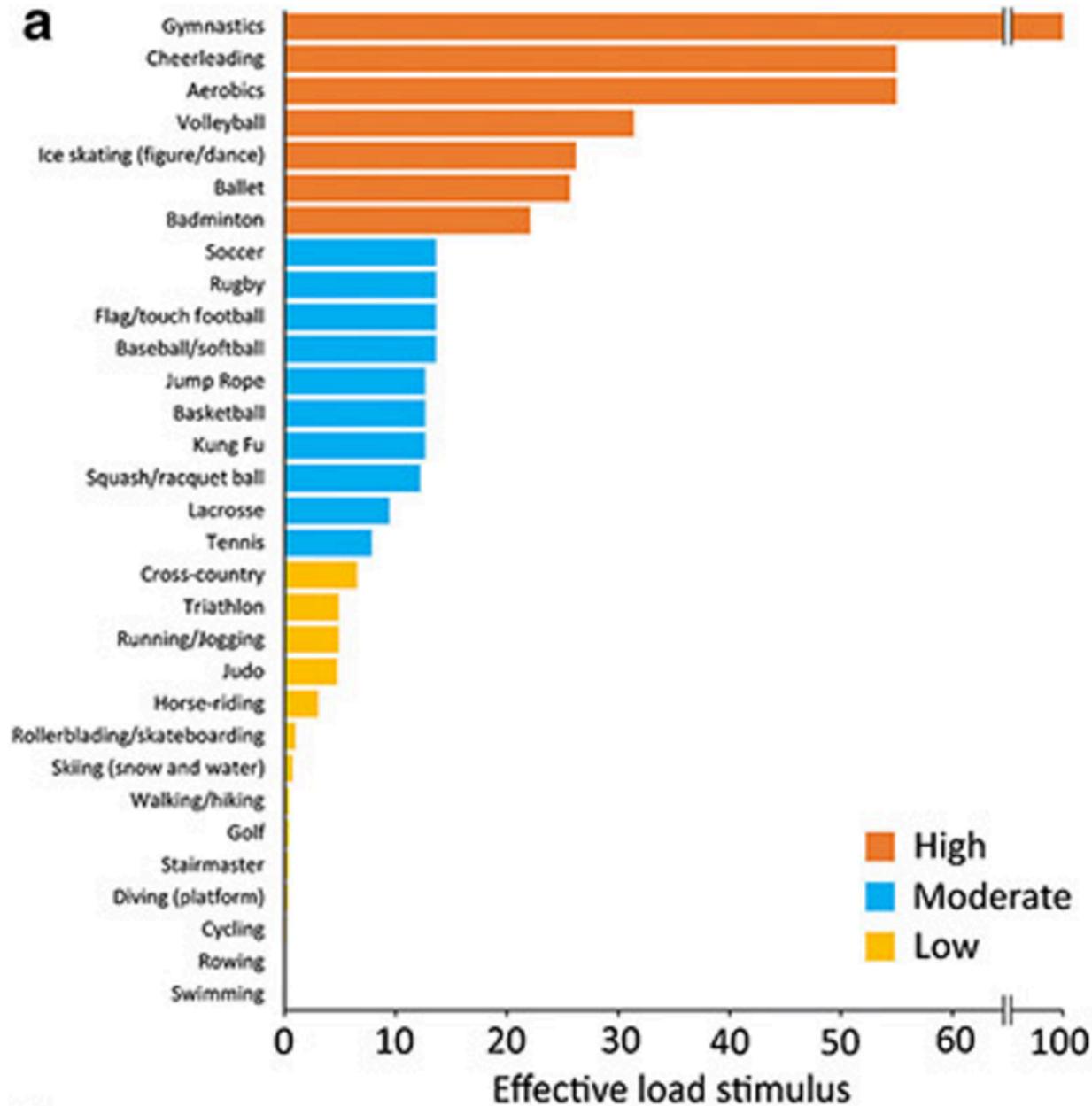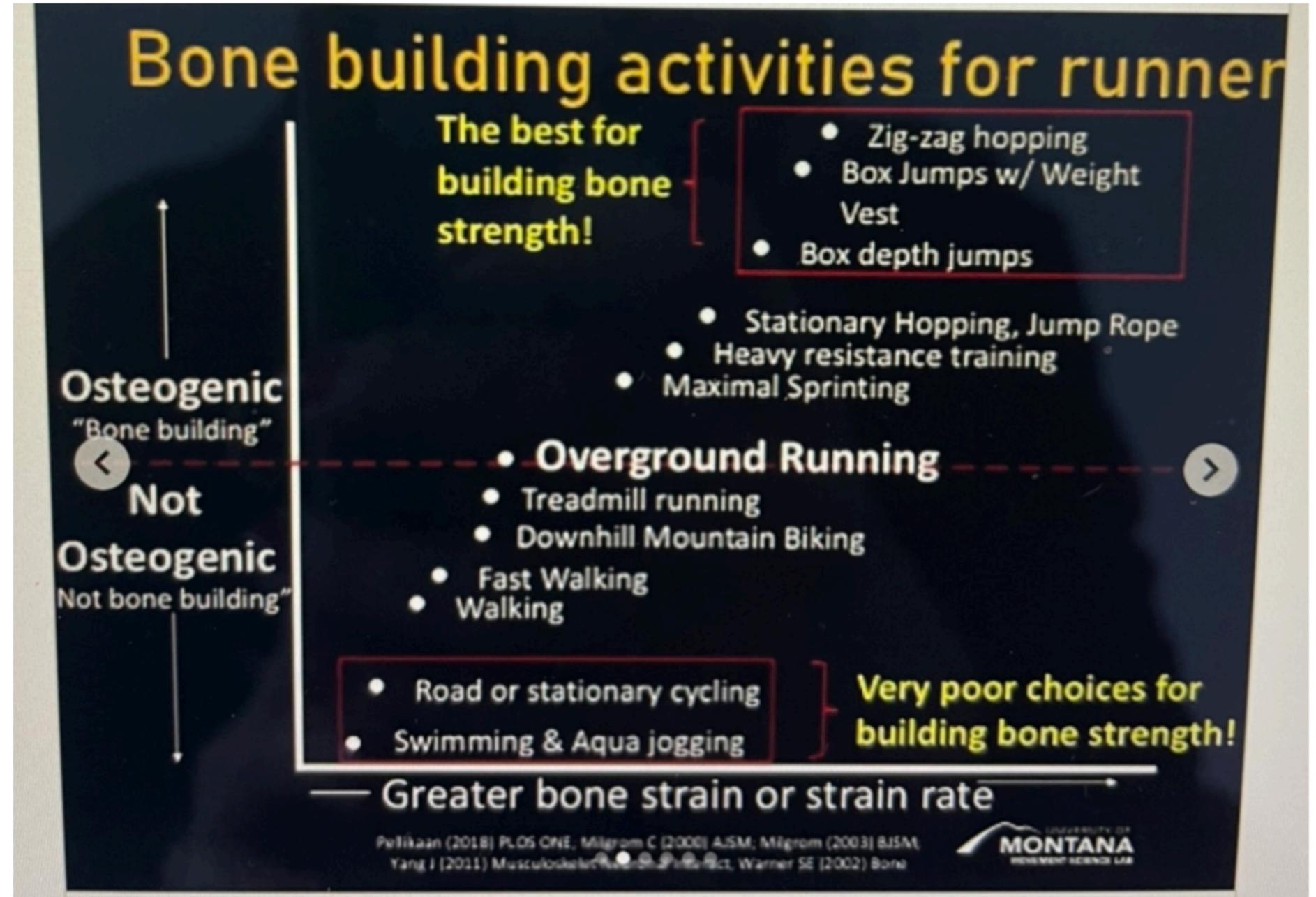
Warden et al., 2021

RESISTANCE TRAINING FOR BONE HEALTH

• Systematic reviews in recent years show lifting moderate to heavy weights have similar results on improving bone density, as long as intensity is matched, i.e. you are going towards failure

  • Lighter weight--> 15-20 reps; heavier weight → max 5-6 reps; with the view of only being able to do 1-2 more reps in each scenario

  • Light loads (20+ reps) are not as likely to be effective (Souza et al., 2020)

  • LIFTMOR trial is famous (ONERO program) & promotes max effort lifting, but this is not the only way (Watson et al., 2017)

MODERATE LOADS LIFTED FOR HIGH REPS MAY BE ENOUGH TO PREVENT BONE LOSS – IN THE SHORT TERM

- Body pump: 6 months study post menopausal women (Nicholson et al., 2015).

- Prevented bone loss in the spine over the course of the study

- ? long term maintenance of effect

- ? because people are new to exercise

- → reassuring that it is likely to have some effect in some cases

NO ONE SIZE FITS ALL APPROACH

- We have clients who have never lifted weights and come to us in their 70s with good bone density.

- It is impossible to generalise advice to the general population.

- It is however important to know what is the most likely to be the most effective, particularly for people who are already doing lots of exercise – they often want to know what they should maybe be trying to focus on if they are still losing bone.

RUNNING IS ALSO NOT THAT HELPFUL FOR BONE (BUT JUMPING MAY BE)

- Running is moderate to high impact, but runners do not have higher BMD than non runners – endurance athletes often have lower BMD (various factors contributing to this)

- Repetitive nature of running may blunt osteogenic effect (Warden et al., 2017) (theoretical)

- Impact loading – short, sharp, multidirectional e.g. hopping side to side

- Impact loading more risky & likely less important than strength training as it is more local (not whole skeleton)

IS IT POSSIBLE TO RE-BUILD BONE ONCE IT HAS BEEN LOST?

- Modest ability to improve BMD in post menopause. Exercise more effective at influncing spine> hip (Kumar et al., 2025, Kitagawa et al, 2022, Xiaoya et al., 2025, Souza et al., 2020).

- The presence of muscle mass alone can positively influence bone mass → more argument for strength training! (Note: VERY hard to gain significant size as a woman & particularly post menopause).

- Case studies & anecdotally some women have rebuilt significant bone mass, however, very variable person to person . 1-2% per year increase may be significant over time

WEIGHTED VESTS

- Wearing a weighted vest to do strength exercises is a form of adding load

- you will be restricted in how much you can progress by how much weight you can add – small ceiling

- Simply adding a vest while walking unlikley to have significant difference as it doesnt generate large muscle forces

- If you do choose to wear one to do strength training, remember it won't help BMD in your arms for e.g.

- No harm but probably not super worthwhile

Injury risk lifting weights is LOW

- Human body gets used to the load you place on it
- If introduced gradually and with a solid program the injury risk is very low
- Aches and pains can come up but often can get over them quickly
- Low incidence of significant injuries recorded specifically in this population (e.g. Bone Clinic released numerous studies with low stats & our experience is similar)
- Research on general population finds weightlifting is safe: 2–4 injuries per 1000 hours of training which is less than almost all other sports (Aasa et al., 2016)
- If you have osteopenia or in particular osteoporosis you should start with supervised training with someone who has training in bone density

STRUCTURING AN EXERCISE SESSION

- Big compound movements first when fresh (eg Squat and deadlift)
- Followed by isolated exercises that use less muscles e.g. seated row, lunges.
- Isolated exercises beneficial for joint health/function/injury management
- Jumping + core towards end
- Rest essential to maximise strength gains vs cardio

GENERAL STRENGTH PROGRAM SHOULD INCLUDE

- Squat
- Hinge
- Split squat/lunge
- Upper body vertical push & pull
- Upper body horizontal push & pull
- Core
- Impact loading

Bone density classes at FKB

- We offer **supervised small group classes** of no more than 4 people at FKB physio
  - Classes are $49 per person, claimable on private health
  - Classes are programmed and tailored to you with progressive increases in weight recorded and monitored over time
- We also provide **tailored 1:1 bone health strength programs** that you can practice at your own gym
  - These are charged as a regular physiotherapy consultation of $130– $150 an hour, claimable on private health
- You can use **medicare funded sessions** (health care plan) for physiotherapy to fund part of these sessions

NUTRITION: KEY NUTRIENTS

- **Calcium**
- **Vitamin D**
- **Protein**
- **Magnesium**
- **Vitamin K2**

CALCIUM

- Calcium is the **primary mineral found in bones**, providing them with **structure** and **strength**.
- It also plays a vital role in **bone remodelling**.
- Calcium levels on a **blood test don't reflect** whether calcium intake is adequate.
- Daily requirements are dependant on **age**.
- **Food first if possible**
- **Supplementation** shown to improve BMD – 1200mg/day most effective
  - Absorption issues >500mg – ideal to split this up AM/PM – adherence concerns
  - Important to note: Ca supplementation has been linked with small increase in CVD

	Recommended Daily Intake
Men: 19-70 yr	1,000mg/day
Men: >70 yr	1,300mg/day
Women: Pre-Menopause	1,000mg/day
Women: Post-Menopause	1,300mg/day
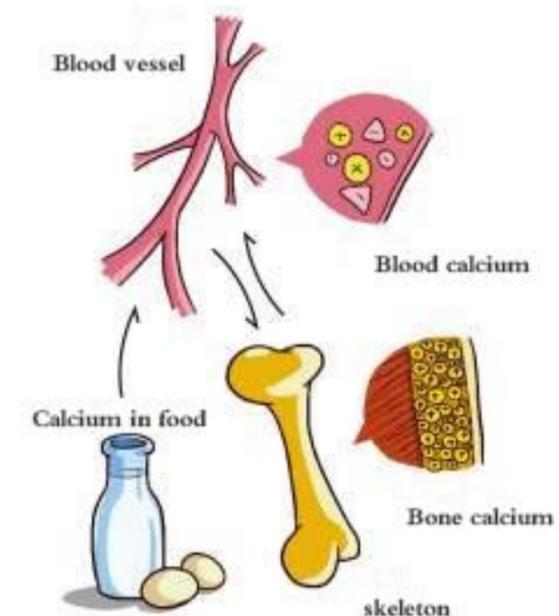
DAIRY PRODUCTS

Milk
~300mg/250ml

Kefir
~300mg/250ml

Hard Cheese
~200mg/25g

Yoghurt
~120-200mg/100g

Cottage Cheese
~100-160mg/100g

Ice Cream
~60mg/50g

NON-DAIRY PRODUCTS

Tuna Calcium+
~838mg/78g (90g tin)

(calcium set e.g. calcium sulfate)

Tofu
~350mg/100g

Sardines
~320mg/85g

Fortified Alt. Milk
~300-400mg/250ml

Blackstrap Molasses
~200mg/15g

Almonds
~75mg/30g

GREEN VEGETABLES

Bok Choy
~75mg/cup (raw)

Kale
~50mg/cup (raw)

Broccoli
~45mg/cup (raw)

Watercress
~40mg/cup (raw)

Silverbeet
~30mg/cup (raw)

Spinach
~30mg/cup (raw)

Rocket (Arugula)
~30mg/cup (raw)

Cabbage
~30mg/cup (raw)

Iceberg Lettuce
~15mg/cup (raw)

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lactose free

Rokeby Smoothie
833mg/serve

YoPro Yoghurt
187mg/serve

YoPro Perform
439mg/serve

Milo Duo
200mg/cup

Tahini
231mg/tbsp

Berri OJ w/ Calcium
200mg/cup

VITAMIN D

- Based on recent data – **47.9% of the world** is vitamin D deficient (<50nmol/L).
- Vitamin D plays a crucial role in maintaining bone health as it helps the body **absorb calcium.**
- You can get *some* through the diet, however majority is from **sunlight.**
- As you age, the ability to absorb and metabolise **vitamin D declines.**
- For every 25-nmol/L drop in vitamin D levels, the risk of a hip fracture increases by about **33%** (Cauley et al., 2008).
- Also helps with lean mass – prevention of falls & fractures.

VITAMIN D SUPPLEMENTATION

- First – Check your levels via a **blood test**.
- Meta–Analysis: Vitamin D supplementation reduced the relative risk (RR) of **hip fracture by 26%** and any **non–vertebral fracture by 23%** (Bischoff–Ferrari, 2005) – 700–800IU/day
- To address a deficiency though, there is no reason you can't go **more aggressive & likely have more immediate benefits.**
- I personally will start at ~4000IU/day and reassess after 2 months.

PROTEIN

- Bone is **~35%** made up of protein/collagen.

- Keeping protein relatively high **(>1.2g/kg)** is a good idea.
    - for maximising muscle growth, 1.6–2.2g/kg anyway

PROTEIN SOURCES

To reach 30g protein (raw weight)

135g

150g

150g

140g

180g

5 lrg

¼ of your plate lean protein

Portion:
Palm size

E.g. 70kg x 1.6g = ~112g/day

VITAMIN K2

- Better absorbed than K1, and has a more direct role on bone health.
- Vitamin K2 is **responsible for storing calcium in the "right" places** e.g. bones instead of arteries.
- It's hard to measure intake, but the only study I'm aware of looking at the topic found that **sub-clinical deficiencies in vitamin K2 are common.**
- Recent review found that **supplementation** improves key bone turnover biomarkers – osteocalcin (Zhang et al., 2025)
  - **100mcg/day**
- K2 is found in **fermented foods and animal foods** (but mainly organ meats). Intake is hard to measure which is part of why I'd often consider supplementation for this unless somebody specifically wanted food-first.
-

IS YOUR VITAMIN K INTAKE ADEQUATE?
THE ADEQUATE INTAKE OF VITAMIN K FOR HEALTHY ADULTS IS 60MCG/DAY FOR FEMALES & 70MCG/DAY FOR MALES.

Parsley 1600mcg/100g
Spinach 480mcg/100g
Collard Greens 440mcg/100g
Kale 400mcg/100g
Broccoli 100mcg/100g
Kiwi Fruit 40mcg/100g
Natto 900mcg/100g
Goose Liver 670mcg/100g
Hard Cheeses 75cmg/100g
Soft Cheeses 50mcg/100g
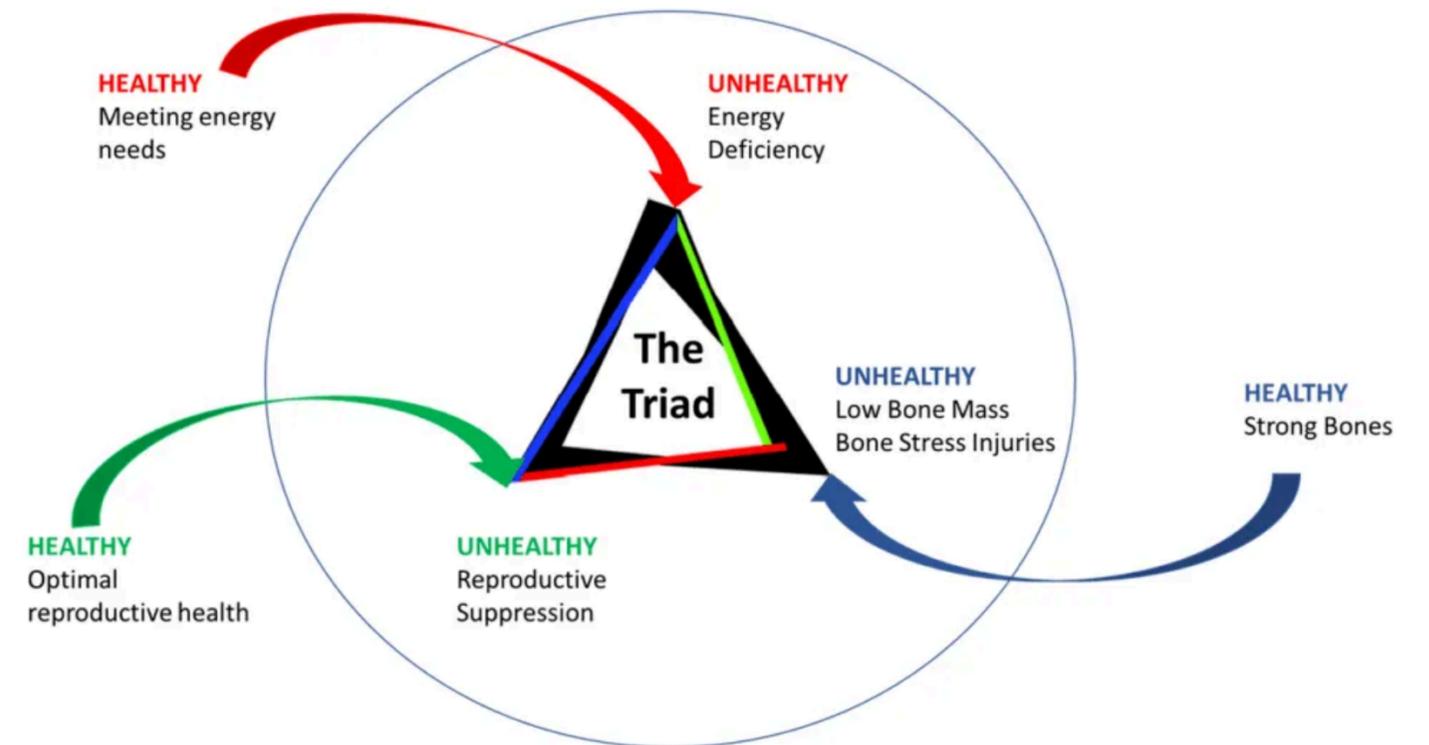Butter 15mg/100g
Chicken 10cmg/100g

MAGNESIUM

- >40% population likely have **sub-optimal** Mg levels
  - <1% Mg is in the blood, so difficult to test i.e. pay attention to how you feel / reflect on intake
- Impacts bones directly & indirectly
  - Deficiency reduces bone stiffness, increasing **osteoclasts** and decreasing **osteoblasts.**
  - Magnesium has a role to play in **calcium absorption**.
  - Helps convert **vitamin D into** its active form.
- Significant associations between **low Mg and osteoporosis.**
  - Lowest quintile of intake have geratest risk and highest have lowest
- Women who met the recommended Mg intake had a **27% reduced risk of fractures** compared to those with lower intakes (Veronese et al., 2017).
- **250mg/day** supplementation for 2 years, shown to significantly improve BMD (Rondanelli et al., 2021).
  - Glycinate is best

Magnesium Cheat Sheet

Amounts of Magnesium in Foods

- Cashews 30g — 88mg
- Almonds 30g — 80mg
- Brown Rice 1 cup cooked — 79mg
- Dried Seaweed 15g — 48mg
- Pumpkin Seeds 30g — 115mg
- Spinach 1/2 cup cooked — 78mg
- Silverbeet 1/2 cup cooked — 75mg
- Tahini 1 tbsp — 50mg
- Dark Chocolate 30g — 68mg
- Edamame 100g — 64mg
- Rolled Oats 1/2 cup dry — 56mg
- Chia Seeds 1tbsp — 39mg
- Brazil Nuts 30g — 78mg
- Avocado 1 medium — 80mg
- Kidney Beans 1/2 cup cooked — 37mg

Recommended Daily Intakes:
Males: 420mg | Females: 320mg

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LOW ENERGY AVAILABILITY

- Energy In vs Energy Out
  - (EA (kcal/kgFFM/day) = [EI (kcal/day) – EEE (kcal/day)] / FFM (kg)
- In this state, there is a **lower amount of energy than required** for the body's normal physiological functions.
- Body adapts and **saves energy** by down regulating non essential functions (e.g. reproductive axis)
  - Oestrogen & testosterone drops
- Oestrogen promotes **bone formation, slows down the rate of bone loss**, and **increases effectiveness of vit D**.
- Signs & Symptoms:
  - Fatigue, GI issues, frequent injuries, loss of period, reduced HR & **RMR**, reduced libido, weight loss, sleep issues
- Amenorrheic athletes have **2 to 4 times** greater risk for a stress fracture (Bennell et al., 2012).

HEALTHY Meeting energy needs

UNHEALTHY Energy Deficiency

UNHEALTHY Low Bone Mass Bone Stress Injuries

HEALTHY Strong Bones

HEALTHY Optimal reproductive health

UNHEALTHY Reproductive Suppression

The Triad

SARCOPENIA & NUTRITION

	Daily Protein Intake
Healthy Adults	1.0-1.2g/kg
Older Adults	1.2-1.5g/kg
To Maximise Muscle Growth	1.6-2.2g.kg

MPS response was ~16% lower >75yo (Calvani et al., 2023)

- **Omega-3s**: Been shown to help with anabolic resistance
  - 4–5g/day (over ~6mo): increased MPS, muscle mass, grip and overall strength.
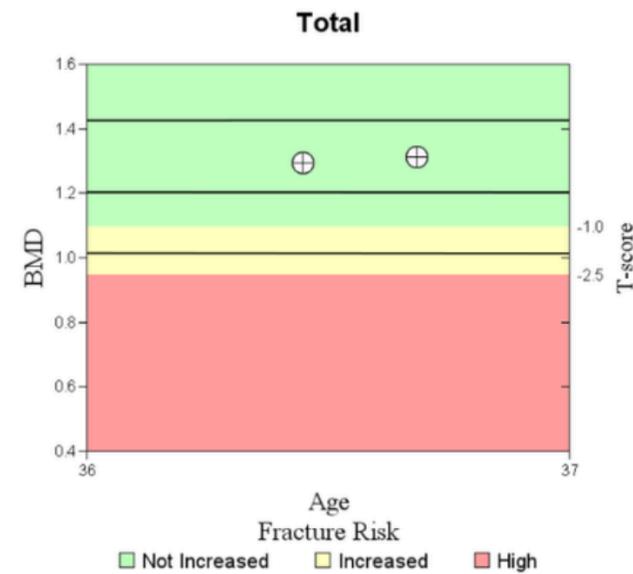
EXAMPLE RESULTS: FOLLOW UP SCANS

Recommended Follow Up Period:

- Body Composition: **~3-4 months** OR planned around particular phases
- Bone Density: **~12 months**
  - Early Detection
  - Monitoring Treatment
  - Efficacy Preventative Care

BEST PRACTICE

- Be in a fasted state
- Leave >12 hours between strenuous exercise and scanning
- No alcohol <12 hours before
- Go to the bathroom before the scan
- **No metal to be worn**
- Lightweight clothing
- Similar for RMR testing too

Notes
- 252kg maximum limit
  - If too wide, arms can be duplicated
- 195cm scanning length
  - If too tall, hang feet off
- Unable to do scan if
  - Pregnant / chance of being
  - Pacemakers / medical implants

PRICE LIST

DEXA
- Initial – $90
  - '**GOODLIFE**' – $70
- Review – $80

RMR
- Initial – $129
- Review – $99

Package Deal – $155

If you have private health, you may also receive a rebate!