Exercise for osteoporosis and fall prevention: evidence to action

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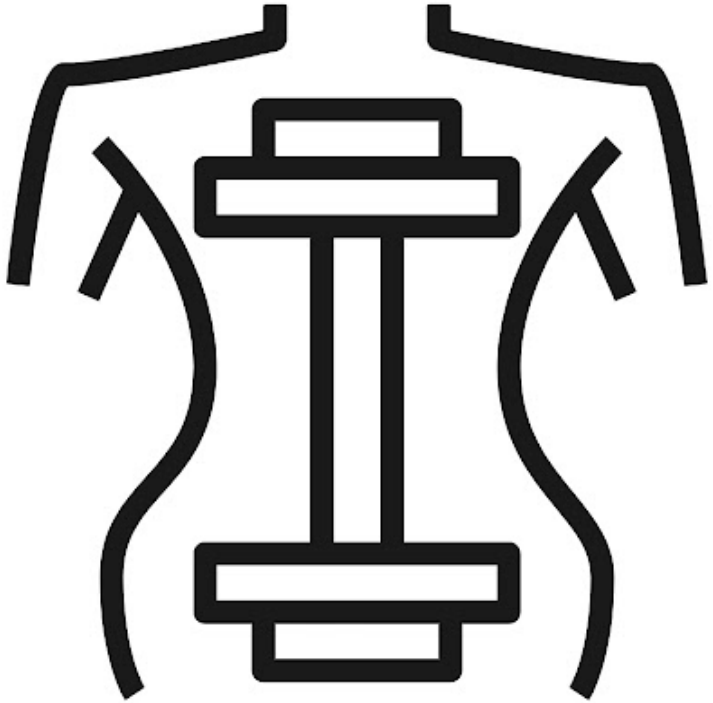
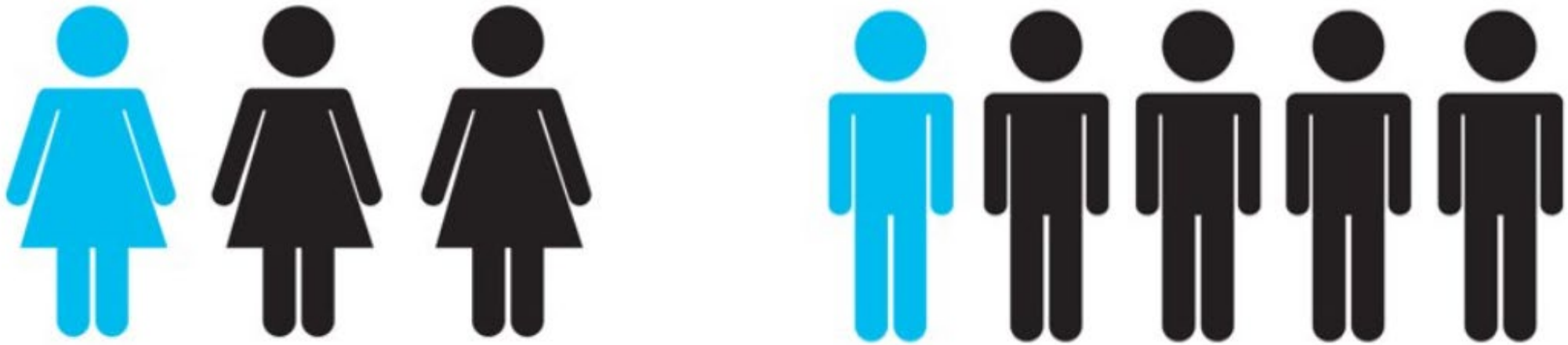
Find us at BonES lab YouTube or Facebook

What will we learn about

- What is osteoporosis?
- What do clinical practice guidelines and research say about exercise for fall and fracture prevention?
- How do I get started or progress my strength and balance training program?

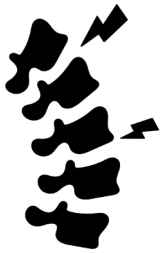




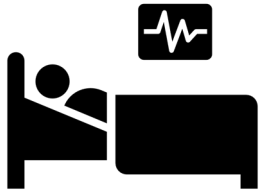
Osteoporotic or fragility fractures are more common than heart attack, stroke and breast cancer combined

Fractures and falls in older adults

Fall-related injuries are #1 cause of hospitalizations in older adults



Pain, impaired mobility, loss of independence, long term care admission



Mortality 25%+

What is Osteoporosis?

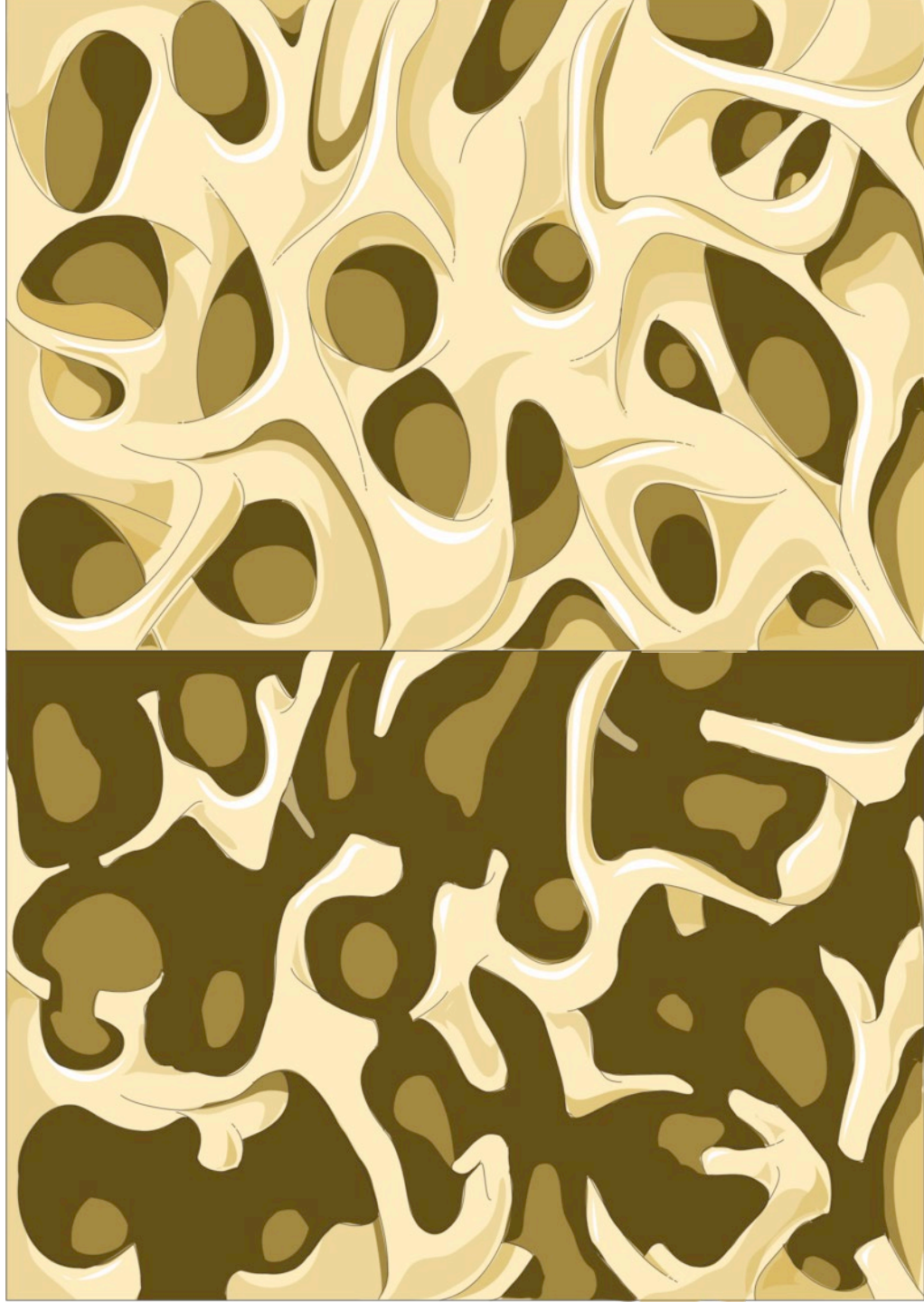
Low bone mass

Deterioration of bone tissue

Increased risk of fracture

Normal Bone

Porous Bone



Laboratoires Servier, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons

What are the symptoms of osteoporosis?

Hint: Trick question!

Common Fragility Fracture Sites

Major osteoporotic fracture sites: Humerus, distal radius, spine, proximal femur

Most common fracture type in women < 75yrs

20% re-fracture in 1 year

Under-diagnosed

Mortality = 28-37%

Impaired mobility in survivors = 50%

Fracture Risk Factors - Who should have a bone mineral density (BMD) scan?

Older age is a risk factor: screen at 50 for other risk factors:

- Fragility fracture after age 40
- Prolonged use of glucocorticoids*
- Falls ≥ 2 in last year
- Parental hip fracture
- Current smoking
- High alcohol intake (≥ 3 units/day)
- BMI < 20 kg/m^2
- Causes of secondary osteoporosis

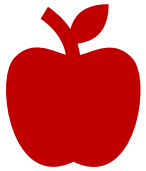
Who should have a DXA scan?
50-64 years old with ≥ 2 risk factors
65-69 years old ≥ 1 risk factor
≥ 70 years old
Any age with history of hip or spine fracture or ≥ 2 fracture events

*≥3 months cumulative therapy in the last year at prednisone-equivalent dose of ≥ 5 mg daily

2023 Clinical Practice Guidelines for the Management of Osteoporosis and Fracture Prevention in Canada

Fracture prevention strategies

Medication



Adequate nutrition

Fall prevention

Exercise

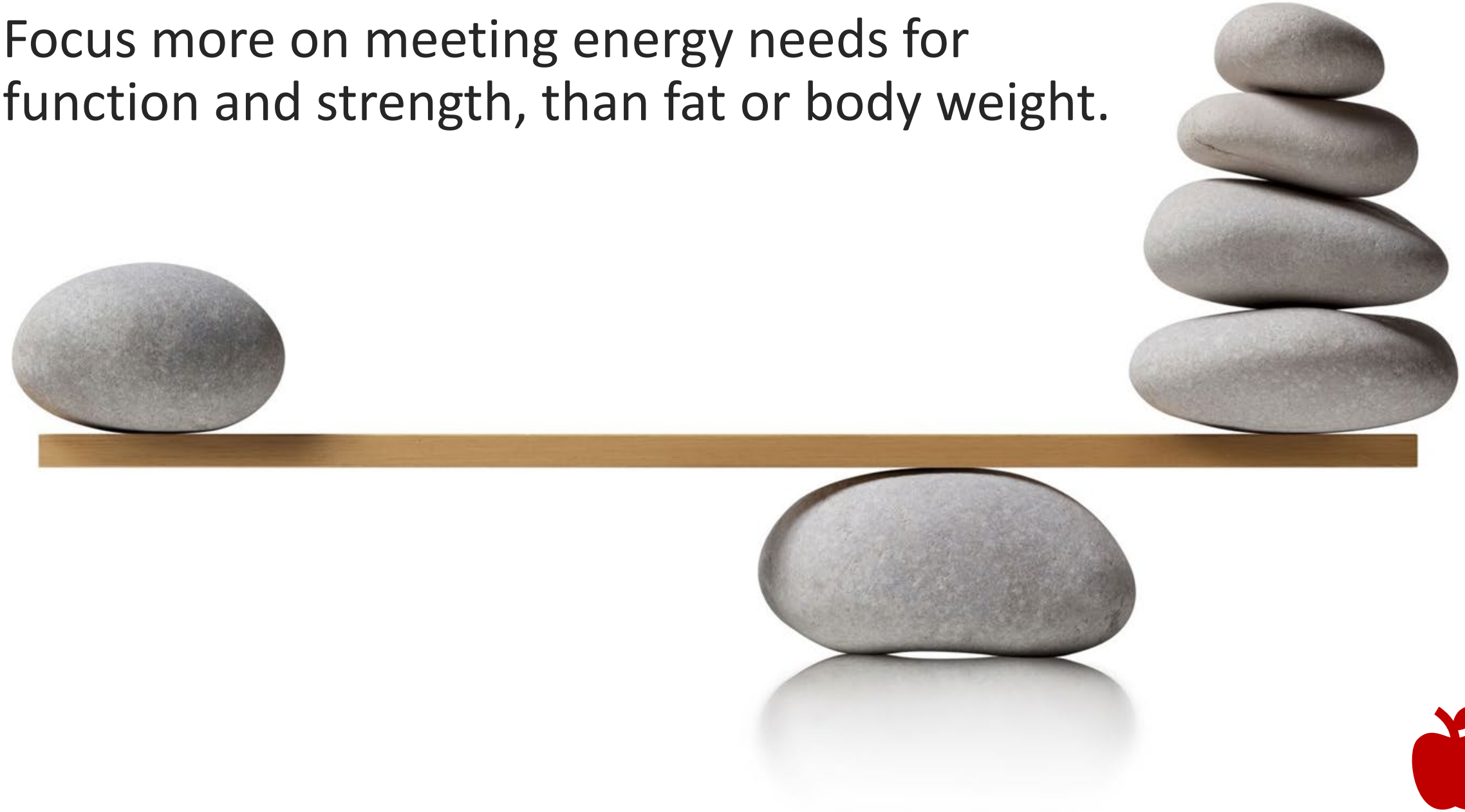
Clinical practice guideline for management of osteoporosis and fracture prevention in Canada: 2023 update

Key Points

- If you are at high risk of osteoporosis-related fractures, starting medication is your recommended course of action.
- Bisphosphonates are the first-line treatment in Canada. They are safe and will reduce your risk of fractures.
- For high-risk individuals, the benefits of taking bisphosphonates for 3 to 6 years far outweigh their potential harms.

What do I need to eat to prevent fractures?

Focus more on meeting energy needs for function and strength, than fat or body weight.



Get calcium from food sources whenever possible

If your diet is giving you enough calcium, ***do not*** take extra in supplements.

Females >50: 1200mg

Males 51-70: 1000mg

Males >70: 1200mg

Calculate the amount of calcium you are getting in your diet

Free nutrient calculator:

How much protein should I consume?

Health Canada recommends **at least** 0.8 g of protein per kg of body weight each day.

As we get older or more physically active, we may need more protein: 1.2 to 1.6 g protein per kg body weight each day.

Consume protein-rich foods at every meal and snack.

- Beef, pork, chicken, fish and dairy products
- High protein plant foods: legumes, beans, nuts, and seeds.

Protein Primer: https://youtube.com/playlist?list=PLP4lC7QVU-S3nKnO-xvCVlWYD0HVsJxuR

Vitamin D

Health Canada's Dietary Reference Intakes for vitamin D assume that sun exposure is minimal.

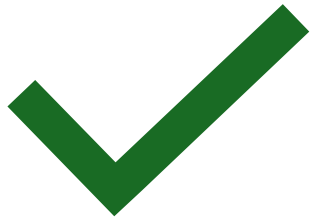
- 600IU for ages 19-69 years
- 800IU for age 70+

Too much vitamin D can lead to calcium being deposited in the kidneys, heart, lungs and blood vessels.

https://jamanetwork.com/journals/jama/fullarticle/2679279

How to prevent falls?

Exercise → but what types?



Address risk factors

Get rid of trip hazards

Review medications

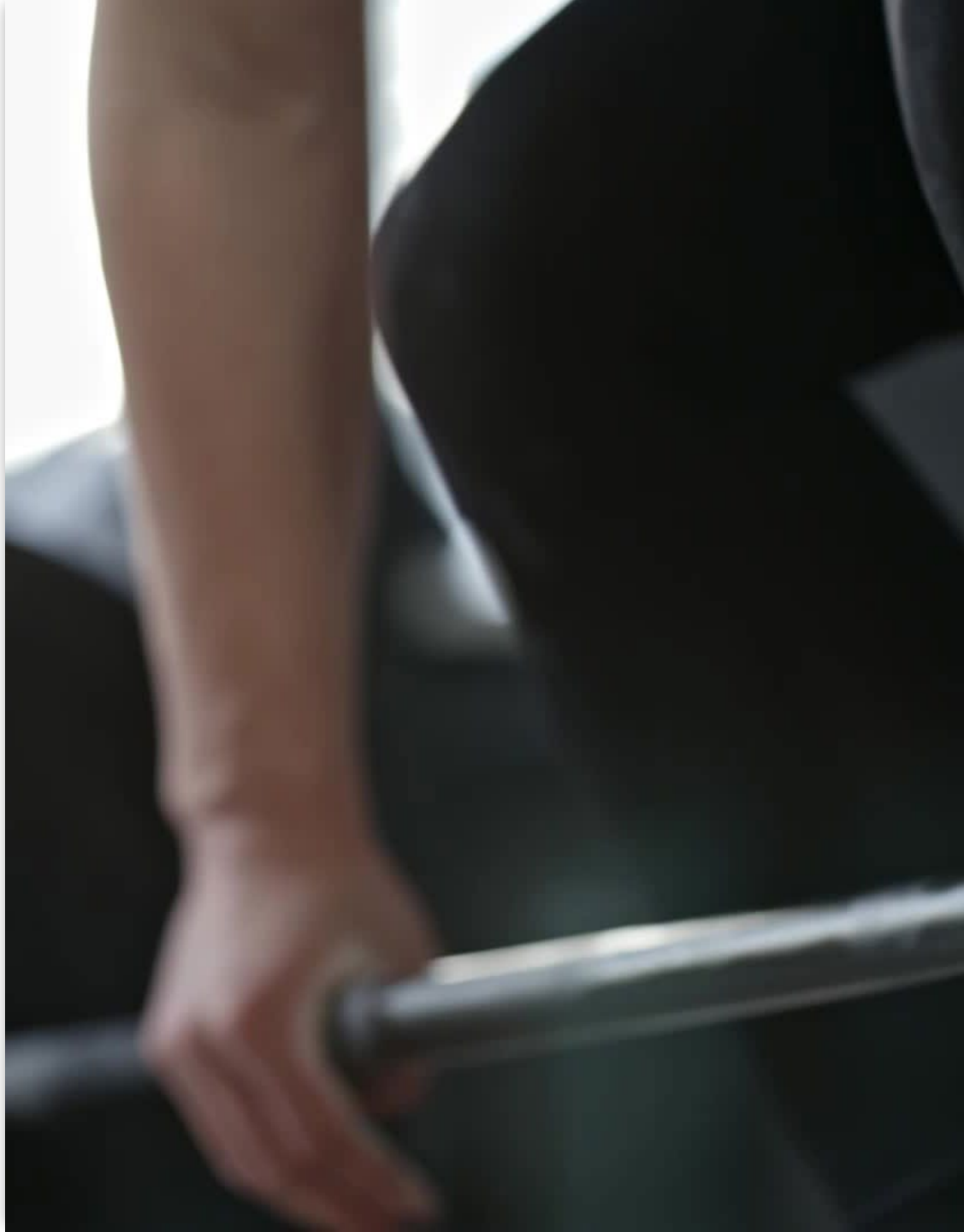
Use assistive devices correctly

Wear shoes with good traction

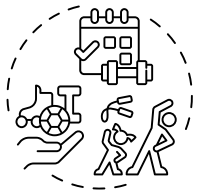
Keep blood pressure in safe ranges

Think before doing silly things

What does the evidence say about exercise for fall and fracture prevention?



What types of exercise prevent falls in older adults?



Multicomponent (balance, functional, resistance):

↓ rate 34%, ↓ risk 22%, moderate certainty

Balance and functional training:

↓ rate 24%, ↓ risk 13%, high certainty

Tai chi:

↓ rate 19%, ↓ risk 20%, low/high certainty

Uncertain: Yoga, dance, resistance exercise, walking

Sherrington C et al, Cochrane Database of Systematic Reviews 2019

What types of exercise may improve bone mineral density (BMD) in people with low BMD?

Resistance and impact exercise.

Many exercise modes may improve physical functioning or quality of life.

Serious adverse events associated with exercise seem to be rare.

Muscle soreness or minor injuries can occur.

Exercise for fall and fracture prevention

- **We recommend balance and functional training at least twice a week.**
- **We suggest strength training at least twice a week.**
- People who want to participate in other activities for enjoyment or other benefits should be encouraged to do them*, if they can be done safely or modified for safety.
- If participating in impact exercise, progress to moderate-impact or high-impact exercise only if appropriate for fracture risk or physical fitness level.

Good practice statement:

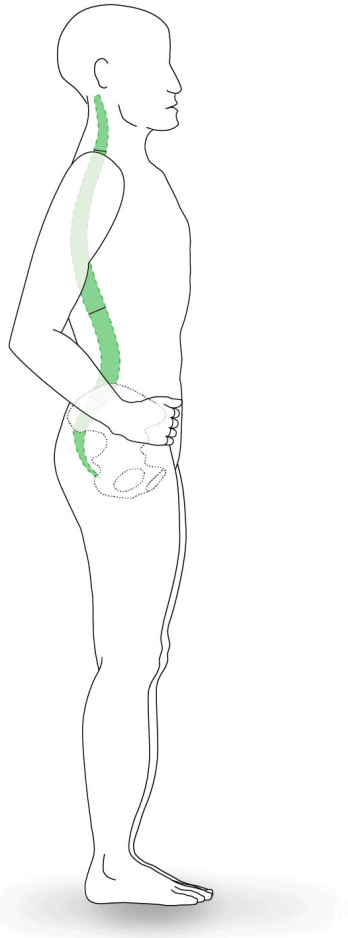
Activities that involve rapid, repetitive, sustained, weighted or end range-of-motion twisting or flexion of the spine may need to be modified, especially in people at high risk of fracture.

DON'T: Avoid all bending and twisting

DO: Consider modifying/avoiding activities if you do not feel you can do them safely

High risk - may need to:

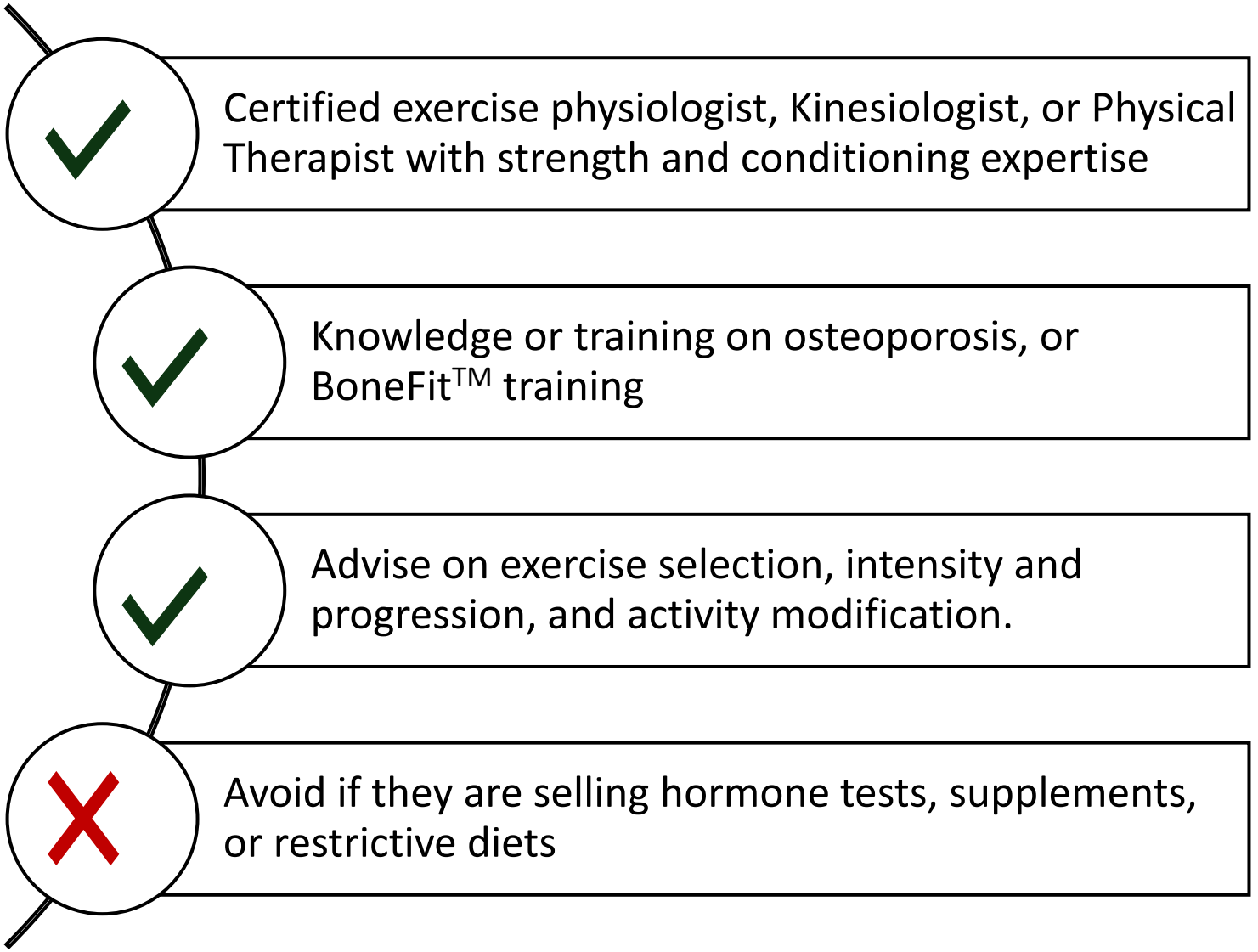
- Use slow, controlled movements
- Avoid extremes
- Shorter bouts
- Hold loads close to body, divided between hands
- Use step-to turn → feet, knees, trunk face same direction



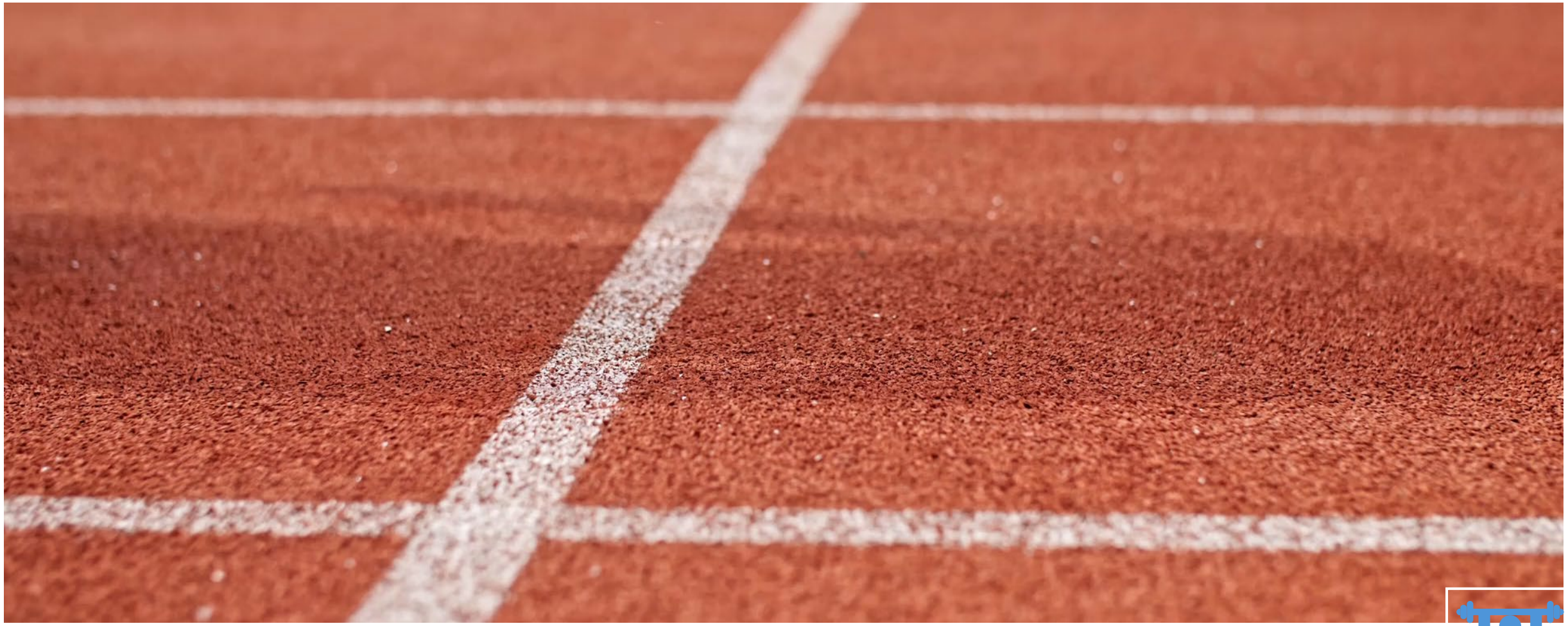
Good Practice Statement

When available, seek advice from exercise professionals who have training on osteoporosis, especially after recent fracture or if there is high risk of fracture.

When not available, refer to Osteoporosis Canada resources.



Putting the exercise recommendations into practice



What types of balance training are most effective?

Anticipatory control:

Proactively adjust body position or movement before making a movement that might cause instability

Dynamic control:

Have control of centre of mass position when changing position

Functional stability limits:

Move centre of mass as far as possible in any direction, stay stable

Reactive balance control:

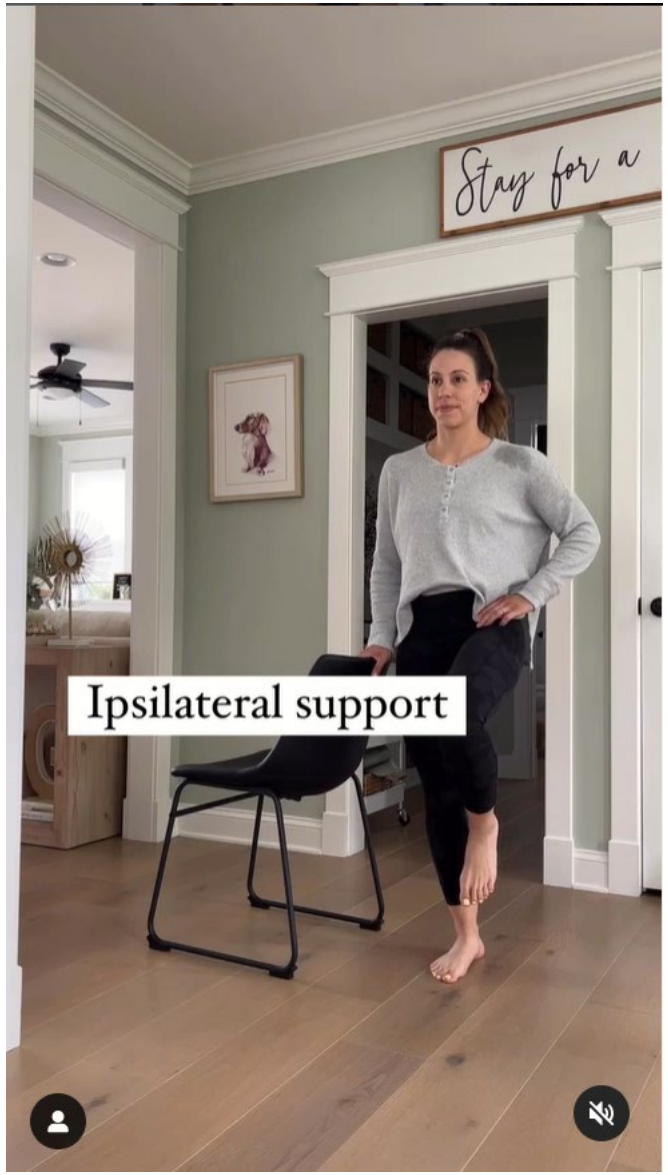
Ability to re-establish stability in face of internal or external instability

What are some examples of balance training exercises?

Sibley et al, Exp Gerontol, 2021

Example Balance Exercises:

Anticipatory control and dynamic stability	Heel raises, walk on toes or heels, toe taps on a step, Clock Yourself app, Agility ladder, lateral hops, shrimp squats, step-ups
Functional stability limits	Reaching or weight shifting in all directions standing or on one foot, one or two-legged hinge or Romanian deadlift, hip airplanes
Reactive control	Moving while standing on unstable surface Catching and throwing a ball External push/pull on part of body while doing activity



Resistance training ≥ twice per week: Start with one exercise per category

PUSH: chest and arms

PULL: upper back and arms

SQUAT: upper legs and lower legs

HINGE: upper legs and lower legs

CARRY: whole body, including abdominals and back extensors, and forearm muscles

REACH or PRESS: arms, shoulders, upper back

Example approach: Pick one exercise per category

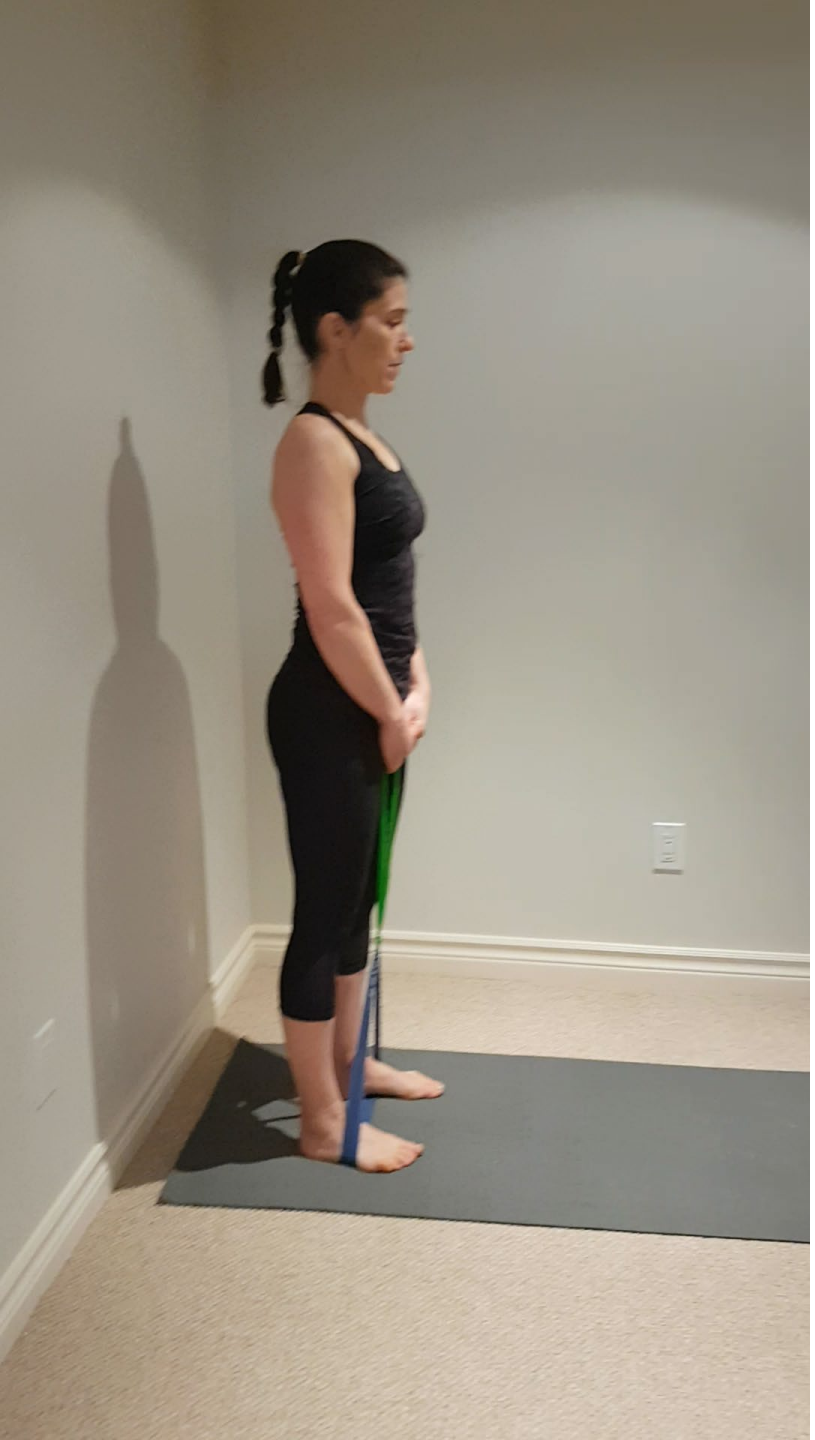
Movement	Beginner	Moderate	Hard
Push	Wall push-up	Counter push-up	Floor push-up Bench press
Pull	Elastic band row	Supported dumbbell row, band row, lat pull	Pull-up
Squat	Sit-to-stand	Bodyweight squat	Goblet or back squat
Hinge	Bridge	Hip hinge with resistance band or kettlebell	Deadlift
Carry	Farmer's carry	Suitcase carry	Bottom's up carry
Reach/ Press	Elastic band press	Landmine press	Pike push-up, overhead press

Continuum of difficulty: easier to harder

Squat progressions:

What if I have knee osteoarthritis?

- Alignment: hips, knees over toes
- Stability: abdominal and back extensor muscles
- Box squats, partial squats
- Knees out, band on thighs



Hinge progressions

Hinge progressions

https://www.instagram.com/p/Cz1JComPIuz/?utm_source=ig_web_copy_link&igshid=MzRlODBiNWFlZA==

Instagram: meghancalloway

Shoulder press variations

Scenario: Modifying exercises for someone with hyperkyphosis (rounded upper back)

- Avoid too much weight in front of body
- Use pillow for supine exercise to maintain neutral cervical spine positioning
- Modify shoulder exercises to avoid impingement
- Strengthen muscles that extend the hip, work on range of motion (hip flexors)
- Target back extensor and shoulder stabilizers

Scenario: Restricted shoulder external rotation

- Risk of impingement
- Back squat → safety bar, split squat
- Lat pull → half kneeling lat pull down, bent over dumbbell row
- Bench press → dumbbell press
- Shoulder press → landmine or incline press
- Accessory exercises:
  - External rotation strength (side-lying, face pulls with rotation)
  - Internal/External rotation mobility (e.g., slow eccentric)
  - Scapular retraction/protraction

https://www.youtube.com/watch?v=GEmGEMSEeVQ&t=468s

What about posture?

Back extensors and abdominals:

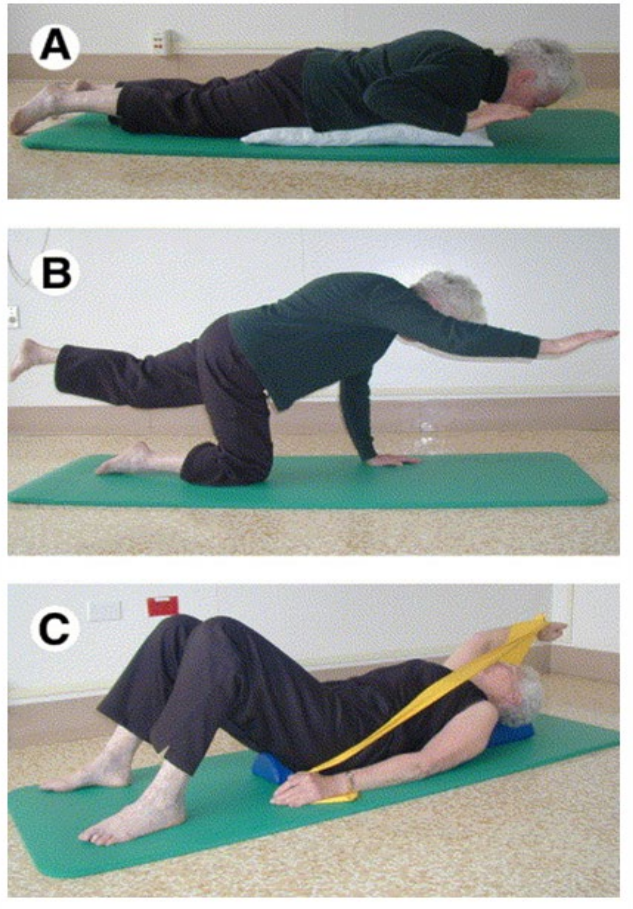
Work on endurance – lots of sets and reps, or longer holds

Shoulder stabilizers:

Include presses, pushes, and pulls as part of strength training program

Add extra exercises to work on range of motion, external rotation if needed.

Figure 1. Spinal extensor muscle strengthening
A: prone trunk extension; B: quadruped arm/leg lift; C: supine theraband arm flexion and extension



Video of Bird-dog on Boneslab YouTube: https://youtu.be/eLbUNcZz-nI

How to design a resistance training program

≥ 2x /week, 2 sets per exercise

Pick a version you can do 6-10 times, but it feels hard. Practice form first.

Progress to a version of the exercise where you can do 6-10 reps but requires **high effort**

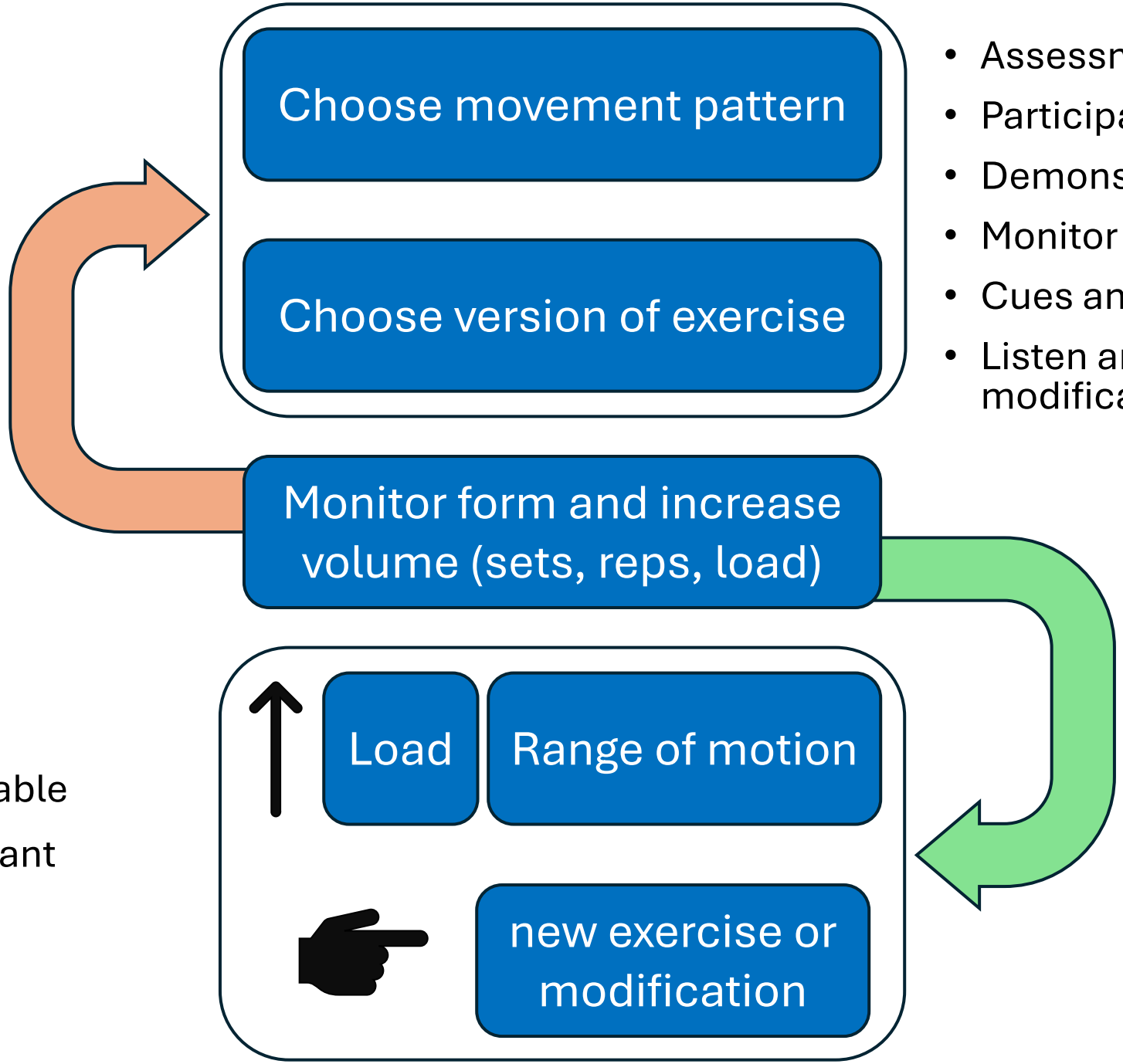
Lower for 4 seconds, lift for 2 seconds.

Progress:

Reps→ to 12

Sets → to 3-5

Then choose a harder version of the exercise



- Assessment informed
- Participant goals and needs
- Demonstration
- Monitor visually
- Cues and feedback
- Listen and make modifications

- Equipment available
- Goals of participant
- Novelty

Make your Life Easier, courtesy of Dustin Jones

TOO FIT TO FRACTURE

Evidence-Based Recommendations to Help Reduce the Risk of Fractures

DO EXERCISES THAT CHALLENGE BALANCE

Two or more times per week
Increase difficulty of exercise over time

Balance exercises involve staying steady during movements that make you unstable. You should practice:

- Leaning forward, backward, or side to side
- Unusual walking or dance patterns, such as walking heel-to-toe or sideways, or using an agility ladder
- Reacting to things that upset your balance, like stopping or changing directions
- Tai chi

tai chi

You should practice exercises that improve functional abilities, such as:

- Sit to stands or squats, to make it easier to get out of a chair
- Stair climbing or toe taps on a step

sit to stand

goblet squat

DO EXERCISES THAT IMPROVE MUSCLE STRENGTH

Two or more times per week
Increase difficulty of exercise over time

Muscle strengthening exercises are exercises where your muscles work against resistance using high effort - it should feel like hard work! You should:

- Start with using your own body weight against gravity, and progress to using elastic bands or weights for resistance
- Include exercises for muscles that control movement of your spine and shoulders to improve your posture

body weight lunge

supported bent over dumbell row

A basic muscle strengthening exercise program can include:

- Squat, lunge, hinge, or bridge exercises to improve leg strength
- Push, pull, and press exercises for upper body and shoulder muscles, such as pull downs, rows, and counter or floor push-ups
- Planks, side planks, and bird dog exercises to target abdominal and back extensor muscles and to improve posture

side plank

CONTINUE TO DO OTHER PHYSICAL ACTIVITIES

yoga

Being physically active is important for health and wellness. Many people choose activities like yoga, Pilates, walking, dancing, and jogging to improve health or for fun.

pickle ball

Do them **in addition to**, not instead of, the balance and muscle strengthening exercises as previously mentioned. Be mindful of fall risk and spine safe movement for all exercise and physical activity.

SPINE SAFE MOVEMENT

Safe movement applies to all physical activities in our community, at home, work or leisure and exercise. Everyday life involves bending and twisting of your spine. When bending or twisting your spine, move mindfully. People at high risk of fracture may need to limit:

- Repetitive bending and twisting
- Bending all the way forward or to the side
- Twisting all the way to the side
- Holding a bent over or twisted position for an extended period of time
- Bending or twisting while holding a weight or something heavy

For example, bend with your hips and knees instead of your spine and use slow and controlled movements.

✗ bending all the way forward

✓ bending at the hips and knees

REMINDER

The information contained on this guide is not intended to replace health professional advice. Consult your healthcare provider or a physical therapist about what exercises are right for you.

Seek advice from a physical therapist, kinesiologist, or exercise physiologist on exercise selection, intensity, and progression, or about safety of other physical activities, especially if you have had a recent fracture or if you are at a high risk of fracture. Bone Fit™ trained professionals are able to deliver safe and effective exercises for those with osteoporosis or related fractures. Locate a professional near you at: Bonefit.ca

For more information and additional resources, contact us:

1-800-463-6824
info@osteostrategy.on.ca
osteostrategy.on.ca

Ontario Osteoporosis Strategy
Ontario
Geras Centre for Aging Research
OSTEOPOROSIS
University of Waterloo
McMaster University

Summary

We recommend balance and functional training at least twice a week.

We suggest strength training at least twice a week.

Do other activities for fun or fitness in addition to, but not instead of, balance, functional and strength training.

Some movements may need to be modified or avoided, especially if high risk.

When available, seek advice from exercise professionals who have training on osteoporosis.

THANK YOU!

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CIHR IRSC Canadian Institutes of Health Research | Instituts de recherche en santé du Canada

OSTEOPOROSIS

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Enhancing Life

Do you have a spine fracture due to osteoporosis?

You may be eligible for a study about a virtual rehabilitation program

Participants in this study

- ☑ Men or women aged 50 or over
- ☑ Are willing to participate in virtual once weekly sessions for 8 weeks
- ☑ Have had one or more spine fractures and have pain

This study involves

- ☑ Once-weekly education and training sessions for 8 weeks that cover pain management, exercise, nutrition, and safe movement.
- ☑ Assessment of balance and physical function
- ☑ Questionnaires

If you would like to learn more, please visit our website:

This study has been reviewed by and received ethics clearance through Hamilton Integrated Research Ethics Board and UBC Clinical Research Ethics Board.

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