Exercises for Osteoporosis and Fall Prevention: Practical Tips for Clinicians

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Canadian Physical Activity Guidelines

FOR OLDER ADULTS - 65 YEARS & OLDER

Guidelines

To achieve health benefits, and improve functional abilities, adults aged 65 years and older should accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week, in bouts of 10 minutes or more.

It is also beneficial to add muscle and bone strengthening activities using major muscle groups, at least 2 days per week.

Those with poor mobility should perform physical activities to enhance balance and prevent falls.

More physical activity provides greater health benefits.
Knee OA
Sarcopenia
Hyperkyphosis
Osteoporosis
Cognitive impairment
Visual impairment
Cardiovascular and pulmonary changes
Obesity
Diabetes
Falls
Reduced mobility, ROM

What impairments are present?

What is the person’s goals?

Falls

Prioritize physical activity and exercise goals
Provide tailored advice
We strongly recommend that people with osteoporosis:

- Engage in a multicomponent exercise program that includes **resistance training** in combination with **balance training**.

- Do not engage in aerobic training to the exclusion of resistance or balance training.

Consult a physical therapist to ensure safe and appropriate exercise if you have a spine fracture.

Too Fit To Fracture Recommendations

For preventing bone loss and falls, recommend:

• Strength training for major muscle groups ≥ 2x/week
• Balance challenges **daily**
• Moderate-to-vigorous aerobic physical activity ≥ 150 min/week, or 20-30 min per day

To reduce spine loads, recommend:

• Exercises for back extensor muscles daily
• Spine sparing strategies – hip hinge, step-to-turn instead of twisting, holding loads close to body

Mary is a 92 year old woman who lives in an assisted living setting.

- History of falls
- BMD: Spine - 3.4, FN -2.3
- Spine X-rays: two **vertebral fractures**

How do your recommendations change with the presence of chronic disease or risk of injury?

Too Fit To Fracture: High Risk

Recommendations that are the same for high risk:

- Strength training ≥ 2x/week, balance challenges daily
- Back extensor exercises, spine sparing strategies

Revised recommendations for high risk individuals:

- Get up & move every 30min → prolonged sitting compresses vertebrae
- Moderate intensity aerobic physical activity only (≥ 150 min/week, can break into 10 min bouts)
- Many need physical therapist referral re: safe movement and exercise, help beyond light ADLs
- Supine lying promotes spinal extension and may help with pain relief – 15+ min, 2-4 times per day

Why emphasize multicomponent exercise program?

• Consistent with best evidence and guidelines
• People with impaired mobility at ↑ fall risk
• Build endurance, skills and self-efficacy
• Older adults with limited mobility may find short bouts of balance and strength exercises more realistic than prolonged physical activity.
Strength Training

Features: major muscle groups, work to fatigue, <12 reps.
progression

Examples:

• Squats: sit-to-stand → standard → one-leg
• Step ups
• Calf raises
• Bow and arrow “pulls” with an exercise band
• Pushups: wall, counter, hands/knees, military
• Diagonal shoulder raises
• Thoracic extension
• Upright rows

Hint: google Too Fit To Fracture
New! Effect of Exercise on Falls

Overall: RaR 0.79 (95% CI 0.73 to 0.85)

3 hours per week of exercise, including high challenge to balance reduces falls by 39%!

Table 4 Results of multivariable meta-regression exploring the impact of trial-level characteristics on the effect of exercise on falls in general community-dwelling older populations

<table>
<thead>
<tr>
<th>Variables included in multivariable meta-regression (number of trials with this characteristic)</th>
<th>Effect on effect size, meta-regression coefficient (95% CI), p value</th>
<th>Effect on falls, IRR (95% CI), p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction of high challenge balance training* (31)</td>
<td>0.87 (0.76 to 1.00), 0.04</td>
<td>0.79 (0.71 to 0.88), &lt;0.001</td>
</tr>
<tr>
<td>3+ hours per week of intervention (20)</td>
<td>0.78 (0.66 to 0.92), 0.004</td>
<td>0.70 (0.60 to 0.83), &lt;0.001</td>
</tr>
<tr>
<td>Neither high challenge balance training or 3+ hours per week of intervention</td>
<td></td>
<td>0.90 (0.82 to 0.99), 0.03</td>
</tr>
<tr>
<td>High challenge balance training and 3+ hours per week of intervention</td>
<td>0.61 (0.53 to 0.72), &lt;0.001</td>
<td></td>
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</table>

*All three criteria: movement of the centre of mass, narrowing of the base of support and minimising upper limb support. Note: 72% heterogeneity explained by both variables; statistically significant comparisons shown in italics.
Forest plots of trials of exercise to prevent falls undertaken in community dwellers with clinical conditions: A) Parkinson’s disease; B) Stroke; C) Recent hospital discharge; D) cognitive impairment.

<table>
<thead>
<tr>
<th>Author</th>
<th>Effect (95% CI)</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Canning, 2014</td>
<td>0.73 (0.45, 1.18)</td>
<td>20.56</td>
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<tr>
<td>Gao, 2014</td>
<td>0.44 (0.19, 1.01)</td>
<td>14.17</td>
</tr>
<tr>
<td>Goodwin, 2011</td>
<td>0.68 (0.43, 1.07)</td>
<td>20.99</td>
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<tr>
<td>Morris, Movement, 2015</td>
<td>0.38 (0.18, 0.81)</td>
<td>15.52</td>
</tr>
<tr>
<td>Morris, Strength, 2015</td>
<td>0.15 (0.07, 0.32)</td>
<td>15.34</td>
</tr>
<tr>
<td>Protas, 2005</td>
<td>0.62 (0.26, 1.48)</td>
<td>13.32</td>
</tr>
<tr>
<td>Overall (I-squared = 65.4%, p = 0.013)</td>
<td>0.47 (0.30, 0.73)</td>
<td>100.00</td>
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<tr>
<th>Author</th>
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<tr>
<td>Haines, 2009</td>
<td>0.72 (0.33, 1.57)</td>
<td>10.61</td>
</tr>
<tr>
<td>Latham, 2003</td>
<td>1.08 (0.87, 1.35)</td>
<td>49.64</td>
</tr>
<tr>
<td>Sherrington, 2014</td>
<td>1.43 (1.06, 1.92)</td>
<td>39.75</td>
</tr>
<tr>
<td>Overall (I-squared = 46.7%, p = 0.153)</td>
<td>1.16 (0.88, 1.52)</td>
<td>100.00</td>
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<th>Weight</th>
</tr>
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<tr>
<td>Dean, 2012</td>
<td>0.96 (0.60, 1.54)</td>
<td>52.82</td>
</tr>
<tr>
<td>Taylor Pilae, Silver Sneakers, 2014</td>
<td>0.84 (0.35, 2.05)</td>
<td>27.65</td>
</tr>
<tr>
<td>Taylor Pilae, Tai Chi, 2014</td>
<td>0.31 (0.10, 0.96)</td>
<td>19.53</td>
</tr>
<tr>
<td>Overall (I-squared = 38.5%, p = 0.197)</td>
<td>0.74 (0.42, 1.32)</td>
<td>100.00</td>
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<tr>
<th>Author</th>
<th>Effect (95% CI)</th>
<th>Weight</th>
</tr>
</thead>
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<tr>
<td>Pitkala, 2013</td>
<td>0.50 (0.41, 0.61)</td>
<td>77.12</td>
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<tr>
<td>Suttanon, 2013</td>
<td>1.00 (0.42, 2.38)</td>
<td>17.71</td>
</tr>
<tr>
<td>Wesson, 2013</td>
<td>0.34 (0.06, 1.92)</td>
<td>5.16</td>
</tr>
<tr>
<td>Overall (I-squared = 20.9%, p = 0.282)</td>
<td>0.55 (0.37, 0.83)</td>
<td>100.00</td>
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</table>
Key features in Sherrington et al:
- Minimizing upper limb support
- Narrow base of support
- Moving COM

Reduce your base of support
- Stand with feet together or on 1 leg (see photo).
- Balance on your heels only or on your toes only.
- Walk while you balance on your toes or heels only.
- Stand with 1 foot in front of the other. Your front heel touches your back toes.

Respond to things that upset your balance
- Correct your balance after something upsets your balance. For example, catch a ball and correct your balance.
- Balance on an unstable surface. For example, a piece of foam or a BOSU ball. A BOSU ball has a flat bottom and a round top. It doesn’t roll.

Do activities that require coordination or shifting weight while moving around
- Dance.
- Do Tai Chi.
- Walk heel to toe in a line or in a figure eight.

Shift your weight
- Move your weight more to 1 foot than the other.
- Lean side to side or front to back.
- Shift your weight from toes to heels.
Did you know?

Hyperkyphosis is associated with:

- an increased risk of death
- an increased risk of non-spine fractures?

• **Kyphosis > 53° → 50% ↑ non-spine fracture**
  (95% CI 1.10–2.06) *after adjusting for BMD, prevalent vertebral fractures, prior history of fractures, and other fracture risk factors.

• **prevalent fractures + hyperkyphosis ↑ mortality - relative hazard per SD ↑, 1.58 [CI, 1.06 to 2.35] *independent of age, self-reported health, smoking, spine bone mineral density, number of vertebral fractures, and severe vertebral fractures**
Bad Posture

Over time, having poor posture can lead to pain and possibly damage to our body. Check regularly that you are avoiding these habits:

- Forward head posture: is your chin jutting out past your chest or your ears ahead of your shoulders?
- Rounded Shoulders: are your shoulders positioned in front of your hips? Are your palms facing backwards?
- Rounded middle back: are you slouching so that your spine between your shoulder blades is becoming curved?
- Slumped lower back: are you slouching so that your lower spine is becoming flattened or losing its natural curve?
Exercise and hyperkyphosis

- Small # of RCTs report modest improvements with exercise
- Emphasis on improved back extensor strength/endurance, supervision
- Limited # trials, trial quality variable
- SHEAF trial!

Endurance Training for Back Extensor Muscles

What type of activity?  
Supine presses/holds → (prone extension to neutral) → core activation in standing

How often each week?  
• 5-10 minutes per day of posture exercises  
• Attention to posture during daily activities

Individuals with a history of a spine fracture:  
- Might need a pillow under head if spine is curved  
- with a Bone Fit™ trained professional

Core activation in standing – see “Intro to theraband” video: www.osteoporosis.ca/after-the-fracture/videos/
ARM LENGTHENER

1. Lying in the Unloading Position to start.

2. Bring one hand into your side and then move arm to finish with your arm beside your ear. Imagine that your favorite treat is a few inches from your finger tips. Lengthen your arm from the shoulder to reach that treat.

HOLD THE PRESS FOR _____ SECONDS  •  PERFORM _____ REPETITIONS

NOTE: ONLY DO THIS EXERCISE IF PRESCRIBED TO YOU BY A HEALTH CARE PROVIDER. Photography © 2010 Done Art. All rights reserved.
## Alignment and Core Stability Cues

<table>
<thead>
<tr>
<th>Target</th>
<th>Example Cues</th>
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<tbody>
<tr>
<td><strong>Forward head posture</strong></td>
<td>- Gently bring head back so it is as aligned with shoulders as possible</td>
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</tbody>
</table>
| **Hyperkyphosis, rounded shoulders**        | - Imagine there are weights hanging from your shoulder blades, pulling them toward your back pockets;  
- Lift your breastbone gently up to the ceiling;  
- Take a breath, fill the back of your lungs first.                                                                                                                                                                                                                           |
| **Abdominal bracing to support the spine**  | - Gently brace your abdomen as if someone were about to poke you in the stomach.                                                                                                                                                                                                                                                          |
What is “spine sparing”?
Recommend that patient modify activities that apply rapid, repetitive, weighted or end-range flexion (forward bending) or twisting torque to the spine.

How?
- Hip hinge
- Step-to-turn
- Avoid lifting from/lowering to floor
- Slow, controlled twist, not to end of range of motion
- Balance loads on either side of body
- Support trunk when flexing
- Hold weight close to body, not overhead
Teach “spine sparing” during ADL and physical activity

Recommend that patient modify activities that apply rapid, repetitive, weighted or end-range flexion (forward bending) or twisting torque to the spine.

Saying “Don’t bend or twist” doesn’t teach them how TO move → instills fear, disincentive to physical activity.
How to move an object

How NOT to move an object

Do NOT twist when putting an item down

Do NOT have feet planted on the floor
Spine Fractures and Pain

Supine Lying 15-20 min, 2-4x/day for pain

Lie on your back, bend both knees to 90 degrees with feet flat on the floor. Use a pillow if your head does not touch the floor. Your chin should not be pointing toward the ceiling or tucked in to your chest.

Place both arms out from your side, about 30-45 degrees, with palms facing up.

When beyond acute stage, can begin to add exercises for back extensors.

Lift the breastbone while keeping your back in contact with the floor. Hold for 3-5 seconds and repeat 8-12 times.
**Practice tips:**

- Multijoint, functional exercises, large muscle groups
- Sufficient intensity and progression
- Adequate protein intake post-exercise and throughout the day—1.2g/kgBW/day or 25–30 g high-quality protein per meal (2.5 g of Leu)
  - **Lean meat, fish, dairy, lentils, white and kidney beans, peanuts**

**Sarcopenia:** Loss of muscle mass and strength with aging
- ↓# myocytes, protein content in remaining cells
- ↓protein synthesis
- disproportionate atrophy Type 2a fibres
- ↓ anabolic stimuli (hormones, protein intake, physical activity)

Phillips 2015, Adv Nutr
Osteoarthritis:

- Pain, stiffness, limited ROM
- Low quad strength: ↑ incidence & progression of knee OA?
- Increased body weight: ↑ incidence & progression of knee OA
- Obesity or metabolic syndrome: proinflammatory, risk of underlying cardiovascular disease, hypoglycemia during exercise

Practice tips:

- Joint sparing e.g., water exercise, multijoint movements
- Core stability, alignment, functional exercises, mobility
- Increase strength and size of muscles surrounding joint to reduce impact on bones and cartilage
- Weight loss, limiting inflammation
- Cardiac rehab or exercise physiologist supervision
GLA:D Canada

Education sessions
Warm up, Circuit, Cool Down
2-3 sets of 10-15 repetitions

Features:
• Core stability (abdominals)
• Postural orientation
• Muscle strength in the legs
• Functional training exercises

http://gladcanada.ca/
Alzheimer’s Disease and Related Dementias:
• Impaired confrontation naming (word retrieval)
• Impaired ability to learn/recall new info
• Language disorder
• Impaired visuospatial skills
• Impaired executive function
• Apraxia with sequential motor tasks
• Loss of social inhibitions
• Impaired sleep/wake cycle

Practice tips:
• Written action plan and contingency plans, routine
• Balance and strength training
• Activities with rhythm, ingrained motor patterns e.g., dancing, cycling
• Social support or group exercise with instruction

TOOLS for Patients:
www.osteoporosis.ca/osteooporosis-and-you/too-fit-to-fracture/

Tell your patients about free booklet, 20+ videos on exercise:
- How to do strength and balance exercises
- How to modify golf game
- Incorporating balance training into daily home activities
- Exercises for older adults with higher fall risk, spine fractures

Locate: ON, SK, AB, NS, NB. Or, arrange for a workshop in your town!
www.bonefit.ca
Too Fit to Fall or Fracture

Strength Training At least 2 days/week
- Exercises for legs, arms, chest, shoulders, back
- Use body weight against gravity, bands, or weights
- 8 - 12 repetitions per exercise

Try these to get started:
- Classes at YMCA/community centre
- Consult a physical therapist/physiotherapist
- Contact Osteoporosis Canada

Strength Training (more examples) At least 2 days/week
Other exercises include:
- Upright row
- Step up

Balance Exercises Every day
- Tai Chi, dancing, walking on your toes or heels
- Have a sturdy chair, counter, or wall nearby, and try (from easier to harder): shift weight from heels to toes while standing; stand heel to toe; stand on one foot; walk on a pretend line

Posture Awareness Every day
- Gently tuck your chin in and draw your chest up slightly
- Imagine your collarbones are wings - spread your wings slightly without pulling your shoulders back

Aerobic Physical Activity At least 150 mins/week
- Bouts of 30 mins or more, moderate to vigorous intensity
- You should feel like your heart is beating faster and you are breathing harder
- You might be able to talk while doing it, but not sing

What are spine sparing strategies?
Spine sparing strategies help "spare" the spine from injury. Injuries to the spine can occur when you bend forward or twist the spine quickly or repeatedly, or if you lift something heavy, bend far forward (e.g., tying shoes) or twist the torso all the way to the side. Bending or twisting while holding a weighted object (e.g., groceries, grandchild) is also risky.

Spine sparing strategies:
- Bend with your hips and knees, not your spine
- Turn your whole body rather than twisting your spine

Ready to learn more?
Osteoporosis Canada has developed tools to help you get too fit to fracture!
- Download a free booklet, one-page summary, and other tools
- Watch videos about exercise, balance training, and safe physical activity
- Watch webcasts by expert researchers

http://www.osteoporosis.ca/osteoporosis-and-you/too-fit-to-fracture/

Not online? No problem! Just call the hotline number below to order a free booklet.

The information contained in 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.

Questions? Want a free physical activity booklet? Contact Osteoporosis Canada: English 1 800 463 6842 / French 1 800 977 1778 or www.osteoporosis.ca
Locate a Bone Fit™ trained instructor: English 1 800 463 6842 / French 1 800 977 1778 or www.bonefit.ca

http://www.osteoporosis.ca/osteoporosis-and-you/too-fit-to-fracture/
Too Fit To Fracture Summary

Recommend:
• Strength training ≥ 2x/week
• Balance & posture exercises daily
• Moderate/vigorous physical activity, ≥150min/week
• Spine sparing strategies

Resources:
• Use Osteoporosis Canada’s tools: videos, booklet, one pager for EMR  
  www.osteoporosis.ca/osteoporosis-and-you/too-fit-to-fracture/
• Bone Fit Trained Physiotherapist or Kinesiologist  
  www.bonefit.ca
• Identify community programs that teach strength and balance exercises