



# Exercise: Preventing bone loss and reducing fracture risk

## Intervention

Multimodal exercise program including progressive resistance training in combination with multidirectional, weightbearing exercises and challenging balance/mobility training.

## Indication

1 in 2 women and 1 in 3 men suffer an osteoporosis-related fracture over their lifetime. Reduced bone strength is an important predictor of fracture risk; however, the majority of fractures result from a fall.

Postmenopausal women and older men at risk of falls and fracture with the aim of improving bone mineral density (BMD) or slowing bone loss, as well as improving muscle mass, strength and function.

Postmenopausal women (or women who experience early menopause) are at increased risk of fracture due to rapid loss of bone associated with loss of oestrogen in addition to bone loss with ageing. Hip, spine and wrist are the most common osteoporotic fracture sites.

## Contraindications

Those with severe osteoporosis or who have previously sustained an osteoporotic vertebral fracture should generally avoid dynamic, explosive and high-impact loads, excessive spinal (trunk) flexion (particularly when lifting objects), dynamic abdominal exercises and twisting movements of the spine. Yoga or Pilates postures should be avoided or modified.

## Precautions

Exercise training is generally safe and effective for most patients with an increased risk for osteoporosis, but some activities may need to be modified (see Contraindications). Individuals at high risk should receive advice in safe lifting and postural techniques to avoid dangerous or excessive loading during everyday activities, and they should undertake modified exercises that minimise the risk of falling.

## Adverse effects

Possible adverse events – particularly in high-risk patients with spinal osteoporosis or a history of vertebral fracture – include increased pain, exercise-related injury, falls and spontaneous vertebral fracture with excessive forward flexion activities.

Exercise frequency and intensity should be gradually increased to minimise risk of injury.

## Availability

Exercise can be carried out in a variety of settings, including the home and local health and fitness centres. It can be self-directed; however, a specific program from a physiotherapist or an accredited exercise physiologist with expertise in osteoporosis may be useful, particularly for patients at high risk.



## Description

For adults without osteoporosis or a history of low-trauma fracture, exercise programs should combine a diverse range of weightbearing impact exercises (eg hill-walking, jogging, jumping, skipping, dancing, circuit training) and progressive resistance training involving high load and low repetition. Challenging balance and mobility training should also be incorporated to reduce the risk of falls.

Postmenopausal women and older men should aim for the following.  
(Also see Consumer resources.)

### Resistance training exercise

- › At least two 30- to 45-minute progressive resistance training sessions per week.
- › Each session should comprise 6–8 exercises with 2–3 sets of 8–10 repetitions at an intensity corresponding to hard to very hard (rating of 14–16 on the Borg scale).
- › Exercises should target the major muscles attached to or near the hip and spine (including hip extensors and abductors), knee extensors and flexors, calves and back extensors.

### Multidirectional weightbearing activities

- › To be performed 4–7 times per week.
- › Activities can include short exercise bouts (eg 50–100 jumps, bench step-ups, heel drops divided into 3–5 sets of 10–20 repetitions).
- › Moderate- to-high-impact and odd-impact exercise appear to have greater benefit than low-impact, but may need to be introduced after a 4- to 8-week period of resistance training to ensure adequate strength and function.

### Challenging balance and mobility exercises

- › At least 3–4 times per week.

## Tips and challenges

While low-impact activities such as walking are beneficial to general health, they do not improve bone density. To improve or maintain bone health, exercises need to create a 'loading' effect on the bone. However, relatively few loading cycles (repetitions) are needed – short bouts separated by periods of rest are more effective than the same number of loads performed all at once.

Risk factors that limit the benefits of exercise include smoking, excessive alcohol consumption, vitamin D deficiency and insufficient dietary calcium or protein.

The benefits of exercise on bone density are lost over time if exercise is not maintained, so adherence strategies are important.

High-impact exercise may be a problem for women with continence issues, and so pelvic floor exercise training is important.

## Grading

NHMRC Level I evidence.



## References

Xu J, Lombardi G, Jiao W, Banfi G. Effects of exercise on bone status in female subjects, from young girls to postmenopausal women: An overview of systematic reviews and meta-analyses. *Sports Med* 2016;46(8):1165–82. doi: 10.1007/s40279-016-0494-0.

Zhao R, Zhao M, Xu Z. The effects of differing resistance training modes on the preservation of bone mineral density in postmenopausal women: A meta-analysis. *Osteopor Int* 2015;26:1605–18.

Beck BR, Daly RM, Singh MAF, Taaffe DR. Exercise and sports science Australia (ESSA) position statement on exercise prescription for the prevention and management of osteoporosis. *J Sci Med Sport* 2016.

## Consumer resources

[Osteoporosis Australia – Prevention: Exercise](#). This includes an exercise fact sheet and information about strategies to avoid falls.

Example of a structured exercise program

Warm-up:

Choice of treadmill, stationary bike or stair/bench step-ups

5–10 minutes at moderate intensity

	<b>Progressive resistance training</b>	<b>Weightbearing impact exercises*</b>	<b>Challenging balance and mobility exercises</b>
<b>Type</b>	Target muscles attached to the hip and spine: weighted lunges, squats, hip abduction/adduction, knee extension/flexion, plantar flexion/dorsi-flexion, back extension and core/postural muscles (eg abdominals)	Multidirectional activities: heel drops, jumping (forward/backward, side-to-side), hopping, skipping, dancing, bench step-ups/ drop jumps, stair climbing	Standing and mobility exercises: <ul style="list-style-type: none"> <li>› reduce base of support (standing with feet together, semi-tandem or on one leg);</li> <li>› perturb centre of mass with leaning and reaching exercises;</li> <li>› tandem walking;</li> <li>› backwards, sideways, crossover or figure-of-eight walking;</li> <li>› stepping over obstacles;</li> <li>› reduce the need for upper limb support;</li> <li>› Tai Chi and dancing</li> </ul>
<b>Frequency</b>	At least twice a week	4–7 times per week	At least 3 times per week



<b>Intensity</b>	Moderate to very high (75–85% of maximum strength or 14–17 on Borg 6–20 point Rating of Perceived Exertion [PRE] scale)  Program must be progressive	Moderate- to high-impact and odd-impact (multidirectional) exercises, as tolerated	Challenging
<b>Dose</b>	2–3 sets of 8–10 repetitions	Progress to 50–100 jumps per session (3–5 sets of 10–20 repetitions with 1–2 minutes rest between sets)  Intersperse impact exercise between resistance and balance activities  Teach correct landing techniques	20–30 minutes of a variety of balance exercise or 2–3 sets of 10–20 repetitions or 10–60 seconds for each exercise  These can be performed throughout the day (eg while waiting for kettle to boil)

Exercise prescription will vary depending on individual risk factors, including bone density, comorbid conditions, falls risk, history of fracture, current physical activity status and goals and preferences.

\*For previously sedentary adults, those with osteoporosis or at high risk of falling, weightbearing exercises should be avoided or initially modified (to include low-impact exercises) or introduced after a period of 4–8 weeks of resistance training to ensure adequate strength and function.

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