

What you need to know about Osteoporosis

Consumer guide



osteoporosis australia

Introduction

1.2 million Australians are affected by osteoporosis, which means that their bones are fragile and at risk of fracture. A further 6.3 million people have low bone density (osteopenia), a possible precursor to osteoporosis.

However, as many as 4 out of 5 people with osteoporosis don't know that they have it and therefore don't know that they are at risk of fracturing a bone. This is because osteoporosis is a 'silent' disease without obvious symptoms. It can progress without people being aware that they have the disease until they break a bone. It is therefore important that osteoporosis is diagnosed and treated as early as possible. Sometimes osteoporosis is not diagnosed, even after a fracture has occurred. This is because the underlying cause of the fracture has not been properly investigated.

After the first fracture, there is a 2-4 times greater risk of another fracture occurring within 12 months. This risk rises rapidly with each fracture, and is known as the 'cascade effect.' Unfortunately, most Australians do NOT receive the investigations and treatment necessary to prevent fractures, either before or after the first fracture occurs. This booklet will help you to identify your risk of osteoporosis and sets out the steps you can take to improve your bone health. If you have already had a fracture, it gives advice on what you can do to minimise further damage to your bones.

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Osteoporosis

What is osteoporosis?

Osteoporosis is a condition in which the bones become fragile and brittle, leading to a higher risk of fractures than in normal bone. Osteoporosis occurs when bones lose minerals, such as calcium, more quickly than the body can replace them, leading to a loss of bone thickness (bone mass or density). As a result, bones become thinner and less dense, so that even a minor bump or fall can cause serious fractures. These are known as 'fragility' or 'minimal trauma' fractures.

Fractures and osteoporosis

A fracture is a complete or partial break in a bone. Any bone can be affected by osteoporosis but the most common fracture sites are the spine, hip, upper arm, wrist, ribs or forearm. These fractures often result from a minor incident. Osteoporosis usually has no signs or symptoms until a fracture happens – this is why osteoporosis is often called the 'silent disease.'

Anyone who experiences a fracture following a minor bump or fall and is 50 years or over should be investigated for osteoporosis.

Fractures due to osteoporosis can be serious, leading to chronic pain, disability, loss of independence and even premature death.

Fractures in the spine due to osteoporosis can result in the vertebrae losing height or changing shape. This can lead to changes in posture (eg: a stoop or Dowager's hump in your back), loss of height and deformity of the spine.

The fracture cascade

About 50% of people with one fracture due to osteoporosis will have another.

The risk of further fractures increases with each new fracture. This is known as the 'cascade effect.'

For example, a person who has suffered a fracture in their spine is over 4 times more likely to have another fracture within the next year.

Two thirds of fractures of the spine are not identified or treated. People often believe that the symptoms of spinal fracture – back pain, height loss or rounding of the spine are just due to 'old age.' However for many people, osteoporotic fractures can be prevented or at least the risk of having further fractures greatly reduced.

To stop the fracture cascade, it is essential that osteoporotic fractures are identified and treated as quickly as possible.

Women are at a greater risk of developing osteoporosis than men. Women generally have smaller bones than men and also experience a rapid decline in the production of the hormone oestrogen during the menopause.

Oestrogen protects the bones; when oestrogen levels decrease, the bones lose calcium and other minerals at a much faster rate. As a result, bone loss of approximately 2% per year occurs for several years after menopause.

Men also lose bone as they age. However, men's testosterone levels decline more gradually – and as a result, their bone mass generally remains adequate until much later in life. Reduced calcium intake and low levels of vitamin D can worsen age-related bone loss.

What's your risk of osteoporosis?

Your risk of osteoporosis can be estimated before the disease occurs.

We know that women are more likely than men to get osteoporosis; advancing age is another contributing factor. However, certain people have other 'risk factors' that make them even more likely to develop osteoporosis. These include:

Your family history

- Bone strength is strongly inherited. Having a parent who had osteoporosis, experienced fractures, lost height or had a 'Dowager's hump' indicates low bone density in your family.



Your calcium and vitamin D levels

- Low calcium intake. It is recommended that adults take in at least 1,000 mg of calcium per day, preferably through a calcium-rich diet, increasing to 1,300 mg per day for women over 50 and men over 70.
- Low vitamin D levels. A lack of sun exposure can mean you are not getting enough vitamin D, which your body needs to absorb calcium and to maintain muscle strength.

Your medical history

Certain conditions and medicines can have an impact on your bone health:

- Corticosteroids, when taken for long periods – commonly used for asthma, rheumatoid arthritis and other inflammatory conditions.
- Low hormone levels
In women: early menopause.
In men: low testosterone.
- Conditions leading to malabsorption eg: coeliac disease, inflammatory bowel disease.
- Thyroid conditions – over active thyroid or parathyroid.
- Some chronic diseases eg: rheumatoid arthritis, chronic liver or kidney disease.
- Some medicines for epilepsy, breast cancer, prostate cancer and depression.

Lifestyle factors

- Low levels of physical activity.
- Smoking.
- Excessive alcohol intake.
- Weight – thin body build or excessive weight (recent studies suggest that some hormones associated with obesity may play a role in the development of osteoporosis).

If you have any of the above risk factors for osteoporosis, it is important that you advise your doctor.

If you are over 50 and have experienced a fracture as a result of a minor incident, you should talk to your doctor about osteoporosis. It may also be possible that you are unaware that a spinal fracture has occurred, especially as the pain usually disappears in 6-8 weeks. Signs that this type of fracture may have occurred include:

- Loss of height (more than 3 cm, 1 inch).
- Sudden, severe, unexplained back pain.
- Developing a 'dowager's hump' or curve in the spine.





How is osteoporosis diagnosed?

Could I have osteoporosis?

Osteoporosis is diagnosed by combining information about your medical history with a physical examination and some specific tests for osteoporosis.

Your doctor will ask you about any possible risk factors and check your medical history including information about any past or current fractures.

Osteoporotic fractures generally occur after a small bump or fall – for example, falling from standing height, stumbling on steps or even coughing.

Your doctor may also measure your height, order an x-ray to check if any bone fractures have occurred and do some blood tests to look for any other medical causes of osteoporosis.

Bone density test

The measurement of bone density is an important tool for diagnosing osteoporosis.

The most common method of measuring bone density is a 'Dual-energy X-ray Absorptiometry' (DXA) scan. DXA scans are widely available in most medical imaging facilities and in many hospitals.

It is a quick, painless test that emits one-tenth of the radiation of a chest x-ray and is used to measure the density of the bones in the spine and hip, the bones most commonly affected by an osteoporotic fracture.

The test gives a result called a T-Score, which compares your bone density with the average of young healthy adults. A very low T-Score indicates that you have osteoporosis. The table below explains what your T-Score means and what action you and your doctor may need to take.

Rebates for bone density testing

Medicare rebates are available for DXA scans if your doctor considers you to be at risk of osteoporosis due to another medical condition and for all women and men aged 70 years and over. Your doctor will be able to advise you if you are eligible for a rebate.

You may see advertisements for other types of bone density tests in chemists and shopping centres, called Heel Ultrasounds. Heel Ultrasound is not the recommended standard test to measure your bone strength and predict your risk of fracture as it is not as accurate as a DXA scan.

What can I do to prevent fractures?

There are a number of things you can do at every stage of life to improve and maintain your bone health.

Bone health is maintained by:

- Adequate calcium levels.
- Adequate vitamin D levels.
- Regular 'bone friendly' exercise.
- Avoiding negative lifestyle factors such as excessive alcohol and smoking.
- Taking medicine as directed, if you have been diagnosed with osteoporosis.

T-Score	Result	What is the outcome?
1 to -1	Normal	You should ensure you have adequate calcium, enough vitamin D and that you do regular exercise – these are all important factors for maintaining healthy bones.
-1 to -2.5	Osteopenia At risk of developing osteoporosis. Fracture risk depends on T-score as well as other factors	Take immediate action to minimise further bone loss. Your doctor will ensure calcium and vitamin D levels are adequate and discuss any possible risk factors for osteoporosis. Osteoporosis medication may be needed, depending on your overall fracture risk. Your doctor will monitor your bone density with a follow up DXA scan after 2-5 years.
-2.5 or lower	Osteoporosis Fracture risk is high	Your doctor will start treatment with specific osteoporosis medicines and ensure adequate calcium and vitamin D levels. Your doctor should discuss possible medical causes and risk factors with you. Follow up tests to monitor bone health and treatment. Your doctor may suggest measures to reduce your risk of falls.



Calcium

Calcium and your bones

Almost 99% of the body's calcium is found in the bones. Calcium combines with other minerals to form the hard crystals that give your bones their strength and structure. A small amount of calcium is dissolved in the blood; this calcium is essential for the healthy functioning of the heart, muscles, blood and nerves. Calcium is also lost from the body in natural wastes.

Bones act like a calcium bank. If you do not take in enough calcium from your diet to replace losses and maintain adequate levels in the blood, the body reacts by 'withdrawing' calcium from your 'bone bank' and depositing it into the bloodstream. If your body withdraws more calcium than it deposits over a long period, your bone density (bone strength) will gradually decline and you may be at risk of developing osteoporosis.

FAST FACT:
 Less than half of all Australian adults get their recommended daily intake of calcium.

Calcium requirements at different stages of life

The amount of calcium you need depends on your age and sex. The highest daily requirements are for teenagers (a period of rapid bone growth) and for women over 50 and men over 70.

We achieve our Peak Bone Mass – the point at which our bones are at their highest density – by the age of 30. Nearly 40% of our Peak Bone Mass is acquired during puberty. Achieving a high Peak Bone Mass during these younger years can help maintain better bone health throughout life, and an adequate calcium intake is therefore essential for children and teenagers.

In adulthood, adequate dietary calcium is vital to maintain bone strength. For women in particular, menopause is a time of more rapid bone loss – calcium requirements increase at this stage of life.

In older adults, calcium is absorbed less effectively from the intestine and more can be lost through the kidneys, so calcium intake needs to be maintained at a higher level.

Recommendations for adequate calcium intake

Category	Age (yrs)	Recommended dietary intake
Children	1-3	500 mg/day
	4-8	700 mg/day
Girls and boys	9-11	1,000 mg/day
Teens	12-18	1,300 mg/day
Adults: women and men	19+	1,000 mg/day
Increasing to:		
Women	Over 50	1,300 mg/day
Men	Over 70	1,300 mg/day

Source: National Health and Medical Research Council of Australia (2006) Nutrient Reference Values for Australia and New Zealand including Recommended Dietary Intakes.

The calcium content of selected foods



GOOD TO KNOW:

Low fat dairy products have just as much calcium (and sometimes even more) than regular varieties.

	Calcium/serve (mg)	Std serve	grams/serve	kJ/serve
Milk, reduced fat, calcium fortified	520	cup (250 ml)	–	382
Skim milk	341	cup (250 ml)	–	382
Reduced fat milk	367	cup (250 ml)	–	551
Regular milk	304	cup (250 ml)	–	762
Reduced fat evaporated milk	713	cup (250 ml)	–	908
Regular soy milk	309	cup (250 ml)	–	660
Reduced fat soy milk	367	cup (250 ml)	–	702
Low fat soy milk	367	cup (250 ml)	–	606
Tofu firm	832	cup (250 ml)	260	1378
Regular natural yogurt	386	tub	200	734
Low fat natural yogurt	488	tub	200	498
Cheddar cheese	160	1 slice	21	349
Reduced fat cheddar cheese (15%)	209	1 slice	21	233
Shaved parmesan	204		21	355
Edam cheese	176	1 slice	21	312
Pecorino	156	1 slice	21	318
Reduced fat mozzarella	200	1 slice	21	258
Camembert	121	1 wedge	25	322
Sardines, canned in water, no added salt	486	can	90	649
Sardines, canned in oil, drained	330	can	90	824
Pink salmon, canned in water, no added salt	279	small can	90	552
Pink salmon, canned in brine	183	small can	90	575
Red salmon, canned in water, no added salt	203	small can	90	734
Red salmon, canned in brine	175	small can	90	688
Mussels, steamed or boiled	173		100	503
Snapper, grilled, with olive oil	163	1 fillet	100	635
Oysters, raw	132		100	303
Tahini	66	1 tablespoon	20	543
Almonds, with skin	30	10 almonds	12	300
Dried figs	160	6 figs	80	866
Dried apricots	32	6 apricots	45	399
Brazil nuts	53	10 nuts	35	1,010
Curley parsley, chopped	12	1 tablespoon	5	6
Mustard cabbage, raw	91	1 cup, shredded	70	54
Bok choy, raw	65	1 cup	75	61
Watercress, raw	60	1 cup	70	77
Silverbeet, boiled	87	1/2 cup	100	82
Lebanese cucumber, raw	68	1 cup sliced	120	61
Celery, raw	31	1 cup, chopped	70	45
Broccoli, raw	15	2 florets	45	56
Baked beans in tomato sauce	43	cup	120	426
Chickpeas, canned	90	cup	200	898
Soy beans, canned	106	cup	200	844
Boiled egg	21	medium	55	321
Carob bar	56	1 bar	15	323
Licorice	34	1 stick	12	114
Vanilla ice cream, reduced fat	48	1 scoop	50	176
Vanilla custard, reduced fat	130	1 tub	100	359
Cheesecake	163	1 slice	125	1786

* Source: NUTTAB 2010.

Calcium from food

The best way to get your recommended calcium intake is to eat a diet rich in calcium. Nearly all people consume some calcium as part of their general diet, but calcium content in different foods varies significantly. It is important to consume 'calcium rich' foods on a regular basis, as part of a normal diet.

Osteoporosis Australia recommends 3-5 serves of calcium rich food daily.

The number of serves needed will depend on the calcium content of the particular food.

For most Australians, dairy foods are the main source of calcium and an easy way to obtain adequate calcium. Milk, yoghurt and most cheeses are particularly high in calcium (this includes reduced fat and low fat options). Three serves of dairy food per day will generally provide adequate calcium.

Individuals with lactose intolerance (not allergy) are often able to eat yoghurt and cheese, as the lactose in these foods has been broken down. People who dislike or are intolerant to dairy products require more serves of other high calcium-containing foods; for example, calcium rich vegetables, tinned sardines or tinned salmon (including the bones), calcium rich nuts and fruits, or calcium fortified foods.

Practical tips for getting more calcium

- Calcium is more concentrated in dairy products than most other food groups, and is easily absorbed. Try to include 3 serves of dairy per day in your normal diet. A serving size is equivalent to a glass of milk (250 ml), tub of yoghurt (200 g) or a slice of cheese (40 g).
Note: hard cheeses such as parmesan have a higher concentration of calcium than softer varieties such as ricotta.
- Consider eating the bones that are present in canned fish (salmon and sardines), as this is where most of the calcium is concentrated.
- Add milk or skim milk powder to soups or casseroles.
- Use yoghurt in soups, salads and desserts.
- Soy does not contain a significant amount of calcium. However, calcium is added to many soy-based products such as calcium set (firm) tofu and several brands of soy milk. The calcium in these products is as easily absorbed as it is from other products that naturally contain calcium.
- Include more broccoli, mustard cabbage, bok choy, silverbeet, kale, spinach and chick peas in your regular diet.
- Eat more almonds, dried figs and dried apricots.
- Products fortified with calcium, such as breakfast cereals and some breads and fruit juices, can help improve your calcium intake.

How much calcium does the body absorb?

Not all the calcium we consume is used by the body – some is not absorbed by the digestive system. It is normal for a small amount of calcium to be lost in this way, and this is taken into consideration when setting the recommended level of calcium intake (1,000 mg per day for adults generally). However, there are some factors that can lead to an abnormally low absorption of calcium:

- Low vitamin D levels.
- Excessive caffeine and alcohol.
- Diets high in phytates or oxalates. Phytates (found in some cereals and brans) may reduce the calcium absorbed from other foods that are eaten at the same time. Oxalates (contained in spinach and rhubarb) only reduce the calcium absorbed from the food in which they are present.
- Certain medicines; for example, long term glucocorticoid use (eg: prednisone, prednisolone).
- Certain medical conditions for example, coeliac disease, kidney disease.

These factors can impact on bone health and should be discussed with your doctor.



Calcium supplements

Osteoporosis Australia recommends that you obtain your required calcium intake from your diet. When this is not possible, a supplement may be required, at a dose of 500-600 mg calcium per day. The most common supplements are calcium carbonate, calcium citrate or hydroxyapatite. Supplements may take the form of oral (swallowed) tablets, chewable tablets, effervescent tablets or soluble powder.

It is best to talk to your doctor and pharmacist about when and how to take supplements. If you do take a supplement, it is important that you take it in the correct way:

- Calcium carbonate requires stomach acid in order to be absorbed, so these supplements should be taken with meals.
- Calcium citrate is not dependent on stomach acid, so can be taken at any time.
- If you are also taking oral bisphosphonates (a type of osteoporosis medication), the calcium supplement and osteoporosis medicine should be taken at least 2 hours apart, otherwise the absorption of one medicine interferes with the other.

Possible side effects of calcium supplements

Calcium supplements are usually well tolerated.

Some people may experience bloating or constipation. If this occurs, talk to your doctor or pharmacist. While rare, calcium supplements may cause kidney stones in people who are predisposed to developing problems with their kidneys, or in people who are already taking in a high level of calcium through their diet (1,200 mg per day or more).

Some recent studies (and subsequent media reports) have suggested an increased risk of heart attack in people who take calcium supplements. This is an area of ongoing research and discussion. Osteoporosis Australia stresses the importance of achieving the recommended daily intake of calcium and continues to recommend calcium supplements at a dose of 500-600 mg per day when dietary calcium is low. The use of calcium supplements at this level is considered to be safe and effective.

Only take supplements as directed, and consult your doctor or pharmacist.

Calcium and osteoporosis

If you have osteoporosis and have experienced a fracture, calcium alone is not sufficient to prevent further fractures; you will also require a specific osteoporosis treatment. However, it is important to have adequate calcium and vitamin D to support your bone health while you are on osteoporosis treatment.

Calcium and the elderly

People of advancing age often do not consume enough calcium through their diet, or are unable to absorb calcium properly. If you are elderly, there are some specific factors that you and your doctor should consider when discussing your calcium intake and your bone health:

- Factors that have an impact on your diet, such as poor appetite, illness, or social or economic problems. Any of these may make it hard for you to eat well.
- Poor absorption of calcium in the intestine (made worse if your vitamin D levels are low).
- Less frequent exposure to sunlight, which is needed to make vitamin D (this is particularly the case if you are house-bound or have limited mobility).
- Poor kidney function, leading to increased loss of calcium in the urine.





Vitamin D

The role of vitamin D

Vitamin D plays an essential role in bone health. By improving the absorption of bone-building calcium from the intestine, vitamin D is important to the growth and maintenance of a strong skeleton. Vitamin D also helps to control calcium levels in the blood and maintain muscle strength.

Vitamin D and sunshine

For most Australians, sunshine is the main source of vitamin D. Vitamin D is produced when our skin is exposed to ultraviolet B (UVB) light emitted by the sun. The amount of sun exposure required to produce adequate levels vitamin D is relatively low. However, many Australians do not have adequate vitamin D levels, especially during winter. Required sun exposure times will vary based on season, location, area of skin exposed and skin type. In summer, exposure is best at mid morning or mid afternoon (outside peak UV times). In winter, longer exposure times are needed, preferably around midday.

It is important to balance the need for sun exposure to produce adequate vitamin D, at the same time avoiding the risk of skin

damage from too much exposure. When the UV index is above 3 (all states during summer and some states in the winter months), you should use sun protection measures (hat, sunscreen, clothing, sunglasses and staying in the shade) if you are outdoors for more than a few minutes. In summer, most Australian adults will maintain adequate vitamin D levels during typical day to day outdoor activities. Sun protection isn't needed in autumn or winter in states where the UV index is below 3 for most of the day. For more information about UV index where you live, see the website of Cancer Council Australia.

The table below shows average UV index levels by month for Australian capital cities. The white boxes identify the months where sun protection is not required by most people.



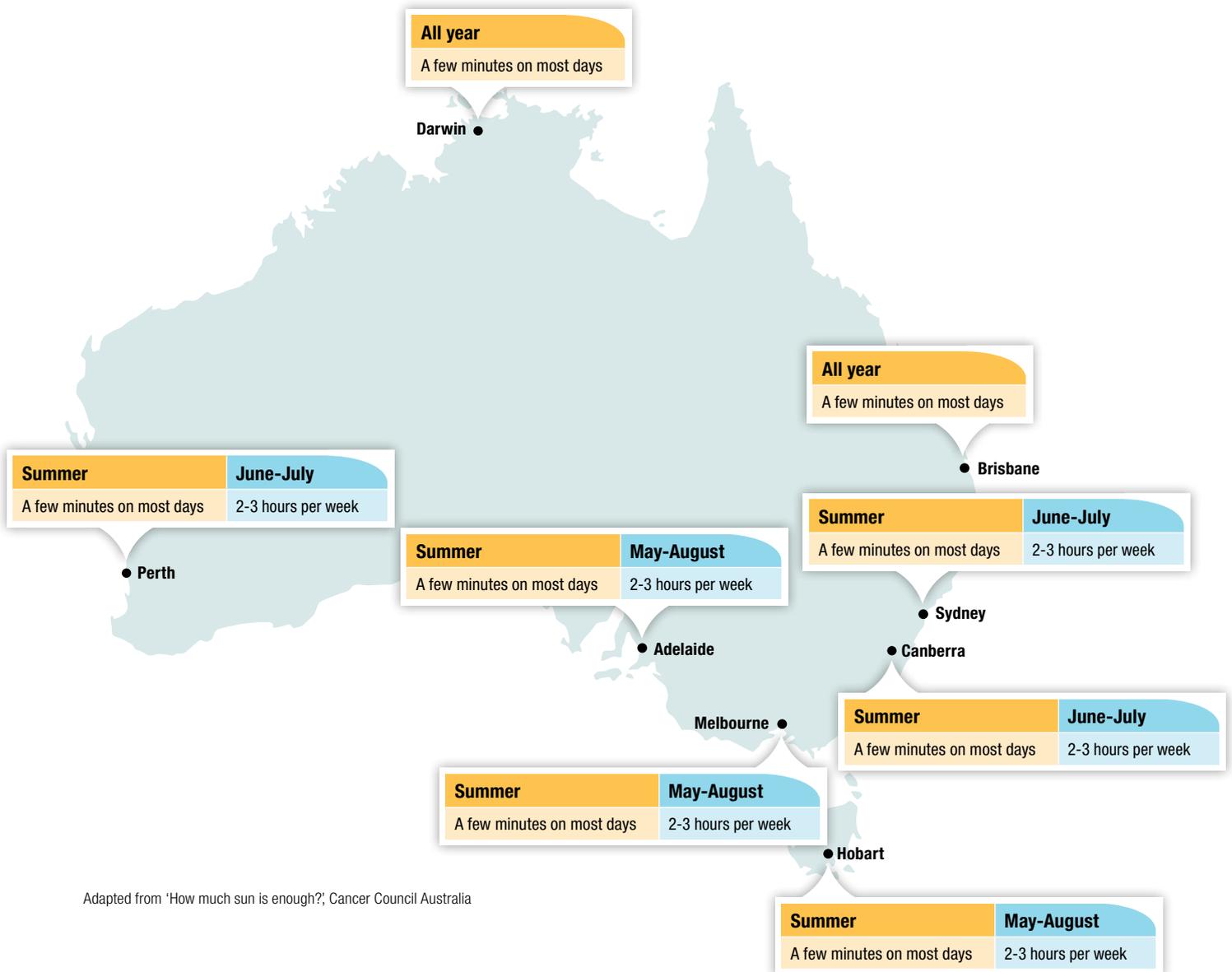
UV index in Australian cities (average each month)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Darwin	12	12	12	11	9	8	8	10	11	12	12	12
Brisbane	11	11	9	6	4	3	4	5	7	8	10	11
Perth	11	11	8	5	3	2	3	4	6	8	9	11
Sydney	10	9	7	5	3	2	2	3	5	7	8	10
Canberra	10	7	6	4	2	1	2	3	5	6	8	10
Adelaide	11	10	7	5	3	2	2	3	5	7	9	10
Melbourne	10	9	7	4	2	1	1	2	4	6	8	9
Hobart	8	7	4	3	1	1	1	2	3	4	6	7

UV levels remain below 3

Table adapted from Gies P, Roy C, Javorniczky J, et al. Photochemistry and photobiology, 2004; 79:32-39

Recommended sun exposure for vitamin D based on location



Adapted from 'How much sun is enough?', Cancer Council Australia

Useful to know:

There is minimal transmission of UVB radiation through normal clear windows, so sun exposure should be outdoors.

Vitamin D deficiency

Vitamin D deficiency is common in Australia – over 30% of Australians have a mild, moderate or even severe deficiency.

Vitamin D deficiency can have a major impact on bone health. In older people, it can increase the risk of falls and bone fracture. Low levels of vitamin D can also lead to bone and joint pain and muscle weakness. In infants and children, vitamin D deficiency can result in rickets, a condition that causes bone and muscle weakness and bone deformities. Vitamin D deficiency may occur in babies born to mothers who have low vitamin D levels and unless rectified, will have an ongoing impact on the child's normal bone growth.

You may be at risk of vitamin D deficiency if:

- You are elderly, particularly if you are housebound or are in institutional care.
- You are naturally darker skinned – the pigment in dark skin reduces the penetration of UV light.
- You avoid the sun for long periods by choice or for medical reasons.
- You cover your body for religious or cultural reasons.
- You have other medical conditions that may affect the way your body absorbs or processes vitamin D.
- Babies of vitamin D deficient mothers are also at risk of vitamin D deficiency.

Testing for vitamin D

Your vitamin D level can be determined with a blood test. Your doctor will decide whether you require a blood test, based on your general level of sun exposure and a review of your other risk factors. Your body can store a certain amount of vitamin D. However, your vitamin D levels are likely to change throughout the year, with concentrations being highest in late summer and lowest at the end of winter.

As a general guide, Osteoporosis Australia recommends that most people should aim for a vitamin D level of no less than 50 nmol/L at the end of winter, which means people may have higher levels during summer of 60-70 nmol/L.





Supplementation of vitamin D

For people who are low or deficient in vitamin D, a supplement may be required. Vitamin D supplements are available as tablets, capsules, drops or liquid. Most supplements come as 'vitamin D3', with the dose on the product shown in international units (IU).

Your doctor will advise you on the best dose for your needs – your pharmacist can also provide general advice on vitamin D supplements.

As a general guide only, Osteoporosis Australia recommends the following doses of vitamin D:

- For people who obtain some sun exposure but do not achieve the recommended level of exposure:
 - Under 70 years: at least 600 IU per day.
 - Over 70 years: at least 800 IU per day.
- For sun avoiders or people at risk of vitamin D deficiency (see 'Vitamin D deficiency' to find out if you may be at risk), higher doses may be required:
 - 1,000-2,000 IU per day.
- For people with moderate to severe vitamin D deficiency – (levels lower than 30 nmol/L):
 - 3,000-5,000 IU per day may be required for 6-12 weeks to raise the vitamin D level quickly, followed by a maintenance dose of 1,000-2,000 IU per day. This should be supervised by your doctor.

Note: It may take 3-5 months for a full improvement in vitamin D levels to be seen, so it is important to take supplements as advised.

Can you take too much vitamin D?

Vitamin D is rarely harmful and problems have been reported only when very excessive doses have been taken (much higher doses than those mentioned). Large, single, yearly doses are not recommended.

However, in patients with severe vitamin D deficiency, higher than recommended monthly doses, administered by a doctor, can be effective.

Vitamin D and food

Food cannot provide an adequate amount of vitamin D and most people are reliant on sun exposure to reach recommended levels. A limited number of foods contain small amounts of vitamin D (oily fish such as herring and mackerel, liver, eggs and some foods to which vitamin D has been added – fortified foods, for example, margarine, some milk).



Exercise

Exercise and bone density

Regular physical activity and exercise plays an important role in maintaining healthy bones. Exercise is recognised as one of the most effective lifestyle strategies to help make bones as strong as possible, reducing the risk of fractures later in life. As well as improving or maintaining bone density, exercise increases the size,

strength and capacity of muscles. Exercise must be regular and ongoing to have a proper benefit.

Exercise is important at different stages of life. In children exercise helps growing bones to become as strong as possible to help minimise the impact of bone loss as we grow older. Exercise also maintains bone health in adulthood, helps to prevent or slow bone loss after menopause and helps to improve balance and co-ordination in the elderly to reduce the risk of falls. Exercise can also help speed rehabilitation following a fracture.

Research studies on exercise and bone health have shown that:

- Children who participate in moderate to high impact weight-bearing exercises, for example, hopping, skipping and jumping, have higher bone density compared to less active children.
- For adults, a combination of progressive resistance training with a variety of moderate impact weight-bearing activities is most effective for increasing bone density or preventing the bone loss that occurs as we age.
- Hip fractures have been found to be as much as 38-45% lower in older adults who have been physically active in their daily life, compared to less active people.
- When 'stress' is not placed on bone, a decline in bone density can result. This can occur after prolonged bed rest or in people who are wheelchair bound and can even impact on astronauts due to the weightlessness of space.



Exercise throughout life

The specific goals of exercising for bone health change throughout life; from building maximum bone strength in childhood and adolescence, optimising muscle and bone strength in young adulthood, to reducing bone loss in old age. For the elderly, the focus is on prevention of sarcopenia (muscle wasting) and addressing risk factors for frailty and falls, particularly difficulties in balance, walking ability and mobility.

Exercise and its effects

Age	Bone status	Exercise effect
Childhood/ Adolescence	In girls and boys the major build up of bone occurs in the pre-teen and adolescent years. Peak bone density is reached during mid to late 20s.	Can increase bone density and structure to maximise peak bone strength, which helps keep bones strong for longer in adulthood.
Early to mid adulthood	Bone density is maintained or starts to decrease very gradually when a person reaches their 30-40s although increases are still possible during middle adulthood.	Can maintain or increase (1-3%) bone density and improve cardiovascular health and fitness; resistance training can also improve muscle mass and strength.
Post menopausal women	In women from the age of 45 years, bone loss begins to increase to 1-2% per year. Bone loss accelerates up to 2-4% per year at the onset of menopause.	Can maintain bone strength by helping to slow the rate of bone loss following menopause. It is very difficult to increase bone density during or after menopause by exercise alone. Can effectively improve muscle function (balance) and reduce falls risk.
Men	Bone density tends to remain relatively stable until middle age, decreasing by about 0.5-1.0% per year from the age of 45-55 years. Low testosterone or hypogonadism can increase bone loss in men.	Can maintain or increase (1-2%) bone density, improve muscle mass, strength, balance and co-ordination to help prevent falls and maintain general health.
Older adults without osteoporosis	After 75 years of age, further increases in bone loss occur in both sexes, especially from the hip. The risk of fracture increases as bone loss increases.	Helps to maintain bone strength and increase muscle strength, balance and co-ordination, which in turn help to prevent falls.
Older adults with osteoporosis/ fractures	Bones are increasingly thin and fragile.	Exercises recommended by physiotherapists and exercise physiologists can improve bone strength, muscle strength, balance and posture to prevent falls and reduce the risk of further fractures.

The right kind of exercise

Specific types of exercise are important for improving bone strength. Bones become stronger when a certain amount of impact or extra strain is placed on them. Exercises that work the muscles attached to bones that are most at risk of fracture, including the hip and spine, are the most effective. Exercises recommended for bone health include:

- Weight-bearing aerobic exercise (exercise done while on your feet) – for example, brisk walking, jogging and stair climbing.
- Intense, progressive resistance training (lifting weights that become more challenging over time).
- Moderate to high impact weight-bearing exercise – for example, jumping, skipping, dancing, basketball and tennis.
- Balance and mobility exercise. While not improving bone or muscle strength, these exercises can help to reduce falls – for example, standing on one leg with the eyes closed, heel-to-toe walking.

Regular weight-bearing exercise (including exercise at moderate to high impact), as well as resistance training, is recommended. The older you are, the more important resistance training is for maintaining bone strength.

Some exercises are better at building bones than others. The ability of an exercise to build bone (its osteogenic capacity) depends on the specific way that stress is applied to the bone during the exercise.

The impact of selected exercises on bone health

Highly osteogenic	Moderately osteogenic	Low osteogenic	Non-osteogenic*
Basketball/Netball	Running/Jogging	Leisure walking	Swimming
Impact aerobics	Brisk/Hill walking	Lawn bowls	Cycling
Progressive resistance training	Stair climbing	Yoga/Pilates/Tai Chi	
Dancing/Gymnastics			
Tennis			
Jump rope			

* While certain exercises may have low to no osteogenic benefits, this does not imply that these exercises do not offer a wide range of other health benefits.



Getting the most out of exercise

Exercise must be regular:

- At least 3 times per week.

Exercise must be challenging:

- Lifting heavy weights with few repetitions is more effective than lifting lighter weights with many repetitions.

Exercise should progress over time:

- The amount of weight used, degree of exercise difficulty, height of jumps, etc. must increase or vary over time to challenge the bones and muscles.

Exercise routines should be varied:

- Variety in routines is better than repetition.

Exercise should be performed in short, intensive bursts:

- Regular short bouts of weight-bearing exercise separated by several hours are better than one long session. Lifting weights quickly is more effective for improving muscle function than lifting them slowly. Rapid, short bursts of movement such as jumping or skipping are more effective than slow movements.

If exercise needs to be reduced, it is better to reduce the length of each session rather than the number of sessions per week.

Recommended exercises for different stages of life

Group	Type of exercise
Healthy adults	A variety of weight-bearing activities and progressive resistance training for at least 30 min, 3-5 times per week. AVOID prolonged periods of inactivity.
Post menopausal women and middle aged men	Varied exercise regime – include moderate to high impact weight-bearing exercise and high intensity progressive resistance training, at least 3 times per week. Tip: specific 'spinal extension' resistance training during middle-age has been shown to reduce spinal fractures.
Older adults and people at risk of osteoporosis	Participation in varied and supervised exercise programs is encouraged. These include weight-bearing activities, progressive resistance training and challenging balance and functional activities, at least 3 times per week.
Frail and elderly	A combination of progressive resistance training and balance exercises is recommended to reduce falls and risk factors for frailty (which may include muscle wasting, poor balance, fear of falling).
Osteoporosis*	A combination of weight-bearing exercise with supervised progressive resistance training and challenging balance and mobility exercises, at least 3 times per week. AVOID forward flexion (bending over holding an object, sit ups with straight legs) and twisting of the spine, as this may increase risk of a spinal fracture.
Osteoporosis – after a fracture has occurred	Exercise is an important part of rehabilitation and a program will normally be planned and supervised by a physiotherapist. Exercises will be determined by the type of fracture and the patient's age and level of physical function. Resistance training has been shown to be effective following hip fracture.

* Moderate to high impact activities are only recommended for people with osteoporosis who do not have a previous fracture(s) or lower limb arthritis. Consult your doctor and physiotherapist for advice.

Weight-bearing activities may either be moderate impact (for example, jogging, hill walking), moderate to high impact (for example, jumping, skipping, step ups) and/or various sports that involve moderate to high impact (for example, basketball, tennis).

Resistance training requires muscles to contract when lifting weights, placing stress on the muscle and related bones. The bones strengthen as they adapt to this extra strain. It is best to target specific muscle groups around areas that are most vulnerable to osteoporotic fractures – usually the hip and the spine. It is also wise to strengthen leg muscles to improve balance.

Note: Leisure walking on its own is not recommended as an adequate strategy for bone health, although it has benefits for general health and fitness. Swimming and cycling are also considered low impact sports that are not specifically beneficial for bone health.

Preventing falls

Falls are a common cause of fracture. As people age, their chance of falling increases. Approximately 33% of people over 65 fall each year. For people with osteoporosis, even a minor fall can cause a fracture. Half of all falls occur in the home or the area surrounding the home. It is estimated that up to 6% of falls result in a fracture and that around 90% of hip fractures occur as the result of a fall. Therefore, preventing falls has become an important part of managing bone health.

Falls are most commonly caused by:

- Poor muscle strength.
- Poor vision.
- Problems with balance (due to weak muscles, low blood pressure, inner ear problems, medicines, poor nutrition).
- Home hazards which lead to tripping.

Strategies to avoid falls

Strategy	How it is done
Exercise	<p>Physiotherapists can assist with a falls prevention program and advise on programs run in the community.</p> <ul style="list-style-type: none"> • Supervised Resistance Training to strengthen muscles (this can also give confidence and reduce the fear of falling). • Balance exercises, for example, heel-to-toe walking, Tai Chi, standing on one leg.
Medical Review	<ul style="list-style-type: none"> • Doctor to review any conditions or medicines that may be causing poor balance or dizziness. • Doctor may recommend a visit to an optometrist to correct vision and/or a podiatrist for proper footwear.
Around the home	<ul style="list-style-type: none"> • Occupational therapist can conduct a home audit and suggest important changes to the home environment (and may recommend walking aids if needed). • Use a 'home checklist': <ul style="list-style-type: none"> • Install handrails on steps and in bathrooms (beside toilet, shower, bath). • Non-slip strips on stairs and non-slip mats in bathroom. • Ensure rooms are well lit. • Ensure edges of rugs and mats are flat or remove altogether. • Secure electrical cords and remove loose cords from walkways. • Ensure regularly used items in kitchen are within easy reach. • Maintain outside paths.
Nutrition	<ul style="list-style-type: none"> • Improving nutrition can assist muscle strength. This includes adequate calcium and vitamin D levels.





Medicines

Understanding prescription medicines for osteoporosis

If you are diagnosed with osteoporosis or are at high risk of a fracture, your doctor will prescribe a medicine to strengthen your bones and help prevent fractures. These medicines have the effect of preventing further bone loss and in many cases will make the bones stronger over time.

Prescribed medicine plays an essential role in the management of osteoporosis. Your doctor will also ensure that you are getting adequate calcium, vitamin D and exercise to support your bone health and recommend lifestyle changes to help reduce your risk factors. While calcium, vitamin D, exercise and lifestyle changes are important these measures alone will not be sufficient to prevent further bone loss and fractures. You will need to take specialised osteoporosis medicine.

An estimated 1.2 million people in Australia have osteoporosis; many of these people take regular osteoporosis medicines to improve their bone health and reduce the risk of fractures. In many cases, but not all, these medicines are subsidised by the government under the Pharmaceutical Benefits Scheme (PBS).

Osteoporosis medicines

Bone is constantly 'turned over' – new bone is formed at the same time that older bone is broken down. In osteoporosis, the finely tuned balance between the production and breakdown of bone is lost and more bone is lost than is formed. Most osteoporosis medicines work by making the cells that break down bone (osteoclasts) less active, while allowing the cells that form new bone (osteoblasts) to remain active. The overall result is a reduction in bone loss and a gradual increase in bone strength (density) over a period of time.

There are a range of osteoporosis medicines available in Australia. Your doctor will determine the appropriate treatment for your situation and take into consideration any other medical conditions.

Osteoporosis medicines are grouped into 'classes' depending on their 'active ingredients.'

Bisphosphonates

Alendronate (brand name: Fosamax).
Taken as a tablet.

Risedronate (brand name: Actonel).
Taken as a tablet.

Zoledronic acid (brand name: Aclasta).
Taken by intravenous infusion.

Bisphosphonates can increase bone density by approximately 4-8% in the spine and 1-3% in the hip, over the first 3-4 years of treatment. Although these increases may appear to be small, they have a very positive effect on fracture rates. For example, bisphosphonates have been shown to reduce spinal fractures in people with osteoporosis by as much as 30-70% and in the hip by as much as 30-50%. A positive effect can be seen as early as 6-12 months after starting treatment.

Bisphosphonates are available on the PBS for both men and women with osteoporosis and fractures. They are also available to older people over 70 with very low bone density who have not fractured. In addition, they can be prescribed on the PBS to people who are taking glucocorticoids (for example, prednisone or cortisone) at a dose of 7.5 mg for at least 3 months, in order to reduce the risk of fracture.

Most bisphosphonates are taken as tablets and come with specific instructions as to how they should be taken. Tablets may be taken as a daily, weekly or monthly dose and may be provided with calcium tablets or calcium/vitamin D sachets to be taken on other days. It is important to follow your doctor's directions, to ensure you receive the most benefit from your tablets and to reduce your risk of side effects. For example, with all oral bisphosphonates it is very important to stay upright (not lie down) for at least half an hour after taking the medication, to reduce any gastric reflux (heartburn).

Most oral bisphosphonates are prescribed for several years. Your GP will monitor your progress during this time.

Zoledronic acid is given as a once yearly intravenous infusion (the drug is given directly into the bloodstream through a vein). This takes approximately 15 minutes and will be given by your doctor or practice nurse.

Please review the Consumer Medicine Information (CMI) provided with your prescription about the benefits and any possible side effects of your medicine. Ask your doctor or pharmacist if you have any questions.

Denosumab

(Brand name: Prolia). Given as an injection every 6 months.

Denosumab is another treatment for osteoporosis. It works in a different way to bisphosphonates but has the same effect of slowing the rate at which bone is broken down. Treatment with Denosumab can reduce spinal fractures by two thirds, and it has a significant effect on hip fractures and other fracture types.

Denosumab is available on the PBS for men and women who have osteoporosis and a fracture, or for men and women 70 years or over who have very low bone density.

Please review the Consumer Medicine Information (CMI) provided with your prescription about the benefits and any possible side effects of your medicine. Ask your doctor or pharmacist if you have any questions.





Selective oestrogen receptor modulators (SERMS)

Raloxifene (brand name: Evista).
Taken as a daily tablet.

Raloxifene acts very much like the hormone oestrogen in the bones, helping to reduce bone loss. It is most effective in reducing spinal fractures.

In addition, Raloxifene has been shown to reduce the risk of invasive breast cancer in postmenopausal women with a personal or family history of breast cancer when it is taken for more than five years, without increasing the risk of endometrial cancer.

Raloxifene is available on the PBS for postmenopausal women with osteoporosis and a fracture.

Please review the Consumer Medicine Information (CMI) provided with your prescription about the benefits and any possible side effects of your medicine. Ask your doctor or pharmacist if you have any questions.

Hormone replacement therapy (HRT)

The active ingredient of HRT is the hormone oestrogen. Some HRT treatments also contain progestogen – this is known as combined HRT. Oestrogen is important for maintaining strong bones. Osteoporosis is more likely to develop when oestrogen levels fall during and after the menopause. HRT, even at low doses, helps to slow down the loss of bone, reducing the risk of osteoporosis and bone fractures.

HRT is of greatest benefit to women below the age of 60 who have low bone density and are suffering menopausal symptoms. It is particularly useful for women who have undergone early menopause (before 45 years of age); these women are at the greatest risk of osteoporosis.

Above the age of 60, the risk of heart disease, blood clots, stroke and breast cancer increases. HRT is thought to increase these risks; other osteoporosis medications are more suitable for women over 60.

Please review the Consumer Medicine Information (CMI) provided with your prescription about the benefits and any possible side effects of your medicine. Ask your doctor or pharmacist if you have any questions.

Teriparatide

(Brand name: Forteo). Given as an injection (self-administered) daily for up to 18 months.

Teriparatide is based on human parathyroid hormone. This treatment stimulates bone-forming cells (osteoblasts), resulting in improved bone strength and structure. In postmenopausal women who have had spinal fractures, teriparatide reduces the risk of further spinal fractures, as well as other fracture types.

Teriparatide is restricted to those people who have tried other treatments but continue to have very low bone density and further fractures. It is prescribed only by specialists and is available for both men and women.

Once the drug course is finished, another osteoporosis medicine will need to be used so that the new bone produced by teriparatide is maintained and improved.

Please review the Consumer Medicine Information (CMI) provided with your prescription about the benefits and any possible side effects of your medicine. Ask your doctor or pharmacist if you have any questions.

Tips for taking osteoporosis medicines

Be patient

It is likely that your bone loss has occurred over many years, so it will take some time to rebuild. The good news is that by using the right medication in the right way, you should stop losing further bone virtually straight away and can start reducing your risk of fracture.

Talk to your doctor

Discuss your progress regularly with your doctor. If you think you are experiencing a side effect from your osteoporosis medicine, it is important that you advise your doctor. In many cases, your doctor will be able to rectify the problem. Many people take regular osteoporosis medicines without any problems, but all medicines have the potential to produce side effects.

Take your medicine as directed

You will only gain the full benefit of your treatment if you continue to take your medicine as directed.

Be careful not to miss a dose. Many of these medicines will not be effective if you take them with food, or at the same time as other medicines or supplements. Your doctor or pharmacist can advise you about how your medication must be taken. Taking the medicine as instructed will also reduce your chance of experiencing side effects.

Have sufficient calcium and vitamin D

Most osteoporosis medicines have been shown to be more effective when taken with calcium and/or vitamin D supplements. For this reason, your doctor may also prescribe these supplements.





Bone health

Recovering from a fracture

Rehabilitation

Rehabilitation is important following all fractures. The rehabilitation approach will depend on the type of fracture and your age. It can take place in hospital, outpatient clinic, rehabilitation centre, private practice, community centre, fitness facility or at home. A physiotherapist will usually plan an exercise program as part of your rehabilitation and an occupational therapist can conduct a home audit and may recommend walking aids. Rehabilitation is designed to get you back to your previous level of functioning, or, if you are elderly, to a level that is above the level of frailty (or problems with mobility) that led to the fall and fracture.

Rehabilitation can involve:

- Prescribed exercise (for example; muscle strengthening exercises, weight bearing exercises, walking, transfer and balance training, hydrotherapy and other exercises to improve fitness, posture and mobility).
- Walking aids.
- Pain relief (for example; medication, massage, physiotherapy, TENS (Transcutaneous Electrical Nerve Stimulation), hydrotherapy, ultrasound, heat and cold packs, acupuncture and relaxation techniques).

Wrist fractures

Most wrist fractures require a cast for about 6 weeks. During that time, exercises are recommended for the fingers and shoulder to prevent muscle wasting and reduced flexibility. Patients should avoid weight-lifting activity using the lower arm while the cast is on. After removal, a physiotherapist can advise on rehabilitation exercises for the wrist.

Spinal fractures

Pain from spinal fractures usually lasts 6-8 weeks and should lessen as the fracture heals. Initially, exercise will be supervised by a physiotherapist, to prevent any further injury. Hydrotherapy is a good way to introduce exercise following a spinal fracture. Abdominal bracing exercises and advice on posture may also be given. When the fracture has healed, your physiotherapist may start exercises to strengthen the back extension muscles, as this has been shown to reduce the risk of spinal fractures.

Hip fractures

Rehabilitation is essential following hip fracture and usually starts 1-2 days after surgery. Most 'in hospital' programs run for several weeks. Resistance exercise (lifting weights) has been shown to be effective in recovering from a hip fracture. Patients who do intensive resistance exercise for 6-12 months following surgery improve their ability to get up, walk, climb stairs, do household tasks and are better able to maintain bone and muscle strength compared to those who have not participated in ongoing rehabilitation exercises.

What action can I take?

If your doctor has diagnosed osteoporosis, be pro-active and take steps to change your bone health.

You can reduce further bone loss and your risk of fractures:

- Take your osteoporosis medicine as directed.
- Follow advice about adequate calcium, vitamin D and exercise to improve your bone health.
- Decrease your alcohol intake.
- Stop smoking.
- Be informed – discuss your bone health with your doctor, pharmacist and physiotherapist. Use this guide and visit the Osteoporosis Australia website for information: www.osteoporosis.org.au



Discussing your bone health with your doctor

Questions to ask your doctor

- Am I at risk of osteoporosis?
- Do I need a bone density test (DXA scan)?
- How can I maintain or improve my bone health?
- If you have been prescribed medicine for osteoporosis:
 - How does my medicine work?
 - How do I take it?
 - How long will I need to take it for?
 - Will there be any side effects?

Things to tell your doctor about:

- Any other medicines or treatments you are taking (including vitamins and supplements).
- Unexplained back pain.
- Loss of height.
- Any family history of osteoporosis.
- Any possible side effects of your osteoporosis medication.

This guide is based on a review of the current evidence and research.



Osteoporosis Australia

Osteoporosis Australia is a national, not-for-profit organisation committed to improving awareness and understanding of osteoporosis. Our goal is to reduce the incidence of osteoporosis and osteoporotic fractures in the Australian community.

Our services include:

- Toll-free information number.
- Educational materials for consumers.
- National website and magazine.
- Know Your Bones online self-assessment.
- Translated fact sheets in Arabic, Chinese, Greek, Italian and Vietnamese.
- Prevention and self-management programs.
- Community education seminars.
- Health Professional education.

Our activities include:

- World Osteoporosis Day (October 20).
- Support for medical research.
- Advocacy to improve patient care.

Contact us

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Osteoporosis Australia website: **www.osteoporosis.org.au**

Know Your Bones website: **www.knowyourbones.org.au**

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