



What is osteoporosis?

Osteoporosis occurs when the struts which make up the mesh-like structure within bones become thin causing them to become fragile and break easily, often following a minor bump or fall. These broken bones are often referred to as 'fragility fractures'. The terms 'fracture' and 'broken bone' mean the same thing. Although fractures can occur in different parts of the body, the wrists, hips and spine are most commonly affected. It is these broken bones or fractures which can lead to the pain associated with osteoporosis. Spinal fractures can also cause loss of height and curvature of the spine.

What is a bone density scan?

A bone density scan - sometimes called a DXA scan uses low dose X rays to see how dense your bones are

A bone density scan is used to help understand how strong your bones are and how likely you are to have a fragility fracture. The most commonly used method is a type of X ray called dual energy x-ray absorptiometry, usually shortened to DXA (pronounced DEXA). DXA machines usually scan bones in the lower spine and hip, two of the main areas where fragility fractures occur. This is called an 'axial' or 'central' scan. DXA uses a low radiation dose, which is similar to natural background radiation - less than one tenth of the dosage of a chest x-ray and equivalent to a transatlantic flight.

What is the scan measuring and how does it do it?

The machine calculates how much calcium and other minerals (called 'bone mineral') is in the area being measured. It does this by counting x rays going in and

out of the body- the difference is the amount absorbed by the bone and other tissues. This is called your 'bone density'. Research has shown that your bone density measurement especially in later life, is linked to your bone strength - having 'low bone density' as measured on a scan, increases your risk of having a fracture.

Bone density increases as your bones grow, reaching maximum levels in your late 20s. It then starts to decrease in later life. Women lose bone density more rapidly after the menopause and bone density continues to decrease in both men and women as they move into old age. Some other medical conditions and medications can make you lose bone density more rapidly too.

Bone density measurements increase as our bones grow and then decrease particularly after the menopause for women and throughout later life for everyone. Some other medical conditions and some medications, can make bone density decreases happen faster.

What can I expect when I have the scan?

A DXA scan takes 10 -20 minutes. You may have to change into a hospital gown. You don't go into a 'tunnel' or need an injection.

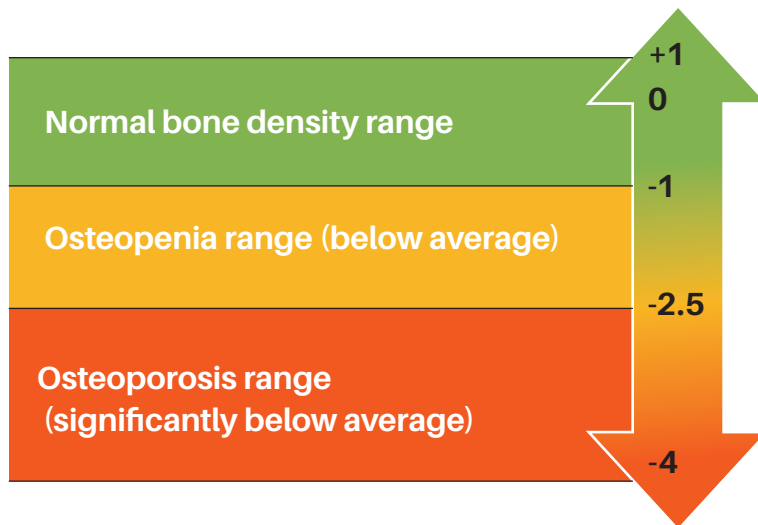
A DXA scan will take between ten and twenty minutes and isn't unpleasant. An axial DXA scan involves lying on your back on a firm couch while a scanning arm passes over your body taking an image of your spine and hips. When the spine is being scanned, you will be asked to rest your legs on a large cushion and, for the hip part of the scan, your leg will be supported to keep it in the correct position. You won't be enclosed in a tunnel or need an injection. Each hospital will have its own procedure - you may be asked to change into a hospital gown although wearing clothing without metal zips and fasteners might avoid the need for this.

What will my results tell me?

As explained above – the lower your bone density the higher your risk of fracture.

Your results will show whether your bone density is in the average range for a young healthy person ('normal'); below that range (osteopenia) or significantly below ('osteoporosis'). By the age of 75, about 50% of the population will have bone density in the osteoporosis range.

You may be given your 'T score', expressed in terms of Standard Deviations (SD). This is a measure of how far you are away from the average and is the standard way of expressing bone density.



A T score of '0' means your score is in the middle of the average range; a positive score (+1 etc) would mean you are 'above average', and a negative score (-1) would mean you are below average. The larger the negative number of the T score, the lower is your bone density level compared to average. For instance, a T score of -3.5 is lower than -2.5.

'Osteopenia' and 'osteoporosis' are terms used, in bone density scanning, to describe how far below average a score is:

'Normal' T score is from + 1 to -1

'Osteopenia' is the term used for a T score from -1 to -2.5

'Osteoporosis' is the term used for a T score of -2.5 and below

A Z score can also be calculated which compares your bone density to other people in your age group. This can help put your bone density levels into context for your age. For example, if you have a T-score of -1.5 and a Z-score of 0 this is not an unexpected result and is within the average range for your age and gender. However, a Z score doesn't indicate how weak or strong your bones are. As women pass the menopause and men move into older age bones might be fragile even though the Z score is normal for your age.

Z scores are used instead of T scores for children and young people, below the age of 30 who are still growing and have not yet reached their 'peak bone mass'. At any age, having a low Z score may suggest another medical condition or a medicine is affecting your bone density levels. Your doctor may need to arrange for further investigations such as blood and urine tests in this situation. If no other condition is identified, a low bone density result in a younger person may simply mean you have smaller bones and does not necessarily indicate a high risk of fracture.

The scan compares your result to an average range. If your result is much below average it's called osteoporosis. If it's just below, it's called osteopenia. These aren't medical conditions in themselves but they mean your bones might have lost strength. (just like having high blood pressure means a greater risk of having a stroke).

The further below average your result is the greater your risk of breaking a bone – sometimes described as 'having a fracture'.

You might be given a T score – if it's -2.5 or below (eg. -3) you are in the osteoporosis range. If it's -1 or below you are in the 'osteopenic' range.

If my scan shows 'osteoporosis' does that mean I have fragile bones and need a drug treatment?

Not always – it depends what your other risk factors are.

If you have osteoporosis on a scan and have broken a bone easily as well – then this is often a clear sign your bones have lost strength and you probably need a treatment to strengthen your bones.

Not always. It's important to understand that your 'bone density' result isn't a perfect measure of your bone strength as the scan doesn't assess the 'quality' of your bone, only the 'quantity'. A DXA scan only measures how much 'bone mineral' is in the area being measured, not whether the structure inside your bones has broken down or is of poor quality which is what often makes bones lose their strength. DXA results are also affected by the size of your bones but this will be taken into account when the results are reported.

Osteoporosis, as diagnosed on a scan, is a 'risk factor for fracture' just as high cholesterol is a risk factor for having a heart attack. Your doctor or other health professionals advising you, will therefore need to consider all the other risk factors that research has shown are linked to fragility fractures to determine how fragile your bones really are. This is called a 'fracture risk assessment'. It will help build up a more accurate picture of your bone strength and likelihood of breaking bones in the future. If you have a high risk of fracture then your doctor will recommend that you take an osteoporosis drug treatment to strengthen your bones.

What is involved in a 'fracture risk assessment'?

This is when your doctor or another health professional puts together all the risk factors that apply to you including your bone density result, your age and whether you have broken a bone easily and decides how likely you are to break a bone in the next 10 years. If your risk is at a certain level then a medication will be prescribed to strengthen your bones.

Your doctor or health professional will make a clinical assessment based on all the risk factors you may have that have been linked to low bone strength and a high risk of fracture. They will ask you questions about your family history, your medical conditions, if you have had a fragility fracture, your height and weight as well as lifestyle factors such as smoking and alcohol intake. Having a bone density scan (DXA) may be part of this assessment.

There are a several 'fracture risk assessment tools' available to help health professionals. They are computer based questionnaires (or 'tools') which put together all your different risk factors, and calculates your risk of having a fragility fracture in the next 10 years. Initially the tool might be used without a bone density scan result. However if more information is then needed you might be referred for a scan and the result 'added in' to provide a more complete assessment of your fracture risk. The research used to develop these 'tools' has focussed on older people who are much more likely to have a fracture so these questionnaires are only applicable if you are over 40 years of age (or after the menopause for women which is when drug treatments are available.)

One of the commonly used tools is called FRAX™. This questionnaire has been incorporated in the UK into a guideline to help health professionals identify people at highest risk of fracture who would benefit from a drug treatment to strengthen their bones. You can see and try the FRAX tool yourself if you use a computer

but remember it only provides guidance. Any specific decisions about your need for an osteoporosis drug treatment will need to be made in discussion with your doctor considering your own specific situation. (For more information see our booklet All about Osteoporosis or our website)

In addition to low bone density, which of these other 'risk factors' are most significant?

'Older age' is very important, so if you have low bone density when you are 80 years old for instance, it's much more likely that the structure inside your bones will have broken down and you will be more likely to fracture than someone with low bone density at 50 (see the diagram below).

Having had one fragility fracture already is also an important sign that bones have lost strength and research shows you are at a greater risk of having a further fracture. Another important risk factor is taking glucocorticoids ('steroids') for another medical condition (see our fact sheet 'Glucocorticoids and osteoporosis').

There are some risk factors for fracture that need to be considered that are completely separate from bone density such as your risk of falling.

If the scan shows I have 'osteopenia' what will that mean for me?

As osteopenia means your bone density is higher than someone in the osteoporosis range it often means you don't need a drug treatment . There may be lifestyle changes such as taking more exercise and eating healthily or stopping smoking that will still be important for you.

Sometimes if you are in the osteopenic range but you have broken a bone very easily then you may be advised to have a drug treatment because your overall risk of fracture is considered high enough.

If your scan shows 'osteopenia' but your overall fracture risk is not considered to be high, you would be recommended to simply consider lifestyle changes to keep your bones strong. However, if your bone density is in the osteopenia range but you have other strong risk factors, especially if your bones are breaking very easily, then a drug treatment may be considered appropriate. A referral to a specialist can be helpful in this situation.

When is a bone density scan useful?

If you are over 40 with risk factors and a 'bone check' or 'fracture risk assessment' indicates that more information is needed to decide if you need an osteoporosis drug treatment.

If you are younger and have broken a bone easily or you have a condition or take a medicine that reduces bone strength.

It is generally thought that scanning is most appropriate if it will affect a decision about whether you need an osteoporosis drug treatment.

Bone density scan results may also be needed if they will make a difference to how your doctor 'manages' or treats other medical conditions you may have.

Should I have further scans in the future to monitor my progress?

It depends on your situation. It's rarely useful to have a scan more often than every 2-3 years because the results aren't always accurate or significant until then. Also if your risk of fracture is very high then having another scan isn't going to change anything. You will need a drug treatment anyway.

Often scanning will be used as part of your 'bone' or 'fracture risk' assessment every 5 years or so to help with decisions about whether you need to continue with a drug treatment,

If your bone density is lower than the normal range but your fracture risk is not high enough to need a drug treatment, a repeat scan might be performed to determine whether a treatment is needed at a later date. If you are under the age of 50, when bone density normally doesn't change much, a repeat scan may be needed to see if you are losing bone density (suggesting another condition or drug is affecting your bones). A scan may be repeated after an interval of two to five years. It is not usually useful to do it sooner than two years as changes in bone density will be too small to be meaningful.

If you are taking an osteoporosis drug treatment and having no side effects and you have not had fractures whilst taking it, then it is likely that the drug is working (as shown in the drug trials) and regular scans won't be necessary. It is considered 'good practice' to review a drug treatment every few years, especially the bisphosphonates (alendronate, risedronate, ibandronate and zoledronic acid) and denosumab which have been linked to some rare side effects. A repeat scan will often

be part of the treatment review to see if you can stop taking a drug treatment ; have a 'pause' in treatment for a year or so or if you need to continue. If scans are repeated it is important they are performed on the same machine or in the same hospital so that comparisons can be made.

Who explains the results

You will be referred to hospital for a bone density scan usually carried out by a radiographer a DXA technician or a specially trained nurse. The interpretation of the scan results may involve a radiologist who is a doctor specialising in interpreting scans and X-rays. The results will often be sent to your GP. They should be accompanied by an explanation to help your doctor understand and describe their significance to you. There will usually be a recommendation from the hospital about whether you need a drug treatment to strengthen your bones and reduce your risk of fracture.

Does having 'low bone density' mean I may have another bone condition?

Yes it may, so it is important you have a proper medical assessment to ensure your low bone density is linked to osteoporosis.

You would also have low bone density if you have osteomalacia (soft bones caused by low vitamin D) and rarely, osteogenesis imperfecta, a brittle bone disease that is usually diagnosed in childhood.

Is a bone density scan useful for everyone?

There are many lifestyle changes that everyone can make to help strengthen their bones especially if they have risk factors, and sometimes a bone density scan would not add any additional information in this situation. As DXA scans are not a perfect measure of bone strength or fragility, screening everyone, even over the age of 50, would not always pick up those at highest risk of breaking bones. Screening large numbers of people who have no risk factors would also be very expensive and could result in long waiting times for a scan, and it is always preferable to avoid unnecessary exposure to an X-ray dose. Having a fracture risk assessment first has been found to be the best way to identify those who would benefit most from having a scan.

Sometimes your risk of fracture is so high because of other risk factors, that a scan is not necessary before drug treatment is prescribed. This is particularly likely if you are over 75 years of age. Interpretation of the results of bone density measurements, especially of the spine, may also be more difficult as we age because the spine can be affected by other degenerative processes

such as osteoarthritis ('wear and tear'). Such changes can make your bones appear denser on a scan than they actually are affecting the accuracy of the results. The presence of previous fractures in the spine can also affect the results of a bone density scan.

Although research has shown that the lower your bone density, the greater your risk of 'fragility fractures', this is much more certain if you are a postmenopausal woman. If you are a younger woman or a man then it can be helpful to have a hospital specialist advising you what your scan means and whether you need an osteoporosis drug treatment.

How useful are DXA scans of the forearm or other sites?

Peripheral DXA (pDXA) machines scan parts of the body other than the hip and spine. They scan your forearm, heel or even a finger. They are used:

when a 'central scanner' (for your hip and spine) is not available. If a pDXA scan shows that you have a result in the osteoporosis range your doctor might decide to prescribe a drug treatment. However, when a pDXA scan shows that you have bone density slightly below average, your doctor would usually refer you for a further scan of your hip and spine.

If you have a specific condition that affects bone density in the forearm such as hyperparathyroidism.

If there are likely to be problems accurately scanning your hip and spine because you exceed the weight limit for the machine or you have other conditions such as osteoarthritis (or a hip replacement) that can give a falsely 'high' result.

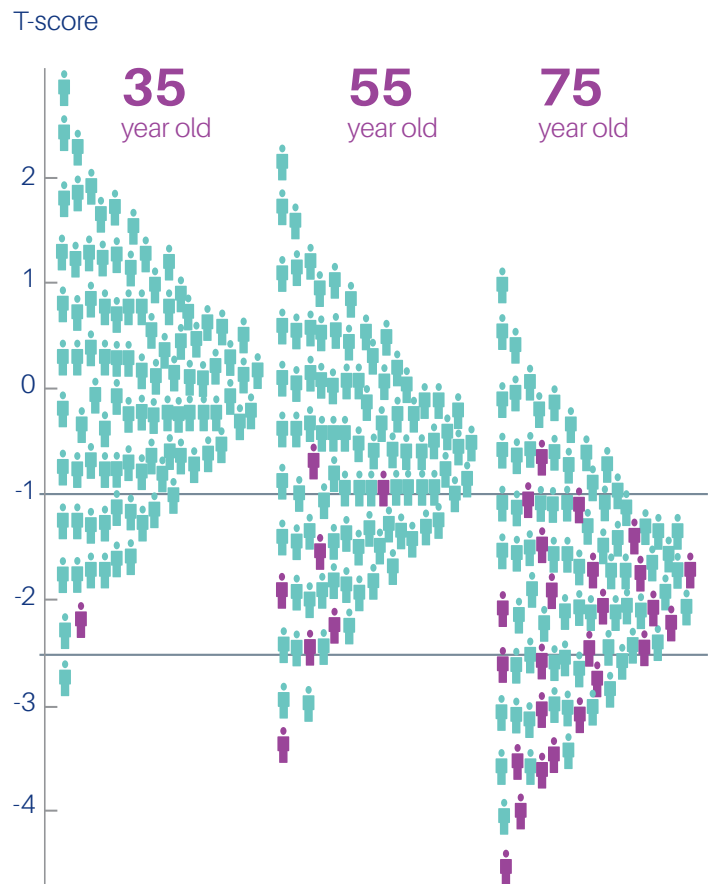
What is vertebral fracture assessment (VFA)

This type of scanning uses DXA to identify if you have had spinal compression fractures and can be performed alongside your DXA scan. An image is produced of the individual bones in your back to see if any of them have an abnormal shape. These shapes are then analysed and if the height of any of the bones is less than would be expected it may be due to a compression fracture.

Although not all hospitals provide this service, it can be a useful way of identifying if you have had fractures without having to refer you for an additional x ray. You also have a much lower exposure to radiation when you have a DXA scan as opposed to a conventional x ray which is considered better for your general health. Your experience of having VFA would be much the same as your standard DXA scan although you would often need to lie on your side. If you have had spinal fractures and this might be difficult for you, discuss your concerns with the hospital staff so that they can make you comfortable.

Currently if your GP wants to see if you have had spinal fractures you are more likely to be referred for a conventional X-ray initially.

The National Osteoporosis Society specialist helpline nurses are happy to discuss your bone density scan results but there is no facility for general scan interpretation. This should take place at scanning centres, with explanations and recommendations for drug treatments sent to your GP. For more general information about osteoporosis and other scans and tests see our booklet 'All about Osteoporosis'.




Susan Ott (adapted and with permission)

This diagram shows bone density T scores along the side of the graph and, to the right, the proportion of the population with different scores according to age. As you can see, our bone density levels reduce as we get older. You can see the number of people with a T score of -2.5 SD at 35 compared to 75.

The darker shaded people show the proportion who will have a fragility fracture in each age group according to their T score. Significantly more people aged 75 have fragility fractures (indicated by the dark-shaded figures) - most of them will be in the osteoporosis and osteopenia range.


The **National Osteoporosis Society** is the only UK-wide charity dedicated to improving the prevention, diagnosis and treatment of osteoporosis and fragility fractures. The Charity receives no Government funding and relies on the generosity of individuals to carry out its vital work.


For osteoporosis information and support contact our Helpline:

 **0808 800 0035**


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To become a member or make a donation:

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To order an information pack or other publications:

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This fact sheet is one of a range of publications produced by The National Osteoporosis Society. If you would like more general information about osteoporosis see our booklet All about Osteoporosis.

This information reflects current evidence and best practice but is not intended to replace the medical advice provided by your own doctor or other health professional.