

Bone density scanning and osteoporosis

What is osteoporosis?

Osteoporosis occurs when the struts that form the mesh-like structure inside bones become thin. This causes the bone to become fragile and break easily, even after a minor bump or fall. You might hear these breaks described as 'fragility fractures'. The terms 'fracture' and 'broken bone' mean the same thing.

Fractures can occur in many parts of the body, but they are most common in the wrists, hips and spine. These broken bones can cause pain. Spinal fractures can also cause height loss and a curved 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, similar to natural background radiation – less than one tenth of the dosage of a chest x-ray and similar to a transatlantic flight.

What does the scan measure and how does it work?

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 wear a hospital gown. You don't go into a 'tunnel' or need an injection.

A DXA scan will take between 10 and 20 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.

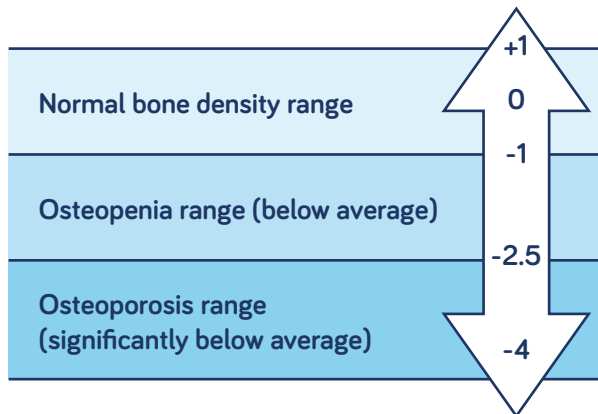
Each hospital will have its own procedure – you may be asked to change into a hospital gown, although wearing clothing without metal zips and fasteners might avoid the need for this.

What will my results tell me?

As explained on the previous page, the lower your bone density the higher your risk of fracture.

Your results will show whether your bone density is in the average or 'normal' range for a young healthy person, 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': a T score from -1 to +1

'Osteopenia': a T score from -1 to -2.5

'Osteoporosis': a T score of -2.5 or 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, a low Z score may suggest

another condition or medicine is affecting your bone density. Your doctor may 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.

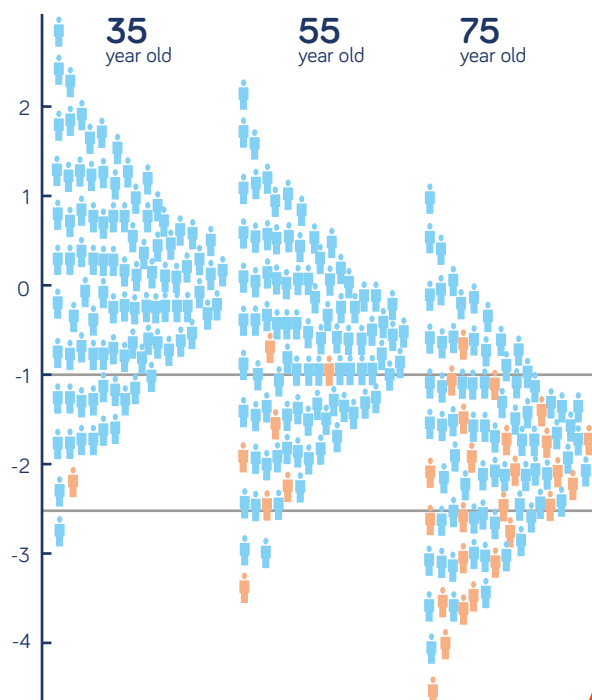
You might be given a T score. If it's -2.5 or below (eg. -3), you are in the osteoporosis range. If it's -1 or below you are in the 'osteopenic' range.

T scores

The diagram below shows bone density T scores along the side of the graph and, to the right, the proportion of people 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 at 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 or osteopenia range.



Susan Ott (adapted with permission)

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

Not always – it depends on your other risk factors.

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 them.

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 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 you take an osteoporosis drug treatment to strengthen your bones.

What is a fracture risk assessment?

This is where your doctor – or other health professional – considers all of your risk factors, including your bone density, age, and whether you've broken a bone easily. This shows them how likely you are to break a bone in the next 10 years. If you have a certain level of risk, they'll prescribe a bone-strengthening medication.

Your health professional will make a clinical assessment based on any risk factors you have for low bone strength and fractures. They will ask about your family history, any medical conditions, if you've had a fragility fracture, your height and weight, as well as lifestyle factors such as smoking and alcohol intake. A bone density scan (DXA) may be part of this assessment.

There are several fracture risk assessment tools available to help health professionals. They are

computer based questionnaires (or 'tools') that put together all your different risk factors, and calculate 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 needed, you might then 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 focused on older people who are much more likely to have a fracture. So these questionnaires are only suitable if you are over 40 years of age (or after the menopause for women, which is when drug treatments are available.)

One commonly used tool is called FRAX™. This questionnaire has been incorporated into a UK 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 try the FRAX tool yourself if you use a computer, but remember it only provides guidance. Any decisions about whether you need an osteoporosis drug treatment will need to be made in discussion with your doctor, considering your own specific situation.

In addition to low bone density, which 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 steroids (glucocorticoids) for another medical condition. Read more about this in our fact sheet, '**Steroids ('glucocorticoids') and osteoporosis**'.

There are also some risk factors for fracture 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?

Osteopenia means your bone density is higher than someone in the osteoporosis range. So it often means you won't need a drug treatment. Lifestyle changes – such as exercising more, eating healthily or stopping smoking – may be important for you.

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 you have broken a bone very easily – then a drug treatment may be appropriate. A referral to a specialist can be helpful in this situation.

When is a bone density scan useful?

A bone density scan may be useful if:

- you are over 40 with risk factors, and a bone check or fracture risk assessment suggests more information is needed to decide if you need an osteoporosis drug treatment
- you are younger and have broken a bone easily
- 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 any other medical conditions you may have.

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

This 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 won't change anything. You will need a drug treatment anyway.

Often scanning will be used as part of your bone or fracture risk assessment every five 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 have had no side effects or fractures whilst taking it, then it is likely that the drug is working 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, as these have been linked to some rare side effects. A repeat scan will often be part of this treatment review, to see if you can stop taking a drug treatment, have a 'pause' in treatment for a year or so, or need to continue on treatment.

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 explain them 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.

For example, you would also have low bone density if you have osteomalacia (soft bones caused by low vitamin D) and, rarely, osteogenesis imperfecta, which is a brittle bone disease that's 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. In this situation, a bone density scan might not add any useful information.

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 people who would benefit most from having a scan.

Sometimes, a person's risk factors mean their risk of fracture is so high that a scan isn't necessary to prescribe a drug treatment. This is particularly likely if you are over 75 years of age.

Interpreting bone density measurements, especially of the spine, can also become 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 shows that the lower your bone density, the greater your risk of fragility fractures, this is much more certain for postmenopausal women. If you are a younger woman or a man, it could help to speak to a hospital specialist. They can explain 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:

- If a 'central scanner' (for your hip and spine) is not available – if a pDXA scan shows you have a result in the osteoporosis range, your doctor might decide to prescribe a drug treatment. However, if a pDXA scan shows your bone density is only slightly below average, your doctor will usually refer you for a further scan of your hip and spine.
- If you have a condition affecting bone density in your forearm, such as hyperparathyroidism.
- If there are likely to be problems scanning your hip and spine – for example if you exceed the machine's weight limit, or you have a condition such as osteoarthritis (or a hip replacement) that could 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 a sign of a compression fracture.

Although not all hospitals provide this service, it can be useful for identifying fractures without having to refer you for an additional x-ray. You also have a much lower exposure to radiation during a DXA scan than during a conventional x-ray, which is considered better for your general health.

Having VFA is similar to having a standard DXA scan, although you will 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 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.

The Royal Osteoporosis Society specialist Helpline nurses are happy to discuss your bone density scan results with you, but do not offer general scan interpretation. This should take place at a scanning centre, with explanations and recommendations for drug treatments sent to your GP.

Getting more information and support

We hope this fact sheet will help you feel more informed and more confident when discussing your bone health with your medical team.

For more information about osteoporosis and bone health, including fact sheets on all available drug treatments, visit our website at theros.org.uk/info or order more of our printed publications.

If you need more information or support, talk to your healthcare professional.

You can also call our specialist Helpline nurses with any questions or concerns about bone health or living with osteoporosis, for free, on **0808 800 035**, or email them at nurses@theros.org.uk



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