**Variation of measured Bone Mineral Density**

**Concordance**

(/kənˈkɔːd(ə)ns/)

*Noun*

agreement or consistency.

"the concordance between the teams' research results"

**Discordance**

/dɪˈskɔːd(ə)ns/

*Noun*

lack of agreement or consistency.

"the discordance between sales and evidence should be a focus"

Osteoporosis is defined by the World Health Organisation (WHO) as:

A systemic condition characterised by low bone mineral density (BMD) in the osteoporosis range measured by bone densitometry (T score < -2.5) *or* a significant fracture risk based on fracture risk assessment e.g. FRAX *with or without* fragility (low trauma) fractures.

*Systemic* means affecting the whole body and, in this case, refers to the whole skeleton. Generally, in premenopausal women, it is expected that the bone density of the spine and hips will of the same order of magnitude unless there are specific reasons for them to be different such as playing sport where the impact is taken more on one lower limb than the other e.g. javelin throwing.

In postmenopausal women there often is more variation, which can also be the case in people who have specific reasons not to use certain parts of their bodies such as those who have suffered paralysis because of a stroke.

When the T-scores fall into the same WHO diagnostic category (normal, osteopenia, osteoporosis) they are defined as being concordant. If they fall into different WHO diagnostic categories, they are discordant.

A minor discordance is defined as T-scores in adjacent WHO diagnostic categories of bone density:

|  |  |
| --- | --- |
| **Hip** | **Spine** |
| Normal | Osteopenia |
| Osteopenia | Osteoporosis |
| Osteopenia | Normal |
| Osteoporosis | Osteopenia |

A major discordance is present if either the hip or spine T-score is normal and the other osteoporotic.

Even if T-scores at hip and in the spine put a woman’s bone density into the same WHO diagnostic category, large differences between T-scores e.g. -2.5 at the hip and -4.7 in the spine need to be explained if there is no clear clinical reason why such a difference exists.

There are a number of reasons for discordance:

**Physiological**  The skeleton’s adaptive reaction to mechanical strain

**Pathophysiological** A disease state affecting the skeleton

**Anatomical**  Differences between sites in content of cortical and trabecular bone and/or rate of bone loss

**Artefactual**  The presence of manmade items within the region of interest of the test

**Technical**  Faulty device hardware or software or the technologist’s method of acquiring or analysing the test

Physiological, pathophysiological and anatomical reasons for discordance refer to clinical variation and they are therefore unrelated to the actual bone density test.

Anatomical reasons include the different distribution of hard (cortical) bone and softer (cancellous) bone in the hip and spine. With advancing age, an increased incidence of degenerative conditions in the spine and hip can cause errors in DEXA analysis so leading to discordant results. Other factors include ages of onset of menarche (puberty) and menopause (more discordance with late menarche and early menopause), Body Mass Index (less discordance with obesity) and secondary causes of osteoporosis (chronic inflammatory conditions and long-term use of some medications all predispose to discordance). In addition, some populations that are prone to vitamin D deficiency (women in Muslim communities wearing the Burka and Niqab) show different rates of discordance compared to populations that are more expose to sunlight.

Artefactual and technical reasons for discordance are the result of equipment calibration and operator error and can be eliminated by strict adherence to correct bone densitometry principles and practice. For DEXA the latter include correct patient positioning and interpretation of the x-ray images. Neither of these are relevant for REMS scans.

Four large studies published between 2000 and 2012 showed the rates of concordance and discordance as:

Concordance 57%

Minor discordance 40%

Major Discordance 3%

Therefore, if a woman has a DEXA scan showing a major discordance, and she has no obvious reasons for such a result, she should query the DEXA result with the local unit. If an answer is not forthcoming, asking for a second opinion is entirely reasonable and appropriate.