Disclaimer

The following presentation is for informational purposes only and is not intended to provide medical advice, diagnosis, or treatment. Always seek the advice of your physician or other qualified health provider with any questions you may have regarding a medical condition. Never disregard professional medical advice or delay in seeking it because of something you have read or seen in this presentation. There is nuance in specific individual cases requiring differing clinical judgement. The information provided here cannot explain all subtleties of bone mass measurement.

This presentation was created in 2025.

Understanding Your Bone Density Test Results

Objectives

1. Discuss BMD, T-scores, and Z-scores.
2. Explain the role of FRAX® scores and TBS scores.
3. Recognize the significance of prior fracture history.
4. Evaluate risk for future fracture.

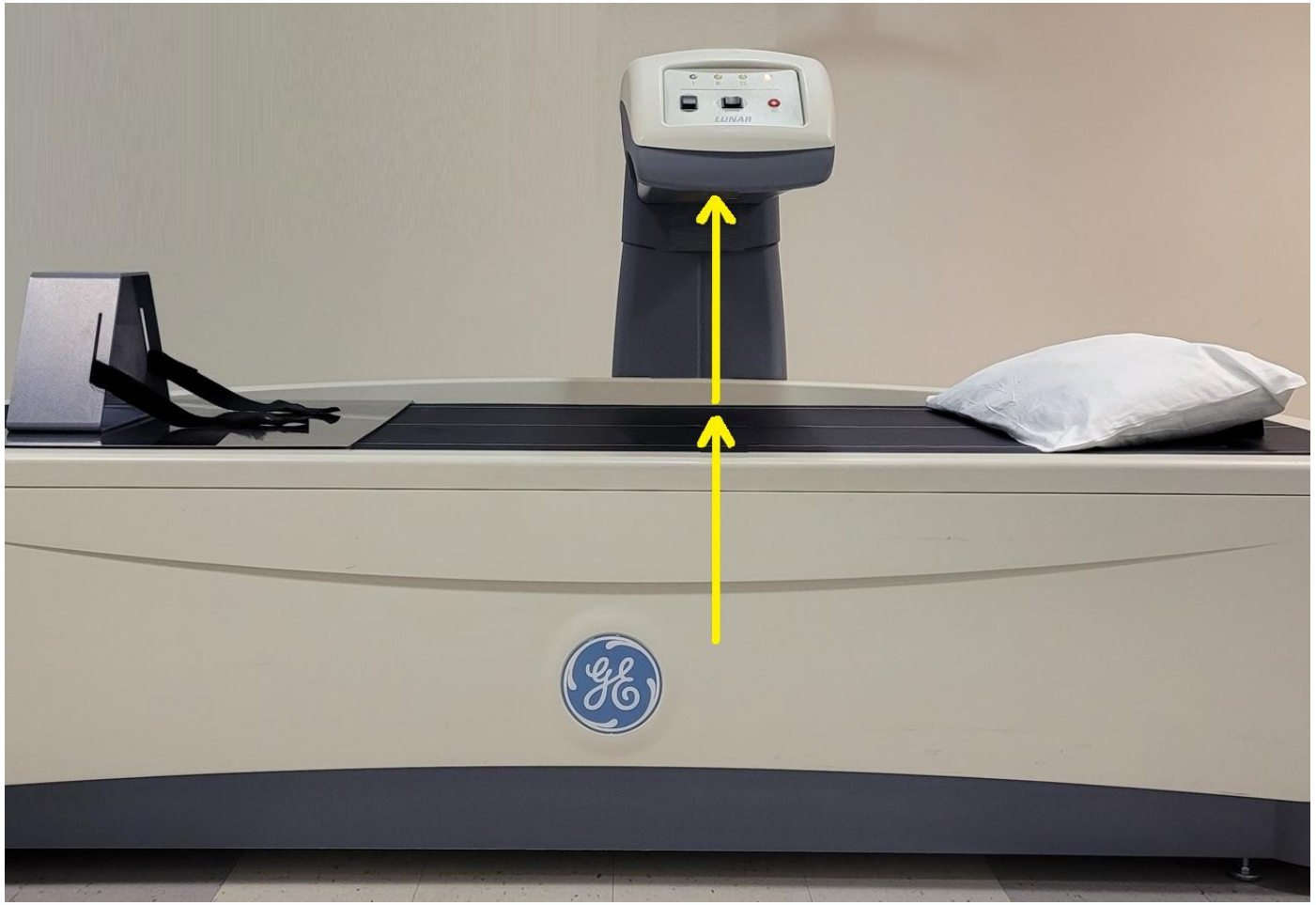
The purpose for DXA bone density scans

- To measure how much calcium is inside of the bones.
- To help assess whether your bones are as strong as they should be.
- To evaluate if you are at higher risk for breaking bones.
  - The medical term for any broken bone is a “fracture”.
- DXA scans are used to diagnose osteoporosis and identify low bone mass and to monitor **B**one **M**ineral **D**ensity (BMD) changes over time.

DXA Technology

DXA measures how much energy is blocked by the bone versus how much passes through.

This translates into numbers showing how much calcium is packed into the bone.



DXA system output

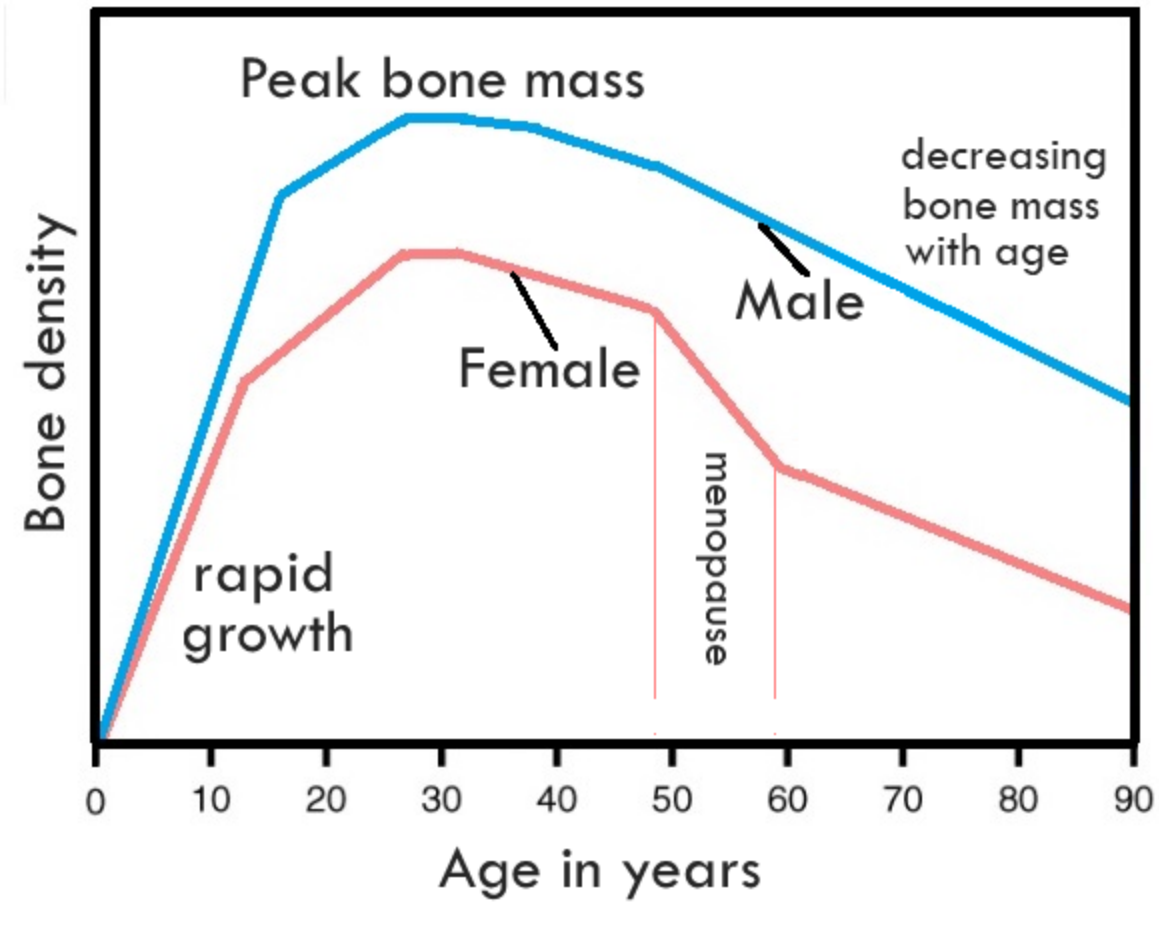
- DXA scans produce images, numbers and graphs
- The results are based on the numbers, rather than the image.
  - The image is used to ensure proper positioning, check for the presence of artifacts, and to place region-of-interest (ROI) lines.
  - We get away with such a low x-ray dose because we don't need a very sharp image for this technology.

Types of output provided by DXA scans

- DXA measures Bone Mineral Content (BMC) in grams.
- When BMC is divided by the size of the ROI area, we get results in g/cm^2 called **Bone Mineral Density (BMD).**
- Some DXA reports additionally include TBS and FRAX®.

"Peak" bone density

- "Peak" occurs when a person is at their maximum bone mass.
- Boys tend to build more bone while they grow and men lose bone more gradually as they age.



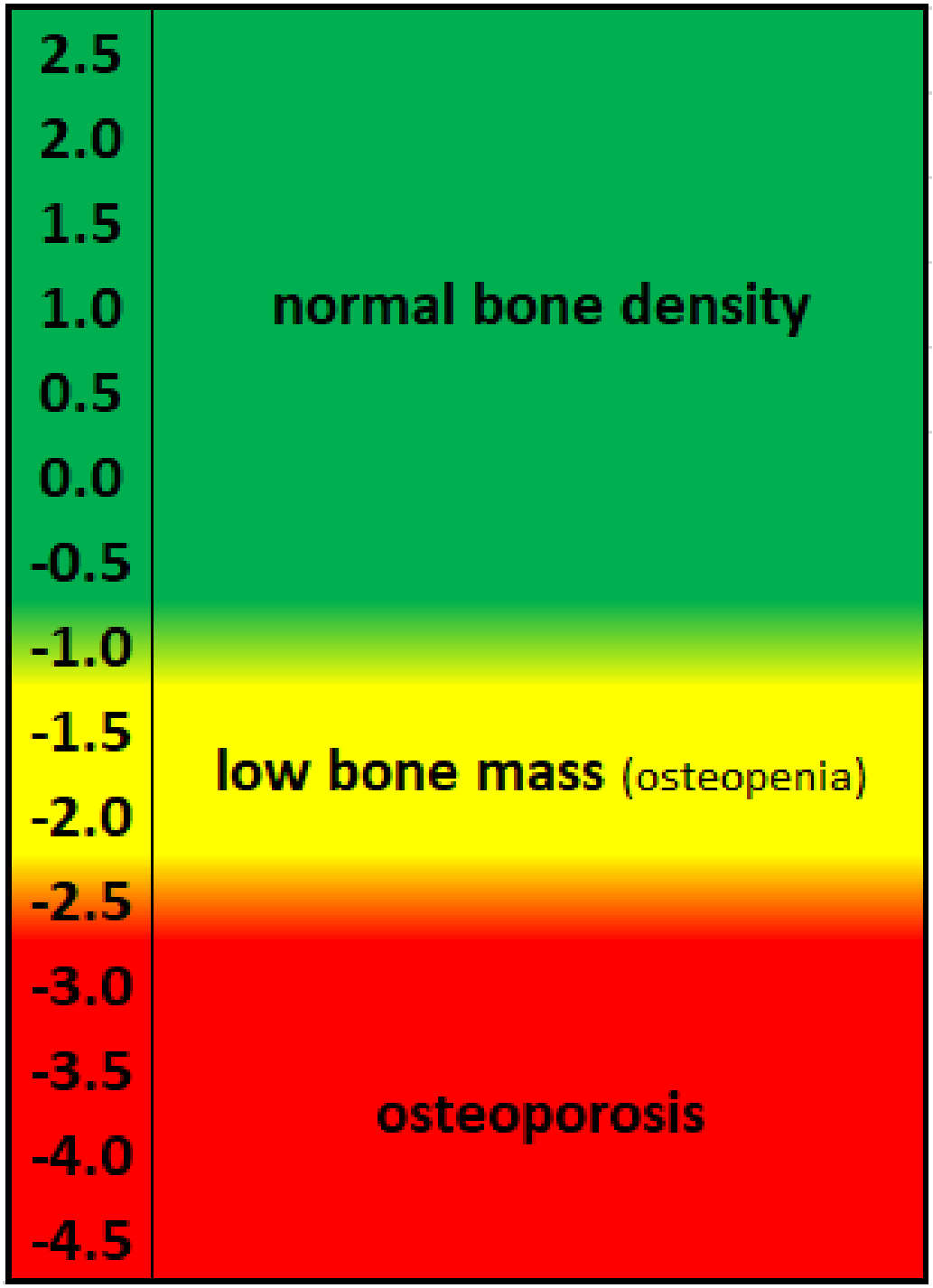
Standard deviation "scores" are used to compare your BMD values to specific reference populations

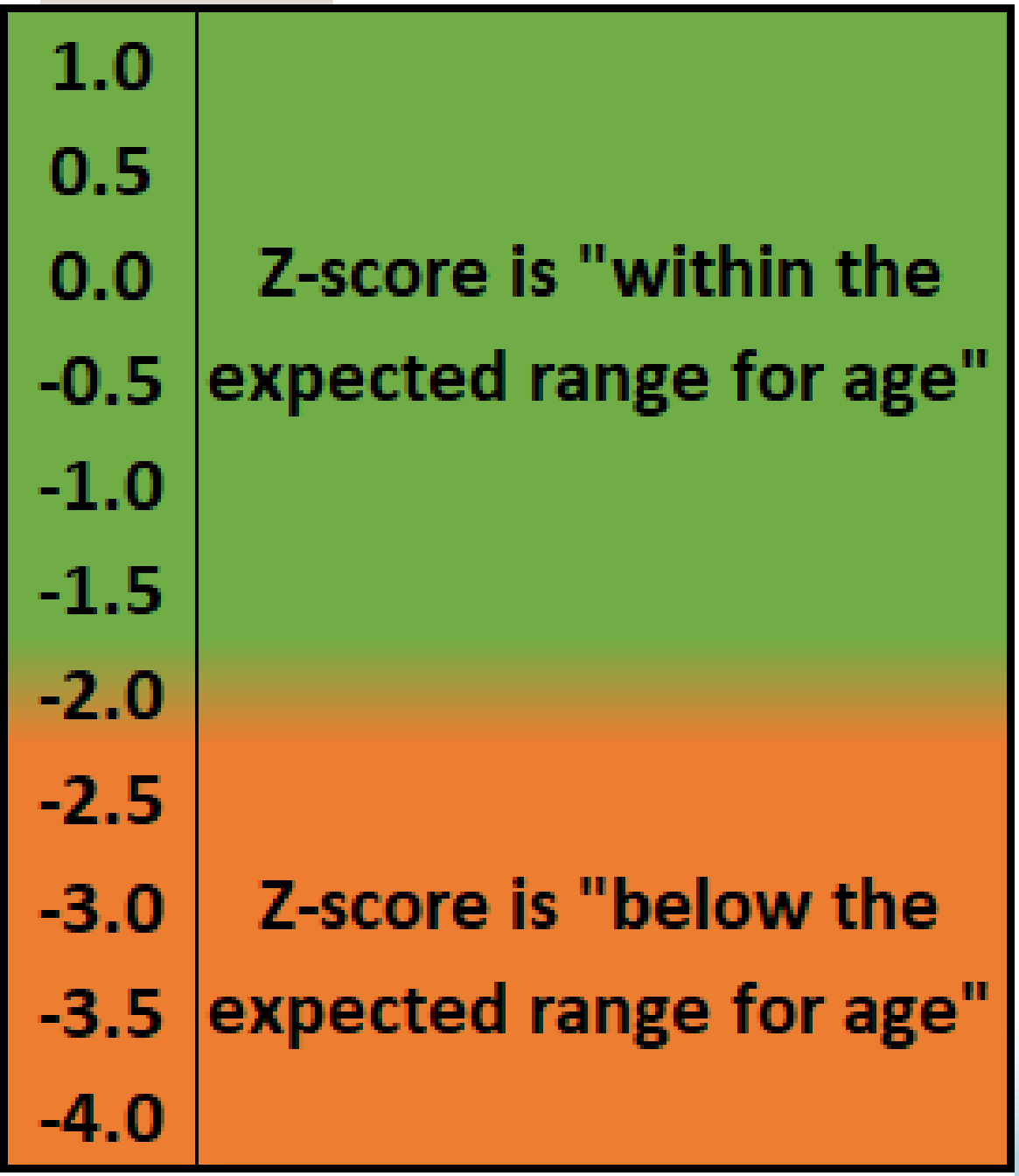
- **T-scores** are a comparison of your BMD to peak BMD.
  - Average peak bone density is calculated as the mean BMD measurements of the young adults in the reference population.

- **Z-scores** are a comparison of the patient's BMD to the average age-matched bone density of the reference population.

T-scores

- T-scores are used to place you in a category as to whether your bone density is normal or not.
  - T-scores are most appropriate for people over the age of 50 (and younger women if in the menopausal transition).
- "Osteopenia" is not a disease. According to the ISCD Official Positions, the preferred term is "low bone mass" or "low bone density".



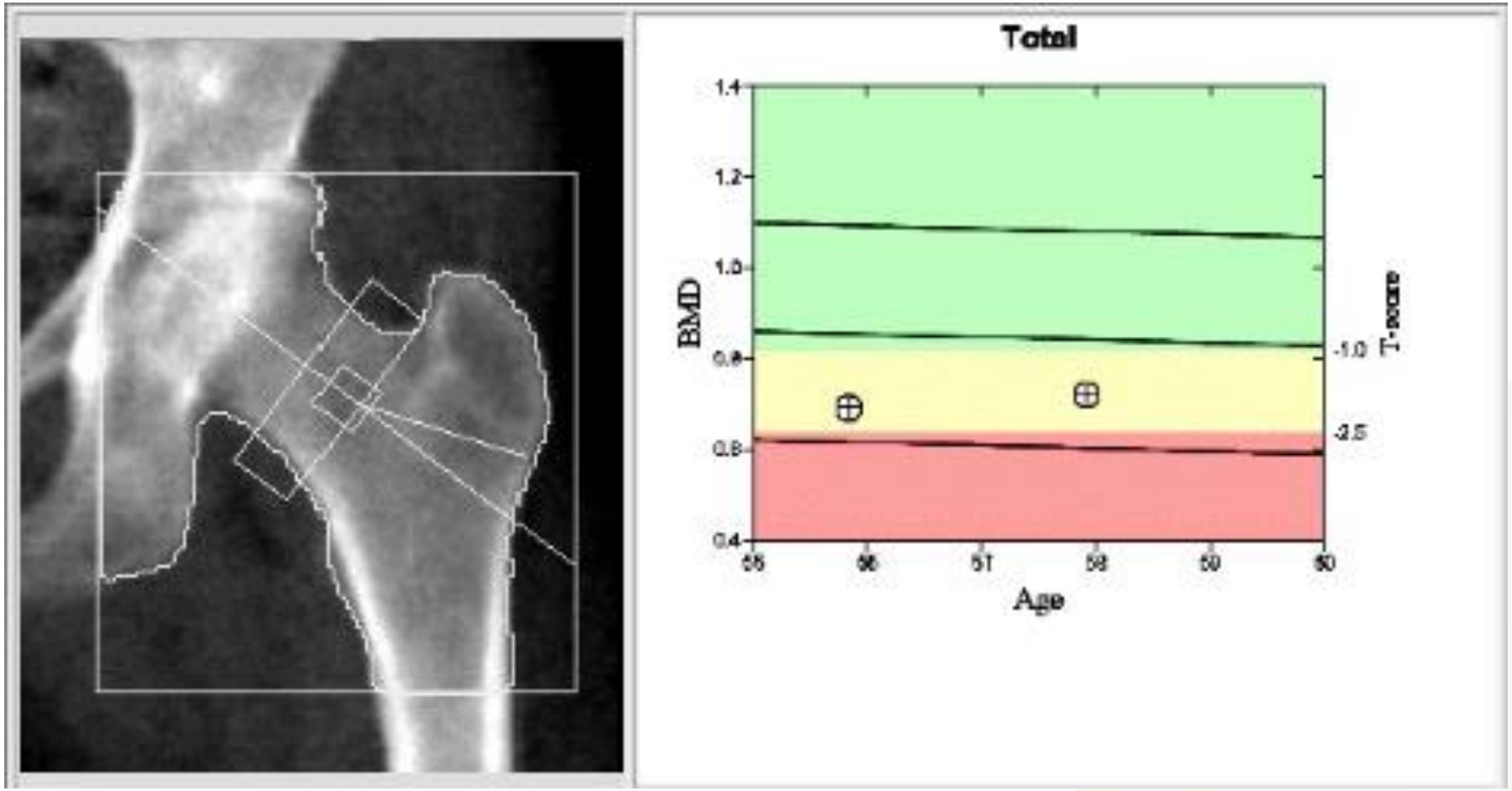


Z-scores

- When a Z-score is very low, *secondary causes* of bone loss should be considered.
- For younger persons, Z-scores are more appropriate than T-scores.

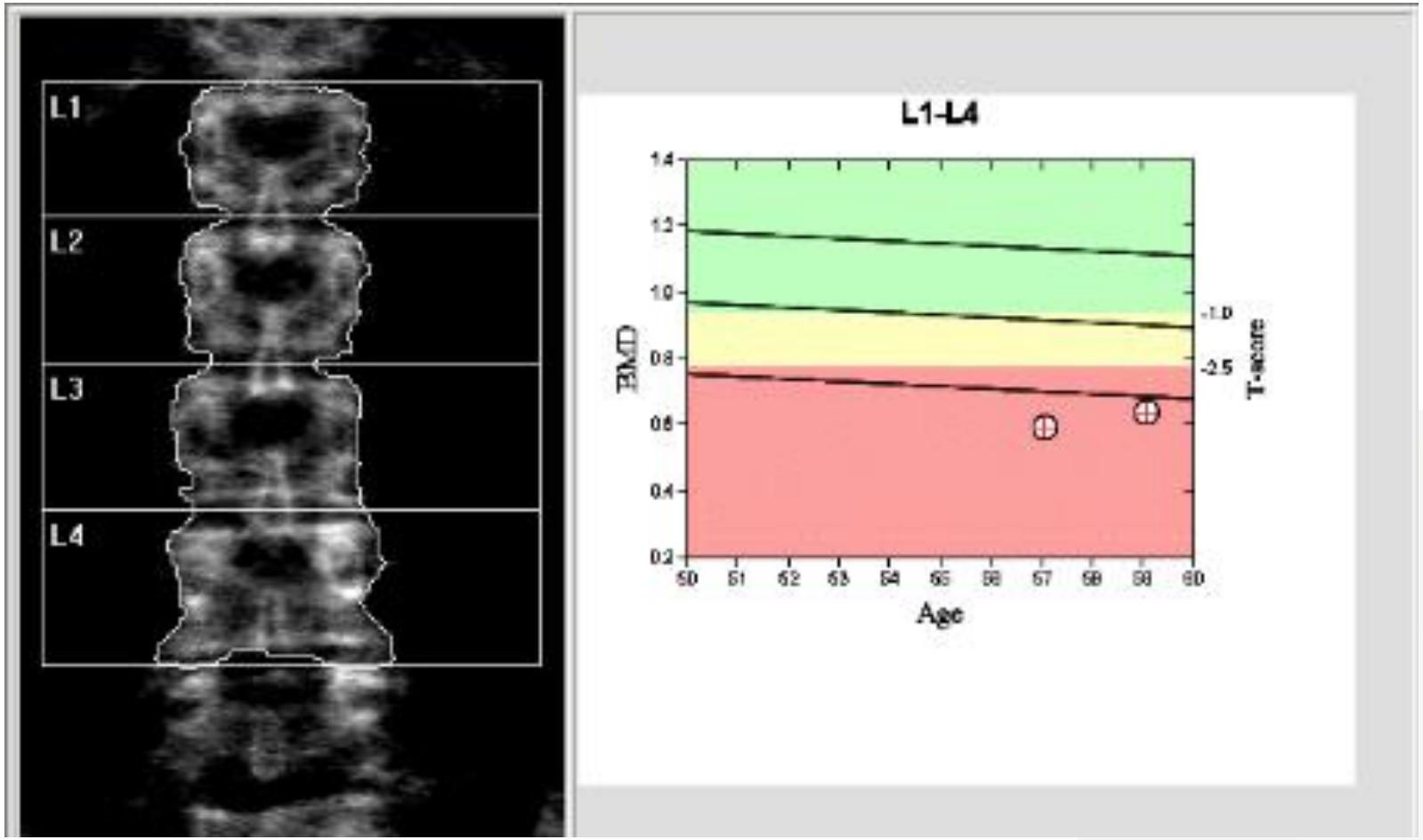
For example: An 80-year-old woman is very likely to have Z-scores within the expected range, however, she may also be at high-risk for breaking bones.

Hologic DXA Femur scan image page*



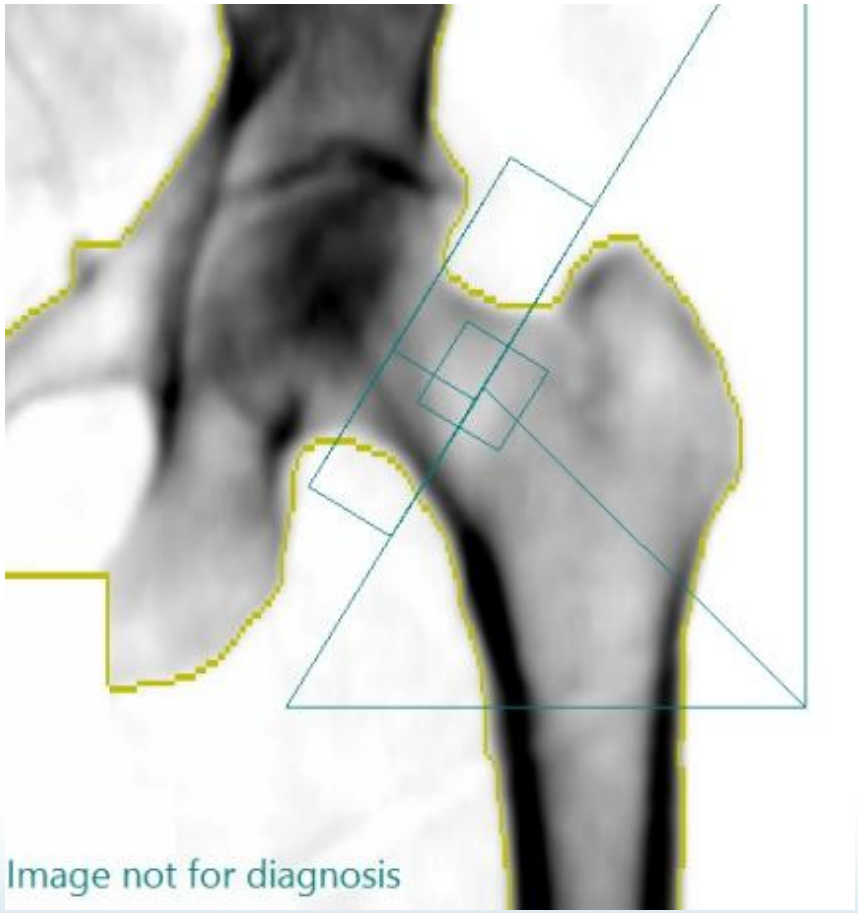
*schematic representation of DXA image

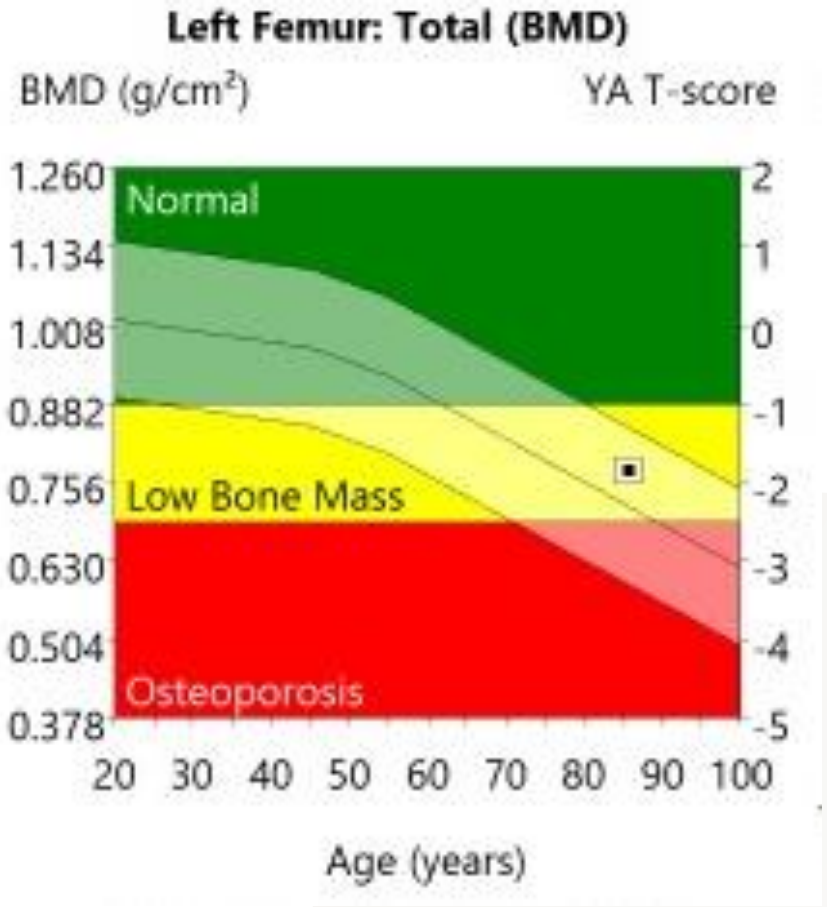
Hologic DXA Spine scan image page*



*schematic representation of DXA image

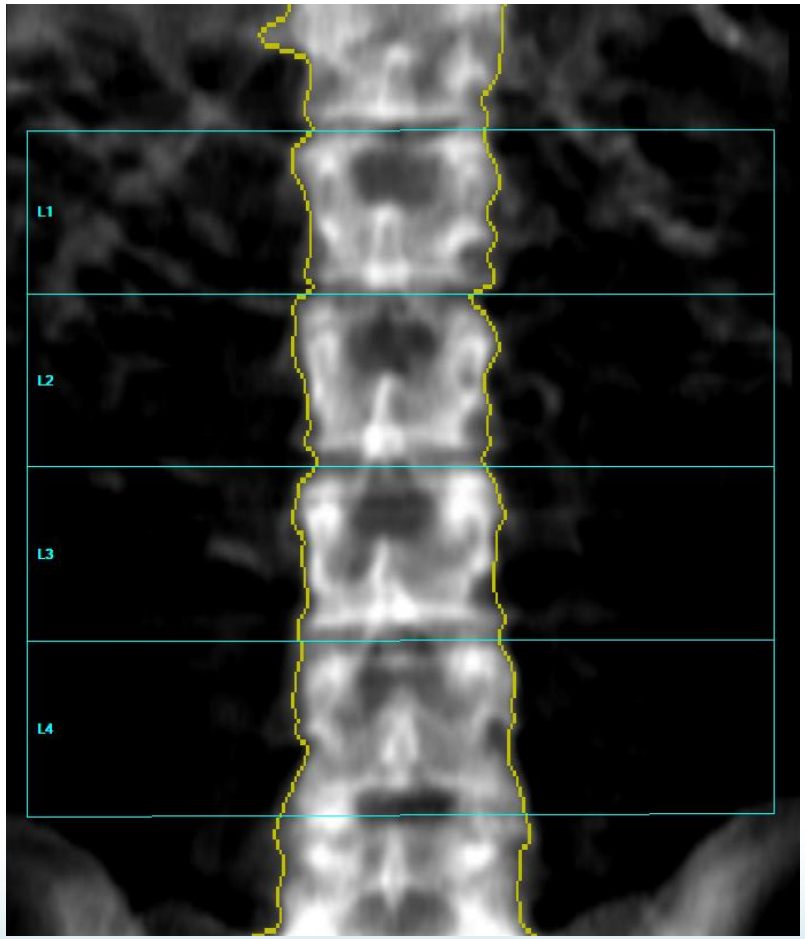
GE Lunar DXA Femur scan image page

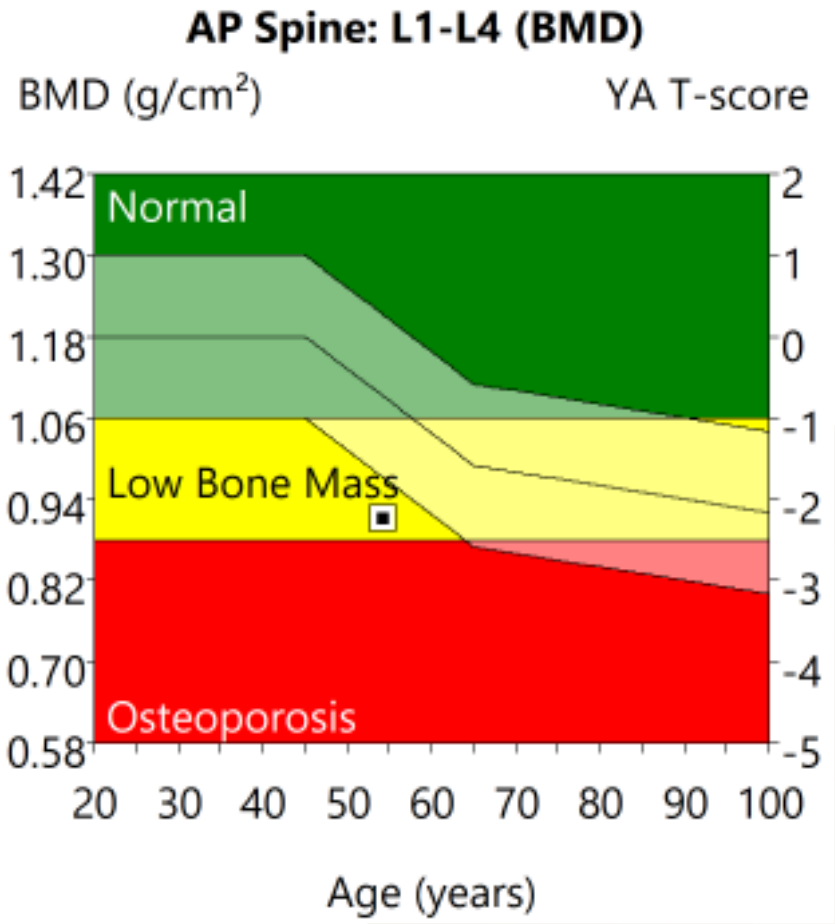




*schematic representation of DXA image

GE Lunar DXA Spine scan image page*





*schematic representation of DXA image

Your risk for breaking bones

- Fracture risk is dependent on many factors, not just bone density.
  - These include your age, a history of prior fractures, history of falls, tobacco use, alcohol abuse, certain medical conditions, and taking certain medications.

- Age plays a major role in fracture risk:
  - In younger persons, even at a -3.5 T-score, the risk for fracture is far less than it is with advancing age.
  - You also do not "have the bones of a 30-year-old" if you are 60.
  - You do not ever "have the bones of a 90-year-old" if you are 60.

FRAX® scores

- FRAX® is a Fracture Risk Assessment Tool.
- It helps to integrate your own risk factors for breaking bones with your calculated bone mineral density.
- *FRAX is an **estimate** of fracture probability which can be over or underestimated*. It doesn't replace the clinical judgement of your provider.
- FRAX only includes fracture risk factors that:
  - (1) are independent risk factors for fracture,
  - (2) have an adequate amount of supporting data, and
  - (3) can be reduced by current pharmacological treatments.

frax.shef.ac.uk/FRAX/

TBS (Trabecular Bone Score)*

- TBS is a bone image texture analysis that correlates with the quality of bone micro-architecture (the inner latticework).
- Trabecular Bone Score (TBS) results are most useful when bone density results are close to an intervention threshold.

	Compatible with
TBS ≥ 1.310	**Normal microarchitecture**
1.230 < TBS < 1.310	**Partially degraded microarchitecture**
TBS ≤ 1.230	**Degraded microarchitecture**

*TBS is not available at all DXA centers

TBS Limitations*

- In order to obtain TBS scores, your facility must have purchased special software to allow for it to be measured during the DXA scan.
- TBS requires a diagnostic *spine* DXA scan.
- It is only applicable for BMI ranges of 15-37 kg/m^2

TBS should not be used alone, but it does add predictive value when used in association with FRAX® and BMD to adjust the probability of fracture.

*TBS is not available at all DXA centers

DXA Interpretation

- The interpretation of your DXA scans is usually performed by either an osteoporosis specialist or a radiology doctor.
- If you have a history of certain fractures, that may trump T-scores for the purpose of diagnosing osteoporosis.
- Diagnosis is usually based on the lowest score out of the total spine, total femur (hip) or femoral neck.
  - Note: “neck” does not refer to the cervical spine in this context.

In summary

- DXA bone densitometry helps to evaluate your risk for fractures.
- Even though some DXA scans will include FRAX® scores and/or TBS scores to enhance fracture risk determination, a "good" TBS or FRAX does not overrule T-scores in the osteoporotic range.
- A personal history of prior *fragility* fracture is more important than the T-score category for the diagnosis of osteoporosis.
- ***DXA scan output does not replace the clinical judgement of your medical provider.***

Thank you.

ISCD
The International Society
For Clinical Densitometry