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Inaugural National Conference

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VIRTUAL CONFERENCE



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DEXA Interpretation: What You Need to Know

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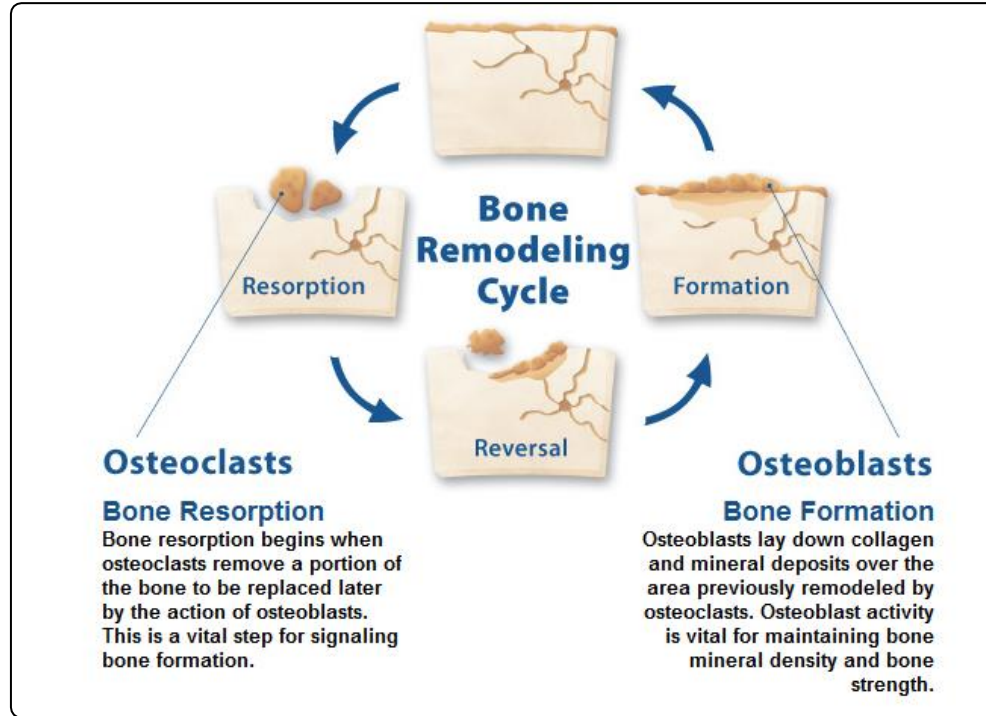
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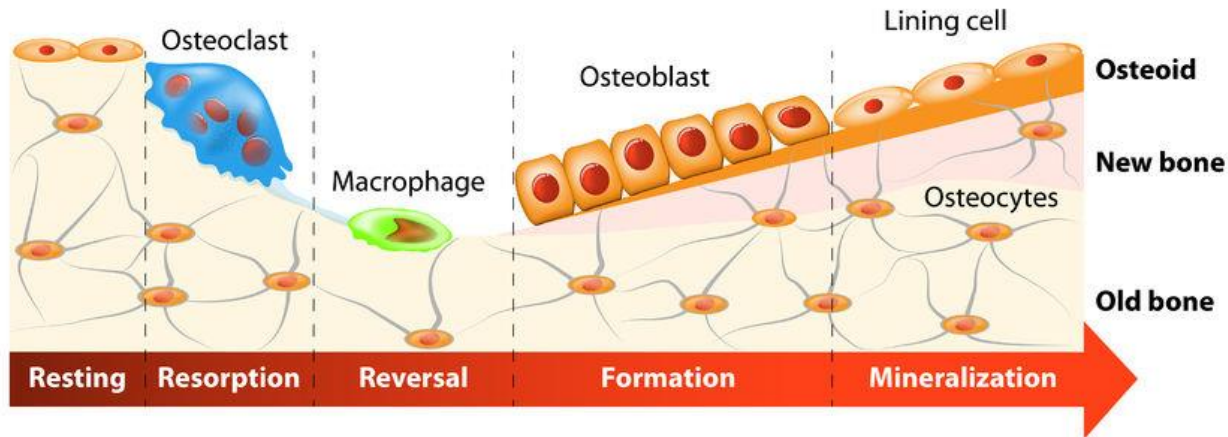
Faculty Disclosures

- Laurie Hughell, PA-C, MPH
 - There are no relationships to disclose at this time.

Cycle of Bone



The bone remodelling process

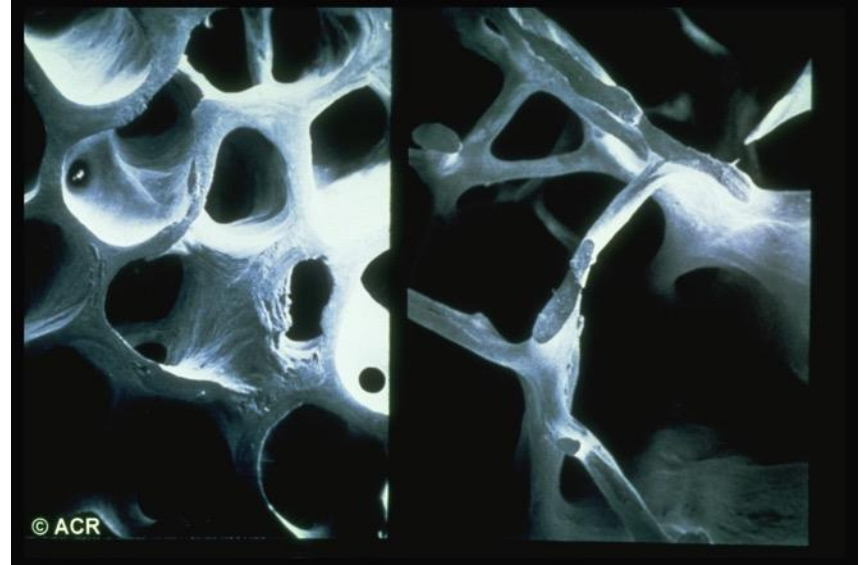


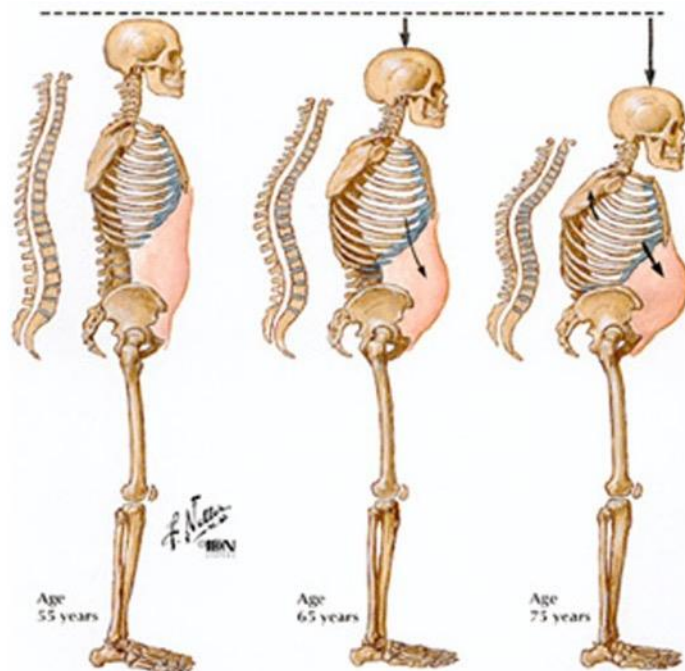
Bone Facts

- Women build bone from birth until age 30-35 when they achieve peak bone mass
 - Most women maintain peak bone mass until menopause
 - Bone loss occurs most rapidly in the 3 years after menopause
 - Increased life expectancy leads to more years of potential bone loss

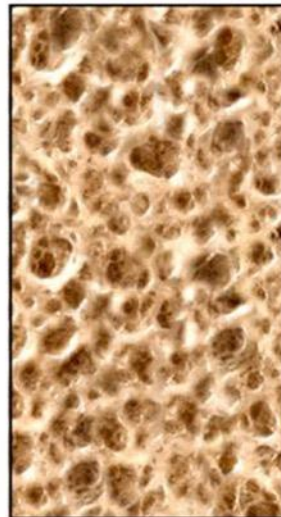
What Is Osteoporosis?

- Osteoporosis literally means “POROUS BONE”
- Defined as “a disease characterized by low bone mass and microarchitectural deterioration of bone tissue leading to enhanced bone fragility and a consequent increase in fracture risk”

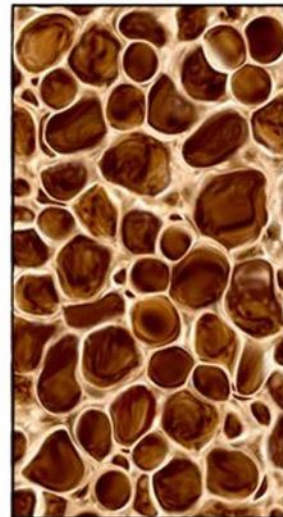




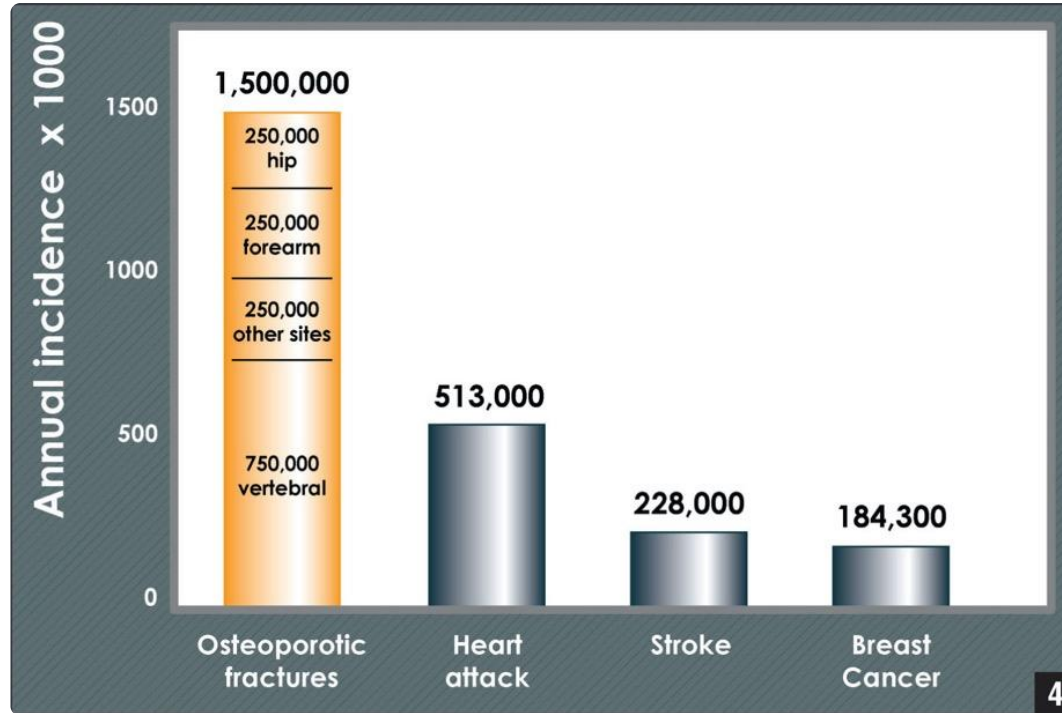
Normal bone matrix



Osteoporosis



The Burden of Osteoporosis



Silent Disease

Osteoporosis is considered a “silent” disease as there are no symptoms unless a fracture occurs!

Common Osteoporosis Fragility Fracture Locations



Risk Factors for Bone Loss

- Female Gender
- Low BMI
- Family history of osteoporosis
- Lack of weightbearing exercise
 - Wheelchair, mobility issues
- Corticosteroid use
- Seizure medication use
- Malabsorption
- Smoking
- Excess ETOH use

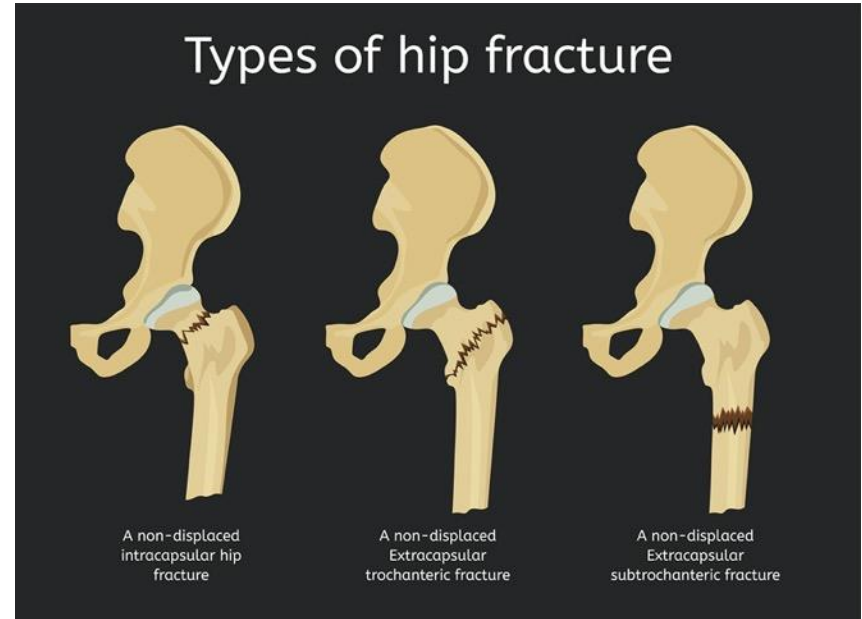
Not Just in Women...

- 80% occurs in women with 20% in men
- Women are 2-3 times more likely to have a hip fracture
 - However, one year mortality following a hip fracture is nearly twice as high for men as for women



Hip Fractures

- Women with a hip fracture are 4 times more likely to fracture the other hip
- At 6 months after a hip fracture,
 - Only 15% can walk across a room without help
 - 15% require long-term care
- An average of 24% of hip fracture patients aged 50 and over die in the year following their fracture



Bone Mineral Density (BMD) Testing

- BMD Test is an easy, reliable test that measures the density or thickness of bones
- It measures the amount of mineral (calcium) in a specific area of the bone
- The more mineral in the one measured, the greater is the bone density or bone mass

What Can a BMD Test Do?

1. Measures the bone mineral density (BMD) and compares it to an established standard
2. Detects low bone mass before a fracture occurs
3. Monitor the effectiveness of treatments for osteoporosis and low bone mass



- Governing organization for bone density testing
 - Certifies densitometry clinicians and technologists
- Develops position papers on bone density testing
 - Adult testing:
 - https://iscd.org/wp-content/uploads/2019/07/logo_footer.png
 - Pediatric testing:
 - https://iscd.org/wp-content/uploads/2019/07/logo_footer.png

Indications for BMD Testing in Women

- **Women** aged 65 and older
- For post-menopausal **women** younger than age 65 a bone density test is indicated if they have a risk factor for low bone mass such as:
 - Low body weight
 - Prior fracture
 - High risk medication use
 - Disease or condition associated with bone loss
- **Women** during the menopausal transition with clinical risk factors for fracture, such as low body weight, prior fracture, or high-risk medication use

Indications for BMD Testing in Men

- **Men** aged 70 and older
- For **men** < 70 years of age a bone density test is indicated if they have a risk factor for low bone mass such as:
 - Low body weight
 - Prior fracture
 - High risk medication use
 - Disease or condition associated with bone loss

Indications for Bone Density Testing

- Adults with a fragility fracture
- Adults with a disease or condition associated with low bone mass or bone loss
- Adults taking medications associated with low bone mass or bone loss
- Anyone being considered for pharmacologic therapy
- Anyone being treated, to monitor treatment effect
- Anyone not receiving therapy in whom evidence of bone loss would lead to treatment

Why the DEXA??

- The World Health Organization (WHO) criteria for the diagnosis of osteoporosis are based on reference data obtained by DXA
- The fracture risk algorithm (Fracture Risk Assessment Tool [FRAX]) uses femoral neck BMD measured by DXA
- Randomized, clinical trials showing a reduction in fracture risk with drug therapy have selected subjects based on BMD measured by DXA
- There is a strong relationship between decreased fracture risk with drug therapy and the magnitude of BMD increase measured by DXA
- Accuracy and precision are excellent; radiation exposure is very low

Bone Mass Density (BMD)

- The same DXA instrument should be used for serial BMD testing whenever possible. It is not possible to quantify BMD changes on measurements made on different instruments unless a cross-calibration study has been done
- BMD tests can be repeated every 2 years with patients with low bone mass
 - OR every 5 years in patients with normal BMD and no new risk factors

DEXA Machine



How Does a DEXA Work?

- The DEXA machine transmits a beam of low-dose x-rays with two distinct energy peaks
- One peak absorbed mainly by soft tissue and the other by bone
- The soft tissue amount is subtracted from the total and what remains is a patient's bone mineral density
- DEXA machines have software that compute the information and can compare to previous DEXAs

Changes in BMD

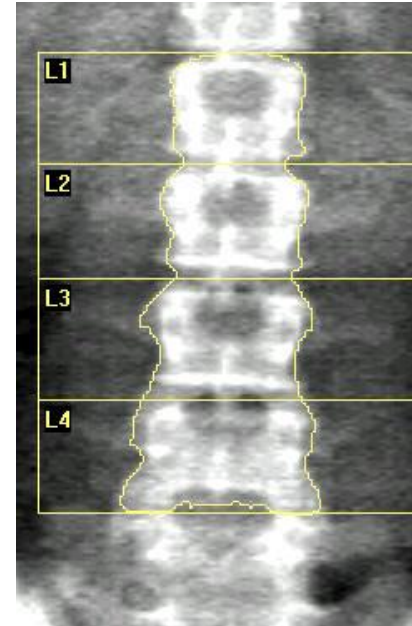
- Can indicate a change (improvement or decline) if there is a statistically significant change
 - Indicated on the DEXA report often with an * asterisk
- Otherwise can indicate a “trend towards” improvement or decline

What Is Measured on a DEXA?

- **Lumbar Spine**
- **Femur**
- **Forearm**

Lumbar Spine BMD Measurement

- Lumbar Spine Vertebrae L1-4
- Negate vertebrae that are 1 standard deviation from the lowest vertebrae T-score
- Osteoarthritis can cause increased BMD due to osteophytes/bony hypertrophy



Femur BMD Measurement

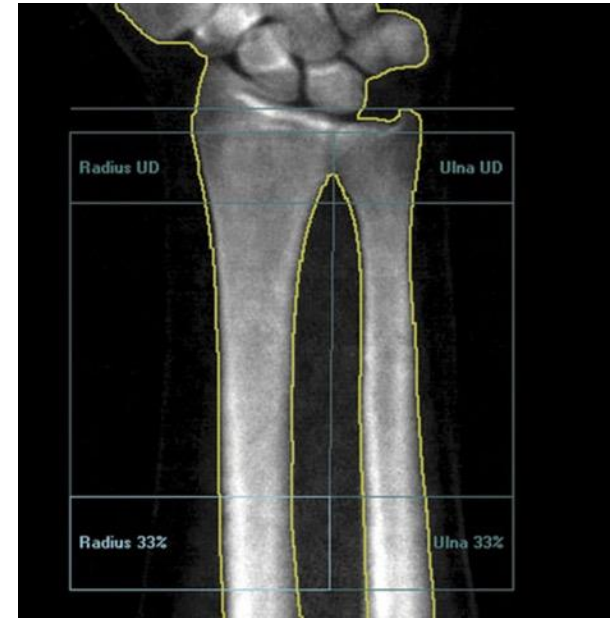
2 areas measured:

- Neck of femur
- Total femur
- Compare BMD of TOTAL femur between each test
- Can NOT compare the BMD of NECK of femur due to nuances of positioning



Forearm BMD Measurement

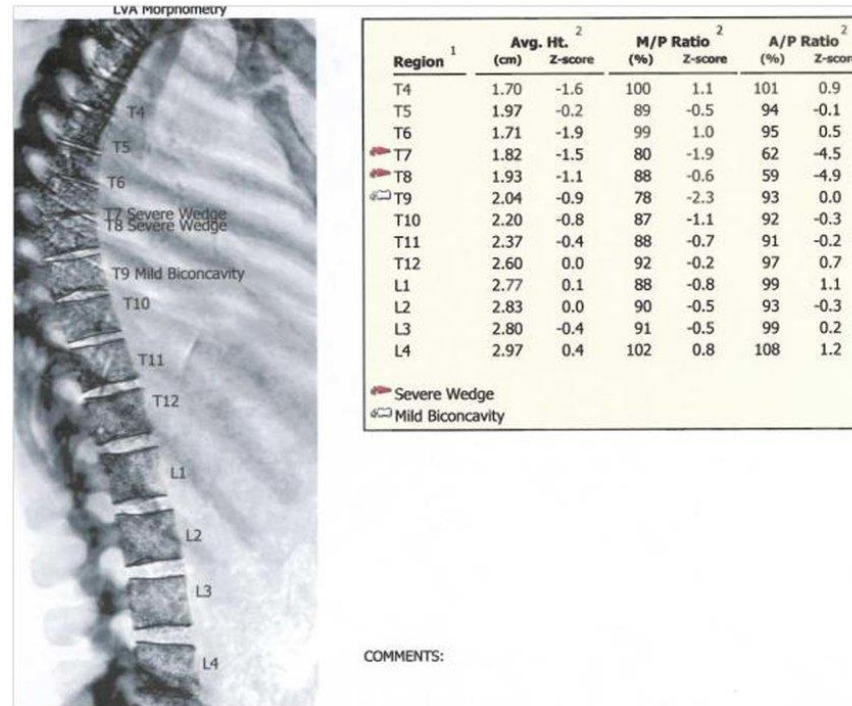
- Used if the lumbar spine and vertebrae can not be measured or are not valid
- Should only be measured once in a lifetime, cannot compare test to test
- Special situations;
 - Hyperparathyroidism
 - Obese patients over the weight limit for the DEXA table



Vertebral Fracture Analysis (VFA)

- Identification of previously undetected vertebral fractures (VFs) could affect:
 - The diagnostic classification, fracture risk assessment, and clinical management
- Vertebral fracture assessment (VFA) by DXA is a method of visualizing the spine to detect VFs. VFA compares favorably with spine radiographs in detecting moderate and severe VFs, but it does not perform as well for diagnosing mild VFs

Vertebral Fracture Analysis



Patient Intake Questionnaire

AutoSave BMDQuestionnaire-2 (1).doc - Compatibility Mode - Saved to \\uk12\Redirection\Folders - Search

File Home Insert Design Layout References Mailings Review View Help

Share Comments

Developed by Diane [Thériault](#) for the Canadian Panel, International Society for Clinical Densitometry, April, 2004

Patient Questionnaire

Name (print): _____ Date: _____

Is there a chance that you are pregnant? Yes No

Have you had a barium X-ray in the last 2 weeks? Yes No

Have you had a nuclear medicine scan or injection of an X-ray dye in the last week? Yes No

Have you had hyperparathyroidism or a high calcium level in your blood? Yes No

If you answered yes to any of the above, speak to our receptionist right away.

1. Your Age: _____ Sex: Male Female

2. Your ethnicity (check one):
____Caucasian (White) ____Black ____Aboriginal ____Asian ____Hispanic ____Other
Your country of birth: _____

3. Have you ever had a bone density test? Yes No
If YES, when and where? _____

4. Have you had a recent weight change? Yes No
If YES, tell us about it: _____

5. Your tallest height (late teens or young adult): _____

6. Have you ever broken a bone? Yes No

Bone broken	Simple fall?	If not a simple fall, please describe the circumstances	Age when this occurred

7. Has a parent or sibling had a broken hip from a simple fall or bump? Yes No

8. Has a parent or sibling had any other type of broken bone from a simple fall or bump? Yes No

9. How many times have you fallen in the last year? _____

10. Have you ever had surgery of the spine, hips, legs or arms? Yes No
If YES, describe what type of surgery you had and which side was affected

11. Are you currently receiving or have you previously received prednisone pills (cortisone)?
Yes, currently _____ Yes, previously _____ No _____
If YES, for how long? _____ What is your dose? _____ mg or _____ pills each day

12. List any chronic medical conditions that you have:

13. Are you currently receiving or have you previously received any of the following medications?

	No	Yes	For how long?
Medication for seizures or epilepsy			
Chemotherapy for cancer			
Medication for prostate cancer			
Medication to prevent organ transplant rejection			

14. Have you been treated with any of the following medications?

Medication	Ever?	Currently?	If current, how long?
Hormone replacement therapy (Estrogen)			
Tamoxifen			
Raloxifene (<u>Evista</u>)			
Testosterone			
Etidronate (<u>Didronel/Didrocal</u>)			
Alendronate (<u>Fosamax</u>)			
Risedronate (<u>Actonel</u>)			
Intravenous pamidronate (<u>Aredia</u>)			
Cidronate (<u>Bonelos, Ostac</u>)			
Calcitonin (<u>Miacalcin</u> nasal spray)			
PTH (<u>Forteo</u>)			
Zoledronic acid (<u>Zometa</u>)			
Sodium fluoride (<u>Fluolic</u>)			

15. How many servings of the following do you eat/drink per day (on average)?

	Milk (full cup)	Orange juice fortified with calcium (full cup)	Yogurt (small container or ½ cup)	Cheese
Number of servings				

16. Do you take any calcium supplements (including TUMS)? Yes No

17. Do you take any vitamin D supplements (including multivitamins and halibut liver oil)? Yes No

18. Do you smoke? Yes No

For women only...

19. Are you still having menstrual periods? Yes No

20. Before menopause, have you ever missed your periods for 6 months or more, besides during pregnancy? Yes No

21. Have you had your menopause? Yes No
If yes, at what age? _____

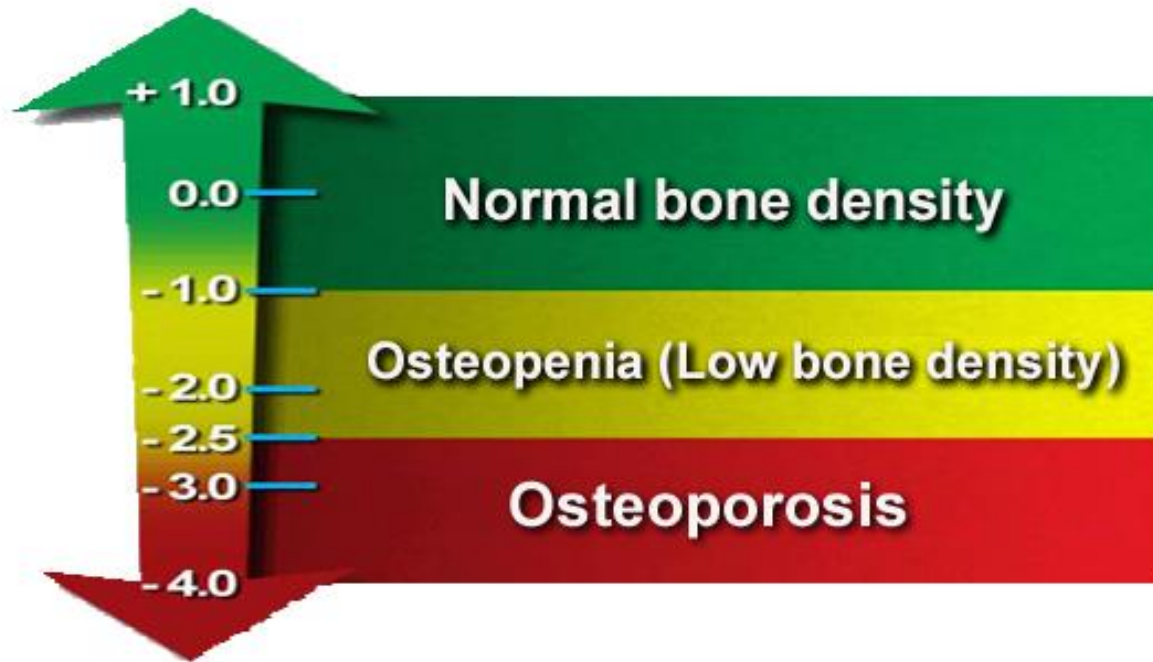
22. Have you had a hysterectomy? Yes No
If YES, at what age? _____
Have you had both of your ovaries removed? Yes No

Page 1 of 2 535 words

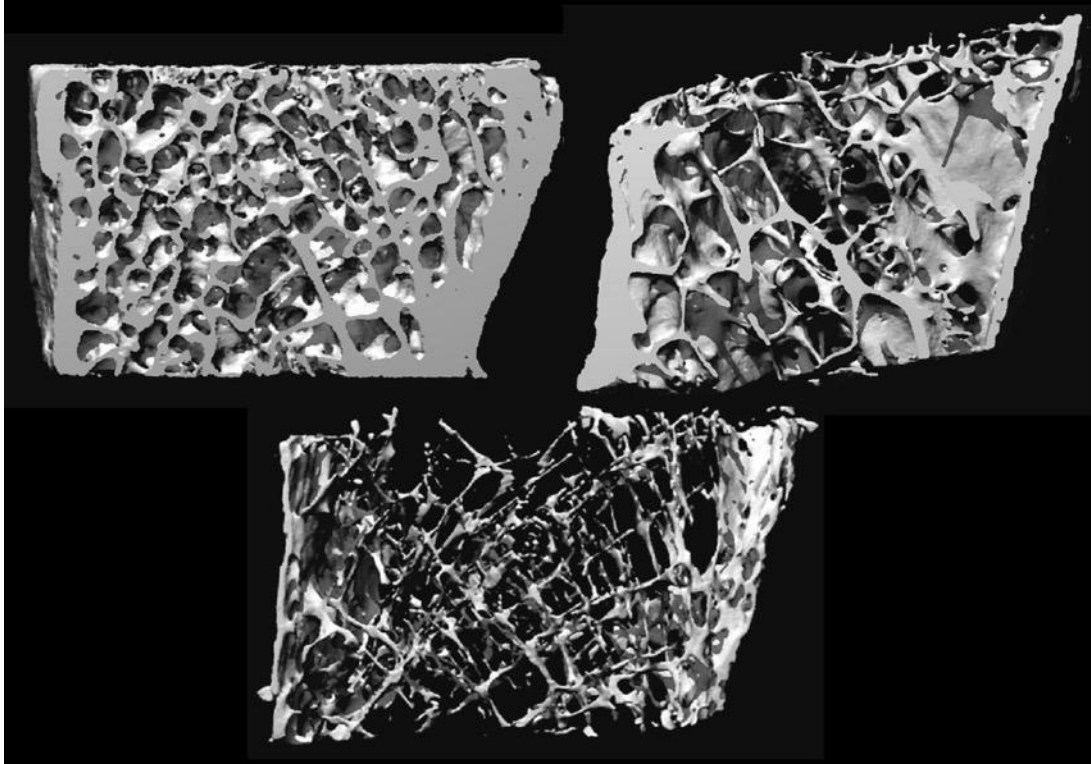
Focus 100%

T-score vs. Z-score

- T-score:
 - Calculated by comparing current BMD to the mean peak BMD of normal young adult of same gender
 - For postmenopausal females
- Z-score:
 - Calculated by comparing current BMD and mean of a reference population of same gender, age, ethnicity
 - For premenopausal women under age 50



Osteoporosis – CT Scan



Picture courtesy of Harry Genant MD, University of California (San Francisco)

Diagnosis of Osteoporosis


- Osteoporosis is diagnosed with T-score below -2.5
OR
- Fragility fracture that occurs without much trauma in the following regions:
 - Hip
 - Wrist
 - Vertebrae
 - Humerus



Who to Treat??

- Osteoporosis
 - Generally recommend treatment
- Osteopenia
 - Need to take into account risk factors by using a risk assessment measurement like the FRAX

FRAX Risk Assessment Measure

**FRAX[®]** Fracture Risk Assessment Tool

HomeCalculation Tool▼Paper ChartsFAQReferencesEnglish▼

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: **Poland**

Name/ID:

[About the risk factors](#)

Questionnaire:

1. Age (between 40 and 90 years) or Date of Birth

Age:
Date of Birth: Y: M: D:

2. Sex

☒ Male ☐ Female

3. Weight (kg)

4. Height (cm)

5. Previous Fracture

☒ No ☐ Yes

6. Parent Fractured Hip

☒ No ☐ Yes

7. Current Smoking

☒ No ☐ Yes

8. Glucocorticoids

☒ No ☐ Yes

9. Rheumatoid arthritis

☒ No ☐ Yes

10. Secondary osteoporosis


☒ No ☐ Yes

11. Alcohol 3 or more units/day


☒ No ☐ Yes

12. Femoral neck BMD (g/cm²)


Select BMD



Weight Conversion

Pounds  kg

Height Conversion

Inches  cm

00136594

Individuals with fracture risk
assessed since 1st June 2011

Other Fracture Risk Calculators:

- **CAROC** – Canadian Association of Radiologists and Osteoporosis Canada Risk Assessment Tool – <http://www.osteoporosis.ca/multimedia/pdf/CAROC.pdf>
- **FORE** – The FORE 10-Year Fracture Risk Calculator (FORE FRC) estimates 10-year fracture risk for postmenopausal women and men age 45 and older who are not receiving treatment for osteoporosis – <https://riskcalculator.fore.org/default.aspx>
- **Garvan** – This Fracture Risk Calculator was developed using data collected in the internationally renowned Dubbo Osteoporosis Epidemiology Study conducted by the Bone and Mineral Research Program of Sydney's Garvan Institute of Medical Research. – <http://www.garvan.org.au/bone-fracture-risk>
- **Osteoporosis Canada 10 Year Fracture Risk Assessment** – Online Calculator – <https://www.osteoporosis.ca/multimedia/FractureRiskTool/index.html>

Case Study 1

- 65 year old Caucasian Female
 - Risk Factors
 - Family history (Mother)
 - Paternal hip fracture
 - Estrogen deficiency
 - Fractures:
 - Ankle, tibia/fibula
 - Treatment: Reclast

PATIENT:

Name: [REDACTED] Physician: [REDACTED]
Birth Date: [REDACTED] Age: 65.7 Gender: Female Weight: 212.0 lbs. Height: 62.0 in.
Machine: GE Healthcare Lunar Prodigy Advance Exam Date: 02/03/2020
Indications: Caucasian Race, Estrogen deficiency, Family history (mother), Paternal hip fracture, Family history
Menopause: Natural with LMP around 2000
Fractures: Postmenopausal: Ankle, Tibia/Fibula
Treatment: Reclast

Densitometry Values:

Diagnosis for the DXA was given as osteoporosis. The bone density was evaluated in the femurs, forearm and lumbar spine from L1-L4. The values of the lumbar spine at L1-L4 did not meet the official positions of ISCD in 2002 and today and therefore were excluded from the report. The test showed the following results.

Measured	Scan Type	Region	BMD	YA %	T-Score	Z-Score
02/03/2020	DualFemur	Neck Right	0.828 g/cm ³	80%	-1.5	-0.7
12/26/2017	DualFemur	Neck Right	0.774 g/cm ³	75%	-1.9	-1.2
05/18/2010	DualFemur	Neck Right	0.862 g/cm ³	83%	-1.3	-0.9
08/19/2005	DualFemur	Neck Right	0.831 g/cm ³	80%	-1.5	-1.3
06/14/2002	DualFemur	Neck Right	0.863 g/cm ³	83%	-1.3	-1.0
02/03/2020	DualFemur	Total Mean	1.064 g/cm ³	106%	0.4	0.9
12/26/2017	DualFemur	Total Mean	1.024 g/cm ³	102%	0.1	0.4
05/18/2010	DualFemur	Total Mean	1.048 g/cm ³	104%	0.3	0.3
08/19/2005	DualFemur	Total Mean	1.042 g/cm ³	103%	0.3	0.0
06/14/2002	DualFemur	Total Mean	1.030 g/cm ³	102%	0.2	0.1
02/03/2020	Left Forearm	Radius 33%	0.903 g/cm ³	102%	0.2	1.6
06/14/2002	AP Spine	L2-L4 (3)	0.885 g/cm ³	74%	-2.6	-3.1

World Health Organization (WHO) criteria for post-menopausal, Caucasian Women:

Normal: T-score at or above -1 SD

Low Bone Mass: T-score between -1 and -2.5 SD

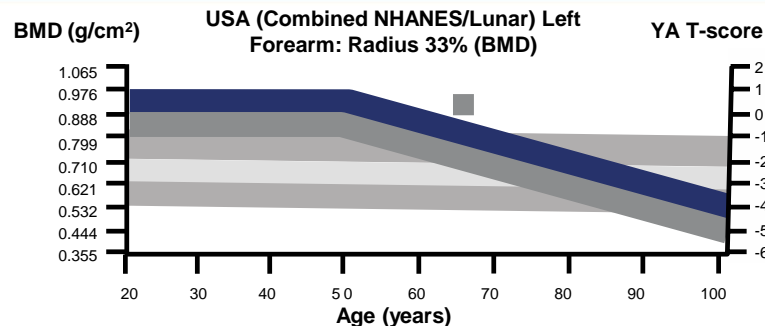
Osteoporosis: T-score at or below -2.5 SD

IMPRESSION:

Densitometry Trend: Total Mean

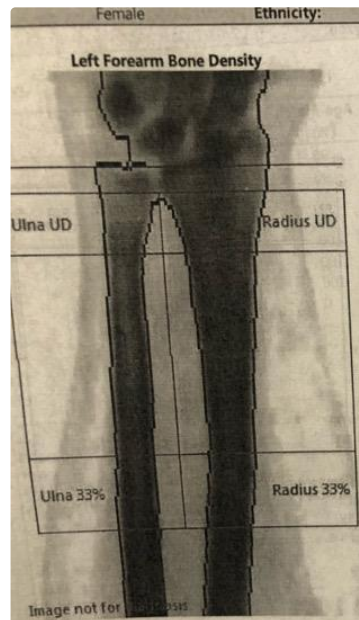
Measured Date	Age (years)	BMD (g/cm ²)	Change vs Previous (%)	Change vs Baseline (%)
02/03/2020	65.7	1.064	3.9*	3.3*
12/26/2017	63.6	1.024	-2.3	-0.6
05/18/2010	55.9	1.048	0.6	1.7
08/19/2005	51.2	1.042	1.2	1.2
06/14/2002	48.0	1.030	-	baseline

Total femur shows 3.9%* improvement in BMD



Densitometry: USA (Combined NHANES/Lunar)

Region	BMD (g/cm ²)	Young-Adult T-score	Age-Matched Z-score
Radius UD	0.564	2.1	3.5
Ulna UD	0.401	-	-
Radius 33%	0.903	0.2	1.6
Ulna 33%	0.885	-	-
Both UD	0.508	-	-
Both 33%	0.895	-	-
Radius Total	0.730	0.8	2.2
Ulna Total	0.652	-	-
Both Total	0.669	-	-



Used as the
lumbar spine was
deemed not valid

COMMENTS:

Statistically 68% of repeat scans fall within 1SD (± 0.020 g/cm² for Left Forearm Radius 33%); USA (Combined NHANES (ages 20-30/Lunar (ages 20-40)) Forearm Reference Population (v113); Matched for Age, Ethnic; Lunar calibration in use; World Health Organization- Definition of Osteoporosis and Low Bone Mass for Caucasian Woman: Normal=T-score at or above -1.0 SD; Low Bone Mass=T-Score between -1.0 and -2.5 SD; Osteoporosis=T-Score at or below -2.5 SD; (WHO definitions only apply when a young healthy Caucasian Women reference database is used to determine T-scores.) Date created: 02/03/2020 3:26:34 PM 15 (SP 4); Filename: stocks_76a55q6i9l.dfa; Left Forearm; 76;0.15:50.03:12.0 0.00;6.20x1.05 6.0;%Fat=49.8%; 0.00;0.00 0.00;0.00; Forearm Length: 24.9 cm; Scan Mode: Standard; 2.0 μ Gy

Densitometry Trend: L2-L4 (L3)

Measured Date	Age (years)	BMD (g/cm ²)	Change vs Previous (%)	Change vs Baseline (%)
02/03/2020	65.7	0.969	21.7*	9.5*
12/26/2017	63.6	0.796	1.1	-10.1*
05/18/2010	55.9	0.787	-13.0*	-11.1*
08/19/2005	51.2	0.905	2.3	2.3
06/14/2002	48.0	0.885	-	baseline

Significant lumbar spine changes with each DEXA

ANCILLARY RESULTS: AP Spine

Region	BMD (g/cm ²)	Young-Adult		Age-Matched	
		(%)	T-score	(%)	Z-score
L1	0.918	81	-1.8	98	-0.2
L2	0.859	72	-2.8	85	-1.2
L3	0.925	77	-2.3	92	-0.7
L4	1.064	89	-1.1	106	0.5
L1-L2	0.887	76	-2.3	91	-0.7
L1-L4 (L3)	0.954	82	-1.8	98	-0.2
L2-L4 (L3)	0.969	81	-1.9	96	-0.3

L2-L4(3) no longer valid;
Would be more valid to use L2-3 but that was not part of original measurements

How to Interpret??

- AP spine L2-4(3) last done in 2002 with T-score of -2.6
- Femur in the Osteopenia range
 - Improvement of Total dual femur T-score by 3.9%*
- Left forearm T-score 0.2
- History of fragility fractures so has diagnosis of Osteoporosis

Case Study #2

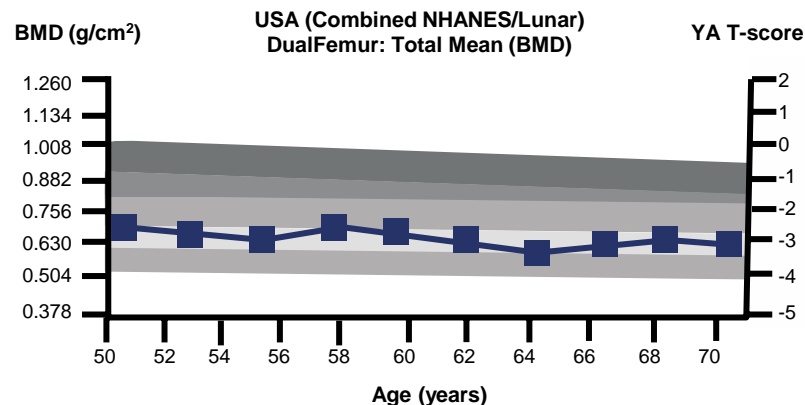
- 70 year old Caucasian female
 - Weight 125 lbs.
 - Height 64 inches
- Risk Factors:
 - Estrogen deficiency (menopause in late 40's)
 - Rheumatoid Arthritis
- Fracture History:
 - Elbow
 - Foot
- Treatment History:
 - Alendronate weekly x 6 years
 - Started drug holiday September 2020 when DEXA showed stability
 - New ankle fracture occurred October 2020

Measured	Scan Type	Region	BMD	YA %	T-Score	Z-Score
09/01/2020	DualFemur	Neck Mean	0.661 g/cm ²	64%	-2.7	-0.8
08/02/2018	DualFemur	Neck Mean	0.668 g/cm ²	64%	-2.7	-0.8
07/11/2016	DualFemur	Neck Mean	0.673 g/cm ²	65%	-2.6	-0.9
05/08/2014	DualFemur	Neck Mean	0.650 g/cm ²	63%	-2.8	-1.2
01/17/2012	DualFemur	Neck Mean	0.685 g/cm ²	66%	-2.5	-1.0
11/23/2009	DualFemur	Neck Mean	0.717 g/cm ²	69%	-2.3	-0.9
10/09/2007	DualFemur	Neck Mean	0.719 g/cm ²	69%	-2.3	-1.0
05/19/2005	DualFemur	Neck Mean	0.709 g/cm ²	68%	-2.4	-1.1
12/03/2002	DualFemur	Neck Mean	0.728 g/cm ²	70%	-2.2	-1.1
09/12/2000	DualFemur	Neck Mean	0.749 g/cm ²	72%	-2.1	-1.1
09/01/2020	DualFemur	Total Mean	0.685 g/cm ²	68%	-2.6	-0.9
08/02/2018	DualFemur	Total Mean	0.694 g/cm ²	69%	-2.5	-0.8
07/11/2016	DualFemur	Total Mean	0.681 g/cm ²	68%	-2.6	-1.1
05/08/2014	DualFemur	Total Mean	0.663 g/cm ²	66%	-2.7	-1.4
01/17/2012	DualFemur	Total Mean	0.702 g/cm ²	70%	-2.4	-1.1
11/23/2009	DualFemur	Total Mean	0.740 g/cm ²	73%	-2.1	-1.0
10/09/2007	DualFemur	Total Mean	0.752 g/cm ²	75%	-2.0	-1.0
05/19/2005	DualFemur	Total Mean	0.726 g/cm ²	72%	-2.2	-1.3
12/03/2002	DualFemur	Total Mean	0.747 g/cm ²	74%	-2.1	-1.2
09/12/2000	DualFemur	Total Mean	0.758 g/cm ²	75%	-2.0	-1.3
05/19/2005	Right Forearm	Radius 33%	0.474 g/cm ²	66 %	-3.4	

Total Dual Femur Shows Stability of BMD in Comparison With Last DEXA in 2018

Densitometry Trend: Total Mean

Measured Date	Age (years)	BMD (g/cm ²)	Change vs Previous (%)	Change vs Baseline (%)
09/01/2020	70.9	0.685	-1.3	-9.6*
08/02/2018	68.8	0.694	1.9	-8.4*
07/11/2016	66.8	0.681	2.7	-10.2*
05/08/2014	64.6	0.663	-5.6*	-12.5*
01/17/2012	62.3	0.702	-5.1*	-7.4*
11/23/2009	60.1	0.740	-1.6	-2.4*
10/09/2007	58.0	0.752	3.6	-0.8
5/19/2005	55.6	0.726	-2.8	-4.2*
12/03/2002	53.2	0.747	-1.5	-1.5
09/12/2000	50.9	0.758	-	baseline



How to Interpret??

- Stability of the total femur between 2018 and 2020
- However, New ankle fracture after 6 year course of bisphosphonates
 - Recommended anabolic therapy so started on Evenity once monthly x 12 months

Case Study 3

- 73 year old Caucasian Female
 - Weight: 97 lbs.
 - Height: 66 inches
- Risk Factors:
 - Estrogen Deficiency (menopause in her early 50's)
 - Low BMI
- NO history of fractures
- Treatment History:
 - Previous use of ibandronate orally x 5 years then alendronate orally x 5 years; off treatment since 2017 DEXA

opause: Natural with LMP around 1999
 stures: Postmenopausal: None
 atment: None Prior: Alendronate

Densitometry Values:

agnosis for the DXA was given as osteoporosis. The bone density was evaluated in the femurs and lumbar spine from L1-L4. The values of the lumbar spine at L3-L4 did not meet the official positions of ISCD in 2002, and therefore were excluded from the report. The test showed the following results.

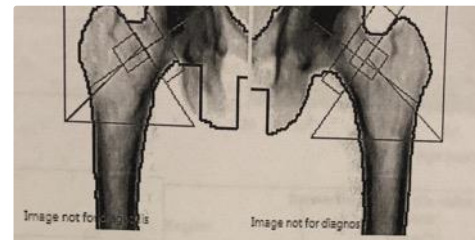
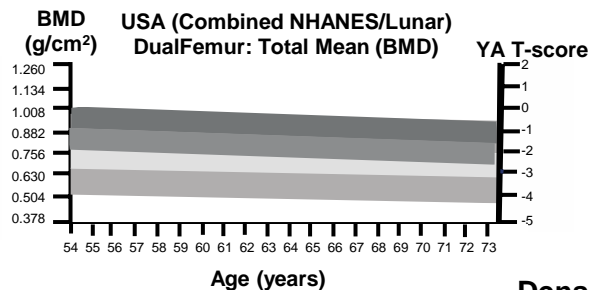
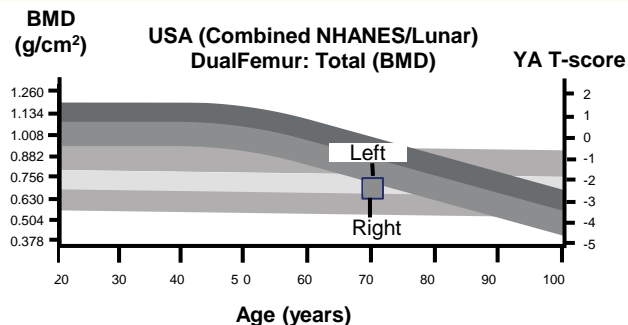
Measured	Scan Type	Region	BMD	YA %	T-Score	Z-Score
12/01/2020	AP Spine	L1-L2	0.804 g/cm ²	69%	-3.0	-1.3
09/13/2017	AP Spine	L1-L2	0.894 g/cm ²	77%	-2.3	-0.6
09/06/2013	AP Spine	L1-L2	0.942 g/cm ²	81%	-1.9	-0.3
08/19/2011	AP Spine	L1-L2	0.978 g/cm ²	84%	-1.6	-0.1
07/29/2009	AP Spine	L1-L2	1.020 g/cm ²	88%	-1.2	0.1
07/18/2007	AP Spine	L1-L2	1.029 g/cm ²	88%	-1.1	0.0
03/08/2002	AP Spine	L1-L2	1.045 g/cm ²	90%	-1.0	-0.3
01/20/1998	AP Spine	L1-L2	1.186 g/cm ²	102%	0.2	0.6
12/01/2020	DualFemur	Neck Mean	0.683 g/cm ²	66%	-2.6	-0.3
09/13/2017	DualFemur	Neck Mean	0.774 g/cm ²	75%	-1.9	0.1
09/06/2013	DualFemur	Neck Mean	0.858 g/cm ²	83%	-1.3	0.5
08/19/2011	DualFemur	Neck Mean	0.818 g/cm ²	79%	-1.6	0.7
07/29/2009	DualFemur	Neck Mean	0.896 g/cm ²	86%	-1.0	0.6
07/18/2007	DualFemur	Neck Mean	0.906 g/cm ²	87%	-0.9	0.6
03/08/2002	DualFemur	Neck Mean	0.908 g/cm ²	87%	-0.9	0.1
12/01/2020	DualFemur	Total Mean	0.618 g/cm ²	61%	-3.1	-1.0
09/13/2017	DualFemur	Total Mean	0.682 g/cm ²	68%	-2.6	-0.8
09/06/2013	DualFemur	Total Mean	0.773 g/cm ²	77%	-1.9	-0.3
08/19/2011	DualFemur	Total Mean	0.788 g/cm ²	78%	-1.7	0.3
07/29/2009	DualFemur	Total Mean	0.867 g/cm ²	86%	-1.1	0.2
07/18/2007	DualFemur	Total Mean	0.878 g/cm ²	87%	-1.0	0.2
03/08/2002	DualFemur	Total Mean	0.864 g/cm ²	86%	-1.1	-0.4

World Health Organization (WHO) criteria for post-menopausal, Caucasian Women:

Normal: T-score at or above -1 SD

Low Bone Mass: T-score between -1 and -2.5 SD

Total and Neck Femur Scores



Densitometry: USA (Combined NHANES/Lunar)

Region	BMD (g/cm ²)	Young-Ad T-score	Age-Matched Z-score
Neck Left	0.677	-2.6	-0.3
Neck Right	0.690	-2.5	-0.2
Neck Mean	0.683	-2.6	-0.3
Neck Diff.	0.013	0.1	0.1
Total Left	0.643	-2.9	-0.8
Total Right	0.593	-3.3	-1.2
Total Mean	0.618	-3.1	-1.0
Total Diff.	0.050	0.4	0.4

Hip Axis Length Comparison (mm)

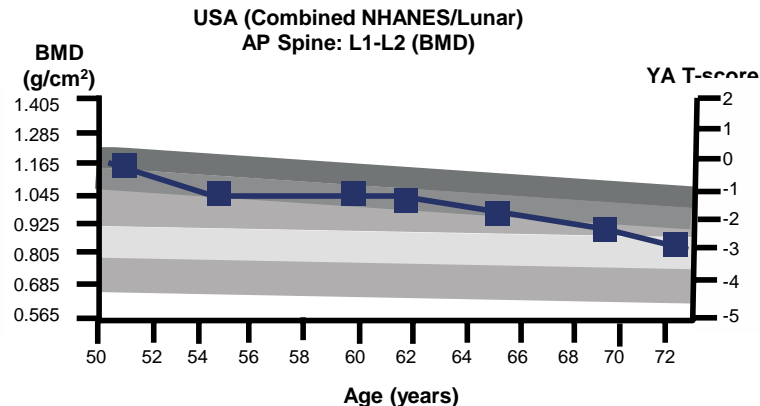
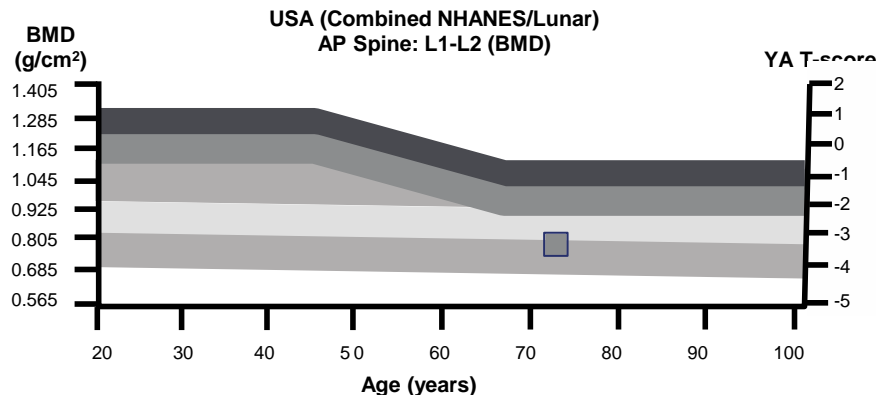
Densitometry Trend: Total Mean

Measured Date	Age (years)	BMD (g/cm ²)	Change vs Previous (%)	Change vs Baseline (%)
12/01/2020	72.7	0.618	-9.4*	-28.5*
09/13/2017	69.5	0.682	-11.8*	-21.1*
09/06/2013	65.5	0.773	-1.9	-10.5*
08/19/2011	63.4	0.788	-9.1*	-8.8*
07/29/2009	61.4	0.867	-1.3	0.3
07/18/2007	59.4	0.878	1.6	1.6
03/08/2002	54.0	0.864	-	baseline

Densitometry Trend: Total Mean

Measured Date	Age (years)	BMD (g/cm ²)	Change vs Previous (%)	Change vs Baseline (%)
12/01/2020	72.7	0.618	-9.4*	-28.5*
09/13/2017	69.5	0.682	-11.8*	-21.1*
09/06/2013	65.5	0.773	-1.9	-10.5*
08/19/2011	63.4	0.788	-9.1*	-8.8*
07/29/2009	61.4	0.867	-1.3	0.3
07/18/2007	59.4	0.878	1.6	1.6
03/08/2002	54.0	0.864	-	baseline

Lumbar spine had a 9.4%* decline in BMD between 2017 and 2020



Densitometry: USA (Combined NHANES/Lunar)

Region	BMD (g/cm ²)	Young-Adult T-score	Age-Matched Z-score
L1	0.736	-3.3	-1.6
L2	0.863	-2.8	-1.1
L3	1.000	-1.7	0.0
L4	0.952	-2.1	-0.4
L1-L2	0.804	-3.0	-1.3

Only L1-L2 used due to L3-4 being statistical outliers with lowest T-score of -3.3 in L1

Densitometry Trend: L1-L2				
Measured Date	Age (years)	BMD (g/cm ²)	Change vs Previous (%)	Change vs Baseline (%)
12/01/2020	72.7	0.804	-10.1 *	-32.2 *
09/13/2017	69.5	0.894	-5.1	-24.6 *
09/06/2013	65.5	0.942	-3.7	-20.6 *
08/19/2011	63.4	0.978	-4.1	-17.5
07/29/2009	61.4	1.020	-0.9	-14.0
07/18/2007	59.4	1.029	-1.5	-13.2
03/08/2002	54.0	1.045	-11.9	-11.9
01/20/1998	49.9	1.186	-	baseline

Lumbar spine shows significant decline of 10.1%* between 2017 and 2020

32.2%* decline between 1998 and 2020

How to Interpret??

- Lumbar spine:
 - Significant decline of 10.1%
- Total Dual femur:
 - Significant decline of 9.4%
- Lab work-up, recommend consideration of an anti-resorptive such as IV zoledronic acid or Prolia
 - Has not fractured, but could consider anabolic therapy

Resources

- International Society for Clinical Densitometry
 - www.iscd.org
- National Osteoporosis Foundation:
 - www.nof.org



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Questions??