Menopause: Bone and Muscle Health

A focus on prevention
10/11/25

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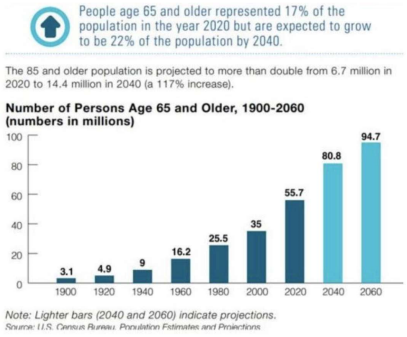
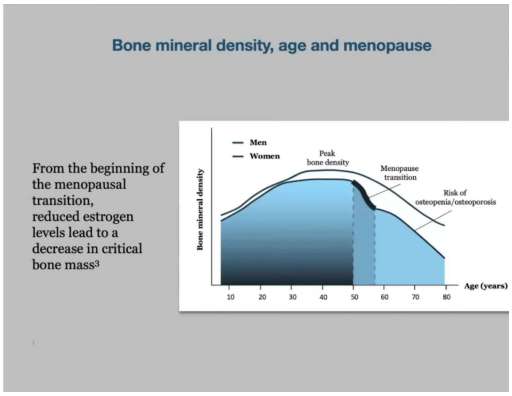
Objectives

1. Risk factors for osteoporosis
2. Preventive measures
3. What is the scope of the problem?
4. What does the data show?

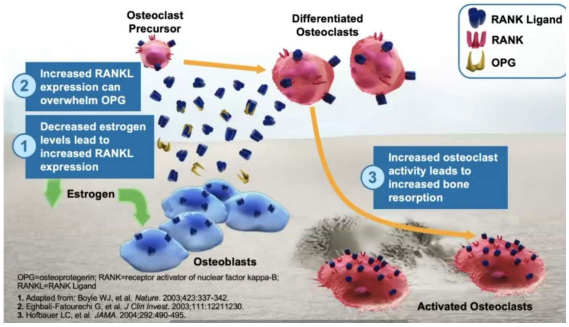
Disclosure: speaker for Astellas

Why is this topic important?





Decreased estrogen levels lead to Increased RANK Ligand expression and accelerated Bone Resorption [1-3]



OPG=osteoprotegerin; RANK=receptor activator of nuclear factor kappa-B; RANKL=RANK Ligand

1. Adapted from: Boyle WJ, et al. *Nature*. 2003;423:337-342.
2. Eghbali-Fatourechi G, et al. *J Clin Invest*. 2003;111:1221230.
3. Hofbauer LC, et al. *JAMA*. 2004;292:490-495.

What have we learned from SWAN?

Study of Women's health Across the Nation. Longitudinal study of 3302 women followed from perimenopause >20 years. 2407 BMD subset.

- Accelerated bone loss occurs from 1-2 years before the final menstrual period till 3-4 years after the final menstrual period at both the lumbar spine and femur neck.
- Bone loss is maximal in the period one year before FMP and for 2 years after FMP.
- Cumulative BMD loss averages during this time were 10.6% at lumbar spine and 9.1% at the femur neck amounting to a lowering of about 1 standard deviation(1 T-score unit).

Greendale et al. J Bone Miner Res. 2012:27:1118

What have we learned from SWAN?

Study of Women's health Across the Nation. Longitudinal study of 3302 women followed from perimenopause >20 years. 2407 BMD subset.

BMD at time of menopause is a highly significant predictor of the risk of future osteoporosis as significant bone loss (and loss of bone structure) will lead to earlier attainment of fracture thresholds.

Other risk factors

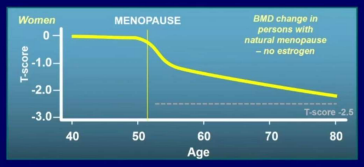
- Low BMI
- Rate of bone loss
- History of fracture
- Family history of osteoporosis/fractures
- Medical conditions associated with bone loss

Zaitlin et al. Arch Osteoporos. 2023;18:78.

Bone Mineral Density, Menopause and Age

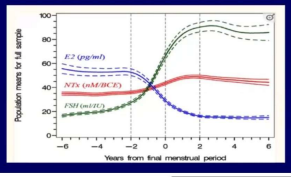
Key Points:

- **Bone loss is a continuous process beginning in midlife, including an interval of relatively rapid loss that occurs across the menopausal transition**



Key Points:

- **Bone loss in perimenopausal women occurs before increases in bone resorption or declines in serum estradiol (1,2)**
- **In SWAN, higher serum FSH was weakly correlated with increased NTX levels and rates of bone loss (3)**
- **FSH inhibitors prevent bone loss in ovariectomized rats (4)**
  - **clinical trials are evaluating this therapy in humans**



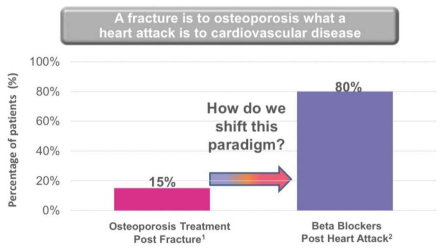
1. Ausmanas MK et al. *Climacteric* 2007;10: 427–37
2. Zaidi M et al. *Curr Rheumatol Rep* 2009;11: 191–5
3. Sowers MR et al. *J Clin Endocrinol Metab* 2013;98: 2854–63
4. Liu S et al. *J Endod* 36: 658–63

Timeline: Consequences post fracture

Lifetime risk of hip fracture in women >50 is **12.1%**[5]

1. Hajcsar EE, et al. CMAJ 2000;163:819-822; 2. Cooper C. Am J Med. 1997:103:12S-19S; 3. Jean S, et al. J Bone Miner Res. 2013; 28:360-71; 4. Ioannidis G, et al. CMAJ 2009;181: 265-271; 5. Hopkins RB, et al. Osteoporos Int. 2012; 23:921-927.

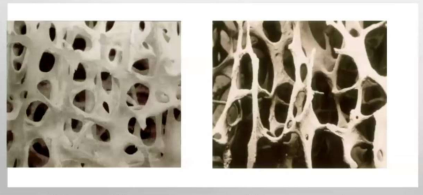
Which Raises the Question: Why do 80% of Patients Post-MI vs. 15% Post Fracture Leave the Hospital on Treatment?



1. Bessette L, et al. Osteoporos Int. 2008;19:79-86.
2. Austin PC, et al. CMAJ. 2008;179:895-900.

Definition of Osteoporosis

A systemic skeletal disease characterized by **low bone mass** and **microarchitectural deterioration** of bone tissue leading to enhanced **bone fragility** and a consequent **increase in fracture risk** when falling from own body height



Normal bone Osteoporosis

Consensus development conference. Am J Med 1993;94:646-650

- Osteoporosis is the most common bone disorder affecting humans
- The risk of hip fracture doubles for every 5- to 6-y increase in age from ages 65-85 y
- Of the 10 million Americans estimated to have osteoporosis, 8 million are women (80%)
- 1 in 2 women aged older than 50 y will sustain osteoporosis-related fracture in their lifetimes
- A prior low-trauma fracture (fragility fracture) is also a diagnosis of osteoporosis regardless whether dual energy x-ray absorptiometry (DXA) is available or reported
  - Excludes fingers, toes, face, skull, or pathologic or traumatic fractures

Kim SH, et al. *Arthritis Care Res (Hoboken)*. 2012;64(5):751-75.7

Latest recommendations for screening

The U.S. Preventive Task Force (USPSTF)
JAN 14 2025 JAMA

Recommendation Summary

Population	Recommendation	Grade
Women age 65 years or older	The USPSTF recommends screening for osteoporosis to prevent osteoporotic fractures in women age 65 years or older.	B
Postmenopausal women younger than age 65 years with one or more risk factors for osteoporosis	The USPSTF recommends screening for osteoporosis to prevent osteoporotic fractures in postmenopausal women younger than age 65 years who are at increased risk for an osteoporotic fracture as estimated by clinical risk assessment.	B

Screening is defined as central DXA examination with or without risk factors

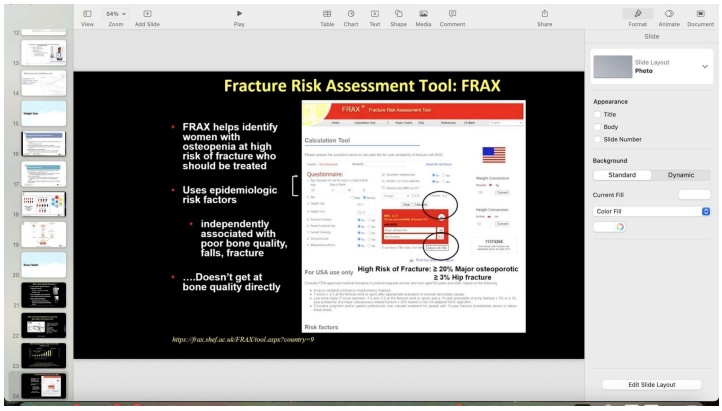
Risk factors for fracture

For the clinical risk factors a yes or no response is asked for. If the field is left blank, then a "no" response is assumed. See also notes on risk factors.
The risk factors used are the following:

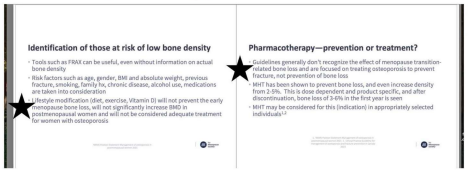
Age	The model accepts ages between 40 and 90 years. If ages below or above are entered, the programme will compute probabilities at 40 and 90 year, respectively.
Sex	Male or female. Enter as appropriate.
Weight	This should be entered in kg.
Height	This should be entered in cm.
Previous fracture	A previous fracture denotes more accurately a previous fracture in adult life occurring spontaneously, or a fracture arising from trauma which, in a healthy individual, would not have resulted in a fracture. Enter yes or no (see also notes on risk factors).
Parent fractured hip	This enquires for a history of hip fracture in the patient's mother or father. Enter yes or no.
Current smoking	Enter yes or no depending on whether the patient currently smokes tobacco (see also notes on risk factors).
Glucocorticoids	Enter yes if the patient is exposed to oral glucocorticoids or has been exposed to oral glucocorticoids for more than 3 months at a dose of prednisolone of 5mg daily or more (or equivalent doses of other glucocorticoids) (see also notes on risk factors).
Rheumatoid arthritis	Enter yes where the patient has a confirmed diagnosis of rheumatoid arthritis. Otherwise enter no (see also notes on risk factors).
Secondary osteoporosis	Enter yes if the patient has a disorder strongly associated with osteoporosis. These include type I (insulin dependent) diabetes, osteogenesis imperfecta in adults, untreated long-standing hyperthyroidism, hypogonadism or premature menopause (<45 years), chronic malnutrition, or malabsorption and chronic liver disease.
Alcohol 3 or more units/day	Enter yes if the patient takes 3 or more units of alcohol daily. A unit of alcohol varies slightly in different countries from 8-10g of alcohol. This is equivalent to a standard glass of beer (285ml), a single measure of spirits (30ml), a medium-sized glass of wine (120ml), or 1 measure of an aperitif (60ml) (see also notes on risk factors).
Bone mineral density (BMD)	BMD of the femoral neck is entered either as a T-score or as a Z-score. In patients without a BMD test, the field should be left blank (see also notes on risk factors).

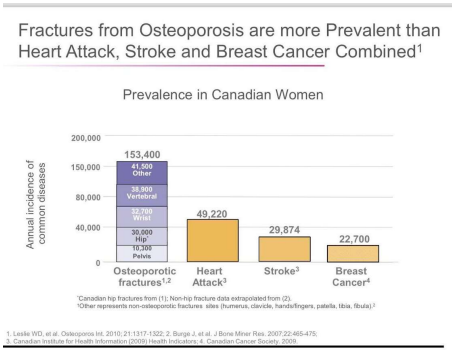
Why is FRAX without DXA not appropriate at peri/post menopause

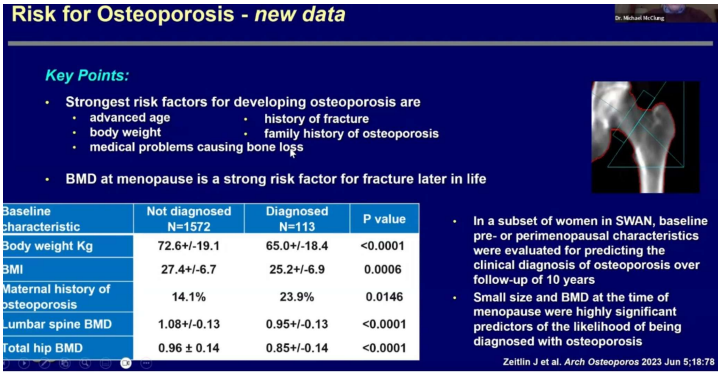
- FRAX is based on risk factor for fracture.
- DXA BMD is based on risk for osteoporosis



***BONE HEALTH:* It is all about PREVENTION and having a lifelong plan.**

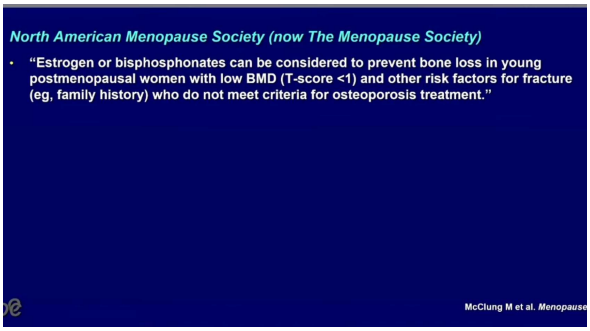






Approach to Bone Health in the Perimenopause and Postmenopause

So we have identified risk factors and the gravity of bone loss, now let's shift to talk about prevention.



Preventing Bone Loss in Young Postmenopausal Women: *General Measures*

Key Points:

- It would be ideal – and most women want to believe – that good nutrition, regular physical activity and avoiding bad habits are sufficient to prevent bone loss in early menopause

While general measures are important for overall health, no non-pharmacological intervention prevents perimenopausal bone loss

ESTROGEN PREVENTS BONE LOSS

Key Points

- In the WHI studies, estrogen with or without progestin significantly reduced the risk of vertebral, hip and other fractures in a population with low fracture risk

	Risk reduction	
Fracture type	E only	E + P
Vertebral	39%	34%
Hip	38%	34%
Total	30%	24%

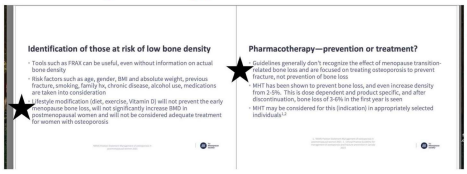
E = estrogen; E+P = Conjugated equine estrogen + medroxyprogesterone acetate

E only:
- Mean age 63.6 years
- 14% had previous fracture
- Mean LS T-score -1.16
- Mean TH T-score -0.81

E+P study
- Mean age 63.6 years
- 39% had previous fracture
- Mean LS T-score -1.28
- Mean TH T-score -0.92

Rossouw JE et al. *JAMA* 2002;288:321
Anderson G L et al. *JAMA* 2004;291:1701

BONE HEALTH: **It is all about PREVENTION and having a lifelong plan.**



Preventing vs Treating Osteoporosis

Osteoporosis treatment
Identify patients at risk of fracture
Treat to prevent fractures

vs

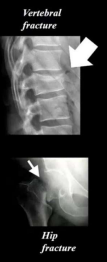
Osteoporosis prevention
Identify women at risk for osteoporosis
Treat to maintain BMD

Therapies approved for osteoporosis prevention
All are anti-remodeling agents that inhibit bone turnover

- estrogen, oral or transdermal
- conjugated estrogen 0.45 mg daily with bazedoxifene 20 mg daily
- raloxifene 60 mg po dailypo daily
- tibolone 0.625 mg
- Bisphosphonates, oral and IV
  - alendronate po 35 mg/week
  - risedronate po 35 mg/week
  - ibandronate po 150 mg/month
  - zoledronate 5 mg IV Q 2 years

Why is Bone Quality Important ?

- 1 in 3 women age 50+ have a fragility fracture
  - Trauma = fall from standing height or less
- Pain, disability, cost, increase risk of death after hip fracture
- Assess bone quality to
  - Identify those at risk before a fracture (or subsequent fracture) occurs



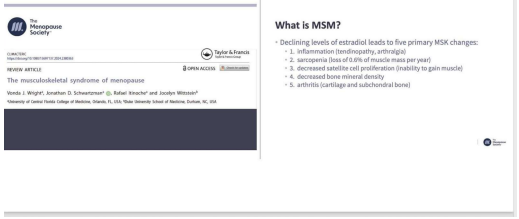
http://www.iofbonehealth.org/what-osteoporosis-0; http://www.4bonehealth.org/world-osteoporosis-day-stop-at-one/

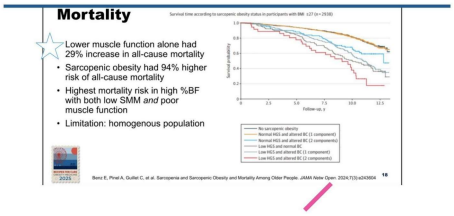
Muscle

Impact of Sarcopenia

Postmenopausal women with sarcopenia have 13 times the risk of having osteoporosis as those without sarcopenia.

Musculoskeletal Syndrome of Menopause





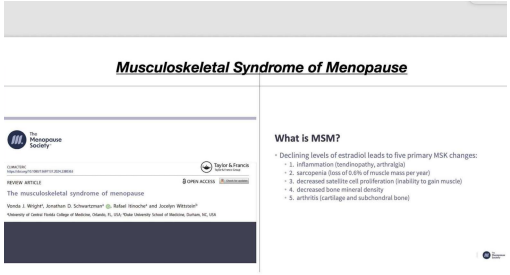
Sarcopenia

- Peak muscle mass is achieved at age 30, and decreases by 3-8% per decade until age 75, when loss may be 1% per year[1]
- Sarcopenia is age related loss of lean muscle mass and is characterized by atrophy of muscle fibres with increase in intramuscular adipose tissue[2]
- ★ Sarcopenia is **probable** when low muscle strength is detected, **diagnosed** when the quality and quantity of muscle is low, and considered **severe** when low muscle strength and performance are present[3]

Definition of sarcopenia from 2022

★ 1. International Journal of Women's Health 2022;14:805-809 2. Climacteric epub 30 July 2024 3. Age Ageing 2019;48(1):16-31

Musculoskeletal Syndrome of Menopause



Women need more protein to maintain SMM.

Changes in dietary intake:

Decreased appetite
Changes in taste and smell
Poor dentition/trouble swallowing
Food insecurities

Macronutrient changes

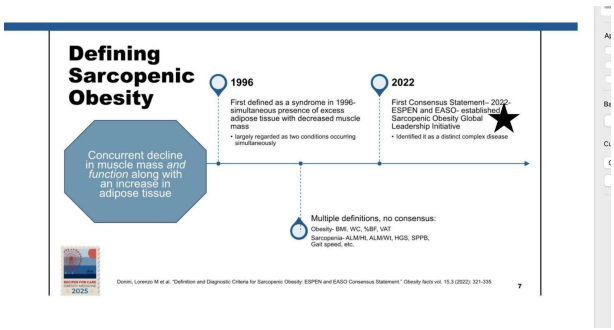
10-25% of adults consume <0.8g/kg/day protein
5-9% older adults consume < EAR of protein

Micronutrient changes

Polypharmacy- PPI/H2 blockers, metformin
NHANES- older women deficient in calcium, magnesium and potassium and lower consumption of vitamins D, E and K

Khanal et al examined 281 PMP women >60 yo, threshold of 1.17 g/kg/d protein required to maintain high SMM and consuming more than this threshold was associated with lower BMI, lower fat mass, higher MM and improved QOL scores

Khanal, Praval et al. "Dietary Protein Requirement Threshold and Micronutrients Profile in Healthy Older Women Based on Relative Skeletal Muscle Mass." Nutrients vol.



Assess muscle weakness:

Establish altered skeletal muscle functional parameters BEFORE assessing altered body composition

	Caucasian Male	Caucasian Female	Asian Male	Asian Female
Hand Grip Strength	<27 kg	<16 kg	<28 kg	<18 kg
Knee Extension Strength	<0.40 kg/kg Strength/W	<0.31 kg/kg Strength/W	<18 kg	<16 kg
Chair stand test	≥ 17 seconds			

Donini et al. , Obes Facts 2022; 15: 321-335, ESPEN and EASO Consensus Statement

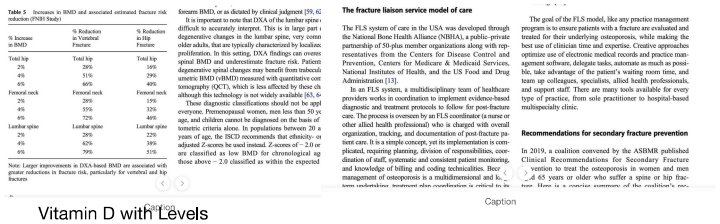


Table 5 Increases in BMD and associated estimated fracture risk reduction (FNIH Study)

% Increase in BMD	% Reduction in Vertebral Fracture	% Reduction in Hip Fracture
Total hip	Total hip	Total hip
2%	28%	10%
4%	51%	29%
6%	66%	40%
Femoral neck	Femoral neck	Femoral neck
2%	20%	15%
4%	55%	32%
6%	72%	46%
Lumbar spine	Lumbar spine	Lumbar spine
2%	28%	22%
4%	62%	39%
6%	79%	51%

Note: Larger improvements in DXA-based BMD are associated with greater reductions in fracture risk, particularly for vertebral and hip fractures

forearm BMD, or as dictated by clinical judgment [59, 62

It is important to note that DXA of the lumbar spine difficult to accurately interpret. This is in large part degenerative changes in the lumbar spine, very comm older adults, that are typically characterized by localize proliferation. In this setting, DXA findings can overes spinal BMD and underestimate fracture risk. Patient degenerative spinal changes may benefit from trabecul umetric BMD (vBMD) measured with quantitative com tomography (QCT), which is less affected by these ch although this technology is not widely available [63, 6

These diagnostic classifications should not be appl everyone. Perimenopausal women, men less than 50 y age, and children cannot be diagnosed on the basis of tometric criteria alone. In populations between 20 a years of age, the ISCD recommends that ethnicity- or adjusted Z-scores be used instead. Z-scores of − 2.0 or are classified as low BMD for chronological ag those above − 2.0 classified as within the expected

The fracture liaison service model of care

The FLS system of care in the USA was developed through the National Bone Health Alliance (NBHA), a public–private partnership of 50-plus member organizations along with representatives from the Centers for Disease Control and Prevention, Centers for Medicare & Medicaid Services, National Institutes of Health, and the US Food and Drug Administration [13].

In an FLS system, a multidisciplinary team of healthcare providers works in coordination to implement evidence-based diagnostic and treatment protocols to follow for post-fracture care. The process is overseen by an FLS coordinator (a nurse or other allied health professional) who is charged with overall organization, tracking, and documentation of post-fracture patient care. It is a simple concept, yet its implementation is complicated, requiring planning, division of responsibilities, coordination of staff, systematic and consistent patient monitoring, and knowledge of billing and coding technicalities. Best management of osteoporosis is a multidimensional and lo

The goal of the FLS model, like any practice management program is to ensure patients with a fracture are evaluated and treated for their underlying osteoporosis, while making the best use of clinician time and expertise. Creative approaches optimize use of electronic medical records and practice management software, delegate tasks, automate as much as possible, take advantage of the patient's waiting room time, and team up colleagues, specialists, allied health professionals, and support staff. There are many tools available for every type of practice, from sole practitioner to hospital-based multispecialty clinic.

Recommendations for secondary fracture prevention

In 2019, a coalition convened by the ASBMR published Clinical Recommendations for Secondary Fracture vention to treat the osteoporosis in women and men d 65 years or older who suffer a spine or hip frac-

Caption

Vitamin D with Levels

Calcium (split up)

3 days of week weight training

Maybe creatine

Hormones, know your history.

Secondary fall prevention

indicate that 5 years of HT may decrease vertebral fractures by 35 to 50% and non-vertebral fractures by about 25%. Ten or more years of use might be expected to decrease the rate of all fractures by about 50%.

IF YOU ARE NOT WEIGHTLIFTING , YOU ARE CHOOSING CHRONIC DISEASE

CLINICAL RESOURCES

1. MENOPAUSE.ORG
2. BHOF
3. INTERNATIONAL MENOPAUSE SOCIETY
4. PODCASTS: DR. LAUREN STREICHER
   DR. GABRIELLE LYONS
   DR. MARY CLAIRE HAVERS
   DR.PETER ATTIA