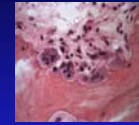


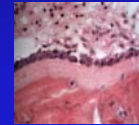
EPIDEMIOLOGY, PATHOGENESIS AND DIAGNOSIS OF OSTEOPOROSIS

Professor R.M.Francis,
 Institute for Ageing and Health,
 Newcastle University, UK.
 Consultant Physician, Bone Clinic,
 Freeman Hospital.

BONE IS A LIVING TISSUE!



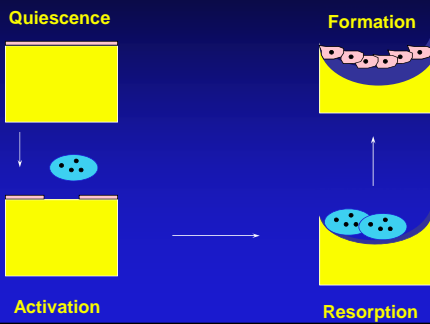
Bone Resorption:
Osteoclasts



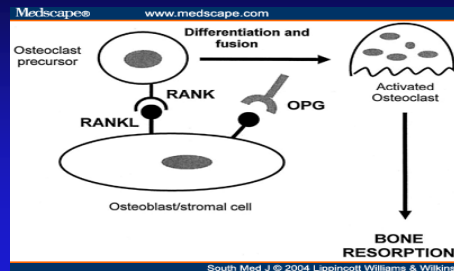
Bone Formation:
Osteoblasts

Histology courtesy of Juliet Compston

BONE REMODELLING



BONE REMODELLING: RANK AND RANK LIGAND



TYPES OF BONE

Cortical

- 80% of skeleton
- Slow turnover

Trabecular

- 20% of skeleton
- Rapid turnover

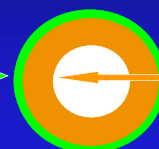


BONE CHANGES WITH AGE



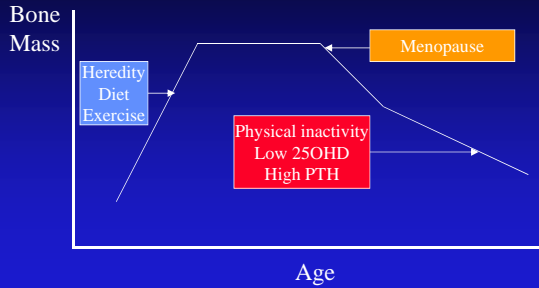
Cortical

Periosteal Apposition:
Men > Women



Endosteal Resorption:
Women > Men

BONE MASS WITH AGE



DETERMINANTS OF BONE MASS

PEAK BONE MASS

- Genetic factors
- Age at puberty
- Exercise
- Dietary calcium
- Smoking & alcohol
- Chronic disease
- Secondary OP

BONE LOSS

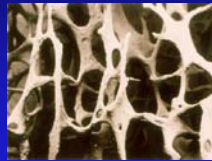
- Oestrogen deficiency
- Immobility
- Smoking & alcohol
- Chronic disease
- ↓ Vitamin D
- ↑ PTH
- Secondary OP

WHAT IS OSTEOPOROSIS?

“Osteoporosis is a skeletal disorder characterized by compromised **bone strength** predisposing a person to an **increased risk of fracture**” Consensus Development Conference, 2001.



Normal



Osteoporosis

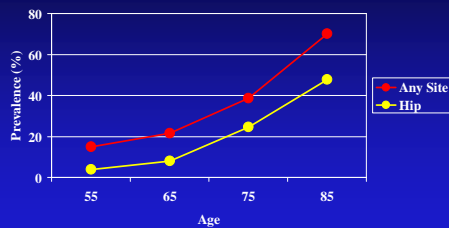
QUANTITATIVE DEFINITION OF OSTEOPOROSIS

Bone Mineral Density (BMD) 2.5 standard deviations or more below the mean value for young normal adults (T-score < -2.5).



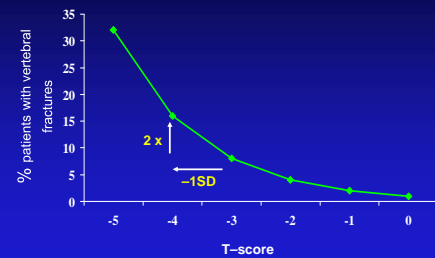
WHO Report, 1994

PREVALENCE OF OSTEOPOROSIS IN WOMEN



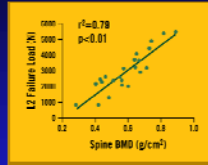
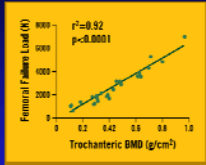
WHO Report, 1994

BMD AND FRACTURE RISK



Watts, Oral Presentation at ASBMR 2001
Reproduced with permission

BMD AND BONE STRENGTH

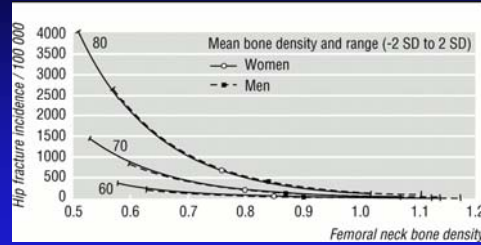


Adapted by Hosking with permission from Bouxsein

Lee et al, Bone 1997;21:119-125.

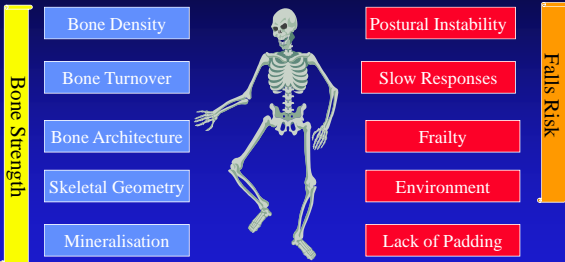
Moro et al, Calcif Tissue Int 1995;56:206-209.

BMD AND FRACTURE RISK



De Laet et al, Br Med J, 1997; 315: 221-225

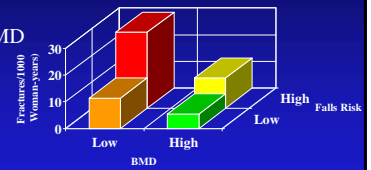
RISK OF FRACTURE



RISK FACTORS FOR HIP FRACTURE

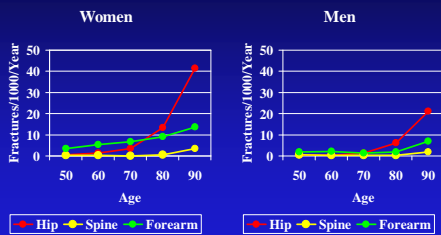
Risk Factors

- Femoral neck BMD
- Gait speed
- Tandem walk
- Poor vision



Dargent-Molina et al, Lancet 1996; 348: 145-149.

WHO GETS FRAGILITY FRACTURES?



Johansen et al, Injury 1997; 28: 655-660.

LIFETIME RISK OF CLINICAL FRACTURE AT AGE 50

	Women	Men
Any	53.2%	20.7%
Forearm	16.6%	2.9%
Vertebra	3.1%	1.2%
Hip	11.4%	3.1%

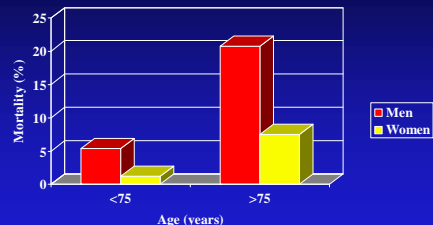


van Staa et al, Bone 2001; 29: 517-522.

WHY ARE FRAGILITY FRACTURES IMPORTANT?

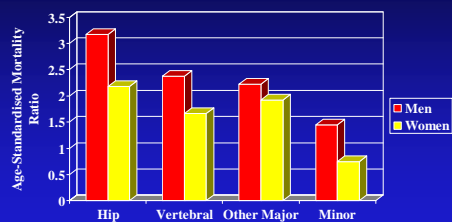
- Excess mortality
17-20% after hip and vertebral fractures
- Substantial morbidity
25-50% more dependent after hip fracture
- Health & social service costs > £1.7 billion
>£12,000 for hip fracture
- Increased risk of further fractures
Even after adjustment for BMD

MORTALITY AFTER HIP FRACTURE



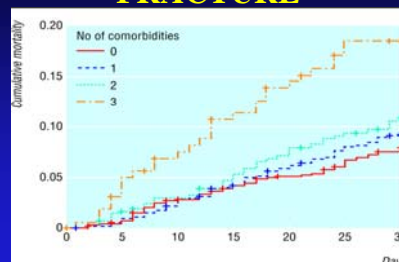
Poor et al. Facts Research Gerontology 1994; 7: 91-109.

EXCESS MORTALITY AFTER FRACTURES



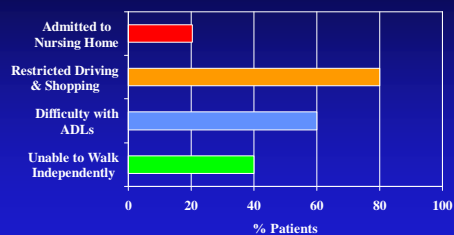
Center et al. Lancet 1999; 353: 878-882.

MORTALITY AFTER HIP FRACTURE



Roche et al. Br Med J 2005; 331: 1374-1378.

MORBIDITY AFTER HIP FRACTURES



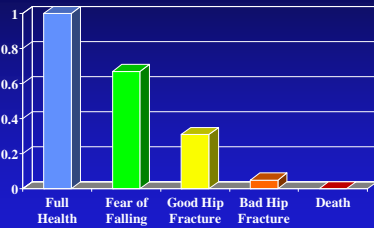
Cooper. Am J Med 1997; 18: 12S-17S.

HIP FRACTURE AND QUALITY OF LIFE

- Quality of life survey in 194 women aged 75 and above.
 - **“Good” Hip Fracture**
Maintaining independent life in the community.
 - **“Bad” Hip Fracture**
Resulting in admission to a nursing home.
- Respondents rated own health using Euroqol and asked to rate fear of falling, “good” hip fracture & “bad” hip fracture

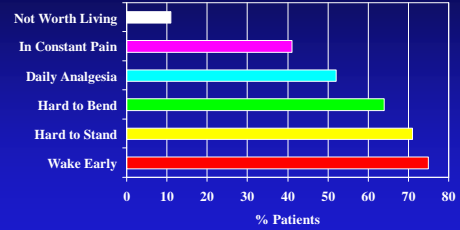
Salkeld et al. Br Med J 2000; 320: 241-246.

HIP FRACTURE AND QUALITY OF LIFE



Salkeld et al, Br Med J 2000; 320: 241-246.

MORBIDITY AFTER VERTEBRAL FRACTURES IN MEN



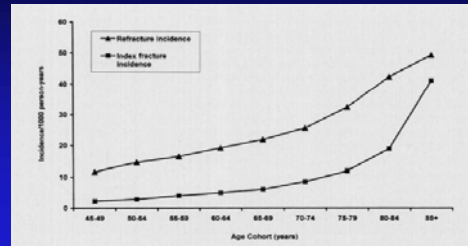
Scane et al, Osteoporosis Int 1994; 4: 89-92.

COST OF FRAGILITY FRACTURES

- The combined NHS and social care cost of each hip fracture estimated to be over £20,000 in 2001.
- The total NHS and social care costs of hip fracture exceeds £1.73 billion
- This is very similar to the £1.75 billion that coronary heart disease costs the healthcare system each year.

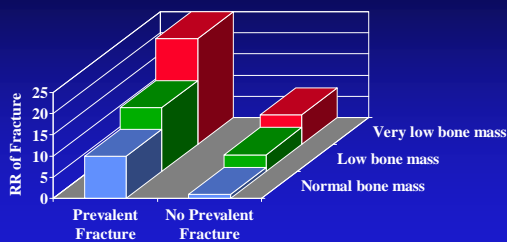
National Osteoporosis Society, 2007

FRACTURES PREDICT FRACTURES



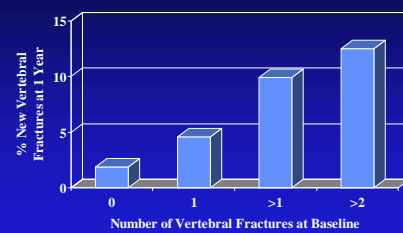
Robinson et al, JBJS, 2002; 84A: 1528-1533.

FRACTURE RISK BY BMD AND PREVIOUS FRACTURE



Ross et al, Ann Intern Med 1991; 114: 919-923.

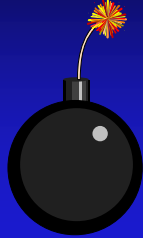
PREVALENT VERTEBRAL FRACTURES AND FRACTURE RISK



Lindsay et al, JAMA 2001; 285: 320-323.

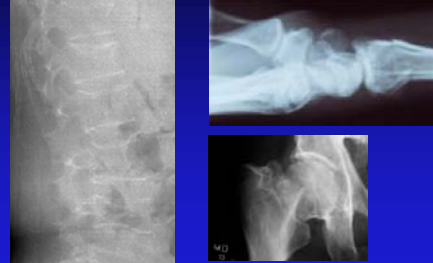
INCIDENT VERTEBRAL FRACTURES AND FRACTURE RISK

- 19.2% risk of further vertebral fracture in the year after incident fracture
- 1 in 5!!

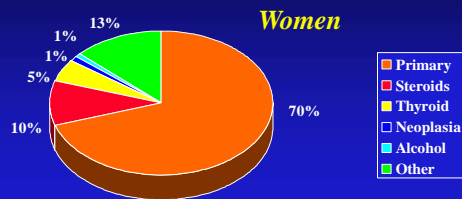


Lindsay et al, JAMA 2001; 285: 320-323.

MAJOR FRAGILITY FRACTURES

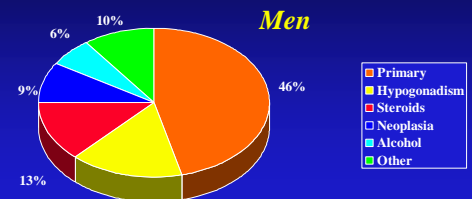


SECONDARY OSTEOPOROSIS: VERTEBRAL FRACTURES



Caplan et al, JRSM 1994; 87: 200-202.

SECONDARY OSTEOPOROSIS: VERTEBRAL FRACTURES



Baillie et al, Age Ageing 1992; 21: 139-141.

RISK FACTORS FOR HIP FRACTURE

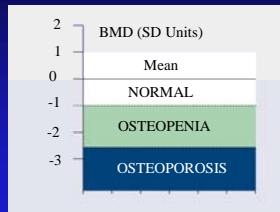
- Low femoral neck BMD, reduced muscle bulk, increased postural sway.
- Secondary osteoporosis: oral steroid therapy, hypogonadism in men, thyroid disease, vitamin D deficiency.
- Conditions associated with falls: Stroke, Parkinson's, dementia, blindness.

DIAGNOSIS OF OSTEOPOROSIS

- Early menopause
- Amenorrhoea
- Male hypogonadism
- Oral steroid therapy
- Other 2^o Causes
- Osteopenia on x-ray
- *Previous fragility fracture*



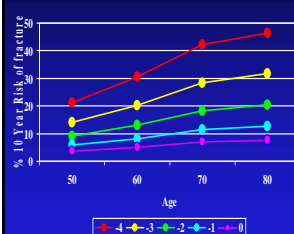
DIAGNOSIS OF OSTEOPOROSIS



Only 50% of patients with fragility fractures have osteoporosis!

WHO, 1994

FRACTURE RISK ASSESSMENT



- Prior fracture after age of 50
- Parental hip fracture
- Current smoking
- Oral steroids
- Alcohol intake > 2 units/day
- Low BMI
- Chronic conditions (RA)

➔ Ten Year Absolute Risk of Fracture

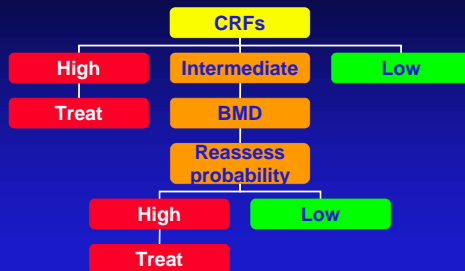
Kanis et al, Osteoporos Int 2001; 12: 989-995.

FRACTURE RISK ASSESSMENT



www.shef.ac.uk/FRAX

USING FRAX



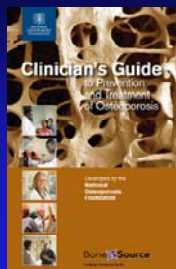
Kanis et al, Osteoporos Int, 2008 19: 1395-1408.

USING FRAX

The US Approach

Consider treatment when:

- FRAX 10 year probability of major osteoporotic fracture $\geq 20\%$
- FRAX 10 year probability of hip fracture $\geq 3\%$



National Osteoporosis Foundation, Clinicians Guide, 2008.

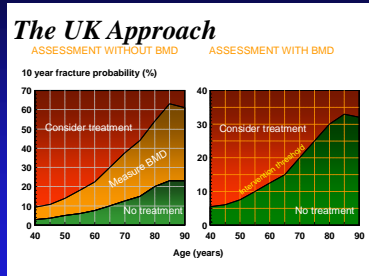
USING FRAX

The US Approach

- Using FRAX alone, treatment would be advocated in over 50% of women above the age of 65 years!

Donaldson et al, ASBMR Abstract 1022, 2008.

USING FRAX AND NOGG



www.shef.ac.uk/NOGG

CONCLUSIONS

- Osteoporosis is associated with skeletal fragility and increased fracture risk.
- Fragility fractures are a major cause of excess mortality, substantial morbidity and health and social service expenditure.
- Diagnosis of osteoporosis may be made using BMD, but fracture risk assessment may be a better way of targeting treatment.

THANK YOU!

