The diagnosis of osteoporosis relies on the quantitative assessment of bone mineral density (BMD), which is a major determinant of bone strength.

The probability of fracture is dependent not only on BMD but also on other risk factors such as age, previous fracture, family history of hip fracture, gender, etc.

Relevant references:

With advancing age, BMD decreases and the prevalence of osteoporosis increases.

The prevalence of osteoporosis, assessed using the reference values from the young population, varies by region and countries.

The risk of sustaining an osteoporotic fracture increases exponentially with age due to a decrease in BMD and the appearance of other age-related factors, e.g. increasing incidence of falls.

Relevant References:
- One in two women and one in five men who are 50 years of age will have an osteoporotic fracture in their remaining lifetime.
- Lifetime risk of osteoporotic fractures depends on both fracture incidence and life expectancy, which are markedly different between countries.
- The lifetime risk of radiographic vertebral fractures, which do not necessarily come to clinical attention, is however much higher than the risk of clinical vertebral fractures.

Relevant references:

- Hip fractures: Most hip fractures take place after a fall. The exponential rise in hip fracture rates with age in both men and women results from both an age-related decrease in bone mass at the proximal femur and the accelerated increase in the incidence of falls.
- Vertebral fractures: Vertebral fracture is the most common osteoporotic fracture. They often result from routine activities such as bending, turning or lifting light objects, and are also associated with falls. The prevalence of vertebral fractures is near similar in men and women, which is thought to reflect occupation-associated traumatic fractures in men.
- Wrist fractures: Wrist fractures have a different pattern of occurrence from vertebral and hip fractures. Most wrist fractures happen in women, 50% of whom are older than 65 years. The incidence of wrist fractures in men is low and does not increase much with age. The risk of wrist fracture sharply increases after the menopause.

Relevant references:

- The annual incidence of osteoporotic fractures in the USA is equal to the incidence of heart attack and stroke jointly, and more than 10 times the incidence of breast cancer.
- About 25% of incident fractures are vertebral fractures confirmed by radiography. It suggests that the real annual incidence of vertebral fractures is even higher than that presented here.

Relevant reference:
The burden of osteoporotic fractures worldwide is projected to increase dramatically.

While Europe and North America account for about half of all hip fractures among elderly people today, this proportion will fall to around one quarter in 2050, by which time steep increases will be observed throughout Asia and Latin America.

A recent reduction in age-adjusted incidence of fractures has been observed in Western societies. However, the impact of these positive trends on the number of the fragility fractures worldwide is limited.

The greatest increase in the number of osteoporotic fractures (mainly hip fractures) can be expected in Middle East, Asia, and Latin America, where life expectancy is predicted to increase the most in the coming decades. It is estimated that, in these regions, the total number of hip fractures will increase more than fivefold between 1990 and 2050.

Relevant reference:

Long-term mortality after a vertebral fracture is similar to mortality after a hip fracture and significantly higher in comparison to the general population – the Dubbo study.

Relevant reference:

Clinical vertebral fractures are associated with an 8-fold increase in age-adjusted mortality, which is similar to the increase in mortality seen following hip fractures.

The excess mortality in patients with vertebral fractures may, in part, be attributable to their poorer health status prior to fracture.

Relevant references:
• Epidemiological studies report a higher mortality in patients with osteoporotic vertebral fractures, with age-adjusted mortality rates increasing with the number of vertebral fractures.

Relevant reference:

Relevant references:

• The increased risk of future vertebral fracture is, in part, independent of BMD. For each BMD tertile, there was a significant increase in risk of vertebral fractures in people with prior osteoporotic fractures.

Relevant reference:

• The risk of future vertebral fractures increases with the number of prior vertebral fracture.

Two or more prevalent vertebral fractures increase the risk 7-fold of having a subsequent vertebral fracture within a year.

Relevant reference:
• Not only are prevalent vertebral fractures a strong risk factor for incident vertebral fractures independent of BMD but their presence may alter the association between bone mineral density and incident vertebral fractures.
• The more severe the vertebral fracture at baseline (according to Genant’s semi-quantitative SQ score), the higher is the risk of another vertebral fracture independently of BMD. Similarly, the more vertebral fractures at baseline, the higher is the risk of another vertebral fracture independently of BMD.
• For example, with a T-score of -2, the risk of new vertebral fractures is more than 3 fold higher in a woman with 2 prevalent fractures compared to a woman with no prevalent fractures.

Relevant reference:
- Siris et al. (2007) Enhanced prediction of fracture risk combining vertebral fracture status and BMD. Osteoporos Int 18: 761-770

• The presence of vertebral fractures also indicates a higher risk of a non-vertebral fracture.
• The more severe the vertebral fracture at baseline (according to Genant’s semi-quantitative score), the higher is the risk of a non-vertebral fracture independently of BMD. Similarly, the more vertebral fractures at baseline, the higher is the risk of a non-vertebral fracture independently of BMD.
• For example, at a T-score of -2, women with 2 or more prevalent vertebral fractures doubles the risk of new non-vertebral fractures compared to women without prevalent fractures.

Relevant references:
- Nevitt MC et al. (2000) Effect of alendronate on limited-activity days and bed-disability days caused by back pain in postmenopausal women with existing vertebral fractures: Fracture Intervention Trial Research Group. Arch Intern Med 160: 77-85
Approximately 4% of women with a clinical vertebral fracture become dependent in activities of daily living. Quality of life becomes progressively impaired as the number and severity of vertebral fractures increases. Back pain and disability as well as difficulties in performing activities of daily living are observed mainly in patients with fractures in lower thoracic and lumbar spine, whereas fractures in the mid-thoracic spine can result in a mild reduction of pulmonary function.

**Relevant references:**
- Oleksik A et al. (2000) Health-related quality of life (HRQOL) in postmenopausal women with low BMD with or without prevalent vertebral fractures. *J Bone Miner Res* 15: 1384-1392

Short-term clinical management of vertebral fractures is dominated by treatment of the symptoms that include back pain, depression and decreased pulmonary function. Treatment of back pain comprises bed rest, pharmacological treatment (analgesics or narcotics), physical therapy, bracing, local steroid injections and vertebral augmentation (vertebroplasty, kyphoplasty).

**Relevant reference:**

The financial burden of osteoporotic fractures includes direct costs (hospital acute care, in-hospital rehabilitation, outpatient services, long term nursing care) and indirect costs (morbidity, loss of working days). Some costs are difficult to quantify, e.g. deterioration of quality of life, and time spent by the family on the care of the patient.

Treatment of co-morbid conditions after a fracture constitutes 75% of the overall healthcare cost of osteoporotic fractures. In Europe, the total direct costs of osteoporotic fractures are over €36 billion and are expected to increase to €54 billion and €77 billion in 2025 and 2050 respectively. In the USA, there were over 2 million fractures predicted, costing $17 billion. By 2025, annual fractures are projected to increase by 50%, costing over $25 billion. In China, 1.5 billion USD was spent on treating hip fractures alone, which is expected to rise to 12.5 billion USD in 2020, and up to 265 billion USD in 2050.

**Relevant references:**
The financial burden of vertebral osteoporosis and associated fractures is significant and, in the elderly, includes the costs of hospitalization and of subsequent rehabilitation.

In the working population, medical costs associated with vertebral fractures are related to outpatient care and to the loss of working days.

Relevant references:
- Kanis JA, Johnell O (2005) Requirements for DXA for the management of osteoporosis in Europe. Osteoporos Int 16: 229-238

In a large cohort of postmenopausal women followed up prospectively for 3.7 years, an incident vertebral fracture was associated with higher risk of back pain, back disability, necessity of bed rest and limited activity.

On average, every incident vertebral fracture was associated with 1 to 2 days of bed rest and 10 days of limited activity.

Relevant reference:

One third of vertebral fractures need hospitalisation and account for as many hospital beds as other diseases.

Relevant reference:
Under-diagnosis of vertebral fractures

Slide 28

- Retrospective studies show that vertebral fractures are the most commonly under-diagnosed fractures. In elderly hospitalized patients who had a lateral chest radiograph, less than 50% of vertebral fractures identified later on X-rays were reported in the radiological reports and even fewer in the medical records.

- Only about 40% of older women with vertebral fractures visible on X-ray are referred for DXA measurement of BMD and the figure is even lower (less than 20%) for men.

- Up to one fifth of patients identified with vertebral fractures received appropriate treatment for osteoporosis. Of those recognised in the radiology report, only 40% will receive appropriate treatment for osteoporosis.

Relevant references:

Slide 29

- Overall, one in three vertebral fractures is misdiagnosed in radiology reports (34% false negatives), attributable in part to a lack of radiographic detection or use of ambiguous terminology in reports.

- On the other hand, only 5% of vertebral fractures are wrongly diagnosed (false positives).

Relevant reference:

Osteoporosis treatment

Slide 32

- Awareness and treatment of vertebral fractures is low despite widely available effective therapies (antiresorptive and anabolic agents) that can reduce vertebral fractures by 30% to 70% in postmenopausal women. Similar values are found in men.

- These treatments must be taken with adequate supplementation of calcium and vitamin D.

Relevant reference:
Action is needed by radiologists and other clinicians to ensure:

- Recognition of vertebral fractures using radiography, DXA-VFA or other imaging techniques.
- Reporting as FRACTURED to avoid ambiguity.
- These actions will help patients receive effective treatment and prevent subsequent fractures.