National Institutes of Health

Fact Sheet — *Osteoporosis*

Osteoporosis, or porous bone, is a disease characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased risk of fractures of the hip, spine, and wrist. It is often called a "silent" disease because it has no discernable symptoms until there is a bone fracture. Like other tissues in the body, bone tissue is in a state of constant flux – remodeling and rebuilding. There are many influences on bone mass and strength, such as genetics, hormones, physical exercise and diet (especially intake of calcium, phosphate, vitamin D, and other nutrients). Osteoporosis occurs when there are problems with these factors, resulting in more bone loss than bone rebuilding. Osteoporosis can strike at any age and affects both men and women. One out of every two women and one in four men over 50 will have an osteoporosis-related fracture in their lifetime. In the U.S. today, 10 million individuals already have osteoporosis and 34 million more have low bone mass, placing them at increased risk for this disease.

Thirty Years Ago

- Relatively little was known or could be done about osteoporosis; both the disease and the fractures that go along with it were thought of as an inevitable part of old age. Few risk factors other than the menopause had been identified.
- A limited number of effective diagnostic tools were available to assist health care providers in identifying and treating individuals at risk for osteoporosis.
- Osteoporosis was viewed solely as a "woman's disease." Men did not recognize the disease as a significant threat to their mobility and independence.

Today

- The contributions of NIH-supported research in areas such as bone cell physiology, hormonal and growth factor regulation, drug development, and identification of risk factors have resulted in new treatment and prevention strategies that have transformed the outlook for the millions of Americans who are at risk for life-changing fractures. Identifying the role that genes play in the development of osteoporosis has helped many individuals to better understand their risk of fracture.
- It is important to build bone across the lifespan. NIH support for clinical studies in nutrition and physical activity interventions provides strong evidence that fractures can be prevented and bone loss reduced even in older individuals, providing evidence that osteoporosis does not need to be a natural consequence of aging.
- The identification of risk factors for osteoporosis is providing clinicians with important information about which individuals are at most risk for this debilitating disease. Major contributions from the Study of Osteoporotic Fractures, which began over 20 years ago, include the findings that for women, bone mineral density (BMD) of the hip is one of the best predictors of fracture, and that weight loss in the elderly and parental history of hip fractures are among the most important risk factors for this condition. Similar epidemiological studies have now been launched to learn about risk factors for osteoporosis in men.
- Genetics can account for up to 75 percent of BMD. In the area of genetic-based research, NIH-supported researchers used a combination of mouse breeding and genetic technology to identify a gene that strongly influences peak bone mass in mice. The gene, which is present in humans as well as mice, was not previously known to be involved in bone biology, and represents a promising new target for development of drugs that could prevent or reverse the bone loss that leads to osteoporosis.
- Within the past 10-15 years new classes of drugs have been developed that significantly reduce the risk of fractures in individuals with bone disease. Federal support for unique clinical intervention

studies of combination therapies for osteoporosis has played an important role in determining the best therapeutic practices associated with these drugs, potentially minimizing drug use and cost.

- Dual energy x-ray absorptiometry (DXA) has become one of the most commonly used methods of assessing BMD; however, this procedure does not provide insight into all of the qualities of bone that may contribute to fracture risk. NIH-supported researchers are examining the utility of other diagnostic tools such as micro-computed tomography and magnetic resonance imaging to better understand the relationship between bone architecture and fracture risk. Other tools are also being evaluated for clinical application including ultrasound and dental x-rays, both of which would be less expensive options for patients.

Tomorrow

Advances in scientific knowledge have ushered in a new era in bone health, one in which bone fractures can be prevented in the vast majority of individuals, and identified early and treated effectively in those who do get them.

- *Predictive.* Although BMD is one of the best measures for assessing osteoporosis and fracture risk, there are some limitations to using BMD as a single predictive measure of fracture risk. Cutting edge imaging, as well as biomarker research, will continue to provide insight into the other characteristics of bone that may inform studies of skeletal health.

- *Personalized.* Results from additional long-term studies in the elderly, minority populations, and women and men will assist researchers and clinicians in designing and prescribing targeted therapies and prevention strategies based on the individual characteristics of patients.

- *Preemptive*. Genetic studies continue to broaden the base of science. By locating relevant bone formation pathways, scientists may find additional clues to the prevention of osteoporosis and resulting fractures.