

Highlights of Osteoporosis Prevention

a report by

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Epidemiologic Aspects

Osteoporosis is a metabolic disorder characterized by low bone mass and structural deterioration of bone tissue leading to increased bone fragility and susceptibility to fractures, especially of the hip, wrist, and spine.¹ In aging individuals and in the presence of genetic or behavioral risk factors, the low bone mass results from an increased bone resorption rate that exceeds the bone formation rate.^{2,3} Timely identification of risk factors for osteoporosis is extremely useful for assessing the risk, early diagnosis, and implementation of pharmacologic and non-pharmacologic interventions. Among the most important genetic and behavioral risk factors are:¹

- female gender;
- white and Asian race;
- small-boned frames;
- family and personal history of osteoporotic fractures;
- malnutrition and low body weight;
- low lifelong calcium and vitamin D intake;
- smoking and excessive alcohol intake;
- sedentary lifestyle;
- estrogen deficiency;
- certain drugs; and
- chronic diseases.

The progressive and insidious manifestation of clinical signs, such as loss of height, bone deformities, chronic pain and physical limitation, postural changes, and alteration of other body structures and functions, leads to biological, functional, psychological, and social traumas, besides a potential fracture.^{1,4} In the US, osteoporosis affects four to six million women aged 50 and older; while another 13 to 17 million have osteopenia, which is the preceding phase of osteoporosis.¹ The highest prevalence by racial group is in non-Hispanic white women, out of whom 13% to 18% have osteoporosis, followed by 10% to 12% of Mexican American women, and 5% to 8% of non-Hispanic black women.⁵ In addition, up to 4% of men aged 50 and older, which is approximately one million, have osteoporosis and another 15% to 33% have osteopenia.⁵

Individual and Societal Costs

The most serious and life-threatening complication of osteoporosis is the osteoporotic fracture, particularly the hip fracture. The severity of osteoporotic fractures stems not only from the significant functional impairment, disability, mortality, and progressive deterioration in health and quality of life, but also on the medical and long-term care expenditures incurred by the necessary treatment.⁶ These individual and societal outcomes are even more resounding when the annual incidence of the osteoporotic fractures is considered, namely approximately 1.5 million cases.⁴ Half of the hip fracture patients aged 50 and older become unable to walk without assistance and, even after one year, more than 40% of them still cannot walk unaided.⁷ Only one in three of these patients fully regains their pre-fracture level of independence, more than half never recover their pre-fracture ability to perform activities of daily living, and about one in four of them die within 12 months after the fracture occurrence.⁷

Out of the estimated US\$13.8 billion spent on healthcare services for osteoporotic fractures in 1995, with an average cost of US\$37,000 per patient, 62.4% was paid for in-patient care, 28.2% for nursing home care, and 9.4% for out-patient services.⁸ Medicare pays for almost 75% of the hospital care for osteoporosis and its complications.⁶ Continuing care, including nursing homes, paid care-takers, and assistance from family members greatly increases the expense for hip fractures beyond that of hospitalization and surgery. The fact that the healthcare expenditures for the group least prone to osteoporotic fractures, which is non-white men, were US\$174 million in 1995 highlights the necessity of considering osteoporosis an issue for the general older population, and not only for older white women.⁸ These figures clearly indicate that osteoporosis represents a significant public health challenge that must not be ignored. Moreover, the projected increase in the number of older adults in the next decades will translate in substantial escalations in the economic costs for osteoporosis management unless effective preventive interventions are widely implemented.

Preventive Strategies

Research conducted in the last decades indicated that osteoporosis is largely preventable through a four-step non-pharmacologic preventive therapy addressing some modifiable risk factors.^{4,9} This four-step program consists of:

- a balanced diet with an adequate amount of calcium and vitamin D;
- weight-bearing exercises;
- a healthy lifestyle with no smoking and moderate alcohol intake; and
- and periodic bone density testing.⁹

This program is beneficial for everyone at all ages, especially when started early and performed consistently and thoroughly, in terms of reducing bone mass loss, slowing the evolution of osteoporosis, and decreasing the risk for fractures.⁹ Such a program might be used widely as a public health measure that is not expensive to be administered, and can be practiced by the targeted population.¹⁰

Dietary Recommendations

A healthy diet has to include (besides balanced caloric and nutritional elements) the adequate amount of both calcium and vitamin D. The synchronized effects of calcium and vitamin D on bone metabolism and mineral homeostasis justify this requirement. This step in preventing osteoporosis is especially important in older age because calcium absorption and vitamin D production are affected by normal biological age changes at the organ, cellular, and molecular level affecting the absorption, transport, synthesis, and depositing mechanisms. Additionally, environmental and behavioral changes in the lifestyles of older adults, such as higher likelihood of being home-bound or institutionalized, may significantly affect the availability of appropriate nutrition and sun exposure. The daily necessary amount of calcium (1,200–1,500mg) and vitamin D (400–800IU) may come from both nutritional sources and supplements. In addition, 15 minutes of sun exposure two or three times a week are enough for the skin to produce vitamin D naturally. A diet without any dairy products or calcium-rich foods only contains approximately one-fifth of the recommended dose (i.e. 200–300mg) of calcium a day.

Healthcare professionals should educate patients with regard to:

- estimating the amount of calcium and vitamin D in

their diet by reading food labels in order to calculate the appropriate dose of supplements;

- dietary sources of calcium (diary and non-diary);
- environmental (i.e. sun exposure) and dietary sources of vitamin D;
- pharmacological interactions between calcium and vitamin D supplements and the other medications taken by the patients;
- criteria for choosing supplements, such as purity of components and gastric disintegration; and
- scheduling and conditions of administration of supplements (i.e. supplements should be taken with meals, and ideally should be divided into several small doses across the day to increase calcium absorption).

Healthy Lifestyle Recommendations

Smoking and heavy alcohol consumption speed up bone mass loss, and thus significantly increase the risk for osteoporotic fractures. Although moderate drinking means one drink a day for women and two drinks a day for men, age-related changes in alcohol metabolism and liver functioning require a reduction in half of this amount. Healthcare professionals should inform patients that a drink means either 12oz of beer, 4–5oz of wine, or 1.5oz of 80-proof liquor.

Physical Activity Recommendations

Regular physical exercise benefits the person in terms of preventing, delaying the onset of, or easing several diseases and chronic conditions, such as cardiovascular disease, diabetes, hypertension, colon cancer, depression, anxiety, excess weight, osteoporosis, and osteoarthritis. The clinical effects of regular physical activity result from improvements in:

- the glucose metabolism and the insulin sensitivity of the tissues;
- cholesterol profile and level;
- the rate of age-related bone and muscle mass loss;
- muscle strength, joint flexibility, gait, and balance; and
- quality of sleep.

Moreover, numerous studies found that regular physical exercise can reduce and even negate the deleterious effects of risk factors, such as imbalanced lipoprotein and glycemic profile, high blood pressure,

obesity, or smoking.¹¹⁻¹⁴

The recommended type of physical exercise for reducing the rate of bone mass loss is weight-bearing exercise, in which the body supports its own weight. Examples of weight-bearing exercise are walking, stair climbing, jogging, dancing, hiking, aerobics, Tai Chi, or racquet sports. Research studies have found that 30 minutes of exercise three or four times a week is enough for significantly reducing bone mass loss. Moreover, in older adults who are more likely to have multiple comorbidities, it was found that results can be obtained even when the 30 minutes are divided in 10- or 15-minute sessions.

Regular Bone Mineral Density Measurement

The bone mineral density (BMD) test can be utilized either as a screening test or as a monitoring test. Early accurate detection of osteopenia and/or osteoporosis before a fracture occurs significantly improves the prognosis and progression of osteoporosis. Regular BMD testing also predicts the risks of fracturing in the future, determines the rate of bone mass loss, and monitors the effects of therapy when implemented. Since 1 July 1998 Medicare has supplied national

coverage on BMD tests under the provision of the Bone Mass Measurement Act.^{9,15} According to this policy, Medicare-eligible individuals are covered for a BMD measurement performed every two years, unless it is required more often by some specific conditions.^{1,15}

These preventive steps should be continued even if the patient is on medication or has already had an osteoporotic fracture. Although nowadays there is a wide array of available osteoporosis medication, research shows that better results can be obtained by combining pharmacological and non-pharmacological interventions. In addition to these interventions, when addressing bone mass maintenance and bone mass loss reduction, prevention of falls is of paramount importance. Falls represent the greatest risk factors for fractures in patients with low bone density.

Besides interventions directly geared toward improving gait and balance, patients at risk should be educated about the little changes in their home environment, clothing, and lifestyle that can reduce the risk for falls to a great extent. Last but not least, healthcare providers should offer people at risk for osteoporosis or for falls additional sources of information for resources at community, state, or national level. ■

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