

Osteoporosis-Related Hip Fractures Cost \$13 Billion to \$18 Billion Yearly

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Osteoporosis—a bone disorder associated with increased susceptibility to fracture of the hip, spine, wrist, shoulder, and ribs—afflicts an estimated 25 million people in the United States. Osteoporosis accounts for approximately 1.5 million new fractures each year, with associated medical charges (including rehabilitation and extended treatment facilities) costing an estimated \$10 billion, according to the National Osteoporosis Foundation. Because osteoporosis affects primarily the elderly, the National Osteoporosis Foundation estimates that these costs will increase to \$60 billion by the year 2000 and to \$200 billion by the year 2040, as the number of Americans over the age of 65 years grows.

But medical charges are not the only costs to consider. Lost productivity (from missing work due to disability and premature death) from osteoporosis-related fractures pose additional costs. This article is based on research funded by USDA's Economic Research Service (ERS) to estimate economic costs of osteoporosis-related hip fractures. Economic costs include medical charges

and costs associated with lost productivity.

Hip fractures are the most serious consequence of osteoporosis. About 20 percent result in death, and those who survive often have disability and loss of independence. Osteoporosis-related hip fractures result in estimated costs of \$12.8 billion to \$17.8 billion per year for medical care, extended treatment facilities, and the value of lost productivity. Rehabilitation and institutionalization costs, at about \$5.1 billion to \$7.1 billion, account for 40 percent of the estimated total economic cost of osteoporosis-related hip fractures. The value of lost productivity due to missed work is less than 1 percent of total economic costs, while value of premature death accounts for 35.3 percent. Initial medical costs for hospitalization and outpatient care, at about \$3.1 billion to \$4.3 billion, account for 24.4 percent of the total economic cost of osteoporosis-related hip fractures.

Bone Is Constantly Being Renewed

Many people think of bone as a hard, permanent substance that does not change after childhood. However, bone is alive and dynamic, constantly renewed through a process of removal or reabsorption of old bone and formation or laying down of new bone. Through this remodeling process, about one-fifth of

the skeleton is replaced each year in adults.

Bone grows in length at first, then during adolescence there is a dramatic increase in bone mass or density. Peak bone mass is the maximum skeletal mineral content achieved by a person. During the first three decades of life more bone is formed than lost, and peak bone mass is achieved. After that time the body removes old bone faster than new bone forms, leading to a loss of bone mass. If bone loss is excessive, bones become fragile and more susceptible to fracture.

Half of All Women Over Age 50 Are Affected

Bone loss is a natural part of the aging process. Two factors make women more susceptible to osteoporosis than men. First, women are susceptible to greater bone losses than men. Starting around the fourth or fifth decade of life, both men and women lose bone mass at a rate of 0.3 to 0.5 percent per year. After the onset of menopause, the rate of bone loss in women can increase as much as 10-fold due to the reduced production of estrogen, a female hormone that plays an important role in maintaining bone mass. Women can lose up to 20 percent of their total bone mass in the

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first 5 to 7 years following menopause. By age 70 or 80, women have typically lost about 30 to 50 percent of their bone mass, compared with a loss of only 20 to 30 percent among men.

Second, women achieve peak bone mass earlier than men. Consequently, men have more years to build up bone mass and fewer years to lose bone mass. A related factor is that men also tend to have larger bones than women.

The National Osteoporosis Foundation estimates that half of all women over the age of 50 are affected by osteoporosis, compared with one in every five men. By age 75, 90 percent of women will experience an osteoporosis-related fracture, as opposed to only 33 percent of men.

Higher Intake of Calcium May Prevent/Delay Hip Fractures...

Genetics is a major determinant of osteoporosis. Women account for 80 percent of the 25 million Americans affected by osteoporosis. National incidence rates of hip fractures in the United States are highest for White women, about 2 to 2.4 times the rates for White men and Blacks. Blacks have about 10 percent more bone mass than Whites.

There is interest in learning more about the factors within an individual's control, such as exercise and diet, that might reduce the risk of suffering an osteoporosis-related fracture. Research suggests that among the dietary factors, calcium may play an important role in preventing or delaying the onset of osteoporosis and that higher intakes of calcium could prevent 40 to 60 percent of osteoporosis-related hip fractures.

Calcium is the most abundant mineral in the body, accounting for about 2 percent of total body weight. The bones and teeth contain about 99 percent of the calcium in the human body, with the remaining 1 percent circulating in the blood. Without calcium, the body cannot maintain strong, healthy bones.

Calcium requirements are greatest during the periods of rapid growth during childhood and adolescence, during pregnancy and lactation, and in later adult years to compensate for age-related bone loss. Increased calcium intake during the first three decades of life may allow for attainment of genetic peak bone mass. Increasing the level of bone mass from which loss occurs reduces a person's risk of hip fracture.

...But Women Often Do Not Consume Enough Calcium

The Recommended Dietary Allowance (RDA) for calcium is 800 milligrams per day for children age 10 years and under and for most adults age 25 years and over (not including pregnant and lactating women) and is 1,200 milligrams per day for those ages 11-24 years. However, experts at the National Institute of Health's 1994 Consensus Development Conference on Optimal Calcium Intake recommended increasing these levels to between 1,000 and 1,500 milligrams and between 1,200 and 1,500 milligrams, respectively, per day.

Dairy products are good sources of calcium, with 1 cup of lowfat milk and plain yogurt providing 37 and 52 percent, respectively, of the RDA for most adults 25 years of age and older. Leafy green vegetables, canned sardines and salmon, and fortified fruit juices are other easily accessible sources. Collard greens provide 22 percent of the calcium RDA in each half-cup serving, while

a half cup of broccoli contains 6 percent of the RDA. Canned sardines and salmon provide 41 and 23 percent, respectively, of the calcium RDA per 3-ounce serving.

Dairy products are the major source of calcium in the U.S. food supply, contributing 75 percent in 1990. Fluid milk provided 37 percent of the calcium in 1990, while cheese provided 23 percent and other dairy products provided 15 percent. Meat, eggs, and legumes together provided 9 percent of the calcium in 1990, and vegetables provided 6 percent.

Most American men get the recommended calcium intake, but most women do not consume enough calcium. USDA consumption surveys indicate that men's calcium intake from dietary sources increases with age, peaks during late adolescence at 1,145 milligrams, and then declines. The pattern is similar for women, although the peak occurs at age 11 with 916 milligrams per day. Average calcium intake among boys ages 12 to 19 is 95 percent of the RDA, but only 66 percent for girls in the same age group—making it unlikely that many of them will fully reach their genetic potential for peak bone mass. In fact, after age 11, most American girls never get their calcium consumption up to recommended levels.

Men 20 years and older consume an average of 101 percent of the RDA for calcium, while women of the same age consume an average of only 75 percent of the RDA for calcium. Calcium intake for women ages 20 and over is typically 632 milligrams per day, 25 percent lower than among men 20 and over. Calcium intake for women generally increases during pregnancy and lactation.

Hip Fractures Are the Most Serious Consequence of Osteoporosis

Although hip fractures are not as numerous as fractures of the wrist or spine, they are by far the most serious consequence of osteoporosis. Often times, spinal fractures will go untreated. However, osteoporosis-related hip fractures typically require surgery, hospitalization, and an extended period of rehabilitation. Hip fractures also lead to premature death, with an estimated 20 percent of people who fracture their hip dying within 1 year.

The Older Women's League estimates that hip fractures account for 18 percent of the annual 1.5 million osteoporosis-related fractures, while the National Osteoporosis Foundation estimates that hip fractures account for 25 percent. This range of 270,000 to 375,000 osteoporosis-related hip fractures each year is used as the basis for the medical and lost productivity cost estimates in this article.

The annual costs of osteoporosis-related hip fractures were estimated by using the traditional cost-of-illness method. This method categorizes disease cases by the level of severity, then calculates the costs of medical treatment and lost productivity for each severity category, and sums up the categories for an estimate of the total economic cost.

Hospitalization and Outpatient Care Cost \$3.1 Billion to \$4.3 Billion a Year

The initial medical costs of hip fractures include hospitalization and outpatient care (table 1). Because hip fractures are generally associated with an accidental fall, all patients are assumed to arrive at the hospital in an ambulance and to be admitted through the emergency room. Inpa-

tient and outpatient care costs are based on Medicare cost data and are conservative estimates of actual costs, because Medicare reimburses approximately 80 percent of the market value of medical services.

Room and board in the hospital after surgery accounts for 73 percent of the estimated \$11,582 cost per patient associated with inpatient and outpatient care for hip fractures. Multiplying this cost by the 270,000 to 375,000 cases of osteoporosis-related hip fractures in the United States each year results in total initial medical costs of between \$3.1 billion and \$4.3 billion.

High Costs for Longer Term Care

The criteria for developing the cost estimates for longer term care were taken from studies reported in various medical journals. These studies used medical records and observations of fracture patients over time. Depending on the severity of the fracture, patients require varying degrees of assistance in re-

habilitation and personal care for daily activities.

In this analysis, about 96 percent of the patients were assumed to be discharged from the hospital after the initial care, and 4 percent were assumed to die. Of those discharged from the hospital, 32 percent go home and 68 percent are sent to some type of facility for rehabilitation or extended care. Half of this 68 percent go to an intermediate-care facility to recuperate. The other half require more intensive medical care and are discharged to a skilled nursing facility.

Due to the late stage in life in which hip fractures tend to occur, this study assumes that in the first year after the fracture only about 23 percent of all people who fracture their hips fully recover to their pre-fracture status, 32 percent regain near normal functioning with minimal assistance, and 25 percent are injured more severely and require dependent care in a facility for at least 1 year. The remaining 20 percent are assumed to die within 1 year. Figure 1 shows the various dis-

Table 1
Initial Medical Costs of Hip Fractures

Initial medical costs	Cost per patient
	Dollars
Inpatient costs	11,508
Ambulance	290
Emergency room doctor fee	53
Nonmedical emergency room services	554
Room and board	8,500
Initial doctor visit	107
Surgery	1,312
Anesthesia	270
Daily doctor visits	360
Hospital discharge visit	62
Outpatient costs	74
Office followup visit	36
X-ray	38
Total initial medical cost per patient	11,582

Source: Chrischilles, E., T. Shireman, and R. Wallace. "Costs and Health Effects of Osteoporotic Fractures," *Bone*, Vol. 15, No. 4, 1994, pp. 377-86. Updated to 1995 dollars.

charge destinations and health outcomes within 1 year of the fracture.

Table 2 shows the estimated per patient cost associated with the various levels of rehabilitation and long-term care. The patients discharged to their homes are assumed to require a minimum amount of care after being discharged from the hospital. This study conservatively assumes that these patients require a minimum of 6 weeks of rehabilitation, regardless of whether they fully recover to their prefracture status or to a near normal level. Three-fourths of the patients discharged to an intermediate-care facility are assumed to recover to a near normal level of functioning and return home after spending an average of 90 days in the facility.

The remaining patients discharged to an intermediate-care facility are assumed to remain se-

verely handicapped and to require care for at least 1 year. Among the patients discharged to a skilled nursing facility, 51 percent are assumed to require institutional care for at least 1 year, 10 percent are assumed to die within 6 months, and 39 percent are assumed to die within 6 to 12 months. Total costs associated with rehabilitation and institutional care are estimated at \$5.1 billion to \$7.1 billion each year.

Lost Productivity Increases the Annual Cost of Hip Fractures

The estimate of lost productivity due to osteoporosis-related hip fractures uses average weekly earnings to value lost wages for those who miss work and, for those who die within a year, the Landefeld-Seskin

value of a statistical life. This value provides a conservative estimate of the value of a statistical life, because it does not account for the value of lost leisure time of patients or for their pain and suffering. This study assumes that the average patient suffers an osteoporosis-related hip fracture at age 75, about 20 percent of whom die within the year. Based on \$83,632 as the value of a statistical life at age 76 and the two earlier estimates of annual cases, osteoporosis-related hip fractures result in losses from premature death of \$4.5 billion to \$6.3 billion.

The study assumes that individuals in the laborforce miss work for the duration of their rehabilitation following osteoporosis-related hip fractures. The laborforce participation rate is the percentage of the total population (or a subgroup of the population) that is in the labor-

Figure 1
Almost Half of Those Hospitalized With Osteoporosis-Related Hip Fractures Never Fully Recover

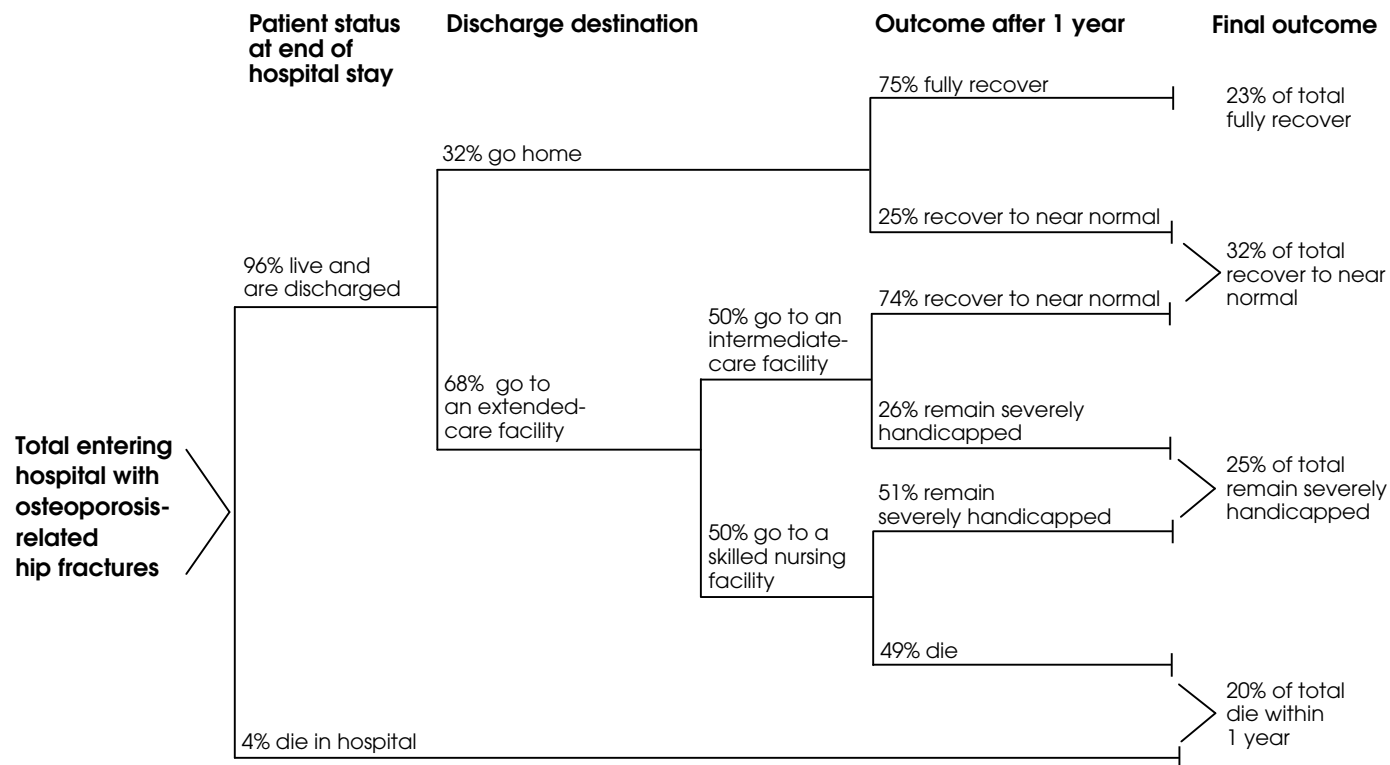


Table 2

Although the Majority of Patients Recover From Osteoporosis-Related Hip Fractures, Two-Thirds Require Institutional Care

Discharge destination	Outcome after discharge	Share of patients	Days in care facility ¹	Daily rate	Total cost	
		Percent	Number	Dollars	Low range ²	High range ³
		Million dollars				
Home	Fully recover	23.0	42	8	20.87	28.98
Home	Near normal	7.7	42	8	6.99	9.70
Intermediate care facility	Near normal	24.1	90	73	427.50	593.76
Intermediate care facility	Severely handicapped	8.5	360	73	603.12	837.68
Skilled nursing facility	Severely handicapped	16.6	360	135	2,178.25	3,025.35
Skilled nursing facility	Die within 3 months	1.3	90	135	42.64	59.23
Skilled nursing facility	Die within 3-6 months	2.0	180	135	131.22	182.25
Skilled nursing facility	Die within 6-12 months	12.7	360	135	1,666.49	2,314.57
Total	N/A	95.9 ⁴	N/A	N/A	5,077.08	7,051.52

Notes: Costs are in 1995 dollars. N/A = Not applicable. ¹Assumes that patients discharged to the home still require an average of 6 weeks of rehabilitation regardless of their final outcome. Patients discharged to an intermediate care facility and who recover stay an average of 3 months in the facility; others stay 1 year. Patients discharged to a skilled nursing facility stay at least 1 year, unless they die. ²Based on the Older Women's League estimate that 18 percent of the 1.5 million fractures each year are osteoporosis-related hip fractures (270,000 hip fractures per year). ³Based on the National Osteoporosis Foundation estimate that 25 percent of the 1.5 million fractures each year are osteoporosis-related hip fractures (375,000 hip fractures per year). ⁴The remaining 4 percent of patients die in the hospital before being discharged.

force. For the 80 percent of patients who survive, osteoporosis-related hip fractures result in \$75 million to \$104 million in lost productivity due to missed work (using a 4.6-percent laborforce participation rate for people 75 years and older and an average daily wage rate of \$48.14 for those working at the time of the hip fracture) (table 3).

This study estimates that the total economic cost of osteoporosis-related hip fractures is \$12.8 billion to \$17.8 billion each year. The costs of hospitalization and outpatient care are \$3.1 billion to \$4.3 billion per year. Further, because hip fractures tend to occur among the elderly, the value of lost productivity due to missed work is a smaller component of the total cost than is the value of premature death or the costs of rehabilitation and institutionalization. Rehabilitation and institutionalization costs of \$5.1 billion to \$7.1 billion account for 40 percent of the es-

Table 3

Largest Cost of Osteoporosis-Related Hip Fractures Due to Rehabilitation and Extended Care

Item	Cost	
	Low range ¹	High range ²
Million dollars		
Initial medical costs	3,127.14	4,343.25
Rehabilitation and institutional costs	5,077.08	7,051.52
Value of missed work	74.72	103.79
Value of premature death	4,516.13	6,272.4
Total cost	12,795.07	17,770.96
Costs attributed to diet ³	5,118.03	10,662.58

Notes: Costs are in 1995 dollars. ¹The low range is based on the Older Women's League estimate that 18 percent of the 1.5 million fractures each year are osteoporosis-related hip fractures (270,000 hip fractures per year). ²The high range is based on the National Osteoporosis Foundation estimate that 25 percent of the 1.5 million fractures each year are osteoporosis-related hip fractures (375,000 hip fractures per year). ³Studies suggest that 40 to 60 percent of osteoporosis-related hip fractures could be prevented by increasing calcium intake.

estimated total economic cost of osteoporosis-related hip fractures.

Since there is no known cure for osteoporosis, preventive measures are important. Increasing evidence indicates that inadequate calcium intake is at least partly responsible for the risk of osteoporosis-related hip fractures. Medical research suggests that increased consumption of calcium could prevent 40 to 60 percent of osteoporosis-related hip fractures. This study estimates that these diet-related fractures result in costs of \$5.1 billion to \$10.7 billion per year for medical care, extended-treatment facilities, and the value of lost productivity. Since bone loss begins in the mid-thirties, it is best not to wait

until the process begins to start preventive action. Consuming adequate dietary calcium should be a lifelong process, especially for women because of their increased risk.

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