Osteoporosis in Illinois: Analysis of Hospital Discharge Records from 1992 to 1995

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Abstract

To assess the health and financial impact of osteoporosis on populations in Illinois, hospital discharge records from all acute care hospitals in Illinois were analyzed. From 1992 to 1995, there were 14,580 to 15,800 persons 45 years of age and older who were hospitalized each year for osteoporosis or osteoporotic fractures. Hospitalization rates due to hip fractures, which accounted for 78 percent of all osteoporosis-related hospitalizations, were higher in Illinois than nationally. The annual direct cost of the hospitalizations in 1995 was $242 million. Among persons 45 years of age and older, osteoporosis-related complications were responsible for two of every 100 hospitalizations, $2 of every $100 spent on hospitalizations, and 2.5 of every 100 days of hospital stays in Illinois. These numbers were greater among women and more than doubled for persons 85 years of age and older. Compared with all other diseases combined, hospitalizations due to osteoporosis or osteoporotic fractures were more costly and required longer stays. The higher cost and longer stay were somewhat reduced during the study period by discharging more patients to nursing facilities. The long-term health consequence of this practice, however, could not be examined. These results highlight the public health importance and economic implications of preventing osteoporosis-related complications in Illinois.
Introduction

Osteoporosis is a degenerative disease characterized by excessive reductions in bone mass. Described as a *normal* aging process by some a little more than 10 years ago, osteoporosis is now regarded as an insidious *silent epidemic* among elderly individuals. An estimated 25 million Americans are affected by osteoporosis, including half the women 45 years of age and older and 90 percent of women older than 75 years.

Osteoporosis constitutes a health threat primarily through its associations with age-related fractures (1,2). The most common sites at which these fractures occur are hip, vertebrae, and wrist; nearly all these fractures require hospitalization. For many elderly individuals, bone fractures often result from a combination of osteoporosis and a fall. The mutual dependence, or synergistic effect, between osteoporosis and falls in creating osteoporotic fractures should be clearly recognized when designing prevention measures, for either of the two pathways could be considered for intervention (2-9). This conceptual model of fracture pathology and some major factors determining the risk of osteoporosis and falls are presented in Figure 1.

In 1994, Illinois Governor James Edgar signed the legislation creating the Osteoporosis Prevention and Education program, making Illinois one of the first states in the country to initiate this type of statute. The law required the Illinois Department of Public Health to initiate a program to increase the awareness, prevention, and control of osteoporosis. As part of the Illinois Osteoporosis Awareness and Prevention Initiative, an epidemiological assessment of the health and financial impact of osteoporosis on populations in Illinois was conducted. Specifically, the volume, distribution, cost, discharge destination, and temporal pattern of hospitalizations due to osteoporosis-related complications that occurred from 1992 to 1995 were examined.
Methods and Materials

Hospital discharge records from Illinois hospitals for Illinois residents from 1992 to 1995 were used for this analysis. In Illinois, all non-federal, acute care hospitals with 50 beds or more are required by state law (Public Law 83-1243) to submit patient uniform bill discharge records to the Illinois Health Care Cost Containment Council (IHCCCC). The compliance rate for these submissions was about 97 percent in 1990 and 1991 (10). The information in these discharge records includes, but is not limited to, hospital code, patient age, sex, primary diagnosis, secondary diagnosis, cost, type of payer(s), dates of admission and discharge, and discharge destination.

To fully capture osteoporosis-related discharges and also maintain a reasonable level of specificity, we selected all patients who were 45 years of age when discharged between 1992 and 1995 and had a principal diagnosis of (a) osteoporosis (ICD9 733.0); (b) pathological fracture (ICD9 733.1); (c) hip fracture (ICD9 820.0 through 820.9); or (d) fracture of forearm (ICD9 813.0 through 813.9) or vertebral column (ICD9 805.0 through 806.9) and with osteoporosis as a secondary diagnosis.

Costs associated with hospitalizations were expressed in actual terms and, when compared over years, in deflated terms relative to 1992. Consumer price indices used for the deflation were obtained from the Illinois Department of Commerce and Community Affairs. These indices were similar to those compiled for the whole United States by the U.S. Department of Commerce.

Distributions of hospitalizations, costs and length of hospital stays (in days) were examined by calendar year, payer type and discharge destination. Proportions of osteoporosis-related hospitalizations to all hospitalizations in Illinois were computed by dividing osteoporosis-related hospitalization frequencies, costs and average length of stay with corresponding statistics for
hospitalizations of all diseases. Temporal trends in distributions were estimated by calculating regression slope coefficients from 1992 to 1995.

Hospitalization rates were calculated for all patients and also for gender- and age-specific groups. Because the actual magnitude of osteoporosis-related complications was of primary interest in this analysis, age adjustment was not used and only crude rates are presented. Intercensal population estimates as denominators for these rates were obtained from the U.S. Census Bureau for Illinois from 1992 through 1995.

Student’s t tests were used for comparisons of continuous variables (e.g., dollar costs) among groups. Chi-square tests were used for comparisons of count variables (e.g., hospitalization rates) and for evaluation of trends over years (e.g., slope differences). Statistical analyses were performed with PC SAS, version 6.10 (SAS Institute, Cary, N.C.), and EPI-Info, version 6.4b (CDC, Atlanta, G.A.). P values below 0.05 were considered to indicate statistical significance.

Results and Discussion

The number of hospitalizations due to osteoporosis among persons 45 years of age and older in Illinois increased by 8.3 percent (p<0.05), from 14,582 in 1992 to 15,802 in 1994, despite an unchanged number of hospitalizations for all other diseases during the same period (Figure 2). The number of osteoporosis-related hospitalizations plateaued in 1995, at slightly more than 15,600 a year, or about 43 hospitalizations per day. Hip fractures and pathological fractures accounted for about 97 percent of all osteoporosis-related hospitalizations. Fractures of distal arms or vertebral columns with osteoporosis as a secondary diagnosis were less than 2 percent. Osteoporosis as a primary diagnosis accounted for less than 1 percent of all osteoporosis-related hospitalizations. These
results indicated that bone fractures, especially hip and pathological fractures, were the predominant reason for which osteoporosis patients were admitted to hospitals.

Osteoporosis-related hospitalizations accounted for tangible proportions of all hospitalizations in Illinois. Figure 3 shows that, on average, for every 100 hospitalizations among persons 45 years of age and older in Illinois each year, about two were related to osteoporosis. The proportion of osteoporosis-related hospitalizations increased dramatically with age. For every 100 hospitalizations among persons 45 to 64 years of age, less than half were related to osteoporosis. This was about 2 percent for persons 65 to 84 years of age and almost 6 percent for persons older than 85 years of age. The pattern was quite consistent from year to year between 1992 and 1995.

All proportions of osteoporosis-related hospitalizations were higher among women. For every 100 hospitalizations among women 45 years of age and older each year, about three were related to osteoporosis (Figure 4). A strong age gradient also was observed. For every 100 hospitalizations, 0.5, three, and seven were due to osteoporosis for women 45 to 64, 65 to 85, and older than 85 years of age, respectively.

Similar to the trend in the number of hospitalizations, hospitalization rates increased significantly from 1992 to 1994, by 3.6 percent for females, 12.1 percent for males, and 5.3 percent for both genders combined (Figure 5). All the rates stabilized in 1995, at the same levels as in 1994. The rate among females, ranging from 56.3 per 10,000 to 59.0 per 10,000, was nearly three times that among males (from 19.2 per 10,000 to 21.6 per 10,000) for every year during 1992-1995 (p<0.01). The rate difference between males and females primarily occurred among persons 65 years of age and older. Figure 6 shows that among persons 45 to 64 years of age, the hospitalization rate was almost identical between males and females. The gender difference in hospitalization rates, however, reached about 50 per 10,000 among persons 65 to 84 years of age and 130 per 10,000 among persons 85
years of age and older. Clearly, osteoporosis affected females more than males and persons 65 years of age and older more than younger groups.

National rates were available for comparison for hip fractures among persons 65 years of age and older from 1992 to 1994 (11). Figure 7 indicates that hospitalization rates for hip fractures in Illinois for the same period were 10 percent to 20 percent higher than the national average. Because hip fractures represent the majority of osteoporotic fractures, it is reasonable to conclude from this comparison that the hospitalization rate of all osteoporotic fractures was also higher in Illinois than nationally.

During 1992-1994, the annual cost of hospitalizations due to osteoporosis-related complications in Illinois increased by 13.6 percent, from about $215 million in 1992 to $244 million in 1994 (Figure 8). This increase was higher than that for costs of all hospitalizations in Illinois during the same period (10.5 percent). The total cost of osteoporosis-related hospitalizations declined slightly, by 0.7 percent, from 1994 to 1995. Similar changes were also observed when costs were deflated relative to 1992 prices. According to the deflated cost, the increase from 1992 to 1994 was 10.1 percent and the decrease from 1994 to 1995 was 0.8 percent. Despite the changing cost of hospitalizations, cost proportions of osteoporosis-related hospitalizations to those of all hospitalizations were quite stable over years. Figure 9 shows that among Illinoisans 45 years of age and older, about $2 out of every $100 spent on hospitalization went to osteoporosis-related complications. This number increased to about $3 for women alone (Figure 10). The cost proportion of osteoporosis-related hospitalizations increased dramatically as age increased. Among persons 85 years of age and older, for example, about $7 was spent on osteoporosis-related stays for every $100 on hospitalizations. Among women 85 years of age and older, it was about $8.50.
Average costs of hospitalization for osteoporosis-related complications were higher than those for other diseases in Illinois. Although the difference narrowed over years, the average cost of hospitalization for osteoporosis-related complications was still at $15,550 per admission in 1994 and 1995, at least $1,000 more than the cost for other diseases (p<0.01) (Figure 11). Most osteoporosis-related hospitalizations were covered at least partially by Medicare and Medicaid (90 percent), followed by private insurance (66 percent) and self-pay (7 percent) (Figure 12). While most coverages remained constant, a notable increasing trend was observed for private insurance. Note that these coverages referred to numbers of hospitalizations, not amounts of money paid. Also, because a hospitalization could be jointly paid by more than one payer, the sum of coverages by different payers was greater than 100 percent.

Figure 13 shows that proportions of osteoporosis-related hospital stays per 100 days of hospitalization for all diseases remained stable at about 2.5 days from 1992 to 1994 among persons 45 years of age and older. The number dropped to 2.3 days in 1995, an 8 percent reduction from 1994. Across age groups, the proportion of osteoporosis-related hospital stays varied greatly, from about 0.6 days for persons 45 to 64 years of age to more than six days for persons 85 years of age and older. Among women alone, a similar temporal pattern and an age gradient were observed (Figure 14). However, all proportions were higher than for both genders combined. These results were consistent with the proportions of osteoporosis-related hospitalization frequencies and costs and, taken together, they indicated that osteoporosis posed a proportionally greater threat to women than to men and progressively affected older persons after 45 years of age.

The average length of stay (ALS) for osteoporosis-related hospitalizations declined from 10.1 days in 1992 to 7.4 days in 1995 (Figure 15). Although the length of hospital stay for all diseases shortened during this period, the reduction was greater for osteoporosis-related diseases than for
others (2.7 days vs. 1.1 days, p<0.05). Figure 16 shows discharge destinations for osteoporosis-related complications. While discharges to other destinations (including deceased) remained relatively constant, home discharges steadily decreased and discharges to skilled nursing facilities increased from 1992 to 1995. This shift of care for patients with osteoporotic fractures from hospitals to nursing homes explains the greater decrease in length of hospital stays and smaller increase in cost of hospitalizations for osteoporosis-related complications (Figure 11) because some hospital costs were displaced by costs of nursing facilities. Nursing home stays are certainly less costly than hospital stays, although they still cost between $36,500 to $42,700 annually for private pay rates in 1996 (12). Insufficient data were available at the time of this study to evaluate how the increasing shift to nursing homes affected long-term recovery rates and quality of life of patients with osteoporotic fractures.

In conclusion, osteoporosis poses a serious public health problem, with annual hospitalization costs topping more than $240 million each year since 1994 in Illinois. As the general population in Illinois continues to age, hospitalizations due to osteoporotic fractures are expected to increase. From 1992 through 1995, among persons 45 years of age and older, osteoporotic fractures were responsible for about two out of every 100 hospitalizations, $2 out of every $100 spent on hospitalizations, and 2.5 out of every 100 days of all hospital stays. These numbers more than doubled for persons 85 years of age and older. Compared with hospitalizations for other diseases, hospitalizations due to osteoporosis required longer stays and were more costly. Although both the cost and length of stay in hospitals have been curtailed somewhat by the increased patient discharge to nursing homes, preventing osteoporosis and its related bone fractures before they occur or preventing falls for people at risk of osteoporosis, or both, is certainly a far better choice than treating
them. Enough knowledge has been gained to make such preventions feasible and achievable (13,14).

As a continuously evolving public health problem, osteoporosis and its health consequences should be regularly evaluated to assess the burden of the disease and to use that information to guide prevention and treatment programs. Because of difficulties in measuring bone density adequately and accurately, surveillance of osteoporosis in at-risk populations needs to focus on its major health outcome--bone fractures. Hospital discharge records can be used for this purpose, since all osteoporotic fractures require hospitalization. The present analysis demonstrated the value of using these data to estimate the magnitude of health and financial burdens of osteoporosis on populations in Illinois.
References


Figure 1. Osteoporosis and Bone Fracture

Age, race, estrogen levels, body size, physical activity, peak bone mass at maturity, calcium intake, alcoholism, smoking, family history, menopause, hysterectomy, etc.

Neuromuscular function, environmental hazards, time spent at risk, potential force, protective responses, energy absorption, etc.

Osteoporosis  →  Force of impact

Bone fracture

Figure 2. Number and Proportion of Hospitalizations with Different Osteoporosis-Related Complications, Illinois, 1992-1995

Figure 3. Percent of Hospitalizations Due to Osteoporosis-Related Complications, All Persons, 45 Years of Age and Older, Illinois, 1992-1995


Figure 4. Percent of Hospitalizations Due to Osteoporosis-Related Complications, Women, 45 Years of Age and Older, Illinois, 1992-1995

Figure 5. Gender-Specific Osteoporosis-Related Hospitalization Rates for Persons 45 Years of Age and Older in Illinois, 1992-1995


Figure 6. Age- and Gender-Specific Osteoporosis-Related Hospitalization Rates in Illinois, 1992-1995

Figure 7. Hip Fracture Rates Among Persons 65 Years of Age and Older in Illinois and the United States


Figure 8. Annual Cost of Hospitalizations Due to Osteoporosis-Related Complications in Illinois, 1992-1995

Figure 9. Percent of Hospitalization Costs Due to Osteoporosis-Related Complications, All persons, 45 Years of Age and Older, Illinois, 1992-1995


Figure 10. Percent of Hospitalization Costs Due to Osteoporosis-Related Complications, Women, 45 Year of Age and Older, Illinois, 1992-1995

Figure 11. Average Cost of Hospitalizations for Osteoporosis-Related Complications and All Other Hospitalizations, Illinois, 1992-1995


Figure 12. Proportion of Hospitalizations with Osteoporosis-Related Complications by Payer Type, Illinois, 1992-1995

Figure 13. Percent of Days of Hospitalization Due to Osteoporosis-Related Complications, All Persons, 45 Years of Age and Older, Illinois, 1992-1995


Figure 14. Percent of Days of Hospitalization Due to Osteoporosis-Related Complications, Women, 45 Years of Age and Older, Illinois, 1992-1995

Figure 15. Average Length of Stay for Osteoporosis-Related Complications and All Other Diseases, Illinois, 1992-1995


Figure 16. Proportion of Hospitalizations with Osteoporosis-Related Complications by Discharge Destinations, Illinois, 1992-1995
