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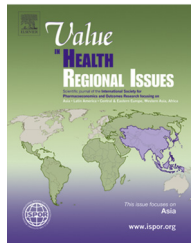

# Economic Burden of Osteoporotic Fracture of the Elderly in South Korea: A National Survey

*Jinhyun Kim, PhD*[1], *Eunhee Lee, PhD*[2,*], *Sungjae Kim, PhD*[3], *Tae Jin Lee, PhD*[4]

[1]*College of Nursing and The Research Institute of Nursing Science, Seoul National University, Seoul, Korea;* [2]*Division of Nursing, Hallym University, Gangwon-do, Korea;* [3]*Department of Nursing, Kyungbok University, Gyeonggi-do, Korea;* [4]*Graduate School of Public Health, Seoul National University, Seoul, Korea*

ABSTRACT

**Background:** Osteoporotic fractures (OFs) in the elderly are common worldwide, and the predicted number of the aging population is increasing the burden of OF on health care systems. **Objectives:** To estimate the economic burden of OF in people older than 65 years in South Korea from a societal perspective. **Methods:** National Health Insurance claim databases were used to analyze health care utilization and medical costs of OF in the Korean population (49 million). We identified medical claims records with a diagnosis of OF and estimated the costs from 2007 to 2011. **Results:** From 2007 to 2011, there were 244,798 patients with at least one medical insurance claim related to OF. Most patients had a single fracture (80%), whereas 20% of all patients had two or more. For fracture sites, vertebral fracture accounted for 75.6% of all fractures, followed by hip and wrist fractures. The societal cost of OF increased annually, from US $88.8 million in 2007 to US $149.3 million in 2011. Among the entire cost, the direct medical cost was US $134.9 million in 2011, which includes the cost of treatment (US $91.2 million) and long-term care (US $48.1 million). The direct nonmedical cost was US $9.9 million in 2011. Costs associated with morbidity and mortality of OF were excluded. **Conclusions:** The economic burden associated with OF in elderly is expected to rise with the predicted increase in life expectancy and the number of elderly in South Korea. Therefore, effective management of the disease is necessary to reduce the growth in the economic burden of OF.

*Keywords:* economic burden, osteoporosis, osteoporotic fracture.



## Introduction

The incidence of osteoporotic fracture (OF) is increasing worldwide in aging populations, and the economic burden of OF on health care systems is continuously increasing as well. According to the National Health Insurance (NHI) database, a total of 244,000 cases of fractures occurred in Korea, 186,000 of which occurred in females. The societal costs associated with OF reached roughly US $105 million in South Korea [1]. Moreover, in cases involving hip fractures, the mortality rate was approximately 16% and 28% within 1 to 2 years, respectively [1]. Because the aging index in Korea is estimated to increase up to 213.8% by 2030, the prevalence of OF and its associated costs are also expected to increase markedly. Moreover, the economic and caregiving burdens for families are expected to increase, because the elderly living with OF have a higher risk of multiple fractures, which can result in immobility or difficulties in activity of daily living (ADL) [2–4]. Therefore, the aim of this study was to investigate, from a societal perspective and using the population-based database, the economic burden of OF in people older than 65 years in South Korea.

## Methods

### Study Design

In this retrospective observational study, we used data drawn from the NHI claims database and the Long-term Care Insurance (LCI) claims database to estimate the medical cost associated with OF. For the nonmedical cost, we used the Korea National Health and Nutrition Examination Survey database. Approval from the Institutional Review Board and Ethics Committee was not required for this study.

Individuals living in Korea receive health care through the NHI program and the Medical Aid Program. Therefore, the NHI claims database included medical claims for the entire population in Korea (approximately 51 million people). This large, longitudinal database provided data on integrated enrollment, treatment costs, payments made by the NHI, the number of outpatient visits, the number of days per hospital stay, and prescriptions, which can be classified into age, sex, medical care institution, and disease.

Conflicts of interest: The authors have indicated that there are no conflicts of interest with regard to the content of this article.

* *Address correspondence to:* Eunhee Lee, Division of Nursing, Hallym University, 1 Hallymdaehak-gil, Chuncheon, Gangwon-do, Korea. E-mail: ehlee@hallym.ac.kr

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The LCI program is available for those elderly who meet certain eligibility criteria, including physical limitations, mental capacity, nursing needs, and rehabilitation services. The LCI claims database provided a listing of elderly enrollees, including the number of their hospital visits, and the cost of nursing care and home care services.

### Patient Identification

The study population included patients with OF who were 65 years and older, and who were discharged from hospitals during the study years of 2007 to 2011. For the sake of extracting the data related to OF, we first extracted the data related to osteoporosis, and then identified the fracture events among patients with osteoporosis. To avoid omission within the study population, patients with osteoporosis were determined by two methods. We used data from medical claims with the *International Classification of Diseases, 10th Revision* (*ICD-10*) codes for osteoporosis and data from prescriptions for osteoporosis medications. Therefore, as the first step, we extracted the patients' information using *ICD-10* codes M80 (osteoporosis with pathological fracture), M81 (osteoporosis without pathological fracture), and M82 (osteoporosis in diseases classified as others). In the second step, among the patients who were excluded from the first step, the patients who were prescribed osteoporosis medications (bisphosphonate, in combination with bisphosphonate and vitamin D, selective estrogen-receptor modulators, vitamin $K_2$, calcitonin, ipriflavone, and calcium carbonate) were extracted. Last, we identified the fracture events of the patients with osteoporosis using the *ICD-10* code. The codes for fractures included those for vertebral fracture (M48.4, M48.5, S22.0, S22.1, and S32.0), clavicle (S42.0), upper arm (S42.2 and S42.3), wrist (S52.5 and S52.6), hip (S72.0 and S72.1), and ankle (S82.3, S82.5, and S82.6) (Fig. 1).

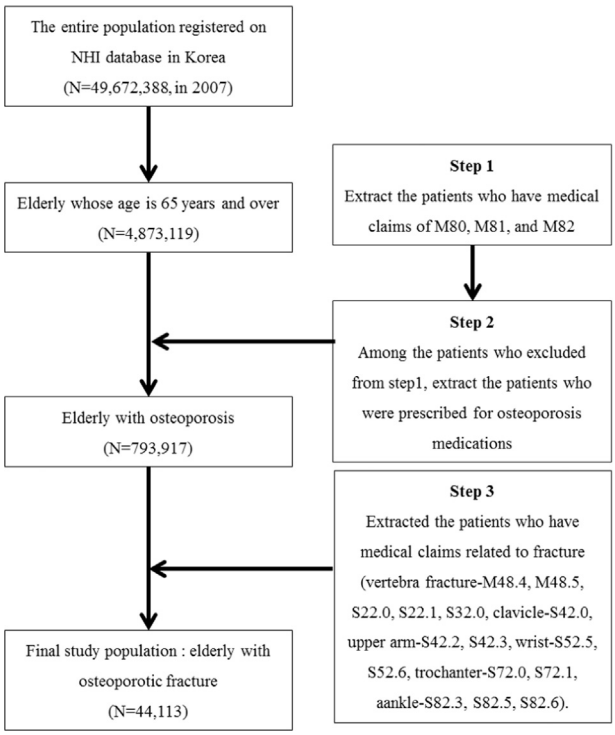


**Fig. 1 – Process of extracting OF data from NHI database.**

### Cost

The analysis used a cost-of-illness framework and included direct medical costs, direct nonmedical costs, and indirect costs such as productivity loss resulting from morbidity and mortality due to OF [5,6]. The societal cost, including direct costs and indirect costs, was estimated by using a macrocosting method. The direct cost (incurred as a result of treating OF) included direct medical costs such as those for hospitalization, outpatient care, and long-term care service and direct nonmedical costs such as those for transportation and caregivers. The associated costs are the typical OF-related expenditures for patients with OF in this study. We used the NHI and LCI databases for estimating the NHI payment and the costs for long-term care service, as well as a national survey report to determine out-of-pocket payments [7].

The OF-related NHI payment information was obtained by summing up each patient's payments, as extracted from the NHI database using the three steps outlined in Figure 1. In addition, we used the results of a previous survey to calculate out-of-pocket payments for patients with OF [7]. This survey was conducted by the NHI, using a stratified random sampling of medical institutions, and reported on the out-of-pocket payments according to the type of medical institution involved, medical specialties, and diseases.

The LCI payments summed up the typical expenditures of each patient with OF, which were extracted from the LCI database [8]. Because the LCI started in Korea in 2008, we used the period between 2008 and 2011 to estimate the average expenditure for long-term care services. Therefore, the total medical cost included NHI payments for hospitalization and outpatient care, NHI-related out-of-pocket expenditures, and LCI payments:

$$\text{Medical cost} = \sum_i \sum_j (\text{InNHI}_{ij} + \text{OutNHI}_{ij}) + \text{OOP} + \text{LCI} \quad (1)$$

where $\text{InNHI}_{ij}$ is the NHI payment for hospitalization, $\text{OutNHI}_{ij}$ is the NHI payment for outpatient care, OOP is the out-of-pocket payment, LCI is the LCI payment, $i = 0, 1, \ldots, n$ (age), and $j = 1$ or 2 (sex).

The nonmedical cost included transportation expenditures involved with visiting medical institutions and caregiver expenditures during hospitalization. The total transportation cost was estimated by multiplying the number of hospital visits by average per-visit transportation cost. We extracted the number of a patient's hospital visits from the NHI database, and estimated the transportation cost by using the average transportation costs reported in a previous study and adjusted by the transportation price index because patients used various vehicles [9,10]. We excluded the transportation cost of caregivers because no information on the number of caregiver visits was available. As a result, the transportation cost may be significantly underestimated.

In terms of caregiver costs, we included informal care provided by relatives, as well as formal care. According to the National Elderly Survey in 2008, among the elderly hospitalized with ADL, 74.9% were being cared for by relatives, whereas 8.8% received informal care services [11]. We estimated the total caregiving cost and applied its percentage to this survey. First, we calculated the cost of formal caregiving, together with its average percentage (8.8%), and the average caregiver cost. We quoted the average caregiver cost according to the Korea National Health and Nutrition Examination Survey and adjusted by service price index [9,10]. Second, for the cost of informal caregiving, we calculated the loss of the caregiver's productivity by multiplying the number of days the patient spent in the hospital by the labor market participation rate, the employment rate, and the average daily earnings for each age and sex [10]. We applied the characteristics of the caregivers (sex and age), as reported in the National Elderly Survey in 2011 [11]. After estimating the