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Direct healthcare costs of hip, vertebral, and non-hip, non-vertebral fractures ☆

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ABSTRACT

Limited data exist regarding the cost of non-hip, non-vertebral (NHNV) fractures. Although NHNV fractures may be less expensive than hip and vertebral fractures, they have a higher incidence rate. The objective of this study was to quantify first-year healthcare costs of hip, vertebral, and NHNV fractures. This was a claims-based retrospective analysis using a case-control design among patients with commercial insurance and Medicare employer-based supplemental coverage. Patients were ≥50 years old with a closed hip, vertebral, or NHNV fracture between 7/1/2001 and 12/31/2004, and continuous enrollment 6 months prior to and 12 months after the index fracture. Adjusted mean first-year healthcare costs associated with these fractures were determined. Six cohorts were identified. Patients 50–64 years: NHNV ($n=27,424$), vertebral ($n=3386$) and hip ($n=2423$); patients ≥65 years: NHNV ($n=40,960$), vertebral ($n=11,751$) and hip ($n=21,504$). The ratio of NHNV to hip fractures was 11:1 in the 50–64 cohort and 2:1 in the ≥65 cohort. Adjusted mean first-year costs associated with hip, vertebral, and NHNV fractures were $26,545, $14,977, and $9183 for the 50–64 age cohort, and $15,196, $6701, and $6106 for patients ≥65 years. After taking prevalence rate into account, the proportion of the total fracture costs accounted for by NHNV, hip, and vertebral fractures were 66%, 21% and 13% for the 50–64 age cohort, and 36%, 52% and 12% for the ≥65 age cohort. Limitations included the exclusion of the uninsured and those covered by Medicaid or military-based insurance programs. The results of this study demonstrate that osteoporotic fractures are associated with significant costs. Although NHNV fractures have a lower per-patient cost than hip or vertebral fractures, their total first-year cost is greater for those 50–64 because of their higher prevalence.

Introduction

A major public health threat, osteoporosis is estimated to affect 44 million Americans. About 40%–50% of women and 13%–22% of men are at risk of having an osteoporotic fracture in their lifetime [1]. Burge et al. estimate that 2 million fractures related to osteoporosis occurred in 2005 and project that 3.5 million osteoporotic fractures will occur in 2025. The associated costs of these osteoporotic fractures were estimated to be $19 billion in medical costs in 2005, with an anticipated increase to $25.3 billion in 2025, given the aging population [2].

In addition to the substantial cost burden, hip fractures are also associated with a high mortality rate. Approximately 24% of hip fracture patients ≥50 years of age die in the year following their fracture [3]. As expensive as hip fractures are, Gabriel et al. found that they represent only 37% of the total incremental cost of all moderate-trauma fractures combined [4]. While hip fractures remain a key driver of osteoporosis-related costs, some research indicates that osteoporosis-related, non-hip fractures, such as those of the spine, wrist/forearm, pelvis, humerus, and leg, are more prevalent than hip fractures [2,5]. Burge et al. report that, of the 2 million osteoporotic fractures estimated in 2005, hip fractures account for only 14%, while spine fractures represent 27%, and the remaining 59% includes fractures of the wrist, pelvis, and other sites (clavicle, scapula, humerus, carpal bone, metacarpal, other femur, patella, tibia and fibula) [2]. Much is known about the health and economic impact of hip and vertebral fractures; however, to accurately characterize the burden of all osteoporotic fractures, further research is needed on the clinical and economic burden associated with NHNV fractures, which account for more than half of the total number of osteoporotic fractures.

Numerous studies conducted in various countries [6–11] using both retrospective [6] and prospective study designs [7–9], as well as case-control comparisons [10,12,13] have analyzed the cost of hip fractures. While there is growing literature examining the cost of vertebral and non-vertebral fractures, many of the studies estimate cost based on economic models instead of data from real-world practice settings [2,14–17]. Other studies are confined to a specific gender or age cohort [12,14,18] or use data drawn from a single

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county in the US [4,19]. Lack of comparison cohorts makes it difficult to gauge the incremental cost associated with these fractures [20]. To better understand the economic burden of osteoporotic fractures in our healthcare system, this study estimated the incremental cost associated with closed hip, vertebral, and NHNV fractures by comparing healthcare cost in the first year following the fracture among fracture patients and their age–gender–region–comorbidity-matched controls who were fracture-free during the study period. Additionally, given that NHNV fractures are more prevalent in the younger population [20], costs were analyzed separately for patients of 50–64 years and ≥65 years.

Methods

Data source

This retrospective study was based on Thomson Reuters MarketScan® Commercial Claims and Encounters, and Medicare Supplemental and Coordination of Benefit (COB) Databases. The commercial database contains individual-level healthcare claims, encounters, enrollment, and drug data on approximately 166 million covered lives in the working population and is contributed to by employers and health plans for individuals under fee-for-service, fully capitated, and partially capitated health plans (PPOs and HMOs). Enrollees maintain their unique identifier even if they change health plans as long as they continue to work for the same employer.

The Medicare database includes patient-level medical and pharmacy claim histories of 33 million covered lives belonging to 12 national and regional health plans in the US. It is representative of the national commercially insured population and those who have both Medicare coverage and supplemental employer-sponsored coverage. All claims reflect the coordination of benefits between the commercial insurer and Medicare such that all costs of services paid for under either entity are captured in the database. Any services a patient may have received from another insurer, such as the Veteran's Administration, would not be captured in this database. The overall age distribution of the MarketScan® Medicare population is similar to that of a nationally representative population in the Medical Expenditure Panel Survey (MEPS) and the Medicare Beneficiary Survey (MCBS). Among enrollees ≥65 years, the distribution of age in 15-year increments is also similar to that of the national Medicare population, with a somewhat higher proportion of individuals aged 65–74. The Medicare database includes the Medicare-covered portion of payment, the employer-paid portion, and any patient out-of-pocket expenses. The patient data used in this analysis have been de-identified in compliance with the Health Insurance Portability and Accountability Act (HIPAA) regulations and therefore, the study is exempt from Institutional Review Board approval.

Patient selection

Patients who were ≥50 years of age with a primary or secondary diagnosis for closed hip, vertebral, or NHNV (pelvis, humerus, wrist, clavicle, and leg) fracture between July 1, 2001 and December 31, 2004 were identified (Fig. 1). Osteoporosis diagnosis was not required for patient eligibility because it would be unlikely for a clinician to code for osteoporosis when evaluating a fracture. Osteoporosis is often undetected until a fracture occurs, and the requirement of a diagnosis that might have been made months or years earlier would exclude relevant fractures from the analysis. Radiology claims were ignored since they can be used to rule out fracture and do not improve the positive predictive value of probable fractures [21]. In an effort to limit the analyses to osteoporotic fractures, open fractures and closed cervical and sacrum/coccyx fractures were excluded as they are more often associated with trauma rather than osteoporosis. A list of ICD-9-CM fracture diagnosis codes is provided in Table 1.

The first observed fracture during the index period was denoted as the index fracture. Eligible patients were required to be continuously enrolled 6 months prior to, and 12 months after the index fracture. Patients were excluded if they had any fracture during the pre-period or did not have complete medical and pharmacy data available during the study period. Six fracture cohorts were selected and analyzed individually: hip, vertebral, and NHNV, for patients 50–64 years and ≥65 years.

To estimate the incremental healthcare costs associated with fractures, comparison groups were identified that consisted of enrollees who were fracture-free during the study period. For each of the 6 fracture cohorts, patients were matched to controls based on exact age, gender, and region, as well as ±3 diagnostic cluster score (DCS). The diagnosis clusters (version 4.2, 2001) classify clinical conditions into 120 clusters, including osteoporosis and fracture, based on almost 90% of all diagnoses recorded by family physicians in different settings. These clusters are adapted for use with ICD-9-CM diagnoses. Fifteen supplemental clusters are added for the ≥65 population. The DCS is regarded as one of the best individual predictors of future healthcare expenditures [22,23]. A patient-level summary score based on the total count of diagnostic clusters was generated in this study. The highest possible DCS was 120 for patients <65 and 135 for patients ≥65.

Matching was achieved through a 2-stage process. Fracture patients and controls were first matched 1:10 based on exact age, gender, and region. Subsequently, the controls were assigned the same index date as that of their matched fracture patient. The controls were required to be continuously enrolled 6 months prior to and 12 months after the acquired index date. DCS was calculated from the claims during the 6-month pre-period. A 1:1 matching was performed to pair fracture patients with controls within ±3 DCS.

Outcomes

The outcome of this study was the incremental healthcare costs associated with hip, vertebral, and NHNV fractures during the first year following the fracture. A 12 month period was chosen because fractures, especially in the elderly, can have long-term effects and treatments, such as rehabilitation and physical therapy, which can extend beyond 3 to 6 months. Total healthcare costs were assessed separately for the fracture and the control cohorts. The difference in healthcare cost between the comparison cohorts served as an estimate of the incremental cost associated with fracture. Costs were also categorized into inpatient, outpatient, and pharmacy expenses to depict the care setting of fracture-related expenditures. Outpatient expenses included physician visits and other services rendered in the outpatient setting.

A generalized linear model with the variance proportional to the mean and a log link was used to estimate total incremental healthcare cost associated with fracture, adjusting for differences in the DCS and pre-period medical expenditures. Additionally, fracture-associated confounding conditions, such as endocrine disease, cancer, alcoholism, and rheumatoid arthritis were included in the multivariate models where significant differences were detected between groups. Due to differences in fracture type and age group, confounding conditions varied for the 6 models, as shown in Table 2.

Cost was defined as the total net payment from paid and adjudicated claims, including payment by both health plans and patients. All costs were inflated to 2006 dollars by multiplying each year's cost by the Medical Care Consumer Price Index. Costs for services provided under capitation insurance coverage were estimated from encounter records using fee-for-service equivalents defined by procedure code and region.