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Cost of Osteoporotic Fractures in Singapore

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ABSTRACT

Objectives: To estimate the 3-month direct and indirect costs associated with osteoporotic fractures from both the hospital's and patient's perspectives in Singapore and to compare the cost between acute and prevalent osteoporotic fractures. **Methods:** Resource use and expenditure data were collected using interviewer-administered questionnaires at baseline and at a 3-month follow-up between July 2013 and January 2014. Estimated osteoporotic fracture–related costs included hospitalizations, accident and emergency room visits, outpatient physician visits, laboratory tests, medications, transportation, health care and community services, special equipment and home/car modifications, and productivity loss. **Results:** A total of 67 patients agreed to participate, giving a response rate of 64.4%. The mean (median) 3-month direct medical cost from the hospital's perspective was found to be SGD 3,886.90 (SGD 413.10), of which 74.2% was accounted for by inpatient services, 25.2% by outpatient services, and 0.6% by accident and emergency services. Moreover, considerable variation (SD = SGD 2,615.40) was observed in the costs of outpatient rehabilitation services. Findings were similar when the patient's perspective was taken. The total costs, with both direct and indirect costs included, were SGD 11,438.70 (acute) and SGD 1,015.40 (prevalent), of which 34.7% and 8.0%, respectively, were accounted for by inpatient services. **Conclusions:** Hospitalization was associated with the highest cost borne by both the hospital and the patient, and informal care dominated indirect costs. Better knowledge of the financial consequences of fragility fractures could enable proactive and preventive measures to be undertaken, especially at sites of care with high cost drivers.

Keywords: cost analysis, cost of disease, cost of illness, economic burden, osteoporosis, osteoporotic fracture.

Introduction

Osteoporosis is a bone condition closely related to advancing age that is characterized by reduced bone mass and microarchitectural deterioration of bone tissue with a consequent increase in bone fragility and susceptibility to fractures [1–3]. It is considered to be a serious public health concern, with an estimated 200 million people worldwide suffering from this disease [4]. Osteoporosis-related fractures are associated with a high degree of morbidity and mortality [5]. The average risk that a person older than 50 years will experience osteoporotic fracture has been estimated at 40% to 50% for women and at 13% to 22% for men [6]. In 2000, 9 million osteoporotic fractures occurred worldwide, including 1.6 million hip fractures, 1.7 million forearm fractures, and 1.4 million clinical vertebral fractures [7,8]. In Singapore, hip fracture incidence rates have risen 1.5-fold for men and 5-fold for women since the 1960s. In addition, the age-adjusted hip fracture rate among women older than 50 years is about 402 per 100,000 females, and this rate is now among the highest in Asia [9–11].

An osteoporotic fracture is a chronic condition and is one of the most common causes of disability, incurring substantial costs in many regions of the world. The annual costs of all osteoporotic fractures have been estimated to be US $20 billion in the United States [12], €30 billion in the European Union [13], and A$1.8 billion in Australia [14]. In addition, a study conducted in Singapore in 2001 estimated the mean hospitalization cost for patients with hip fractures treated surgically to be SGD 10,515 [15].

By 2050, the percentage of the population aged 60 years and older in Singapore is projected to increase to 38% [16]. With this aging population, the number of hip fractures per year is projected to increase from 1300 in 1998 to 9000 by 2050 [10]. Despite the large number of people affected by osteoporosis, no previous study in Singapore has compared the costs of acute osteoporotic fractures to those with prevalent ones or examined their indirect costs. It is the right time to estimate various costs of osteoporotic fractures to help decision makers to develop interventions that may potentially result in financial savings.

The aim of the present study was to identify the total direct and indirect costs of osteoporotic fractures in Singapore from both the hospital's and the patient's perspectives and also compare the costs between acute and prevalent osteoporotic fractures.

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

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Methods

Study Design

This study adopted a prevalence-based approach and a bottom-up method to estimate different cost components. The prevalence approach can yield more precise estimates because it ascertains the current economic burden of a disease rather than projected ones [17]. The perspective of the National University Hospital (NUH) and that of the patients were taken in this study. This study was approved by the National Healthcare Group Domain-Specific Review Board.

Data Collection

A prospective observational study of patients with osteoporotic fractures was conducted from late July 2013 to January 2014 at the NUH, which is a 997-bed public tertiary hospital that served more than 670,000 outpatients and 59,000 inpatients in 2010 [18].

Data regarding resource use were collected using interviewer-administered questionnaires at baseline (i.e., the date of interview) and at a 3-month follow-up to minimize recall bias. The interviews were conducted at the Department of Orthopaedics of the NUH. The questionnaires used for data collection were adapted from existing instruments developed by the collaborating NUH rheumatologist and the author of a previous cost-of-illness (COI) study conducted in Singapore. Either the English or the Chinese version of the questionnaire was administered, depending on the patient's preference. At baseline, patients' demographic characteristics, clinical characteristics, and resources used for that particular visit were obtained. Patients were then asked, for the next 3 months, to take note week by week of all fracture-related physician visits, receipts, or bills they had. At the 3-month follow-up, the resource use since the last visit was collected. If a face-to-face interview was not feasible at the follow-up, a telephone interview was conducted instead. In circumstances in which the patient was unable to respond to the questions accurately, the questionnaires were given to a "proxy responder" (i.e., a person in close contact with the patient).

Patient Selection

To be included in the study, patients were required to have a bone mineral density scan or relevant x-ray examinations to ensure that their fractures were low-trauma (i.e., sustained from standing height or less). In addition, the patients needed to fulfill the following criteria: 1) they were older than 50 years; 2) they had a fragility fracture of the vertebral column, hip, humerus, wrist, or other bone (excluding the skull and bones distal to the ankles and wrists); and 3) they were able to ambulate with or without aid before fall (i.e., not wheelchair- or bed-bound). Eligible patients were identified at their visits to the Department of Orthopaedics (inpatient ward and outpatient specialist clinics), the Accident and Emergency (A&E) Department, or other relevant clinics. This was an institutional review board–approved study and written informed consent was obtained from each patient.

After a fracture occurs, there is an acute incident phase and a prevalent fracture phase. Patients were categorized as being in the acute phase if the fracture first occurred 4 weeks or less before the interview, whereas patients who had had their present fracture for more than 1 year were considered prevalent. Patients with a pathological fracture due to metastasis or those seeking care for multiple fractures at the same visit were excluded. Patients with apparent cognitive impairment that could prevent them from answering the questions accurately were also excluded.

Estimation of Direct Medical Costs

Singapore provides all its citizens with health care coverage, and the amount of coverage is determined by patient age, citizenship, income, and disability. The three tiers of coverage are government subsidies, Medisave, and MediShield. The government subsidies tier covers up to 80% of a patient's bill in an acute public hospital and up to 50% in specialist clinics. Medisave is a compulsory medical savings account for individuals, from which citizens can make co-payments for their treatments, whereas MediShield is a basic health insurance plan [19].

Direct medical cost was classified as one of three types of service: inpatient hospitalization, A&E services, and ambulatory outpatient care, the last of which included physician visits, laboratory tests, rehabilitations, and medications. The total costs were estimated using the total before-subsidy and after-subsidy charges, which are the total medical charges before and after any deductions that resulted from general government subsidies, respectively.

Costs of inpatient care and A&E services were estimated by the total charge, which was determined by the length of stay and the resources used. A&E visits that resulted in hospitalization were included as a part of the inpatient costs. In outpatient care cost calculation, physician visits included visits to primary care clinics (polyclinics) and specialist outpatient clinics (hospitals), whereas laboratory tests included x-rays, magnetic resonance imaging, bone mineral density, and blood tests. Rehabilitation costs that required admission to the community hospital were also included in the cost estimation. A standardized rate obtained from the pharmacy was used as the unit price of osteoporosis-related prescription medications (Table 1). Medication costs were estimated by multiplying the number of medications prescribed by the unit price of each medication. The expenditures on nonprescription medications such as vitamins or supplements were estimated on the basis of the receipts provided by the patients.

Estimation of Direct Nonmedical Costs

Direct nonmedical costs consisted of costs for transportation, health care, and community services as well as special equipment and home/car modifications. Health care and community services included, but were not limited to, massage therapy, acupuncture, traditional Chinese medicine, meal delivery, domestic helpers, and community private nursing. Special equipment and home/car modifications included bathroom equipment

Table 1 – Osteoporosis-related prescription medications.

Drug	Brand name
Alendronate	Fosamax 10 mg® Fosamax 70 mg®
Denosumab	Prolia 60 mg®
Risedronate	Actonel 35 mg®
Strontium ranelate	Protelos 2 g®
Teriparatide	Forteo 20 mcg®
Zoledronate	Aclasta 5 mg® Zometa 5 mg®
Calcitonin (nasal spray)	Calcitonin Novartis Nasal Spray®
Calcium carbonate (450 mg) + vitamin D (200 IU)	Nonspecific
Vitamin D_3 (1,000/5,000 IU)	Lynae®
Ergocalciferol (1.25 mg) + vitamin D (50,000 IU)	Nonspecific

IU, international unit.