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Clinical burden and incremental cost of fractures in postmenopausal women in the United Kingdom

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ABSTRACT

This cohort study of postmenopausal women in the United Kingdom aged ≥50 years determined the incremental cost of health care and clinical outcomes in the 12 months following incident, selected fractures (non-vertebral non-hip [NVNHF], vertebral [VF] and multiple [MF]). Incremental costs and outcomes of the fracture cohorts were compared with those of cohorts comprised of women without fractures who were individually matched on age and comorbidity. Cohorts were identified from The Health Improvement Network database, a primary health care database, from 2001 to 2005. We estimated 1-year incremental costs (hospitalizations; general practice, accident/emergency, and referral visits; and prescription medications) associated with each fracture type. Descriptive analyses examined occurrence of subsequent fractures and death. No long-term health care costs or outcomes were assessed. Overall, 14,030 women had NVNHF, 1471 had VF, and 193 had MF. The risk of death was greater for women with fractures than for women in the non-fracture cohorts. Mean incremental cost for fractures compared with no fractures was £1152 for VF; £690 for NVNHF, and £2581 for MF. Of the total incremental cost, hospitalizations represented 54%–90% and medications represented 7%–29%. In all fracture cohorts, most of the total annual costs were concentrated in the 6 months after the date of fracture. Fractures among postmenopausal women represent an important burden to the health system due to the increase in health resource utilization and related costs. In this study, hospitalizations were the main driver of the overall incremental cost during the 12 months following the fracture. Mortality in women in the selected fracture cohorts was higher than in women in the non-fracture cohorts.

Introduction

Osteoporosis-related fractures, also known as fragility fractures, are a major cause of morbidity in the elderly and place a large medical and economic burden on the health care system [1]. The annual number of osteoporotic fractures is expected to increase due to the rapid growth rate of the elderly population worldwide [1]. The incidence of fractures is known to increase steadily with age in postmenopausal women due to the rapid bone loss associated with the decrease in circulating estrogens that characterizes menopause. In the United Kingdom (UK) the lifetime risk of any fragility fracture in women at the age of 50 years has been estimated to be 53% [2]. This lifetime estimate is over two times higher than the lifetime risk in men at the same age, meaning that in the UK one in two women and one in five men who are 50 years of age will have an osteoporotic fracture in their remaining lifetime [2].

The majority of studies evaluating the burden of osteoporosis-related fractures have focused on hip and vertebral fractures. However, the effect of osteoporosis on the skeleton is systemic. Large prospective studies have shown that almost all types of fracture are increased in people with low bone density and, irrespective of the type of fracture, adults who sustain a fracture are 50%–100% more likely to have another fracture of a different type [3–6]. For example, vertebral fractures, a major source of morbidity and mortality among the elderly female population, are strong predictors of further osteoporotic fractures, including hip fractures [6,7].

Abbreviations: CCI, Charlson Comorbidity Index; CI, confidence interval; GP, general practitioner; MD, difference between means; MF, multiple fracture; NA, not applicable; NHS, National Health Service; NVNH, non-vertebral non-hip; NVNHF, non-vertebral non-hip fracture; RR, relative risk; SD, standard deviation; THIN, The Health Improvement Network; UK, United Kingdom; VF, vertebral fracture.

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Studies evaluating the clinical and economic burden of osteoporotic fractures, other than hip fractures, in populations of postmenopausal women are needed to help assess the impact of these fractures on the overall health status of women and the associated utilization of health care resources, including the impact on different cost components (i.e., hospitalization, outpatient care, medications, disability, and premature death). Such studies will improve the understanding of the clinical and societal costs of osteoporotic fractures.

The work presented here is part of a larger project that assessed the clinical and economic burden of various types of fractures among postmenopausal women aged 50 years or older in a UK general population setting. In the absence of availability of data on bone mineral density, the fracture types selected included those known to be most commonly associated with osteoporosis among postmenopausal women. The results of the analyses of the hip fracture cohort have been published [8]. The goal of the study was to determine the incremental cost of care associated with the clinical consequences and health care resource utilization of specific fracture types in the study population. This paper presents the analysis and results associated with non-vertebral non-hip (NVNH), vertebral, and multiple fractures.

Methods

Study design and source population

In this retrospective cohort study, we identified three fracture-specific cohorts of women (NVNH, vertebral, and multiple fractures) and corresponding age- and comorbidity-matched non-fracture cohorts from a population of postmenopausal women (aged 50 years or older) registered with a general practitioner (GP) and with health information accessible through The Health Improvement Network (THIN) research database. The THIN database is a longitudinal primary care database of computerized GP medical records that has been used extensively for research purposes and which contains diagnostic and prescribing information recorded by GPs as part of their routine clinical practice. Data are recorded using READ codes, which consist of a hierarchically arranged comprehensive list of clinical terms to describe the care and treatment of patients in general practice. In the UK, GPs are responsible for primary health care and referrals to specialists. The population registered in the THIN database represents nearly 4% of the general population in the UK, and studies have reported on the validity of THIN data [9,10]. Approval for this study was obtained from the South East Multi-centre Research Ethics Committee in accordance with THIN requirements. All data supplied by THIN were anonymized, with the identities of patients and practices fully protected. The data accrued included demographic information, GP visits, prescription details, referrals to specialist care, accident and emergency (A&E) visits, hospital admissions, and clinical events of interest.

Study population

The study population consisted of all women aged 50 years or older who had a minimum of 12 months of continuous enrollment in THIN and who were registered at one of the THIN practices during the study period from January 1, 2001, through December 31, 2005.

Study cohorts

The fracture-specific cohorts consisted of all eligible women in the study population with a first recorded diagnosis for a closed fracture (i.e., fracture in which the broken bones do not pierce the skin) of interest, with continuous enrollment in their THIN practice for at least 12 months prior to the date of fracture, and who had not had a fracture of any type during the 12 months before the date of the fracture of interest (index date). This first incident fracture was considered to be the index fracture. The selection of the fractures for evaluation focused on those known to be associated with low bone mass and osteoporosis but confirmation of diagnoses of osteoporosis was not within the scope of the study. Two fracture-specific cohorts, NVNH and vertebral, were identified and defined by READ codes compatible with the diagnosis of the specific fracture type. Vertebral fractures are known to be underdiagnosed in the UK general practice and most patients with vertebral fractures remain undetected [11]. Therefore in this study, the vertebral fracture cohort consisted of women with a recorded diagnosis of a vertebral fracture, thus including clinical (e.g., vertebral fractures that receive clinical attention) or radiological confirmed-fractures and referred to hereafter as "symptomatic." The NVNH fracture cohort included fractures of the clavicle, arm, humerus, elbow, wrist/forearm (radius, ulna), pelvis, and leg (distal femur, tibia, and/or fibula). A third cohort, the multiple fractures cohort, consisted of women who had two or more fractures occurring on the same date and who were included in at least two of the following fracture-specific cohorts: NVNH, vertebral, or hip (reported separately in Gutierrez et al. [8]).

For a given fracture-specific case, the matched control (to be included in the non-fracture cohort) was identified from all eligible women in the study population that had continuous enrollment in their THIN practice for at least 12 months prior to the calendar index date of the fracture-specific case. As in the fracture cohorts, women in the non-fracture cohorts were required to be free of any fracture during the 12 months prior to the index date (the "pre-index period"). Previous history of fractures prior to the pre-index period was determined by examining records of cohort members for the time from enrollment in the THIN practice to the pre-index period (the "lookback period").

However, if a woman in a non-fracture cohort developed a fracture during follow-up, she was allowed to become eligible for the fracture-specific cohort (depending on the type of fracture sustained) but her time contribution to the non-fracture cohort of origin was censored one day prior to the date of the fracture. A matched control that met the matching criteria was then assigned to this woman. The follow-up start date for each fracture-specific case and her corresponding matched control was the same calendar date. The matched controls for the multiple fractures cohort were maintained according to the original matching in the cohort.

Matching and assessment of comorbidity

For each woman in each fracture-specific cohort, one matched control woman without fractures (non-fracture control) was identified from the eligible population of women at the index date of the woman in the fracture cohort. Matching of women in the non-fracture cohorts to women in the NVNH, vertebral, and multiple fractures cohorts was based upon age (± 2 years), THIN practice, and comorbidity score. Matching also accounted for the time from THIN enrollment (± 2 years) to the index date, to enable periods of comorbidity ascertainment to be of similar duration across the study cohorts. The Charlson Comorbidity Index (CCI) score was used to ensure a similar burden of baseline comorbidities of women across the study cohorts [12]. The analyses were performed by weighting patient comorbidity profiles using Charlson's suggested weights, and matching was accomplished according to CCI score groups, i.e., CCI = 0, CCI = 1 or 2, CCI = 3 to 5, and CCI = 6 or higher.

Health care utilization and clinical outcomes

To derive cost estimates associated with health care resource utilization, we evaluated data on the frequency of hospitalizations, A&E visits, GP visits, referrals to specialists, and prescription of medications (regardless of the underlying reason for health care resource use), separately for the fracture and the non-fracture cohorts. The evaluation of clinical endpoints included the occurrence of subsequent fractures and deaths. Subsequent fractures in each of the fracture cohorts were defined as a diagnosis of any bone fracture at sites distinct from the index fracture