Economic burden of osteoporosis in women: data from the 2008 French hospital database (PMSI)

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Abstract

Objectives

To estimate the number and costs of hospitalisations associated with osteoporosis in France.

Methods

Data for women aged 50 years and over were extracted from the 2008 French Hospital National Database. Criteria for acute care were established according to ICD-10 codes related to osteoporosis. As coding rules are not systematically used, an additional extraction which included surgical stays for hip fractures was performed in order to be more exhaustive. The two datasets were merged and duplicate stays excluded. Among women hospitalised in acute care during 2008, we selected those progressing to rehabilitation care within the year. We assessed the numbers of hospitalisations and women, proportion of surgical management, length of stay in acute care and numbers of rehabilitation days and costs. Hospital costs were calculated according to the National Hospital Tariff and National Scale of Costs, respectively, for acute and rehabilitation care based on 2009 tariffs.

Results

There were 67.807 hospitalisations (64.793 patients) associated with osteoporosis; 83% of total hospitalisations were in patients aged ≥75 years. A total of 80% of hospitalisations were associated with surgical management of fractures and 31.458 patients (49%) progressed from hospitalisation to rehabilitation. The mean ±SD length of stay was 12±8 days for hospitalisation and 43±31 days for rehabilitation care. The overall cost of hospitalisations was €415.4 million, of which 4.2% was related to medical devices. The overall cost of rehabilitation was €331.8 million.

Conclusion

In 2008, postmenopausal osteoporosis was associated with a substantial economic burden at hospital in France.

Key words

osteoporosis, women, France, hospitalisation, economic burden

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Introduction

Osteoporosis is recognised by the World Health Organisation as an important musculoskeletal disease. Literature is increasingly available on the burden of this disease throughout the world. These data are helpful for improved organisation and financial planning and for international comparison and for the validation of fracture risk assessment at the patient level (1-2). According to the level of available information, many countries have tried to evaluate not only the burden of hip fracture, recognised as one of the most disabling fractures seen in osteoporosis, but also of osteoporosis in general. For the year 2000, the worldwide burden of osteoporotic fractures was estimated to be 9 million cases (16% vertebral, 18% hip, 19% forearm) (3). Thirty-five percent of cases occurred in Europe (3). Some countries have evaluated the burden of osteoporosis either in terms of fracture events (4-5) or costs (6) or both (7-12). A recent paper summarised the epidemiology of osteoporosis-related fractures in France, using a variety of sources (13), highlighting the underestimation of some fractures, *i.e.* vertebral and non-hip non-vertebral. Information is available from the national hospital database on the burden of hip (9, 14-17), forearm (18) and wrist fractures (16, 18) in the acute care setting. However, no publication has been available of a similar analysis of hospitalisations encoded for osteoporosis, whether associated with fracture or not, in acute and rehabilitation care. In this article, we describe the burden of postmenopausal osteoporosis with or without fracture, managed in acute and rehabilitation care, using data from the 2008 French Hospital National database (the Programme de médicalisation du système d'information [PMSI]).

Methods

PMSI database

The PMSI database includes the data of overall hospitalisations, in particular for acute and rehabilitation care, that occur in public and private hospitals. These data contain administrative information, such as gender, age and type of discharge, and medical information including diagnosis and procedures encoded with the ICD-10 codes and the French Common Classification of Medical Procedures, respectively, according to the French rules of coding. In French law, the database of each hospital must be complete and accurate for the hospital to receive financial support, especially in acute care based on disease-related group (DRG). In addition, especially in acute care, the hospital-declared consumption of some medications and medical devices defined in a specific list is reviewed regularly to further reimbursement. The data from acute care, rehabilitation care and medications and medical devices can be merged using the anonymous unique personal identification number assigned to each patient. Our objective is to assess the economic burden of osteoporosis in hospitalised women using the PMSI database.

Data from acute care

Our first approach was to identify all hospitalisations for osteoporosis in the database, using the ICD-10 codes related to osteoporosis. However, ICD-10 codes for osteoporosis are not systematically used to code a hospitalisation for osteoporosis, especially when a fracture has occurred. We found that if a fracture occurred, whatever the type of trauma, the code mainly used to record the fracture began with an "S", indicating a traumatic event. The correct procedure of coding for osteoporosis (fracture occurred without or with minor trauma) would be the ICD-10 codes beginning M80 and using the 5th digit to provide information about the location of the fracture. In France, hip fracture is considered the most disabling osteoporosis-related fracture and the major indicator of follow-up for this disease (19, 20). Consequently, we performed a second data extraction focusing on hip fracture, the most disabling osteoporotic fracture, in order to be more exhaustive in estimating the economic burden of osteoporosis.

For the first extraction, inclusion criteria were established according to ICD-10 codes related to osteoporosis with or without any type of fracture (M80.-, M81.-: postmenopausal, pos-

tovariectomy, or not specified). We included hospitalisations of women aged 50 years and over where osteoporosis was encoded as the primary, related or associated diagnosis (n=74.871 hospitalisations). For hospitalisations with osteoporosis encoded as the associated diagnosis, we included cases where the primary diagnosis was dorsalgia, dorsopathy, or fractures other than skull, cervical vertebra, fingers or toes. We excluded all stays associated with chemotherapy. This gave 19.461 hospitalisations for further analysis, representing 26% of the initial selection.

In the second extraction, we selected hospitalisations for surgical management of hip fractures in women aged 50 years and over, as described previously (17), and extracted 50.848 hospitalisations.

The two sets of extracted data were merged and duplicate hospitalisations excluded (n=2.502). The number of hospitalisations used for the analysis was 67.807 (Fig. 1).

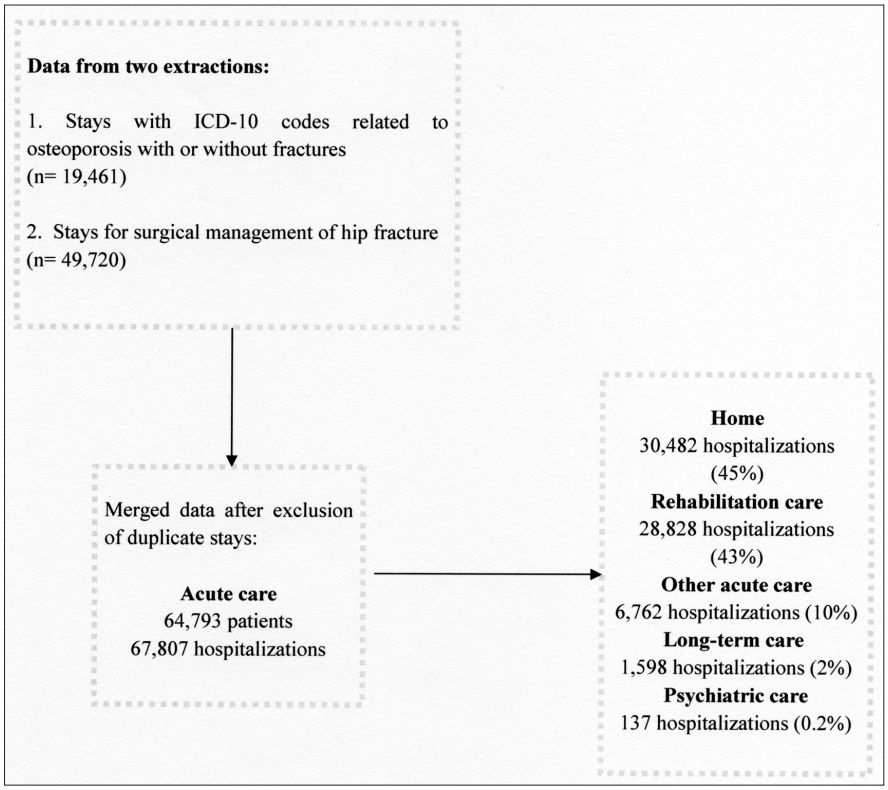

Fig. 1. Patient selection and trajectory at the end of initial acute care for osteoporosis.

Data for rehabilitation care

Data were extracted from the 2008 French Hospital National Database for rehabilitation care. Among all women hospitalised in acute care in the previous selection, we included those who went into rehabilitation care during the same calendar year, where osteoporosis was encoded as the reason for care. We counted 289.908 weeks. Osteoporosis was the reason for 77% of them (223.178 weeks).

Hospital costs

All hospital costs were included, irrespective of the type of reimbursement by social security. All costs are given in year 2009 Euros (€) from a hospital perspective. The French consumer price index was used to adjust costs where needed (21). 2009€ values were used as these were the most recent tariff available at the time of analysis.

For acute care, we used the 2009 public and private French hospital tariff per DRG (22). For private acute care, the private French hospital tariff did not include the doctors' honoraria, which were added using the national common cost scale per DRG (Echelle Nationale Commune des Coûts) (23). In addition, we included the medical device costs used for surgical management of hip fracture declared by each hospital according to the 2009 responsibility tariff, including VAT according to the rule of declaration. As the cost data for medical devices (*i.e.* hip replacement) were only available from public hospitals, we decided to apply them to private admissions that mentioned a hip replacement. As we observed that this cost increased with age, we calculated the mean prices per device for 5-year age groups (50–55, 55–60, 60–65, 65–70, 70–75 years) and for patients older than 75 years. The mean public hospital medical device costs for the corresponding age groups were added to the cost of hip replacement with hospitalisation in private hospitals.

As the French hospital tariff for rehabilitation care was not available, we used the 2000–2001 National Scale of Costs (24).

Statistics

For acute and rehabilitation care, we describe the patients' characteristics (mean age, number of patients in different age classes: 50–59, 60–74,75–84, ≥85 years; the percentage of some comorbid conditions encoded as secondary diagnoses and described in Table I), and information concerning hospitalisations (number of hospitalisations in acute care and days spent in rehabilitation care, length of stay expressed as the mean ± standard deviation, SD, part of the hospitalisation due to surgical management in acute care, or occurring in public care).

Costs were adjusted to 2009€ values. Hospital costs were also analysed for all the studied population and in the different age classes (overall, mean ±SD).

Data extraction and statistics were performed by HEVA, Lyon, France (BJ, AV).

Results

Patients and hospitalisations

Table I shows the main results of the analysis. A total of 64.793 women with a mean age of 82.5±9.5 years were hospitalised in acute care with an osteoporosis diagnosis in 2008. We counted 67.807 hospitalisations with a mean duration of 12±8 days for these women. About 83% (53.727/64.793) of the

Table I. Burden of postmenopausal osteoporosis.

	Acute care	Rehabilitation care immediately or after initial acute care
Patients' characteristics		
Number of patients	64.793	31.458
Mean age ± SD, years	82.5±9.5	83.5±8.2
Age classes: %		
50–59 years	4	2
60–74 years	14	11
75–84 years	38	42
85 years and over	45	46
Comorbid conditions (ICD-10 codes): n (%)		
Hypertension with cardiac complication or not (I1-)	21.130 (33)	12.300 (39)
Cardiac arrhythmias (I44–I49)	7.352 (11)	4.262 (14)
Diabetes (E10–E14)	5.608 (9)	3.320 (11)
Dementia (F00–F03)	5.401 (8)	2.307 (7)
Ischaemic heart disease (I20–I25)	4.015 (6)	2.303 (7)
Heart failure (I50)	2.963 (5)	1.650 (5)
Urinary tract infection (N10, N30.0, N30.9)	2.712 (4)	1.648 (5)
Cutaneous ulcer (I83, L97, L98, L89)	1.811 (3)	1.053 (3)
Parkinson (G20–G22)	1.584 (2)	896 (3)
Renal insufficiency (N18)	1.483 (2)	840 (3)
Chronic respiratory disease (J44)	1.157 (2)	692 (2)
Connective disease (M05, M06, M3)	1.123 (2)	582 (2)
Respiratory infection (J13–J18, J20)	985 (1)	531 (2)
Thromboembolic disease (pulmonary and veins) (I26–I80)	932 (1)	559 (2)
Atherosclerosis of lower limber (I70–I74)	843 (1)	491 (2)
Hepatic disorder (K7)	375 (1)	203 (1)
Peptic ulcer (K25–K28)	309 (0.5)	178 (1)
Characteristics of hospitalisations		
Number of hospitalisations	67.807	N/A
Public care, n (% total hospitalisation)	53.194 (78%)	N/A
Surgical care, n (% total hospitalisation)	54.099 (80%)	N/A
Total number of rehabilitation days	N/A	1.359863
Length of stay ± SD, days	12±8	43±31
Hospital costs (2009€)		
Overall costs	415.429.993	331.755.797
Mean costs ± SD per stay	6.127±2.352	10.546±7.869
Age class-adjusted costs: overall (%)		
50–59 years	10.719.339 (3)	6.011.829 (2)
60–74 years	47.509.606 (11)	32.379.926 (10)
75–84 years	159.139.979 (38)	134.476.087 (41)
85 years and over	198.061.068 (48)	158.887.955 (48)
Ageclass-adjusted costs; mean ± SD		
50–59 years	4.655±2.584	9.904±9.051
60–74 years	5.415±2.925	9.426±7.631
75–84 years	6.423±2.655	10.226±7.738
85 years and over	6.384±2.228	10.886±7.836
% of costs for medical devices	6.5%	N/A

ICD: International Classification of Disease, 10th version; N/A: not applicable; SD: standard deviation.

women belong to the two last age classes (*i.e.* aged 75 years and over); this group accounted for 83% (56.186/67.807) of hospitalisations. The most frequent comorbidity was hypertension, complicated or not, which was present in 33% (21.130/64.793) of patients. A total of 78% (53.194/67.807) of the hospitalisations in acute care occurred in public hospitals and 80% (54.099/67.807) of all hospitalisations were related to surgical management.

As seen in Figure 1, the two most frequent trajectories upon discharge after initial acute care were return home and transfer to rehabilitation care.

We found that 49% (31.458/64.793) of patients managed in acute care were transferred to rehabilitation care within the same calendar year. Among these patients, 89% (27.975/31.458) underwent prior surgical management. As observed in acute care, 87% (27.496/31.458) of the women hospitalised for rehabilitation care belonged to the last two age groups, *i.e.* aged 75 years and over. As observed for acute care, the most frequent comorbidity was hypertension, which was present in 39% of the women. The mean number of day spent in rehabilitation care was 43±31 days.

Costs

In Table I, we describe the costs for each type of care. The overall cost was €747 million. Especially in acute care, the mean cost per stay increased with age class. According to the age distribution, women aged 75 years and over accounted for 86% (€357.201.047/€415.429.993) and 88% (€293.364.042/€331.755.797) of the overall costs for hospitalisations in acute and rehabilitation care, respectively. This same group represented 88% (1.197.737/1.359.863) of the overall days spent in rehabilitation care. The rehabilitation costs after surgery represented 91% (€301.179.682/€331.755.797) of the overall rehabilitation costs.

Discussion

We assessed the economic burden of osteoporosis using database analyses, in postmenopausal women in France, using 2008 hospital data for acute and rehabilitation care with a focus on hip fractures. The major economic burden was seen in the public hospital system, especially after surgical management, and in women aged 75 years and over. Nearly half of the women went to rehabilitation care within the same calendar year as initial acute care. The burden of osteoporosis was associated with substantial costs, *i.e.* €747 million, of which 56% was due to acute care.

Comparison of our results with other studies is difficult, especially because different methodological approaches were used, *i.e.* definition of osteoporosis, source of data and economic approach. The burden of osteoporosis also varies considerably from country to country.

Investigators have used different definitions of osteoporosis. While many included only subjects with evidence of fracture known to be related to osteoporosis (4, 6, 7, 9, 10, 12), others in-

cluded subjects both with and without fractures (8, 11, 25). Hip, forearm and wrist fractures have been commonly described. To be sure that fractures were related to osteoporosis, several strategies have been followed: looking at the rate of fractures encoded for osteoporosis (10, 11, 26, 27); looking at the rate of fractures recorded under codes for transport accidents and malignancies (4); exclusion of fractures encoded for other benign (9, 12) or malignant bone diseases (9, 25); exclusion of open fractures and closed cervical and sacrum/coccyx fractures (these are more often associated with trauma than osteoporosis) (12); excluding fractures at other locations (vertebrae, trunk, face/skull, fingers and toes) (25); and taking into account whether the diagnosis of osteoporosis during the study period was in the medical records (5, 8, 25). Some authors have compared the burden of osteoporosis in patients with fracture to that in those without fracture (25).

Different data sources have been used in different studies. Indeed, some fractures were exclusively managed in hospital (hip fractures), others such as forearm or wrist fractures were managed through either in the inpatient or outpatient services. Others such as vertebral fracture cannot be fully described because of their asymptomatic expression in some cases. Data from outpatients and inpatients were easily available for some countries (8, 10, 12, 25) at national level (4, 5, 10, 11), for a part of the population only (6, 8, 9, 12, 25), or extrapolated to the whole population (7).

A direct comparison between this analysis and others is difficult as various methodologies and approaches have been used for the economic evaluation, *i.e.* perspective, type of cost, endpoints, type of analysis, source for the economic valorisation, year and monetary value, and time period. Among the many studies, two have a societal perspective (6, 10). Although all studies included inpatient medical costs, few considered outpatient costs (7, 8, 10, 12, 25) or inpatient rehabilitation costs (9, 10). Some described only the costs, others focused on the incremental cost for a fracture patient compared to a non-fracture patient with (25) or without (12) a diagnosis of osteoporosis; the estimate of excess of hospital expenditure before the index stay from those after for a patient experiencing hip fracture (9) or hip, vertebral, and non-hip non-vertebral fracture (8); or in comparison with other disease (11). The type of analyses used for these cost-of-illness studies were mainly valorisation of resource utilisation (observational data from existing databases, cohort studies) but also simulation based on a Markov model (7). Regarding the source for economic valorisation, some used a fracture cost study (6), others health-plan paid and subject paid amounts (8), or total net payment from paid and adjudicated claims by Medicare (12), actual payment to health providers from third-party payers (25), or operational costs for general hospitals per day taken from Administrative Statistics, in particular from PMSI, French Financing (9). When using these operational costs, the assumption was made that the mean length of stay was the same within a given age group, whether osteoporosis was the underlying cause or not (9, 11). The same assumption was made in our study.

In our study, hip fractures represented the majority of the hospital and rehabilitation costs. This is not surprising, given the methodological approach. In a French regional study in 2005, of the 6.019 patients with hip fractures, 36% and 55% were admitted (for any reason) to acute and rehabilitation care, respectively, within the year after the initial acute care (9). Excess hospitalisations attributable to osteoporotic fracture averaged 22.7 days (95% CI 21.7–23.7) in rehabilitation care and estimated excess costs per patient in 2005 were €5.673 (95% CI 5.419–5.928). In Slovenia, hip fractures accounted for 66% of total hospital costs, 82% of rehabilitation costs, and of a higher number of days spent in rehabilitation than the other fractures studied, *i.e.* hip, spine, and wrist (10). In Germany in 2002, the number of osteopenia- and osteoporosis-attributable hip fractures was estimated at 108.341 (78% women, 85% in people aged 70 years and over) (28). For women, these fractures were responsible for costs of €2.351 million, of which 94% was direct costs (€593 million for inpatient treatment and €43 million for rehabilitation care).

We believe that our focus on hip fractures in this study is relevant. Hip fracture has been associated not only with higher 1-year direct medical costs after hospitalisation than other fractures (vertebral and non-hip non-vertebral fractures) (8, 12), but also with a higher incremental cost than in patients without fracture (in 2006, US$ 21.423 *vs.* 9.740 in people aged 50–64 and those over 64 years) (12).

In our study, the burden is especially apparent in the elderly, with over 80% of costs incurred by women aged 75 years and over. In a Markov decision model produced in the USA in 2005, the cost of fractures in women was estimated at US$ 12.8 billion, increasing with age; 36% and 40% of the fracture costs occurred in the age groups 75–84 and ≥85 years (7). Women aged 75 years and over bore the overwhelming share of total costs (89%).

Our study has some limitations. Firstly, due to our methodology, we included mainly data from hip fracture. This allowed the exclusion of data for other fractures known to be related to osteoporosis. Our first approach based on ICD-10 code for osteoporosis only was not exhaustive enough to estimate burden of osteoporosis in women. We chose to focus on hip fractures because they all imply a hospitalisation, and can be easily linked to osteoporosis if they are not traumatic and occur in women over 50 years old. These characteristics are not met for other fractures known to be related to osteoporosis, especially vertebral and non-hip nonvertebral fractures. Secondly, our analysis focused only on inpatient data because outpatient data were not available. Thirdly, we focused only on rehabilitation care after initial acute care and rehabilitation related to osteoporosis. Other patient trajectories have not been included, such as those related to specific fractures other than of the hip and discharge towards long-term care, for example. This analysis shows a substantial economic burden of osteoporosis in women in French hospitals. The limitations indicate that this burden could be higher.

Evaluating the economic burden of osteoporosis at a country level is important for health policy decision making and financing. The relevance of the data depends on the definition of osteoporosis, and whether they are limited to fractures or not.

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