



# Updated incidence and costs of hip fractures in elderly Italian population

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## Abstract

**Purpose** We aimed at updating our previous researches about the burden of hip fractures in elderly Italian population.

**Methods** We analyzed national hospitalizations records from 2000 to 2014 to compute age- and sex-specific standardized rates.

**Results** 1,335,375 hospitalizations were recorded in people  $\geq 65$  (1,031,816 women: 77.27% and 303,559 men: 22.73%) over 15 years, passing from 73,493 in year 2000 to 94,525 in 2014, with an overall increase of 28.62% over the 15-year period (females: +25.1%; males: +41.2%). About 84.9% of total hip fractures were suffered by patients aged  $\geq 75$  years old. Direct hospitalization costs and rehabilitation costs increased from 343 to 457 million Euros and from 392 to 504 million Euros from year 2000 to 2014, respectively. Overall costs of hip fractures raised from 735 to 961 million Euros (+30.74% from 2000 to 2014).

**Conclusion** The number of hip fractures and related hospitalizations costs in Italian elderly population is still increasing due to the absolute number of fractures occurring in people  $\geq 65$  years old and particularly over 75 years old.

**Keywords** Hip fractures · Osteoporosis · Hospitalizations · Incidence · Costs

## Introduction

Life expectancy of the Italian population has constantly increased during the last 50 years, so that Italy is currently the country with the highest percentage of elderly people in the general population in the world, thus representing an

interesting case study for all industrialized countries [1]. People aged  $\geq 85$  years old are estimated to exceed 12% of the entire population by the year 2050 [1]. In this perspective, chronic and degenerative diseases including osteoporosis and fragility fractures will represent a dramatic challenge for health professionals and decision makers. Actually, the World Health Organization considers osteoporosis to be second only to cardiovascular diseases as a critical health problem [1]. In our previous studies, we have shown that incidence and costs of hip fractures in Italy are already comparable to those of acute myocardial infarctions, with costs per patient having been computed at € 13,500 [2], thus confirming the very high burden of these fractures in terms of expenditures [3].

Hip fractures, the most catastrophic complication of osteoporosis, result in significant 1-month and 1-year mortality (5% and 20%, respectively) [4]. Furthermore, 30% of patients are estimated to become permanently disabled, while 40% of them lose the ability to walk independently, and 80% are unable to perform independently activities of daily living after the fracture has occurred [4].

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The correct perception of the epidemiological picture of fragility fractures and their impact on the population over 65 of age is essential. Actually, information about fracture incidence allows institutions to understand the importance of planning large-scale prevention initiatives and to identify the target population who need to be treated.

In our previous researches, we have already provided some pictures about the burden of hip fractures in Italy between the years 2000 and 2005 [2, 5–7]. More recently, in our study carried out with Kanis et al. Italy has been classified as belonging to the group of nations with the highest incidence of hip fractures, with rates per 100,000 being > 300 for women and > 150 for men, respectively [8]. However, in some countries a decreasing trend in the number of hip fractures in elderly people has been observed [9]. Also in Italy, our researches have documented for the first time a decreasing trend in the incidence of hip fractures from 2000 to 2009 in women aged 65–74 based on hospitalization records [10]. The aim of this new work was to provide an updating of these incidence data and related costs.

## Materials and methods

Information concerning all hospitalizations occurring in Italy are registered in hospital discharge records, which are collected at central level by the Italian Ministry of Health (National Hospitalization Database, SDO). This information is anonymous and includes the patient's age, sex and diagnosis. The present manuscript focuses on the number of hospitalizations due to femoral neck fractures in Italy from year 2000 to 2014. We assumed that almost all hip fractures occurred in the elderly resulted in hospital admissions, as confirmed by a previous study on this specific topic [10]. Population data were obtained from the National Institute for Statistics (ISTAT) for each year [1]. Hip fractures were defined by the following ICD-9CM major diagnosis codes: 820.0 (femoral neck fractures), 820.2 (per-trochanteric femoral fractures), 820.8 (other femoral neck fracture). Data were stratified by gender and into age groups (65–74, 75–84, and  $\geq 85$  years) to specifically evaluate the incidence of hip fragility fractures in the oldest people. Data were processed using Stata (StataCorp, College Station, USA) and Excel (Microsoft, Redmond, USA) softwares. We performed descriptive statistical analyses of the incidence in each gender and age subgroup also by region, across the 8 examined years. The incidence of hospitalization due to hip fractures per 10000 inhabitants has also been computed.

Hip fractures in patients aged 45–64 represented about 8% of all fractures and were excluded from the analysis as

conservatively considered as unlikely to be osteoporotic. We performed descriptive statistical analyses of the incidence in each gender and age subgroup across the 6 examined years. Analyses of direct costs were based on the costs ascribed to diagnosis-related groups (DRGs), according to the Ministerial Decree DM 549 of 30 June 1997. This law defined the national DRG rate list adopted during the 6 years examined in our study, whose values have been only slightly revised after 2005. However, the Italian system allows each region to drop the DRG value at the local level and the average reduction adopted is about 15%. Therefore, in the present analysis, we used the 1997 DRG rates reduced by 15% to be more conservative. DRGs considered relevant to hip fractures were: 209 (surgical procedures on major joints and hip replacement), 210–211 (hip and femur surgery) and 235–236 (hip, femur or pelvis fractures). Because not all patients assigned these DRGs had a main diagnosis of hip fracture (i.e., osteoarthritis accounts for a substantial number of hip replacements), we asked the Ministry of Health to determine the percentage of costs due to hip fracture for each DRG. The analysis was performed for patients living in Lazio (including Rome), a region with 5.3 million inhabitants, with an aging index comparable to the national average [1] and a number of large hospital and orthopaedic centres. The information provided by the Ministry of Health was consistent with the findings we obtained on a smaller sample of almost 1 million people assisted by the local health authority of Lecce [11]. According to this analysis performed by the Ministry of Health, 30% of costs ascribed to DRG 209 and 80% of costs ascribed to DRGs 210, 211, plus 100% of DRGs 235 and 236 were attributable to a main diagnosis of hip fracture. We considered these rates to represent the weight of hip fracture-related costs for each DRG. The analysis of direct costs was conducted assuming that the length of hospitalization for hip fractures did not exceed the average values calculated in the DRG rates. Table 1 resumes the cost parameters considered for DRGs analysis.

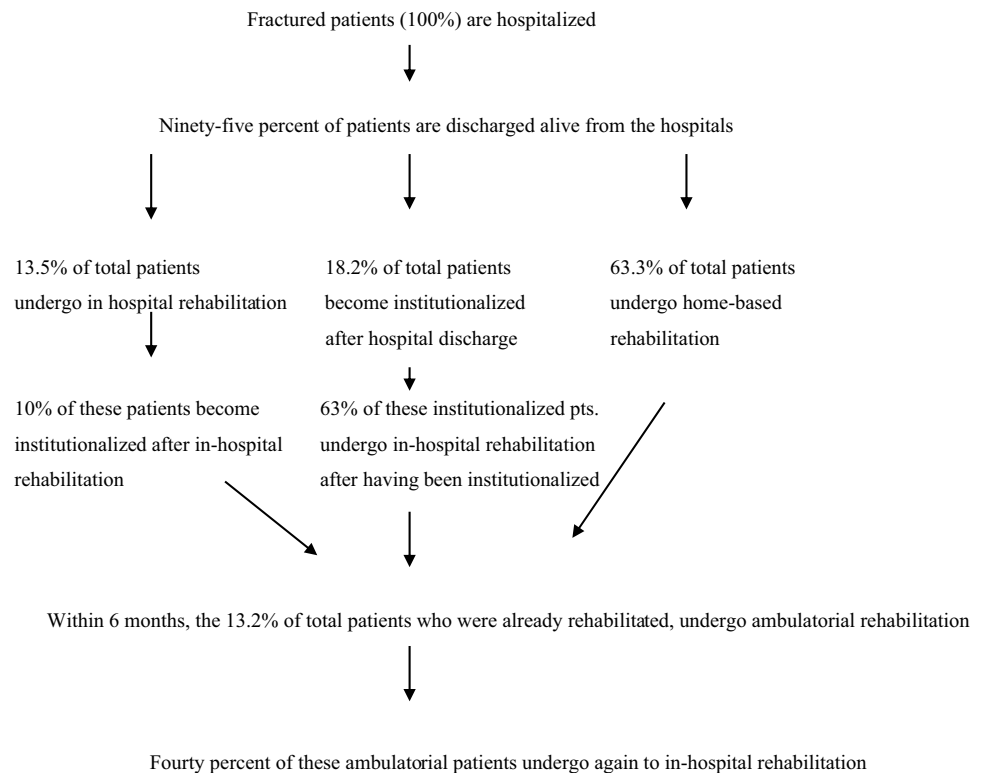
**Table 1** Cost parameters used in DRGs analysis

DRGs	DRG rate (Euros)	Max hospitalization length (days)
DRG 209	7.97978	42
DRG 210	7.58210	62
DRG 211	4.26490	37
DRG 235	3.87549	50
DRG 236	3.89409	51

Although our study intended to focus on hospitalization costs, because they could be more accurately measured thanks to the availability of institutional databases (i.e., hospitalization records), we have also provided a detailed estimation of rehabilitation costs following hip fractures, as they are supposed to be at least comparable to the costs directly related to hospitalization [2]. This secondary cost analysis was carried out according to the most recently published Italian data and official rate lists (Fig. 1). First of all, we assumed that 5% of patients currently die few days after the fracture (acute mortality rate) [2, 12]. Among the patients who survive (95% of people hospitalized), 13.5% begin immediately 1 month in-hospital intensive rehabilitation programs (average cost: 6600 Euros per subject) [13, 14]. At the end of this in-hospital intensive rehabilitative period, 10% of these patients move to long-term facilities after leaving the hospital (average yearly cost: 9920 Euros per patient) [13, 14]. We have then to consider that 18.2% of the subjects who survived (namely 95% of people hospitalized) become directly institutionalized because of the hip fracture (9920 Euros per patient) [14], and that 63% of these

people immediately treated in nursing homes undergo in-hospital rehabilitation (6600 Euros per patient) [2, 14] at the end of the institutionalization period [2, 14]. All the remaining patients (63.3% of patients discharged alive from the hospital) enter the home-based rehabilitation program provided by the Italian Local Health Authorities, which consists in a 3 months therapeutical cycle (2304 Euros per patient, according to the Regional healthcare services rate lists and to the Italian Society of Rehabilitative Medicine, SIMFER) [2, 14]. Furthermore, within 6 months from their hospitalization, 13.2% of the overall fractured people discharged alive from the hospital are treated at ambulatories ruled by the Local Health Authorities (1767 Euros per patient) [2, 13], after having completed other kinds of rehabilitative programs (both home-based or in-hospital and nursing homes rehabilitation), but 40% of these patients treated at ambulatorial level need to be hospitalized once again to undergo in-hospital rehabilitation (6600 Euros per patient) [2, 14]. Social costs, indirect costs and those related to the loss of productivity of patients and their relatives were not computed in this study.

**Fig. 1** Flow chart showing the percentages used for the different rehabilitative outcomes of fractured patients



**Table 2** Number of hospitalizations following hip fractures in Italy in patients  $\geq 65$  years old, by age categories and sex between the years 2000 and 2014

Age group	2000		2001		2002		2003		2004		2005		2006			
	M	F	M	F	M	F	M	F	M	F	M	F	M	F		
65–74	3 611	9 589	3 716	9 618	3 715	9 879	4 107	10 903	4 518	11 455	4 369	11 300	3 716	9 043		
$\geq 75$	12 426	47 867	13 153	51 867	13 582	53 628	15 613	59 173	15 345	59 426	16 540	62 262	15 792	57 603		
Subtotal	16 037	57 456	16 869	61 485	17 297	63 507	19 720	70 076	19 872	70 881	20 909	73 562	19 508	66 646		
$\geq 65$	73,493		78,354		80,804		89,796		90,753		94,471		86,154			
Age group	2007		2008		2009		2010		2011		2012		2013		2014	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
65–74	3 822	9 574	3 763	9 681	3 800	9 357	3 674	8 976	3 609	8 716	3 609	8 909	3 556	8 975	3 550	8 718
$\geq 75$	16 232	59 973	17 334	61 754	17 545	62,467	18 146	61 753	18 341	61 067	18 530	62 277	18 743	62 842	19 093	63 164
Subtotal	20 054	69 547	21 097	71 435	21 345	71 824	21 820	70 729	21 950	69,783	22 139	71 186	22 299	71 817	22 643	71 882
$\geq 65$	89 601		92 532		93 169		92 549		91 733		93 325		94 116		94 525	

## Results

Tables 2, 3, and Fig. 2 show the annual number of hospitalizations and standardized hospitalization rates per each age group and gender (males and females). We recorded a total of 1,335,375 hospitalizations (women: 1,031,816; men: 303,559) due to femoral neck fractures in people  $\geq 65$  years old between 2000 and 2014 passing from 73,493 to 94,525, with an overall increase of 28.62% over the 15-year period (females: +25.1; males: +41.2%). About 84.9% of total hip fractures were suffered by patients aged  $\geq 75$  years old. Direct hospitalization costs and rehabilitation costs increased from 343 to 457 million Euros and from 392 to 504 million Euros from year 2000 to 2014, respectively. As reported in Table 4, overall costs of hip fractures raised from 735 to 961 million Euros (+30.74% from 2000 to 2014).

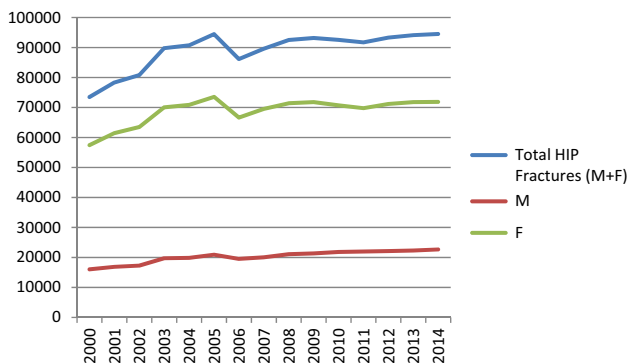
Hospitalizations due to hip fractures were: 73,493 in year 2000 (16,037 men and 57,456 women); 78,354 in year 2001 (16,869 men and 61,495 women); 80,804 in year 2002 (17,297 men and 63,507 women); 89,796 in year 2003 (19,720 men and 70,076 women); 90,753 in year 2004 (19,872 men and 70,881 women); 94,471 in year 2005 (20,909 men and 73,562 women); 86,154 in year 2006 (19,508 men and 66,646 women); 89,601 in year 2007 (20,054 men and 69,547 women); 92,532 in year 2008 (21,097 men and 71,435 women); 93,169 (21,345 men and 71,824 women) in year 2009; 92,549 (21,820 men and 70,729 women) in year 2010; 91,733 (21,950 men and 69,783 women) in 2011; 93,325 in 2012 (22,139 men and 71,186 women); 94,116 (22,299 men and 71,817 women) in 2013; 94,525 (22,643 men and 71,882 women) in 2014. The incidence rate per 10,000 inhabitants in people aged 65–74 passed from 29.8 in year 2000 to 25.3 in 2014 for women, and from 13.9 (year 2000) to 11.7 (2014) for men.

## Discussion

The increase in the absolute number of hip fractures is due to a higher number of fractures occurred in people in the oldest age group. The higher increase in hospitalizations due to hip fractures was observed in men (+41.2% from 2000 to 2014). About 84.9% ( $n = 1,133,538$ ) of total hip fractures observed in people  $\geq 65$  years old over the entire 15-year period were suffered by people aged  $\geq 75$  years old. Women aged  $\geq 75$  accounted for 66.43% ( $n = 887,123$ ) of total fractures. This work updates the findings of our previous researches started in year 2000 [2, 10]. As showed in Fig. 2, we observed an overall increase of hip fractures both in men and in women aged 65 years old and over, with a peak in year 2005. This observation has already been deeply presented in our most recent work

**Table 3** Number of hip fractures per 10000 inhabitants by age categories and sex between the years 2000 and 2014 (population data provided by the National Institute for Statistics for each examined year)

Age group	2000		2001		2002		2003		2004		2005		2006			
	M	F	M	F	M	F	M	F	M	F	M	F	M	F		
65–74 years old	13.9	29.8	14.2	29.7	14.2	30.4	13.8	33.5	16.8	35.2	16.2	34.8	13.1	27.1		
≥75 years old	77.9	165.8	82.2	178.9	84.9	185.0	86.8	187.0	85.2	187.8	91.9	196.7	79.1	167.7		
Age group	2007		2008		2009		2010		2011		2012		2013		2014	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F		
65–74 years old	13.4	28.7	13.1	29.0	13.2	28.0	12.8	27.0	12.6	26.5	12.8	26.9	12.0	26.6	11.7	25.3
≥75 years old	78.4	169.8	81.2	171.3	79.9	169.9	80.2	164.9	78.8	159.9	79.0	163.3	77.5	161.7	75.7	157.9

**Fig. 2** Hospitalizations trend in people aged > 65 between year 2000 and 2014 (total hip fractures; males; females)

[15] and has been documented to include people up to 79 years of age. The possible explanation for that could be found by taking into account all the efforts made since year 2000 by the scientific community in rising the awareness about prevention and treatment of osteoporosis.

Having found a continuous increase in the incidence of hip fractures among the oldest people (75 years old and over) confirms the dramatic impact of osteoporosis in the frame of increasing ageing of the Italian population. The improvement of social standards and care led to a lengthening of life with an increase in the number of people over 75 in Italy, which represent the subjects at higher risk of fracture, as well as falls and low-energy trauma. The continuous increase and the figures of direct costs related to hip fractures in the elderly are consistent with International Osteoporosis Foundation estimations concerning the overall incidence and costs of hip fractures in Italy and provide detailed information regarding hospitalizations occurring in the elderly age groups [16, 17]. Furthermore, these results are consistent

with the analyses we had already performed [2, 10] and with data from other European or non-European countries, where an increasing trend of hip fractures incidence and costs was shown [18–24].

A good knowledge of the real number of fractures is necessary to set health prevention programs aimed at reducing the incidence of falls and following fractures as the number of people over 65 in all industrialized countries will continue to increase, with a remarkable burden on people and on the healthcare system, unless specific preventive strategies will be adopted. Our data claim for preventive interventions aimed to primary prevention of osteoporosis and to further reduce the incidence of hip fractures above all, as their consequences have a considerable impact on the elderly and their families in terms of reduced levels of health, loss of productivity and quality of life. A proper allocation of resources will allow to prescribe antifracture drugs in subjects at higher risk of fracture (i.e., those presenting low BMD), including elderly men and not only women.

## Conclusion

The number of hospital admissions for hip fractures in Italy is continuously increasing due to the fractures occurring in the oldest age groups. However, in people aged 65–74 years old, we observed a progressive reduction starting from year 2006 both in men and women. Men were found to present a remarkable increase in the number of hospitalizations after 75 years of age, despite representing a minor proportion of total hip fractures compared to women.

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**Table 4** Number of fractures and Direct costs (million Euros) sustained for hospitalizations due to hip fractures in the elderly Italian population ( $\geq 65$  years old) from 2000 to 2014

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Hospitalizations due to hip fractures (femoral neck) (N)	73,493	78,354	80,804	89,796	90,753	94,471	86,154	89,601	92,532	93,169	92,549	91,733	93,325	94,116	94,525
Overall hospitalizations direct costs (Euros)	343,000,000	373,000,000	394,000,000	433,000,000	448,000,000	467,500,000	416,564,342	433,230,977	447,402,694	450,482,661	447,484,891	443,539,438	451,236,938	455,061,513	457,039,074
Overall rehabilitation costs (Euros)	392,876,272	418,852,367	431,970,539	480,005,732	485,140,236	531,986,400	459,923,170	478,324,581	493,971,385	497,371,936	494,062,138	489,706,016	498,204,724	502,427,386	504,610,785
Overall direct costs estimation (Euros)	735,876,272	791,852,367	825,970,539	913,005,732	933,140,236	999,486,400	876,487,511	911,555,558	941,374,079	947,854,597	941,547,028	933,245,454	949,441,663	957,488,899	961,649,800

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**Authors contributions** UT, PP, MF, CN, ER, AA, CR, have conceived the study and participated in its designed coordination and helped to draft the manuscript. UT, PP, MF, CN, AM, ER, AA, CR, MR, AD, SE all participated to draft the manuscript and performed all the analyses and statistics of the paper. All authors read and approved the final manuscript.

## Compliance with ethical standards

**Conflict of interest** UT and GI has received research grant and funding for consulting/speaking by Merck, Sanofi-Aventis, Novartis, Stroder-Servier, Ely Lilly, Roche, Glaxo; Nicomed; PP, CN, MF, ER, AA, MA, MR, CR, AM, AD, SE: no disclosures.

**Statement of human and animal rights** No animal or human rights were addressed for the purpose of this study.

**Informed consent** No informed consent was needed, as this is a mere observational and statistical research.

## References

- Kanis JA, Burlet N, Cooper C et al (2008) European guidance for the diagnosis and management of osteoporosis in postmenopausal women. *Osteoporos Int* 19:399–428. <https://doi.org/10.1007/s00198-008-0560-z>
- Piscitelli P, Iolascon G, Gimigliano F et al (2007) Incidence and costs of hip fractures compared to acute myocardial infarction in the Italian population: a 4-year survey. *Osteoporos Int* 18:211–219. <https://doi.org/10.1007/s00198-006-0224-9>
- Bouee S, Lafuma A, Fagnani F et al (2006) Estimation of direct unit costs associated with non-vertebral osteoporotic fractures in five European countries. *Rheumatol Int* 26:1063–1072. <https://doi.org/10.1007/s00296-006-0180-x>
- Cooper C (1997) The crippling consequences of fractures and their impact on quality of life. *Am J Med* 103:12S–17S
- Piscitelli P, Brandi ML, Tarantino U et al (2010) Incidence and socioeconomic burden of hip fractures in Italy: extension study 2003–2005. *Reumatismo* 62:113–118
- Piscitelli P, Chitano G, Johansson H et al (2013) Updated fracture incidence rates for the Italian version of FRAX(R). *Osteoporos Int* 24:859–866. <https://doi.org/10.1007/s00198-012-2021-y>
- Piscitelli P, Gimigliano F, Gatto S et al (2010) Hip fractures in Italy: 2000–2005 extension study. *Osteoporos Int* 21:1323–1330. <https://doi.org/10.1007/s00198-009-1084-x>
- Kanis JA, Oden A, McCloskey EV et al (2012) A systematic review of hip fracture incidence and probability of fracture worldwide. *Osteoporos Int* 23:2239–2256. <https://doi.org/10.1007/s00198-012-1964-3>
- Cooper C, Cole ZA, Holroyd CR et al (2011) Secular trends in the incidence of hip and other osteoporotic fractures. *Osteoporos Int* 22:1277–1288. <https://doi.org/10.1007/s00198-011-1601-6>
- Piscitelli P, Feola M, Rao C et al (2014) Ten years of hip fractures in Italy: For the first time a decreasing trend in elderly women. *World J Orthop* 5:386–391. <https://doi.org/10.5312/wjo.v5.i3.386>
- Piscitelli P, Camboa P, Forcina B et al (2006) Incidence and costs of hip fractures vs acute myocardial infarction among population of Local Health Authorities Lecce/1 and Lecce/2: a two years survey. *Ital J Public Health* 3:75–77
- Tediosi F, Bartolacci S, Roti L et al (2003) La valutazione economica dei percorsi assistenziali dei soggetti con Ictus e Frattura del femore in Toscana: risultati di uno studio pilota. *Mecosan* 48:21–32
- Tediosi F, Bartolacci S, Roti L et al (2004) L'assistenza ospedaliera e riabilitativa per le fratture osteoporotiche in Toscana. *Politiche sanitarie* 5:61–69
- Visentin P, Ciravegna R, Fabris F (1997) Estimating the cost per avoided hip fracture by osteoporosis treatment in Italy. *Maturitas* 26:185–192
- Tarantino U, Piscitelli P, Feola M et al (2018) Decreasing trend of hip fractures incidence in Italy between 2007 and 2014: epidemiological changes due to population aging. *Arch Osteoporos* 13:23. <https://doi.org/10.1007/s11657-018-0423-y>
- Compston J (2004) Action plan for the prevention of osteoporotic fractures in the European community. Springer, Berlin
- Piscitelli P, Brandi M, Cawston H et al (2014) Epidemiological burden of postmenopausal osteoporosis in Italy from 2010 to 2020: estimations from a disease model. *Calcif Tissue Int* 95:419–427. <https://doi.org/10.1007/s00223-014-9910-3>
- Autier P, Haentjens P, Bentin J et al (2000) Costs induced by hip fractures: a prospective controlled study in Belgium. *Belgian Hip Fracture Study Group. Osteoporos Int* 11:373–380
- Dolan P, Torgerson DJ (1998) The cost of treating osteoporotic fractures in the United Kingdom female population. *Osteoporos Int* 8:611–617. <https://doi.org/10.1007/s001980050107>
- Hernandez JL, Olmos JM, Alonso MA et al (2006) Trend in hip fracture epidemiology over a 14-year period in a Spanish population. *Osteoporos Int* 17:464–470. <https://doi.org/10.1007/s00198-005-0008-7>
- Johnell O, Gullberg B, Allander E et al (1992) The apparent incidence of hip fracture in Europe: a study of national register sources. *Osteoporos Int* 2:298–302
- Mann E, Icks A, Haastert B et al (2008) Hip fracture incidence in the elderly in Austria: an epidemiological study covering the years 1994 to 2006. *BMC Geriatr* 8:35. <https://doi.org/10.1186/1471-2318-8-35>
- Ray NF, Chan JK, Thamer M et al (1997) Medical expenditures for the treatment of osteoporotic fractures in the United States in 1995: report from the National Osteoporosis Foundation. *J Bone Miner Res* 12:24–35. <https://doi.org/10.1359/jbmr.1997.12.1.24>
- Vestergaard P, Rejnmark L, Mosekilde L (2008) Strongly increasing incidence of hip fractures in Denmark from 1977 to 1999]. *Ugeskr Laeger* 170:621–623

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