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# **Osteoporosis Economic burden of disease in Italy**

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## Abstract

**Background and objective:** Today osteoporosis is the most common bone disease and important public health problem in all developed countries. The objective of this study was to estimate the costs associated with the management and treatment of osteoporosis in order to assess the economic burden in Italy for 2017, in terms of direct medical costs and social security costs.

**Methods:** A Cost of Illness model was developed to estimate the average cost per year sustained by the NHS (National Health Service) and Social Security System in Italy. A Systematic Literature Review was performed to obtain epidemiological, direct and indirect costs parameters where available. Hospitalization costs were calculated considering the administrative database of Hospitalization available in Italy between 2008-2016. Patients were enrolled in the analysis if they report the subsequent inclusion criteria: age  $\geq 45$  years and presence of osteoporosis in primary or secondary diagnosis (ICD9-CM 733.0) and/or presence of a major fracture in primary or secondary diagnosis (excluding road accidents) in the following locations: spine (codes ICD9-CM: 805;806), femur (codes ICD9-CM: 820; 821), radius and ulna (codes ICD9-CM: 813.4; 813.5), humerus (codes ICD9-CM: 812.0-812.5), pelvis (code ICD9-CM: 808), tibia and fibula (codes ICD9-CM: 823), ankle (code ICD9: 824) and ribs (codes ICD9-CM: 807.0; 807.1).. Costs were estimated considering the DRG (Diagnosis-related group) national tariff associated with each hospitalisation. Finally, the administrative databases of the National Social Security Institute (INPS) (2009-2015) were analysed for the estimate the pension and disability costs from the social perspective.

**Results:** The model estimated an average annual economic burden of osteoporosis in Italy of € 2.2 billion. Of this cost, 80 % (€ 1.8 billion) was associated to hospitalizations, 16% (€ 0.35 billion) for pharmacological treatments, 3% (€ 0.07 billion) to ambulatory visits, and 1% (€ 0.01 billion) to social security costs. The average yearly cost per patient was equal to € 8,691 (€ 8,591 for hospitalizations). Analysing severe patients, hospitalization costs increase to € 12,336 (+44% if compared to general osteoporosis patients).

**Conclusions:** The analysis showed that osteoporosis represents one of the main health problems in Italy and the ability to maintain patients in a non-severe health state could decrease the economic burden from both NHS and social perspective.

## **Key Points:**

- Overall, the economic burden associated to the osteoporosis patients in Italy was equal to € 2.2 billion from the NHS and social security system perspective;
- 81% (€ 1.8 billion) of the total economic burden was associated to hospitalization costs (63% related to hospitalizations due to fractures, 37% to hospitalizations due to other causes), 16% (€ 351 million) to pharmacological treatments cost, 3% (€ 71 million) to ambulatory visits and 1% (€ 13 million) to social security cost;
- the average annual hospitalization cost per patient with severe osteoporosis (subjects aged  $\geq 45$  years with osteoporosis in primary or secondary diagnosis and with a fracture, the subjects aged  $\geq 45$  years with two fractures and those aged  $\geq 45$  years with three or more fractures.) was € 12,336 (+XX% if compared to non severe patients € 8,591)

## **Compliance with Ethical Standards.**

**Funding:** This study received an unrestricted institutional grant from the pharmaceutical company Eli Lilly Italy.

**Conflicts of interest:** AM, MAR, CN, PS, SG, MR, MB and FSM had no conflict of interest. AA and DV are employee of Eli Lilly Italy

# 1. Introduction

Osteoporosis is a systemic disease characterized by low bone mass and by qualitative alterations of macro- and micro-architecture of the skeletal tissue, such as to increase bone fragility and, therefore, the risk of fracture even for low/medium energy traumas [1].

The most frequent osteoporotic fractures are those of the wrist, humerus, ribs, pelvis, spine column and femur. These fractures can cause complex disabilities, morbidity, reduced quality of life and functional limitation. Moreover, spine and hip fractures increase the relative risk of mortality [2].

Although osteoporosis has been historically considered a disease mainly affecting postmenopausal women, in recent years it has been shown that fragility fractures are a statistically significant event in men [3]. Conventionally, this disease occurs into two distinct forms:

1. Primary osteoporosis: occurring after menopause (type I osteoporosis) or with ageing (type II osteoporosis).
2. Secondary osteoporosis: due to the presence of other clinical conditions (endocrine-metabolic diseases, myelo-and lymphoproliferative diseases, conditions associated with intestinal malabsorption, rheumatic diseases, kidney diseases, organ transplantation) or to the taking of certain medication in the medium-long term (glucocorticoids, aromatase inhibitors).

The term idiopathic osteoporosis, on the other hand, identifies a form of osteoporosis for which there is no clear cause that can explain the onset of the disease [4-6]. The incidence and prevalence of osteoporotic fractures increase exponentially with age [7], generating significant social and economic costs. Certainly, gathering exact information and data on welfare flows and related expenditure is a starting point for the improvement of healthcare programmes and the development of cost containment policies.

In Italy, during the last decade, the demographic structure of the population increases the number of osteoporosis patients due to the ageing population. It was estimated that more than the half of postmenopausal women aged 50 and older in Italy have osteoporosis on the basis of the most recent criteria [8]. The increasing level of osteoporosis disease represents one of the main in issue not only from the NHS perspective but also from a social perspective. In Italy, information on the burden of osteoporosis across age groups, sex, and fracture sites is also lacking.

The objective of this study was to develop a Cost of illness (CoI) model able to estimate the costs associated with the management and treatment of osteoporosis in Italy in one year, from the perspective of the National Health Service (NHS) and that of the national social security system.

## 2. Methods

### 2.1 Study design

The CoI model was developed starting from the prevailing patients. The reference year for the analysis was 2017.

The perspective used was that of the NHS and the national social security system. Therefore, direct costs (the costs directly related to the diagnosis and treatment of the disease) and social security costs (the costs related to disability allowances and pensions paid, under certain conditions, to patients) respectively were estimated.

Epidemiological and cost data were obtained by conducting a systematic review of the literature (SRL) and by consulting the administrative database of hospital discharge records (HDR) and the database of the National Social Security Institute (INPS).

### 2.2 Systematic literature review

In order to find the national epidemiological and cost data available from the literature, in January 2019, a SLR was conducted, using different search engines (PubMed, EpiCentro) and consulting Italian health economics journals (Farmacoeconomia e Percorsi Terapeutici, PharmacoEconomics Italian Research Articles, Global and Regional Health Technology Assessment). Articles relating to the past 5 years have been reviewed.

In accordance with the recommended guidelines for the systematic analysis of scientific literature [9], the systematic process was divided into 4 stages: identification, screening, eligibility and inclusion.

In the first stage (identification), the search terms to be used to extract articles from each single consulted electronic database were identified:

- Pubmed:
  - Cost items:  
(economic evaluation[Title/Abstract] OR cost[Title/Abstract] OR burden[Title/Abstract] OR economic impact[Title/Abstract]) AND (osteoporosis[Title/Abstract] OR BMD[Title/Abstract] OR Osteoarthritis[Title/Abstract] OR OSTC[Title/Abstract] OR “Osteoporosis”[Mesh])
  - Epidemiological articles:  
(epidemiology[Title/Abstract] OR epidemiology[MeSH Terms] OR prevalence[MeSH Terms]) AND osteoporosis[MeSH Terms]
- PharmacoEconomics and therapeutic pathways: COST + OSTEOPOROSIS

- Google scholar: EPIDEMIOLOGY OR PREVALENCE + COST OR BURDEN + OSTEOPOROSIS
- EPICENTRO: COST + EPIDEMIOLOGY + OSTEOPOROSIS
- Pharmacoeconomics Italian Research Articles: EPIDEMIOLOGY OR PREVALENCE + COST OR BURDEN + OSTEOPOROSIS
- Global & Regional Health Technology Assessment: EPIDEMIOLOGY OR PREVALENCE + COST OR BURDEN + OSTEOPOROSIS

This first stage identified 232 articles through PubMed and 238 articles through the other electronic databases mentioned above.

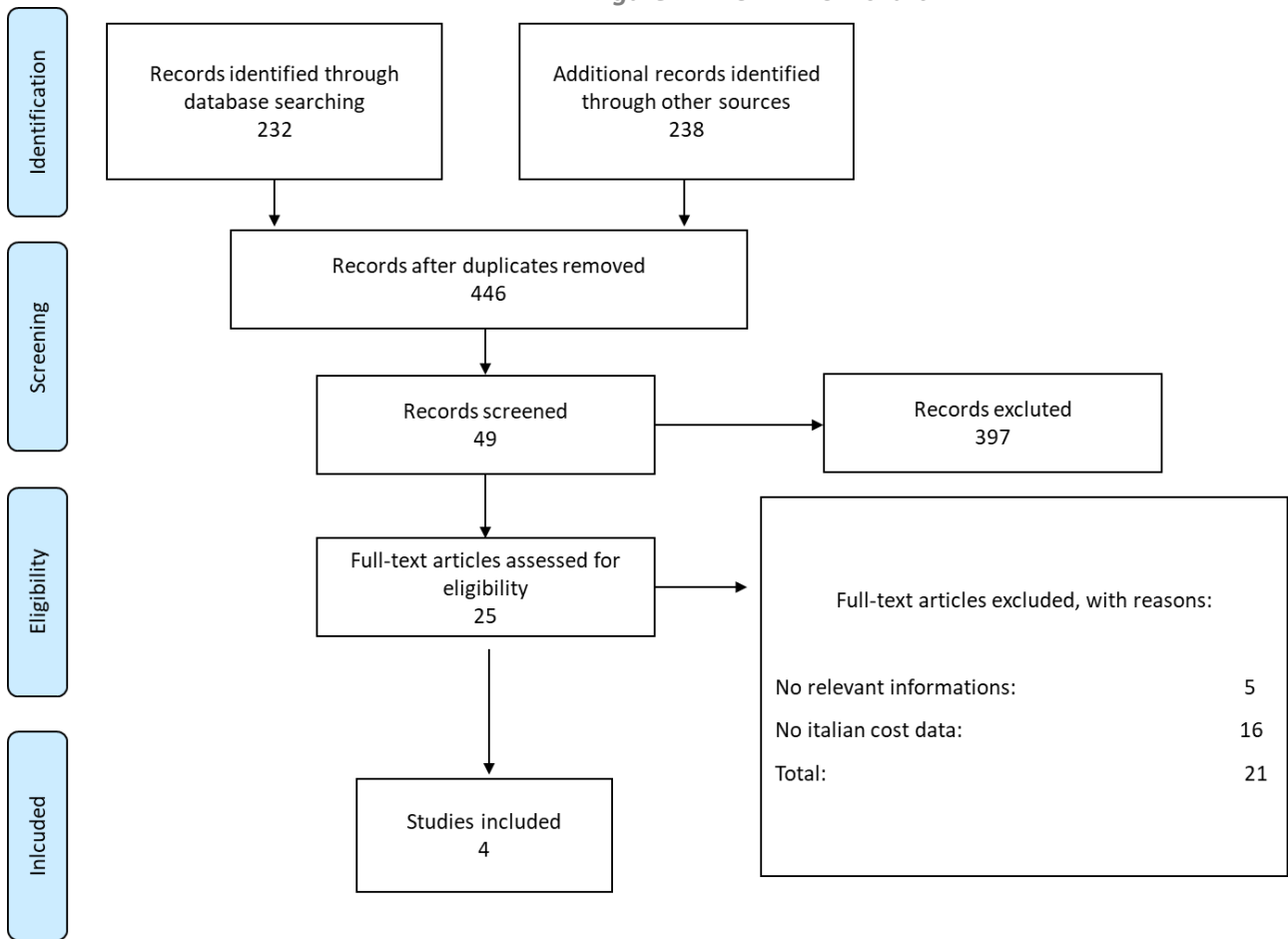
In the second stage (screening), duplicates were removed from the total number of identified articles. This process is necessary when the SLR is carried out on more than one electronic database.

In the third stage (eligibility), two researchers independently reviewed the studies, using the title, abstract or extended text, in order to include (fourth stage) only the studies meeting at least one of the following inclusion criteria:

- nationwide studies containing data on the direct costs of the disease, examined from the perspective of the NHS, and expressed in monetary values by hospital groups related to the disease (DRG) and outpatient rates;
- nationwide observational studies on epidemiological and/or cost data for osteoporosis;
- national or international studies reporting significant nationwide data for osteoporosis.

At the end of the review process, 4 articles were included in the analysis (Figure 1).

Figure 1 PRISMA Flow chart





## 2.3 Querying administrative databases

In order to estimate the hospitalization costs related to osteoporosis disease, it was developed an analysis on the administrative database of the Hospital Discharge Records (HDR) for the period 2008-2016. HDR collects all hospitalizations events occurred in all public and private institutes of Italy. The discharge records include the patient's demographic (gender, age, education, residence) and clinical information, the diagnosis and the main and secondary procedures (5 fields) as set out in the International Classification of Diseases (ICD-9-CM). Costs were estimated considering the DRG (Diagnosis-related group) national tariff associated with each hospitalisation

Through the analysis conducted on the HDR, it was possible to select the number of subjects with osteoporosis, according to the following inclusion criteria: age  $\geq 45$  years and presence of osteoporosis in primary or secondary diagnosis (ICD9-CM 733.0) and/or presence of a major fracture in primary or secondary diagnosis (excluding road accidents) in the following locations: spine (codes ICD9-CM: 805;806), femur (codes ICD9-CM: 820; 821), radius and ulna (codes ICD9-CM: 813.4; 813.5), humerus (codes ICD9-CM: 812.0-812.5), pelvis (code ICD9-CM: 808), tibia and fibula (codes ICD9-CM: 823), ankle (code ICD9: 824) and ribs (codes ICD9-CM: 807.0; 807.1).

The subjects were broken down into three age groups ( $< 60$ ,  $60-74$ ,  $\geq 75$ ). The national average annual number of admissions and the average annual expenditure for subjects with osteoporosis were obtained as the average value of the number of admissions and the expenditure estimated for the nine years being analysed.

A further objective of this study was to focus on the costs related to patients with severe osteoporosis, where severe means the presence of a previous fracture in the patient with osteoporosis. Using the HDR information database analysed for the period 2008-2016, it was possible to select all the subjects aged  $\geq 45$  years with osteoporosis in primary or secondary diagnosis and with a fracture, the subjects aged  $\geq 45$  years with two fractures and those aged  $\geq 45$  years with three or more fractures.

The estimate of social security costs was calculated by consulting the databases of the National Social Security Institute (INPS) for the period 2009-2015. The national social security system in Italy aims to protect workers and family members in the event of (partial or total) loss of working capacity due to illness. This protection function is carried out through the payment of Disability Benefits (DB) or Incapacity Pension (IP). All categories of workers registered with the Italian National Social Security Institute (INPS) have the right to receive DB or IP in case of an accident or illness and after five years of welfare insurance contributions [10].

The DB is a financial benefit for all categories of workers registered with INPS (mainly private sector employees and self-employed workers), with five years of social security contributions, and with workability reduced to less than one-third due to physical or mental illness. It is necessary to

apply for it, and if the medical board approves, it is not required to cease work. The allowance is recognized for a period of three years and is confirmable for periods of the same duration. After three consecutive awards, it is automatically confirmed. This type of allowance is funded and paid for thirteen months by INPS. The IP is a financial benefit for all categories of workers registered with INPS to which has been recognized an absolute and permanent inability to work. Also in this case, five years of social welfare contributions, and a specific application are necessary. Retirement from work is required. This type of pension is funded and paid by INPS and it is paid for thirteen months, too [10].

All patients with a recognised Disability Benefits (DB) - paid to individuals with a degree of disability between 67% and 99% - or an Incapacity Pension (IP) - paid to individuals with a degree of disability equal to 100% - were identified considering the subjects diagnosed with osteoporosis and/or the subjects aged > 60 years with a fracture, in primary or secondary diagnosis; these patients were subsequently broken down according to the presence or absence of comorbidity in the secondary diagnosis. As in the case of hospitalizations, the average annual number of accepted applications and the related average annual expenditure were obtained as the average of the accepted applications and the estimated expenditure in the seven years being analysed.

A variability measure of the total economic burden was estimated considering: the minimum and maximum parameter reported in table 1 for drug and specialistic visits, the minimum and maximum annual hospitalization cost registered between 2008 – 2016, the minimum and maximum annual social security cost between 2009 – 2015.

### 3. Results

#### 3.1 Estimate of the population with osteoporosis

According to the information found in the literature [11, 12], the average age of the patients suffering from osteoporosis in Italy is 50 years, specifically 45 years for women and 55 years for men.

With regard to the prevalence data available in the literature, an average value for women (*base case*) of 20.95% (min=18.50%; max=23.40%) [11, 12], and an average value for males of 8.45% (min=6.90% [11]; max=10% [12]) have been estimated.

Applying the average prevalence values obtained from the literature to the population living in Italy as of 1 January 2017 aged  $\geq 45$  years (16,701,772 women and 9,669,652 men) [13], the number of people suffering from osteoporosis in Italy in 2017 was 4,316,107 subjects (3,499,021 women and 817,086 men).

The prevalence values clearly show that the majority of individuals with osteoporosis are female (81%).

The consequences of osteoporosis are measurable, among other elements, in the number of fractures that the patient undergoes due to the microarchitectural deterioration of the bone tissue caused by the disease and that exposes the patient to a greater risk of fracture.

Not all the patients suffering from osteoporosis actually experience a fracture. The average annual number of fractures identified analysing the national HDR administrative database for the period 2008-2016 was equal to 215,302 (from an estimated number equal to 207,884 patients). With reference to the location of the fracture, 53.9% (115,972) of the total fractures were hip fractures, 10.3% (22,120) humerus fractures, 9.1% (19,575) spinal column fractures, 8.3% (17,785) ribs fractures, 6.3% (13,593) fractures of the radius or ulna, 5% (10,764) pelvis fractures, 4.1% (8,867) ankle fractures and 3.1% (6,626) fibula or tibia fractures.

However, the number of fractures obtained is underestimated. With the data at our disposal, it has not been possible to trace the patients who are not hospitalized, due to the fact that they might have been treated only in the emergency department or they might not have been treated at all in an emergency department, as it often happens with spine fractures.

The epidemiological parameters identified through the systematic review process and the analysis of the HDR database are reported in table 1.

**Table 1 – Epidemiological parameters**

EPIDEMIOLOGICAL PARAMETERS	BASE CASE	MIN	MAX	OSTEOPOROTIC POPULATION	SOURCE	NOTES
Women population aged 45+ resident in Italy at 1st January 2017	16,701,772	-	-	-	[13]	-
Men population aged 55+ resident in Italy at 1st January 2017	9,669,652	-	-	-	[13]	-
Prevalence of osteoporosis in women	20.95%	18.50%	23.40%	3,499,021	[11, 12]	Age: 40+ ; 50+
Prevalence of osteoporosis in men	8.45%	6.90%	10%	817,086	[11, 12]	Age: 50+ ; 60+
Total osteoporotic population in Italy in 2017	-	-	-	4,316,107	-	-
Average annual number of fractures	215,302	-	-	-	-	-

### 3.2 Estimated costs associated with patients with osteoporosis

The direct health costs considered in the analysis were referred to the cost of drugs, ambulatory visits and hospitalizations.

The cost of drugs and ambulatory visits has been obtained through the average cost estimates emerging from the literature [12, 14, 15]. These average values have been subsequently re-valued to 2017 [16].

By applying the average costs per patient to the total number of patients with osteoporosis in Italy in 2017, it was possible to obtain a total cost for drugs and ambulatory visits of € 350,793,740 and € 70,697,830 respectively.

Hospitalization costs were estimated considering the expenditure associated with hospitalizations due to fractures and other causes (See Appendix for detail of the main DRGs registered) of the patients selected by the HDR database (Table 2).

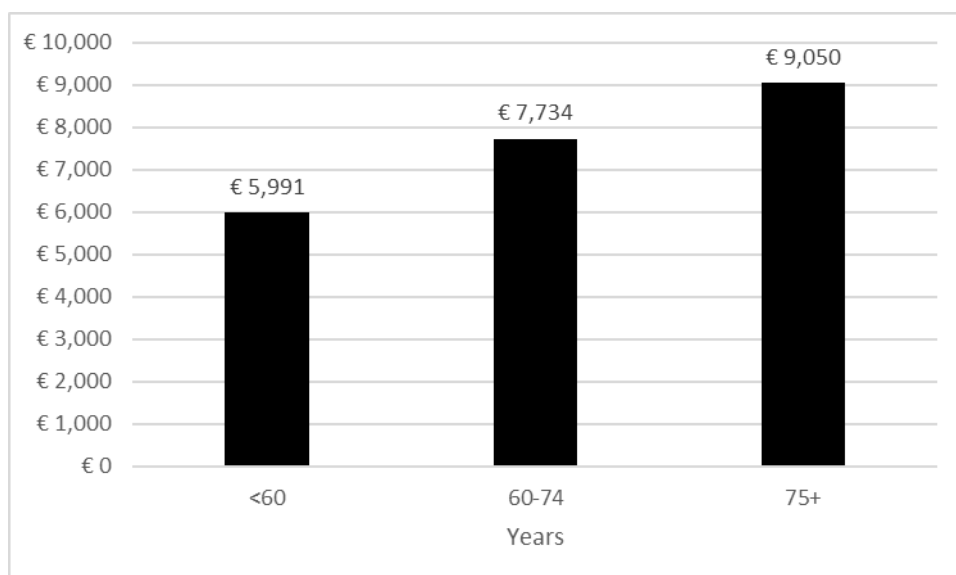
**Table 2 – Average number of subjects with osteoporosis and hospitalizations due to fractures or other causes – HDR database analysis 2008-2016**

Age groups	Subjects with osteoporosis	Hospitalizations due to fractures	Other hospitalizations	Average hospitalizations per patient (hospitalizations due to fractures)	Average hospitalizations per patient (other hospitalizations)
<60	4,245	392	7,627	0.09	1.80
60-74	62,685	58,195	52,558	0.93	0.84
75+	140,953	145,374	110,750	1.03	0.79
<b>Total</b>	<b>207,884</b>	<b>203,961</b>	<b>170,935</b>	<b>0.98</b>	<b>0.82</b>

The average annual cost of hospitalizations, obtained as the average value of the estimated costs for each year of analysis (2008-2016), was equal to € 1,785,874,284. 63% of this cost (€ 1,120,328,011) was attributable to hospitalizations for fractures, while the remaining 37% (€ 665,546,274) for causes other than fractures. The average annual cost per patient with osteoporosis was € 8,591.

The highest average annual cost of hospitalization per patient was recorded for patients aged over 75 years (€ 9,050), followed by the average cost per patient in the 60-74 age group (€ 7,734) and the average cost per patient aged under 60 years (€ 5,991) (Figure 2).

**Figure 2 – Hospitalization expense by age group**



The average annual cost per patient with osteoporosis in terms of direct costs was € 8,688; about 81% of this average cost was attributable to hospitalizations (€ 8,591), while about 16% and 3% to pharmacological treatment and ambulatory visits respectively.

The identification of the applications accepted by DB and IP through the ICD9 codes, according to the inclusion criteria described above, has identified an average annual number of beneficiaries equal to 1,528 (1,422 beneficiaries of DB and 106 beneficiaries of IP) and an average annual cost of € 13,377,798 (Table 3), estimated for the period 2009-2015. 90% of this average cost was characterized by the payment of DB (Table 4). In particular, 83% (€ 11,155,565) of the estimated national average annual cost was characterized by social security costs related to osteoporosis-and/or fracture-diagnosed patients in primary or secondary diagnosis, presenting other diseases in primary or secondary diagnosis. The remaining 17% (€ 2,222,233) was due to costs related to patients with osteoporosis-and/or fracture in primary or secondary diagnosis with no other comorbidity.

**Table 3 – Social security costs and number of beneficiaries (Italy 2009 – 2015)**

	<b>Total costs 2009-2015</b>	<b>Average annual beneficiaries</b>	<b>Average annual costs</b>
<b>DB</b>	€ 84,052,611	1,422	€ 12,007,516
<b>IP</b>	€ 9,591,974	106	€ 1,370,282
<b>Total</b>	<b>€ 93,644,585</b>	<b>1,528</b>	<b>€ 13,377,798</b>

DB = Disability Benefits; IP = Incapacity Pension

### 3.3 2017 Italy CoI

The model estimated a total cost for osteoporosis in Italy in 2017 of about € 2.2 billion, of which 99.4% was characterized by direct costs. Table 4 reports the estimated national annual average, minimum and maximum (considering the variability registered in the literature and from the administrative databases) annual costs, and the percentage distribution for each cost item considered in the analysis.

**Table 4 – 2017 CoI of osteoporosis in Italy**

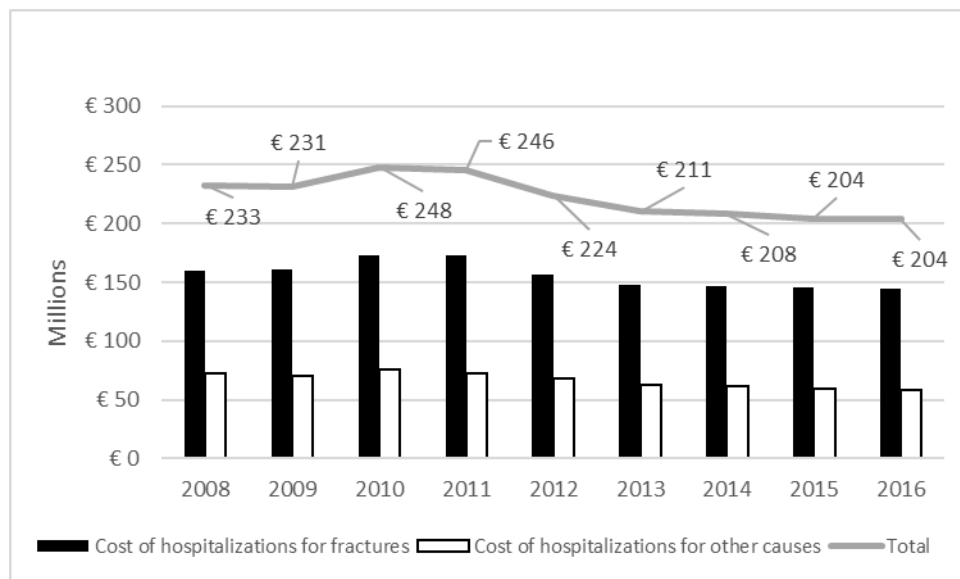
	<b>Average annual cost in Italy</b>	<b>Min</b>	<b>Max</b>	<b>Percentage</b>
<b>Pharmacological treatment</b>	€ 350,793,740	€ 344,790,997	€ 453,386,587	15.93%
<b>Ambulatory visits</b>	€ 70,697,830	€ 69,488,056	€ 91,374,058	3.21%
<b>Hospitalizations</b>	€ 1,785,874,284	€ 1,651,198,711	€ 1,898,846,999	80.26%
<b>Social security system</b>	€ 13,377,798	€ 9,981,115	€ 18,249,383	0.60%
<b>Total Cost</b>	<b>€ 2,220,743,653</b>	<b>€ 2,075,458,879</b>	<b>€ 2,461,857,027</b>	<b>100%</b>

## 4. Focus on patients with severe osteoporosis

The average annual number of hospitalizations due to fractures in patients with severe osteoporosis was 33,150, while the average annual number of hospitalizations for reasons other than fracture was 16,131. The average annual cost associated with admissions of patients with severe osteoporosis was € 223,257,024, of which 70% (€ 156,389,721) was attributable to hospitalizations for fractures and 30% (€ 66,867,303) to hospitalizations for other causes. Figure 4 reports the average annual costs associated with hospitalizations for fractures and hospitalizations for other causes estimated for each year of analysis.

The average annual cost associated with hospitalizations for patients with severe osteoporosis was € 12,336, thus higher (+ € 3,745) than that estimated for a patient with non-severe osteoporosis (€ 8,591).

**Figure 4 – Average annual costs associated with patients with severe osteoporosis**



## 5. Discussion

Today osteoporosis is the most common bone disease and represent a socially relevant public health problem in all developed countries [8]. However, there are currently no studies in the literature that have attempted to quantify the cost of osteoporosis, going beyond the quantification of costs directly related to the diagnosis and treatment of the disease. As a result, although this analysis (as it will be shown in the presentation of the limitations of the study) most likely tends to underestimate the overall economic burden of the disease, it estimates the costs from a broader perspective than in previous studies [14].

In addition to the information found in the literature on drug costs and ambulatory visits, this analysis has allowed to include the costs of hospitalizations, estimated thanks to the consultation of the national HDR database, and social security costs, obtained through the administrative database of the National Social Security Institute.

In fact, although social security costs represent a very small part of the total cost quantified in this study, they have increased over the years (especially with regard to Ordinary Disability Allowances).

The analysis resulted in a total disease cost of more than € 2 billion in 2017, about 99% of which is made up of direct health costs. Among the items considered (pharmacological treatment, ambulatory visits and hospitalizations), the cost of hospitalizations, amounting to about €1.8 billion (approximately 80% of the total direct health costs), was the cost weighing more on the total. This is most likely due to the longer average length of hospitalization time of a patient with osteoporosis than that of other chronic diseases - fractures (especially femoral/hip ones) require longer rehabilitation time - and to the costs for prostheses, which are frequent for the treatment of hip fractures.

The costs associated with pharmacological treatments (basically aimed at reducing the risk of fractures) and ambulatory visits amounted to about € 351 million (approximately 16% of the total) and about € 71 million (about 3% of the total) respectively.

Social security costs, which accounted for only 0.6% of the total costs associated with osteoporosis, amounted to about € 13 million, of which approximately 89% was characterised by costs relating to the payment of DB.

The study is not without limitations. First of all, the costs of fragility fractures that do not involve hospitalization have not been considered because they are managed only in the emergency department or they are not treated at all, as it often happens for spinal fractures. Secondly, some cost items associated with the disease, such as indirect costs for patients or caregivers (i.e. costs related to the loss of productivity at work due to the disease) have not been estimated. Indeed, the management and drug treatment didn't remain the same over the 5 years considered in the analysis. However, these



costs may not represent a high share of the total cost because osteoporosis mainly affects aged people and therefore no longer in working age (2% of the HDR analysis had an age lower than 60 years).

Finally, the databases consulted are administrative and not clinical. Therefore, it has not been possible to carry out a breakdown of patients according to the disease severity, as these databases do not take into account the risk factors that may affect hospitalizations.

Considering the above limitations, we can, therefore, state that the analysis conducted tends to underestimate the overall economic burden of osteoporosis.

## **6. Conclusions**

This Cost of Illness (CoI) study was conducted in order to quantify the overall burden of the patients suffering from osteoporosis in Italy from the perspective of the NHS and that of the social security system. This cost was equal to € 2,220,743,653 in 2017, demonstrating that osteoporosis represents a significant health problem because it generates a high economic burden, especially in terms of hospitalization. In particular, most of the estimated costs were due to hospitalizations because an osteoporotic patient who experiences a bone fracture, especially a hip fracture, encounters medium-long hospitalization time due, above all, to the time of post-operative rehabilitation. Moreover, it was shown that hospitalization costs increase in patients with severe osteoporosis (+€3,745 (+44%) compared to the estimated average annual cost for a patient with non-severe osteoporosis).

# Appendix

Tabella 1 - DRGs considered

DRG	Description	%
249	AFTERCARE, MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE	9,4
127	HEART FAILURE & SHOCK	4,8
087	PULMONARY EDEMA & RESPIRATORY FAILURE	3,4
256	OTHER MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE DIAGNOSIS	3,4
245	BONE DISEASES & SPECIFIC ARTHROPATHIES WITHOUT COMPLICATIONS, COMORBIDITIES	2,2
012	DEGENERATIVE NERVOUS SYSTEM DISORDERS	2,1
088	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	1,8
089	SIMPLE PNEUMONIA & PLEURISY AGE >17 WITH COMPLICATIONS, COMORBIDITIES	1,8
538	LOCAL EXCISION AND REMOVAL OF INTERNAL FIXATION DEVICES EXCEPT HIP AND FEMUR WITHOUT CC (added 10-1-03)	1,7
014	INTRA CRANIAL HEMORRHAGE AND STROKE WITH INFARCTION (beginning 10-1-02, used to 10-1-04)	1,6
410	CHEMOTHERAPY WITHOUT ACUTE LEUKEMIA AS SECONDARY DIAGNOSIS	1,5
316	RENAL FAILURE	1,5
395	RED BLOOD CELL DISORDERS AGE >17	1,5
247	SIGNS & SYMPTOMS OF MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE	1,4
243	MEDICAL BACK PROBLEMS	1,3
544	MAJOR JOINT REPLACEMENT OR REATTACHMENT OF LOWER EXTREMITY (added 10-1-05)	1,3
239	PATHOLOGICAL FRACTURES & MUSCULOSKELETAL & CONNECTIVE TISSUE MALIGNANCY	1,3
576	SEPTICEMIA W MECHANICAL VENTILATOR W/0 96+ HOURS AGE >17 (added 10-1-06)	1,2
462	REHABILITATION	1,1
241	CONNECTIVE TISSUE DISORDERS WITHOUT COMPLICATIONS, COMORBIDITIES	1,1
240	CONNECTIVE TISSUE DISORDERS WITH COMPLICATIONS, COMORBIDITIES	1,0
244	BONE DISEASES & SPECIFIC ARTHROPATHIES WITH COMPLICATIONS, COMORBIDITIES	1,0
234	OTHER MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE OPERATING ROOM PROCEDURES WITHOUT COMPLICATIONS, COMORBIDITIES	1,0
202	CIRRHOSIS & ALCOHOLIC HEPATITIS	1,0
524	TRANSIENT ISCHEMIA (added 10-1-02)	1,0
467	OTHER FACTORS INFLUENCING HEALTH STATUS	0,9
039	LENS PROCEDURES WITH OR WITHOUT VITRECTOMY	0,8
296	NUTRITIONAL & MISCELLANEOUS METABOLIC DISORDERS AGE >17 WITH COMPLICATIONS, COMORBIDITIES	0,7
183	ESOPHAGITIS, GASTROENTERITIS, & MISCELLANEOUS DIGESTIVE DISORDERS AGE >17 WITHOUT COMPLICATIONS, COMORBIDITIES	0,7
248	TENDINITIS, MYOSITIS & BURSITIS	0,7
429	ORGANIC DISTURBANCES & MENTAL RETARDATION	0,6
182	ESOPHAGITIS, GASTROENTERITIS, & MISCELLANEOUS DIGESTIVE DISORDERS AGE >17 WITH COMPLICATIONS, COMORBIDITIES	0,6
082	RESPIRATORY NEOPLASMS	0,6
466	AFTERCARE WITHOUT HISTORY OF MALIGNANCY AS SECONDARY DIAGNOSIS	0,6
015	NONSPECIFIC CEREBROVASCULAR AND PRECEREBRAL OCCLUSION WITHOUT INFARCTION (beginning 10-1-02)	0,5
090	SIMPLE PNEUMONIA & PLEURISY AGE >17 WITHOUT COMPLICATIONS, COMORBIDITIES	0,5
138	CARDIAC ARRHYTHMIA & CONDUCTION DISORDERS WITH COMPLICATIONS, COMORBIDITIES	0,5
035	OTHER DISORDERS OF NERVOUS SYSTEM WITHOUT COMPLICATION, COMORBIDITIES	0,5

174	GASTROINTESTINAL HEMORRHAGE WITH COMPLICATIONS, COMORBIDITIES	0,5
203	MALIGNANCY OF HEPATOBILIARY SYSTEM OR PANCREAS	0,5
139	CARDIAC ARRHYTHMIA & CONDUCTION DISORDERS WITHOUT COMPLICATIONS, COMORBIDITIES	0,5
016	NONSPECIFIC CEREBROVASCULAR DISORDERS WITH COMPLICATIONS, COMORBIDITIES	0,5
134	HYPERTENSION	0,5
297	NUTRITIONAL & MISCELLANEOUS METABOLIC DISORDERS AGE >17 WITHOUT COMPLICATIONS, COMORBIDITIES	0,5
144	OTHER CIRCULATORY SYSTEM DIAGNOSES WITH COMPLICATIONS, COMORBIDITIES	0,5
078	PULMONARY EMBOLISM	0,5
320	KIDNEY & URINARY TRACT INFECTIONS AGE >17 WITH COMPLICATIONS, COMORBIDITIES	0,5
430	PSYCHOSES	0,5
294	DIABETES AGE >35	0,4
404	LYMPHOMA & NON-ACUTE LEUKEMIA WITHOUT COMPLICATIONS, COMORBIDITIES	0,4
403	LYMPHOMA & NON-ACUTE LEUKEMIA WITH COMPLICATIONS, COMORBIDITIES	0,4
017	NONSPECIFIC CEREBROVASCULAR DISORDERS WITHOUT COMPLICATIONS, COMORBIDITIES	0,4
216	BIOPSIES OF MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE	0,4
207	DISORDERS OF THE BILIARY TRACT WITH COMPLICATIONS, COMORBIDITIES	0,4
545	REVISION OF HIP OR KNEE REPLACEMENT (added 10-1-05)	0,4
205	DISORDERS OF LIVER EXCEPT MALIGNANCY, CIRRHOSIS, ALCOHOLIC HEPATITIS WITH COMPLICATIONS, COMORBIDITIES	0,4
266	SKIN GRAFT &/OR DEBRIDEMENT EXCEPT FOR SKIN ULCER OR CELLULITIS WITHOUT COMPLICATIONS, COMORBIDITIES	0,4
130	PERIPHERAL, VASCULAR DISORDERS WITH COMPLICATIONS, COMORBIDITIES	0,4
181	GASTROINTESTINAL OBSTRUCTION WITHOUT COMPLICATIONS, COMORBIDITIES	0,3
552	OTHER PERMANENT CARDIAC PACEMAKER IMPLANT WITHOUT MCV DIAGNOSIS (added 10-1-05)	0,3
034	OTHER DISORDERS OF NERVOUS SYSTEM WITH COMPLICATIONS, COMORBIDITIES	0,3
301	ENDOCRINE DISORDERS WITHOUT COMPLICATIONS, COMORBIDITIES	0,3
321	KIDNEY & URINARY TRACT INFECTIONS AGE >17 WITHOUT COMPLICATIONS, COMORBIDITIES	0,3
233	OTHER MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE OPERATING ROOM PROCEDURES WITH COMPLICATIONS, COMORBIDITIES	0,3
180	GASTROINTESTINAL OBSTRUCTION WITH COMPLICATIONS, COMORBIDITIES	0,3
009	SPINAL DISORDERS & INJURIES	0,3
042	INTRAOCULAR PROCEDURES EXCEPT RETINA, IRIS & LENS	0,3
079	RESPIRATORY INFECTIONS & INFLAMMATIONS AGE >17 WITH COMPLICATIONS, COMORBIDITIES	0,3
230	LOCAL EXCISION & REMOVAL OF INTERNAL FIXATION DEVICES OF HIP & FEMUR	0,3
208	DISORDERS OF THE BILIARY TRACT WITHOUT COMPLICATIONS, COMORBIDITIES	0,3
131	PERIPHERAL VASCULAR DISORDERS WITHOUT COMPLICATIONS, COMORBIDITIES	0,3
085	PLEURAL EFFUSION WITH COMPLICATIONS, COMORBIDITIES	0,3
125	CIRCULATORY DISORDERS EXCEPT ACUTE MYOCARDIAL INFARCTION, WITH CARDIAC CATHETER WITHOUT COMPLEX DIAGNOSES	0,3
172	DIGESTIVE MALIGNANCY WITH COMPLICATIONS, COMORBIDITIES	0,3
132	ATHEROSCLEROSIS WITH COMPLICATIONS, COMORBIDITIES	0,3
463	SIGNS & SYMPTOMS WITH COMPLICATIONS, COMORBIDITIES	0,3
121	CIRCULATORY DISORDERS WITH ACUTE MYOCARDIAL INFARCTION & MAJOR COMPLICATION, DISCHARGED ALIVE (beginning 10-1-97)	0,3
162	INGUINAL & FEMORAL HERNIA PROCEDURES AGE >17 WITHOUT COMPLICATIONS, COMORBIDITIES	0,3
145	OTHER CIRCULATORY SYSTEM DIAGNOSES WITHOUT COMPLICATIONS, COMORBIDITIES	0,3
271	SKIN ULCERS	0,3

311	TRANSURETHRAL PROCEDURES WITHOUT COMPLICATIONS, COMORBIDITIES	0,3
143	CHEST PAIN	0,3
141	SYNCOPE & COLLAPSE WITH COMPLICATIONS, COMORBIDITIES	0,2
470	UNGROUPABLE	0,2
142	SYNCOPE & COLLAPSE WITHOUT COMPLICATIONS, COMORBIDITIES	0,2
122	CIRCULATORY DISORDERS WITH ACUTE MYOCARDIAL INFARCTION WITHOUT MAJOR COMPLICATION, DISCHARGED ALIVE (beginning 10-1-97)	0,2
423	OTHER INFECTIOUS & PARASITIC DISEASES DIAGNOSES	0,2
566	RESPIRATORY SYSTEM DIAGNOSIS WITH VENTILATOR SUPPORT <96 HRS (added 10-1-06)	0,2
175	GASTROINTESTINAL HEMORRHAGE WITHOUT COMPLICATIONS, COMORBIDITIES	0,2
246	NON-SPECIFIC ARTHROPATHIES	0,2
189	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE >17 WITHOUT COMPLICATIONS, COMORBIDITIES	0,2
140	ANGINA PECTORIS	0,2
204	DISORDERS OF PANCREAS EXCEPT MALIGNANCY	0,2
231	LOCAL EXCISION & REMOVAL OF INTERNAL FIXATION DEVICES (NO HIP & FEMUR)	0,2
029	TRAUMATIC STUPOR & COMA, COMA <1 HR AGE >17 WITHOUT COMPLICATIONS, COMORBIDITIES	0,2
479	OTHER VASCULAR PROCEDURES WITHOUT COMPLICATIONS, CORMORBIDITIES	0,2
300	ENDOCRINE DISORDERS WITH COMPLICATIONS, COMORBIDITIES	0,2
019	CRANIAL & PERIPHERAL NERVE DISORDERS WITHOUT COMPLICATIONS, COMORBIDITIES	0,2
572	MAJOR GASTROINTESTINAL DISORDERS AND PERITONEAL INFECTIONS (added 10-1-06)	0,2
099	RESPIRATORY SIGNS & SYMPTOMS WITH COMPLICATIONS, COMORBIDITIES	0,2

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