



The Impact of Hip Fractures in the Public Health System in Brazil (SUS) 2008 - 2017: The Orthopedist Task

O impacto das fraturas do quadril no SUS 2008 - 2017: O papel do ortopedista

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Abstract

Objective The present study intends to describe the profile of hospitalization and ambulatory rehabilitation of patients ≥ 50 years old due to hip fracture in the Brazilian Public Health System (SUS, in the Portuguese acronym).

Methods This is a cross-sectional study of patients hospitalized due to hip fracture in the SUS between 2008 and 2017. Data included 441,787 hip fracture-related hospitalizations from the hospitalization database of the department of informatics of the Brazilian Unified Health System (SIH/DATASUS, in the Portuguese acronym), and data of patients who underwent rehabilitation from the ambulatory database of the department of informatics of the Brazilian Unified Health System (SIA/DATASUS, in the Portuguese acronym.).

Results Most of hip fracture-related hospitalizations (83.5%) happen to people ≥ 50 years old, with an average annual growth of 5.6% in hip fracture-related hospitalizations. The costs for the government have been growing in the same proportion and reached almost BRL 130 million in 2017, although with a 13.6% decrease in average cost per hospitalization. Besides the financial impact, hip fractures result in an in-hospital mortality rate around 5.0% in patients aged ≥ 50 years old. In addition, the percentage of patients that have undergone hip fracture-related rehabilitation increased from 2008 (14.0%) to 2012 (40.0%), and remained stable after that.

Conclusions The progressive increase in the incidence of hip fractures shows the financial and social impact, and the need for immediate actions to prevent this rising

Keywords

- ▶ hip fractures
- ▶ rehabilitation
- ▶ datasus
- ▶ secondary prevention

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trend. Hip fractures are a risk for secondary fractures, the prevention is crucial, and the orthopedist plays a central role in this process.

Resumo

Objetivo O presente estudo tem como objetivo descrever o perfil de hospitalização e reabilitação ambulatorial de pacientes com idade ≥ 50 anos por fratura de quadril no Sistema Público de Saúde no Brasil (SUS).

Métodos Trata-se de um estudo transversal de pacientes internados por fratura de quadril no SUS entre 2008 e 2017. Os dados incluíram 441.787 internações relacionadas à fratura de quadril do banco de dados de internação (SIH/DATASUS) e dados de pacientes submetidos à reabilitação do banco de dados ambulatorial (SIA/DATASUS).

Resultados A maioria das hospitalizações relacionadas à fratura de quadril (83,5%) ocorre em pessoas ≥ 50 anos, com um crescimento médio anual de 5,6% nas hospitalizações relacionadas à fratura de quadril (HRFQ). Os custos para o governo cresceram na mesma proporção e atingiram quase 130 milhões de reais em 2017, embora com uma redução de 13,6% no custo médio por hospitalização. Além do impacto financeiro, as fraturas de quadril resultam em uma taxa de mortalidade hospitalar em torno de 5,0% em pacientes ≥ 50 anos. Além disso, o percentual de pacientes submetidos à reabilitação relacionada à fratura de quadril aumentou de 2008 (14,0%) para 2012 (40,0%) e permaneceu estável após esse período.

Conclusões O aumento progressivo da incidência de fraturas de quadril mostra o impacto financeiro e social e a necessidade de ações imediatas para evitar essa tendência crescente. As fraturas de quadril são um risco para fraturas secundárias, a prevenção é crucial e o ortopedista desempenha um papel central nesse processo.

Palavras-chave

- ▶ fraturas do quadril
- ▶ reabilitação
- ▶ Datasus
- ▶ prevenção secundária

Introduction

Osteoporotic fractures are a growing public health condition with an increasing incidence as the population ages. Hip fractures are strongly associated with substantial morbidity and mortality, low bone mineral density, implies in higher costs to repair, and cause more disability than others fractures.^{1,2} Despite the fact that all osteoporotic fractures are associated with increased mortality risk for 5 years, hip fracture has the worst prognosis. Hip fracture-associated mortality remains elevated for up to 10 years,³ and predict subsequent fractures, especially during the 1st year.⁴ The risk of fractures after a hip fracture that arise with a minimum trauma is almost four times higher.⁵ A previous study developed by our group showed that 86% of patients with proximal hip fracture had at least 1 prior fracture.⁶ Epidemiological studies demonstrated that proximal femur fractures lead to 20% mortality in 12 months, permanent functional incapacity in 30%, and inability to walk in 40% of the subjects.²

Preventative measures such as starting treatment early after a hip fracture can decrease the recurrence of fractures by ~ 30 and 60%⁷ and reduce mortality. Risk factors as age, medication use, poor balance and chronic conditions play a critical role in the recurrence of hip fractures, especially for those patients who need rehabilitation after prior fractures.⁸ Several factors affect recovery following a hip fracture, but there is substantial evidence that exercises are beneficial and

show promising outcomes from rehabilitation.⁹ Systematic reviews and meta-analyses studies have shown the benefits of rehabilitation, and recommend it after the occurrence of hip fractures.¹⁰

Since 1994, several Brazilian studies describe the epidemiology of osteoporotic fractures in Brazil.¹¹ The majority of studies on hip fracture reports incidence and mortality regionally, and for a limited period of time.^{12–15} The high incidence of hip fractures – which, in turn, leads to elevated costs for the Brazilian government – should be a public health priority.^{14,16} Moreover, the inability of patients to return to the community is an additional component of the costs associated with hip fracture,¹⁷ which highlights even more the importance of rehabilitation.

A countrywide incidence data of hip fractures is missing in Brazil. In addition, the proportion of patients who underwent rehabilitation after hospitalization due to hip fracture is unknown. Therefore, the present study aims to describe the profile of hospitalization due to hip fracture and ambulatory rehabilitation of patients ≥ 50 years old in the Brazilian Public Health System (SUS, in the Portuguese acronym).

Methods

Study Design and Data Source

This is a cross-sectional study of adult patients hospitalized due to hip fracture in the SUS. Data were first extracted from the Hospital Information System of the department of

informatics of the SUS (SIH/DATASUS, in the Portuguese acronym) records. In addition to hospitalization data, we extracted data from the Ambulatory Information System of the department of informatics of the SUS (SIA/DATASUS, in the Portuguese acronym) regarding all individualized ambulatory procedures that were related to a patient who underwent rehabilitation after a hip fracture. The SIH/DATASUS and the SIA/DATASUS are databases that cover ~ 160 million people in the SUS with information from all hospitalizations and ambulatory procedures reimbursed by the Brazilian Federal Government, and aims to give it financial control for audit purposes. The system includes the International Classification of Diseases (ICD-10), and demographic data, among other information.

Study Population

The inclusion criteria for the patients in the SIH/DATASUS were hospitalized patients who had femur fracture from January, 2008 to December, 2017, with one of the following ICD-10 codes as cause of hospitalization (field DIAG_PRINC): S72.0 (fracture of head and neck of femur), S72.1 (pertrochanteric fracture), or S72.2 (subtrochanteric fracture of femur). Then, data from the SIA/DATASUS were collected for patients that went through rehabilitation (Procedure code 0302050019–Physiotherapeutic Care for Pre- and Post-surgery Patients with Musculoskeletal Disorders) related to a hip fracture (ICD 10: S72.0, S72.1, and S72.2). **Fig. 1** describes the flow diagram of the eligibility criteria.

Data Analysis

The ambulatory information system (SIA, in the Portuguese acronym) tables have anonymized identification that allows the direct count of patients. However, for the hospital information system (SIH, in the Portuguese acronym) database, there is no identification field and the number of patients who were included just once in the datasheet were estimated from the block created by the fields gender, date of birth, and ZIP code. We evaluated the frequency of hip fracture-related hospitalization (HFRH) in the population by year and according to age and gender. The percentage of hospitalizations that ended in death, hospitalization length, and procedures related to hip fracture were also noted. Subsequently, percentages of patients undergoing ambulatory rehabilitation procedures were evaluated. Descriptive data were reported as mean \pm standard deviation (SD) for continuous variables and frequencies, and percentages for categorical variables.

Results

Data from 2,046 Brazilian hospitals, including 441,787 HFRHs occurred between 2008 and 2017, were evaluated. The mean age of the patients at the moment of hospitalization was 68.5 ± 20.9 years old. **Table 1** describes the characteristics of the study population.

Fig. 2 shows HFRHs by year in those < 50 years old and ≥ 50 years old. Hip fracture-related hospitalization in people < 50 years old has been stable, while most of the

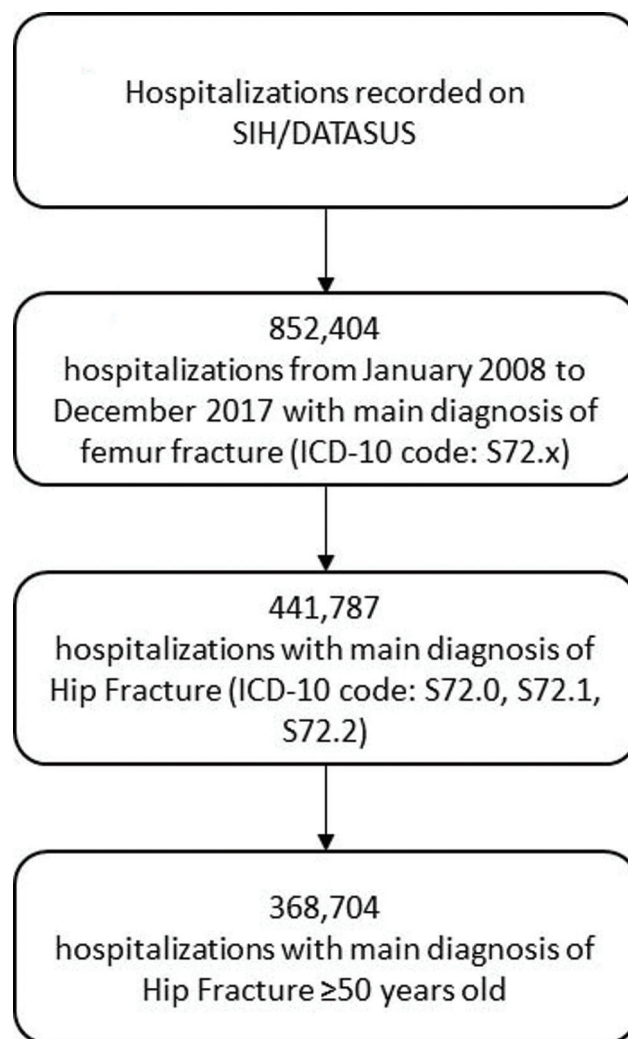


Fig. 1 Flow diagram of the eligibility of the study population.

Table 1 Characteristics of the Study Population ($n = 441,787$)

Variables	Frequency	Percent
Patients ≥ 50 years old at hospitalization time	368,704	83.5%
Gender		
Male	184,667	41.8%
Female	257,120	58.2%
Year of hospitalization		
2008–2009	74,592	16.9%
2010–2011	78,920	17.9%
2012–2013	85,013	19.2%
2014–2015	93,848	21.2%
2016–2017	109,414	24.8%

growth is attributed to people ≥ 50 years old. There was an average annual growth of 5.6% in HFRH in people aged ≥ 50 years old, with lower growth from 2009 to 2010, and maximum growth from 2015 to 2016 (12.2%).

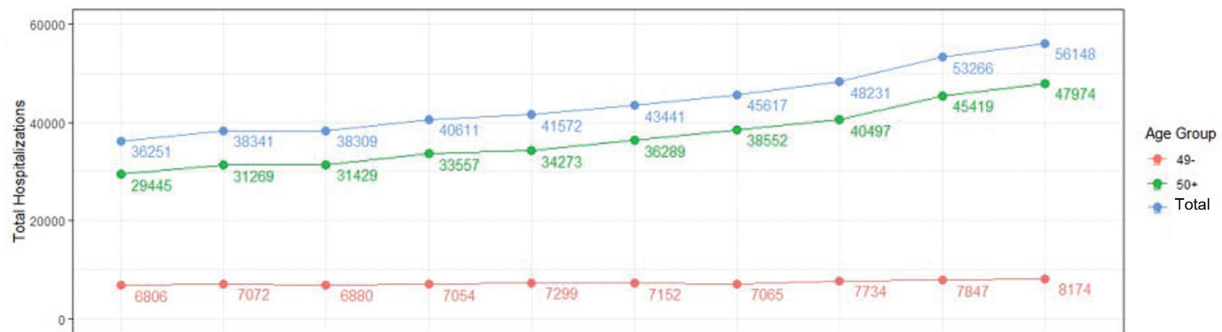


Fig. 2 Hip fracture-related hospitalizations per year. Brazil 2008–2017.

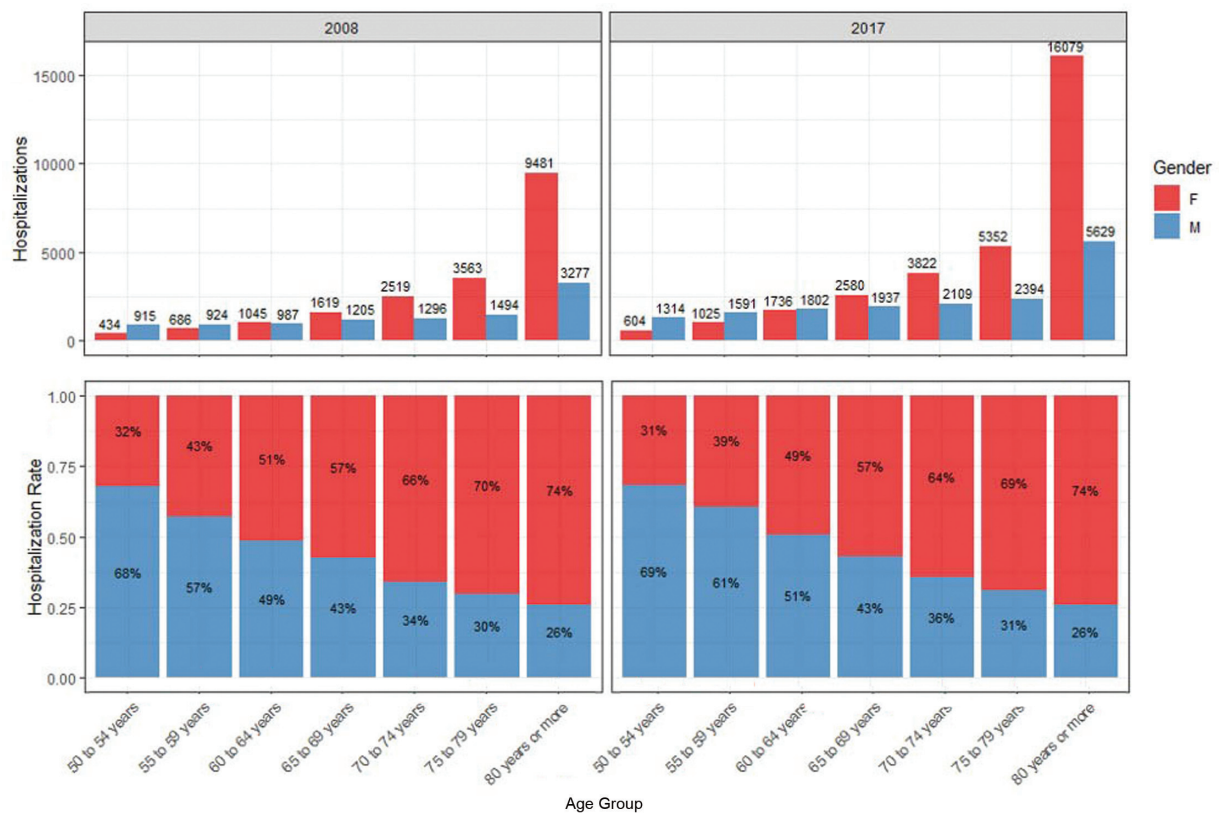


Fig. 3 Age distribution by gender of hip fracture-related hospitalizations per year. Brazil 2008–2017.

The distribution of fractures by gender varies according to age. More hip fractures were observed in men between 50 and 60 years old. A similar prevalence between genders is observed ~ 60 to 65 years old, and is higher in women ≥ 65 years old (► Fig. 3).

From 2008 to 2017, the proportion of HFRH that resulted in death during the hospitalization period in patients aged ≥ 50 years old was between 4.0 and 5.0% (► Fig. 4). However, when those outcomes are assessed considering gender and age groups, the mortality rates profile changed from 2008 to 2017. Generally, the mortality rate was higher in men in most age groups. The mortality rates in men were considerably higher for those ≥ 65 years old, reaching 8.6% in men > 80 years old compared with 6.9% in women in the same age group (► Fig. 5).

It is important to note that length of hospitalization is higher in patients who died during hospitalization and,

consequently, the costs of hospitalization are also increased compared with those discharged from the hospital. Despite treatment and technology development in the past 10 years, the hospitalization length did not change from 2008 to 2017, neither for those patients discharged from the hospital, nor for those who died (► Table 2).

► Table 3 describes the top 10 individual procedures performed for HFRH during the hospitalization according to costs in the years 2008 and 2017. The treatment procedures related with the higher rates of mortality in patients aged ≥ 50 years old were conservative both in 2008 and 2017. We notice that the individual procedure “splinting, in lower limbs, a conservative treatment of fractures” listed as 7th in the ranking in 2008, and with higher mortality rate, is not listed in 2017, which indicates a change in the management of fractures in the lower limbs.

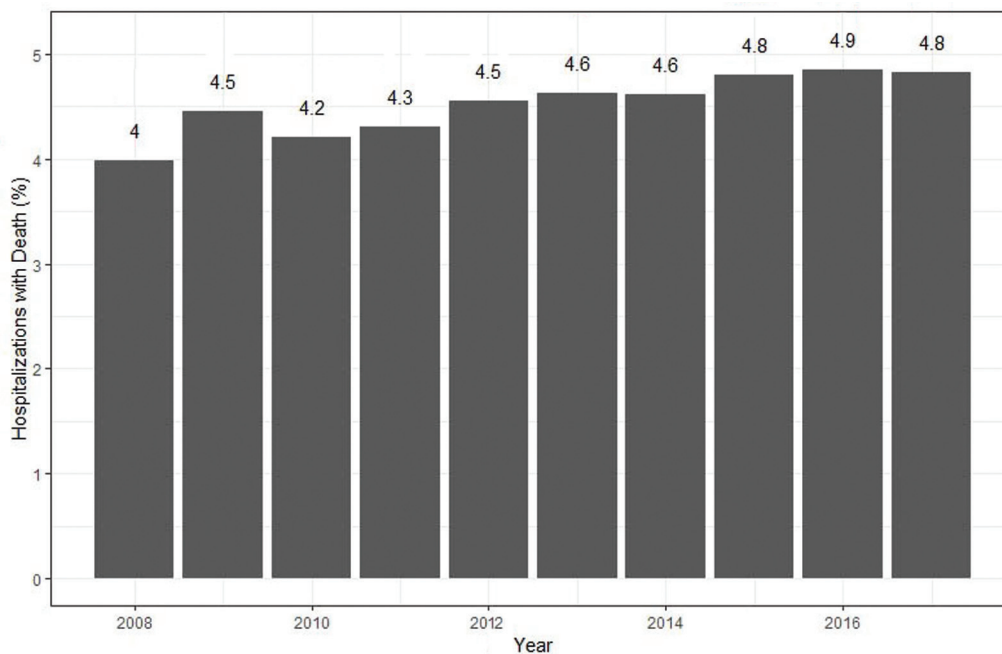


Fig. 4 Percentage of hospitalizations that ended in death per year (≥ 50 years old). Brazil 2008–2017.

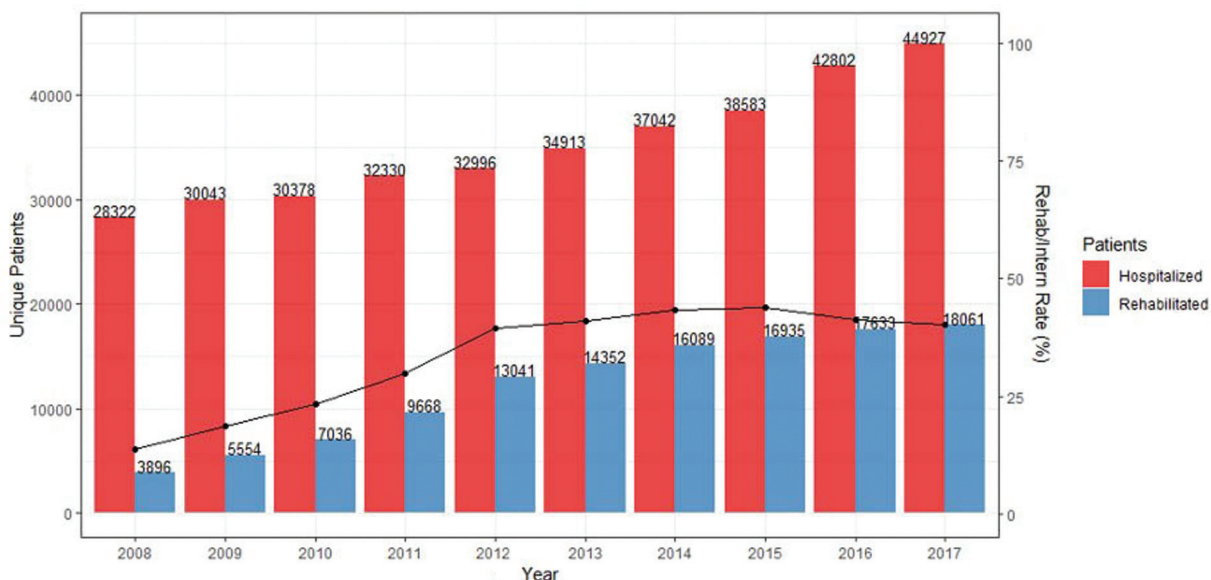


Fig. 5 Patient counts in hip fracture-related hospitalization and hip fracture-related rehabilitation (≥ 50 years old). Brazil 2008–2017.

Table 2 Hospitalization Length and Costs according to Hospitalization Result in Patients ≥ 50 years old - Brazil 2008–2017

		Discharged from Hospital	Death
2008	n	28,272	1,173
	Average Hospitalization length	8.0 ± 7.5	11.0 ± 13.9
	Average Cost (BRL)*	3,016 ± 1,798	4,433 ± 5,006
2017	n	45,658	2,316
	Average Hospitalization length	8.2 ± 7.9	10.5 ± 11.8
	Average Cost (BRL)	2,581 ± 1,824	4,090 ± 4,425

*Values corrected for inflation with the factor of 1,608 according to IGP-M.

Table 3 Individual procedures performed in Hip Fracture Related Hospitalizations for patients ≥ 50 years old. Brazil 2008, 2017

Individual procedure	2008					2017						
	2008 Ranking by Total Cost	No. of hospitalizations	Mean hospitalization length (days) -	Mortality rate (%)	Cost per procedure (BRL) - mean*	Total cost (BRL)*	2017 Ranking by Total Cost	No. of hospitalizations	Hospitalization length (days) - mean	Mortality rate (%)	Cost per procedure (BRL) - mean	Total cost (BRL)
SURGICAL TREATMENT OF TRANSSTROCHANTERIC FRACTURE	1	13,228	8.1	2.8%	3,013	39,865,398	1	19,220	8.7	3.8%	2,562	49,240,036
PARTIAL HIP ARTHROPLASTY	2	3,858	9.0	4.8%	4,552	17,562,345	2	6,847	9.9	5.9%	3,957	27,090,220
NECK/PROXIMAL FEMUR FRACTURE SURGICAL TREATMENT (INTERNAL FIXATION)	3	4,420	8.4	3.5%	2,854	12,612,317	3	4,983	9.0	3.5%	2,105	10,487,855
CEMENTED PRIMARY TOTAL HIP ARTHROPLASTY	4	1,698	8.9	4.8%	5,332	9,054,779	7	1,742	11.5	3.0%	3,936	6,856,209
UNCEMENTED/HYBRID PRIMARY TOTAL HIP ARTHROPLASTY	5	689	11.2	4.5%	6,049	4,167,558	4	2,085	10.8	3.6%	4,794	9,994,540
SURGICAL TREATMENT OF SUBSTROCHANTERIC FRACTURE	6	1,367	9.8	3.2%	2,545	3,480,386	6	3,110	9.8	4.1%	2,236	6,954,768
SPLINTING, IN LOWER LIMBS. A CONSERVATIVE TREATMENT OF FRACTURES	7	2,540	8.8	8.9%	568	1,440,772						
POLYTRAUMA SURGICAL TREATMENT	8	175	9.9	7.4%	4,752	831,553	8	971	8.9	3.8%	4,164	4,043,205
TREATMENT WITH MULTIPLE SURGERIES	9	159	10.5	5.0%	4,588	729,328	5	1,762	7.5	3.3%	4,182	7,368,639
REMOVAL OF LARGE JOINT REPLACEMENT PROSTHESIS (SHOULDER/ELBOW/HIP/KNEE)	10	128	11.9	4.7%	1,676	214,424	18	61	16.4	14.7%	2,004	122,249
TREATMENT OF SPECIFIED/UNSPECIFIED TRAUMA	27	7	12.1	0%	479	3,361	9	1,613	7.4	10.9%	602	971,212
CONSERVATIVE TREATMENT/LIGAMENT INJURY/PELVIS FRACTURE	13	113	13.1	8.0%	490	55,431	10	1,945	9.1	11.2%	410	797,749
OTHER		1,063	4.7	3.4%	423	450,411		3,635	6.3	7.2%	938	3,408,854
TOTAL		29,445	8.4	4.0%	3,073	90,468,062		47,974	8.9	4.8%	2,654	127,335,535

*Values corrected for inflation with the factor of 1.608 according to IGP-M.

The estimated number of patients who were included just once in the datasheet and that went through a HFRH continuously increased since 2008. Moreover, the percentage of patients that went through a hip fracture-related rehabilitation increased from 2008 (14.0%) to 2012 (40.0%). However, from 2012 onwards, the percentage of patients who had hip fracture-related rehabilitation remained stable until 2017. It is important to notice that despite such increase, currently, less than half of the patients who were hospitalized due to hip fracture will go to a rehabilitation center.

Discussion

The present study evaluated data from the SUS from 2008 to 2017. According to our outcomes, there was a mean annual growth of 5.6% in hip fractures attributed to people aged ≥ 50 years old. Considering that Brazil had a 0.9% population annual growth in the same period,¹⁸ the increase in hip fractures occurrence is greater than the population growth, which suggest that the population is aging with associated health care costs. Moreover, the Brazilian profile is contrasting with data from the United States, Canada, Europe, Australia, and New Zealand, where there has been a progressive reduction of hip fractures in the past 10 years.^{19–21}

However, even in countries where hip fractures have been decreasing, there are some trend changes. In the United States, after 10 years of progressive decrease in the incidence of hip fractures, the rates of hip fractures in women aged ≥ 65 years old did not further decrease. During this period, a lower number of densitometries was performed due to change in reimbursement and, along with lower prescription of osteoporosis drugs, further reduction in hip fracture incidence was halted.²² Patients with hip fracture due to fragility are at higher risk for subsequent fractures. After suffering a hip fracture, an initial fragility fracture evaluation of bone mineral density is indicated, and in case osteoporosis is diagnosed, subsequent treatment should be installed to avoid future fractures.⁶

Despite evidence that an occurrence of hip fracture due to fragility is a risk for secondary fractures, and the treatments available have proven to be extremely efficient for decreasing subsequent fractures, the rates of treatment after a fracture due to fragility varies from 10 to 30%.⁶ Our study showed that there was an increase in rehabilitation of patients with hip fracture from 2008 to 2012, reaching $\sim 40\%$. However, after that, the rate of rehabilitation is stable. The reason for the stagnation of rehabilitation rates in the SUS is supposed to be the saturation of rehabilitation services or the lack of initiative by part of the doctors to indicate rehabilitation for fractured patients or even the low adherence of patients to the rehabilitation procedures. As the rehabilitation could prevent secondary fractures, this scenario leads to the hypothesis that the low rate of rehabilitation might expose a higher number of patients at risk of secondary fractures, which in turn increases the number of hip fractures

Besides rehabilitation, anti-osteoporosis medications are efficient in reducing the secondary fractures due to fragility.²³ In Brazil, some drug products are offered by the SUS or

special programs sponsored by state governments. Despite the fact that injectable medication has better adherence to treatment, both oral and injectable drugs are not often prescribed. In addition, low adherence to treatment in general could further affect secondary fractures.²⁴

The progressive increase in the incidence of hip fractures in Brazil demonstrated in our study highlights the impact in the costs for the SUS, which has been growing in the same proportion and reached almost BRL 130 million in 2017. Although the total cost has increased 40%, this growth is exclusively due to a higher number of hospitalizations, since the average cost per hospitalization has decreased 13.6%, keeping a similar length of hospitalization. Besides the financial impact, hip fractures in the elderly population results in a mortality rate of $\sim 5.0\%$ in patients aged ≥ 50 years old. Considering the growing population of the elderly in Brazil, these data show the impact on the society and the need for immediate actions for fracture prevention.

In this context, the orthopedist plays a central role. Fragility fractures increase the risk for secondary fractures. Therefore, the intervention of the orthopedist is more than performing surgery, consolidation, and rehabilitation of the fractured patients. It is necessary to avoid new fractures, and the preventive treatment is crucial. If the orthopedist is not able to perform further diagnosis and preventive treatment, the patients must be referred to another professional to receive the appropriate treatment and patient management. Brazil offers osteoporosis treatment through SUS ambulatories, and also by the Fracture Liaison Service (FLS) program.

The FLS is a service accredited by the International Osteoporosis Foundation aiming to ensure that all patients presenting with fragility fractures receive fracture risk assessment and treatment as appropriate. Those services are based on secondary or primary health care settings around the world and are considered the best tool for reducing fractures in large-scale. Brazil has 22 FLS accredited by the “Capture the Fracture” program,^{25,26} and about half of them are based in SUS hospitals. Thus, it is clear that the preventive system is available for the Brazilian population and several secondary fractures could be avoided if well-managed, decreasing the financial and social impact. Despite the availability of FLS, its implantation and prevention of secondary fractures are not part of the Ministry of Health Programs.

It is important to consider the limitations of our study. The ICD-10 coding used by DATASUS does not allow stratification between fragility fractures and impact fractures. The DATASUS system does not allow the individual connection of hospitalizations (SIH/DATASUS) and ambulatory (SIA/DATASUS) databases, thus the rates presented here for rehabilitated patients are estimated based on the total of care rendered and not by individual patients. Another point to consider is that we evaluated data from population covered by the SUS who does not have private health insurance. Data from the National Supplementary Health Agency show that almost 50 million Brazilian people in 2017 were beneficiaries of private health insurance, which represent $\sim 25\%$ of the population.²⁷ Another point to be considered is that the data obtained does not identify the origin of the fracture, thus several hip fractures

cases included here can be originated from trauma and do not due to fragility. However, epidemiology of osteoporotic fractures supports our findings as most fractures in older people occurs due to fragility. Our data support that hypothesis as the prevalence of fractures is higher in men ~ between 50 and 60 years old than in women, which probably have a contribution of traumatic fractures. On the other hand, after 60 years old, there is an increase in fracture rates in women, making the prevalence in women higher than in men. This phenomenon probably happens due to the effect of menopause, which starts ~ between 45 and 50 years old, and it is well known that it affects bone density.²⁸ At the same time, trauma fractures are probably lower in older men.

However, despite the limitations of our study, we could demonstrate that there is a progressive increase in hip fractures due to fragility in the population ≥ 50 years old in the last decade, a stagnation in the rehabilitation treatments, and a reduction in the average cost per hospitalization. Other countries with health care systems similar to ours experienced a decrease, or at least an annual stabilization, in the incidence of hip fractures in the last 2 decades. This goal was achieved due to a better management of patients followed by actions that greatly contributed to a better outcome, as the increased awareness of orthopedic surgeons and the encouragement of new FLS.²⁹ In summary, based on our data, orthopedic surgeons need to be aware about the importance of rehabilitation and preventive treatment after a hip fracture due to fragility, to prevent secondary fractures and associated costs.

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Conflict of Interests

The authors have no conflict of interests to declare.

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