Original Article

Analysis of older patients hospitalized for burns in Brazil

Análise de pacientes idosos internados por queimaduras no Brasil

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■ **ABSTRACT**

Objective: Analyze the available variables on the Department of Informatics of the Unified Health System (DATASUS) platform of hospitalized burn older people and compare older people over and under 80. **Method:** A retrospective study collected data in DATASUS from January 2009 to December 2019. Patients aged 60-79 years or older and 80 years or older were included in the study, with variables such as time average hospitalization, healthcare costs, and mortality rate. **Results:** During the studied period, 168,955 patients aged 60-79 and 50,410 aged 80 or over suffered burns. The highest mortality occurs in flame accidents, followed by contact burns, third-place scalds, and electrical burns ($p=0.01$). The incidence of hospitalizations in people over 80 is higher than in those aged 60-79 ($p<0.001$). There was a directly proportional relationship between age and length of stay only in the most advanced age groups. It was also possible to verify that the higher the health costs, the higher the mortality rate. **Conclusion:** The length of stay is longer in older patients, and the longer average stay is related to a higher mortality rate. Furthermore, a greater number of days of hospitalization does not result in a lower mortality rate, showing that prevention and adequate management of supplies are more important than a large investment in treatment.

Keywords: Burns; Aged; Epidemiology; Frail elderly; Accidents; Brazil.

■ **RESUMO**

Objetivo: Realizar uma análise das variáveis disponíveis na plataforma do Departamento de Informática do Sistema Único de Saúde (DATASUS) de idosos queimados internados, e comparar entre idosos maiores e menores de 80 anos. **Método:** Estudo retrospectivo realizado por coleta de dados no DATASUS no período de janeiro de 2009 a dezembro de 2019. Foram incluídos no estudo pacientes com idade igual ou superior a 60-79 anos e igual ou maior a 80 anos, sendo avaliadas variáveis como tempo médio de internação, custos com saúde e taxa de mortalidade. **Resultados:** No período estudado, sofreram queimaduras 168.955 pacientes com 60-79 anos e 50.410 com 80 anos ou mais. A maior mortalidade ocorre nos acidentes com chama, seguidos por queimadura de contato, terceiro lugar escaldado e por último queimadura elétrica ($p=0,01$). A incidência de internações em pessoas com mais de 80 anos é maior do que entre 60-79 anos ($p<0,001$). Houve relação diretamente proporcional entre idade e tempo de internação apenas nas faixas etárias mais avançadas. Também foi possível verificar que, quanto maiores os custos com saúde, maior a taxa de mortalidade. **Conclusão:** O tempo de internação é maior em pacientes mais velhos e a maior média de dias de internação está relacionada a maior taxa de mortalidade. Além disso, um maior número de dias de internação não resulta em menor taxa de mortalidade, mostrando que a prevenção e a gestão adequada dos insumos são mais importantes do que grande investimento no tratamento.

Descritores: Queimaduras; Idoso; Epidemiologia; Idoso fragilizado; Acidentes; Brasil.

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INTRODUCTION

Burns are one of the leading causes of death in the world. According to the World Health Organization (WHO), there are around 265,000 deaths per year[1]. In Brazil, it is estimated that around 1,000,000 individuals are burn victims and that mortality is approximately 2,500 patients per year. In the period from 2015 to 2020, there were 19,772 deaths from burns, of which 53.3% (n=10,545) were attributed to thermal burns, 46.1% (n=9,117) to electrical burns, and 0.6% (n=110) to other causes of burns, which include chemical agents, frostbite and radiation. The costs of treating burns are quite high around the world[1]. It is estimated that the average National Health Service (NHS) cost of wound care in clinical practice over 24 months from the initial presentation was £16,924 per burn, ranging from £12,002 to £40,577 for a healed wound and unhealed, respectively[2].

The increase in the world's elderly population proves the importance of knowing the epidemiology of accidents due to external causes, of which burns represent an important fraction. According to the Brazilian Institute of Geography and Statistics (IBGE), in 2010 there were 20.6 million older people in Brazil, representing 10.8% of the total population[3]. Some projections indicate that, in 2060, this population group will increase to 58.4 million inhabitants, corresponding to 26.7% of the entire Brazilian population[3]. Other predictions show that people aged 65 and over will make up 20% of the US population by 2030, requiring significant healthcare resources.

The definition of older people in the literature on burns has been variable. Some studies consider increased life expectancy has resulted in greater functionality; therefore, only patients over 75 are considered older people[4]. According to the World Health Organization (WHO) definition, the population over 60 years of age is considered elderly, which confirms the level established by the United Nations in 1982. Worldwide, the older population's size has increased faster than any other age group in the 20th century[5]. Compared to general studies on aging, very little literature in international academia has paid special attention to a special field of aging studies, which is the study of the majority of older people. There is evidence in the literature[6] that the anesthesia-dependent oscillatory characteristics and reactivity of super-older people are different from those of young people, highlighting the importance of studying this age group.

Increasing age also predisposes patients to burn exposure due to social, cognitive, and organic changes, such as decreased reflexes[7]. Therefore, it is essential to study the epidemiology of burns in older age groups, considering the increase in life expectancy of the world population and the long-term costs of accidents for the health system.

The present study aimed to carry out an analysis of the epidemiological profile of elderly patients, using the WHO definition of older people as patients over 60, and to make a comparison between the groups of patients aged 60 to 79 and patients aged 80 or older, who are defined as super-older people. The aspects involved are health expenses, average length of hospital stay, comparison between sexes, and mortality rate.

OBJECTIVE

This study aims to evaluate the epidemiology of burns in Brazil on the Department of Informatics of the Unified Health System (DATASUS) platform of hospitalized burned older people. In addition, the study also compared causes of burns, healthcare costs, and average length of hospital stay between these two groups and compared the epidemiology in five different geographic regions of Brazil.

METHOD

This retrospective study collected data from January 2009 to December 2019 through the Department of Informatics of the Unified Health System (DATASUS) under the "Health information" icon. The Universidade Estadual de São Paulo Research Ethics Committee, protocol 63399622.7.0000.5411, approved the study.

The variables analyzed were total number of hospitalizations, mortality rate, and average number of days of hospitalization. Categorical variables were compared using the Chi-square test or Fisher's exact test, and continuous non-parametric variables were compared using the Mann-Whitney U test or Kruskal-Wallis test.

The inclusion criteria were burn victims during the studied period in patients over 60. The International Classification of Diseases (ICD-10) codes selected were those corresponding to burns, divided into large groups of separate causes in the data tabulation. from DATASUS: W85-W99 (related to electrical burns, radiation burns, and non-ionizing radiation), X00-X09 (related to fires in buildings and other constructions) and X10-X19 (related to hot liquids, meals, gases, machines, and other common sources).

Data in DATASUS available online, under the "Health Information" icon, were used. The selection on this platform was directed to "Epidemiological and

Morbidity" and "SUS hospital procedures." The data were tabulated in the Microsoft Excel program, and absolute and relative counts were performed using Descriptive Statistics data. Thus, it was possible to research the epidemiology of burn patients and study several quantitative and qualitative variables, such as average length of stay, healthcare costs, and the number of patients affected by each cause of burn in different Brazilian regions, separated by main burn ICDs.

To answer some questions and calculate the statistical association, it was necessary to compare with other age groups not included in the study, such as patients under 60; therefore, these groups were included in some scatter plots in the article. Furthermore, all accidents due to External Causes in the age groups included in the study were also evaluated to quantify the impact of burns concerning the total number of accidents due to other causes. The SPSS 20.0 program was used to perform statistical associations. P-values lower than 0.05 were considered statistically significant.

RESULTS

According to DATASUS, among all deaths included in the External Causes group in the age group of 60 to 79 in the last 10 years in Brazil (195,149 deaths), burns represented 7.71% of all causes (15,055). In the age group of 80 years and over, the number of deaths related to burns was 1,133, and the total due to external causes in this age group was 116,492, with burns representing 0.9% of deaths.

The study included 219,365 patients aged 60 or over hospitalized for burns, according to the International Classification of Diseases (ICD), from 2009 to 2019. Considering all patients studied, 168,955 (77.02%) were 60 to 79 years old, and 50,410 (22.98%) were 80 or older. There was a significant predominance of women in the latter group compared to the first (64.93% vs. 48.67%, respectively).

When comparing the number of hospitalizations for burns in Brazil in the age groups of 60 to 79 and over 80 years, it is clear that the incidence of hospitalizations in those over 80 is higher, with a statistically significant difference ($p<0.0001$).

The highest incidence rate of hospitalizations (per 1,000 cases) was 129.91 in females over 80, and the lowest was 54.74 in the age group from 60 to 79. There was a statistically significant difference in the increase in hospitalizations in patients over 80 compared to those aged 60 to 79 ($p<0.0001$). These data can be verified in Table 1.

Table 1. Incidence of hospitalizations per 1000 according to age group and sex.

Sex	60-79 years old	>80 years old	*P*
Masculine	62.39	90.19	< 0.0001
Feminine	54.74	129.91	< 0.0001

There was a statistically significant difference in mortality between men and women, with males presenting higher mortality in both age groups studied ($p<0.0001$). Comparing only the age groups, it was also observed that men had higher mortality ($p<0.0001$). Health costs are higher in patients over 80 ($p<0.0001$) than in those aged 60 to 79. There was a direct relationship between age and average length of stay only in older patients, as seen in Figure 1.

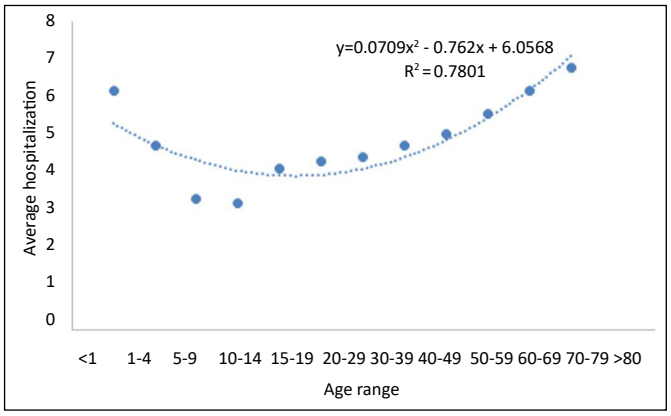

Figure 1. Association between average length of stay and age group.

The analysis of the etiology of accidents with burns showed that, in both groups, the highest mortality occurs in accidents with fire, followed by contact burns, scalds in third place, and, lastly, electrical burns ($p=0.01$), there was no significant difference between etiology and age group ($p=0.05$).

The mortality rate per 1000 inhabitants was 8.91 in those over 80 and 4.19 in those aged 60-79. The average length of stay was 5.8 days for the youngest group and 6.8 days for patients over 80. It was possible to verify that a longer average stay length correlates with a higher death rate, as illustrated in Figure 2. It was also possible to verify that the greater the health expenditure, the higher the death rate, as illustrated in Figure 3.

The average hospital expenses per person considering the age group from 60 to 79 was R$ 3,146.07 and R$ 3,901.85 for the age group equal to or over 80, making it possible to conclude that the latter group presents higher expenses with health concerning the first ($p<0.0001$).

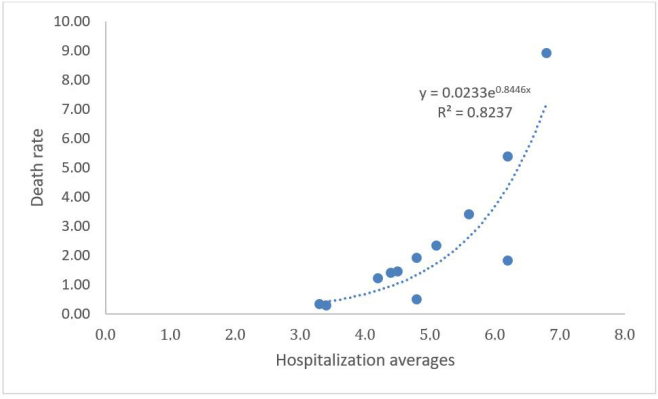

Figure 2. Association between average length of stay and mortality rate.

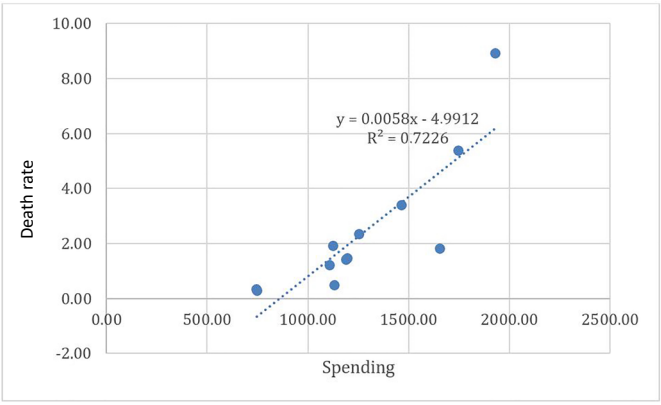

Figure 3. Relationship between average health expenditure and mortality rate.

DISCUSSION

Accidents involving burns are quite common throughout the world and are associated with high morbidity and mortality[1], and are also important causes of absence from work, aesthetic, physical, and psychological consequences, as well as loss of quality of life. The main findings found in this study were that burns in older people are of great importance, given the increase in this population worldwide. Furthermore, it was observed that older patients have a longer average hospital stay.

The present study revealed that the highest mortality occurred in fire accidents in both groups, showing that this etiology represents greater severity when compared to other causes. An article published by researchers from Japan[7] showed that almost a third of fire burns presented a risk of mortality (almost all patients who died suffered fire burns), second-degree burn area and percentage of body area burned compared to other etiologies[7].

In this article, it was possible to verify that older patients had longer hospital stays and a higher mortality rate. However, no data in the literature indicates whether an age cutoff can be used to report increased mortality. A study by Lionelli et al.[8] aimed to determine whether there was a cutoff age as a prognostic factor for accidents with burns in older people but did not find a specific age group. Two hundred one patients, aged 75 years or over, were admitted to the burn unit between January 1972 and May 2000. The risk of mortality increased by 1.1% for each increase in age per year[8].

Another relevant issue for discussion is the difference in the epidemiology of burns in men and women. In a study carried out at the University of Utah[9], in the United States, it was observed that, of the 1,110 patients admitted during this period, 94 (8.5%) were 65 or older. The majority of burns were fire injuries (73.4%), followed by scalds (14.9%), contact injuries (6.4%), and electrical injuries (1.1%).

Although the etiologies of injury are generally parallel between the sexes, women suffered a higher proportion of scald injuries (32.3% versus 6.3%), probably reflecting that they perform more domestic activities with hot liquids in the kitchen. It was found that women who accounted for 33% of burns in older people aged 65 or over tended to have mild burns (12.0% versus 17.2% of body surface area burned - SCQ; $p=0.20$) and less severe (3.6% versus 9.7% 3rd SCQ); $p<0.05$), but mortality did not differ from men.

In the present study, the total number of burns in men was 103,402 cases, with 17,682 patients (17.10%) aged 80 or over and 85,720 cases (82.89%) in patients aged 60 to 79. The most common causes were fire injuries (73.4%), followed by scalds (14.9%), contact injuries (6.4%), and electrical injuries (1.1%). The total number of women was 115,963 cases, with 32,728 cases (28.22%) in those over 80 and 83,235 cases (71.77%) aged 60 to 79. The higher proportion of women over 80 is probably related to the higher life expectancy of women[9,10].

The most advanced age groups in the present study have the highest mortality rate and days of hospitalization. In a retrospective study by Wang et al.[11] in China, between 2009 and 2018, the etiology, clinical characteristics, and therapeutic efficacy of elderly patients aged 60 or older with severe burns admitted and treated at a burn center were retrospectively analyzed. Twenty-seven deaths were caused among 109 patients, 16 men and 11 women. Overall mortality was 24.8%. The average length of hospital stay for the 109 patients was 19.0 days (range 5.5-49.5 days).

The mortality rate in the present study was lower: 8.91% in those over 80 and 4.19% in the 60 to 79 age group. The average length of stay for those over 80 was 6.8 days; for the age group 60 to 79, it was 5.8 days.

One of the reasons for this discrepancy would probably be the larger sample size of this research.

In a study at the University of Nashville[12], the geriatric age group was likelier than younger people to convert their thermal burns from partial to full thickness. Eleven young (mean age = 23) and older people (mean age = 79.2) patients were studied. Initial research examined 31 cytokines with lower EGF (p=0.032) and RANTES/CCL5 (p=0.026) levels in elderly patients, reflecting their lower immune responsiveness. This result could justify the longer hospital stay and higher mortality of patients in older age groups found in the present study.

Another retrospective observational study in Brazil from 2000 to 2014[13] showed that children between 5 and 14 had the highest number of hospitalizations (69,383), while patients over 85 had the highest hospitalization rate (15.2 hospitalizations/ 100,000 inhabitants/year). Male patients had a higher proportion of premature deaths (96.0% versus 93.0%). There was no visible trend of increase or decrease in time concerning hospital mortality and age. In our study, it was not possible to directly correlate age and mortality rate, but it was found that elderly patients have longer hospital stays, which is related to higher mortality rates.

It was also possible to observe that the super-elderly group had higher expenses, probably due to longer hospital stays. A study in Sweden[14] found that each TBSA% increases hospitalization costs by almost US$16,000 in the older patient group. Elderly patients received more care, which resulted in higher expenses[14,] and another hypothesis to explain this fact is that older people generally have coexisting medical conditions, impaired immune response, and slower healing.

Considering that DATASUS data was researched, the study has some characteristics. First, the study only included patients who received medical care for burns and who were notified through the CIDs included in the study. Furthermore, due to the dependence on the ICD to search for patients, it is possible that not all causes of burns were correctly identified or that the ICD was not specific enough to qualify the reported burn's etiology adequately. Furthermore, concerning CID as a cause of death, such as infection systemic inflammatory response.

Burns represent an important percentage of health expenditures worldwide, and the aging of the world population has created a new field of study for this group's most diverse causes of mortality. Therefore, it is important to study the particularities of burns in elderly patients, especially prevention measures, considering that the health costs of burns in elderly and super-elderly patients are higher than in children and young people. Due to the scarce literature on burns in elderly patients in the literature, it is relevant to study this population, especially with the worldwide increase in life expectancy.

CONCLUSION

Burns represent a large fraction of external accidents in all age groups. They present different responses to trauma compared to young patients, especially regarding biochemical and immunological mechanisms. Our study revealed that length of stay is longer in older patients and that a longer hospital stay is related to a higher mortality rate. Furthermore, higher health expenditures do not result in a lower mortality rate, showing that prevention and adequate management of inputs are more important than large investments in treatment.

COLLABORATIONS

OTD Analysis and/or data interpretation, Conceptualization, Final manuscript approval, Formal Analysis, Funding Acquisition, Methodology, Realization of operations and/or trials, Resources, Visualization.

RFRM Analysis and/or data interpretation, Methodology, Validation, Writing - Original Draft Preparation.

MSS Analysis and/or data interpretation, Conception and design study, Conceptualization.

BFMN Analysis and/or data interpretation, Conceptualization, Funding Acquisition.

AAP Formal Analysis, Project Administration, Resources, Supervision.

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