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## **Epidemiology of Spine Trauma at a Reference Hospital in Rio de Janeiro**

### **Epidemiologia do Traumatismo Raquimedular em um Hospital de Referência no Rio de Janeiro**

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**Lorena Izabel Esteves Adolphsson**

ORCID: <https://orcid.org/0000-0001-7666-6376>

Faculdade de Medicina - Universidade Federal Fluminense, Brasil

E-mail: [lorenaadolphsson@id.uff.br](mailto:lorenaadolphsson@id.uff.br)

**Esther Serman Castro e Silva**

ORCID: <https://orcid.org/0000-0001-9657-5500>

Faculdade de Medicina - Universidade Federal Fluminense, Brasil

E-mail: [sermanesther@id.uff.br](mailto:sermanesther@id.uff.br)

**Paulo Ricardo de Souza Melo**

ORCID: <https://orcid.org/0000-0002-1359-1976>

Faculdade de Medicina - Universidade Federal Fluminense, Brasil

E-mail: [paulomelo@id.uff.br](mailto:paulomelo@id.uff.br)

**Marco Orsini**

ORCID: <https://orcid.org/0000-0002-8526-6937>

Médico Neurologista - Universidade Federal do Rio de Janeiro e Universidade Iguazu, Brasil

E-mail: [orsinimarco@hotmail.com](mailto:orsinimarco@hotmail.com)

**Paulo Henrique Reigota Pinguelo**

ORCID: <https://orcid.org/0009-0001-3727-0552>

Médico Neurocirurgião - Hospital Estadual Alberto Torres, Brasil

E-mail: [reigotablanc@gmail.com](mailto:reigotablanc@gmail.com)

**Bruno Lima Pessoa**

ORCID: <https://orcid.org/0000-0002-9878-3466>

Faculdade de Medicina - Universidade Federal Fluminense, Brasil

E-mail: [brunopessoa@id.uff.br](mailto:brunopessoa@id.uff.br)

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### **RESUMO**

O trauma raquimedular é uma doença heterogênea que pode significar a lesão de qualquer componente da coluna vertebral, apresentando ou não acometimento medular. O TRM é apontado em diversos artigos como uma importante causa de morbidade e mortalidade na população, sendo responsável por uma redução significativa da qualidade de vida das vítimas. Isso muitas vezes está atrelado a questões socioeconômicas, uma vez que a maioria dos casos são homens em idade economicamente ativa. Com isso, a incapacidade e a redução da independência envolvem questões de reorganização familiar/social e econômica. Nesse sentido, as características epidemiológicas do TRM são de extrema importância para a elaboração de políticas públicas e sua maior prevenção. Definindo a principal etiologia e o segmento populacional mais afetado, os esforços preventivos podem ser redirecionados e se tornarem mais efetivos.

**Palavras-chave:** Trauma; Epidemiologia; Medula vertebral; Coluna vertebral

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## ABSTRACT

Spinal cord trauma is a heterogeneous condition that can involve the injury to any component of the vertebral column, with or without spinal cord involvement. Spinal cord trauma is cited in various articles as a significant cause of morbidity and mortality in the population, leading to a substantial reduction in the quality of life for its victims. This is often associated with socio-economic issues, as the majority of cases involve economically active men. As a result, disability and reduced independence give rise to challenges related to family, social, and economic reorganization. In this context, the epidemiological characteristics of spinal cord trauma are of utmost importance for the development of public policies and its prevention. By identifying the primary etiology and the most affected population segment, preventive efforts can be redirected and made more effective.

**Keywords:** Trauma; Epidemiology; Spinal cord; Vertebral column

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## INTRODUCTION

Spinal cord trauma (SCT) is defined as an injury to the vertebral column at any level, can be either temporary or permanent and may be associated with spinal cord damage (MORAIS, 2013; FRISON, 2013). The injury can affect any component of the vertebral column, whether vascular, spinal cord, ligamentous, bony, discal, or radicular (PEREIRA, 2011). Spinal cord injury is described as the restriction or loss of motor/sensory function below the level of the lesion, which can be complete or incomplete depending on the affected nerve fibers (FRISON, 2013).

Due to its critical motor and sensory functions, the management of spinal cord injury should be initiated as early as possible to prevent potential complications, often requiring a multi-professional approach (SANTOS, 2012). Among the possible consequences, there are, not only motor, sensory, and autonomic changes, but also impacts on the respiratory, cardiovascular, gastrointestinal, and genitourinary systems (PEREIRA, 2010; DE SOUSA, 2013).

Most cases occur in men between the ages of 21 and 35, and they are often victims of automobile accidents or falls from heights (MORAIS, 2013; BRITO, 2011; BOTELHO, 2014; PEREIRA 2011). When considering these statistics alongside the high morbidity and mortality associated with SCT, it becomes evident that there are socio-economic repercussions in the lives of patients, their families, and society at large (SILVA, 2018; DE CAMPOS, 2007). Socially, the impact is primarily due to the age of the majority of victims, as young individuals represent a significant part of the workforce. From a family perspective, the often debilitating nature of the injury requires increased

support from family members, meaning lifestyle changes, re-education, restrictions and dependence of the individual injured (SANTOS, 2012; DE CAMPOS, 2007).

Therefore, spinal cord trauma is considered a highly impactful event on an individual, social, and economic level, making it a public health issue. Consequently, greater understanding of the etiology and incidence of spinal cord trauma is necessary so that prevention policies can be implemented. As a consequence, these policies are expected to reduce the number of victims and hospital costs associated with the care of these patients (DE CAMPOS, 2007).

## **METHOD**

The study was conducted through the analysis of medical records of patients who were victims of spinal cord trauma at the Alberto Torres State Hospital. To describe the prevalence of this SCT, the following variables were studied: gender, age, etiology of the injury, and neurological deficit. For group comparisons, the Kruskal-Wallis test was used when the variables did not have a normal distribution. For other comparisons, the Student's t-test was employed. Additionally, Pearson's correlation analysis was used for parametric variables, and Spearman's correlation for non-parametric analysis. The significance level was set at 5%, with a 95% confidence interval.

From the data of medical records, were included in the study patients diagnosed with ICD codes related to spinal cord trauma and had fractures confirmed by imaging methods. Medical records that only had fractures adjacent to the spine, ligamentous or muscular injuries were excluded.

The included ICD codes were: S32 - fracture of the lumbar spine and pelvis (S32.0, S32.1, S32.7, and S32.8); T08 - fracture of the spine, level unspecified; T09 - other injuries of the spine and trunk, level unspecified (T09.0, T09.1, T09.3, T09.6, T09.8, and T09.9); S22 - fracture of rib(s), sternum, and thoracic spine (S22.0, S22.1, S22.8, and S22.9).

## **RESULTS**

A total of 144 medical records were selected, of which 117 were included in this analysis based on the availability of data for the observed variables and inclusion criteria. From the sample, 83 (70.94%) were males and 34 (29.06%) were females. The age of the

patients ranged from 9 to 89, with an average age of 47.32 years, and the highest incidence was observed in the age groups of 50-69 years (41.02%) and 20-29 years (17.95%). Graph 1 illustrates the age distribution pattern.

The population of Metropolitan Region II, excluding the municipality of Niteroi, is the reference area for HEAT, corresponding to 1,199,062 inhabitants, while the number of patients treated between the years 2018-2021 was 62,756. These numbers reflect a prevalence of spinal cord injury of 0.01% of the total population and 0.24% of hospitalized patients.

The most prevalent mechanism of injury was falls from height (45.2%), followed by automobile accidents (33.3%). The most affected spinal segments were the lumbosacral (36.7%) and cervical (31.6%). The average length of hospital stay was 13 days  $\pm$  14.

**Table 1 - age and number of days hospitalized**

	Mean	Median	Mode	Variance	Standard deviation	Min	Max
Age	47,324	50	52	332,566	18,23639	9	89
Days hospitalized	13,440	8	2	206,910	14,38437	0	80

**Graph 1 - age distribution**

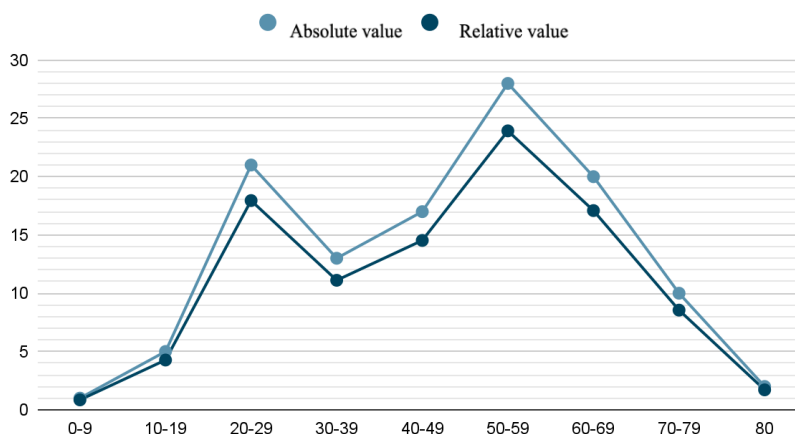


Table 2 presents the average length of hospitalization in days according to gender and colour (white, brown, black, or unspecified) of the analyzed patients. Male patients, especially those who are black and brown, had higher average hospitalization days, but the difference between men and women was not statistically significant ( $p > 0.64$ ).

**Table 2 - Hospital length (mean) by gender and colour**

	White	Brown	Black	Not specified	Total
Men	11,59	15,76	15,33	4,00	14,36
Women	10,42	11,48	0	15,00	11,21
Total	11,18	14,59	15,33	7,67	13,44

Regarding the etiology of trauma, there were a predominance of cases related to automobile accidents (33.3%) and falls from height (45.3%), with both of these categories primarily affecting men and brown individuals, as illustrated in Table 3.

**Table 3 - Etiology of trauma by gender and colour**

	White	Brown	Black	Not specified	Fem	Masc	Total
Automobile accidents	8	28	2	1	10	29	39
PAF	2	4	0	0	1	5	6
PAF + Automobile accidents	0	2	0	0	1	1	2
Fall from own height	8	9	0	0	9	8	17
Fall from height	16	34	1	2	13	40	53
Total	34	77	3	3	34	83	117

The following mean ages were found for each evaluated etiology, as described in Graph 2. For the most prevalent etiologies (falls from height and automobile accidents), the mean ages were 51 and 39.17 years, respectively.

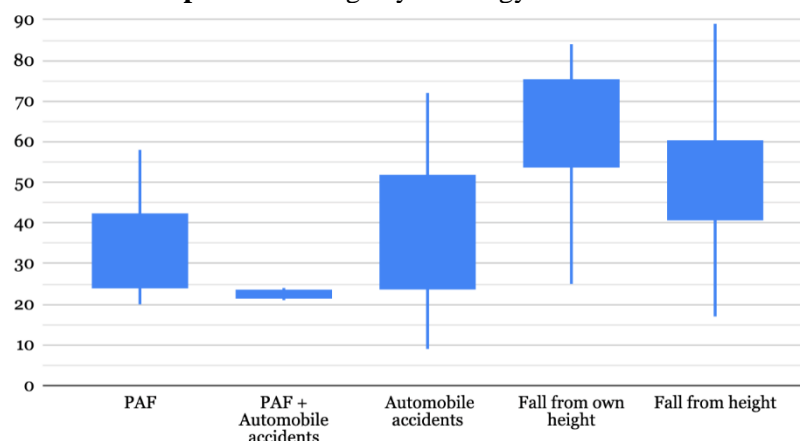
**Graph 2 - mean age by etiology of the trauma**

Table 4 corresponds to the comparison between the injured vertebral segments and the variables of race and gender. In this analysis, it was found that there is a predominance of lumbar segment injuries, where the gender ratio was equivalent. In

contrast, injuries to the cervical, thoracic, and lumbosacral spinal segments were more frequent among men and brown individuals.

**Table 4** - spine level by gender and colour

	White	Brown	Black	Not specified	Feminine	Masculine	Total
Level not specified	5	5	1	0	3	8	11
Cervical	11	24	0	2	7	30	37
Thoracic	4	22	0	0	7	19	26
Lumbosacral	14	26	2	1	17	26	43
Total	34	77	3	3	34	83	117

Regarding the outcome, 81 patients without neurological deficit were identified (69.23%), with an average hospitalization time of 8.83 days (SD = 7.80625). In comparison, the average hospitalization time for patients with deficits (36 - 30.77%) was 23.8 days (SD = 19.6684), although the difference was not statistically significant according to Mann-Whitney test ( $p = 0.453$ ) between these variables.

The association between age and etiology was statistically significant ( $p < 0,05$ ), indicating that younger victims are associated with higher-impact traumas, such as car accidents and falls. No other correlation between variables was statistically relevant, although the age and length of stay showed a trend in the Spearman test ( $p=0.15$ ) of a direct association between age and average length of hospitalization.

## DISCUSSION

SCT is an event that can have disabling consequences in a victim's life, affecting everything from their health and social socio-economic aspects (SILVA, 2018; DE CAMPOS, 2007). It is estimated that the incidence of this trauma is approximately 71 new cases per million inhabitants in Brazil, which is higher than in other countries like the USA (40) (MASINI, 2001). However, because it is not a compulsory notification condition, the epidemiology of SCT is challenging to calculate in some Brazilian states, which consequently underestimates the true incidence of the SCT (SILVA, 2018). In the face of this difficulty, epidemiological studies are essential for greater prevention.

In Brazil, the main causes of trauma are falls and automobile accidents, although the present study showed no significant difference regarding this variable (BOTELHO, 2014). As observed in Table 3, about 60% of patients were victims of falls, while

automobile accidents were responsible for 33.3% of cases. Comparing these data with the age information, it is noticeable that in age groups below 30 years, automobile accidents are more prevalent, while falls become more prominent in the population over 50 years. This result illustrates the role of "falls from height" among the elderly population, while in the younger age group, high-impact mechanisms are more prevalent, indicating their exposure to risk situations.

Greater exposure is also evident in the distribution of gender among victims. According to studies in different regions of Brazil, most cases are men in the economically active age group (MORAIS, 2013; BRITO, 2011; BOTELHO, 2014; PEREIRA 2011). In this dataset, men represented approximately 71% of cases, with a longer average length of hospital stay (mean of 14.33) when compared to women (mean of 11.21). These values indicate that, in addition to having a higher absolute number of SCT victims, men also account for the cases with more complications, considering the longer length of hospitalization.

Race is also an important variable in the study, as black and mixed-race individuals are the main victims of SCT (68.37%) when compared to the white population (29.05%). Additionally, black and mixed-race individuals had a longer average length of hospitalization (15.33 and 14.59 days), while the white population had an average of 11.48 days, suggesting that black and mixed-race individuals are involved in more severe accidents requiring longer hospitalization. The same can be observed among women, where mixed-race women had an average of 11.48 days of hospitalization, while white women had an average of 10.42 days of hospitalization. Another important factor to consider is the Brazilian population's dependence on the public health system (SUS), as 80% of them self-declare as mixed-race and black, consequently increasing the statistics related to accidents among this racial group.

Among the most affected spinal segments, this study pointed to the lumbar segment, which differs from other studies that identified the cervical segment as the most affected (MORAIS, 2013; BOTELHO, 2014; SILVA 2018; PEREIRA, 2011). It's important to note that when comparing the gender ratio between the segments, there is a higher proportion of women (39.6%) in lumbar injuries, while in the cervical segment, there is a higher proportion of men (81%).

This variation may be due to the age difference among trauma etiologies. Represented in the Figure 2, falls from height (45.2%) occur in the age range of 55-75

years, which also has a higher proportion of women (TEIXEIRA, 2014), whereas automobile accidents occur in an age group with a higher proportion of men. Thus, the study indicates that lumbar injuries occur in lower-impact etiologies and are associated with previous degenerative changes, while cervical injuries are more associated with high kinetic energy traumas.

Regarding the neurological outcome and the number of hospitalization days, the data analysis revealed a strong relationship between these two variables ( $p < 0.01$ ). In other words, patients with neurological deficits had a longer hospital stay.

According to a study conducted in Rio de Janeiro between 1996-2011, the average cost of hospitalization in state health units for SCT patients was approximately 653.79 Brazilian reais (SANTOS, 2012). Considering the incidence of this trauma and that about 1/3 of patients had deficits and, therefore, a longer hospital stay, it can be concluded that SCT generates significant hospital costs and also impacts social and family dynamics. Hence, public policies for prevention are necessary to avoid social and economic consequences.

This study has a limitation in relying on the correct filling of the ICD-10 in the AIH, as patients were selected based on this data. Therefore, incorrect filling can lead to the exclusion of a certain number of patients, which may affect the statistical analysis of the study.

## CONCLUSION

The most affected groups were men and individuals of mixed race (brown), with a predominance of those in their 3rd, 6th, and 7th decades of life. The most prevalent causes were falls and automobile accidents, with the cervical and lumbar segments being the main areas affected by the trauma. Less than 1/3 of the patients had neurological deficits, with an average hospital stay of over 3 weeks.

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