

## TRAUMATIC BRAIN INJURY: CAUSES AND PROFILE OF VICTIMS ATTENDED TO AT AN EMERGENCY HEALTH CLINIC IN PELOTAS, RIO GRANDE DO SUL, BRAZIL

TRAUMATISMO CRANIOENCEFÁLICO: CAUSAS E PERFIL DAS VÍTIMAS ATENDIDAS NO PRONTO-SOCORRO DE PELOTAS/RIO GRANDE DO SUL, BRASIL

TRAUMATISMO CRANEOENCEFÁLICO: CAUSAS Y PERFIL DE LAS VÍCTIMAS ATENDIDAS EN UNA GUARDIA HOSPITALARIA DE PELOTAS/ RIO GRANDE DO SUL, BRASIL

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### ABSTRACT

This present study aimed to understand the causes and profile of Traumatic Brain Injury (TBI) victims attended to at an emergency healthcare clinic in the city of Pelotas, in the state of Rio Grande do Sul, Brazil. This is a quantitative, retrospective, and descriptive study in which the data were collected from Patients Charts (PC) of TBI victims who were treated in 2008. A total of 496 TBI PCs were analyzed, the majority of which were male, with an average of 0 to 15 years of age, who lived in urban areas of Pelotas. As regards severity, light TBI was most commonly observed, although for 56.3% of the TBI victims, this information was not present in their PCs. From the total population whose PC presented an ignored TBI, 36% were between 0 and 15 years of age, while 28% were between 16 and 30. The predominant etiologies, when comparing all age ranges, were falls, at 47%, followed by aggressions. The age most affected by TBI was 1-year-olds. It could be observed that TBI most commonly affects children, a fact that can be explained by infantile behavior and growth, as well as by inadequate supervision. Considering the data from this research, the elaboration of a healthcare protocol for these victims, the creation of prevention programs, and further studies on this issue are warranted.

**Keywords:** Craniocerebral Trauma; External Causes; Health Profile.

### RESUMO

O objetivo foi conhecer as causas e o perfil das vítimas com traumatismo craniocéfálico (TCE) atendidas em um Pronto-Socorro da cidade de Pelotas, no Rio Grande do Sul, Brasil. Estudo de caráter quantitativo, retrospectivo e descritivo, no qual os dados foram coletados de Fichas de Atendimento (FA) das vítimas de TCE atendidas no ano de 2008. Foram analisadas 496 FAs de vítimas de TCE, com predomínio do sexo masculino. A faixa etária mais acometida foi de zero a 15 anos e a maioria residia no perímetro urbano de Pelotas. Quanto à gravidade, o TCE leve foi mais evidenciado, embora 56,3% das vítimas de TCE não apresentassem esse registro na FA. Do total da população que apresentou TCE ignorado, 36% tinham zero a 15 anos e 28% de 16 a 30 anos. As etiologias predominantes foram as quedas, com 47%, seguidas pelas agressões, quando comparadas com todas as faixas etárias. A idade mais atingida por TCE foi a de um ano. Percebe-se que o TCE acomete mais as crianças, fato que pode ser explicado pelo comportamento e desenvolvimento infantil e também pela supervisão inadequada. Frente aos dados desta pesquisa, é pertinente a elaboração de um protocolo de atendimento a essas vítimas, realização de programas de prevenção e mais estudos sobre o tema.

**Palavras-chave:** Traumatismos Craniocerebrais; Causas Externas; Perfil de Saúde.

### RESUMEN

El objeto del presente trabajo fue conocer las causas y el perfil de las víctimas con Traumatismo Craneoencefálico (TCE) atendidas en una guardia hospitalaria de la ciudad de Pelotas, Estado de Rio Grande do Sul. Se trata de un estudio de carácter cuantitativo, retrospectivo y descriptivo. La recogida de datos se llevó a cabo en las fichas de atención (FA) de las víctimas de TCE atendidas en 2008. Fueron analizadas 496 FA de víctimas de TCE, con predominio del sexo masculino. La franja de edad más afectada fue la de 0 a 15 años, la mayoría vivía dentro del perímetro urbano de Pelotas. Con relación a la gravedad, el TCE leve fue el más evidente a pesar de que en las fichas de atención un 56,3% de las víctimas no lo indicaba. Del total de la población con TCE ignorado, 36% tenían entre 0 y 15 años y 28% entre 16 y 30 años. Las etiologías predominantes fueron las caídas con 47%, seguidas de las agresiones, cuando

*se comparan con todas las franjas de edad. La edad más afectada por TCE fue la de 1 año. Se percibe que el TCE afecta más a los niños, hecho que puede explicarse por el comportamiento y desarrollo infantil y también por la supervisión inadecuada. Frente a los datos de esta investigación es pertinente la elaboración de un protocolo de atención a estas víctimas, ejecución de programas de prevención y realización de más estudios sobre el tema.*

**Palabras clave:** Traumatismos Craneocerebrales; Causas Externas; Perfil de Salud.

## INTRODUCTION

Traumatic Brain Injury (TBI) stands out as an important cause of death, physical and mental deficiency, and neurological disease with a greater impact on the quality of one's life, surpassed only by strokes. Over the past 10 years, the SARAH network of hospitals provided healthcare services to 5,133 TBI victims, the majority of which were males (77.3%) at an average of 30.9 years of age. Traffic accidents were the main cause, followed by personal aggression.<sup>1</sup>

TBI is defined as lesions that involve the scalp, the cranium, and the brain. It is a process that can last from days to weeks but begins at the moment of impact, occurring from a combination of neural damage, vascular insufficiency, and inflammatory effects.<sup>2</sup> This type of trauma occurs after lesions close or penetrate the brain structure, and include cranial fractures and damage to the brain tissue. The type of brain injuries include concussions, contusions, cranial fractures, epidural or subdural hematomas, subarachnoid hemorrhage, and herniation.<sup>3</sup>

Although the main cause of TBI varies from place to place, automobile accidents, physical aggressions, and falls are among the most frequent causes. According to Brazilian statistics, external causes are among the four most common causes of death in the country. Moreover, if the ill-defined causes of death were excluded, external causes would move into second or third place in the ranking. According to data from the DATASUS website, from the ICD-10 group, in 2010 in Brazil 143,256 deaths by external causes were recorded, including all age ranges. Among these, 43,908 (30.7%) resulted from traffic accidents, placing second in the ranking among causes of death. In the age range between 5 and 39 years, traffic accidents totaled 29,940 (68.2%) deaths, increasing to 41,538 (94.6%) if one considers an extended age range of up to 59 years.<sup>4</sup>

Parallel to the evolution of humanity, a progressive rise in mechanical trauma victims can be identified, which has influenced the growth in so-called violent deaths, currently classified as the main causes of death and sequelae in the population of below 45 years of age.<sup>5</sup> And with the advent of new technologies, modern society has seen an increase in faster transport mediums; however, as a negative factor, it has also witnessed a rise in TBI victims, which today has begun to show important repercussions both socially and economically.<sup>3</sup> TBI stands out, in terms of intensity among death and injured victims, as one of the most frequent lesions resulting from external causes, constituting a serious public health problem, represent-

ing the main determining factor of death and sequelae in multiple trauma patients. It is defined as a public health problem of great magnitude and transcendence, with a heavy impact on morbidity and mortality within the general population.<sup>6</sup>

Within this context of growing mortalities due to external causes, the study of the causes and circumstances of these injuries, together with the profile of the victims themselves, becomes essential in an attempt to allow for the creation of a diagnosis that contributes to the implementation, execution, and evaluation of specific control and prevention strategies. Faced with the high incidence of accidents and violence, studies on the issue become relevant so that healthcare professionals that work both in primary care and in hospital environments can familiarize themselves with these events and exercise their co-participation in the attempt to diminish this important societal ill. This includes investment in healthcare education, in the prevention of accidents through education in traffic laws, and in the creation of healthcare service protocols for TBI victims.

This research proposes to make information of epidemiological interest regarding the profile of TBI patients who receive healthcare services at emergency healthcare clinics, as well as the main etiological factors involved in this societal ill, available to healthcare administrators and professionals, as well as to the population as a whole.

## METHODOLOGY

The present study is an epidemiological, descriptive, and retrospective study, carried out through the analysis of secondary data (Patients Charts), with a sample of 496 TBI patients attended to at the Pelotas emergency healthcare clinic (PEHC) in Brazil from January to December 2008. The samples consisted of 25% of all patients who received healthcare services at PEHC, defined as of the date of hospital admission. Of the total of 365 days, 18 blocks of five days each were chosen by random selection, defined systematically as of January 17<sup>th</sup>, with an interval of 20 days between each block, which provided a regular distribution, including all days of the week and periods of the year.

This study applied a pre-tested instrument with closed questions. The socioeconomic and demographic variables investigated included: gender, age, city of residence, and location of housing (urban/rural). Variables related to TBI included: the etiology and the severity and evolution of the case.

For a better development of the study and to achieve the proposed aims, the following inclusion criteria were considered: being a TBI victim and receiving healthcare services at the PEHC during the period of study.

Ethical principles were respected throughout the entire investigation. This study was approved by the Research Ethics Committee of the College of Nursing from the Federal University of Pelotas (UFPel), under protocol number 17/2009.

The collected data were entered into the Epi Info Software (version 6.04), under two separate entries, so as to analyze the consistency of the typing. After, a descriptive analysis of the distribution of proportions was performed, using the same computer program.

## RESULTS AND DISCUSSION

Within the period of this study, 496 TBI patients were identified, the majority of which were male, from 0 to 15 years of age, residing in an urban zone of the city of Pelotas (Table 1). Similar findings have also been observed in other epidemiological studies.<sup>7-10</sup> Such a fact may well be attributed to the greater exposure of male patients to TBI risk factors, such as motorized vehicle accidents, and to violence, given that males tend to have more access to automobiles and more frequently perform laborious activities outside of their homes. Consequently, they are more exposed to these risk conditions.

Table 1 - Sociodemographic characteristics of TBI victims who received healthcare services at PEHC in Pelotas, Brazil (N:496)

Variable	N	%
<b>Gender</b>		
Female	182	36,7
Male	314	63,3
<b>Age</b>		
0 - 15 years	220	44,3
16 - 30 years	124	25,0
31 - 45 years	55	11,1
46 - 60 years	40	8,1
61 years or more	57	11,5
<b>Location of housing</b>		
Urban	411	82,9
Rural	85	17,1
<b>City of residence</b>		
Pelotas	426	86
Others	70	14

In the studied population, of the 496 TBI victims, 220 victims (44.3%) were below 15 years of age. In addition, when con-

sidering the distribution by age range, the age most commonly affected by TBI was 1-year-olds, with 46 victims, which corresponds to 9.3% of the total of all patients, followed by 2-year-olds, with 35 victims (7.1%); 3-year-olds, with 25 (5.0%) victims; and 4-year-olds, with 20 (4.0%) victims. It was also observed that 196 TBI victims (39.5%) were between 0 and 10 years of age.

Upon examining the age range of the TBI victims by gender, a predominance of the male gender could be observed, except in patients above 60 years of age. In the city studied, there are more elderly women, a fact which can explain why more women than men were affected by TBI only in this age range,<sup>11</sup> coupled with the feminization of old age, which can also be observed in many prior studies.<sup>12-14</sup>

In the present study, TBI patients varied from 27 days to 92 years of age, with 219 (44.2%) from the age range of those who were economically active and the other 277 (55.8%) of children and the elderly. In many studies carried out on different populations, including all ages, it could be observed that the peak of incidence of TBI can be identified in the age range of adolescents and young adults,<sup>3,15,16</sup> while in the study carried out in the city of Pelotas, the majority of victims were concentrated within the age range of infants and newborns.

In a retrospective study carried out with children and adolescents in the region of Cariri, Ceará, Brazil, falls proved to be the most frequent cause of TBI, responsible for 45% of the cases among children and pre-adolescents. Males were more affected by TBI, with 70.3% of the total number of victims.<sup>17</sup> This result was similar to that found in the present study, in which, in children of below 1 year of age, falls were predominant (88.8%). The explanation for this may well be in the characteristics of development of the children, whose curiosity, immaturity, and lack of motor coordination place them in situations of risk, in addition to inadequate supervision.<sup>7,18</sup> Moreover, specifically regarding accidents during infancy, some factors may well be associated with the occurrence of TBI, such as gender, child's age, and personality characteristics (hyperactivity, aggressiveness, impulsiveness, and distraction), in addition to organic and anatomic particularities, such as physical and/or mental deficiency.<sup>19</sup>

In the present study, no statistically significant difference could be observed among the days of the week in which the TBI occurred. It could be observed that, on weekends, period in which the population searches for different means of entertainment and trips, and drinks more alcoholic beverages than during normal weekdays, no expressive rise in TBI could be identified. Therefore, the relation of the victims with the days of the week presents no significant relevance. It should be noted that the day that most presented TBI victims was Saturday, with 79 (15.9%), followed by Sunday and Thursday, with 67 (13.5%); and in last place, Monday, with 53 (10.0%).

According to a descriptive and cross-sectional study carried out at a university hospital with children and adolescents, from 0 to 19 years of age, who had suffered some type of trauma, it was found that Saturday was the day with the highest number of TBIs (244 – 18.2%).<sup>7</sup> Comparing this finding with the present study's results, it can be inferred that no significant difference could be observed among the trauma mechanisms involved as regards the days of the week; however, the cause of traffic accidents in general, where the number was not very significant, presented an increase in TBI victims on the weekend.

Regarding the variable of location of housing (urban/rural), that is, the place where the victims live, 411 (82.9%) of the TBI victims lived in the urban perimeter, while only 85 (17.1%) lived in the rural zone. According to the Brazilian Institute of Geography and Statistics (IBGE), the city of Pelotas has 328,275 inhabitants, of which the majority live in the urban perimeter.<sup>11</sup> Such a fact may explain the high number of cranial trauma victims in this region. Consequently, due to the large number of people who reside in the city, there is also a high number of circulating vehicles, which leads to the conclusion that there is a greater exposure to accident risk factors.<sup>11</sup> The majority of TBI victims, 426 (86.0%), lived in Pelotas, while 70 (14.1%) were from cities throughout the region. The city of Pelotas is included within the 3<sup>rd</sup> Regional Healthcare District and offers healthcare services for the cities within this region. Other studies have also presented similar data.<sup>7,13</sup>

Table 2 shows the trauma mechanism of patients in which the majority of the TBI victims suffered a fall, followed, in a lesser proportion, by aggressions, regardless of gender. In a uni-centric study carried out in Turkey, the medical records of 61 patients of less than 18 years of age, with a severe TBI were analyzed retrospectively, in which 31% were girls and 69% were boys; falls proved to be the main cause of TBI. In this manner, it can be perceived that the trauma mechanism has a close relationship with the socioeconomic characteristics of the region and with the affected age range.<sup>16</sup> Currently, 1.6 million hospital admittances for TBI victims each year in the urgency/emergency clinic throughout Brazil and automobile accidents account for the main cause of this trauma, data which runs in contrast with that from the present study.<sup>21</sup>

The creation of campaigns for the prevention of falls and other accidents reported herein have become imperative. It is still up to the responsible legal authorities to act with greater commitment concerning traffic laws and civil construction norms in an attempt to curb the high number of residential area projects that offer no protection whatsoever against falls, mainly from rooftops, which are common in unfinished buildings in low income housing areas, where children circulate freely and without parental guidance. This type of accident deserves special attention, considering the injuries that affect the low income population.

Table 2 - TBI according to the gender of the victims and the type of accident. Pelotas, RS, Brazil, 2008 (N: 496)

Type of accident	Gender			
	Male		Female	
	%	N	%	N
Falls	40,4	127	58,2	106
Aggressions	15,0	47	7,7	14
Pedestrian injured in transport	6,1	19	3,8	07
Exposure to inanimate mechanical forces	8,3	26	0	0
Injured motorcyclist	7,0	22	4,4	08
Automobile passenger injured in transport accident	4,5	14	3,8	06
Injured cyclist	2,9	9	3,8	07
Others	4,7	24	9,5	11
Ignored	11,1	33	8,8	16
Total	100	321	100	175

In the 220 victims from 0 to 15 years of age, falls were predominant, with 141 cases, of which 137 were males. Falls can be defined as an unexpected event or an unintentional displacement of one's body, which results in the change of position of the individual to a lower level in relation to the original position, with a subsequent inability to correct this quickly and efficiently.<sup>22</sup>

This high number of fall victims may well be related to the behavior, to the types of games, to the hurry to finish one's tasks, among others, which make this age range more susceptible to these types of injuries. Moreover, the predominance of the male gender in this injury, as regards childhood accidents, is most likely highlighted by the difference in activities developed by each gender, with the boy more exposed to dynamic activities that involve high risks, while the girls tend to perform lighter activities.<sup>23</sup>

As regards the etiology of falls with TBI, the data show that, of the 233 (47.0%) falls, 105 (45.0%) were from their own height, 21 (9.0%) from the height of one meter, 13 (5.6%) from falls out of bed, 10 (4.3%) from falls from a bicycle, 10 (4.3%) from a height of two meters, 8 (3.4%) from a height of three meters, 7 (3.0%) from stairs, and 59 (25.4%) from sofas, laps, horses, among others. A statistical similarity could be identified in findings from Melo et al.,<sup>5</sup> which registered falls from heights, especially for children of below five years of age, mainly related to falls from the mother's lap, from the cradle, from the bed, and from stairs, as the main causes of TBI. By contrast, children between 6 and 10 years of age showed a predominance of falls from stairs, beds, walls, and trees.

The most effective treatment is, undoubtedly, prevention, given that the children, as they are in a growth and development stage, are subject to different types of cranial traumas. Some ways in which to prevent children from falling, which was the predomi-

nant cause of TBI in the infantile age range, include placing nets or bars on windows and not allowing children to play or circulate on rooftops, on walkways, and around gates near stairwells.

As regards the severity of the TBI, this study has presented a piece of data that is quite relevant to the non-application or recording, on the part of the healthcare professionals, of the Glasgow Coma Scale (GCS) score. The GCS is a reliable neurological evaluation method that, by means of a points system, has the aim of identifying the level of consciousness, the prognosis of the severity of the trauma, and future sequelae. The GCS evaluates the patient in three commands: ocular opening, verbal response, and motor response, and the final score classifies the TBI as light (13-15), moderate (9-12), and severe (3-8). The scale has a maximum of 15 and a minimum of 3. Of the 496 victims, 279 (56.3%) did not have the GCS score recorded on the PCs, which weakens this variable. In this study, 202 (40.7%) patients presented light TBI, 11 (2.2%) severe, and 4 (0.8%) moderate.

These data are in accordance with research carried out by means of medical records of 555 TBI victims, of which only 380 (68.5%) showed any record of the severity of the trauma and 175 (31.5%) presented no GCS score whatsoever. The present study showed that the majority of the sample presented light TBI, followed by severe and moderate, respectively.<sup>5</sup> Another investigation, also with secondary data, showed that of the 333 medical records analyzed, 160 (48.4%) presented no record of information concerning the GCS scoring upon admittance to the hospital.<sup>17</sup>

As regards the evolution of the case of TBI victims, upon admittance to the emergency clinic, that is, within the first 12 hours, Figure 1 shows that the majority were released from the hospital after the first medical evaluation. However, the literature advocates that patients with brain injuries must remain under observation within the urgency/emergency clinic for a minimum of 24 hours so that healthcare professionals can monitor the signs of a worsening clinical picture, such as the appearance of seizures, disorientation, severe headaches, among other characteristic symptoms of TBI.<sup>2</sup>

It could also be observed that, of the total number of TBI victims that evolved in such a way as to be discharged from the hospital or that required surgical intervention (suture), the falls were the main cause of cranial trauma, followed by aggressions. Of the patients that required hospitalization, the majority had suffered a fall, followed by a motorcycle accident. Two of the patients died, with one death of a 19-year-old who had suffered an automobile accident that caused the TBI, and another death of a 30-year-old male who had been run over. In addition, the trauma mechanisms of a motorcycle accident and being run over can be considered more violent accidents when compared to others found in this study, given that the evolution of the cases of these victims was either hospitalization or death.

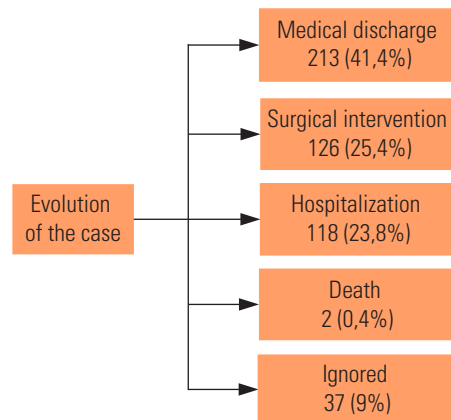


Figure 1 - Evolution of the cases of TBI victims who received healthcare services at PEHC in Pelotas, Brazil – 2008; (N: 496).

In a study carried out in the state of Paraná, Brazil, with 1,337 TBI victims, 733 (70.83%) received a medical discharge after the first medical evaluation, 384 (28.72%) remained hospitalized, and in 6 patients it was impossible to determine if they had been discharged on the first day or if they had been hospitalized for one day.<sup>25</sup> These data are similar to those from the present study.

## FINAL CONSIDERATIONS

This study led to the conclusion that the majority of patients affected by TBI in Pelotas, Brazil are male and belong to the age range of 0 to 15 years of age; the most commonly affected patients were 1-year-olds. As regards the severity of TBI, the majority of patients suffered a light TBI, as compared to the severe and moderate forms. One limitation of this study was that 56.3% of the victims presented no GCS score on their PCs, which would aid in determining the severity of the TBI. Thus, this fact may well demonstrate that the healthcare professionals either apply the GCS scale but forget to log it into the medical records or simply do not apply the GCS scale at all, in turn leading to a loss of important information.

It is well-known that the information logged into medical records and PCs is of utmost importance in professional healthcare practices. Although the dynamic of urgency and emergency healthcare services make the totality of this practice difficult, it is the duty of the healthcare administrators, together with their teams, to draft protocols that make the logging of the services rendered easier so as to not only ensure this right to the victims, but also contribute with data for future research that is essential to the management and quality of healthcare actions.

This study is of great value in the sense of providing a framework for healthcare professionals, since it is through the profile of the TBI victims and of the trauma agent that it is possible to construct and search for ways in which to care for

a given group and invest in the prevention of falls, especially with infants and the elderly, through effective public policies. The results presented in this work are also relevant for healthcare services, since this work can lead to better investments in the actions necessary for the proper healthcare provided to TBI victims, in turn applying a more qualified care.

More specific studies to quantify the magnitude of the problem in Brazil are warranted, given that the number of child TBI victims who seek out healthcare services or who are hospitalized is relatively unknown. Moreover, the clarification of the trauma mechanisms involved, as well as of the sociodemographic and clinical characteristics of these children, can contribute to the implementation of programs for the prevention and enhancement of healthcare services, in turn reducing possible sequelae and minimizing costs.

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