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ORIGINAL ARTICLE

Profile of Hospitalizations of Children and Adolescents Victims of Transport Accidents: A Retrospective Study

Naiana Braga da Silva[1], Taynná Larissa Santos Rodrigues[2], Ane Polline Lacerda Protasio[3], Alessandro Leite Cavalcanti[2]

[1]Uniesp University Center, Dental School, João Pessoa, PB, Brazil.
[2]Post-graduate Program in Dentistry, State University of Paraíba, Campina Grande, PB, Brazil.
[3]Post-doctoral Dentistry Program, Federal University of Paraíba, João Pessoa, PB, Brazil.

Correspondence: Naiana Braga da Silva, UNIESP University Center, Dental School, Rodovia BR 230, km 14, Morada Nova, Cabedelo, PB, Brazil. 58109-303. **E-mail:** neinabs@hotmail.com

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ABSTRACT

Objective: To present the profile of hospitalizations due to transport accidents in individuals aged 0-19 years in a reference hospital for urgent and emergency traumatology care. **Material and Methods:** This retrospective study is grounded on analyzing medical records of children and adolescents hospitalized due to transport accidents in 2016 and 2017. The bivariate analyses included Chi-square and Fischer's exact tests and binary logistic regression, with a 5% significance level. **Results:** Four hundred and seventy-five (43.7%) of the 1,088 medical records investigated corresponded to transport accidents, and accidents involving motorcycles were the most frequent (68.3%), affecting adolescents (81.3%), while children were more involved in accidents as pedestrians (57.1%). Advancing age increases the likelihood of the outcome, with a significant association in the multivariate analysis ($p<0.001$). The mandible was most frequently affected in maxillofacial fractures. **Conclusion:** Transport accidents predominantly affect male adolescents, involving motorcycles, and the lower limbs are the most affected. The mandible was the most affected bone in maxillofacial fractures.

Keywords: Accidents, Traffic; Facial Injuries; Maxillary Fractures; Child; Adolescent.

Introduction

Transport accidents involve a vehicle intended to transport people and goods, and pedestrians are individuals who are not inside or on it, who, in the latter situation, are vehicle passengers or occupants [1]. These accidents are responsible for 1.35 million deaths annually. Moreover, they are the leading cause of mortality among children and adolescents worldwide [2], with the need for care at a tertiary health care level, mainly involving motorcycles, in combination with alcohol consumption and not wearing a helmet [3-6].

The Brazilian vehicle fleet has grown considerably in recent years, accounting for approximately 45 million circulating units, including cars, trucks, and buses, besides about 13 million motorcycles, corresponding to a mean of 4.7 inhabitants per vehicle in 2018. [7]. This expansion concerns for national and international government agencies since it is responsible for the high percentage of transport accidents [2,8].

The type of transport that appears most in the statistics in cases of transport accidents with fatal victims are motorcycles, characterized by multifactorial, mainly listing the factors of schooling, household income, roads and highway conditions, non-use of personal protective equipment, and alcohol intake while driving the vehicle [9]. In addition, the literature shows mortality rates are four times higher for men and are 7.5 times more likely to occur in motorcycle occupants against 3.4 times in occupants of other motor vehicles [10].

The World Health Organization also highlights that pedestrians and bicycle users are vulnerable individuals on public roads, with mortality or disabilities more prevalent in individuals who suffer transport accidents in these conditions than occupants of cars and other motor vehicles [2]. Sousa et al. [11] suggest that children are the most vulnerable age group in transport accidents when using bicycles in recreational activities and Flaherty et al. [12] reported that off-road vehicle-related injuries continue to be a major public health problem, especially for those younger than 18 years old.

The Brazilian National Traffic Policy [13] aims to reduce accidents through legislation directed and guided by traffic safety guidelines, education for citizenship in traffic, the guarantee of mobility, accessibility, environmental quality, strengthening of the National Traffic System, with continuing training, planning, and management, besides articulating actions and programs between the federal, state, and municipal spheres.

These guidelines guarantee more significant inspection, incentives for educational programs for traffic in educational institutions and various media, emphasis on bettering the training and improving drivers, encouraging the vehicle fleet renewal – with a higher safety level and severe punishment for the use of alcoholic beverages associated with driving, protecting pedestrians, and encouraging collective and non-polluting means [13]. As a result, these measures have significantly reduced the rates of Brazilian traffic accidents [2].

Unlike what was observed at the national level, with a 30.6% reduction in death rates from transport accidents, the Northeast region's mortality rate grew by 9.7%. However, the state of Paraíba, Brazil, followed the decline of these numbers in the country and fell 20.9% in the number of fatal victims from 1990 to 2015 [10]. Nevertheless, further investigations are required to monitor the impact of public policies implemented.

Epidemiological research conducted in reference centers has already occurred in Paraíba; however, assessments that include accident data before the new National Traffic Policy's implementation show the importance of new studies that can describe and analyze the likely changes in the setting. Therefore, this study aims to present the profile of hospitalizations due to transport accidents in individuals aged 0-19 in a traumatology care reference hospital.

Material and Methods

Study Design

This documentary and retrospective study evaluated the medical records of victims treated at the Dom Luiz Gonzaga Fernandes Emergency and Trauma Hospital in Campina Grande, Brazil. We analyzed all medical records of patients who were victims of transport accidents hospitalized in 2016 and 2017. Medical records that were incomplete or with erasures that hindered identifying the cause of hospitalization and the age of patients and records referring to return hospitalizations were excluded.

Sample

Information on patients aged 0-9 was considered as belonging to children and individuals aged 10-19 to adolescents, as established by the WHO [14]. The sample comprised 1,088 records of children and adolescents, 996 of which had complete data for logistic regression analysis, from a total of 2,401 medical records, of which 1,271 corresponded to hospitalizations in 2016 and 1,130 to hospitalizations in 2017.

Data Collect

Data were collected by two researchers previously trained by the Hospital's Medical and Statistical Archives Sector (SAME), performing the research from May 2018 to May 2019. In addition, the research tool employed was adjusted through a study pilot, in which the medical records referring to the hospitalizations of May 2015 were used since these documents had a similar organization to the 2016 and 2017 documents.

A structured questionnaire was adopted to collect data, covering the following information: gender; age (by age group); service on weekends (yes or no); service period (day or night); type of transport accident (pedestrian, motorcycle, automobile, bicycle, or others); transport accident mechanism (trampling, overturning, and vehicle fall or collision); body regions affected by trauma (skull, face, chest, abdomen, upper/lower limbs, or hip); characteristic of facial injuries (facial fracture, soft tissue injury, or fractured bones); length of stay (in days) and intensive care unit stay (yes or no), and hospital care outcome (hospital discharge, transfer, or death). Hospitalizations due to transport accidents were used as a dependent variable.

Statistical Analysis

Data were categorized, tabulated in electronic spreadsheet software, and analyzed using descriptive and inferential statistics using the SPSS® version 25 statistical program. First, bivariate analysis was performed using the Chi-Square or Fisher's Exact Test, and the variables with $p<0.20$ were included in the initial logistic regression model. Then, the model was adjusted by the "backward stepwise" method, considering a significance level of 5% ($p<0.05$). Finally, the Hosmer-Lemeshow test was used to analyze the model's quality of fit.

Ethical Aspects

This work complied with the determinations of Resolution N° 466/12 of the National Health Council and was approved by the Research Ethics Committee of the State University of Paraíba under Opinion N° 2.154.228.

Results

Four hundred and seventy-five (43.6%) of the 1,088 medical records analyzed involved children and adolescents hospitalized as victims of transport accidents. Although transport accidents were more prevalent among males, no statistically significant association was found between genders ($p<0.05$). However, regarding age, the most significant number of victims was found in the 15-19 years age group (59.8%), with a statistically

significant association (p<0.001). In addition, we identified a predominance of accidents on weekdays (60.4%) and at daytime (55.2%), with a greater record of injuries in a single region of the body (64%), and the most frequent hospital stay period exceeded five days (56.8%), as described in Table 1.

Table 1. Association of demographic characteristics with transport accidents.

Variables	Transport Accident		p-value
	Yes N (%)	No N (%)	
Sex			0.080[a]
Male	367 (77.6)	442 (72.9)	
Female	106 (22.4)	164 (27.1)	
Age (Years Old)			<0.001*[b]
Less than 1 year old	1 (0.2)	15 (2.5)	
0 to 4	25 (5.3)	121 (19.7)	
5 to 9	63 (13.3)	139 (22.7)	
10 to 14	102 (21.5)	143 (23.3)	
15 to 19	284 (59.8)	195 (31.8)	
Weekend			0.013*[a]
Yes	188 (39.6)	198 (32.3)	
No	287 (60.4)	415 (67.7)	
Service period			
Daytime	257 (55.2)	294 (49.3)	0.060[a]
Night	209 (44.8)	302 (50.7)	
Polytrauma			
Yes	171 (36.0)	116 (21.2)	<0.001*[a]
No	304 (64.0)	432 (78.8)	
Hospital stay			<0.001*[a]
1 at 4 days	205 (43.2)	365 (59.5)	
5 days or more	270 (56.8)	248 (40.5)	
Denouement			0.563[a]
Discharged	400 (94.3)	538 (96.2)	
Death	14 (3.3)	12 (2.1)	
Other	10 (2.4)	9 (1.6)	

*Statistically significant variables at 0.05%; [a]Chi-Square Test; [b]Fisher's exact test.

Adolescents corresponded to 81.4% of the investigated victims of transport accidents, and 78% of these hospitalizations were related to motorcycle accidents. Trampling was the most frequent among children (31.8%). Motorcycle accidents were more prevalent (68.3%), and vehicle fall (58.1%) was the most frequent accident mechanism, as seen in Table 2.

Table 2. Distribution of characteristics of transport accidents.

Variables	N	%
Type of accident		
Motorcycle	323	68.3
Bicycle	54	11.4
Pedestrian	49	10.4
Car	23	4.9
Others	24	5.1
Accident mechanism		
Vehicle fall	176	58.1
Collision	73	24.1
Trampling	49	16.2
Rollover	5	1.7

The most affected body regions were the lower limbs (40.4%), and skull lesions were the more prevalent among fatal victims (53.8%). Table 3 shows the association between the characteristics of maxillofacial fractures and transport accidents. The mandible was the most frequently affected bone (34.6%) but was not associated with transport accidents. Involvement of the zygomatic and nasal bones was significantly associated with transport accidents ($p<0.05$). All bone lesions recorded in the medical records underwent repairing surgical procedures.

Table 3. Absolute and relative frequencies in the associations of the characteristics of maxillofacial fractures with transport accidents.

Variables	Transport Accident		p-value
	Yes N (%)	No N (%)	
Fracture in the jaw			0.266[a]
Yes	27 (34.6)	9 (24.3)	
No	51 (65.4)	28 (75.6)	
Fracture in the zygomatic bone			0.047*[b]
Yes	24 (30.8)	5 (13.5)	
No	54 (69.2)	32 (86.5)	
Fracture in the nose			0.010*[a]
Yes	11 (14.1)	13 (34.2)	
No	67 (85.9)	24 (65.8)	
Jaw fracture			0.218[b]
Yes	11 (14.1)	2 (5.4)	
No	67 (85.9)	35 (94.6)	

*Statistically significant variables at 0.05%; [a]Chi-Square Test; [b]Fisher's exact test.

Table 4 presents the bivariate and multivariate analyses of the associations of the different independent variables with transport accidents. We could identify that the age groups <1, 1-4 years, 5-9 years, and 10-14 years vis-à-vis 15-19 years are negatively associated with hospitalization due to transport accidents.

Table 4. Logistic regression model for transport accidents.

Variables	Raw Model (OR - IC 95%)	p-value	Adjusted Model (OR - IC 95%)	p-value
Sex				
Male	0.787 (0.566-1.095)	0.156		
Female	1		1	
Age group				
<1 year	0.056 (0.007-0.442)	0.006*	0.062 (0.008-0.481)	0.008*
1-4 years	0.133 (0.080-0.222)	<0.001*	0.139 (0.084-0.230)	<0.001*
5-9 years	0.335 (0.230-0.488)	<0.001*	0.345 (0.238-0.500)	<0.001*
10-14 years	0.534 (0.381-0.748)	<0.001*	0.528 (0.378-0.738)	<0.001*
15-19 years	1		1	
Weekend				
Yes	1.310 (0.988-1.735)	0.060	1.321 (0.998-1.749)	0.052*
No	1		1	
Service period				
Night	1.116 (0.851-1.463)	0.427		
Daytime	1		1	
Polytrauma				
Yes	1.931 (1.422-2.623)	<0.001*		
No	1			
Hospital stay				
1 to 4 days	1.931 (1.422-2.623)	<0.001*	0.715 (0.544-0.939)	0.016*
5 days or more	1		1	

Model adjusted using stepwise backward with Hosmer and Lemeshow Test = 0.759; *Statistically significant variables at 0.05%.

Although transport accidents were more prevalent on working days, we identified that weekends were not associated with the prevalence of transport accidents in the final model when adjusting the analysis in a multivariate model.

Hospitalizations for up to four days due to transport accidents were negatively associated with the prevalence of transport accidents compared to hospitalizations for more than five days (OR= 0.715; CI 0.544-0.939).

Discussion

Retrospective documentary research is essential for assessing different morbimortality conditions and their leading associations, especially in vulnerable populations, circumventing the ethical difficulties related to these populations, allowing investigations of large amounts of information at low cost, and sample loss control [15].

Male victims were the most affected, which was also observed by Mascarenhas et al. [9], Pinto et al. [16], and Ul Baset et al. [17], who point out as a possible justification for this finding the fact that this group is more exposed to accidents due to work needs, besides reckless driving.

Advancing age increased the prevalence of traffic accidents. Adolescents were the most frequent victims of accidents involving motorcycles and bicycles, unlike what happened to children, where pedestrian-related accidents were more frequent, confirming what was described in the report by the World Health Organization [2] and studies by Farias et al. [18] and Sousa et al. [11]. Children's immature behavior of poor vigilance on roads and highways [19] and adolescents' use of motorcycles for work and leisure [20] may explain these findings.

Hospitalizations were more prevalent on weekdays, with nighttime hospital records, as observed by Pinto et al. [16], which can be justified because they are days of greater intensity of school and work activities, where night has a greater concentration of vehicles circulating on the roads. However, the weekend was not associated with transport accidents in the studied population, although this period is of greater availability for leisure and reckless behaviors such as using alcoholic beverages before driving vehicles [2].

Transport accident injuries were prevalent in a single-body region and required a five or more days hospital stay. Prolonged hospitalization time causes removal from school or work activities, compromising the individual's active cycle, besides making treatment more expensive in these situations [21,22]. In the study by Sousa et al. [11], medical discharge occurred soon after the treatment due to the lack of bone fractures. The authors pointed out this reason as a justification for their study's underreported nasal and paranasal injuries.

Motorcycle transport accidents were more prevalent, corroborating previous findings [18,23,24], which can be justified by the fact that motorcycles are more affordable, with a lower maintenance value than other motor vehicles [20].

The lower limbs, followed by the skull, were the most affected body regions, as observed by Cavalcanti et al. [24] and Yu et al. [25]. Tenenbaum et al. [26] reinforced that lower limb injuries are the most prevalent non-fatal injuries among children and adolescents. Cranial trauma is associated with higher mortality [27], who point to the use of technology as an additional method of preventing accidents on highways in their study, suggesting the use of pedestrian location applications by drivers or the incorporation of infrared identification cameras in automobiles.

Maxillofacial fractures occurred with greater mandible involvement, requiring surgical repair procedures in all cases, corroborating previous authors [28]. According to Yazici and Aytaç [29], in transport

accidents involving children and adolescents, mandible fractures were less frequent than those of the middle third of the face, a result that the authors argue occurs due to the higher occurrence of pedestrian trampling in their sample, and the victims of this accident mechanism are more likely to project the chin downwards, exposing the jaw and nasal bones to impact and increasing jaw protection. In motorcycle accidents, the most frequent in this study, victims may have been unable to act reflexively by lowering their faces, which would project the jaw to impact.

In this research, a more significant number of fatal victims was observed among adolescents who were on motorcycles and were from the vehicle, corroborating Peden and Franklin [30], who reinforce that the distance from urban centers increases the likelihood of death in this group. Ladeira et al. [10] show that even observing an increase in mortality rates among motorcyclists and cyclists, these rates were still lower than those observed for deaths among pedestrians and other motor vehicles.

The WHO highlights the impact of the Brazilian National Traffic Policy on curbing transport accidents through the control of alcohol consumption while driving, resulting from the intensive inspection and more severe punishments for offenders, stating that the use of verification devices (breathalyzers) could have been responsible for 16% reduction in mortality rates in 2010 [2]. Saltarelli et al. [31] point to a 1.7% reduction in deaths from transport accidents in children from 2000 to 2013. Oliveira et al. [32] reinforce that using restraint devices shrunk hospitalizations and deaths in children 0-4 years of age in the evaluation of traffic accidents until 2015, while similar analyses were not found after 2015.

The profile of hospitalizations remained unchanged from 2016 to 2017, with similar characteristics for the occurrences in the years evaluated, both regarding the characteristics of the victims and the severity of accidents and their consequences in conducting hospitalizations, signaling the need to expand public policies to control transport accidents, mainly aimed at teenagers who use motorcycles.

We could not identify where the accidents occurred through the adopted methodology, nor information such as the use of safety devices or alcohol consumption in all medical records, not allowing evaluations of these data, which is the main limitation of this study. Another limitation of this study is the failure to complete the medical records, with erasures, sometimes illegible or incomplete, in data related to the Accident Type, Accident Mechanism, and details on the Characteristics of the injuries and treatments, hindering the retrieval of additional information about hospitalizations due to transport accidents, or even reducing the number of some variables presented here.

Conclusion

The mandible was the bone most affected by fractures in the facial region due to transport accidents. However, nasal bone fractures were statistically associated with hospitalizations due to transport accidents. Transport accidents are more prevalent among males, and the likelihood of hospitalizations due to this outcome is reduced in individuals under 15. The weekend is not associated with higher hospitalizations due to transport accidents in the age groups studied. Motorcycles were the vehicle most involved in the incidents. A higher prevalence of accidents as pedestrians was observed among children. The lower limbs and skull were among the most affected body regions.

Authors' Contributions

NBS	https://orcid.org/0000-0001-5976-3561	Conceptualization, Methodology, Formal Analysis, Investigation, Writing - Original Draft and Writing - Review and Editing.
TLSR	https://orcid.org/0000-0002-4294-5470	Investigation and Writing - Review and Editing.

APLP https://orcid.org/0000-0003-2895-436X Validation, Formal Analysis and Writing - Review and Editing.
ALC https://orcid.org/0000-0003-3572-3332 Conceptualization, Methodology, Formal Analysis, Data Curation, Writing - Original Draft, Writing - Review and Editing, Supervision and Project Administration.
All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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