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# Brazilian Journal of OTORHINOLARYNGOLOGY

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## ORIGINAL ARTICLE

### Facial trauma among victims of terrestrial transport accidents<sup>☆</sup>



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#### KEYWORDS

Forensic dentistry;  
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#### Abstract

**Introduction:** In developing countries, terrestrial transport accidents – TTA, especially those involving automobiles and motorcycles – are a major cause of facial trauma, surpassing urban violence.

**Objective:** This cross-sectional census study attempted to determine facial trauma occurrence with terrestrial transport accidents etiology, involving cars, motorcycles, or accidents with pedestrians in the northeastern region of Brazil, and examine victims' socio-demographic characteristics.

**Methods:** Morbidity data from forensic service reports of victims who sought care from January to December 2012 were analyzed.

**Results:** Altogether, 2379 reports were evaluated, of which 673 were related to terrestrial transport accidents and 103 involved facial trauma. Three previously trained and calibrated researchers collected data using a specific form. Facial trauma occurrence rate was 15.3% ( $n=103$ ). The most affected age group was 20–29 years (48.3%), and more men than women were affected (2.81:1). Motorcycles were involved in the majority of accidents resulting in facial trauma (66.3%).

**Conclusion:** The occurrence of facial trauma in terrestrial transport accident victims tends to affect a greater proportion of young and male subjects, and the most prevalent accidents involve motorcycles.

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**PALAVRAS-CHAVE**

Odontologia forense;  
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Traumatismos faciais;  
Face

**Traumas faciais entre vítimas de acidentes de transporte terrestre****Resumo**

**Introdução:** Nos países em desenvolvimento, os acidentes de transporte terrestre (ATTs) são uma das principais causas de trauma facial, superando os casos de violência urbana, especialmente aqueles envolvendo automóveis e motocicletas.

**Objetivo:** O objetivo deste estudo transversal censitário foi determinar a ocorrência de traumas faciais com etiologia de acidente de transporte terrestre (ATT): automóveis, motocicletas ou atropelamentos, em uma cidade do Nordeste do Brasil.

**Método:** Foram analisados os dados de morbidade em laudos de um serviço forense de vítimas que procuraram o serviço de janeiro a dezembro de 2010.

**Resultados:** Ao todo, foram avaliados 2.379 laudos; 673 eram referentes a ATTs, e 103 apresentaram traumas faciais. A coleta de dados foi realizada por três pesquisadores previamente treinados e calibrados, sendo elaborado um formulário específico para coleta das informações contidas nos laudos. Destes, 15,3% (n = 103) sofreram trauma facial. A faixa etária predominante para os eventos de trauma facial foi de 20-29 anos (48,3%), acometendo mais homens do que mulheres (2,81:1). A motocicleta foi o principal tipo de veículo com envolvimento de vítimas (66,3%).

**Conclusões:** A ocorrência de traumas faciais em vítimas de acidente de transporte terrestre tende a afetar, em maior proporção, indivíduos homens e jovens, com maior prevalência para os acidentes envolvendo motocicletas.

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**Introduction**

In developing countries, terrestrial transport accidents (TTAs), especially those involving automobiles and motorcycles, are one of the main causes of facial trauma, surpassing even cases of urban violence.<sup>1-4</sup> Facial trauma prevalence has larger negative social consequences as it is related to lower productivity and higher loss of work time rates compared to other morbidities such as heart disease and cancer.<sup>5</sup>

Among the types of vehicles involved in accidents, motorcycles have caused a large number of traffic deaths, primarily because it is a means of transportation that does not ensure the driver's safety, leading to multiple traumas. Incorrect use of personal protective equipment, particularly helmets, can cause serious injuries to victims' faces.<sup>5-7</sup>

Drug and alcohol use is related to TTA occurrence<sup>8,9</sup>; in addition, the number of vehicles in cities has been increasing, putting more individuals at risk.<sup>10,11</sup> Studies aimed at identifying facial trauma highlight the need for improving public road safety policies, which in turn could reduce traffic-related morbidity and mortality.<sup>12,13</sup>

Facial injuries are considered a serious public health issue in both developed and developing countries. Thus, examining factors associated with facial injuries from TTAs can help determine prognosis, identify groups at risk, and establish measures to minimize economic, emotional, psychological and social impacts of these events.

Given the high prevalence of trauma resulting from traffic accidents, this study aimed to determine the socio-demographic characteristics and the occurrence rate of facial trauma with a TTA etiology involving cars, motorcycles, mopeds, and pedestrians admitted to a forensic unit in northeastern Brazil.

**Methods**

A cross-sectional census study was performed using 2379 reports of victims who sought the Department of Forensic Medicine and Dentistry's services, Campina Grande, PB, a city with approximately 687,545 inhabitants in northeastern Brazil, from January to December 2012. Among these, 673 reports had experienced TTAs. The 103 individuals who suffered facial injuries were included in the sample.

The reports were originally written by professionals who acted as medical and/or dentistry experts at the time of examination. The reports, noting the extent of damage caused by the trauma, were completed during the *corpus delicti* examination conducted independently. Legible reports of individuals who were alive at the time of examination were included. Illegible reports required a more thorough analysis by the expert physician or surgeon-dentist who was on duty at the time of data collection. Thus, 0.2% of all reports were excluded because of incomprehensible raw data.

The report is an official document used to apply for the Personal Injuries Caused by Motor Vehicles insurance. This is a compulsory annual contract between the state and insurance companies, paid annually by car owners when renewing their automobile license, with the main purpose of compensating traffic accident victims.

The data collection form gathered socio-demographic (age, sex, marital status, education and occupation), accident-related (accident type, day and time), and injury-related data (anatomical area: front, mastic, mandibular, nasal, oral, orbital, zygomatic, and polytrauma).

Data were analyzed using SPSS, version 20.0 (SPSS Inc., Chicago, IL, USA); frequency distributions were used to characterize socio-demographic and TTA-related data for facial trauma victims. The association between independent variables and the occurrence of facial trauma was examined using Fisher's exact probability test and Pearson's chi-square test at 5% significance. Multivariate analysis was performed using Poisson regression.

This study was registered at the National System of Ethics on Research; it was submitted to and approved under Council of Alumni Association Executives n° 0652.0.133.000-11, and it was authorized by the director of the Forensic Unit responsible for the safekeeping of victims' reports. The study followed the guidelines explained in the "STROBE Statement".<sup>14</sup>

## Results

Facial injuries were observed in 103 cases (15.3%). Table 1 shows the socio-demographic data with bivariate analysis of facial trauma for TTA cases. The age group with the highest number of facial trauma events was 20–29 years

(48.3%,  $n=44$ ). Men were more likely to be involved, with a male–female ratio of 2.81:1. Most victims of facial trauma were unmarried (70%,  $n=63$ ) and had less than 8 years of education. Age and marital status were associated with facial trauma in the bivariate analysis.

The majority of TTA cases with facial trauma victims involved motorcycles (66.3%,  $n=65$ ). Accidents occurred most frequently on Saturdays (20.2%,  $n=20$ ), followed by Sundays (18.2%,  $n=18$ ); regarding month, June and September had the highest frequency (13.1% each,  $n=13$ ). Most accidents occurred at night, between 18:00 to 23:59 (41.9%,  $n=36$ ). The bivariate analysis of facial trauma occurrence and TTA-related variables indicated no significant statistical association (Table 2).

Multivariate analysis from the Poisson regression showed no significant association for variables included in the model. Although age was significant in the bivariate analysis, it could not be adjusted in the multivariate model due to the large number of categories (Table 3).

With regard to the anatomical location of facial trauma, there were more multiple traumas (47.6%); however, in isolation, the frontal region was most affected (21.4%) (Table 4).

**Table 1** Bivariate analysis of the occurrence of facial trauma and socio-demographic characteristics of victims of terrestrial transport accidents.

	Facial trauma						<i>p</i>	PR (95% CI)
	Yes		No		Total			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
<i>Age range</i>								
≥19 years	9	17.3	43	82.7	52	100.0	0.036 <sup>a,b</sup>	1.90 (0.63–5.76)
20–29 years	44	21.0	166	79.0	210	100.0		2.30 (0.87–6.08)
30–39 years	14	9.2	139	90.8	153	100.0		1.01 (0.35–2.90)
40–49 years	14	12.6	97	87.4	111	100.0		1.39 (0.48–3.98)
50–59 years	6	14.6	35	85.4	41	100.0		1.61 (0.49–5.30)
≥60 years	4	9.1	40	90.9	44	100.0		1.00
<i>Sex</i>								
Female	27	18.2	121	81.8	148	100.0	0.261 <sup>c</sup>	1.26 (0.85–1.88)
Male	76	14.5	449	85.5	525	100.0		1.00
<i>Marital status</i>								
No partner	63	17.9	289	82.1	352	100.0	0.014 <sup>a,c</sup>	1.68 (1.10–2.55)
With partner	27	10.7	226	89.3	253	100.0		1.00
<i>Education</i>								
No education	4	13.3	26	86.7	30	100.0	0.926 <sup>b</sup>	1.00
<8 years	26	14.9	149	85.1	175	100.0		1.11 (0.42–2.97)
8 years	10	18.2	45	81.8	55	100.0		1.36 (0.47–3.98)
>8 years	17	15.2	95	84.8	112	100.0		1.14 (0.41–3.13)
<i>Occupation</i>								
With	63	13.4	407	86.6	470	100.0	0.471 <sup>c</sup>	1.00
Without	16	16.2	83	83.8	99	100.0		1.21 (0.73–2.00)

PR, prevalence ratio; CI, confidence interval.

<sup>a</sup> Statistical difference at 5%.

<sup>b</sup> Fisher's exact test.

<sup>c</sup> Chi-square test.

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**Table 2** Bivariate analysis between facial trauma and data related to the occurrence of terrestrial transport accidents.

	Facial trauma						<i>p</i>	PR (95% CI)
	Yes		No		Total			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
<i>Type of accident</i>								
Motorcycle	65	14.9	372	85.1	437	100.0	0.712 <sup>a</sup>	1.15 (0.62–2.13)
Automotive	23	17.0	112	83.0	135	100.0		1.31 (0.66–2.61)
Running over	10	13.0	67	87.0	77	100.0		1.00
<i>Day</i>								
Monday	11	14.9	63	85.1	74	100.0	0.588 <sup>a</sup>	1.12 (0.56–2.25)
Tuesday	11	12.4	78	87.6	89	100.0		0.93 (0.46–1.88)
Wednesday	11	12.5	77	87.5	88	100.0		0.94 (0.47–1.90)
Thursday	15	17.4	71	82.6	86	100.0		1.32 (0.70–2.47)
Friday	13	13.8	81	86.2	94	100.0		1.04 (0.54–2.03)
Saturday	20	21.3	74	78.7	94	100.0		1.61 (0.90–2.87)
Sunday	18	13.2	118	86.8	136	100.0		1.00
<i>Month</i>								
January	11	18.6	48	81.4	59	100.0	0.790 <sup>b</sup>	1.57 (0.65–3.77)
February	5	10.9	41	89.1	46	100.0		0.92 (0.31–2.70)
March	10	17.2	48	82.8	58	100.0		1.45 (0.59–3.56)
April	4	9.1	40	90.9	44	100.0		0.77 (0.24–2.46)
May	4	10.0	36	90.0	40	100.0		0.84 (0.26–2.69)
June	13	15.5	71	84.5	84	100.0		1.30 (0.55–3.07)
July	4	10.0	36	90.0	40	100.0		0.84 (0.26–2.69)
August	9	19.6	37	80.4	46	100.0		1.65 (0.66–4.09)
September	13	19.4	54	80.6	67	100.0		1.64 (0.70–3.82)
October	8	13.6	51	86.4	59	100.0		1.14 (0.44–2.95)
November	11	18.3	49	81.7	60	100.0		1.55 (0.64–3.71)
December	7	11.9	52	88.1	59	100.0		1.00
<i>Time of the accident</i>								
00:00 to 05:59	11	22.0	39	78.0	50	100.0	0.073 <sup>a</sup>	1.23 (0.67–2.24)
06:00 to 11:59	14	9.9	127	90.1	141	100.0		0.55 (0.31–0.99)
12:00 to 17:59	25	12.8	171	87.2	196	100.0		0.71 (0.44–1.14)
18:00 to 23:59	36	17.9	165	82.1	201	100.0		1.00

PR, Prevalence ratio; CI, confidence interval.

<sup>a</sup> Fisher's exact test.<sup>b</sup> Chi-square test.

Font: NUMOL: 2012.

**Table 3** Poisson multivariate regression for analysis of percentage of facial injury based on independent variables included in the model.

	Multivariate analysis		<i>p</i>
	Raw (PR – 95% CI)	Adjusted by the model (PR – 95% CI)	
<i>Marital status</i>			
No partner	1.68 (1.10–2.55)	1.52 (0.97–2.38)	0.063
With partner	1.00	1.00	
<i>Time</i>			
00:00 to 05:59	1.23 (0.67–2.24)	1.11 (0.59–2.08)	0.073
06:00 to 11:59	0.55 (0.31–0.99)	0.51 (0.26–0.94)	
12:00 to 17:59	0.71 (0.44–1.14)	0.67 (0.41–1.09)	
18:00 to 23:59	1.00	1.00	

PR, prevalence ratio; CI, confidence interval.

Font: NUMOL: 2012.

**Table 4** Distribution of anatomical location of facial trauma in the victims of terrestrial transport accidents.

Facial region affected	n	%
Frontal	22	21.4
Oral	9	8.7
Orbital	7	6.8
Zygomatic	7	6.8
Masseteric	6	5.8
Nasal	3	2.9
Polytrauma	49	47.6

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## Discussion

Studies in forensic medicine departments are rare since most deal with mortality and morbidity data obtained from hospitals. Thus, the present study provides differing information.

The victims considered highlight the differences which may occur when we observe data for treatment at forensic medical and dental services, in which the individual claims his/her citizen's rights, or in health services, in which the aim is to remedy injury to health.

This study suggests that facial trauma cases – registered in a forensic unit – are not rare and their occurrence is highest among young people, especially those between 20 and 29 years. A similar study conducted in Portugal found a 11.6% prevalence of facial trauma in a forensic institute, a rate consistent with the 15.3% reported in the present study.<sup>15</sup> Young people are more likely to be in accidents that result in facial trauma.<sup>1,3,16–19</sup> They participate more intensely in social life compared to children, adults, and elderly individuals, and are therefore more likely to face TTAs involving fractures and facial trauma.<sup>2</sup> Additionally, young people present traffic behaviors that increase the risk of accidents, such as immaturity, inexperience and recklessness.<sup>20</sup>

Other risk factors for facial trauma that young people are more likely to be exposed to include contact sports, alcohol and recreational drugs.<sup>20</sup> A study conducted in Brazil with victims of facial trauma determined that those between 21 and 30 years are at risk for facial trauma.<sup>6</sup>

Regarding gender, men were more likely to be TTA victims, consistent with previous studies.<sup>3,4,21</sup> In Brazil,<sup>1–4</sup> Africa<sup>21</sup> and the United Arab Emirates,<sup>22</sup> the male–female ratio of facial trauma cases tends to be higher than in more developed countries like Germany,<sup>17</sup> the United States<sup>18</sup> and Switzerland.<sup>23</sup> This is because in developing countries, men, more than women, are involved in active economic life, which exposes them to risk factors such as unsafe traffic behavior.<sup>6,21</sup>

The bivariate analysis in the present study revealed that the occurrence of facial trauma was associated with marital status; a significantly large number of unmarried individuals experienced facial trauma. However, this association was not supported by the multivariate analysis. Other variables such as education and employment were not significantly associated with facial trauma in any of the analyses. Despite the absence of a statistical association, unmarried individuals were most likely to be involved in violent situations,

and most had a low level of education. This low educational level may be a reflection of the socioeconomic conditions of the region under study, where access to education was delayed due to educational policy failures and inefficient health policy implementation.<sup>24,25</sup>

The majority of accidents recorded involved motorcycles, followed by automobiles. The motorcycle is the most unsafe vehicle, as the rider's body is exposed and unprotected, making him/her extremely vulnerable to accidents that could result in morbidity or death.<sup>5</sup> In Brazil, the number of fatal motorcycle accidents increased by 754% within a decade and continues to increase every year.<sup>26</sup>

This increased morbidity and mortality in traffic is explained by reckless driving, mainly resulting from alcohol use.<sup>9,27</sup> In addition, with the increased number of motorcycles in Brazil, the likelihood of accidents has also increased. In 1998, the number of the motorcycles in Brazil was 2,542,732; this increased to 9,410,110 in 2007, corresponding to approximately 4970 motorcycles per 10,000 inhabitants.<sup>26</sup>

In this study, accidents occurred more frequently on Saturdays and Sundays, which are weekend days when people are more likely to consume alcohol. This may explain the high number of alcohol-related accidents and consequently, the occurrence of facial trauma. June and September were the months with the most number of facial trauma cases. The city hosts a popular event every June, resulting in an increase in the number of people in the city and thus increasing the likelihood of TTA occurrences.

TTAs resulting in facial trauma mainly occurred at night between 18:00 to 23:59. This may be a reflection of the greater number of social activities involving alcohol consumption that take place during this time, resulting in a greater number of accidents.

Regarding the anatomical location of facial trauma, polytrauma was most common. The biomechanics of collisions affects trauma profiles; falls at high speed involving motorcyclists often affect the cervical spine and related areas.<sup>28,29</sup> It is therefore unsurprising that several areas were affected. In isolation, the major affected areas were the frontal and oral regions. Typically, trauma location depends on the lesion severity.<sup>1</sup> In accidents involving fractures, the mandible region is more likely to be affected.<sup>18,22,30</sup> In this study, all cases of mandibular fractures were involved in other regions and were included as polytrauma. Soft tissue injuries affect areas around the jaw, such as oral, nasal, and zygomatic regions.<sup>6</sup> The occurrence of facial trauma can complicate individuals' health since it can cause deformities in face physiognomy and emotional sequelae.

A limitation of this cross-sectional study is that it could not establish causal relationships. Because of this region's socioeconomic background, there is no integrated system of epidemiological surveillance between stations of police, forensic services, and emergency units at hospitals. Thus, the prevalence of facial trauma, although considered high, may be an underestimation since several individuals may have been directly forwarded to receive hospital care, bypassing forensic services.

Currently, there is limited information on the prevalence and factors associated with morbidity among victims admitted to forensic services. Most scientific TTA-related studies were conducted within short time periods. Moreover, they



examined cases of individuals admitted to surgery and traumatology departments.

Future research that aims at identifying differences between cases of facial trauma admitted to emergency and forensic services is necessary. In addition, although it was not possible to estimate the impact and consequences of these accidents (as the reports did not include this information), it is essential to carry out surveys to accurately assess the effect of morbidity on victims' quality of life.

This study examined the characteristics of TTAs and their victims, focusing on facial trauma distribution patterns among victims admitted to a forensic service. Moreover, it is a pioneering research in this geographical region.<sup>31</sup>

These results could be used to help authorities create an integrated network for epidemiological monitoring and for planning prevention, rehabilitation, and social support programs for victims of TTA-related trauma.

## Conclusions

This study emphasizes that Brazilian authorities need to pay greater attention to road safety. Regulatory laws may reduce the number of TTAs and the resulting morbidity and mortality.

The occurrence of facial traumas in TTA victims is not rare; it is observed more frequently in young individuals and men, and is most likely to involve motorcycles.

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## Conflicts of interest

The authors declare no conflicts of interest.

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