

# Non-white people have a greater risk for maxillofacial trauma: findings from a 24-month retrospective study in Brazil

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## Abstract

**Aim:** To identify the predominant causes and types of maxillofacial trauma in Brazil. **Methods:** Reports of corporal trauma (7,536) between 2009-2010 in the Brazilian Institute of Forensic Medicine were analyzed as to the presence of maxillofacial traumas. Victims' demographic and trauma characteristics were recorded. **Results:** Data were submitted to chi-square test and to multivariate Poisson regression. 778 reports referred maxillofacial trauma. Most victims were men (50.8%) around 27.6 years. Main causes were physical aggression (88.1%) and traffic accidents (6.7%). The most affected extraoral area was the middle third (60.7%). Risk for trauma in the middle third was significantly higher among patients aged 61-75 (RR 1.32), and non-white patients (black-skinned RR 1.21; brown-skinned RR 1.18); while falls were associated with trauma in the lower third (RR1.79). **Conclusions:** Violence was the main cause of maxillofacial trauma. Prevention of interpersonal violence may be a key element to prevent maxillofacial trauma.

**Keywords:** epidemiology, violence, maxillofacial injuries.

## Introduction

The face is usually the first area to be damaged in case of physical aggression, car accidents and falls, which makes the maxillofacial region very susceptible to traumas due to its prominence<sup>1</sup>. Traumas of the maxillofacial complex represent one of the most important health problems worldwide, especially because of the high incidence and the diversity of facial lesions<sup>2</sup>. Moreover, the face represents the center of human attention and sometimes lesions may leave marks or unreparable sequels that cause physical or psychological damages, burdening the country economy<sup>3</sup>. Within the same country and among different countries the type of maxillofacial trauma is influenced by socio-economic status, cultural and environmental factors, and the period of investigation<sup>4</sup>.

Brazil presents the world's fifth largest geographical area and population. Especially after the 2007-2008 crises, the country has strengthened its status as an economic power, developing more employment opportunities, vehicle sales and social mobility, which may influence public policies. However, the economic growth is not being followed by reduction of social inequalities. Dark-skinned

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people are still the poorest, consequently, the ones who concentrate more social and health problems<sup>5</sup>. Moreover, as they usually live far from the central urban areas, they are more exposed to violent episodes<sup>6</sup>.

There are many studies worldwide evaluating traumas in the oral and maxillofacial region<sup>1,3,7</sup> and some of them conducted in Brazil<sup>4,8</sup>. Literature has identified different causes for traumas in developed and developing countries. There are controversies regarding the association of traffic accident and physical aggression with the country's economic status<sup>3,7,9</sup>. Authors also observed the high prevalence of falls and sports traumas in both developed and developing countries<sup>10</sup>. In Brazil, the conducted studies presented some limitations: (a) evaluation of a specific population, like children<sup>11</sup> or rural population;<sup>8</sup> (b) evaluation of fractures and the required treatment only;<sup>12</sup> (c) analysis of the dental traumas only<sup>13</sup>.

Although there are some minor studies on maxillofacial trauma in some parts of Brazil, this is the first report analyzing data of oral and maxillofacial traumas in the last decade. The main purpose of this study is to evaluate the epidemiological characteristics of prevalence, cause and associated factors of maxillofacial traumas in Southern Brazil in 2009 and 2010.

## Material and methods

This retrospective and cross-sectional study was carried out on the records of consecutive patients with maxillofacial traumas who were referred to the Brazilian Institute of Forensic Medicine, Pelotas, Southern Brazil, from January 2009 to December 2010 (n=7,536). The institute is a reference for 11 cities with a total of 600,000 inhabitants. From these records a selection was made according to the following inclusion criteria: (1) offense to the integrity and/or health of the victim and (2) presence of maxillofacial traumas. Maxillofacial lesions were grouped in the following extraoral regions: lower third (masseter, mandible and mentum regions), middle third (infraorbital, zygomatic and nasal regions) and oral (intraoral, lips and perioral soft tissues). Oral lesions were defined as those involving the following areas: (a) teeth and surrounding supportive tissues (periodontium); (b) oral mucosa including gums, alveolar mucosa in edentulous patient, palate and mucosa; (c) jaw bones (upper and lower); (d) lips (mucosa and skin); (e) tongue; (f) perioral soft tissues (extraoral tissues that surround mouth and cover upper and lower jaw). This study followed the Declaration of Helsinki on medical protocol and was approved by the Institutional Review Board of the Federal University of Pelotas, Dental School (protocol 88/2009).

The selected cases (n=648) were studied for data regarding the victim's and offender's demographic characteristics, nature and number of inflicted traumas and their consequences. Personal information such as gender, race, age and marital status, and lesion's characteristics (location, etiology, type) were recorded in an Excel spreadsheet. In addition, anatomic location and nature of the trauma were identified to evaluate oral traumas.

Data were double typed and analyzed by Stata 12.0 software (StataCorp, College Station, TX, USA). Descriptive statistics was performed using frequency analysis for categorical variables and descriptive analysis for continuous variables. The statistical significance of the difference in the prevalence of oral and maxillofacial traumas according to gender, age group, skin color and cause of trauma was tested using the chi-square test. Multivariate Poisson regression analysis was conducted by using traumas in the different parts of face as the dichotomized dependent variable in order to test the association between the outcomes and the independent variables, adjusting it for potential confounders. For variable selection, the stepwise method with backward selection was used. Variables with  $p < 0.25$  were included in the final model, estimated their Risk Ratio (RR) and set the interval confidence at 95% .

## Results

In this study, out of a total of 7,536 victims only 892 (11.8%) presented maxillofacial traumas. Patients with missing data were excluded from the study, totalizing 648 (8.6%) patients presenting 785 traumas. The number of cases was similar in 2009 (n=306; 47.2%) and 2010 (n=342; 52.8%). The majority were men (50.1%), single (75.2%), most of them white (80.6%). The mean age was 27.6 years (SD=7.37), and victims aged between 16 to 30 years were the most affected (46.1%), followed by those from 31 to 45 years (24.0%).

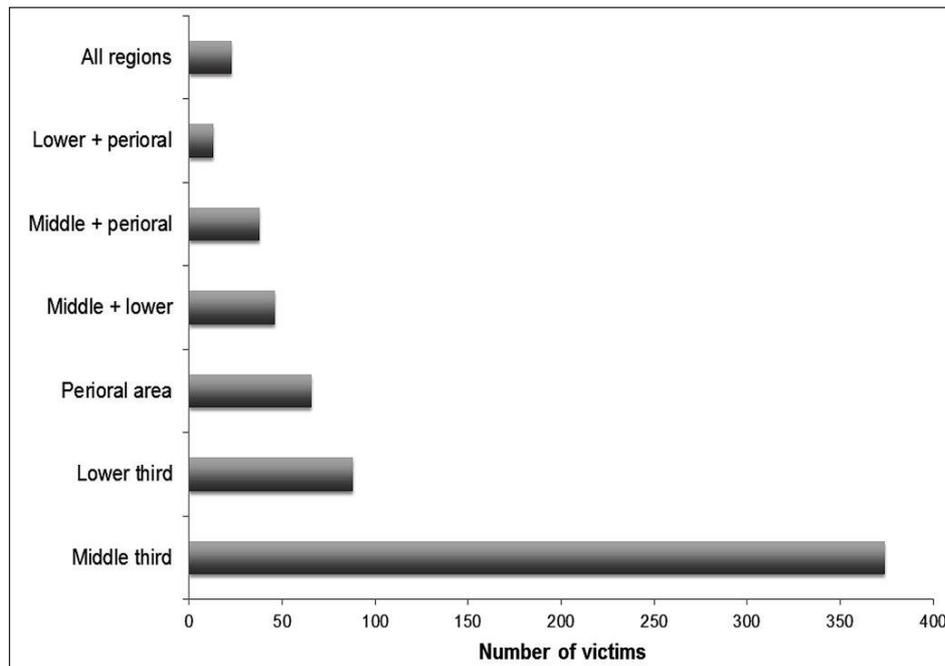
The specialized police station for women's defense (209; 31.9%) referred most of the patients followed by the specialized police station for children and adolescent defense (124; 19.1%) and first assistance police station (120; 18.1%). Most of the maxillofacial traumas were due to physical aggressions (563; 86.8%), traffic accidents (47; 7.2%) and falls (32; 4.9%). About the damage caused by lesions, 22 patients (3.3%) presented permanent and irreversible consequences, becoming unable for daily, social and working activities.

Traumas occurred on all regions of the face in different proportions, with the middle third concentrating most of the traumas (475, 73.3%), followed by the lower third (170, 26.2%) and by the oral region (140, 21.6%). Table 1 describes the associations between the traumas and independent variables, which are listed according to the different regions of face. Traumas occurred in single thirds or more than one third (Figure 1). For dental traumas, tooth fracture was the most prevalent (12, 33.4%) followed by luxation (8, 22.2%) With respect to the intraoral soft tissue lesions, oral and gingival mucosa and tongue were the most affected sites (Table 2).

When the associations between the occurrence of oral and maxillofacial trauma and explanatory variables were considered simultaneously, in the multivariate regression model, (Tables 3 and 4), the risk for trauma in the middle third was significantly higher among patients aged between 61-75 years (RR, 1.32; 95%CI, 1.07-1.62), and non-white patients (brown skinned, RR 1.21, 95% CI, 1.09-1.34; black skinned RR 1.18; 95%CI, 1.01-1.38). The risk for lower third trauma was significantly higher when falls were the main causes of trauma (RR 1.79; 95%CI, 1.18-2.70).

**Table 1.** Lesions distribution in the different regions of the face according to gender, age, skin color and cause of trauma (n = 785)

	Middle third (%)	Lower third (%)	Oral region (%)
	p value	p value	p value
Gender	0.71	0.54	0.30
Male	236 (72.4)	90 (27.3)	77 (23.3)
Female	239 (74.2)	80 (25.1)	63 (19.8)
Age	0.44	0.48	0.94
0-15	74 (68.5)	28 (25.9)	24 (22.2)
16-30	225 (74.8)	79 (26.7)	66 (22.1)
31-45	110 (70.8)	47 (30.3)	33 (21.9)
46-60	46 (74.2)	13 (20.1)	14 (22.6)
61-75	16 (88.9)	2 (11.1)	2 (11.1)
>75	4 (80.0)	1 (20.0)	1 (20.0)
Skin color	0.005	0.08	0.48
White	369 (70.5)	147 (28.1)	117 (22.3)
Brown	29 (82.8)	7 (20.0)	8 (22.9)
Black	77 (85.6)	16 (17.8)	15 (16.7)
Cause of trauma	0.85	<0.05	0.31
Physical Aggression	416 (73.9)	139 (24.7)	122 (21.6)
Traffic Accident	33 (70.2)	16 (34.0)	10 (21.3)
Firearm	4 (66.7)	1 (16.7)	3 (50.0)
Fall	22 (68.7)	14 (43.8)	5 (15.6)

**Fig. 1.** Isolated and combined maxillofacial lesions distribution and number of victims.

## Discussion

Information on health is important for planning, monitoring and management of collective and individual health interventions. In the last years, traumas to the maxillofacial region are becoming more common both in the urban and rural areas.<sup>1</sup> Changes in the global socio-economic scenery are responsible for switches in the pattern of maxillofacial traumas etiologies.

Brazil has emerged as an economic power in the last years, resulting in higher employment and immigration rates, but on the other side growth was accompanied by social disparities. In this way, more traumas due to physical aggression are expected. This study shows for the first time that Brazilian growth is reflecting in increased reports of trauma due to interpersonal violence. In the present study, the main cause for traumas in all three analyzed regions was physical aggression, followed by car accident and falls, as

**Table 2.** Distribution of intraoral trauma (n = 36)

	n	% of intraoral traumas	% of total traumas
<b>Soft tissue lesions</b>			
Tongue	3	8.3	0.5
Buccal mucosa	2	5.6	0.3
Gingival mucosa	4	11.1	0.6
Mouthfloor mucosa	0	0	0
Palate	0	0	0
<b>Dental tissue lesions</b>			
Tooth Fracture	12	33.4	1.9
Tooth Subluxation	0	0	0
Tooth Luxation	8	22.2	1.2
Tooth Avulsion	7	19.4	1.1
Total	36	100	5.6

**Table 3.** Poisson regression crude (b) and adjusted (a) analyzes for occurrence of oral and maxillofacial trauma in the middle third of face. Pelotas, Brazil (n=75)

Independent Variables	RR <sup>b</sup> (CI 95%)	p-value	RR <sup>a</sup> (CI 95%)	p-value
<b>Gender</b>				
Female	1.0	0.61	-	
Male	0.97 (0.88-1.07)			
<b>Age (years)</b>				
0-15	1.0	0.24	1.0	0.021
16-30	1.09 (0.94-1.26)		1.10 (0.95-1.27)	
31-45	1.03 (0.88-1.21)		1.03 (0.87-1.21)	
46-60	1.08 (0.89-1.31)		1.10 (0.90-1.33)	
61-75	1.29 (1.05-1.59)		1.32 (1.07-1.62)	
>75	1.16 (0.73-1.84)		1.15 (0.74-1.78)	
<b>Skin Color</b>				
White	1.0	<0.001	1.0	<0.001
Brown	1.21 (1.09-1.34)		1.21 (1.09-1.34)	
Black	1.17 (1.01-1.37)		1.18 (1.01-1.38)	
<b>Cause of trauma</b>				
Physical Agression	1.0	0.41	-	
Traffic Accident	0.95 (0.78-1.15)			
Firearm	0.90 (0.51-1.59)			
Fall	0.93 (0.73-1.18)			

seen in many urban centers in Germany<sup>14</sup> and the United States<sup>15</sup>.

The explanation for the increase if interpersonal violence is higher alcohol consumption, drug abuse and social disparities due to unequal wealth distribution<sup>1,16,17</sup>. It was found that skin color, a marker of social inequality,<sup>5,6</sup> represents a risk factor for facial traumas, since black and brown victims tended to have more lesions in the middle third of the face. It is important to emphasize that no previously published paper has reported a social marker as a risk factor for oral and maxillofacial traumas. According to Minayo<sup>18</sup> (1990), non-white people are the most vulnerable to violence in urban areas with low quality of life, since they live along with violence on a daily basis. As seen in other reports, non-white people at greatest risk of being victims of violence are men, young, single and belonging to low-income families.<sup>6</sup> On the other hand, the stiffening of road traffic laws and safety norms such as obligatory use of

seat belts, air bags, helmet wearing for motorized two-wheelers and speed surveillance reduced maxillofacial traumas due to traffic accidents<sup>16,17,19</sup>.

According to the age groups, maxillofacial traumas were more frequent in people between 16 and 30 years followed by ages between 31 to 45 years which concurs with previous studies<sup>1,17,20-22</sup>. People in these age groups have more social interaction than other age groups, with higher alcohol and other drugs consumption<sup>1,20</sup>. Despite of it, an increase of oral and maxillofacial traumas in the elderly is being observed. According to Al-Khateeb and Abdullah<sup>9</sup> (2007) this fact is due to an increase in average life expectancy, a more active lifestyle and higher percentage of elderly people in the population. The main cause of traumas in the elderly population was due to falls, which has been related to reduced physical agility, presence of systemic pathologies and use of psychotropic medications. Our data corroborate other studies

**Table 4.** Poisson regression crude (b) and adjusted (a) analyzes for occurrence of oral and maxillofacial trauma in the lower third of face. Pelotas, Brazil (n= 170)

Independent Variables	RR <sup>b</sup> (CI 95%)	p-value	RR <sup>a</sup> (CI 95%)	p-value
<b>Gender</b>		0.54		
Female	1.0		-	
Male	1.08 (0.83-1.40)			
<b>Age (years)</b>		0.38		
0-15	1.0		-	
16-30	1.02 (0.70-1.48)			
31-45	1.16 (0.78-1.74)			
46-60	0.80 (0.45-1.44)			
61-75	0.42 (0.11-1.64)			
>75	0.77 (0.13-4.58)			
<b>Skin Color</b>				0.16
White	1.0	0.07	1.0	
Brown	0.63 (0.39-1.00)		0.61 (0.38-0.98)	
Black	0.71 (0.36-1.40)		0.72 (0.36-1.42)	
<b>Cause of trauma</b>				
Physical Aggression	1.0	0.02	1.0	0.02
Traffic Accident	1.37 (0.90-2.10)		1.39 (0.91-2.12)	
Firearm	0.67 (0.11-4.06)		0.66 (0.11-3.94)	
Fall	1.77 (1.16-2.70)		1.79 (1.18-2.70)	

where the middle third facial area is more affected in elderly victims, with special regards to the orbital-zygomatic region<sup>23,24</sup>.

Another finding was a greater risk for trauma on the lower third associated with falls after adjustment in the final regression model. This fact may be explained by the chin prominence trauma when the victims fall. In addition, Iida et al.<sup>7,14</sup> (2001, 2003) reported that fall is usually observed as a chin impact leading to condyle fracture, and in less cases, multiple fractures when the impact occurs in the lateral sides of mandible.

In contrast to other studies that reported mandible as the most commonly affected site,<sup>22,25,26</sup> in the results of this study middle third was more affected (73.3%) than the lower third (26.2%), which agrees with the studies conducted by Gandhi et al<sup>1</sup> (2011). Among the lower third maxillofacial lesions, dentoalveolar traumas presented a low prevalence (3.6%) concurring with previous studies<sup>27-30</sup>. In this report, crown fracture was the most common (1.9%) followed by luxation (1.2%). As expected, most of these lesions correlate with low-impact traumas due to interpersonal violence that are usually observed as soft tissue abrasion, hematoma, and dentoalveolar fractures<sup>8</sup>. It is supposed that the importance, number and severity of the perioral and intraoral lesions would change with the presence of a forensic dentist at the Institutes of Forensic Medicine and their prevalence would increase.

An example of specific professional care that has increased the number of notified lesions was the creation of specialized police stations for women's defense in Brazil. These units stimulated the notification of aggression against women and reduced the male-to-female ratio of reported traumas to 1.03:1. Some countries have ratios of up to 8:1, but recent studies show a trend towards an equal male-to-female ratio<sup>17,22</sup>. The increase in the number of women

presenting maxillofacial traumas was attributed to an increase in the women's working force and many of them working outdoors in more high-risk occupations, thus becoming more exposed to traumas<sup>9</sup>.

In the last decade, changes in global economy reflected in different aspects of the worldwide development. New economies are emerging with consequences to their population. Specific preventive public policy must respect the differences of each country, especially in countries with different social and economic realities aggravated due to social inequalities. As seen in many countries, there is a worldwide trend of decreasing traffic-related traumas and increasing violence-related traumas. Thus, appropriate strategies at both community and individual levels should be implemented to prevent and reduce overall trauma.

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