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Injuries to the Head and Face in Brazilian Adolescents and Teenagers Victims of Non-natural Deaths

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ABSTRACT

This study aimed to evaluate the occurrence of injuries to the head and face in adolescent and teenager victims of non-natural deaths. A retrospective study was undertaken by the analysis of medical forensic reports obtained from medical forensic examinations performed at the Department of Forensic Medicine of the city of Campina Grande, PB, Brazil, between January 2003 and December 2007. From a total of 607 reports issued during this time span, the study sample consisted of 423 reports (69.6%) referring to adolescents and teenagers of both genders, aged 12 to 18 years, who were confirmed to have died from external causes. The causes of death were encoded according to the Chapter XX of the International Statistical Classification of Diseases and Related Health Problems (ICD-10). The majority of victims were 17 year old males (25.8%). Firearms (33.3%) and transport accidents (32.2%) were the most common causes of death, with boys showing a 3.7 times greater likelihood of getting killed by firearms than girls. There was statistically significant relationship between the occurrence of transport accidents and gender. The majority of victims (71.6%) presented with multiple injuries throughout the body. There was statistically significant relationship between the occurrence of transport accidents and the presence of multiple injuries. A high percentage of the victims presented with injuries to the head and face. There was statistically significant relationship between the occurrence of transport accidents and the presence of injury to the head. Fatal gunshot wounds and transport accidents were the main causes of death of male adolescents and teenagers. The victims presented with multiple injuries, especially to the head and face, and the mandible was the most frequently injured facial bone.

***KEYWORDS*:** Maxillofacial Injuries; Wounds and Injuries; Accidents, Traffic

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INTRODUCTION

According to the World Health Organization (WHO), external causes of mortality are physical damage to the human body causing a fatal bodily lesion as a result of acute exposure to energy in amounts that exceed the threshold of physiological tolerance or impairment of function due to a lack of one or more vital elements (i.e. air, water, warmth)[1].

Unintentional (i.e. accidental) or intentional (i.e. deliberate) injuries due to external causes represent an important public health problem as they kill over 5 million people worldwide every year[2]. External causes are the leading cause of death among children and adolescents between 1 and 18 years of age around the world[3] and are responsible for the deaths of over 40,000 children in Europe[4]. In Brazil, they are the third most common cause of death, accounting for 15.2% of the deaths of individuals from 0 to 19 years[5]

Because it is the most exposed and poorly protected region of the body, the face is more frequently associated with a variety of traumatic injuries that may occur either alone or in combination with other organs or systems[6]. The main causes of facial injuries are transport accidents, physical assaults, falls and sports activities[7]. However, the etiology and incidence of injuries vary from one country to another, and even within the same country, according to social, cultural and environmental factors[7-9].

As external causes of morbidity and mortality are affecting ever younger age groups, several studies have focused on the importance of these events in the child and adolescent population[7,10-12]. The purpose of the present study was to characterize the injuries to the head and face in Brazilian 12-18-year-old adolescents and teenagers victims of non-natural deaths.

MATERIALS AND METHODS

A retrospective study was undertaken by the analysis of expert medical reports derived from medical forensic examinations performed at the Department of Forensic Medicine of the city of Campina Grande, PB, Brazil, between January 2003 and December 2007. From a total of 607 reports issued during this time span, the study sample included 423 reports (69.6%) referring to 12-18-year-old adolescents and teenagers of both genders who were confirmed to have died from external causes. The causes of death were encoded according to the Chapter XX (External causes of morbidity and mortality) in the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) (V01-Y98)[13].

According to the Brazilian legislation, all deaths from external causes and cases of sudden or suspicious death are autopsied at the departments of Forensic Medicine. A road traffic injury was defined as any injury (regardless of severity) that occurred while walking, bicycling, or riding in a vehicle due to a crash involving one or more vehicles (including bicycles) and originating or terminating on a roadway[14].

Data referring to the victims' gender, age, cause of death, number of injuries and anatomic location of injuries to the head, face and oral cavity and maxillofacial fractures (if present) were gathered from the forensic medical reports and transferred to specific registration forms, which were kept in folders classified according to the year and month of occurrence of the event.

This study was conducted in compliance with the ethical guidelines issued by the Brazilian Ministry of Health/National

Health Council Resolution 196/96 on research involving human subjects. The research project was approved by the Ethics Committee of the State University of Paraíba, Brazil.

All statistical analyses were performed using the Epi Info 2007 software (Centers for Disease Control and Prevention, Atlanta, GA, USA). The absolute and percent frequencies were obtained for data analysis (descriptive statistical techniques). The existence of statistically significant relationships between the variables was verified by means of bivariate analysis (Yates' chi-square test) using a value of □=.05

RESULTS

From the 423 forensic medical reports reviewed in this study, 79.9% (n=338) of the victims were male and 20.1% (n=85) were female. Figure 1 presents the distribution of victims according to the gender and year of study.

Most victims were among the older age groups, that is, 17-year-olds (25.8%) and 18-year-olds (24.1%) (Table 1).

Table 1. Distribution of deaths according to the victim's age.

	Sex						
	Male		Female		**Ratio**	**Total**	
Age (years)	n	%	n	%		n	%
12	20	66.7	10	33.3	2:1	30	7.1
13	17	62.9	10	37.1	1.7:1	27	6.4
14	19	67.8	9	32.2	2.1:1	28	6.6
15	41	74.5	14	25.5	2.9:1	55	13.0
16	56	77.7	16	22.3	3.5:1	72	17.0
17	93	85.3	16	14.7	5.8:1	109	25.8
18	92	90.1	10	9.9	9.2:1	102	24.1
Total	338	79.9	85	20.1	4:1	423	100.0

The mean male-to-female ratio was 4:1, increasing to 9.2:1 among the adolescents aged 18 years.

Wounding with firearms was the main cause of death (33.3%) followed closely by transport accidents (32.2%).(Table2). The analysis of mortality due to firearms revealed a statistically significant difference between genders, with boys showing a 3.7 times greater chance of getting killed by firearms than girls (P=0.000; OR=3.7 [1.96-7.18]).

Regarding the transport accidents, there was a predominance of motorcycle accidents (n=60; 44.1%), followed by accidents in which the children and adolescents were pedestrians (n=40; 29.4%) or were in a vehicle (n=23; 16.9%). This information was missing from 7 (5.1%) medical forensic reports. There was statistically significant relationship between the occurrence of transport accidents and gender (P=0.033; OR=0.57 [0.35-0.93]).

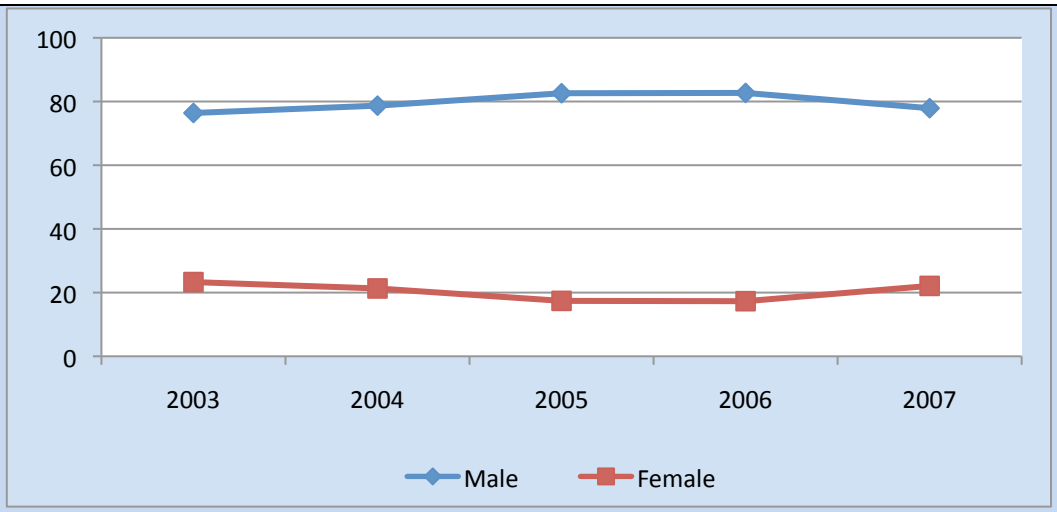

Figure1:Distribution of victims according to gender and year of study

Table 2. Distribution of deaths according to the cause of death and victim's gender

Cause of Death	Sex					
	Male		Female		Total	
	n	%	n	%	n	%
Motor vehicle accident	100	73.5	36	26.5	136	32.2
Drowning	49	75.4	16	24.6	65	15.4
Violence	10	83.3	2	16.7	12	2.8
Knife	18	90.0	2	10.0	20	4.7
Firearm	129	91.4	12	8.6	141	33.3
Electricity	3	75.0	1	25.0	4	0.9
Enforcamento	8	80.0	2	20.0	10	2.4
Poisoning	2	50.0	2	50.0	4	0.9
Undetermined	2	28.6	5	71.4	7	1.7
Intoxication	2	50.0	2	50.0	4	0.9
Other	3	60.0	2	40.0	5	1.2
Fall	9	75.0	3	25.0	12	2.8
Burn	1	100.0	0	0.0	1	0.2
NR*	2	100.0	0	0.0	2	0.5
Total	338	79.9	85	20.1	423	100.0

*Not reported

Overall most victims presented multiple injuries distributed all over the body (n=303; 71.6%), while 11.3% (n=48) of them presented with a single injury. A

total of 72 victims (17.0%) did not show any injuries. There was statistically significant relationship between the occurrence of transport accidents and the presence of multiple injuries, namely that victims of motor accidents had a 46 times greater chance of being polytraumatized (P=0.000; OR=46,7 [11,3-192,7]).

The analysis of injury location revealed that 51.1% the victims had injuries to the head, while 49.9% presented only injuries to the face. Forty-one victims presented with maxillofacial fractures (9.7%) and 12.5% (n=53) with intraoral injuries, including 18 (34.0%) individuals with dental fractures affecting 52 teeth.

There was statistically significant association between the occurrence of transport accidents and the presence of injuries to the head (P=0.000), maxillofacial fractures (P=0.000) and intraoral injuries (P=0.000), as shown in

Table 3. Likewise, there was statistically significant association between the presence of multiple injuries and the occurrence of injuries to the head (P=0.000), maxillofacial fractures (P=0.000) and intraoral injuries (P=0.000) (Table4).

Most facial fractures occurred in the mandible (38.0%), followed by the nasal (22.5%), maxillary (16.9%), zygomatic (12.7%) and orbital (8.5%) bones, and the alveolar bone in a smaller proportion (1.4%) (Table 5).

Table 3. Association between transport accidents and presence of injury to the head, maxillofacial fracture and intraoral injuries

Variable	Transport Accidents				P value	Odds Ratio
	Yes		No			
	n	%	n	%		(IC=95%)
Injury to the head						1
Yes	108	50.0	108	50.0	P=0.000	6.39
No	28	13.5	179	86.5		(3.95-10.32)
Maxillofacial fracture						1
Yes	25	61.0	16	39.0	P=0.000	3.81
No	111	29.1	271	70.9		(1.96-7.41)
Intraoral injuries					P=0.000	1
Yes	30	56.6	23	43.4		3.24
No	106	28.6	264	71.4		(1.80-5.84)

Table 4. Association between presence of injury to the head, maxillofacial fracture and intraoral injuries and the existence of multiple injuries.

Variable	Multiple injuries				P value	Odds Ratio
	Yes		No			
	n	%	n	%		(IC=95%)
Injury to the head						1
Yes	211	69.6	92	30.4	P=0.000	52.7
No	5	4.2	115	95.8		(20.84-133.46)
Maxillofacial fracture						
Yes	41	100.0	0	0.0	P=0.000	*
No	262	68.6	120	31.4		
Intraoral injuries					P=0.000	1
Yes	51	96.2	2	3.8		11.94
No	252	68.1	118	31.9		(2.85-49.87)

Table 5. Distribution of the facial fractures according to the localization

Localization	Frequency	
	n	%
Mandible	27	38.0
Nasal	16	22.5
Maxillary	12	16.9
Zygomatic	9	12.7
Orbital	6	8.5
Alveolar	1	1.4
Total	71	100.0

DISCUSSION

Every year, injuries due to external causes account for 950,000 deaths of children and adolescents under the age of 18 worldwide[15]. It can be said that the life expectancy of thousands of young people is abruptly terminated by transport accidents, acts of violence or even injuries that occur at home or during moments of leisure[4].

In Brazil, from the total over all age groups of 131,471 deaths due to external

causes registered in 2008, 1.8% and 10.3% occurred in the 10-14-year-old and 15-19-year-old age groups, respectively, with higher prevalence among males in both age ranges[5]. As reported by other authors[16-18] and confirmed in the present study, data analysis by gender and age shows that males and older adolescents are more frequent victims of fatal external causes.

Regarding the causes of death, this study showed that in 1.7% of cases it was not possible to establish the cause of death. In some cases, the corpses were found in an advanced stage of decomposition, which made it difficult for the forensic medical expert to establish the cause of death[19].

Unlike the results of studies performed in Switzerland[18], United States[10,20], Lithuania[21] and Manipal[22], in which transport accidents were mentioned as the main cause of deaths among adolescents, in the present study injuries caused by firearms were responsible for the majority of deaths, corroborating the results obtained in Fulton (Georgia)[17]. In the United States, fatal gunshot wounds rank second as the cause of death among youths from 1 to 19 years[23]. In addition to socio-cultural determinants, the violence in Brazil is primarily associated with abuse of alcohol and illicit drugs as well as with the easy access to firearms[24], which potentially increase the risk of death due to external causes[23].

The high morbity and mortality rates related to transport accidents in Brazil have been associated with the facts that private cars are usually the preferred mode of transport, and the road networks offers inadequate conditions in terms of safety[24]. Other additional factors include driving above the speed limit, driving under the influence of alcohol or drugs, inexperience of young drivers and above all lack of use of safety equipments (seal belts, airbags, age-appropriate restraint devices for children, and motorcycle helmets)[20,24].

Transport accidents, as the second major cause of deaths in the studied age group, were responsible for the majority of injuries to the head and face among the victims, which is consistent with previous findings[8,25-27]. In the United States, a study of children and adolescents revealed that transport accidents double the risk of facial fractures and that the association of a higher mortality rate with facial fractures results from the concomitant occurrence of severe injuries to the head[26].

The predominance of deaths involving motorcycles observed in this survey agrees only with the results of studies conducted in Estonia[28] and Iran[29], but the same result was not observed by other authors[10,25,30]. The fact that motorcycle riders have less physical protection compared to car drivers explains the higher risk during motorcycle crashes[31]. Motorcycle riders are at a higher risk for both collision traffic injuries as well as non-collision transport accidents that is not the case with other vehicles[29].

The transportation of children and adolescents on motorcycles is a common practice in small- and medium-sized Brazilian cities, such as Campina Grande, where the present study was conducted, because this is the main means of transportation among low socioeconomic groups [19]. The mortality of a teen driver is a complex phenomenon, which could partially be explained by the inherent characteristics of this group, such as immaturity, feelings of omnipotence, a tendency to overestimate their skills, little experience, limited ability to drive, and risky behaviors[32].

Maxillofacial injuries are common injuries that occur due to motor vehicle accidents. They can occur in isolation or in combination with concomitant injuries. In

general, there are three broad divisions of maxillofacial injuries: facial bone fractures, soft tissue injuries, and dentoalveolar injuries[32].

The association between head, face and intraoral injuries and transport accidents and multiple injuries found in the present study shows that the head is severely injured in the majority of the cases. A study of Portuguese children and adolescents revealed that in all deaths due to transport accidents, all victims presented with multiple fractures, including injuries to the head[25].

Mandible and midfacial skeletal fractures are among the frequently reported facial bone fractures[33]. The present study found a large number of mandible fractures, which has also been observed in previous studies with children older than 10 years involved in motor vehicle accidents[8,25,26]. It is likely that, as the mandible is the only mobile bone of the face, it is more prone to fractures than the bones of the middle third of the face, which have greater bone support[34].

The relatively high incidence of injuries resulting from transport accidents indicates the necessity to reinforce legislation aimed at preventing road traffic accidents and thus to reducing maxillofacial injuries among children and adults[35].

CONCLUSION

Fatal gunshot wounds and transport accidents were the leading causes of death among male adolescents and teenagers. The victims presented with multiple injuries, especially to the head and face regions, and the mandible was the most frequently injured facial bone.

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