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Retrospective study of prevalence of face fractures in southern Brazil

Jefferson Viapiana Paes, Franciana Lima de Sá Paes, Renato Valiati, Marília G de Oliveira[1], Rogério Miranda Pagnoncelli[1]

Department of Oral and Maxillofacial Surgery, Hospital Nossa Senhora dos Prazeres, Lages, SC, [1] Department of Oral and Maxillofacial Surgery, Pontifical Catholic University of Rio Grande do Sul (PUCRS), Porto Alegre, RS, Brazil

ABSTRACT

Context: Trauma has been an important public health problem worldwide. Facial injuries are among the most common types of trauma treated at emergency departments, associated or not with injuries in other anatomic sites. The patterns of facial fractures are usually affected by geography and socioeconomic conditions.
Aim: To investigate the prevalence of facial fractures in Lages, state of Santa Catarina, southern Brazil, from September 2003 to August 2008.
Settings and Design: Cross-sectional, retrospective, epidemiological study.
Materials and Methods: Data on patients' gender, age, etiological agent, and facial region affected by fracture were collected from the charts of patients treated with facial fractures.
Statistical Analysis Used: Qualitative variables were expressed as absolute and relative frequencies, and quantitative variables as means and standard deviation. The Chi-square test was used to evaluate the association between gender, traffic accidents and facial region affected. The association between etiological agents and facial region affected was assessed using the chi-square test and the adjusted residuals analysis.
Results: 492 patients presented with oral and maxillofacial trauma, with 988 facial fractures; 80.9% of the patients were men, and the most frequent age group was 21–30 years (29.5%). The most frequent causes of fractures were: Traffic accidents in 27.9%, physical assault in 14.9%, and bicycle falls in 10.5%; several other causes scored below 10%.
Conclusion: Regular publication of epidemiological data is extremely important for the implementation of prevention campaigns and for an increased awareness of the etiology of fractures affecting the face and other anatomic sites.

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Key words: Epidemiology, face fractures, maxillofacial trauma

Car accidents are the most frequent causes of facial fractures[1-3] in both developed and developing countries. Brazil has a high number of traffic accidents.[4,5] Most facial traumas are seen in young people.[6,7] Moreover, survivors have sequelae, such as difficulties in physical, psychological and social recovery, besides hospital costs.

Address for correspondence:
Dr. Marília Gerhardt de Oliveira
E-mail: gerhardtoliveira@gmail.com

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The frequent association between craniofacial and maxillofacial trauma requires multiprofessional and increasingly complex treatment approaches, with longer hospitalization times and high costs to the Brazilian public healthcare system.[8] In this sense, the conduction of prospective studies is extremely important to allow the development and implementation of policies to guarantee the delivery of quality immediate care to trauma victims.[9,10]

This cross-sectional, retrospective, epidemiological study describes and analyzes facial trauma according to the charts of patients treated in the service of Oral and Maxillofacial Surgery (OMFS) of a tertiary care hospital in Lages, state of Santa Catarina, southern Brazil, from September 2003 to August 2008. Etiological agents of facial fractures, as well as patient age, gender and place of residence, were evaluated.

MATERIALS AND METHODS

This study was approved by the Research Ethics Committee at Pontifícia Universidade Católica do Rio Grande do Sul – PUCRS, Porto Alegre, state of Rio Grande do Sul, Brazil. A total of 545 charts of patients with a diagnosis of facial trauma treated at the OMFS of the hospital were reviewed.

Fifty-three charts were excluded because patients had only soft tissue lesions. The review of the 492 charts included in the study revealed a total of 988 facial fractures.

Data in the charts were analyzed, and the following data were recorded: Patient identification (number on the hospital record), age group, gender, place of residence (Lages or other city in Brazil), seasons of the year in which the trauma occurred, etiological agent of the facial fracture, and facial fracture classification.

Etiological agents were classified as: Car accidents, work accidents, sports accident, physical violence, pedestrian hit by motor vehicle, motorbike accident, wound caused by firearm bullet, bicycle accident, falls on the same level, and other causes. The etiological agent "other causes" included patients hit by a horse kick, as well as falls from elevation associated with the Araucaria trees, frequent in this region. Assaults were included in the category of physical violence.

Patient age was described according to age groups in years: 0–10, 11–20, 21–30, 31–40, 41–50, 51–60, 61–70, 71–80 and 81–90.

Fractures of the facial skeleton were classified as follows: Mandibular bone, zygomatic complex, maxillary and nasal bones. The orbit fractures were included in the fractures of the zygomatic process. Fractures of dentoalveolar processes were recorded in special clinical forms and were included in the category of mandibular or maxillary fracture.

Qualitative variables were expressed as absolute and relative frequencies, and quantitative variables were presented as means and standard deviation. The Chi-square test was used to assess the association between gender, traffic accidents, and the facial region affected. Student's *t* test was used to compare the mean age of patients with facial fractures caused by traffic accidents versus by other factors. The association between etiological agents and facial region affected was assessed using the Chi-square test and the adjusted residuals analysis.

RESULTS

Of the total sample, 80.9% were men (*n*=398), and the male-to-female ratio was 4:1. The distribution of frequency and percentage according to age group revealed that the most frequent was 21–30 years, with 145 patients (29.5%).

Table 1 shows the distribution of frequency and percentage according to age group.

Table 2 describes the most frequent etiological agents of facial fractures in this study.

The comparison of facial fractures caused by traffic accident versus all other etiological agents according to gender revealed no significant association between gender and traffic accident (Chi-square=0.047; *P*=0.829; odds ratio = 0.927, 95% CI = 0.591–1.454) [Table 3].

The comparison of traffic accidents as a group that included car accidents, pedestrian-vehicle accident, motorbike accident, and bicycle fall (*n*=264) with all other etiological agents (*n*=228) associated with age group (mean age: 33.39 ± 16.53 vs. 32.05 ± 17.95) revealed that there was no significant difference in the mean age of patients with facial fractures caused by traffic accidents or other causes (*t* test, *P*=0.390; mean difference=1.34; 95% CI=–1.72 to 4.40).

Table 1: Distribution of frequency and percentage according to age group

Age group (years)	Frequency (*n*)	Percentage
0–10	37	7.6
11–20	82	16.6
21–30	145	29.5
31–40	89	18.1
41–50	58	11.8
51–60	41	8.3
61–70	27	5.5
71–80	08	1.6
81–90	05	1.0
Total	492	100.0

Table 2: Frequency and percentage of facial fractures according to etiological agent

Etiological agent	Frequency (*n*)	Percentage
Traffic accident	137	27.9
Pedestrian-vehicle accident	37	7.5
Motorbike accident	39	7.9
Bicycle fall	52	10.5
Work accident	45	9.2
Sports accident	27	5.5
Assault	73	14.9
Other causes	18	3.6
Firearm bullet	24	4.9
Fall from same level	40	8.1
Total	492	100.0

Table 3: Hospitalization frequency and percentage of traffic accidents and all other etiological agents according to gender

	Gender				Total	
	Female		Male			
	n	%	*n*	%	*n*	%
Traffic accidents	49	52.1	215	54.0	264	53.7
Other etiological agents	45	47.9	183	46.0	228	46.3
Total	94	100.0	398	100.0	492	100.0

The number of patients hospitalized was 492; 297 (60.4%) lived in Lages and 195 (39.6%) in other regions of the state of Santa Catarina, southern Brazil.

Of the 988 fractures, 302 (30.5%) affected the mandible, 285 (28.8%) the zygomatic complex, 250 (25.3%) the maxilla, and 151 (15.2%) the nasal bones. The number of facial fractures was greater in men, and the bone most often affected among women was the maxilla [Table 4].

The distribution of number of fractures according to gender and bone affected showed that the presence of fracture in one of the bones under study was associated with female gender, except fractures in the mandible, for which there was no significant association (Chi-square test, *P*=0.971) [Table 5].

The percentage of facial fractures according to age groups showed that patients in the 21–30 year age group were the most frequently affected, followed by those in the 31–40 year age group. The analysis according to each fractured bone showed that the mandible, the zygomatic complex, the maxilla and the nasal bones had the highest percentage of fractures in the 21–30 year group. The 31–40 year group was the second most frequent in number of facial fractures except for the mandible, for which the greatest frequency was found for the 11–20 year age group [Graph 1].

A Chi-square test and analysis of adjusted residuals at a level of significance of 5% were used to compare the frequency and percentage of etiological agents according to the bone fractured. Results showed that mandibular fractures were associated with motorbike accidents and fall from same level; fractures of the zygomatic bones were associated with work accident, sports accident and physical assault; fractures of the maxilla were associated with car accidents, firearm bullet wound and bicycle fall; fractures of nasal bones were associated with assault [Table 6].

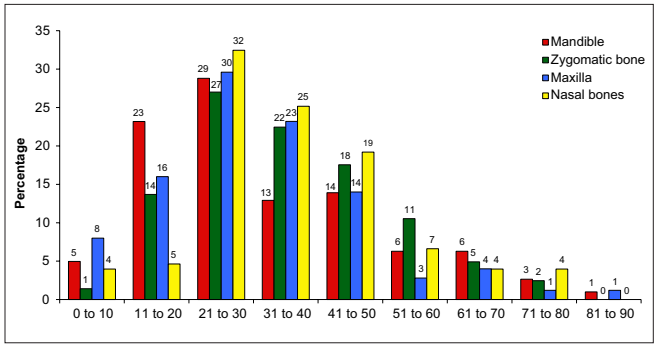
Table 4: Hospitalization frequency and percentage according to fractured bone

	Male		Female	
	n	%	*n*	%
Mandible	235	77.8	67	22.2
Zygomatic bone	211	74	74	26
Maxilla	162	64.8	88	35.2
Nasal bone	95	62.9	56	37.1

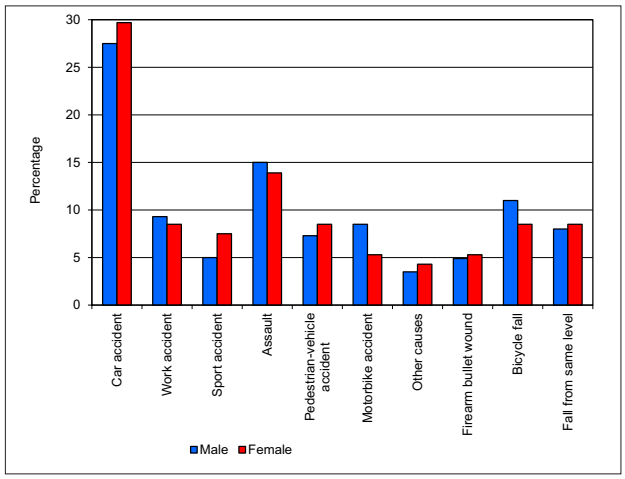
The analysis of gender and etiological agent showed that the most frequent etiological agents for both genders were car accident [(27.5% (*n*=109) for men and 29.7% (*n*=28) for women] followed by assault [15% (*n*=60) for men and 13.9% (*n*=13) for women] [Graph 2].

The association between distribution of etiological agents and age groups for men showed a total of 398 patients, and the most frequently affected age groups were the 21–30 (*n*=118, 30.2%), 31–40 (*n*=73, 18.3%) and 11–20 (*n*=68, 17.0%) year groups [Table 7].

The frequency of patients with facial fractures was also classified according to the seasonal variation: Autumn (*n*=99, 20.1%), winter (*n*=94, 19.1%), spring (*n*=123, 25%) and summer (*n*=176, 35.8%) [Graph 3].



Graph 1: Percentage distribution of facial fracture according to bone fractured and age group



Graph 2: Percentage of facial fractures according to gender and etiological agent

Table 5: Hospitalization frequency and percentage according to bone fractured

Fractured bone	Gender				*P*	95% Confidence interval		
	Female		Male			Odds ratio	Lower	Upper
	n	%	*n*	%				
Mandible	36	38.3	149	37.4	0.971	0.964	0.607	1.531
Zygomatic bone	63	67.0	180	45.2	<0.001	0.406	0.253	0.652
Maxilla	60	63.8	148	37.2	<0.001	0.335	0.210	0.535
Nasal bone	56	59.6	95	23.9	<0.001	0.213	0.133	0.341

P=minimal significance level for Chi-square test

Table 6: Frequency and percentage of etiological agent according to bone fractured

Etiological agent	Bone								Total	
	Mandible		Zygomatic bone		Maxilla		Nasal bone			
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Car accident	89	29.5	85	29.8	92	36.8*	52	34.4	318	32.2
Work accident	18	6.0	29	10.2*	8	3.2	6	4.0	61	6.2
Sports accident	5	1.6	24	8.4*	9	3.6	2	1.3	40	4.0
Assault	14	4.6	67	23.5*	16	6.4	37	24.6*	134	13.6
Pedestrian-vehicle accident	18	6.0	26	9.1	19	7.6	15	9.9	78	7.9
Motorbike accident	41	13.6*	15	5.3	25	10.0	8	5.3	89	9.0
Other causes	12	4.0	11	3.9	9	3.6	6	4.0	38	3.8
Firearm bullet wound	19	6.3	8	2.8	18	7.2*	1	0.7	46	4.7
Bicycle fall	34	11.2	12	4.2	46	18.4*	20	13.2	112	11.3
Fall from same level	52	17.2*	8	2.8	8	3.2	4	2.6	72	7.3
Total	302	100.0	285	100.0	250	100.0	151	100.0	988	100.0

Chi-square=217.42; $P<0.001$. *Adjusted residual analysis: $P<0.05$

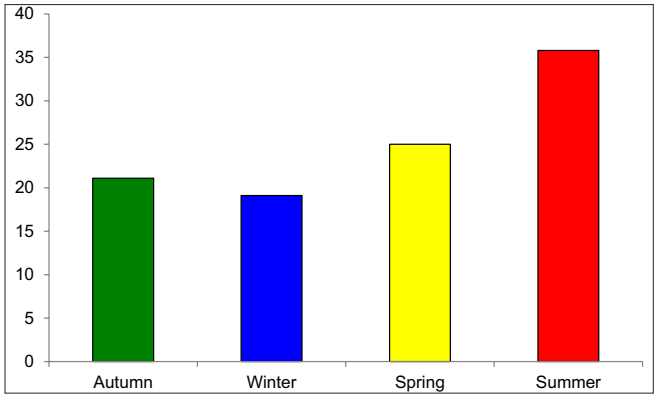
Table 7: Distribution of male patients with facial fractures according to etiological agent and age group

Etiological agent	Age group (years)									
	0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	Total
Traffic accident	5	17	39	22	15	6	4	1	0	109
Work accident	0	5	8	4	9	11	0	0	0	37
Sports accident	3	7	6	2	1	1	0	0	0	20
Assault	1	12	20	16	3	2	5	0	1	60
Pedestrian-vehicle accident	2	5	3	2	5	3	3	4	2	29
Motorbike	0	6	15	9	3	1	0	0	0	34
Other agents	3	2	5	3	0	1	0	0	0	14
Firearm bullet	0	1	6	5	4	2	1	0	0	19
Bicycle fall	5	6	11	10	6	3	3	0	0	44
Fall from same level	10	7	5	0	1	2	5	1	1	32
Total	29	68	118	73	47	32	21	6	4	398

DISCUSSION

This epidemiological study was conducted in a region of southern Brazil that has a population of about 424,000,[11] including urban and rural inhabitants. The OMFS Service of our hospital is a reference center in the region around the city of Lages in the state of Santa Catarina, southern Brazil, and the hospital works within the Brazilian Public Health System (SUS). In Brazil, there are laws against drinking and driving, laws that require the use of seat belts and speed limits for the roads traffic (80 and 100 km/h). In 5 years, from September 2003 to August 2008, 545 patients were treated by OMFS specialists, and the analysis of this sample may provide knowledge about the current distribution of facial fractures in southern Brazil, as well as help to build a database that may improve medical and dental programs to prevent facial trauma.

Some studies showed that the most common cause of facial fractures is associated with traffic accidents,[1,5,8-10,12,13] but others have demonstrated that assault is the most frequent etiological agent.[14,15] According to Taher,[16] fractures caused by firearm bullets are the most common in Iran. Our results showed a high incidence of fractures caused by traffic accidents, particularly those that involve cars, which is particularly significant among individuals 21–30 years of age. However, this and other etiological agents recorded in this study directly depend on the age and gender of the patient and determine the frequency at which a certain region of the facial skeleton sustains a fracture.



Graph 3: Frequency of facial fractures according to seasonal variation in 5 years (September 2003 to August 2008)

This study showed that traffic accidents were the cause of 27.9% of the cases [Table 2]. If pedestrian-vehicle accidents, motorbike accidents and bicycle falls are included in the traffic accident category, this number reaches 53.8%, a high percentage that raises serious concerns. Iida *et al.*[9] conducted a retrospective study with 1502 patients with facial fractures and found that traffic accidents accounted for 52% of the cases, 38.8% of whom were unprotected patients, that is, cyclists (13.5%), pedestrians (2.7%) and motorcyclists (23.1%). The explanation for the high incidence of traffic

accidents found in both the study by Iida *et al.*[9] and our study lies in the type of hospital where both studies were carried out, namely, local reference centers for the treatment of trauma.

The second most frequent etiological agent in this study was assault (13.6%) [Table 2], a finding that is in agreement with other studies.[5,17] Most patients treated at our hospital had a low socioeconomic status, in addition to other social and economic problems. The increase in urban violence observed in Brazil is strongly associated with social/economic conflicts to which many people, especially youngsters, are subjected.[4] Taking into consideration this complex scenario and the current tendency of urban violence and social conflicts to increase, we believe that a potential reduction in interpersonal violence as a major cause of trauma seems to be much more difficult and unlikely than a reduction in facial trauma caused by traffic accidents. In addition, no significant investments in public safety or education have lately been made by the Brazilian government, whereas unemployment rates remain high. As can be seen in Table 6, among the traumatic injuries caused by aggression, the nasal bone was the bone most commonly fractured, followed by the zygomatic bone.

The third most frequent etiological agent was bicycle falls (11.3%), in agreement with findings by de Roche *et al.*,[18] who found that bicycle accidents are common. In our study, most falls were found to occur among young adults who used bicycles as a means of transportation to work, and none of the patients was wearing safety equipment, for example, helmet. The maxilla was the bone most commonly fractured in bicycle falls [Table 6].

Work accidents accounted for 9.2% of the cases [Table 2]. In the study by Iida *et al.*,[9] work accidents accounted for 3.1%. Brasileiro and Passeri[4] reported that work accidents are the fifth most common (4.5%) etiological agent. In our sample, most facial fractures caused by work accidents took place at sawmills or during reforestation activities, a strong business field in the region where the study was conducted.

Falls from the same level accounted for 8.1% of the cases in this study [Table 2]. Simsek *et al.*[19] found that 7.1–22.4% of the facial fractures were due to falls. De Matos *et al.*[10] reported that accidental falls were the third most common cause of facial fractures.

The increase in the use of motorbikes has led to a greater number of accidents and, consequently, facial fractures.[20] According to Huelke and Compton,[12] although car accidents are more frequent, motorbike accidents are usually more serious. Despite the speed limits enforced and respected in, for example, Thailand, accidents result from the difficulty in accepting to wear helmets because of the hot weather.[21] In Brazil, there are two problems: High speeds, together with the disrespect for traffic laws, and a frequent disregard for the need to wear a helmet, either due to hot weather or discomfort, which leads to serious, often fatal accidents. According to Subhashraj *et al.*,[20] motorbike accidents are more frequent in India due to socioeconomic conditions, speeding, disrespect for traffic laws, poor road conservation, and not wearing a helmet or safety equipment.

Ugboko *et al.*[22] reported that 7.9% of the patients suffered pedestrian-vehicle accidents; in our study, a similar percentage (7.5%) was found.

Facial fractures due to firearm bullet wounds accounted for 4.9% of the total number of injuries. Taher[16] reported that 69.04% of the cases were caused by firearm bullets, whereas 24.44% were due to traffic accidents. Ugboko *et al.*[22] reported that 2.7% of the fractures were caused by firearm bullets.

Mandibular fractures in this study accounted for 30.5% of the cases, followed by fractures of the zygomatic complex (28.8%), maxillary bones (25.3%), and nasal bones (15.2%), results that are in agreement with those reported by other authors.[1,2,4,9,13] Hussain *et al.*,[14] however, found that nasal fractures were more frequent. Some other studies[7,23] found that facial fractures in the zygomatic complex were more frequent.

In this study, men sustained more fractures than women at a 4:1 male-to-female ratio. Tanaka *et al.*[13] found a 3:1 male-to-female ratio, and other authors[1,2,4,9,15,20,23,24] have also confirmed the predominance of male gender. The higher overall frequency of oral and maxillofacial fractures observed in men when compared with women in this study may be explained by the fact that men are more exposed to certain risk situations, for example, there are more male drivers on the roads, especially on highways;[10] men are more likely to practice contact sports; men attend bars more often and consequently are more likely to use alcohol and other drugs prior to driving.[6,10] In spite of the predominance of males in our results, the analysis of individual etiological factors, for example, facial fractures caused by traffic accidents, reveals similar percentage results for both men and women (54 and 52.1%, respectively) [Table 3], indicating that both sexes were primarily affected by the same etiological factor. Also, our initial supposition that women would be more affected by fractures resulting from physical aggression, especially as a result of domestic violence, was not confirmed. In sum, the similarity of etiological agents found for both men and women in this study probably results from the social changes that have been developing since the beginning of this century, with men and women increasingly involved in and exposed to the same situations – differently from ancient times, when women were predominantly at home and only occasionally involved in other activities.[9,25]

The age groups most frequently affected were the 21–30 and the 31–40 year groups, in agreement with other studies.[1,4,8,13,16,20,26] Iida *et al.*[9] reported that the most frequent age group was the 11–20 group. The present study showed that young adults [Table 1] were most frequently affected by fractures, probably because they are more exposed to all the etiological agents assessed than any other age group. Because of their wish to enjoy the pleasures of modern life, these subjects are potentially more likely to consume alcohol, exceed speed limits, and even get involved in physical conflicts as a result of their increased physical energy. All these risk behaviors make this age group more susceptible to trauma [Table 7 and Graph 1].

In this study, most mandibular fractures were caused by car accidents; other studies[9,26] reported similar results. According to Simsek *et al.*,[19] assaults were the most frequent cause of mandible fractures in the United States; in the same study, however, the authors reported that car accidents caused more mandibular fractures. Patients in the 21–30 year age group sustained the most mandibular fractures, in agreement with findings by Haug *et al.*,[8] who reported a larger number of mandibular fractures in the 20–30 year age group. Men sustained more mandibular fractures than women, in agreement with the findings by Oikarinen *et al.*[15] and Gabrielli *et al.*[26]

Most hospitalizations of patients with facial fractures occurred in the summer, which is in agreement with other studies.[4,5,22] This result can be explained by the fact that in the summer in Brazil (December to March), people tend to be more exposed to risk situations, for example, by engaging more frequently in physical activities, taking part in social reunions, and consuming increased amounts of alcohol and drugs. All these factors certainly contribute to increase the incidence of major causes of trauma, namely traffic accidents, falls, and aggressions.

The epidemiological study of facial trauma makes it possible to outline the risk situations, as well as the characteristics of individuals susceptible to this type of trauma. Moreover, the evaluation of treatment effectiveness and the understanding of complications may provide a more realistic and consistent interpretation of how to manage these patients. Trauma should not only be seen exclusively as a medical condition, but also as a social and economic problem. Healthcare costs to treat victims, damage to property involved in the traumatic event, losses in wages, and permanent or transient disability often lead to difficulties in the reintegration of victims into society and their return to work.

Periodical epidemiological reviews of facial trauma are important to confirm previously established patterns or to detect new characteristics that may help to develop preventive strategies and qualify therapeutic routines.

Severity of craniofacial injuries is directly associated with the type of etiological agent. Traffic accidents cause the most damage, and prevention campaigns should be conducted to decrease the number of victims of facial trauma or other injuries.

Statistical databases for traffic accidents should be updated regularly because the knowledge of etiological agents is fundamental to establish more organized and efficient measures to avoid losses of life, family disruptions, worker's disability, and unnecessary hospital costs. Resources thus saved should be used in educational efforts to make citizens aware of their role in society. If these changes are implemented, the number of facial fractures due to assault will also see an important reduction.

Traffic education is fundamental to developing citizen awareness, but behavioral changes will be more effective when greater involvement in a common cause is achieved, and individuals develop a feeling of "belonging" to a group that makes efforts to reduce accidents and deaths due to traffic in the country. Traffic accidents are one of most important public health problems in Brazil, second only to homicides.[4]

Technicians, planners, politicians, workers' unions, private companies, nongovernmental organizations, civil associations, for example, must be engaged in promoting preventive measures and in educating users to be thoughtful and conscious in traffic and to have a responsible and civil attitude to avoid accidents. Transportation and traffic are the only services that are part of all activities in society and affect all individuals every day. Therefore, there should be harmony and balance in the road–urban traffic relationship, which can be achieved by establishing a "pact to live together" based on principles of engineering, safety and citizenship.

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