

REVIEW

Facial trauma in the largest city in latin america, são paulo, 15 years after the enactment of the compulsory seat belt law

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Traffic accidents are a reality throughout Brazil. The face is one of the anatomic parts most affected by these accidents, especially when a seat belt is not used. These accidents are costly for the public health system and have a significant impact on society and the lives of families involved. The compulsory use of seat belts in Brazil, especially in São Paulo, has decreased the rate of facial trauma. This suggests that the public health policies and measures adopted by the Brazilian authorities have benefited the population 15 years after the enactment of the law of compulsory seat belts in the city of São Paulo.

KEYWORDS: Traffic accidents; Seat belts; Facial injuries; Trauma severity indices; Wounds and injuries; Tooth injuries.

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INTRODUCTION

The face is a frequent target for trauma in motorvehicle accidents, especially when seat belts are not used. The high rate of motorvehicle accidents leads to economic and social problems and causes harm to the country, including increased costs for hospital care, pension expenses, and changes in family structure.¹ Further, individuals lose their strength and ability to work at their most productive, given that most traumas due to car accidents occur among individuals who are under the age of 45 years. Results of epidemiological studies show that the etiology of facial fractures is variable across the world. However, motorvehicle accidents are among the most frequent causes of facial fractures.^{12,13}

In Brazil, rates of hospitalization due to motorvehicle accidents are high. Consequently, authorities made changes in the Brazilian Traffic Code,² such as the São Paulo Municipal Law of 1994.³ Ultimately adopted by most Brazilian cities, this law regulated the use of seat belts in November 1994. More recently, the "Dry Law" (number 11,705)⁴ also gained prominence in epidemiological indices and effectively reduced the number of accident victims attended in hospitals due to car accidents.⁵ The purpose of this paper is to highlight the importance of these

laws the Brazilian our health system and demonstrate their effectiveness.

Traffic accidents

Brazil has the fifth highest number of traffic deaths in the world. In 2007, 35,100 thousand resulted from motorvehicle accidents in Brazil. In absolute terms, this number is lower than only four other countries: India (1,057,000 deaths), China (966,000 deaths), the United States (426,000 deaths), and Russia (359,000 deaths) (see Figure 1). However, Brazil occupies an intermediate position in a ranking among countries, with 18 deaths for every 100,000 inhabitants. Therefore, the rate of traffic deaths is higher than that of the United States (13/100) and lower than Russia (25/100).^{6,7}

In 2002, motorvehicle accidents claimed the lives of 1.18 million people and injured 20 to 50 million more worldwide. Millions of people were hospitalized and perhaps 5 million have been disabled for life. It is estimated that by 2020, if this frequency is maintained, the annual proportion of people killed and disabled as a result of motorvehicle accidents will rise to more than 60%. Consequently, motor vehicle accidents will be third on the World Health Organization's (WHO) list of the main causes of disease and traumas.⁸

Motorvehicle accidents have become a significant cause of morbidity and mortality among the Brazilian population as a result of the increase in the number of vehicles circulating and the high frequency of inappropriate behavior, coupled with ineffective monitoring and poor public road conditions.⁹ In addition, the number of vehicles on the road continues to grow. São Paulo's fleet of vehicles, which makes up more than 90% of the national fleet,¹⁰ was

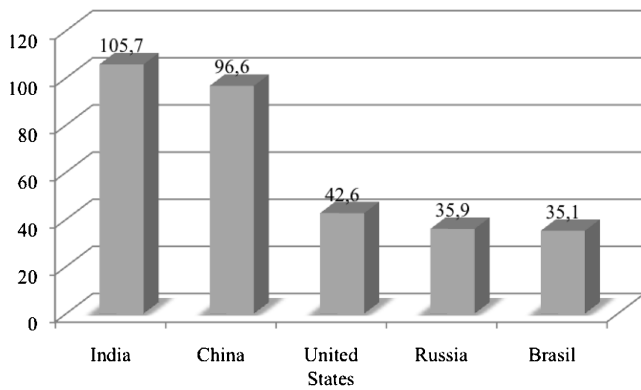


Figure 1 - Absolute number of deaths in motorvehicle accidents according to the World Health Organization.

6,558,463 vehicles in the capital and 19,499,430 vehicles in the state in June 2009.¹¹

Traumas

According to WHO data, traumas are among the main causes of death and morbidity in the world. Every day, 16,000 people die as a result of some trauma.¹⁴ Among the various types of trauma, facial trauma is notable due to its emotional and functional consequences and the possibility of permanent deformities.¹⁵ The increased exposure and little protection increases the likelihood of serious injuries to this part of the body in car accidents. Head and face injuries represent about 50% of all traumatic deaths.¹⁶

Recognizing which etiologies are most prevalent and which population is most affected by face traumas is a fundamental part of structuring services. With the population growth, increasing traffic of motor vehicles, and socio-economic discrepancies, the number of traumatic facial fractures has increased,¹⁷ although fractures from sports activities are less frequent.¹⁸ In general, facial traumas are associated with other factors, such as assaults or falls.^{13,18}

Results of a study of 450 individuals with facial fracture in the city of São Paulo in the 1980s showed that the main cause of facial fracture was motorvehicle accidents.¹⁹ A study carried out more recently in a hospital in the south zone of São Paulo²⁰ found that the most frequent etiology of facial trauma was motorvehicle accidents (25% of cases) and motorcycle accidents (25%), whereas less frequent etiologies were physical assaults (15%) and work accidents (1%). Results of a retrospective study of 323 individuals with facial fractures due to motorvehicle accidents at the São Paulo Clinics Hospital between February 2001 and July 2006 showed that the average age of the patients was 30.9 years and the proportion of men to women was 3.3 to 1 (see Table 1).²¹ The findings are consistent with the results of a Minas Gerais study, which found that 23% of facial injuries

Table 1 - Features of facial fractures occurrences in motorvehicle accidents according to data from a large São Paulo hospital (2007).²¹

Number of patients	With seat belt	Without seat belt	Total
Driver	60	58	118
Front seat passenger	44	67	111
Rear seat passenger	0	94	94
Total	104	219	323

were due to accidents involving bicycles and motorcycles, whereas 21% were due to interpersonal violence. In addition, trauma to the face from motorvehicle accidents was found to be more common among men (80%) than women (20%).¹³ In Recife, motorvehicle accidents account for 31.8%, followed by physical assault (22.2%) and assaults with firearms (18.7%).²² On the other hand, in Porto Alegre, approximately 36% of facial fractures occur as a result of urban violence.²³ Traffic accidents (19%) were reported to be the second most common cause, together with sports accidents (19%).

Seat belts

In São Paulo, a municipal law was passed that mandated the use of seat belts on November 4, 1994.³ Reactions for and against the law were immediate because of the difficulties and adjustments required for its implementation. However, all of this loses importance when it comes to lives and traumas.¹

According to the Traffic Engineering Company (TEC),²⁴ after two years of the Municipal Act's requiring the use of seat belts, the measure was found to be beneficial to the physical safety of both drivers and front seat passengers of vehicles, as well as the entire population. The TEC conducted a survey of victims from the vehicles who received treatment at the emergency room at Santa Casa de Misericórdia in São Paulo (see Table 2). As shown in Table 2, there was a reduction in head injuries following the application of the law. Soriano et al.²⁵ also reported a decrease of 4.9% in the frequency of ocular perforations caused by motorvehicle accidents after the implementation of the law.

In 1997, the new National Traffic Code (NTC) was approved.⁴ Beginning in April 1998, individuals were punished for failing to use their seat belt. Individuals caught driving without wearing a seat belt or allowing a passenger to ride in their vehicle without wearing one received a fine of R\$127.69 and five points on their driver's license, constituting a serious violation.

In Brazil, the mortality rate from motorvehicle accidents has declined from 29.8% in 1996 to 25.3% in 1999.²⁶ This decline can be attributed to several factors, including lower speed limits, more surveillance, greater use of seat belts, the implementation of electronic speed bumps, and an increase in the car fleet.²⁶ Between 1996 and 1998, there was a 30% reduction in the number of traffic deaths in São Paulo because of the introduction of the new Brazilian Traffic Code and the installation of electronic radar cameras for speed surveillance in the city.²⁷

According to results of a survey conducted in the region of Pelotas (RS), 26% of oral and maxillofacial fractures occur as a result of motorvehicle accidents.²⁸ A similar rate of 29% was found in a study of jaw fractures in a hospital in

Table 2 - Location of injuries in vehicle occupants injured before and after the municipal law mandating the use of seat belts was instituted in São Paulo.²⁴

Location of injuries	Before the seat belt law	After the seat belt law
Head	44.2%	30.6%
Body	11.6%	25.6%
Upper members	15.8%	19.1%
Lower members	28.4%	24.7%

Table 3 - Countries' seat belt laws and the occupants of the vehicles who are bound by such laws.

Country	Presence of a national seat belt law	Occupants to whom the law applies
Brazil	Yes	All occupants
Argentina	Yes	All occupants
Chile	Yes	All occupants
Cuba	Yes	Only front seat passengers
Colombia	Yes	All occupants
Ecuador	Yes	Only front seat passengers
Mexico	Yes	All occupants
Venezuela	Yes	Only the driver
Uruguay	Yes	All occupants
Peru	Yes	All occupants

Pernambuco.²⁹ Significant facial impact occurs during a motorvehicle accident. Even with the use of a safety belt and an airbag, simple or multiple fractures can occur that crush the face. Researchers affirm that the major problem is not treating patients with multiple traumas, but their re-entry into society. Many of these individuals lose their teeth and cannot afford dental implants, a treatment that is currently done only in the private sector.³⁰

The seat belt is considered to be the most effective device in reducing the severity of trauma in motorvehicle accidents and the most available safety equipment for vehicles currently operating in Brazil.³¹ Using a seat belt reduces the risk of death in individuals sitting in the front seat of a vehicle by 40-65% and may reduce deaths in rear seat passengers by 25-75%.⁶ However, results of other studies show that only 57% of countries require the use of seat belts in vehicles for all passengers, both seated in the front and back of the vehicle, with only 38% of low-income countries having such laws¹² (see Table 3). Research evaluating young drivers at the Catholic University of São Paulo showed that only 74% of university students always use a seat belt; therefore, one quarter of the population studied does not use frequently use one.

Costs for the health care system

Falls and traffic accidents have been reported, respectively, as the first and second leading cause of hospitalizations from external causes in Brazil.³² In both Brazil and São Paulo, external causes account for increased length of hospital stay, more than natural causes, despite the lower proportion of hospital admissions and shorter average hospital stay of the latter.³³ In São Paulo in 2005, the

proportion of hospital admissions due to external causes was 48% for falls and 17% for motorvehicle accidents, although the proportion of expenditures was 41% for falls and 22% for motorvehicle accidents.³² A study of hospitalizations for external causes paid for by the Unified Health System (Sistema Único de Saúde, SUS) at the Municipal Hospital in São José dos Campos conducted between January 1 and June 30, 2003 found that motorvehicle accidents were not only the leading cause of hospitalization (32%), but also the most expensive to treat (41.2%).³⁴ (see Table 4).

In Brazil, approximately two-thirds of hospital beds in the orthopedics and traumatology sectors are occupied by victims of motorvehicle accidents. They have an average hospital stay of 20 days, generating an average cost of \$20,000 per serious injury. The estimated annual cost exceeds \$3 billion.³⁵

Dry Law

Throughout the world, between one-quarter and one-half of motorvehicle accidents with fatalities are related to alcohol use by some of those responsible for the event.³⁶ In a study conducted between December 2005 and December 2006, on Friday and Saturday nights between 10 p.m. and 3 a.m., it was found that 334 (36.6%) respondents stated that they had been involved in traffic accidents as drivers. Among these individuals, 200 (60%) had a pattern of alcohol consumption two days per week, and 185 (55.4%) were between the ages of 18 and 30 years.³⁷

The positive results of Municipal Law 11,705/08.4 reverberated throughout the Brazilian press.⁴ This law, which became known as the "Dry Law,"³⁸ established zero limit for alcohol in drivers' blood. As a result of this new law, some cities saw a reduction of up to 40% in the number of motorvehicle deaths in the first 30 days of enforcement. The work of the emergency care system, known as the Urgent Mobile Care Service (Serviço de Atendimento Móvel de Urgência, SAMU), was reduced by an average of 25%. The city of São Paulo, for example, saved more than \$4 million reais in hospital expenses.³⁹

DISCUSSION

Facial traumas are of great significance in modern society because they have emotional and functional influences on people's lives and can cause permanent deformities. Further, they frequently involve serious injuries.^{15,16,40} Various researchers have described the etiologies of facial

Table 4 - Admissions due to external causes, total amount, average length of stay, average cost, and daily cost, according to the type of cause. City Hospital of São José dos Campos, São Paulo, Brazil, in the first half of 2003.³⁴

Cause	Hospitalizations		Cost		Average stay	Average Cost	Daily Cost
	n	%	reais	%	days	reais	reais
Motorvehicle accidents	320	32.0	196,682	42.2	7.7	614.63	80.21
Falls	260	26.6	122,845	25.7	8.7	472.48	54.28
Other accidental causes	81	8.3	25,576	5.4	3.2	315.76	99.52
Assaults	49	5.0	29,149	6.1	5.3	594.9	112.11
Self-inflicted injuries	12	1.2	6,007	1.3	4.9	500.61	101.82
Medical care complications	60	6.1	19,821	4.2	7.4	330.35	44.84
Undetermined causes	184	18.9	72,424	15.2	3.9	393.61	102.01
After-effects	10	1.0	5,013	1	7.8	501.33	64.27
All causes	976	100.0	477,521	100.0	6.7	489.26	73.23

trauma. However, these causes change according to location and year, as evidence by the marked change in the epidemiological profile of the population.^{18-20,22,23} Nevertheless, facial traumas continue to be associated with motorvehicle accidents, given that the number of vehicles has increased with the population. In addition, the negligence of the population regarding the dangers of traffic does not seem to have diminished. Brazil faces millions of deaths every year from motorvehicle crashes. In the comparison with other countries, Brazil is one of the worldwide leaders in terms of the number of motorvehicle accidents.^{6,9,10,12}

In order to curb this type of trauma, authorities have taken extreme measures in relation to traffic safety laws. This year, the seat belt law has been enforced for 15 years in São Paulo. The benefits and effectiveness that this law has provided to Brazilian society are unquestionable.

After the law mandating the use of seat belts in São Paulo was approved in 1994, authorities encountered a significant decrease in facial traumas. Several studies were conducted, and all of the authors agreed that facial trauma rates decreased after the implementation of this law. In 1996, just two years after the implementation of the new law, TEC confirmed that there was a decrease from 44.2% to 30.6% in head injuries in São Paulo. The same year, Soriano et al.²⁵ reported a decrease of 4.9% in ocular perforations. Mello Jorge et al.²⁶ reported that traffic accidents decreased from 29.8% in 1996 to 25.3% in 1999. According to results of a study published in 1996 by the TEC, there was a 30% reduction in the number of traffic deaths in São Paulo with the use of the seat belt.²⁴ Between 2007 and 2008, after the seat belt law first came into effect, in a public hospital in the northern part of São Paulo, accidents accounted for only 3% of the causes of facial trauma, which suggested that the epidemiological profile of the population was changing.⁴¹ The most frequent cause of facial trauma in this study was physical assault.⁴¹

In 2007, the WHO⁶ reported that the use of seat belts reduced deaths to 40% from 65% in patients sitting in the front seat and to 25% from 75% in the back seat. Despite all of the reported benefits, Pine et al.⁴² revealed in 2009 that one-quarter individuals in a university population were not using their seat belt. This is an alarming figure, considering that the age group most affected by deaths and facial injuries related to the use of seat belts is 20- to 40-year-olds.^{21,28} This has a significant impact on families and face traumas put these patients away from social interaction. In addition, the treatments represent heavy expenditures for the public health system because hospitalizations for external causes, such as motorvehicle accidents, have the largest average expense and daily costs. They also require greater spending on health care, accounting for up to 41% of the causes of public spending. After the implementation of the law, we noted that the expenses decreased to 22%.^{7,32-34}

The seat belt law provided numerous benefits to São Paulo and other cities in Brazil. As a result, similar laws were created to reduce the accident rate, such as the Dry Law, which restricts the consumption of alcoholic beverages and has a greater impact on the population of individuals between the ages of 18 and 40 years, who are most at risk for this type of accident. After the implementation of the Dry Law, the number of deaths in São Paulo was reduced by 40%. In addition, it accounted for only 25% of the Mobile Service's work and saved 4 million reais on hospital costs.^{37,39}

CONCLUSIONS

There is no doubt that all of these measures have changed the epidemiological indices of Brazil's largest city and had impacts in the population's life. In addition, epidemiological data allows a better planning of the public health services, reducing its costs. The system now provides less assistance to accident victims due to the reduction in the number of accidents and of facial traumas. We are certain that we can improve and reduce these rates. There is still a need for greater awareness among the population, especially young people, in relation to the laws adopted by the authorities. However, it is clear that it has brought only benefits and moved Brazil toward a better future.

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