Original article

Mortality of motorcyclists with traumatic injuries resulting from traffic accidents in São José dos Campos city, Brazil, in 2015: a cohort study*

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Abstract

Objective: To analyze factors associated with mortality from traumatic injuries among motorcyclists. **Methods:** This was a prospective cohort conducted at the Municipal Hospital of São José dos Campos, Brazil, in 2015. Motorcyclists with traumatic injuries, ≥14 years old and hospitalized were included. Sociodemographic, accident and hospitalization variables were analyzed by applying a Poisson regression model showing relative risk (RR) and 95% confidence intervals (95%CI). **Results:** Among 190 motorcyclists, 161 (84.7%) young men were found to have 422 (41.8%) injuries to the lower and upper extremities. Incidence of death increased as physiological injury severity (RR=9.67 [95%CI 1.46;64.26] and RR=4.71 [95%CI 1.36;16.26]), and anatomical injury severity (RR=31.49 [95%CI 3.72;266.38]) increased, but was lower within up to one week of hospitalization (RR=0.39 [95%CI 0.15;0.98]). **Conclusion:** Injury severity and length of hospital stay were associated with motorcyclist deaths. Further studies should be conducted to confirm these findings and to analyze the relationships in greater detail.

Keywords: Accidents, Traffic; Motorcycles; Injury Severity Score; Mortality; Cohort Studies.

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Introduction

Traffic accidents are a Public Health problem globally and also in Brazil given the large number of deaths and post-injury consequences. According to a 2018 World Health Organization (WHO) report, 1.35 million people are victims of traffic accidents every year globally, principally in low-income countries. They are the leading cause of death among young people aged 15-29. In the same report, WHO estimated that deaths related traffic accidents would reach 1.9 million globally by 2020 if measures were not taken immediately.[1]

> *In the moment of collision, motorcycle drivers suffer a high-energy impact generated, as a result, frequently suffer injuries to the head and brain, the spine and the lower and upper limbs.*

With effect from 1990, the progressive improvement in the Brazilian economy has enabled increased purchasing of durable goods by people from less-favored social classes as well as greater access to credit.[2] The fact of motorcycles costing less, together with the reduction in tax on industrialized products, has led to a considerable increase in the number of motorcycles in circulation in Brazil. Between 2003 and 2012, there was an increase of almost 500% in the number of these vehicles in Brazil.[3] The increase in the fleet of motorcycles has resulted in increased traffic accidents, especially because Brazilian legislation allows motorcycles to be driven between cars on the lanes of public highways and, consequently, opens the way for disrespect for the highway code and speed limits, in addition to little highway code enforcement.[1,3,4]

Motorcyclists are among the victims of severe injuries caused by traffic accidents. Both driver and passenger, when colliding with another object, suffer a high-energy impact generated by the collision; motorcycle drivers absorb this energy and, as a result, frequently suffer injuries to the head and brain, the spine and the lower and upper limbs.[5,6] As such, motorcyclists are seven times more at risk of dying and four times more at risk of having body injuries, when compared to other types of traffic accidents.[2] In 2017 and 2018, 114,497 deaths arising from motorcycle accidents were recorded in Brazil.[7]

People injured in motorcycle accidents can have sequelae resulting from their injuries, impairment of cognition and/or mobility, with impact on their professional and everyday lives, social relationships, physical and mental health.[6] This scenario generates high expenditure on hospitalization, rehabilitation and indemnity payments for Insurance for Personal Injury Caused by Motor Vehicles on Overland Thoroughfares.[3]

The growing use of motorcycles and the growing number of motorcyclists involved in traffic accidents highlight the relevance of the subject. Analysis and interpretation of data related to this phenomenon can contribute to the formulation of programs to prevent these accidents, promotion of safer driving behaviors, as well as identification of factors related to hospital mortality that could be reduced through good care practices.

The objective of this study was to analyze factors associated with motorcyclist hospital mortality from traumatic injuries.

Methods

This is a prospective cohort study of motorcyclists hospitalized owing to traumatic injuries caused by land transport accidents.

This study is part of a larger project entitled 'Injury information and quality indicator system: analysis of morbidity and mortality arising from traumatic injuries caused by traffic accidents: Research for SUS – shared health management (PPSUS-SP)'.

The data it is based on were collected at the Dr. José de Carvalho Florence Municipal Hospital (HMJCF). It is a reference center for medium and high complexity hospital care, especially emergency services, and is the largest hospital unit in São José dos Campos city and surrounding region. This municipality is located in the state of São Paulo, is part of the *Vale do Paraíba Paulista* region and had 629,921 inhabitants in 2010, according to data provided by the city administration.[8] The HMJCF is part of a health system organized in a regionalized and hierarchized manner, providing comprehensive care to the population on diverse levels of complexity.[8]

The study participants were motorcyclists (drivers and passengers) who needed to be hospitalized because of traumatic injuries, resulting from Transport Accidents, as defined by the International Statistical Classification of Disease and Related Health Problems, 10th Version (ICD-10: V20-V29). The accidents studied occurred throughout 2015. The study included motorcyclists aged

14 years old or over who received care at the emergency room of the HMJCF Emergency Department. Individuals receiving care in the same period due to sequelae resulting from traumatic injuries caused by accidents involving motorcycles, or who returned to this health service for complementary treatment of their injuries, were not included in the study.

The outcome 'death' during hospitalization was defined as the dependent variable. The demographic variables, incident variables and hospitalization variables were defined as independent variables.

The demographic variables considered were age (in years, later categorized into 14-29, 30-39, 40-49 and 50 or over) and sex (male; female). The variables of the 'incident' category included the position of the victim on the vehicle (driver; passenger), use of crash helmet (yes; no), day of the week on which incident occurred (from Sunday to Saturday) and prehospital care (yes; no). The 'hospitalization' category included length of hospital stay (in days, later categorized into 1-7, 8-14 and 15 or more), clinical conditions (severity of injury and trauma), subsequent complications (yes; no) and recovery after discharge from hospital.

Injury severity was measured using the Abbreviated Injury Scale (AIS).[9] Each injury recorded on the medical records was coded according to the affected region or regions of the body and level of severity. The AIS scores, corresponding to the levels of severity, varied from 1 to 6: level 1 for minor severity; 2, moderate; 3, serious; 4, severe; 5, critical; and level 6 for maximum severity (currently untreatable).

Based on the AIS coding for each injury, injury severity, from the anatomical point of view, was determined by the Injury Severity Score (ISS). The ISS is obtained by taking the highest AIS severity code in each of the three most severely injured body regions, squaring each AIS code and adding the three squared numbers together. It is a numerical variable, with scores varying from 1 to 75: higher ISS scores indicate greater injury severity, related to greater lethality, whereby the maximum score is nearly always fatal.[9] For the purposes of this study, the ISS score was consolidated into two categories: 1-15 and ≥16. From the physiological point of view, injury severity was measured using the Glasgow Coma Scale (GCS) at the time of admission to the Emergency Department. GCS assesses level of consciousness using three indicators: eye opening, verbal response and best motor response. GCS scores vary between 3 and 15, and they were later categorized into 13-15; 9-12; 3-8.

Motorcyclist recovery after hospital discharge was measured using the Glasgow Outcome Scale-Extended,[10] also classified by scores ranging from 0 to 7: 0 for good recovery (+), corresponding to individuals whose life returned to normal without any changes or complaints following injury; 1, good recovery (-), for individuals with resumption of normal life with minor physical or mental deficits; 2, moderate disability (+), for individuals who were not able to resume all activities they did before suffering injury; 3, moderate disability (-), for those capable of carrying out activities with the aid of devices or in adapted environments; 4, severe disability (+), among the basic activities for remaining independent, at least one activity needs the assistance of someone else; 5, severe disability (-), when the person is not able to perform basic self-care activities without the help of another person; 6, persistent vegetative state, unresponsive and speechless; and 7, death. These conditions were summarized into four categories: good recovery (0 and 1); moderate disability (2 and 3); severe disability (4, 5 and 6); and death (7).

Medical records were the main source for data collection on the motorcyclists, taking the data for each day of hospitalization. Data on prehospital care were taken from the care forms, and the telephone number for contact was confirmed with the individual or their family members. Motorcyclists who were discharged from hospital were contacted by telephone, between three and six months after leaving hospital, in order to administer the Glasgow Outcome Scale-Extended.

The qualitative variables were described in absolute numbers and percentages; while the quantitative variables were expressed as average, standard deviation (SD), minimum and maximum values, and median. Fisher's exact test was used to verify association of the 'sex', 'motorcyclist position', 'use of crash helmet', 'day of the week on which incident occurred', 'prehospital care' and 'complications' variables with mortality. Fisher's exact test was used in the analysis of association of age, GCS, length of hospital stay and injury severity score (ISS) with mortality, after using the Shapiro-Wilk to check for absence of normality of the continuous variables. The power of the sample, assessed *a posteriori*, considering a 95% confidence interval (95%CI), was found to be 71.5% for ISS and 72.4% for GCS, while the power of

the other variables was below these values. Poisson regression was used to identify factors associated with death. A 5% statistical significance level was used.

The analyses were performed with the aid of the International Business Machines Corporation Statistical Package for the Social Sciences (SPSS), version 23.0. The study project was approved by the Federal University of São Paulo Research Ethics Committee (Certificate of Submission for Ethical Appraisal [CAAE] No. 34303814.6.0000.5505; Opinion No. 795.233) and by the Dr. José de Carvalho Florence Municipal Hospital Research Ethics Committee (CAAE No. 34303814.6.3001.5451; Opinion No. 832.745). All participants signed a Free and Informed Consent form.

Results

The study sample was comprised of 190 motorcyclists and, as shown in Table 1, 161 (84.7%) were male and average age was 30 years. The incidents happened most frequently on Saturdays (46; 24.2%) and Sundays (41; 21.6%). The majority of the motorcyclists were drivers rather than passengers (144; 88.9%) and 20 (10.5%) were not wearing a crash helmet at the time of the accident. Of the total of motorcyclists who suffered accidents, 174 (91.6%) received prehospital care. The average GCS score was 14.3; and the average ISS score was 8.8. Average length of hospital stay was 8.6 days, 32 cases (16.8%) had complications during hospitalization and hospital mortality was 5.3%. Among the motorcyclists who survived, it was possible to make contact by telephone with 86 (47.7%) of them after they had been discharged from hospital, whereby 42 (48.8%) of them achieved good recovery and 27 (31.4%) were left with severe disability.

The most frequent traumatic injuries were found in the lower limbs, 272 (27.1%), followed by the external region, 222 (22.1%), upper limbs, 148 (14.7%), and head, 136 (13.6%), as shown in Table 2.

Most frequent among total injuries were those classified as minor, 347 (34.6%), and moderate, 408 (40.6%). Injuries classified as serious, severe and critical, although less frequent, i.e. 221 (22.0%), 26 (2.6%) and 2 (0.2%) respectively, were found in the lower extremities, head, thorax, abdomen and spine (Table 2).

Table 3 shows that frequency of death was highest on Wednesdays (2; 8.3%) and Saturdays (4; 8.7%) ($p<0.001$). Greater injury severity, whether anatomical (ISS $\geq$16; $p<0.001$), or physiological (GCS of between 9 and 12; $p<0.001$), and presence of complications (10; 31.2%) ($p<0.001$), were more frequent in the group that died.

In the Poisson regression model (Table 4), injury severity, measured by ISS and GCS, was associated with greater incidence of death, except for the amplitude of the 95%CIs at range 9-12 on the GCS and range $\geq$16 on the ISS. Occurrence of death within a week after being admitted to hospital was lower when compared with hospitalization >15 days.

Discussion

The findings of this study conducted in the city of São José dos Campos in relation to the year 2015 show that motorcyclists hospitalized as a consequence of traumatic injuries resulting from traffic accidents were predominantly young males who suffered minor and moderate injuries on the extremities of the body. It is noteworthy that part of the injured motorcyclists were not wearing crash helmets. In this context, the greater the physiological and anatomical injury severity and the greater the length of hospital stay, the greater the occurrence of death in the sample studied.

It has been found in several different countries that being a young male single adult are characteristics of the majority of motorcycle accident victims. In the majority of these cases, risk behaviors have been found, such as using cell phones and not wearing crash helmets when riding a motorcycle.[11-13] Among university students who drove motorcycles in Vietnam in 2016, the most prevalent risk behaviors found were using cells phones while driving, driving on footpaths, speeding, driving on the wrong side of the road, not wearing a crash helmet and drinking alcohol.[11] In the state of Arizona, United States, between 2008 and 2014, analysis of alcohol and cannabis consumption among young vehicle drives involved in accidents showed that in that state they were more prone to not wearing crash helmets and suffering more severe injuries.[12]

With regard to the activities of motorcycle couriers, other vulnerability factors can be frequently observed, related to work conditions with long working hours that contribute to distraction and tiredness,[14] in addition to the pressure to deliver goods and transport people rapidly, which is capable of favoring negligence and lack of safe attitudes. Greater exposure of these individuals to risk behavior may be influenced by cultural issues, in

Table 1 – Characterization of motorcyclists with traumatic injuries resulting from traffic accidents, São José dos Campos, 2015

Variables	Total n (%)[a]
Sex	
Female	29 (15.3)
Male	161 (84.7)
Day of the week of occurrence	
Sunday	41 (21.6)
Monday	23 (12.1)
Tuesday	18 (9.5)
Wednesday	24 (12.6)
Thursday	18 (9.5)
Friday	20 (10.5)
Saturday	46 (24.2)
Position in vehicle	
Driver	144 (88.9)
Passenger	18 (11.1)
Use of crash helmet	
No	20 (10.5)
Yes	102 (53.7)
No information	68 (35.8)
Prehospital care	
No	16 (8.4)
Yes	174 (91.6)
Hospital leaving status	
Discharge	180 (94.7)
Death	10 (5.3)
Complications	
No	158 (83.2)
Yes	32 (16.8)
Glasgow Outcome Scale-Extended	
Good recovery	42 (48.8)
Moderate disability	17 (19.8)
Severe disability	27 (31.4)

a) Description of the sample studied: n = absolute value; % = frequency.

Table 2 – Absolute and relative frequencies of injuries of motorcyclists with traumatic injuries resulting from traffic accidents, by body region and Abbreviated Injury Scale scores, São José dos Campos, 2015

Affected region of the body	Abbreviated Injury Scale (AIS)												Total[a]	
	Score 1 (Minor)		Score 2 (Moderate)		Score 3 (Serious)		Score 4 (Severe)		Score 5 (Critical)		Score 6 (Maximum)			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Head	12	3.5	39	9.0	76	34.4	8	30.7	1	50.0	–	–	136	13.6
Thorax	8	2.3	35	8.5	42	19.0	13	50.0	–	–	–	–	98	9.7
External	220	63.4	2	0.5	–	–	–	–	–	–	–	–	222	22.1
Upper extremity	35	10.1	113	27.0	–	–	–	–	–	–	–	–	148	14.7
Lower extremity	35	10.1	143	35.0	94	42.5	–	–	–	–	–	–	272	27.1
Face	29	8.3	13	3.0	3	1.4	–	–	–	–	–	–	45	4.5
Neck	–	–	1	2.0	–	–	–	–	–	–	–	–	1	0.1
Abdomen	6	1.7	33	8.0	4	1.8	5	19.3	–	–	–	–	48	4.8
Spine	2	0.6	29	7.0	2	0.9	–	–	1	50.0	–	–	34	3.4
Total	347	100.0	408	100.0	221	100.0	26	100.0	2	100.0	–	–	1,004	100.0

a) Description of the sample studied: n = absolute value; % = frequency.

Table 3 – Characterization of demographic variables, prehospital care, incident and hospitalization of motorcyclists with traumatic injuries resulting from traffic accidents, according to hospital leaving status, São José dos Campos, 2015

Demographic variables	Hospital leaving status		Total n (%)[a]	p-value[b]
	Discharge n (%)[a]	Death n (%)[a]		
Age (years)				
14-29	106 (94.6)	6 (5.4)	112 (100.0)	0.418[c]
30-39	39 (97.5)	1 (2.5)	40 (100.0)	
40-49	22 (95.6)	1 (4.4)	23 (100.0)	
≥50	11 (86.7)	2 (13.3)	13 (100.0)	
Sex				
Female	29 (100.0)	– (–)	29 (100.0)	0.365[c]
Male	151 (93.8)	10 (6.2)	161 (100.0)	
Day of the week on which incident occurred				
Sunday	39 (95.1)	2 (4.9)	41 (100.0)	<0.001[c]
Monday	23 (100.0)	– (–)	23 (100.0)	
Tuesday	17 (94.4)	1 (5.6)	18 (100.0)	
Wednesday	22 (91.7)	2 (8.3)	24 (100.0)	
Thursday	18 (100.0)	– (–)	18 (100.0)	
Friday	19 (95.0)	1 (5.0)	20 (100.0)	
Saturday	42 (91.3)	4 (8.7)	46 (100.0)	
Position on vehicle				
Driver	136 (94.4)	8 (5.6)	144 (100.0)	0.599[c]
Passenger	18 (100.0)	– (–)	18 (100.0)	
Use of crash helmet				
No	17 (85.0)	3 (15.0)	20 (100.0)	0.081[c]
Yes	99 (97.1)	3 (2.9)	102 (100.0)	
No information	64 (94.1)	4(5.9)	68 (100.0)	
Prehospital care				
No	16 (100.0)	– (–)	16 (100.0)	1.000[c]
Yes	164 (94.3)	10 (5.7)	174 (100.0)	
Glasgow Coma Scale (GCS)				
13-15	173 (98.3)	3 (1.7)	176 (100.0)	<0.001[c]
9-12	1 (33.3)	2 (66.7)	3 (100.0)	
3-8	6 (54.5)	5 (45.5)	11 (100.0)	
Injury Severity Score (ISS)				
1-15	166 (99.4)	1 (0.6)	167 (100.0)	<0.001[c]
≥16	14 (60.9)	9 (39.1)	23 (100.0)	
Complications				
Yes	22 (68.8)	10 (31.2)	32 (100.0)	<0.001[c]
No	158 (100.0)	– (–)	158 (100.0)	
Length of hospital stay (days)				
1-7	114 (96.6)	4 (3.4)	118 (100.0)	0.099[c]
8-14	38 (95.0)	2 (5.0)	40 (100.0)	
≥15	28 (87.5)	4 (12.5)	32 (100.0)	

a) Description of the sample studied: n = absolute value; % = frequency.

b) Test p-value.

c) Fisher's exact test.

addition to employability status: whereas the unemployed may take on risk behaviors due to anxiety, stress and depression, those who are employed tend to be more impatient and not obey the highway code, breaking speed limits when they are late for work and pressured to increase productivity.[14]

Motorcyclists are more vulnerable to traffic accidents. Generally, when colliding with larger vehicles, motorcycles

Table 4 – Relative risk of death according to age, Glasgow Coma Scale, Injury Severity Score and length of hospital stay, São José dos Campos, 2015

Factors associated with death	n (%)[a]	RR[b]	95%CI[c]	p-value[d]
Age (years)				
14-29	112 (59.0)	1.00		
30-39	40 (21.1)	0.76	0.09;6.62	0.805
40-49	23 (12.1)	0.41	0.04;4.58	0.468
≥50	15 (7.8)	1.21	0.16;9.28	0.854
Glasgow Coma Scale (GCS)				
13-15	176 (92.6)	1.00		
9-12	3 (1.6)	9.67	1.46;64.26	0.019
3-8	11 (5.8)	4.71	1.36;16.26	0.014
Injury Severity Score (ISS)				
1-15	167 (87.9)	1.00		
≥16	23 (12.1)	31.49	3.72;266.38	0.002
Length of hospital stay (days)				
1-7	118 (62.1)	1.00		
8-14	40 (21.1)	0.68	0.16;2.99	0.615
≥15	32 (16.8)	0.39	0.15;0.98	0.044

a) Description of the sample studied: n = absolute value; % = frequency.

b) RR: relative risk.

c) 95%CI: 95% confidence interval.

d) Test p-value.

do not have sufficient size and resistance to protect the driver and passenger. This inferior motorcycle security results in their drivers absorbing all the energy of the impact and usually being catapulted over a distance.[3,5,6]

With regard to crash helmets, despite the legal obligation to use this safety equipment, it can be seen that some motorcyclists still do not adhere to their use.[5] This fact is of concern, given that wearing a crash helmet can reduce the risk of head and brain injuries and the risk of death. Analysis of the cost of hospitalization of motorcyclists who did not wear crash helmets in the United States showed that it reached approximately US$2.2 billion dollars in 2010;[15] while one billion dollars a year could be saved if all motorcyclists in that country wore a crash helmet.[16] Increased law enforcement could be a considerably effective means of reducing this risk behavior.[17]

Predominance of motorcycle accidents at weekends has been reported,[18] and the sample studied confirmed this. This result may indicate additional use of motorcycles for leisure and after consuming alcohol over the limit established by law. The times of day when these incidents occur vary but it is important to highlight that attitudes such as increased speed, going over crossroads without obeying traffic lights and not wearing crash helmets have been found more frequently at night.[19] It is possible that breaking the highway code and alcohol abuse over the permitted limit are factors related to greater frequency of accidents at weekends.[18,20] In view of this study focusing on hospital mortality, the data retrieved from prehospital care forms referred essentially to clinical conditions and treatment procedures at the site of the incident; information about alcohol consumption, failure to use safety equipment and other risk behaviors was not recorded systematically. For a more accurate analysis of motorcycle accident risk behaviors, data on the incidents themselves would need to be consulted, recorded by police and traffic personnel, as well as the accounts of surviving motorcyclists.

The majority of motorcyclists who suffered injuries were sent to the HMJCF by those who provided prehospital care. Ever since the implementation of the Urgency and Emergency Network and the standardization of the Mobile Urgent Care Service (SAMU 192), prehospital care has increased throughout Brazil, although regional differences can be seen with regard to the availability of these services. Difficulties include equipment maintenance, team composition and resource distribution, in addition to the public not being aware of the purpose of this service which means that sometimes it is called out unnecessarily.[21] These factors can compromise the functionality of this service and it is important to highlight the important of specialized and quality care, at the site of the incident, in order to achieve better results.

Injured motorcyclists frequently have injuries to their extremities, external body areas and heads.[5,6] Analysis of the occurrence of fractures resulting from traffic accidents in Israel between 1997 and 2012 indicated that motorcyclists were more likely to suffer multiple fractures than victims of accidents involving other types of vehicles.[6] Apart from the frequency of the most affected regions of the body, it should be noted that injury severity is greater with regard to the head, spine, thorax, abdomen and lower limbs, as found in the sample studied. Moreover, in the case of motorcycle accidents, the probability of ISS scores over 16, attributed to severe injuries, is greater than for automobile accidents.[22]

The average GCS score, indicative of severity from the physiological point of view, found in this study, indicated that the majority of motorcyclists were conscious[23] during initial care in the emergency room. The protective effect of crash helmets among motorcyclists and cyclists in Taiwan between 2009 and 2015 shows that the average GCS score is higher among those wearing crash helmets, resulting in shorter length of hospital stay.[24]

As association of demographic and clinical variables was found with mortality in individuals with severe traumatic brain injury, GCS revealed itself to be one of the independent factors for predicting death.[25] In this study in São José dos Campos, the finding that lower GCS scores increased the risk of death in the emergency room confirms the importance of assessing level of consciousness and use of GCS when providing initial care to those who have suffered injury.

The mortality rate found in the São José dos Campos sample may appear to be low, however it should be pointed out that this study did not take into consideration deaths at the site of the accident, nor deaths before or after hospitalization. In this context, prevalence of death was greater in motorcyclists with low GCS, high ISS and longer length of hospital stay.

With regard to analyses of the relationship between length of hospital stay and mortality among those who have suffered injury, it is prudent to note that in the case of those with severe injuries, shorter length of hospital stay may occur due to early mortality. Longer hospitalizations, in turn, may be associated with the occurrence of complications during the course of treatment. [26]

It is also important to highlight that the greater the injury severity, the greater the systemic repercussion and probability of progression to systemic inflammatory response syndrome, leading to multiple organ failure and culminating in death.[27] Intracranial injury, pupillary abnormalities and shock at the time of admission to the intensive care unit (ICU) were found to be factors associated with this unfavorable outcome in Mexico in 2014,[28] and in Tunisia between 2009 and 2012.[29] In our study, there was total or good recovery among a considerable proportion of surviving motorcyclists, but also considerable amount of injured motorcyclists with some type of disability, whether moderate or severe. These results regarding motorcyclists of working age involved in traffic and hospitalized for long periods of time draw attention to the high costs for the health system of prehospital care and rehabilitation.[5,13,22,30] Consequently, motorcycle accident prevention is the most effective policy for reducing years of potential life lost, hospital care expenditure, morbidity and mortality related to accidents.

The limitations of this study include the fact of it having been conducted in an emergency department of a single municipal Public Health hospital. However, the data found and analyzed corresponded to a one-year period in order to avoid seasonality as well as accounting for almost all hospitalized motorcyclists. There were signs of variables associated with mortality; however, based on the results obtained, it is important to consider the limitation of the sample power with regard to inferences. Other limitations relate to not observing deaths that occurred at the scene of the accident and, consequently, to the analysis of possible precipitating factors, such as: (i) consumption of alcoholic beverages, not using safety equipment and/or other risk behaviors; (ii) lack of data on motorcyclists cared for and discharged at the emergency department; (iii) difficulties in obtaining secondary data, both from medical records and from prehospital care forms; (iv) the fact of telephone contact after hospital discharge only having been possible for half the sample; and (v) absence of data on comorbidities and sociodemographic data.

Brazil is one of the countries that complies with all the traffic safety recommendations established by WHO;[1] however their enforcement needs to be intensified nationwide along with educational traffic accident prevention campaigns.

Furthermore, in the sample studied, low GCS scores, high ISS scores and long length of hospital stay were associated with hospital mortality. These are data that can contribute to highlighting the need for and the importance of good care practices by multiprofessional teams, right from prehospital care through to rehabilitation.

In conclusion, preventive public policies and actions to reduce traffic accidents, together with the recovery of motorcyclists with traumatic injuries, favor the reduction of the impacts of accidents on quality of life and productivity of those who suffer accidents. Motorcyclists need to be made aware of the importance of safe driving, especially with regard to wearing crash helmets as a preventive measure against injuries to the head region. New research should be conducted to confirm the findings of this study and analyze in greater detail the relationships we have found.

Authors' contributions

Silva CLN, Lopes MCBT and Thomaz RR contributed to obtaining and interpreting the data and drafting the first version of the manuscript. Whitaker IY contributed to the concept and design of the study and data analysis and interpretation. All the authors have approved the final version of the manuscript and are responsible for all aspects thereof, including the guarantee of its accuracy and integrity.

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