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Motorcycle accidents: comparison between the years 1998 and 2010 in Londrina, Southern Brazil

ABSTRACT

OBJECTIVE: To compare the characteristics of motorcycle accidents and victims attended by pre-hospital care services.

METHODS: A cross-sectional study was carried out using data on pre-hospital care of motorcyclists who had been injured in traffic accidents in Londrina, PR, Southeastern Brazil, in 2010, whose results were compared with those of a similar study conducted in 1998. Paramedic assistance registration forms were used as source of data. The fleets of motorcycles and the population of both years were used for estimating risks of accidents occurring. The Chi-square test was used to compare the profiles of accidents and victims.

RESULTS: In 1998 and in 2010, respectively, 1,576 and 3,968 motorcyclists were seen (increase of 151.8%). The rate of injured motorcyclists per 1,000 inhabitants rose from 396.4 to 783.1, and that of the victims per 1,000 motorcycles from 53.1 to 61.1. Changes ($p < 0.05$) in the profile of accidents were observed, with higher proportions of falls from motorcycles, accidents between motorcyclists and occurrence during mornings, and a reduction of those at weekends. Regarding the victims, higher proportions of women, drivers, and those aged 35 years or over were observed. There was a decrease in the relative frequency of positive breathalyzer results and an increase in the prevalence of helmet use. A lower proportion of victims were classified with moderate/severe coma and trauma scores and sent to hospitals. The immediate fatality rate dropped from 1.2% to 0.6%.

CONCLUSIONS: Changes in the profiles of accidents and victims were observed in the period. Despite an absolute and relative increase in the number of victims of motorcycle accidents, a proportionally lower severity of these accidents was observed.

DESCRIPTORS: Accidents, Traffic, trends. Motorcycles. Emergency Service, Hospital. Mortality. Lethality.

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INTRODUCTION

The endemic trauma caused by traffic accidents is worldwide phenomenon. According to the World Health Organization (WHO),^a more than 1.2 million people die each year in traffic accidents in the world, especially in countries with low and middle incomes.

Motorcycle users are considered vulnerable on public roads in Brazil, with significant and growing morbidity in accidents.^{14,15} The popularity of this vehicle is justified by its ability to move through traffic, fuel economy, ease of parking, market expansion of tele-delivery and motorcycle taxis and the credit facilities for its acquisition in recent years.^{3,23}

Mortality among Brazilian motorcyclists increased by more than 700% between 1998 and 2008.³ Hospitalizations covered by the public health care sector went from 16,692 in 2000 to 30,532 in 2005, an increase of 83% in five years. In contrast, during the same period, the increase in hospitalizations for all types of road accidents was just 9.4%.^b The number of deaths due to road accidents increased by 28% in Paraná, Southern Brazil between 1998 and 2010. However, this increase was 399% among motorcyclists.^c Motorbike accidents are a serious problem in Londrina, a municipality located in the north of Paraná (PR),^{2,22} and represent the main cause of death from road accidents between 1998 and 2010.^c

Even after the implementation of the new Brazilian Traffic Code (BTC), in 1998, the number of premature deaths and morbidity caused by road accidents, especially those of motorcyclists, stayed stable or increased.^{3,14} Studies on traffic accidents have shown a considerable increase in this country over the last few years.³ However, there has been only one study, in Campinas, SP, Southeastern Brazil between 1995 and 2008¹⁴ which has analyzed different moments in relation to non-hospital morbidity for these events. As they constitute a serious public health problem in Brazil³ and because of the lack of investigations into changes in the profile of the morbidity of these accidents, this study aimed to compare the characteristics of motorcycle accidents and of the victims treated by pre-hospital health care services.

METHODS

Cross-sectional study using data from pre-hospital care received by motorcyclists who had suffered road accidents in Londrina, PR, Southern Brazil in 2010. The results were compared with those of a similar study carried out in 1998.^d In 2010, in the municipality of Londrina, there were 506,701 inhabitants and, in 1998, 426,609 inhabitants.^e

The population of the study was made up of motorcyclists, both drivers and passengers, who were victims of accidents between 1st January and 31st December, in the two years cited. Individuals were considered to be victims of a motorcycle accident if they were classified under codes V20 to V29 (motorcyclist injured in transport accident) of the International Classification of Diseases, 10th revised edition (ICD-10).^f

The municipality of Londrina has two pre-hospital care services: the Integrated Services for Trauma and Emergencies (SIATE) and the Mobile Emergency Service (SAMU). The SIATE was established in the municipality in June 1996, whereas the SAMU was part of the National Emergency Care Policy and began to function in the municipality in September 2004. The SIATE is dedicated exclusively to traumas, and the SAMU is responsible for the clinical care of patients and victims with serious trauma in need of urgent medical attention.

The Paramedic Care Record (PCR) was used as the standard source of data between 1998 and 2010. Records from both services (SIATE and SAMU) from 2010 were analyzed to find the total number of cases of pre-hospital care provided to motorcyclists who had been victims of road accidents. In 1998, these victims were treated exclusively by SIATE.

In 1998, SIATE had a computerized PCR system. In that year, the codification of the data on the type of accident and the victim was carried out by one of the authors, based on ICD-10 codes. These codes made up the computerized PCR system. The quality of the data was controlled through daily monitoring of paramedic records, tabulations to check for inconsistencies and any necessary corrections were made. By 2010, this system no longer existed. It was necessary to revise and

^a World Health Organization. Global status report on road safety: time for action. Geneva; 2004 [cited 2011 Apr 12]. Available from: www.who.int/violence_injury_prevention/road_safety_status/2009

^b Mello Jorge MHP, Koizumi MS. Acidentes de trânsito no Brasil: um atlas de sua distribuição. São Paulo: ABRAMET; 2007.

^c Ministério da Saúde. DATASUS. Informações de Saúde. Estatísticas vitais: mortalidade por causas externas. Brasília (DF); 2012 [cited 2012 Apr 12]. Available from: <http://www2.datasus.gov.br/DATASUS/index.php?area=0205&VOBJ=http://tabnet.datasus.gov.br/cgi/defiohtm.exe?sim/cnv/ext10>

^d Liberatti CLB. Acidentes de motocicleta em Londrina: estudo das vítimas, dos acidentes e da utilização de capacete [dissertação de mestrado]. Londrina: Universidade Estadual de Londrina; 2000

^e Ministério da Saúde. DATASUS. População residente - Paraná. Brasília (DF); 2012 [cited 2012 Apr 12]. Available from:

<http://tabnet.datasus.gov.br/cgi/tabcgi.exe?ibge/cnv/poppr.def>

^f Organização Mundial da Saúde. Classificação estatística internacional de doenças e problemas relacionados à saúde. 10 rev. São Paulo: Centro Colaborador da OMS para Classificação de Doenças em Português; Universidade de São Paulo; 1995.

transcribe the entire RAS, which was then codified by the authors of the study.

In 1998, 5,601 individuals were treated by SIATE and 1,576 of these were motorcyclists, these being the sample of that study. In 2010, 31,401 PCR were revised, with 4,057 records found relating to motorcycle accidents or with information about the type of victim missing, of these, 57 were duplicated records, having then allocated a unique number to the 4,000 PCR forms. The missing information in the field corresponding to the type of accident (whether a motorcycle was involved) and the situation of the victim (whether or not they were motorcyclists) was meticulously verified. These data were fundamental for inclusion in the research. The variables were organized into spreadsheets containing the name of the victim and date and time of the accident, data necessary for finding out further information from the Fire Service. Of the 4,000 records, 32 were excluded as they did not deal with motorcyclists, leaving 3,968 records in 2010.

The variables were divided into: (1) Characteristics of the accident: a) type of accident (collision with car, motorcycle fall, collision with another motorcycle, collision with stationary object and other accidents); b) accident occurred during the weekend (Friday, Saturday and Sunday) (yes; no); c) the time of day at which the accident occurred (morning – 06.00 to 11.59, afternoon – 12.00 to 17.59, night – 18.00 to 23.59 and early morning – 00.00 to 05.59); and d) the season in which the accident occurred; (2) Characteristics related to the victim: a) sex; b) position on the motorcycle (driver; passenger); c) age (zero to 19; 20 to 34; 35 and over); d) the smell of alcohol on the breath detected by the paramedic during pre-hospital treatment (yes; no); and e) whether a helmet was used (yes; no); (3) Severity of the accident and referral of the victim: a) Glasgow Coma Scale (GCS): scores 13 to 15: minor cranial trauma, 9 to 12: moderate and 3 to 8: severe, grouped into minor and moderate/severe; b) Revised Trauma Score (RTS): scores of 11 and 12: minor trauma, 8 to 10: moderate; 0 to 7: severe, dichotomized as minor and moderate/severe; c) need for medical treatment at the scene of the accident (yes; no); d) referral after pre-hospital treatment (Institute of Legal Medicine; given the all clear at the scene; refused treatment; referred to hospital).

The size of the motorcycle fleets and the populations of Londrina in 1998 and 2010 were used as the denominator for the estimates of risk, due to the lack of other, more suitable parameters (for example, kilometers covered per day). Data on the population were obtained from Datasus.⁶ Data on the motorcycle fleet were obtained from Detran (PR): in 1998, e-mailed to the

authors by this entity and accessible on their website in 2010.⁸ The rates of victims per thousand motorcyclists and per thousand inhabitants were calculated. The immediate fatality rate (death during or shortly after pre-hospital treatment) was calculated by dividing the number of deaths identified in the records (numerator) by the total number of motorcyclists treated by pre-hospital care services (denominator), expressed as a percentage. Statistical analysis was carried out using EpiInfo™ 3.5.1 and WinPepi programs. Pearson's Chi-squared test was used to compare the proportions and the level of statistical significance was 5%. Variables which had three or more categories were analyzed using the Bonferroni correction for multiple comparisons, and presented as odds ratios (OR) and their respective p values.

The research adhered to the norms of Resolution 196/96 of the *Conselho Nacional de Saúde* and the project was approved by the Research Ethics Committee of the Universidade Estadual de Londrina (Process nº 130/10).

RESULTS

The rate of motorcyclists per thousand inhabitants increased from 69.6 to 128.1 (84%) during the period in question. The 3,968 victims observed in 2010 represented an increase of 151.8% in relation to the number in 1998 (1,576). The rate of motorcyclists suffering accidents per thousand inhabitants practically doubles (from 396.4 to 783.1). The number of victims per thousand motorbikes also increased, albeit less dramatically (from 53.1 to 61.1).

There was an increase in the relative frequency of isolated falls from motorbikes and of collisions between motorcycles in 2010. The proportion of victims who suffered accidents at the weekend decreased and accidents predominantly occurred Monday to Thursday (52.7%). It was observed that, in 2010, the highest percentage of victims suffered accidents in the morning. The proportion of victims increased throughout every period of both years, with little difference between the years ($p = 0.076$) (Table 1).

In the two years the victims were predominantly male, with a significant increase in female victims in 2010. With regards to the position on the motorcycle at the moment of the accident, in 2010 a significant increase was observed in the proportion of drivers (Table 2). The proportion of male drivers (86.4%) was higher than that of female drivers (42.8%), in 1998. There was an increase in the proportion of male drivers (90.7%) but, principally, in female drivers (54.6%) in 2010.

⁸ Departamento de Trânsito do Paraná. Estatísticas de trânsito: frota de veículos por Tipo e Município. Curitiba; 2010 [cited 2011 Jun 6]. Available from: <http://www.detran.pr.gov.br/modules/conteudo/conteudo.php?conteudo=304>

Table 1. Distribution of motorcyclists injured in road accidents and attended by paramedics, according to characteristics of the accident. Londrina, PR, Southern Brazil, 1998 and 2010.

Characteristics of accident	1998		2010		p ^b
	n	%	n	%	
Type of accident					< 0.001
Collision with car	892	56.6	2,008	50.6	
Fall	393	24.9	1,169	29.5	
Collision with motorcycle	97	6.2	413	10.4	
Collision with fixed object	34	2.2	96	2.4	
Other	160	10.1	282	7.1	
Weekend					0.049
Yes	792	50.3	1,878	47.3	
No	784	49.7	2,090	52.7	
Time of day ^a					< 0.001
Morning	281	17.8	936	23.6	
Afternoon	531	33.7	1,315	33.2	
Night	624	39.6	1,402	35.4	
Early morning	140	8.9	307	7.8	
Time of year					0.076
First three months	294	18.6	851	21.4	
Second three months	392	24.9	1,001	25.2	
Third three months	414	26.3	1,014	25.6	
Fourth three months	476	30.2	1,102	27.8	
Total	1,576	100.0	3,968	100.0	

^a Eight records with missing information excluded in 2010

^b p value from the Chi-squared test

Alterations were seen in the profiles, with some significant differences: a reduction in the proportion of victims aged 0 to 19 years old, and an increase in those aged 35 and over, fewer cases in which alcohol was noted on the breath of the victim and an increased use of helmets, even with 24.6% of information missing (Table 2).

The percentages of victims classified on the coma (GCS) and trauma (RTS) scales as moderate and severe and in need of medical attention at the scene were reduced in 2010 (Table 3). The immediate fatality rate was halved and there was a decrease in the percentage of victims referred to hospitals, although in absolute terms there was an increase of 134.2%.

There was a significantly lower chance of accidents involving collisions with cars compared with falls and collisions between motorcycles, with OR, respectively, of 0.76 and 0.53 ($p \leq 0.001$). There was a significant

increase in the chances of having a collision with another motorcycle compared with other types of accident (OR = 2.42) for this variable. Differences were found between the morning period (higher chance) compared with other times of the day. With regards the season, the only comparison which was anywhere near statistically significant was the first three months of the year compared with the last three months ($p = 0.06$), whereas comparisons between age groups were significant, with lower chances of having an accident for the younger age group. Men had less chance of having an accident than women (OR = 0.70) and there was a higher chance for both male and female drivers in relation to passengers. The comparisons regarding the victims referrals reinforced the decreasing severity of accidents, and the increased chance of refusing treatment compared with going to hospital stands out (OR = 6.08) (Table 4).

DISCUSSION

A substantial increase in victims of motorcycle accidents in absolute terms was observed in relation to the size of the resident population. There was an increase in the rate of victims per motorcycles, although this was lower than that of the rate per inhabitant, due to the notable increase in the denominator – number of

Table 2. Distribution of motorcyclists injured in road accidents and attended by paramedics, according to characteristics of the victim. Londrina, PR, Southern Brazil, 1998 and 2010.

Characteristics of the victim	1998		2010		p ^b
	n	%	n	%	
Sex					0.019
Male	1,237	78.4	2,994	75.4	
Female	339	21.6	971	24.6	
Position ^a					< 0.001
Driver	1,214	77.0	3,242	81.8	
Passenger	362	23.0	723	18.2	
Age (years) ^a					< 0.001
0 a 19	356	22.6	575	14.5	
20 a 34	941	59.7	2,411	60.8	
≥ 35	279	17.7	979	24.7	
Alcohol on the breath					< 0.001
Yes	219	13.9	280	7.1	
No	1,357	86.1	3,688	92.9	
Helmet					< 0.001
Yes	986	62.5	2,920	73.6	
No	575	36.5	71	1.8	
Unknown	15	1.0	977	24.6	
Total	1,576	100.0	3,968	100.0	

^a Three records with missing information excluded in 2010

^b p value from the Chi-squared test

Table 3. Distribution of motorcyclists injured in road accidents and attended by paramedics, according to severity of trauma and follow up. Londrina, PR, Southern Brazil, 1998 and 2010.

Severity and follow up	1998		2010		p ^c
	n	%	n	%	
GSC					< 0.001
Minor	1,498	94.9	3,880	97.8	
Moderate/ Severe	81	5.1	87	2.2	
RTS ^b					< 0.001
Minor	1,505	95.5	3,897	98.3	
Moderate/ severe	71	4.5	67	1.7	
Need for medical attention at the scene ^b					< 0.001
Yes	258	16.4	176	4.4	
No	1,318	83.6	3,788	95.6	
Follow up ^a					< 0.001
Institute of Legal Medicine (death)	19	1.2	22	0.6	
Given the all clear at the scene	146	9.3	164	4.1	
Refused medical attention	40	2.5	570	14.4	
Hospital	1,371	87.0	3,211	80.9	
Total	1,576	100.0	3,968	100.0	

GCS: Glasgow Coma Scale; RTS: Revised Trauma Score

^a One record with missing information excluded in 2010^b Four records with missing information excluded in 2010^c p value from the Chi-squared test

motorcycles – in the municipality, similar to other locations.^{3,14} With the exception of the season in which the accident occurred, which has results approaching significance, all of the characteristics were significantly different between the two years, indicating changes in the profile of accidents and victims.

Collisions with cars/trucks were prevalent in both years. However, in 2010 there was a significant increase in the number of accidents between motorcyclists and falls from the motorcycle. This change in profile reflects the increase in the number of motorcycles in the city, the poor state of the roads and the larger number of inexperienced drivers, as well as recklessness on the part of some individuals in traffic.⁶ These factors contribute to accidents in which a fall or loss of control of the motorcycle is involved, possibly leading to crashing into objects or fixed structures in the road. In spite of being infrequent and not altering between the years, collisions with fixed objects are reported to be responsible for higher fatality rates among motorcyclists.^{2,7,17}

There was a reduction in the proportion of accident victims during the weekend and an increase in those which occurred in the morning. Studies highlight the, proportionally, greater number of accidents which occur at weekends and during the night.^{2,4,10} However, the greater demand for using the motorcycle for day-to-day family and professional use^{8,17,19} favors the increase in road accidents on working days and during the day, principally in work related activities.¹⁸

During the two years in question, an increase in the proportion of victims was observed, with predominance in the last three months of the year, although with a slight decrease in comparison with the first three months of 2010. This may be related to the pattern of vehicles on the road according to the time of year, because of school holidays or festivals which attract consumers to the region, as well as the predominant weather conditions at different times of the year.^{4,9} Although this study does not contain data on environmental conditions, the vulnerability of motorcyclists to adverse weather conditions,²¹ due to the need for stability and balance when using this vehicle is emphasized.

The predominance of young adult males has been reported in other Brazilian cities^{3,14,19} and in other countries.^{10,17} However, more than half of female victims (54.6%) were characterized as drivers in 2010, which reinforces the theory that women are increasingly using this means of transport to carry out their daily activities, often work related.⁸

Alcohol was less frequently noted on the victim's breath during pre-hospital treatment in 2010. In spite of this being a very rough measure, depending on factors such as the paramedics capacity of perception, high rates of alcohol intake and presence on the victims breath was the only method available to evaluate possible ethanol consumption on the part of the victim before the accident, and was used at all scenes.

Drinking alcohol is a risk factor for dangerous driving and accidents.^{3,12,24} The level of alcohol acceptable for vehicle drivers was lowered to zero in Brazil by Law n° 11,705 (Dry Law)^h in 2008, with severe penalties imposed on those who infringed the law. Research carried out in the state capitals and the Federal District¹⁶ showed that, although there was a decrease in percentages of reports of drink-driving in the first four months after the Law came into force, this practice increased again after this period. Possibly, according to the authors, due to the reduction in inspections and the emphasis placed by the media on the new rules.

^h Brasil. Lei n° 11.705, de 19 de junho de 2008. Altera a Lei no 9.503, de 23 de setembro de 1997, que institui o Código de Trânsito Brasileiro, e a Lei n° 9.294, de 15 de julho de 1996, que dispõe sobre as restrições ao uso e à propaganda de produtos fumíferos, bebidas alcoólicas, medicamentos, terapias e defensivos agrícolas, nos termos do § 4o do art. 220 da Constituição Federal, para inibir o consumo de bebida alcoólica por condutor de veículo automotor, e dá outras providências. *Diário Oficial Uniao*. 20 jun 2008 [cited 2011 Jun 12]:1. Available from: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2008/lei/l11705.htm

Table 4. Comparisons between characteristics of accidents and of motorcyclists attended by paramedics. Londrina, PR, Southern Brazil, 1998 and 2010.

Characteristic	OR	p ^a
Type of accident		
Collision with car <i>versus</i> fall from motorcycle	0.76	0.001
Collision with car <i>versus</i> collision with motorcycle	0.53	< 0.001
Collision with car <i>versus</i> collision with fixed object	0.80	1.000
Collision with car <i>versus</i> other	1.28	0.232
Fall from motorcycle <i>versus</i> collision with motorcycle	0.70	0.039
Fall from motorcycle <i>versus</i> collision with fixed object	1.05	1.000
Fall from motorcycle <i>versus</i> other	1.69	< 0.001
Collision with motorcycle <i>versus</i> collision with fixed object	1.51	0.785
Collision with motorcycle <i>versus</i> others	2.42	< 0.001
Collision with fixed object <i>versus</i> others	1.60	0.307
Time of day		
Morning <i>versus</i> afternoon	1.35	0.003
Morning <i>versus</i> night	1.48	< 0.001
Morning <i>versus</i> early morning	1.52	0.004
Afternoon <i>versus</i> night	1.10	1.000
Afternoon <i>versus</i> early morning	1.13	1.000
Night <i>versus</i> early morning	1.03	1.000
Time of year		
First three months <i>versus</i> second three months	1.13	0.983
First three months <i>versus</i> third three months	1.18	0.366
First three months <i>versus</i> fourth three months	1.25	0.060
Second three months <i>versus</i> third three months	1.04	1.000
Second three months <i>versus</i> third three months	1.04	1.000
Second three months <i>versus</i> fourth three months	1.10	1.000
Third three months <i>versus</i> fourth three months	1.06	1.000
Sex/position on motorcycle		
Male driver <i>versus</i> female driver	0.70	0.001
Male driver <i>versus</i> male passenger	1.53	< 0.001
Male driver <i>versus</i> female passenger	1.12	1.000
Female driver <i>versus</i> male passenger	2.20	< 0.001
Female driver <i>versus</i> female passenger	1.61	0.001
Male passenger <i>versus</i> female passenger	0.73	0.101
Age (years)		
0 To 19 <i>versus</i> 20 to 34	0.63	< 0.001
0 To 19 <i>versus</i> ≥ 35	0.46	< 0.001
20 Ato34 <i>versus</i> ≥ 35	0.73	< 0.001
Helmet		
Yes <i>versus</i> no	23.98	< 0.001
Yes <i>versus</i> unknown	0.05	< 0.001
No <i>versus</i> unknown	0.01	< 0.001
Follow up		
ILM <i>versus</i> given the all clear at the scene	1.03	1.000
ILM <i>versus</i> refused medical attention	0.08	< 0.001
ILM <i>versus</i> hospital	0.49	0.168
Given the all clear at the scene <i>versus</i> refused medical attention	0.08	< 0.001
Given the all clear at the scene <i>versus</i> hospital	0.48	< 0.001
Refused medical attention <i>versus</i> hospital	6.08	< 0.001

ILM: Institute of Legal Medicine (death)

^a p value for multiple comparisons – Bonferroni test (corrected)

An increase in the prevalence of helmet use was observed in 2010, in spite of the large amount of missing data. The protection which this confers on the motorcycle user is demonstrated in the literature, potentially reducing by up to 42% the mortality rates in traffic accidents for motorcyclists, and reducing the risk of head trauma by up to 69%.¹³ Of the 178 countries analyzed in the Global status report on road safety: time for action,^a 40% have laws requiring motorcyclists, both drivers and passengers, to wear helmets. The importance of standardizing and regulating helmet use is also noteworthy, as well as their correct adjustment.²⁵

There was a lower percentage of victims considered to be in a coma or with moderate/severe trauma in 2010. The percentage needing medical attention at the scene also decreased. A greater proportion were recorded as refusing treatment and fewer were referred to hospital. These results suggest that, in spite of the increased number of accidents, there has been a reduction in their severity. However, in absolute terms, hospital demand has more than doubled. The number of hospital beds per thousand inhabitants in the Londrina Metropolitan Region went from 3.2 in 1999 to 2.9 in 2009,ⁱ indicating that this increase has not been accompanied by a greater availability of beds in the health care system, overloading these services and generating higher spending on tertiary care.

The impossibility of obtaining figures for deaths after the victims have been sent to hospital means that the immediate fatality rate lethality coefficient can be identified, which had halved by 2010 (from 1.2% to 0.6%), confirming the theory that the severity of accidents was decreasing. A fatality rate lethality coefficient of 1.7% in the 180 days following the accident was observed in the same municipality in 1996.¹ Nunn¹⁷ observed a fatality rate lethality coefficient of 3.3% in the United States between 2003 and 2008. These difference may be explained by the characteristics of the accidents in these different locations. There are also possible methodological influences considering that analysis of deaths as it may occur directly after the accident (immediate fatality) of days later.

This study has some limitations. The populations studied did not correspond to the total number of motorcycle accidents in the municipality, as pre-hospital services are not always called to every accident.¹¹ It is possible

that the pattern of calling this service has changed over the years, as in 1998 only SIATE was available and had only been in effect for 18 to 30 months, although there was intense media coverage on the necessity to call them in case of accidents. The possibility cannot be ruled out that part of the reduction in the proportion of more seriously injured victims may be due to greater access to pre-hospital care. Other important characteristics in the occurrence of accidents, such as the capacity of the motorcycles motor, speed, driving lessons the motorcyclist had received, among others, are not available. Such limitations notwithstanding, the results reveal an increase in the number of victims of motorcycle accidents and in hospital demand due to this.

In spite of the large increase in the motorcycle fleet and the rate of victims per inhabitant, the rate of victims per motorcycle fleet increased very little. There were increases in the proportion of accident victims wearing helmets, in the number of accidents occurring in the morning, in accidents involving female motorcyclists and in the older age group, as well as a decrease in the proportion of cases in which alcohol was noted on the victim's breath and in more serious accidents. This profile is consistent with the greater participation of women in the labor market and the ageing population, greater access to motorcycles and perhaps the effects of public policies adopted over the last few years in Brazil, especially the changes in legislation, such as the new CTB and the "Dry Law", although there are still challenges in the effective enforcement of these laws in the country.^{3,14,16}

Pre-hospital care, treatment and rehabilitation have a high financial impact and affect the motorcyclists' quality of life after the trauma. Measures such as effectively targeted inspections and effective compliance with the legislation,^{5,12,24} improving roads, proper road signs and street lighting¹² and investment in safety devices for motorcycle users,²⁰ in addition to helmets are some initiatives which may minimize these findings. The need for integrated actions must be emphasized, and that road safety should become a national priority, as indicated in a recent document.^j It is hoped that the results of this study contribute to raising the awareness of legislators and public administrators, in particular, of the importance of preventing motorcycle accidents, considering the magnitude and characteristics of these accidents.

¹ Ministério da Saúde. DATASUS. Indicadores de Recursos. Brasília (DF); 2012 [cited 2012 May 14]. Available from: <http://tabnet.datasus.gov.br/cgi/tabcgi.exe?idb2010/e02.def>

^j Luoma J, Sivak M. Road-safety management in Brazil, Russia, India, and China. Ann Arbor: Transportation Research Institute- University of Michigan; 2012 [cited 2012 May 14]. Available from: <http://hdl.handle.net/2027.42/89427>

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