DOI:10.1590/1414-462X2017000200025

Original Article

Trends in hospitalizations due to motorcycle accidents involving men aged 20 to 39 years in the state of Santa Catarina - Southern Brazil

Tendência das internações por acidentes motociclísticos em homens de 20 a 39 anos no Estado de Santa Catarina - Sul do Brasil

Ione Jayce Ceola Schneider[1,2,3], Marcelo Vargas Schütz[2], Nazaré Otília Nazário[2], Ameg Dalpiaz[3], Alexandre Márcio Marcolino[1,3], Rafael Inácio Barbosa[1,3]

Abstract

Introduction: Motorcycles accidents are responsible for most of the injuries due to external causes and consequent high hospitalization rates. **Objective:** This study aimed to analyze the temporal trend in motorcycle accident morbidity among young male adults in the State of Santa Catarina. **Methods:** This is an ecological study on motorcycle accident morbidity in men aged 20 to 39 years in the State of Santa Catarina between 1998 and 2012. Data from the Hospital Information System of the Brazilian Unified Health System were used in the study. Specific hospital morbidity rates adjusted for age, age group and geographical region, were calculated to analyze the temporal trend in the State through regression model estimates obtained using the Joinpoint program. **Results:** A total of 19.889 hospital admissions for motorcycle accidents occurred in the State of Santa Catarina in the period studied, with a significant increase of 10.9% per year. In the studied age groups, the 20-29 year old group increased 9.7% per year, whilst the 30-39 year old group increased 13.7%. Except for Foz do Rio Itajaí, all geographical regions of the state showed a significant increase of morbidity. **Conclusion:** There has been an increasing trend of morbidity for motorcycle accidents in State of Santa Catarina. These results show the need for improvement of policies to reduce the causes of this type of accident.

Keywords: external causes; motorcycle accidents; epidemiological studies.

Resumo

Introdução: Os acidentes motociclísticos são responsáveis por grande parte dos agravos devido a causas externas e ocasionam altas taxas de internação. **Objetivo:** Este estudo objetivou analisar a tendência temporal de morbidade dos acidentes motociclísticos em adultos jovens do sexo masculino. **Métodos:** Estudo ecológico da morbidade por acidentes motociclísticos em homens de 20 a 39 anos no Estado de Santa Catarina entre os anos de 1998 e 2012. Os dados são oriundos do Sistema de Informações Hospitalares do Sistema Único de Saúde. Calcularam-se as taxas específicas de morbidade hospitalar, ajustadas por idade, faixa etária e macrorregião, para analisar a tendência temporal no Estado por meio das estimativas de modelos de regressão pelo programa Joinpoint. **Resultados:** Houve incremento médio significativo de 10,9% ao ano. Nas faixas etárias estudadas, a de 20-29 anos apresentou aumento anual de 9,7%, enquanto a de 30-39 anos, 13,7%. Com exceção da Foz do Rio Itajaí, todas as macrorregiões apresentaram aumento significativo na taxa de morbidade. **Conclusão:** Houve aumento da tendência de morbidade por acidente motociclístico no Estado. Os resultados demonstram necessidade de aprimoramento das políticas de redução dessa causa de acidentes.

Palavras-chave: causas externas; acidentes motociclísticos; estudos epidemiológicos.

[1]Department of Health Sciences, Universidade Federal de Santa Catarina (UFSC) - Araranguá (SC), Brazil.
[2]Medical School, Universidade do Sul de Santa Catarina (UNISUL) - Palhoça (SC), Brazil.
[3]Laboratory of Assessment and Rehabilitation of Locomotor System, Universidade Federal de Santa Catarina (UFSC) - Araranguá (SC), Brazil.
Study carried out Universidade do Sul de Santa Catarina (UNISUL) – Palhoça (SC), Brazil.
Correspondence: Ione Jayce Ceola Schneider – Department of Health Sciences, Universidade Federal de Santa Catarina (UFSC), Rodovia Governador Jorge Lacerda, 3201, Km 35,4 – Jardim das Avenidas – CEP: 88906-072 – Araranguá (SC), Brazil – Email: ione.schneider@ufsc.br
Financial support: none.
Conflict of interests: nothing to declare.

INTRODUCTION

In the last decades, diseases and injuries due to external causes, which include traffic accidents, falls, burnings and self-inflicted, interpersonal or collective violence, have been one of the leading causes of deaths and sequelae in the world population, with serious damage to individuals, their families, and society[1-6].

In comparison to other countries, Brazil has high mortality rates, and external causes rank first among the main events leading to death in the age group of 1 to 39 years and third among the general population, only behind cardiovascular and neoplastic diseases[3,7,8].

Traffic accidents stand out among the external causes of mortality. They have become a public health problem of global dimension and a challenge for managers, due to their growing incidence[1-3,9]. These accidents generally involve a series of events and environmental factors often linked to the users, the vehicles, and the roads[3,5,9,10].

A growing trend of motorcycle use in Brazil has been observed as a consequence of facilitated purchase, credit access, and extended payment deadlines; these factors attract an increasing number of customers[11]. Besides being a low cost means of transport, it has been increasingly used in recent years as a work instrument, either for transportation of people or goods. Associated with this trend, the occurrence of accidents has also increased and become a major cause of injury, physical disability and death[7,11].

Report from National Institute of Science and Technology about the evolution of the Brazilian fleet of motor vehicles between 2001 and 2012 showed that, while the number of cars increased by around 50%, the number of motorcycles increased more than 400%, reaching 19.9 million motorcycles[12]. This increase in the number of motorcycles is clearly linked to demand for the provision of service with speed and agility and this trend seems irreversible, especially if the quality of the public transportation system does not improve as the proposal of the adopted model. This context of a society based on consumption, need of agility and increasingly chaotic traffic result in a high risk of exposure to traffic accidents[7,11].

Studies have shown that the profile of people involved in motorcycle accidents is predominantly represented by men aged between 15 and 44 years, corresponding to the productive portion of the population[13-16].

Accidents involving motorcycles are among the major public health problems and create a worrying scenario, with numbers that do not stop to grow[16-18]. The number of fatalities due to motorcycle accidents increased about tenfold between 1996 and 2006, from 2% to 20%[19]. Death rates for motorcycle accidents increased 820% from 1996 to 2007, 0.5 to 4.2 per 100,000 inhabitants[20].

In addition to the high mortality rates, an increase of hospitalization due to these injuries is noticeable. From the total number of hospitalizations due to traffic accidents in Brazil from 2001 to 2010, 30.7% were due to motorcycle accidents. During this period, hospitalization rates due to this cause increased at an approximate total cost of 380 million Brazilian Reals and average cost of R$1,073.75 per admission[21].

When death does not occur, temporary or permanent deficiencies cause disability in this important part of the population[22]. The probability and severity of multiple injury is often higher than other types of vehicle accidents, because motorcycle' drivers and passengers have greater portions of the body exposed in the event of an accident[23]. The body areas more frequently affected are lower limbs, hip, and upper limbs, followed by head and neck area; traumatic brain injury is the main cause of death[24,25]. In third place are the maxillofacial injuries; motorcycle accidents are responsible for 51.1% of this kind of injury, with predominance of coronary and mandibular fractures[24]. The victims of motorcycle accidents assisted in a reference rehabilitation center in Santa Catarina were mostly young men with injuries predominantly classified as very serious (lower limb amputation), followed by serious (lower limb fractures), and by extremely serious (traumatic brain injury and spinal cord injury)[26].

In view of the above, and considering the importance of the costs that traffic incidents with motorcycles leading to injuries imply to health and security services, because of both the incidence and severity of the events, this study aims to estimate the temporal tendency of morbidity of motorcycle accidents among young male adults in the State of Santa Catarina.

METHODS

The present study is an ecological time series of morbidity by motorcycle accidents performed in Santa Catarina, a state in the south region of Brazil. This state has nine health macroregions[27]. The population of Santa Catarina in 2010, according to the Brazilian Institute of Geography and Statistics (IBGE), was 6,248,436 inhabitants[27]. The Human Development Index (HDI) is 0.774[28].

Data from the Hospital Information System of the Brazilian Unified Health System (SIH-SUS) were used in the study. The system is managed by the Ministry of Health through the Health Assistance Secretariat along with state health departments and local health departments, and data are processed by the Department of Health Information System (Datasus), the Ministry of Health's Executive Secretariat[27].

The hospitalizations due to motorcycle accidents registered in the Hospital Information System of the Unified Health System (SIH-SUS) in the state of Santa Catarina that occurred in the period from 1998 to 2012 with men aged 20 to 39 years,

declared in the morbidity list per group of causes from the International Classification of Diseases – 10th Edition (ICD-10) as V20 to V29[27], were included in the study. Hospitalizations of individuals with unknown age and sex were excluded from the sample. The information about the number of inhabitants were obtained from IBGE's database, also available on Datasus[27].

Initially, the specific rates of hospital morbidity were calculated as the ratio between the number of hospitalizations due to motorcycle accidents and the estimated population at July 1st in each year in the series. Later, the specific morbidity rates were standardized per age, by the direct method, and this value was used as default to the standard world population.

The calculated rates were used to analyze the trend of morbidity in the different macroregions of the state, based on the estimated regression models. The historical series was filtered using a moving average algorithm centered in five terms. Therefore, the period analyzed corresponds to the years from 2000 to 2010.

The software Joinpoint 4.1.0 (Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute, United States of America) was used to calculate the annual variation of morbidity in the period studied[29].

This study was approved by the Research Ethics Committee from Unisul under CAAE: 27849814.0.0000.5369.

RESULTS

In the period studied, 422,387 hospitalizations for external causes occurred in Santa Catarina, of which 19,889 were motorcycle accidents. Among these accidents, 84.43% of the involved victims were male. The age groups 20 to 29 years and 30 to 39 years were represented in a total of 10,564 hospitalizations; 7,039 and 3,475, respectively. The hospitalization rate due to motorcycle accident in the state of Santa Catarina, overall and per age group, is shown in the Figure 1. The hospitalization rate in 2000, beginning of the period, was 10.91 hospitalizations per 100,000 inhabitants and in 2010, 29.95 hospitalizations per 100,000 inhabitants. When analyzing the annual variation of percentage of the hospitalization rate due to motorcycle accident in Santa Catarina during the studied period (2000-2010), an overall increase of 10.9% per year was observed. There were two periods of variation in this trend, both of significant increase: from 2000 to 2004, 14.9% per year, and from 2004 to 2010, 8.7% per year (Table 1).

As for age-specific morbidity rate, the group of 20 to 29 years had higher rates, with a significant growth of 9.7% per year and two periods of variation. In turn, the group 30 to 39 years had an increase of 13.7% per year, without variation in the trend.

Figures 2, 3, and 4 show the trends of hospitalization per macroregions. All macroregions, except Foz do Rio Itajaí, had significantly increasing hospitalization rates throughout the period studied, 2000-2010, as shown in Table 1.

When analyzing the periodical variation in each macroregion, it was noticed that Planalto Norte and Serra Catarinense had no variation in admission rates. The Nordeste and Vale do Itajaí macroregions had slight significant reductions in admissions in the beginning of the period, and afterwards, significant increase in admissions. Grande Oeste showed two distinctive periods of increase (2000-2006; 2006-2010). Although the Grande Florianópolis and Sul macroregions presented two periods of variation, only the former had a significant increase in the hospitalization rate. The Meio Oeste macroregion had two periods of variation in the hospitalization rate. However, only the variation in the period from 2003 to 2010 was significant, besides also having an increasing trend.

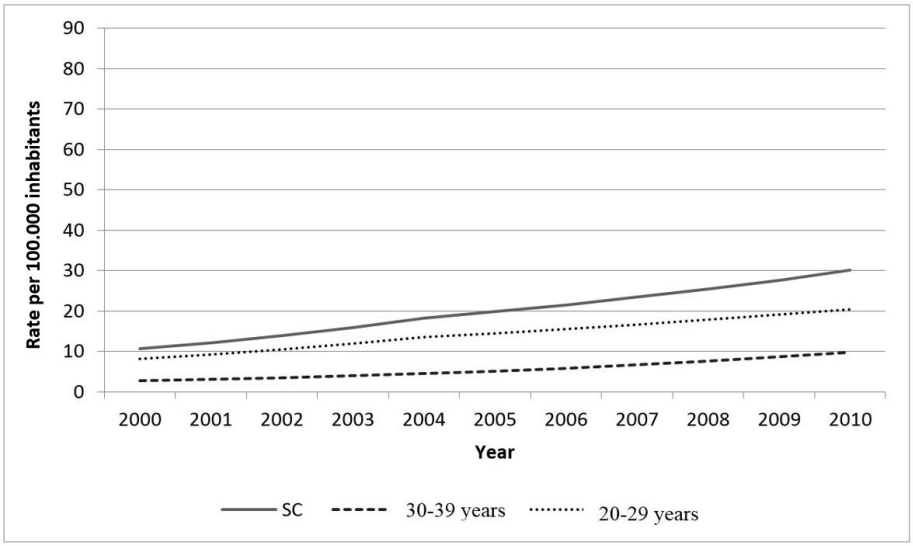

Figure 1. Trend of overall and age-specific morbidity rate due to motorcycle accidents among men aged 20 to 39 years, Santa Catarina, 2000-2010

Table 1. Annual percentage change in the overall, age-specific and macroregion morbidity rate due to motorcycle accidents among men aged 20 to 39 years, Santa Catarina, 2000-2010

Variables	Annual Average Percentage Change (IC95%) (2000-2010)	Period	Annual Percentage Change (IC95%)
General	10.9 (9.6; 12.2)		
		2000-2004	14.3 (10.7; 18.0)
		2004-2010	8.7 (7.3; 10.1)
Age Group			
20 to 29 years	9.7 (8.1; 11.3)		
		2000-2004	13.6 (9.3; 18.1)
		2004-2010	7.2 (5.5; 8.9)
30 to 39 years	13.7 (12.7; 14.6)		
		2000-2010	13.7 (12.7; 14.6)
Macroregion			
Grande Oeste	27.0 (22.8; 31.2)		
		2000-2006	21.4 (14.4; 28.7)
		2006-2010	35.8 (28.8; 43.3)
Foz do Rio Itajaí	-4.4 (-9.6; 1.2)		
		2000-2002	-26.2 (-45.9; 0.7)
		2002-2010	2.0 (-2.1; 6.3)
Grande Florianópolis	11.4 (9.4; 13.5)		
		2000-2005	24.8 (20.2; 29.6)
		2005-2010	-0.6 (-3.2; 2.2)
Meio Oeste	17.2 (6.0; 29.6)		
		2000-2003	-23.3 (-47.7; 12.4)
		2003-2010	40.6 (30.8; 51.2)
Nordeste	11.6 (6.1; 17.5)		
		2000-2005	-16.0 (-24.1; -7.1)
		2005-2010	48.4 (37.2; 60.4)
Planalto Norte	8.4 (5.8; 11.1)		
		2000-2010	8.4 (5.8; 11.1)
Serra Catarinense	29.0 (18.2; 40.7)		
		2000-2010	29.0 (18.2; 40.7)
Sul	9.2 (7.4; 10.9)		
		2000-2004	25.2 (20.0; 30.7)
		2004-2010	-0.4 (-2.1; 1.4)
Vale do Rio Itajaí	3.2 (0.5; 6.0)		
		2000-2006	-5.9 (-9.4; -2.4)
		2006-2010	18.6 (11.4; 26.2)

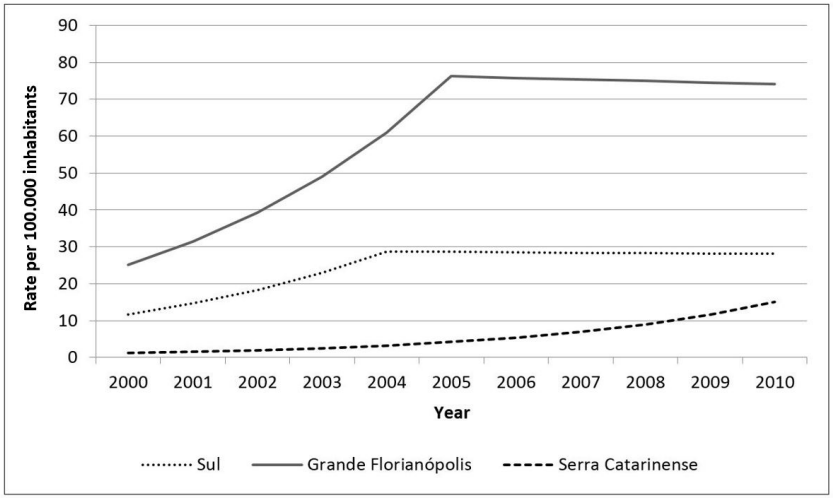

Figure 2. Trend of morbidity rate due to motorcycle accidents among men aged 20 to 39 years in Sul, Grande Florianópolis, and Serra Catarinense macroregions, Santa Catarina, 2000-2010

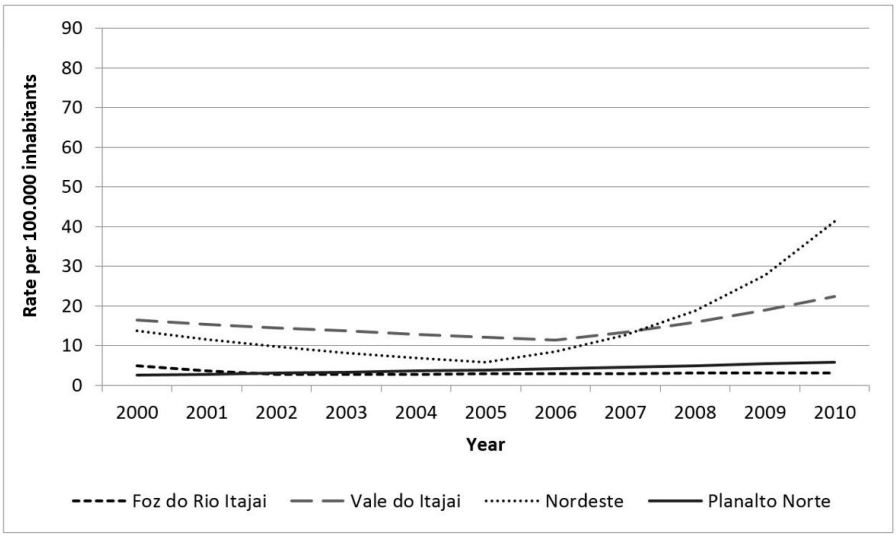

Figure 3. Trend of morbidity rate due to motorcycle accidents among men aged 20 to 39 years in Foz do Rio Itajaí, Vale do Itajaí, Nordeste and Planalto Norte, Santa Catarina, 2000-2010

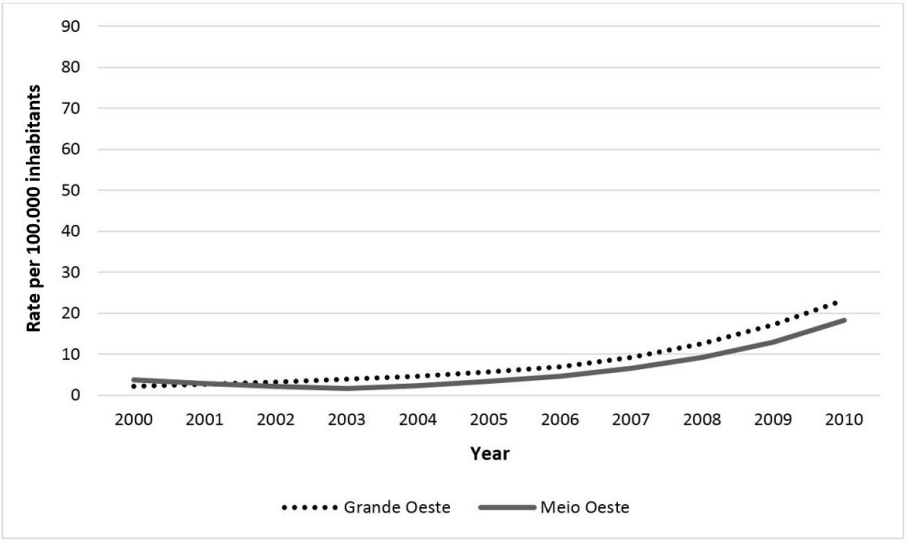

Figure 4. Trend of morbidity rate due to motorcycle accident among men aged 20 to 39 years in Grande Oeste and Meio Oeste, Santa Catarina, 2000-2010

DISCUSSION

This study sought to estimate the temporal trend of morbidity rate for motorcycle accidents among men aged 20 to 39 years in the state of Santa Catarina, which had an overall increase and in all macroregions, except Foz do Rio Itajaí. This is a pioneer study in the state of Santa Catarina and one of the few in Brazil to analyze this kind of event, which limits the comparison of the data found. An example of this limitation can be found in Mascarenhas et al.[30]. In this study, the authors were not able to include the data from Santa Catarina about traffic accidents involving motorcycles.

The number of motorcycles in Brazil has increased and this may have contributed to the number of traffic accidents. Between the period of 2004 and 2014, the number of motorcycles increased from 7 million to 23 million in Brazil. This difference represents an increase of 18.2% to 26.6% in the total number of vehicles in Brazil[31].

The increase in the number of motorcycles, whether as work or transportation vehicle, may have influenced the increased mortality rates in Brazil. The increased fleet of motorcyclists can be attributed to the precariousness of public transportation, phone-delivery services, possibility of work for young people, and the ease of buying a motorcycle[7].

The involvement of young male adults in motorcycle traffic accidents is due to a few factors, such as the way of driving, the vulnerability of drivers and passengers, and the social and

cultural behavior of males that includes the exposure to risks such as alcohol consumption and aggressiveness in traffic[32-34].

The ease of implementation, speed in obtaining results, and the fact of being a low cost method stand out as a strong point of ecological designs. In addition to that, the data obtained from the Datasus system provided quality and credited reliability to the findings.

One of the limitations of the study is related to the accuracy and quality of the data used in the study. Because secondary data were used in the analysis, there may be variation in accuracy and quality of data, such as inadequate or incorrect information, or underreporting of admission data. A study that analyzed the coverage and quality of information about hospitalizations for external causes of morbidity and mortality in the SIH-SUS, based on the medical records from this data source, concluded that there may be underreporting of information[35]. This suggests that the estimates presented here may be underestimated, what worsens the situation of hospital morbidity due to motorcycle accidents.

In the present study, there was an increase of more than 10% per year in the overall rate of hospitalization. This information is corroborated by the Brazil's Violence Map – 2013, which in the period of 1998 to 2008 showed an increase of 10% per year[36]. In 2000, traffic accidents were responsible for 18.2% of the hospitalizations for external causes, involving mainly male victims[37]. A review conducted by Bacchieri and Barros[7] that described the situation of traffic accidents in Brazil between the years 1998 and 2010 observed a growth of 9% in hospitalizations resulting from traffic accidents, the majority involving motorcyclists. This increase in traffic accidents, mostly involving motorcycles, is in agreement with the increase of hospitalizations found in the present study.

Hospitalization rates due to traffic accidents involving motorcycles and 20 to 49-year-old men in the state of São Paulo from 2005 to 2009 had an average of 18.6 per 100,000 inhabitants, with more than 50 admissions per 100,000 inhabitants in some microregions[38]. In the Vale do Paraíba, the hospitalization rate due to motorcycle accidents in the period from 2001 to 2005 reached 48 per 100,000 inhabitants, directly related to the fleet's size in the studied city[3]. The hospitalization rate found in Santa Catarina was lower than in the Vale do Paraíba in all the period studied, with the limitation that this study did not evaluate the relation between hospitalizations and the motorcycle fleet in the state.

A study that analyzed the factors associated to the risks of injuries in motorcyclists in Maringá showed that 78.8% of the victims presented injuries, and more than half of the injured was referred to tertiary hospitals[14]. Accidents involving motorcycles have four-fold higher chance of injury, and eight-fold higher chance of death when compared to car accidents[39]. In a motorcycle accident, the hospitalization rate can reach 11.7%, and lethality can reach 1.7%. More than 40% of the victims who die from motorcycle accidents receive assistance in emergency rooms, and approximately 35% die during the hospitalization[40].

An analysis of the trend of mortality from motorcycle accidents in the period from 1996 to 2009 showed that the highest growth rates of mortality were found in the North, Northeast, and Midwest regions of Brazil[41]. These accidents caused in Brazil in 2003 more than 20% of the deaths due to ground transportation accidents among 20 to 39-year-old men. According to the temporal trend of mortality due to traffic accidents in Brazil from 1980 to 2002, a substantial increase in the mortality rate due to motorcycle accidents took place since 1995, especially among men aged 20 to 29 years[16].

Mascarenhas et al.[30] showed that young people between 20 and 39 years of age and males are the main victims of accidents involving motorcyclists, according to data from urgency and emergency SUS services selected in state capitals and the Federal District. The results of this national study corroborate the present study and both endorse relevance of the problem of accidents involving motorcycles, as well as the need for more effective public policies targeting this population.

In Brasília, over 90% of the deaths due to transport accidents involving motorcycles were men, and 70% of them were aged 20 to 29 years. Furthermore, the mortality rate increased 36% per year[15]. In a study conducted in six cities of Bahia in 1996-2007, the percentage of fatalities resulting from motorcycle accidents ranged from 5.8% to 14% and affected mostly young adults[42].

The age group of 20 to 39 years is the most affected by traffic accidents[2,15,16,42]. Researches that investigated the profile of victims of motorcycle traffic accidents admitted to a hospital in Porto Alegre[43] and Goiania[44] pointed out that the majority were young and male adults.

In relation to age-specific hospitalization rate, there was a lower annual increase among the age group of 20 to 29 years than among the group of 30 to 39 years. In Maringá, over 70% of the motorcycle accidents involved young adults aged 20 to 39 years, with predominance of the group of 20 to 29 years, with a sex ratio of 4.2:1[45]. In Rio Branco-AC, there was an increase of 42% in the rate for motorcycle accidents from 2005 to 2008, with higher incidence among males and among the age group of 20 to 39 years[46]. This was also found in Fortaleza, Brazil[47,48].

Based on the confluence of all the literature about the predominance and involvement of young adults, this study has raised critical data about this type of injury. This predominance is also found in the analyses of pre-hospital care in urgency and emergency services. The analysis of pre-hospital care provided to traffic accident victims in Londrina, Brazil, from 1997 to 2000 showed about 70% cases involving men, and the most affected

age group was 20 to 29 years, more than 40% resulting from motorcycle accidents[18].

Victims from motorcycle accidents in Teresina, Brazil, treated at an emergency service were predominantly male (87.4%); in 85.6% of the cases, the victims were the drivers, mostly in the age group of 15 to 34 years[25].

The cases of provision of assistance to men admitted due to external causes in the São José dos Campos Municipal Hospital-SP from January to June 2003 were 10.3% due to motorcycle accidents and the most affected age group was 20 to 29 years, followed by 30 to 39 years[49]. Another study held in São Paulo from June 2008 to August 2009 compared motorcyclists involved in traffic accidents and victims of other trauma mechanisms. The study found out that males were significantly more affected by the former, with predominance of young adults aged 28.9 years on average[50]. Study held in Tubarão, SC, with traffic accident victims treated in the local hospital found that 78.2% were male, and 74.3% of the injured victims used motorcycles[51].

The predominance of accidents involving motorcycles among young male adults found in the literature is worrisome, because it increased significantly in the statistics in both age groups. The literature points out that traffic accidents involving young adults may be associated with particular behaviors such as the search for strong emotions, pleasure and sensation of risk, alcohol or drug abuse, as well as impulsiveness and inexperience[52]. In addition, being a young male adult and driving a motorcycle are risk factors for traffic accidents[51].

As for the analysis per region, there was a significant increase in all regions, with exception of Foz do Rio Itajaí. However, no data was found in the literature to justify the noticed difference. This increase in the rate may be related to the increase of the motorcycle fleet in the state of Santa Catarina from 167,198 in 1998 to 733,187 in 2012[31]. Furthermore, the road network, the quality of hospital care performed, or the joint effect of these factors may have contributed to the increase. Another possible reason for the stabilization of hospitalization rates in some macroregions is the reduction or stabilization of the number of hospital beds per 1000 inhabitants in the State of Santa Catarina from 2006[27]. The data found may help in future prevention policies, specific to each macroregion, and can be enhanced with specific studies for each geographical region.

From 1990 to 2010, there was a 30% increase in the disability-adjusted life years (DALY) due to the traffic accidents in Brazil[53]. The increasing number of vehicles and the complexity of the traffic, besides the fast urbanization, seems to be key factors for the growth in the number of injuries resulting from traffic accidents[54].

The growth of accidents involving motorcycles requires joint action of public entities and drivers, promoting educational activities to prevent these accidents[16]. Besides prevention, it is necessary that the vigilance of traffic accidents be improved to ensure the quality of care from the health sector.

Another research supports this hypothesis by stating that the detailed study of accidents can help developing preventive strategies to these injuries. Only inter-sectoral preventive and coordinated action will be able to reduce morbidity and mortality caused by traffic accidents[18]. It has been proposed that the assistance to survivors during pre-hospital, hospital and rehabilitation care be expanded and improved[20].

In conclusion, there was an increase in the morbidity trend of motorcycle accidents by 10.9% per year, obtaining the rate of 30 hospitalizations per 100,000 inhabitants. Based on these considerations, it is clear the concern about traffic accidents, especially involving motorcycles. Researches such as the present one, with the survey of government information system data, enable the creation and implementation of strategies for prevention and reduction of traffic accident consequences. It is expected that the observed results serve as a stimulus for further research aimed at assessing, for example, the post-hospital mortality rate, percentage of partial and permanent disability, as well as the costs arising from these admissions.

REFERENCES

1. Debieux P, Chertman C, Mansur NSB, Dobashi E, Fernandes HJA. Lesões do aparelho locomotor nos acidentes com motocicleta. Acta Ortop Bras. 2010;18(6):353-6. http://dx.doi.org/10.1590/S1413-78522010000600010.

2. Andrade-Barbosa TL, Xavier-Gomes LM, Barbosa VA, Caldeira AP. Mortalidade masculina por causas externas em Minas Gerais, Brasil. Cien Saude Colet. 2013;18(3):711-9. PMid:23546198. http://dx.doi.org/10.1590/S1413-81232013000300017.

3. Nunes MN, Nascimento LF. Internações hospitalares por acidentes de moto no Vale do Paraíba. Rev Assoc Med Bras. 2010;56(6):684-7. PMid:21271136. http://dx.doi.org/10.1590/S0104-42302010000600018.

4. Malta DC, Mascarenhas MD, Bernal RT, Andrade SS, Neves AC, Melo EM, et al. Causas externas em adolescentes: atendimentos em serviços sentinelas de urgência e emergência nas Capitais Brasileiras - 2009. Cien Saude Colet. 2012;17(9):2291-304. PMid:22996881. http://dx.doi.org/10.1590/S1413-81232012000900011.

5. Pedrosa AAG, Mascarenhas MD, Costa EM, Cronemberger LP. Atendimentos por causas acidentais em serviços públicos de emergência - Teresina, Piauí - 2009. Cien Saude Colet. 2012;17(9):2269-78. PMid:22996879. http://dx.doi.org/10.1590/S1413-81232012000900009.

6. Minayo MCS, Souza ER, Paula DR. Revisão sistemática da produção acadêmica brasileira sobre causas externas e violências contra a pessoa idosa. Cien Saude Colet. 2010;15(6):2719-28. PMid:20922280. http://dx.doi.org/10.1590/S1413-81232010000600010.

7. Bacchieri G, Barros AJD. Acidentes de trânsito no Brasil de 1998 a 2010: muitas mudanças e poucos resultados. Rev Saude Publica. 2011;45(5):949-63. PMid:21953026. http://dx.doi.org/10.1590/S0034-89102011005000069.

8. Santos AMR, Moura ME, Nunes BM, Leal CF, Teles JB. Perfil das vítimas de trauma por acidente de moto atendidas em um serviço público de emergência. Cad Saude Publica. 2008;24(8):1927-38. PMid:18709233. http://dx.doi.org/10.1590/S0102-311X2008000800021.

9. Caixeta CR, Minamisava R, Oliveira LM, Brasil VV. Morbidade por acidentes de transporte entre jovens de Goiânia, Goiás. Cien Saude Colet. 2010;15(4):2075-84. PMid:20694329. http://dx.doi.org/10.1590/S1413-81232010000400021.

10. Oliveira NL, Sousa RM. Ocorrências de trânsito com motocicleta e sua relação com a mortalidade. Rev Lat Am Enfermagem. 2011;19(2):1-8. PMid:21584389.

11. Soares DFPP, Mathias TA, Silva DW, Andrade SM. Motociclistas de entrega: algumas características dos acidentes de trânsito na região sul do Brasil. Rev Bras Epidemiol. 2011;14(3):435-44. PMid:22069011. http://dx.doi.org/10.1590/S1415-790X2011000300008.

12. Instituto Nacional de Ciência e Tecnologia. Evolução da frota de automóveis e motos no Brasil 2001-2012: relatório 2013 [Internet]. Rio de Janeiro: Coordenação Nacional do Observatório das Metrópoles; 2013 [citado em 2014 out 4]. Disponível em: http://www.observatoriodasmetropoles.net/download/auto_motos2013.pdf

13. Silva DW, Andrade SM, Soares DA, Nunes EFPA, Melchior R. Condições de trabalho e riscos no trânsito urbano na ótica de trabalhadores motociclistas. Physis. 2008;18(2):339-60. http://dx.doi.org/10.1590/S0103-73312008000200008.

14. Oliveira NLB, Sousa RMC. Risco de lesões em motociclistas nas ocorrências de trânsito. Rev Esc Enferm USP. 2012;46(5):1133-40. PMid:23223729. http://dx.doi.org/10.1590/S0080-62342012000500014.

15. Montenegro MMS, Duarte EC, Prado RR, Nascimento AF. Mortalidade de motociclistas em acidentes de transporte no Distrito Federal, 1996 a 2007. Rev Saude Publica. 2011;45(3):529-38. PMid:21552757. http://dx.doi.org/10.1590/S0034-89102011000300011.

16. Souza MFM, Malta DC, Conceição GMS, Silva MM, Carvalho CG, Morais No OL. Análise descritiva e de tendência de acidentes de transporte terrestre para políticas sociais no Brasil. Epidemiol Serv Saúde. 2007;16(1):33-44.

17. Moura IMS. Perfil dos pacientes vítimas de acidentes de trânsito assistidos em um hospital do Agreste de Pernambuco [monografia]. Recife: Departamento de Saúde Coletiva, Centro de Pesquisas Aggeu Magalhães, Fundação Oswaldo Cruz; 2010.

18. Bastos YGL, Andrade SM, Soares DA. Características dos acidentes de trânsito e das vítimas atendidas em serviço pré-hospitalar em cidade do Sul do Brasil, 1997/2000. Cad Saude Publica. 2005;21(3):815-22. PMid:15868039. http://dx.doi.org/10.1590/S0102-311X2005000300015.

19. Vasconcellos EA. O custo social da motocicleta no Brasil. Rev. Transp. Público. 2008;30(2):127-42.

20. Reichenheim ME, Souza ER, Moraes CL, Jorge MHPM, Silva CMFP, Minayo MCS. Violência e lesões no Brasil: efeitos, avanços alcançados e desafios futuros. Lancet. 2011;6736(11):75-89.

21. Martins CC. Análise descritiva das internações por acidentes de trânsito no Sistema Único de Saúde no Brasil entre 2001 e 2010 [monografia]. Florianópolis: Universidade Federal de Santa Catarina; 2011.

22. Chavaglia SRR, Amaral SEM, Barbosa MH, Bittar DB, Ferreira PM. Vítimas de trauma por causas externas na cidade de Uberaba-MG. Mundo Saúde. 2008;32(1):100-6.

23. Golias ARC, Caetano R, Vianna CMM. Caracterização e custos de acidentes de motocicleta com vítimas atendidas em regime de hospitalização no município de Paranavaí-PR no ano de 2007. Physis. 2013;23(4):1123-46. http://dx.doi.org/10.1590/S0103-73312013000400006.

24. Brasileiro BF, Vieira JM, Silveira CES. Avaliação de traumatismos faciais por acidentes motociclísticos em Aracaju/SE. Rev Cir Traumatol Buco-Maxilo-Fac. 2010;10(2):97-104.

25. Santos AMR, Moura ME, Nunes BM, Leal CF, Teles JB. Perfil das vítimas de trauma por acidente de moto atendidas em um serviço público de emergência. Cad Saude Publica. 2008;24(8):1927-38. PMid:18709233. http://dx.doi.org/10.1590/S0102-311X2008000800021.

26. Schoeller SD, Bonetti A, Silva GA, Rocha A, Gelbcke FL, Khan, P. Características das vítimas de acidentes motociclísticos atendidas em um centro de reabilitação de referência estadual do sul do Brasil. Acta Fisiatr. 2011;18(3):141-5.

27. Departamento de Informática do SUS. [Internet]. Brasília: DATASUS; 2014 [citado em 2014 nov 4]. Disponível em: http://www.datasus.gov.br

28. Programa das Nações Unidas para o Desenvolvimento. Atlas do Desenvolvimento Humano [Internet]. Brasília: PNUD; 2013 [citado em 2013 nov 16]. Disponível em: http://www.pnud.org.br/

29. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Stat Med. 2000;19(3):335-51. PMid:10649300. http://dx.doi.org/10.1002/(SICI)1097-0258(20000215)19:3<335::AID-SIM336>3.0.CO;2-Z.

30. Mascarenhas MDM, Souto RMCV, Malta DC, Silva MMA, Lima CM, Montenegro MMS. Características de motociclistas envolvidos em acidentes de transporte atendidos em serviços públicos de urgência e emergência. Cien Saude Colet. 2016;21(12):3661-71. http://dx.doi.org/10.1590/1413-812320152112.24332016.

31. Departamento Nacional de Trânsito. Frota de veículos [Internet]. Brasília: Denatran; 2017 [citado em 2017 maio 16]. Disponível em: http://www.denatran.gov.br/ frota.htm

32. Barreto MS, Teston EF, Latorre MRDIO, Mathias TAF, Marcon SS. Mortalidade por acidentes de trânsito e homicídios em Curitiba, Paraná, 1996-2011. Epidemiol. Serv. Saúde. 2016;25(1):95-104.

33. Marín-León L, Belon AP, Barros MB, Almeida SD, Restitutti MC. Tendência dos acidentes de trânsito em Campinas, São Paulo, Brasil: importância crescente dos motociclistas. Cad Saude Publica. 2012;28(1):39-51. PMid:22267064. http://dx.doi.org/10.1590/S0102-311X2012000100005.

34. Abreu AMM, Jomar RT, Thomaz RGF, Guimarães RM, Lima JMB, Figueiró RFS. Impacto da lei seca na mortalidade por acidentes de trânsito. Rev Enferm UERJ. 2012 Jan-Mar;20(1):21-6.

35. Tomimatsu MFAI, Andrade SM, Soares DA, Mathias TAF, Sapata MPM, Soares DFPP, et al. Qualidade da informação sobre causas externas no Sistema de Informações Hospitalares. Rev Saude Publica. 2009;43(3):413-20. PMid:19347175. http://dx.doi.org/10.1590/S0034-89102009000300004.

36. Waiselfisz JJ. Mapa da Violência 2013: acidentes de trânsito e motocicletas. Rio de Janeiro: CEBELA-FLASCO; 2013.

37. Gawryszewski VP, Koizumi MS, Mello-Jorge MH. As causas externas no Brasil no ano 2000: comparando a mortalidade e a morbidade. Cad Saude Publica. 2004;20(4):995-1003. PMid:15300292. http://dx.doi.org/10.1590/S0102-311X2004000400014.

38. Santana EMC, Nunes MN, Nascimento LFC. Acidentes de trânsito com motociclistas, no Estado de São Paulo (2005-2009): uma abordagem espacial. Hygeia. 2013;9(17):19-28.

39. Barros AJD, Amaral RL, Oliveira MS, Lima SC, Gonçalves EV. Acidentes de trânsito com vítimas: sub-registro, caracterização e letalidade. Cad Saude Publica. 2003;19(4):979-86. PMid:12973564. http://dx.doi.org/10.1590/S0102-311X2003000400021.

40. Andrade SM, Jorge MH. Características das vítimas por acidentes de transporte terrestre em município da Região Sul do Brasil. Rev Saude Publica. 2000;34(2):149-56. PMid:10881150. http://dx.doi.org/10.1590/S0034-89102000000200008.

41. Martins ET, Boing AF, Peres MA. Mortalidade por acidentes de motocicleta no Brasil: análise de tendência temporal, 1996-2009. Rev Saude Publica. 2013;47(5):931-41. PMid:24626498. http://dx.doi.org/10.1590/S0034-8910.2013047004227.

42. Rios PA, Mota EL. Traffic deaths: recent evolution and regional differences in Bahia State, Brazil. Cad Saude Publica. 2013;29(1):131-44. PMid:23370033.

43. Veronese AM, Oliveira DL, Shimitz TS. Caracterização de motociclistas internados no Hospital de Pronto-Socorro de Porto Alegre. Rev Gaucha Enferm. 2006;27(3):379-85. PMid:17263171.

44. Sado MJ, Morais FD, Viana FP. Caracterização das vítimas por acidentes motociclísticos internadas no Hopital de Urgências de Goiânia. Rev Movimenta. 2009;2(2):49-53.

45. Oliveira NLB, Sousa RMC. Fatores associados ao óbito de motociclistas nas ocorrências de trânsito. Rev Esc Enferm USP. 2012;46(6):1379-86. PMid:23380781. http://dx.doi.org/10.1590/S0080-62342012000600014.

46. Rocha GS, Schor N. Acidentes de motocicleta no município de Rio Branco: caracterização e tendências. Cien Saude Colet. 2013;18(3):721-31. PMid:23546199. http://dx.doi.org/10.1590/S1413-81232013000300018.

47. Andrade LM, Lima MA, Silva CHC, Caetano JA. Acidentes de motocicleta: características das vítimas e dos acidentes em hospital de Fortaleza - CE, Brasil. Rev Rene. 2009;10(4):52-9.

48. Pordeus AMJ, Vieira LJES, Almeida PC, Andrade LM, Silva ACG, Lira SVG. Fatores associados à ocorrência do acidente de motocicleta na percepção do motociclista hospitalizado. Rev Bras Promoção Saúde. 2010;23(3):206-12. http://dx.doi.org/10.5020/18061230.2010.p206.

49. Melione LPR, Mello-Jorge MHP. Morbidade hospitalar por causas externas no Município de São José dos Campos, Estado de São Paulo, Brasil. Epidemiol Serv Saúde. 2008;17(3):205-16.

50. Parreira JG, Gregorut F, Perlingeiro JA, Solda SC, Assef JC. Análise comparativa entre as lesões encontradas em motociclistas envolvidos em acidentes de trânsito e vítimas de outros mecanismos de trauma fechado. Rev Assoc Med Bras. 2012;58(1):76-81. PMid:22392320.

51. Trevisol DJ, Bohm RL, Vinholes DB. Perfil epidemiológico dos pacientes vítimas de acidentes de trânsito atendidos no serviço de emergência do Hospital Nossa Senhora da Conceição em Tubarão, Santa Catarina. Sci Med. 2012;22(3):148-52.

52. Robertson LS. Injury epidemiology. New York: Oxford University Press; 1998.

53. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2013;381(9867):628. PMid:23245608. http://dx.doi.org/10.1016/S0140-6736(12)61689-4.

54. Hyder AA, Vecino-Ortiz AI. BRICS: opportunities to improve road safety. Bull World Health Organ. 2014;92(6):423-8. PMid:24940016. http://dx.doi.org/10.2471/BLT.13.132613.

Received on: Feb. 28, 2017
Accepted on: May 30, 2017