DOI: 10.1590/1980-549720190054

ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Traffic accidents among drivers: incidence and differences between motorcyclists and car drivers in population-based study

Acidentes de trânsito com condutores de veículos: incidência e diferenciais entre motociclistas e motoristas em estudo de base populacional

Polianna Alves Andrade Rios[I], Eduardo Luiz Andrade Mota[II], Luciano Nery Ferreira[III], Jefferson Paixão Cardoso[I], Gustavo Jaccoud Santos[III], Tailane Borges Rodrigues[IV]

ABSTRACT: ***Objectives:*** To estimate the incidence of traffic accidents among land vehicle drivers and to verify differences between motorcyclist and car driver accident victims. ***Methods:*** A household survey was conducted in Jequié city, Bahia, Brazil, in 2013, with 1,406 drivers who were selected by cluster sampling strategy. Estimates of the cumulative incidence of traffic accidents were weighted by the sample design and, to compare groups of drivers, incidence rates (IR) and 95% confidence intervals were calculated with Poisson Regression. The Chi-Square test were used with Rao-Scott correction ($p \leq 0.05$) to evaluate differentials of the event between motorcyclists and car driver victims. ***Results:*** Involvement in traffic accidents in the last 12 months before the interview was reported by 10.6% of the drivers. The cumulative incidence was 4.3% for accidents that caused injuries. Motorcyclists had double the risk of being involved in accidents (IR = 2.03; 95%CI 1.40 – 2.94) and higher proportions of injuries ($p < 0.001$), interruption in daily life activities ($p = 0.003$) and use of emergency services ($p = 0.008$). Factors related to time and place of accident were not different between groups. ***Conclusion:*** Higher incidence of traffic accidents and higher proportions of injuries and others repercussions of these events were seen in motorcyclists. These findings reaffirm the vulnerability of this group and explains the different impact that a preventable cause of morbidity and mortality has on each driver group.

Keywords: Traffic accidents. Incidence. Health surveys. Automobile driving.

[I]Health Department II, Universidade Estadual do Sudoeste da Bahia – Jequié (BA), Brazil.
[II]Institute of Collective Health, Universidade Federal da Bahia – Salvador (BA), Brazil.
[III]Health Department I, Universidade Estadual do Sudoeste da Bahia – Jequié (BA), Brazil.
[IV]Universidade Estadual do Sudoeste da Bahia – Jequié (BA), Brazil.

Corresponding author: Polianna Alves Andrade Rios. Health Department II, *Universidade Estadual do Sudoeste da Bahia*. Avenida José Moreira Sobrinho, s/nº, CEP: 45.206-190, Jequié, BA, Brazil. E-mail: polianauesb@yahoo.com.br

Conflict of interest: nada a declarar – **Funding source:** National Council for Scientific and Technological Development (CNPq) (Chamada Universal MCTI/CNPq nº 14/2013 – process nº 484992/2013-9) and Bahia State Research Support Foundation (FAPESB), announcement nº 068/2012 - Agreement- UESB-FAPESB.

RESUMO: ***Objetivos:*** Estimar incidências de acidentes de trânsito entre condutores de veículos a motor e verificar diferenciais do evento entre as vítimas motociclistas e motoristas de automóvel. ***Métodos:*** Foi conduzido um inquérito domiciliar no município de Jequié, Bahia, em 2013, com 1.406 condutores selecionados por amostragem por conglomerado. As estimativas de incidência cumulativa de acidentes de trânsito foram ponderadas pelo desenho amostral e, para comparação entre categorias de condutores, foram estimadas razões de incidência (RI) e intervalos de confiança de 95% (IC95%) com regressão de Poisson. Diferenciais do evento entre vítimas motociclistas e motoristas foram avaliados com teste do χ^2 de Rao-Scott ($p \leq 0,05$). ***Resultados:*** O envolvimento em acidentes de trânsito nos 12 meses anteriores à entrevista foi referido por 10,6% dos condutores. Para acidentes que causaram lesão física, a incidência foi de 4,3%. Motociclistas apresentaram o dobro do risco de envolvimento em acidentes (RI = 2,03; IC95% 1,40 – 2,94) e maiores proporções de lesões ($p < 0,001$), de interrupção de atividades habituais de vida ($p = 0,003$) e de atendimento em serviços de emergência ($p = 0,008$). Fatores relacionados ao tempo e local de ocorrência não se diferenciaram entre grupos. ***Conclusão:*** Maior incidência de acidentes e proporções mais elevadas de lesões e de outras repercussões desses eventos recaíram sobre motociclistas. Tais achados reafirmam a condição de vulnerabilidade desse grupo e explicitam diferentes impactos que uma causa prevenível de morbimortalidade apresenta em cada grupo de condutores.

Palavras-chave: Acidentes de trânsito. Incidência. Inquéritos epidemiológicos. Condução de veículo.

INTRODUCTION

Traffic accidents (TAs) are included in the set of external causes of morbidity and mortality and are one of the most important public health problems worldwide[1]. As events that do not occur at random, TAs affect population groups in different ways, with distribution that varies according to aspects related to people, places and time. Despite the complexity of the phenomenon and the multiplicity of determinants, traffic accidents are preventable[2,3].

Its predominance is expressed by the high number of deaths and injuries that mainly affect the young population, at the peak of productivity, and who reside in areas of greater socioeconomic disadvantage[1]. In addition to the enormous human impact, these events also negatively affect the socioeconomic development of any society, due to health expenditures, social security, material damage and resulting loss of productivity[4].

In the global scenario, Brazil is part of the ten countries that have almost half of the deaths caused by TAs and, therefore, participates in the worldwide initiative called Road Safety in 10 Countries, which aims to reduce morbidity and mortality between 2011 and 2020[5]. The country's inclusion in this program was due to the sustained high rates of deaths and nonfatal injuries due to traffic violence. In 2015, the Ministry of Health recorded 38,651 deaths due to land transport accidents[6] and more than 158,000 hospital admissions in the Unified Health System network[7]. Most of these records refer to automotive vehicle users, a group that showed an increase in mortality and hospitalization rates between

2002 and 2011, mainly due to the contribution of motorcyclists[8]. In relation to the type of TA victim, data from the Violence and Accident Surveillance System (VIVA) show that drivers accounted for approximately 65% of visits to emergency services in 2011 due to traffic accidents in 2011[9].

In Brazil, knowledge on the impact of TA on population health status has traditionally been derived from Ministry of Health information systems such as mortality, hospitalization and VIVA systems. In addition, records of the occurrences are also registered by traffic agencies and road police. However, this variety of data sources does not reveal the true magnitude of people's involvement in these events, as such systems tend to register more serious cases that lead to fatalities or injured victims which cause demands for health care. In order to expand information on TA incidences within the country, the National Household Sample Survey (PNAD) included the topic of TA in the Health Supplement in the 2008 survey[10]. These events were studied again by the National Health Survey (PNS) in 2013 [11].

Thus, there are few studies[10-12] on TAs from primary sources based on population, especially in medium and small sized municipalities; places where various forms of violence, including traffic accidents, have intensified in recent years[13]. For this reason, it is necessary to conduct population surveys in order to contribute to measuring the issue of TAs, giving visibility to cases of minor severity, and enabling the description of these events and their effects on different groups of users of the public roads. Thus, this study aimed to estimate the cumulative incidence of traffic accidents among vehicle drivers in Jequié, Bahia, and to verify differentials between motorcyclists and automobile driver traffic accident victims.

METHODS

Population-based epidemiological study, which derives from a longitudinal research on TA involvement and its repercussions on various aspects of people's lives, conducted in Jequié city, Bahia, between 2013 and 2015. This article used baseline data from the household survey in 2013, when the cohort was formed.

Jequié is located in southwestern Bahia, 365 km from the state capital[14], and is among the 10 most populous cities in Bahia[15]. For 2013, its estimated population was 161,391 inhabitants and had a motorization index of 30.8 vehicles per 100 inhabitants[15,16].

The study population consisted of drivers who reported driving any type of automotive vehicle (motorcycles, scooters, mopeds, automobiles, minivans, trucks and vehicles with more than four wheels). The sample size was estimated to know the incidence of TAs among drivers. The EPI-Info program (version 6.0) was used, considering the following parameters: expected ratio of TA = 9.0%; α = 5.0%; precision = 2.0% and design effect = 2. To define the expected proportion of the outcome, the findings of a health and nutrition survey conducted in Rio Branco, Acre were adopted, in which 7.8% of adults

reported suffering a TA in the last 12 months, as any type of road user[17]. The choice of data from this survey to calculate sample size was due to the fact that it included accidents regardless of how the physical injury occurred; similar to the outcome approach in the present research. As this research focused on the driver population, it was considered pertinent to project the expected frequency to 9.0%. Based on these data, the sample size resulted in 1,572 drivers.

Participants were selected by single-stage cluster sampling, and 35 urban census tracts (CT) were drawn to include the sample. This amount was established based on some criteria attributed by the researchers: after conducting a pilot study, it was found that the fraction of access to the research population represented one third of the households of the CT. Thus, considering such fraction in the average number of households by sector (241 households/CT)[18]; the average density of two adults per household, one of them most likely to be a driver; and the possibility of finding homes without drivers, due to the socioeconomic condition of some regions of the municipality, it was suggested that, on average, 60 households per CT could be included in the study. Thus, 26 CTs were needed for the sample, however some chosen sectors had fewer households than the municipal average, which caused the number to be expanded to 35 sectors. All blocks of CTs were covered and all households were included. All residents who reported being drivers of motorcycles or four-wheel or more vehicles were invited to participate in the survey. The visits were rescheduled for a convenient time for the participant in their homes where it was not possible to conduct the interview during the first attempt. Three attempts was established as the maximum number for scheduling different times, after three failed attempts, the driver was considered as a "non-response".

The following definition was adopted for TA: "every vehicle accident on the public road, which includes any collisions with pedestrian, collisions between vehicles, bicycle, motorcycle accidents and falls on or off buses, truck crashes that occur on streets or roads and may or may not cause injury to people "(adaptation of the concepts of the International Classification of Diseases, 10th revision[19], and the study by Magalhães et al.[12]).

The variables used in this study were:

- Self-reported TA in the last 12 months as a driver at the time of TA. The variable was measured with the question: "Have you had a traffic accident in the last 12 months while driving a vehicle?". From then on, the concept of TA was presented;
- Sociodemographic: gender; age; skin color; marital status; education level; income; occupation;
- Traffic-related: National Driver's License (CNH) and driver type. This last variable derived from the question about the type of vehicle that the participant referred to drive most often and was categorized as: "driver", for those who referred to a car or other four or more wheeled vehicles, and "motorcyclist", for those who referred to motorcycle, scooter or moped;
- TA related: type; number of vehicles involved; place of occurrence and time of day; use of safety equipment; alcohol intake (up to six hours before); work-related

accident; physical injury; affected body region; prehospital and emergency care; hospitalization; interruption of usual activities of life (work, studies, leisure, household chores).

Data analysis was performed using Stata 10.0 software. Cumulative TA incidences were estimated, which were weighted by the svy procedure, which considers the type of sampling used. Weight was considered as the inverse of the product between the probability of inclusion of the cluster (CT) and the response rate in each cluster. To compare the incidences between conductor types, the weighted Poisson simple regression model was employed. The Rao-Scott χ^2 test ($p \leq 0.05$) was used to compare TA proportions according to sociodemographic variables, stratified by driver type, and to compare accident characteristics and their consequences between injured drivers and motorcyclists.

Cumulative incidence was chosen to measure frequency due to the nature of the analyzed event[20].

The project was approved by the Research Ethics Committee of the Public Health Institute of the *Universidade Federal da Bahia* (CAAE 13691013.5.0000.5030, Opinion No. 249,611).

RESULTS

1,407 drivers were interviewed from the sample of 1,572 drivers, and 165 people were not found at home in any of the stipulated attempts to conduct the interview. One participant was excluded from the analysis due to the amount of missing data. Thus, the percentage of sample loss was 10.6% and the final study group consisted of 1,406 people. Among these, 39.0% were motorcyclists.

147 drivers suffered TAs during the last 12 months as an automotive vehicle driver, representing an incidence of 10.6% (for events with or without injury), while 4.3% of participants reported having TA that caused injuries. When stratifying these estimates according to the type of driver, statistically significant differences were observed, with a higher incidence of TAs among motorcyclists, as can be seen in Table 1.

The rates of involvement in TA showed differences according to age categories in both groups. For other characteristics, differences in accident rates were found according to driver type. Among motorcyclists, the incidence of the event was higher for those who do not live with a spouse ($p < 0.001$). Among drivers, involvement in TA was associated with level of education ($p = 0.034$), work occupation ($p = 0.026$) and income ($p = 0.002$), with higher rates for those with higher education (11.4%), who worked (9.5%) and had a higher monthly gross income (12.1%) (Table 2).

Regarding the characteristics of TA, in general, the most frequent type was collisions between cars and motorcycles, an event that accounted for 32.6% of the 147 reported accidents. Second place was occupied by motorcycle crashes (21.8%), a vehicle that was present in 66.7% of the occurrences (data not shown). Table 3 shows other

characteristics and conditions of drivers at the time of the accident. Among motorcyclists, 11.1% reported having had consumed alcohol before the TA, a proportion that did not show statistical difference from that observed for car drivers. Work-related occurrences were also not associated with the type of driver, unlike what was observed for the interruption of usual life activities (p = 0.003), reported by 33.3% of motorcyclists (Table 3).

The proportion of accident victims who suffered physical injuries was 40.1%. Among these, 88.1% were motorcyclists. The most frequent types of injuries were cuts, lacerations and contusions (47.7%), and the extremities of the body were the most affected parts (81.4%) (data not shown). Table 4 presents the frequency of injuries and use of health services by the victims, where there are differences between the types of drivers. The frequency of injuries was higher among motorcyclists (p <0.001), as was attendance at emergency services (p = 0.008).

DISCUSSION

The TAs were addressed in this study through a population-based survey, which is a strategy still little adopted in epidemiological research in this theme in Brazil. The results reaffirm the potential of surveys to produce complementary information for secondary databases, as it made it possible to register minor occurrences and produce knowledge in relation to this serious public health problem.

Although there are few national studies with a similar methodology to this research, similarities were observed with findings from health information systems and other investigations. The cumulative incidence of TAs showed high levels of the event in the

Table 1. Cumulative incidence [a] of traffic accidents over the past 12 months[b] among drivers of vehicles[c], incidence ratios and 95% confidence intervals. Jequié, Bahia, 2013 (n = 1,406).

Traffic Accident	Total		Type of driver				IR[d] (CI95%)
			Car driver		Motorcyclist		
	n	%	n	%	n	%	
As a vehicle driver (with or without physical injury)	147	10.6	66	7.6	81	15.5	2.03 (1.40 – 2.94)
As a vehicle driver with a a physical injury	59	4.3	7	0.7	52	10.0	13.4 (5.57 – 32.50)

[a]Cumulative effects weighted by cluster design; [b]12 months prior to first contact with participant; [c]driver: frequent driver of a vehicle with 4 or more wheels (n = 857); motorcyclist: frequent driver of 2-wheeled vehicle (n = 549); [d]incidence ratios obtained by simple Poisson regression, weighted by the conglomerate sample design, considering driver as the referring category; IR: incidence ratio; 95% CI: 95% confidence interval.

Table 2. Absolute frequencies and proportions of traffic accidents among vehicle drivers [a] according to sociodemographic variables. Jequié, Bahia, 2013 (n = 1,406).

Variables	Car driver				Motorcyclist			
	Total	TA	%	p-value[b]	Total	TA	%	p-value[b]
Gender								
Male	552	47	8.5	0.484	382	59	15.4	0.545
Female	305	19	6.2		167	22	13.2	
Age group (in years)								
16 to 29	130	12	9.2	0.010	237	50	21.1	0.003
30 to 44	287	32	11.1		230	25	10.9	
45 and older	440	22	5.0		82	6	7.3	
Skin color								
White and yellow	294	18	6.1	0.247	163	18	11,0	0.066
Brown and black	563	48	8.5		386	63	16,3	
Married								
Yes	580	42	7.2	0.426	276	26	9.4	< 0.001
No	277	24	8.6		273	55	20.1	
Education level								
Third level	236	27	11.4	0.034	62	10	16.1	0.560
High school	387	24	6.2		333	46	13.8	
Primary school	234	15	6.4		154	25	16.2	
Employed								
Yes	514	49	9.5	0.026	376	49	13.0	0.141
No	343	17	4.9		173	32	18.5	
Driver´s license								
Yes	782	59	7.5	0.531	381	52	13.6	0.519
No	75	7	9.3		168	29	17.3	
Monthly income								
< R$ 680	93	5	5.4	0.002	102	17	16.7	0.657
R$ 680 to R$ 2 mil	366	17	4.6		310	45	14.5	
> R$ 2 mil	306	37	121		53	6	11.3	

[a]Driver: driver of a vehicle of 4 or more wheels; motorcyclist: 2-wheeled vehicle driver; [b]χ^2 test with correction Rao & Scott; [c]n = 1,230 due to missing data for this variable; TA: traffic accidents; CNH: National Driver's License

Table 3. Absolute and relative frequencies of traffic accident characteristics and conditions of vehicle drivers who have been victims of accidents (with or without physical injury). Jequié, Bahia, 2013 (n = 147).

Variables	Car driver (n = 66)		Motorcyclist (n = 81)		p-value[b]
	n	%	n	%	
Number of vehicles involved					
1 vehicle	16	24.2	32	39.5	0.079
2 or more vehicle	50	75.8	49	60.5	
Place of accident					
Urban area	51	77.3	71	87.6	0.129
Highway	15	22.7	10	12.4	
Day of occurrence					
Working day	45	68.2	51	63.0	0.742
Weekend/holiday	21	31.8	30	37.0	
Time of occurrence					
Morning and afternoon	46	69.7	56	69.1	0.987
Night	20	30.3	25	30.9	
Use of safety equipment					
Yes	38	59.4	78	963	–[c]
No	26	40.6	3	3.7	
Alcohol consumption (up to 6 hours before)					
Yes	6	9.1	9	11.1	0.596
No	60	90.9	72	88.9	
Work related accident					
Yes	24	36.4	39	48.1	0.138
No	42	63.6	42	51.8	
Interruption of day-today activities					
Yes	8	12.1	27	33.3	0.003
No	58	87.9	54	66.7	

[a]Driver: driver of a 4 or more wheeled vehicle; motorcyclist: 2-wheeled vehicle driver; [b]χ^2 test with correction Rao & Scott correction; [c]No statistical test was performed due to the absence or reduced number of observations in some categories.

driver population, reaffirming the increasing victimization of this group in the country, as they corresponded to the majority of victims of traffic accidents attended in emergency departments since 2011[9], as well as in the results of national surveys conducted in 2008[10]and 2013[21].

The estimated overall incidence for the occurrence of physical injuries was higher than the national frequency reported by PNAD 2008 (2.5%)[10] and PNS (3.1%)[11], whose results include all road users. It should be mentioned that involvement in TA regardless of physical injuries was not the object of the above-mentioned surveys, suggesting a persistent lack of knowledge about milder events, which, although not causing serious injury, can lead to repercussions of another nature.

Incidences stratified by type of driver highlight the situation of motorcyclists having the highest levels of victimization, corroborating differences observed nationwide[21], where motorcycles have been protagonists of the accident epidemic. This seems to be a contemporary problem shared by other middle-income countries[22,23], which show higher risks of accidents for motorcyclists. A study conducted in India found a high incidence (26.4%) of TAs, with or without injury, among motorcyclists [22]. This country is, together with Brazil, the group of ten nations involved in the global initiative to reduce traffic-related injuries[5]. In Iran, the cumulative incidence of AT with injury to motorcyclists was 9.5%, compared with 1.0% among car drivers[23].

The higher risks of TAs sustained by motorcycle drivers are due to a set of factors, among which risky driving behaviors in traffic can be highlighted, which is largely made up of young people with less driving experience[23]. As crucial as this is, the lack

Table 4. Absolute and relative frequency of injuries and use of health services by vehicle drivers who were victims of traffic accidents (with or without physical injury). Jequié, Bahia, 2013 (n = 147).

Variables	Car driver (n = 66)		Motorcyclist (n = 81)		p-value[b]
	n	%	n	%	
Physical injury					
Yes	7	10.6	52	64.2	< 0.001
Prehospital Care					
Yes	5	7.6	12	14.8	0.113
Emergency Service Assistance					
Yes	9	13.6	28	34.6	0.008

[a]Driver: driver of a vehicle of 4 or more wheeled vehicle; motorcyclist: 2-wheeled vehicle driver; [b]χ^2 test with Rao & Scott correction; by the Mobile Emergency Response Service (SAMU) or Fire Department.

of investment in road infrastructure capable of protecting the most vulnerable road users, since, historically, traffic has been a space that favors the car over other users, placed citizens lower in this environment[4], thus contributing to increased tensions between these groups.

Thus, new demands for road safety are imposed when other means of individual mobility, such as motorcycles, are consolidated as affordable transport alternatives for a large part of the population, especially in smaller cities. Indeed, the Brazilian Association of Manufacturers of Motorcycles, Mopeds, Scooters, Bicycles etc., emphasizes that the advancement of consumption of this type of vehicle in the interior regions was due to the versatility of its use, supplying diverse needs in less favored regions[24].

The largest victimization of motorcycle occupants in Jequié has in its genesis determinants related to urban mobility issues, such as the exorbitant increase of the motorcycle fleet that, since 2007, surpasses the number of cars and other vehicles together, reaching 50.3% of the total fleet in 2013[16]. Thus, the vehicle meets the transport demands of the population and as a working tool. It is believed that such determinants are also shared by other medium-sized municipalities in the country, which highlights the worrying situation of motorcycle users in these locations and the possible neglect of safety issues in roadways outside major urban centers.

It was noted that the event occurred without distinction between men and women, a result that surprised the authors. The lack of association between TA occurrence and gender differs from much of the literature in the area, which highlights men as having the highest risk of accidents[1,11,25]. However, with the intense motorization over the years, there is a growing participation of women as vehicle and, more recently, as motorcyclists. In 2005, 19% of sales of this vehicle were destined to females, a share that reached 25% in 2015. That same year, among the total of women in the country with a driver´s license, 28.2% had a license that allowed them to drive this type of vehicle[24]. This exposes women more to traffic and may contribute to reducing differences in TA frequency between the sexes. Regarding age, the findings were consistent with the scientific literature[21,25].

Regarding other sociodemographic characteristics, it was found that the event varied according to the type of driver, suggesting a different pattern of involvement according to the category of road user. With regard to drivers, TAs were more frequent among people with higher education and higher monthly income. For this last variable, although there was no association with TAs among motorcyclists, it was observed that the proportions of involvement in accidents increased as income levels decreased. This inverse relationship was also noted for the education level. Thus, there are indications that despite being part of a vulnerable group in traffic, victimization can be even higher among those with worse socioeconomic status.

Regarding the circumstances of TA, the reference to illegal behavior in traffic is highlighted, such as driving after drinking alcohol. The proportion of this conduct among motorcyclists was noteworthy, as it reveals an excessively risky relationship in traffic due to

the vulnerable nature of this vehicle. Indeed, data from VIVA 2014[26] show that 13.3% of motorcyclists involved in TAs had consumed alcohol.

As for the consequences of TA, differences were observed that reveal a greater impact of accidents in motorcyclists, causing this group to interrupt their usual activities, sustain more bodily injuries and use the health services more. Such situation is consistent with the vulnerable condition of the motorcyclist, which, due to the greater exposure of the body, presents a higher risk of serious injury and death compared to car occupants, which are better protected by devices and barriers available in this type of vehicle[27]. Consequently, motorcyclists end up generating considerable demand for health services, from prehospital to rehabilitation, leading to productivity loss and high socioeconomic costs[2].

Regarding the limitations of the study, survival bias resulting from cross-sectional and self-reported studies on illegal conduct are cited. In addition, it was not possible to reach the sample size, as some drivers were not found after all the stipulated attempts to apply the interview, and no additional value calculation was foreseen for the sample. However, it is believed that the losses did not negatively impact the power of the analyzes, since much of the results were consistent with data from the country's information systems and the literature cited.

CONCLUSION

The study allowed to estimate incidences of a serious public health problem in the country and revealed differences in the event between groups of drivers. In conclusion, young motorcyclists are relatively socially vulnerable, and present high risks of TAs in a medium-sized urban center in Bahia, sustaining physical injuries and causing demands for health services. Public TA prevention policies may contain what has become a true epidemic of road traffic injuries and deaths in Brazil, especially in medium and small municipalities, with little or no investment in the road system. Special attention should be directed to the protection of the most vulnerable in this system, with planned road infrastructure based on the characteristics and needs that enable safe travel; in addition to strengthening educational and enforcement measures regarding traffic.

ACKNOWLEDGMENTS

We would like to thank the National Council for Scientific and Technological Development (CNPq) for the financial support (Universal Call MCTI/CNPq No. 14/2013); the Bahia State Research Support Foundation (FAPESB), the announcement that allowed the participation of scientific initiation scholars in the project (nº BOL2817 / 2015); the Public Health Institute, Universidade Federal da Bahia, and the Universidade Estadual do Sudoeste da Bahia for the institutional support.

REFERENCES

1. World Health Organization. Global status report on road safety: time for action. Genebra: World Health Organization; 2009.
2. World Health Organization. Global status report on road safety 2013: supporting a decade of action. Genebra: World Health Organization; 2013.
3. Bonilla-Escobar FJ, Gutiérrez MI. Injuries are not accidents: towards a culture of prevention. Colomb Méd (Cali) 2014; 45(3): 132-5.
4. Vasconcellos EA. Políticas de Transporte no Brasil: a construção da mobilidade excludente. Barueri: Manole; 2013.
5. Peden M. Road safety in 10 countries. Inj Prev 2010; 16(6): 433. https://doi.org/10.1136/ip.2010.030155
6. Brasil. Sistema de Informações sobre Mortalidade [Internet]. Brasília: CGIAE/Secretaria de Vigilância em Saúde-SVS [acessado em 3 mar. 2017]. Disponível em: http://www2.datasus.gov.br/DATASUS/index.php?area=0205
7. Brasil. Sistema de Informação Hospitalar [Internet]. Brasília: CGIAE/Secretaria de Vigilância em Saúde-SVS [acessado em 20 mar. 2017]. Disponível em: http://www2.datasus.gov.br/DATASUS/index.php?area=0203
8. Bahia CA, Malta DC, Mascarenhas MDM, Montenegro MMS, Silva MMA, Monteiro RA. Acidentes de transporte terrestre no Brasil: mortalidade, internação hospitalar e fatores de risco no período 2002-2012. In: Brasil, editor. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise de Situação em Saúde. Saúde Brasil 2012: uma análise da situação de saúde e dos 40 anos do Programa Nacional de Imunizações. Brasília: Ministério da Saúde; 2013. p. 299-326.
9. Brasil. Sistema de Vigilância de Violências e Acidentes [Internet]. Brasília: CGIAE/Secretaria de Vigilância em Saúde-SVS; 2011 [acessado em 25 set. 2015]. Disponível em: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?viva/2011/viva11p.def
10. Malta DC, Mascarenhas MDM, Bernal RTI, Silva MMA, Pereira CA, Minayo MCS, et al. Análise das ocorrências das lesões no trânsito e fatores relacionados segundo resultados da Pesquisa Nacional por Amostra de Domicílios (PNAD) - Brasil, 2008. Ciênc Saúde Coletiva 2011; 16(9): 3679-87. http://dx.doi.org/10.1590/S1413-81232011001000005
11. Malta DC, Andrade SSCA, Gomes N, Silva MMA, Morais Neto OL, Reis AAC, et al. Lesões no trânsito e uso de equipamento de proteção na população brasileira, segundo estudo de base populacional. Ciênc Saúde Coletiva 2016; 21(2): 399-410. http://dx.doi.org/10.1590/1413-81232015212.23742015
12. Magalhães AF, Lopes CM, Koifman RJ, Muniz PT. Prevalência de acidentes de trânsito auto-referidos em Rio Branco, Acre. Rev Saúde Pública 2011; 45(4): 738-44. http://dx.doi.org/10.1590/S0034-89102011005000031
13. Morais Neto OL, Montenegro MMS, Monteiro RA, Siqueira Júnior JB, Silva MMA, Lima CM, et al. Mortalidade por Acidentes de Transporte Terrestre no Brasil na última década: tendência e aglomerados de risco. Ciênc Saúde Coletiva 2012; 17(9): 2223-36. http://dx.doi.org/10.1590/S1413-81232012000900002
14. Bahia. Superintendência de Estudos Econômicos e Sociais da Bahia. Regiões Econômicas do Estado da Bahia. Bahia: Superintendência de Estudos Econômicos e Sociais da Bahia; 2015 [acessado em 20 nov. 2015]. Disponível em: http://www.sei.ba.gov.br/site/geoambientais/mapas/pdf/regioes_economicas_2015.pdf
15. Brasil. Instituto Brasileiro de Geografia e Estatística. Estimativas populacionais [Internet]. Brasil: Instituto Brasileiro de Geografia e Estatística [acessado em 29 jul. 2014]. Disponível em: http://www.ibge.gov.br/home/estatistica/populacao/estimativa2013/estimativa_dou.shtm
16. Brasil. Departamento Nacional de Trânsito. Frota de veículos [Internet]. Brasil: Departamento Nacional de Trânsito [acessado em 1º jun. 2014]. Disponível em: http://www.denatran.gov.br/frota.htm
17. Magalhães AF, Lopes CM, Koifman RJ, Muniz PT. Caracterização dos acidentes de trânsito auto-referidos, em inquérito de base populacional, Rio Branco, Acre, 2008. In: Magalhães AF. Prevalência dos acidentes de trânsito auto-referidos em Rio Branco-Acre [dissertação]. Rio Branco: Universidade Federal do Acre; 2009. p. 54-79.
18. Brasil. Instituto Brasileiro de Geografia e Estatística. Resultados do Censo 2010 [Internet]. Brasil: Instituto Brasileiro de Geografia e Estatística [acessado em 9 jan. 2013]. Disponível em: http://www.censo2010.ibge.gov.br/
19. Organização Mundial da Saúde. Classificação Estatística Internacional de Doenças e Problemas relacionados à Saúde [Internet]. 10ª revisão. Genebra: Organização Mundial da Saúde; 2008 [acessado em 6 out. 2012]. Disponível em: http://www.datasus.gov.br/cid10/V2008/cid10.htm
20. Santana VS, Cunha S. Estudos Transversais. In: Almeida Filho N, Barreto ML, editores. Epidemiologia e Saúde: fundamentos, métodos, aplicações. Rio de Janeiro: Guanabara Koogan; 2011. p. 186-93.

21. Brasil. Sistema de Informações em Saúde. Pesquisa Nacional de Saúde 2013. Módulo de acidentes e violências - trânsito e trabalho [Internet]. Brasília: CGIAE/Secretaria de Vigilância em Saúde-SVS [acessado em 25 jan. 2016]. Disponível em: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?pns/pnsoa.def
22. Dandona R, Kumar GA, Raj TS, Dandona L. Patterns of road traffic injuries in a vulnerable population in Hyderabad, India. Inj Prev 2006; 12(3): 183-8. https://dx.doi.org/10.1136%2Fip.2005.010728
23. Saadat S, Soori H. Epidemiology of traffic injuries and motor vehicles utilization in the Capital of Iran: A population based study. BMC Public Health 2011; 11: 488. https://doi.org/10.1186/1471-2458-11-488
24. Associação Brasileira dos Fabricantes de Motocicletas, Ciclomotores, Motonetas, Bicicletas e Similares. Anuário da Indústria Brasileira de Duas Rodas [Internet]. Brasil: Associação Brasileira dos Fabricantes de Motocicletas, Ciclomotores, Motonetas, Bicicletas e Similares; 2016 [acessado em 23 jan. 2017]. Disponível em: http://www.abraciclo.com.br
25. Seerig LM, Bacchieri G, Nascimento GG, Barros AJD, Demarco FF. Use of motorcycle em Brazil: users profile, prevalence of use and traffic accidents occurrence – a population-based study. Ciênc Saúde Coletiva 2016; 21(12): 3703-10. http://dx.doi.org/10.1590/1413-812320152112.28212015
26. 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. Ciênc Saúde Coletiva 2016; 21(12): 3661-71. http://dx.doi.org/10.1590/1413-812320152112.24332016
27. Keall MD, Newstead S. Analysis of factors that increase motorcycle rider risk compared to car driver risk. Accid Anal Prev 2012; 49: 23-9. http://dx.doi.org/10.1016/j.aap.2011.07.001

Received on: 07/04/2018
Revised on: 08/28/2018
Accepted on: 09/27/2018

Authors' Contributions: P.A.A. Rios participated in the project design, data collection, analysis and interpretation, writing of all versions of the article and approval of the final writing. SHE. Mota participated in the project design, data interpretation, review of all versions of the article and approval of the final draft. L.N. Ferreira participated in the project design, data collection and interpretation, critical review of the content and approval of the final wording. J.P. Cardoso participated in the project design, data collection and interpretation, critical review of the content and approval of the final wording. G.J. Santos participated in the data collection and interpretation, critical review of the content and approval of the final wording. T. B. Rodrigues participated in the data collection and interpretation, critical review of the content and approval of the final wording.