

## Analysis of the causes of auto accidents on federal highways in Bahia between 2014 and 2017

### *Análise das causas dos acidentes automobilísticos nas rodovias federais da Bahia entre 2014 e 2017*

Lucas de Abreu Ribeiro<sup>1</sup>, João Luis Pimentel<sup>1</sup>, Helton Ribeiro<sup>1</sup>, Márcia Lopes Hostalácio  
Benedito<sup>2</sup>, Karina Luiza Pereira Ribeiro<sup>3</sup>

Ribeiro LA, Pimentel JL, Ribeiro H, Benedito MLH, Ribeiro KLP. Analysis of the causes of auto accidents on federal highways in Bahia between 2014 and 2017 / *Análise das causas dos acidentes automobilísticos nas rodovias federais da Bahia entre 2014 e 2017*. Rev Med (São Paulo). 2020 Jan-Feb;99(1):27-34.

**ABSTRACT:** Estimates indicate that millions of people die each year due to traffic accidents. Because it is such a serious matter that is often overlooked by the political authorities, this study aimed to analyze the main causes of traffic accidents on federal highways in Bahia, considered one of the most violent regions when it comes to traffic. As research material was analyzed the accident report produced by the Regional Superintendent of Bahia Federal Highway Police in the 2014 period and 2017. The data were tabulated in the statistical software SPSS and analyzed later. The causes were grouped into similar categories. The results show that although the number of accidents in 2017 have reduced compared to the years 2014 and 2015, accidents have become more serious in the region and were associated with a higher percentage of deaths. The data also indicate that the events that had occurred the consumption of alcohol or psychotropic substances are more severe and produce a greater number of deaths. Considering the categories presented, the “reckless actions of the driver” was the main cause of accidents on federal highways in Bahia in the analyzed period, mainly due to the violation of traffic laws.

**Keywords:** Public Health; Traffic-Accidents; Mortality.

**RESUMO:** Estimativas indicam que milhões de pessoas morrem por ano em decorrência de acidentes de trânsito. Por se tratar de um assunto tão sério que, muitas vezes é negligenciado pelas autoridades políticas, o presente estudo teve como objetivo analisar as principais causas dos acidentes automobilísticos nas rodovias federais da Bahia, considerada uma das regiões mais violentas quando o assunto é trânsito. Como material de investigação foi analisado o relatório de acidentes produzido pela Superintendência Regional da Bahia da Polícia Rodoviária Federal no período de 2014 e 2017. Os dados foram tabulados no Software Estatístico SPSS e analisados posteriormente. As causas foram agrupadas em categorias semelhantes. Os resultados mostram que, apesar do número de acidentes em 2017 ter reduzido quando comparado aos anos de 2014 e 2015, os acidentes tornaram-se mais graves na região e estiveram associados com uma maior porcentagem de óbitos. Os dados também indicam que os eventos em que havia ocorrido o consumo de álcool ou de substâncias psicotrópicas são mais graves e produzem um número maior de óbitos. Considerando as categorias apresentadas, a “atitudes imprudentes do condutor” foi a principal causa dos acidentes nas rodovias federais da Bahia no período analisado, principalmente, em decorrência do desrespeito às leis de trânsito.

**Descritores:** Saúde Pública; Acidentes de Trânsito; Mortalidade.

1. Specialist Doctor in Traffic Medicine, Medical and Psychological Clinic São João, Lavras, MG. ORCID: Ribeiro LA - <https://orcid.org/0000-0003-1757-4847>; Pimentel JL - <https://orcid.org/0000-0001-7220-1790>; Ribeiro H. <http://orcid.org/0000-0002-2298-3226>. Email: [lavraslucas@hotmail.com](mailto:lavraslucas@hotmail.com), [joao.pimentel@yahoo.com.br](mailto:joao.pimentel@yahoo.com.br), [heltonribeirolavras@gmail.com](mailto:heltonribeirolavras@gmail.com).
2. Psychologist, Specialist in Traffic Medicine, Medical and Psychological Clinic São João, Lavras, MG. ORCID: Benedito MLH- <https://orcid.org/0000-0003-4421-3430>. Email: [psiqlh@gmail.com](mailto:psiqlh@gmail.com).
3. Medical Student, University of Iguaçu- UNIG, São João Medical and Psychological Clinic, Lavras, MG. ORCID: <https://orcid.org/0000-0003-4314-6440>. Email: [ribeiro.pereira.karina@hotmail.com](mailto:ribeiro.pereira.karina@hotmail.com).

**Correspondence:** Lucas de Abreu Ribeiro. Via San Michelle, 245. Belvedere, Condomínio Província de Lucca. Lavras, MG. CEP: 37200-000. E-mail: [lavraslucas@hotmail.com](mailto:lavraslucas@hotmail.com)

## INTRODUCTION

According to the World Health Organization (WHO) estimates 1.2 million people are killed in traffic accidents which not only affect whole families but also charge the country's health systems<sup>1</sup>. Such events have a great impact on Brazil, a country with the most violent traffic in the world.

According to the Mortality Information System of the National Health Service Data Department of the Ministry of Health, 1.756.000 deaths related to external causes were entered between 2012 and 2013. From these, 490.000, i.e. 27.9% were related to land traffic accidents. The land traffic accident mortality rate is 21.5 deaths per 100.000 inhabitants<sup>2</sup>. This concern-causing picture has been worsened in the last years. Analyses show that the number of traffic-accident-caused deaths increased from 28.885 to 42.266 (46.32%) between the years 2000 and 2013<sup>3</sup>. Furthermore, between 2002 and 2011 around 15% of the people taken to public hospitals in Brazil were injured in traffic accidents<sup>4</sup>. Costs as high as R\$40 billion and R\$10 billion have been estimated for road and urban accidents respectively<sup>5</sup>.

In order to both prevent and minimize the car accidents effects, new policies on traffic education, legislation and management improvements, as well as on accidents records and analyses should be adopted.

Actions intended to either prevent or minimize the traffic accidents consequences shall rely on the characterization of each region and on the outline of the occurrences, grounded on encompassing and circumstance-focused records. If it is designed during a long and encompassing period, this profile can help both describe the evolution and characterize the victims of these events, thus enabling the public power to both adopt and reorient actions intended to attack such occurrences and minimize their consequences as well.

## MATERIAL AND METHODS

The data source for this research work was the "Report of Accidents Involving Types of Collisions among Vehicles" produced by the Bahia Regional Superintendence of the Federal Highway Police (PRF). They grounded on records filed every six months at Bahia federal highways from January, 2014 to July 2017.

In this report were recorded the name of the municipality, the type of vehicle, the causes of the accidents, the date (month and week day), the time, and the severity of the injuries. In order to deep the analyses this work focused on evaluating the causes of those accidents.

Data were descriptively analysed and tabulated by using the IBM SPSS Statistics, 22.0.0.0 version.

## RESULTS

Bahia State is crossed by 24 Federal Roads or BRs (020, 030, 101, 110, 116, 122, 135, 242, 251, 324, 330, 342, 349, 367, 407, 410, 415, 418, 420, 423, 430, 489, 498), which extend for 8866kms, according to the "21st Highways CNT Research" conducted in 2017 by the Federal Transportation Confederation<sup>6</sup>. According to this work, only 35.2% of those roads are appropriately preserved, whereas 28.8% were found to be in bad conditions<sup>6</sup>.

During the study (from January 2014 to June 2017, 1276 days, 182 weeks and 2 days) 25.628 reports on accidents on Bahia federal roads (Figure 1) were recorded, totaling around 20.08 occurrences per assessed day, or around 140.81 accidents a week, in average, on the 24 federal roads in Bahia.

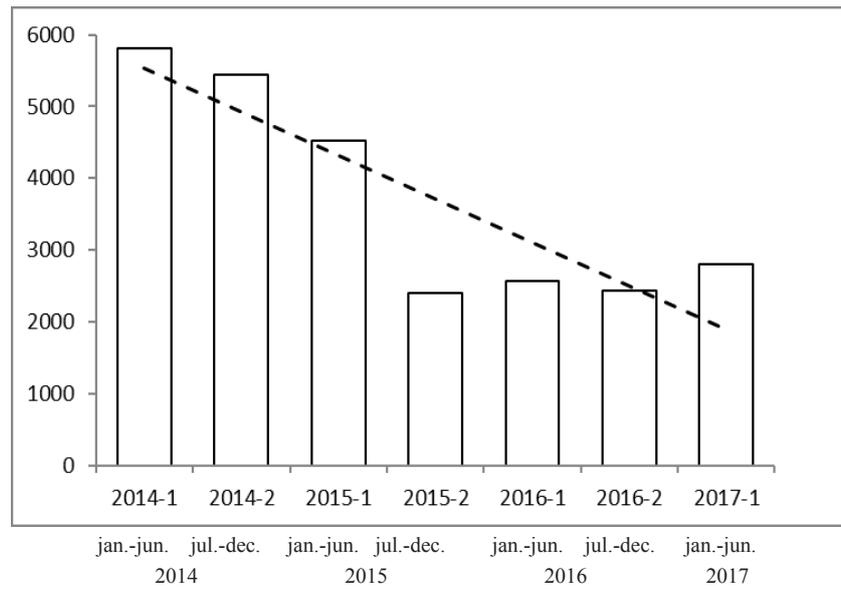
Although the number of occurrences was significantly high, it tended to decrease in the region during this study ( $P < 0.05$ ). This way, the highest numbers were noticed during the first six months of 2014, and the lowest from the beginning of 2015 ( $P < 0.05$ ). From the mid 2015 a 56.32% decrease was noticed in the occurrences numbers when compared to means of the values observed in 2014. In spite of this, the total of accidents occurred in the first six months of 2015 did not change ( $P < 0.05$ ; Figure 1).

Such accidents resulted in 7809 minor injuries. However, 3058 serious accidents resulted in 2887 severe injuries and 1541 deaths.

Several reasons were mentioned for the observed accidents (Table 1).

"Defects in the cars" such as mechanical problems, vehicle light system deficiency and tire breakdowns, which only accounted for 1.87% of accidents (Table 1). The influence of "natural phenomena" such as weather conditions, slippery track due to rain and low visibility related to fog and fog also had little impact (0.4%) on the occurrence of accidents (Table 1). The same can be said for the category "road defects" such as fixed obstacles, potholes, wear, poorly designed curves, which were considered as reasons for the occurrence of few car accidents (0.67%; Table 1).

Finally, the group "others" outstood the evaluated factors. It involves either multiple causes or those difficult to be defined, and has reached higher values (21.66% Table 1). The category "pedestrians and drivers' careless attitudes", which is part of this group, is responsible for 75.79% of the accidents filed (Table 1).



SOURCE: “Accident Report Involving Types of Collisions Between Vehicles” by the Bahia Regional Superintendent of the Federal Highway Police.

**Figure 1-** Total of semi-annual car accidents registered on the federal highways of the state of Bahia between January 2014 and July 2017

**Table 1.** Contribution and percentage representation of the different causes associated with car accidents registered in the state of Bahia between January 2014 and July 2017

	2014		2015		2016		2017		TOTAL							
	jan.-jun.	jul.-dec.	jan.-jun.	jul.-dec.	jan.-jun.	jul.-dec.	jan.-jul.									
<b>Pedestrians and drivers' careless attitudes</b>	4386	43,00	4044	42,62	3344	42,55	1779	42,62	1843	41,77	1759	41,97	2526	47,47	<b>19681</b>	43,12
Lack of attention	2146	21,04	1902	20,04	1654	21,05	829	19,86	920	20,85	869	20,73	1258	23,64	<b>9578</b>	20,98
Do not keep safety distance	1126	11,04	1000	10,54	796	10,13	257	6,16	251	5,69	248	5,92	304	5,71	<b>3982</b>	8,72
Improper overtaking	337	3,30	349	3,68	248	3,16	187	4,48	179	4,06	158	3,77	222	4,17	<b>1680</b>	3,68
Disobedience to signaling	355	3,48	288	3,04	237	3,02	162	3,88	167	3,79	131	3,13	198	3,72	<b>1538</b>	3,37
Alcohol Intake/Psychoactive Substances	170	1,67	217	2,29	175	2,23	164	3,93	170	3,85	167	3,98	187	3,51	<b>1250</b>	2,74
Incompatible speed	169	1,66	206	2,17	141	1,79	114	2,73	118	2,67	125	2,98	232	4,36	<b>1105</b>	2,42
Sleeping	83	0,81	82	0,86	93	1,18	66	1,58	38	0,86	61	1,46	105	1,97	<b>528</b>	1,16
Pedestrian Inattention	-	-	-	-	-	-	-	-	-	-	-	-	11	0,21	<b>11</b>	0,02
Badly Packed Cargo	-	-	-	-	-	-	-	-	-	-	-	-	9	0,17	<b>9</b>	0,02
<b>Others</b>	1306	12,80	1287	13,56	1069	13,60	570	13,66	660	14,96	601	14,34	132	2,48	<b>5625</b>	12,32
<b>Defects in the car</b>	89	0,87	89	0,94	77	0,98	36	0,86	43	0,97	65	1,55	87	1,64	<b>486</b>	1,06
<b>Road defects</b>	34	0,33	25	0,26	25	0,32	10	0,24	23	0,52	7	0,17	50	0,94	<b>174</b>	0,38
<b>Total</b>	<b>10201</b>	<b>9489</b>	<b>7859</b>	<b>4174</b>	<b>4412</b>	<b>4191</b>	<b>5321</b>	<b>45647</b>								

SOURCE: “Accident Report Involving Types of Collisions Between Vehicles” by the Bahia Regional Superintendent of the Federal Highway Police.

Because they are associated to about three fourths of the studied events, this last category requires a more detailed analysis. The item “lack of attention” is the principal factor, in this category as it was the cause of 48.66% of the accidents. It is followed by “reckless driving”, involving “do not keep safe distance”, which is associated to 20.23% of the car accidents studied in this work, “improper overtaking” (8.53%) “disobedience to the road signs” (7.81%). The accidents caused by the items “alcohol intake/psychoactive substances” and “incompatible speed” were responsible for 6.31% and 5.61% respectively of the events studied.

## DISCUSSION

In a quarter of a century, the evaluation results of the mortality rate associated to traffic accidents in Bahia showed a 22.2% decrease – from 32.4 deaths per 100.000 inhabitants in 1990 (28.7 for women and 36.2 for men) to 25.2 (21,0 – 31,2) in 2015<sup>7</sup>. In spite of this decrease, the traffic accidents prevalence in the region is still higher than those found for the South and the Southeast regions in Brazil, and definitely high when compared with the whole world<sup>8</sup>.

A significant decrease ( $P < 0.05$ ) of 56.32% was noticed on the records done between the beginning of the analyses (2014 and 2015) and the end of the sampled period (PRF 2017). However, the same decrease trend was not noticed between the last six months in 2015 and the first semester in 2017, which showed similar values for car accidents ( $P < 0.05$ ).

According to a balance performed by the Federal Road Police (PRF) in 2017, despite the countrywide increase – almost 3 million vehicles (11,6%) - in the circulating fleet from 2016 to 2017, there was a 7.5% decrease in the number of accidents, followed by a decrease in the number of deaths (2.7%), injuries (3.5%), and severe injuries (13.8%) on federal roads (PRF, 2017) compared to 2016<sup>52</sup>.

A survey performed by the Federal Road Police (PRF) in 2017 shows that 89.318 accidents occurred on federal roads, which resulted in 6.244 deaths and 83.978 injuries. Such values are lower than those found for 2016, when 96.590 accidents, 6.419 deaths and 87.006 injuries were recorded. However, regarding Bahia federal roads 4.662 accidents occurred in 2017. This value is as high as that recorded in 2014 and 2016, but 32.5% lower to those found for 2015 ( $P < 0.005$ ) the year when the most records in this research<sup>52</sup>.

The traffic education campaigns, the reinforcement in policing and enforcement and the investment in federal highways mentioned in the PRF report unfortunately had little effect in Bahia<sup>52</sup>. A study conducted in 2015 evaluated the critical sections for traffic accidents on Bahia state highways and their authors observed that only

between 2010 and 2013 there were 27952 traffic accidents, registered by the State Highway Police, with 14603 injuries and 1579 deaths<sup>43</sup>.

Record numbers in the current study may even be higher due to underreporting, a common trend in less serious accidents. Some authors have shown, when investigating traffic accidents recorded in police reports and emergency room records that about 39% of accidents are not registered by the police authority<sup>55</sup>.

It should also be considered that, although it is common to indicate a particular causal factor of traffic accident, a large proportion of these events are associated with multiple causes involving drivers, vehicles, the road and the environment<sup>30</sup>.

Traffic accidents are in many cases complex events. In this sense, such an occurrence may be associated, for example, with the following picture: it involves a car that travels on a rainy night on a poorly signposted road full of potholes. This car is at an incompatible speed and, when attempting an undue overtaking, cannot deviate from another vehicle. The latter, in turn, is driven by a drunk driver who therefore has difficulty avoiding a collision. Thus, the indication of a single cause can lead to a mistaken simplification of the traffic accident.

Despite these difficulties, several authors corroborate the data obtained in the research<sup>41,42,43,44,45,46,47,48</sup> and indicate that, although there are more motor vehicle accidents on urban roads, accidents on highways such as highways Federal vehicles are more severe, probably due to higher vehicle speeds<sup>33</sup>. Problems with signaling and road maintenance also contribute to the severity of these events<sup>33,34</sup>.

Accidents on federal highways contribute to a high proportion of traffic-related deaths. In 2014, for example, there were 8,227 deaths in these places, or about 20% of the total recorded in the country due to car accidents<sup>38</sup>. The current research corroborates this trend, indicating the occurrence of 1,541 deaths in a total of 25.628 accidents, a rate of 6.01% of accidents with deaths.

Assessments indicate that there is a significant contribution of human error and recklessness in car accidents. For example, an assessment of the causes of car accidents on BR163 in *Mato Grosso* in 2004 indicated that most of these events (63.3%) occurred under good weather conditions and at locations with satisfactory rolling conditions (60.2%) vertical signage (50.9%) and horizontal (61%) signs<sup>27</sup>. The main causes associated with accidents observed by these authors were lack of attention from drivers (16.4%), the presence of potholes (13.1%), non-observance of segment distance (8.0%) and undue overtaking (7.8%).

Brazilian studies that analyze the importance of lack of attention in the occurrence of traffic accidents are rare<sup>52</sup>. However, studies in other countries indicate that driver inattention is a major contributor to road accidents.

The US National Road Traffic Safety Administration, for example, estimates that at least 25% of accidents involve driver inattention<sup>53</sup>. This interference causes drivers to have difficulty recognizing the information necessary for safe driving because any event, activity, object, or person inside or outside the vehicle induces them to divert attention. In the present investigation, the “lack of attention” had a greater impact, being associated with 48.66% of the occurrences.

Another important factor related to the occurrence of automobile accidents is speeding. According to WHO, driving above the road limit is the main factor for fatal accidents, being associated with 50% of traffic deaths in developing countries<sup>32</sup>. Still according to WHO, with every 1 km / h increase in speed, the incidence of accidents with victims increases by 3% and the risk of death by 4 to 5%<sup>32</sup>.

Although the item “speed incompatible with the road” was cited as a causal factor for only 5.61% of the evaluated accidents, it is possible that part of it is included in the item “Disobedience to signaling”, associated with 7.8% of the registered accidents. Alternatively, these reports may have been underreported or other causal factors attributed to the accident. In this regard, it is important to note that checking for speeding is difficult and often depends on the presence of witnesses or the statement of the drivers.

However, the number of deaths caused by the adoption of “speed incompatible with the road” in the assessed accidents is 46.48% higher than would be expected by the representativeness of this item in the total of events. That is, if it is considered a contribution of the 5.61% referring to “speed incompatible with the road” in the total deaths (1541), this item would be expected to be related to 86.45 deaths. However, this behavior resulted in 186 deaths, indicating that speeding drivers tend to cause accidents with more serious consequences.

In absolute numbers, the Southeast and Northeast regions have the highest number of traffic deaths, with 13275 and 12337 victims respectively. In the Northeast should be emphasized *Ceará*, *Pernambuco* and *Bahia*, which have a higher prevalence of traffic accidents<sup>9</sup>. In addition, the Northeast states have recently experienced a significant increase in car accident-related mortality rates<sup>14</sup>. Dos Santos Júnior et al.<sup>45</sup>, when evaluating the hospitalization of adults in Bahia between 2000 and 2010, reported an average increase of 18.4% in the number of hospitalizations due to external causes, especially traffic accidents<sup>45</sup>.

In a recent investigation<sup>47</sup>, the causes of death among young people in Bahia between 2001 and 2011 were evaluated and 16.2% (n = 7201) of these deaths were related to traffic accidents.

An evaluation of the data obtained (Figure 1) indicates that, although there was a decrease in the number of events over the sampled period, accidents became more

severe and were associated with a higher percentage of deaths. Thus, although the events occurred in 2017, for example, represented only 43.59% of the average of those occurred in 2014 (2457 and 5635.5, respectively), 2017 presented a higher percentage of major accidents (18.19%) than in 2014 (8.34%). In addition, in 2017 the assessed accidents produced a higher percentage of deaths than in 2014 (9.93% and 4.60%, respectively).

Less frequent use of seat belts in the front and rear seats, non-compliance with traffic rules, the adoption of speeds above the permitted limit on the roads and the association between driving and consumption of alcohol contribute to the higher number of deaths in northeastern states<sup>11</sup>.

The easy access to the purchase of alcoholic beverages, the low cost and the media influence contribute to the increase of alcohol consumption<sup>20-23</sup> and, consequently, to the increased occurrence of car accidents associated with the presence of alcoholic drivers<sup>12,13,19,20,23</sup>.

The data obtained indicate that, as well as accidents associated with “speed incompatible with the road”, the events in which the “consumption of alcohol or psychotropic substances” had occurred are more severe and produce a higher number of deaths. In this sense, despite representing only 6.31% of the records, accidents involving drunk drivers or under the effects of psychotropic drugs produced 104 deaths, ie 10.31% higher than would be expected only by their percentage representation.

According to data from the 2013 National Health Survey of the Ministry of Health in partnership with the Brazilian Institute of Geography and Statistics (IBGE), it indicated that almost a quarter of the Brazilian population has the habit of consuming alcohol and driving shortly thereafter (24.3%)<sup>49</sup>. This practice is predominant in the Midwest and Northeast regions, where we highlight *Piauí* (38.9%) and *Maranhão* (37.1%). In Bahia, 27.3% of individuals 18 years of age or older have the habit of drinking and driving<sup>48</sup>.

The change in the Brazilian Traffic Code following the sanction of Law 11.705 in 20089, known as *Lei Seca*, and its subsequent modification in 2012 reducing the tolerance in the blood alcohol level of drivers to a maximum level of 0.05 mg/l, It was an important step towards reducing automobile accidents<sup>24,25</sup>. However, the occurrence of these events is still quite frequent and represents a huge impact on the lives of several Brazilian families and economic losses for the country. In this sense, further measures are necessary to minimize the effects of alcohol consumption on traffic<sup>48</sup>.

The high rate of traffic accidents in the country may be related to the population’s habit of occupying and disposing of the public space as their own, not caring about other individuals who also have the right to use and enjoy this space<sup>12</sup>. The habit of considering motor vehicles as an instrument of power and the adoption of disobedience to

traffic laws also contribute to the picture<sup>54</sup>.

The data evaluated indicate that “disobedience to signaling” was associated with 7.81% of accidents. However, it should be noted that the items “do not keep safe distance” (20.23%), “speed incompatible with the road” (6.31%) and “improper overtaking” (8.53%) which in most In some cases, they also involve disrespect for vertical and horizontal traffic signs, which are ways of indicating on the road some of the precepts of traffic laws. From this point of view, it can be considered that 42.88% of the accidents observed occurred for violation of traffic laws.

## CONCLUSIONS

This study aimed to analyze the main causes of car accidents on federal highways in Bahia. To this end, the accident report produced by the Bahia Federal Superintendence of the Federal Highway Police during 2014 and 2017 was used as research material.

The results showed that, in the period analyzed,

there was a significant decrease in the number of accidents, however, there was also a significant increase in their severity causing a higher number of deaths. Accidents in which the use of alcohol and / or psychotropic substances by drivers was found to have contributed greatly to the growth of this number. Considering the categories presented, “reckless driver attitudes” was the main cause of accidents on the federal highways of Bahia in the period, mainly due to the violation of traffic laws.

Traffic accidents and their consequences can be considered as a preventable public health problem, as they result from road deficiencies, mechanical problems in vehicles and, mainly, human failures, as shown. Implementation of improved road conditions, enhanced road enforcement and punishment of violators should be urgently adopted to minimize the alarming picture presented. However, a truly lasting decrease in the number of traffic accidents and their consequences will only occur if there is concern about investing in educational campaigns that can educate the population about the risks of irresponsible and reckless driving.

**Authors’ contributions:** *Ribeiro LA:* project conception and elaboration, data analysis, writing and article submission. *Pimentel JL:* data collection. *Ribeiro H:* data analysis. *Benedito MLH:* Final article review. *Ribeiro KLP:* help in discussions of data analysis.

## REFERÊNCIAS

- World Health Organization (WHO). Violence; injury prevention. Global status report on road safety: time for action. Geneva: WHO; 2009. Available from: [https://www.who.int/violence\\_injury\\_prevention/road\\_safety\\_status/2009/en/](https://www.who.int/violence_injury_prevention/road_safety_status/2009/en/).
- Waiselfisz JJ. Mapa da violência 2011: os jovens do Brasil. São Paulo: Instituto Sangari/Ministério da Justiça; 2011. Disponível em: <https://www.mapadaviolencia.org.br/pdf2011/MapaViolencia2011.pdf>.
- Andrade SSCA, Jorge MHPM. Internações hospitalares por lesões decorrentes de acidente de transporte terrestre no Brasil, 2013: permanência e gastos. *Epidemiol Serv Saúde*. 2017;26(1):31-8. doi: 10.5123/S1679-49742017000100004.
- Mascarenhas MDM, Barros MBA. Evolução das internações hospitalares por causas externas no sistema público de saúde-Brasil, 2002 a 2011. *Epidemiol Serv Saúde*. 2015;24:19-29. doi: <https://doi.org/10.5123/S1679-49742015000100003>.
- Instituto de Pesquisa Econômica Aplicada (IPEA). Acidentes de trânsito nas rodovias federais brasileiras: caracterização, tendências e custos para a sociedade - relatório de pesquisa. Brasília: Polícia Rodoviária Federal/IPEA; 2015. Disponível em: [http://www.ipea.gov.br/portal/images/stories/PDFs/relatoriopesquisa/150922\\_relatorio\\_acidentes\\_transito.pdf](http://www.ipea.gov.br/portal/images/stories/PDFs/relatoriopesquisa/150922_relatorio_acidentes_transito.pdf)
- Confederação Nacional do Transporte CNT. Pesquisa CNT de rodovias 2017: relatório gerencial. Brasília: CNT; SEST; SENAT; 2017. Disponível em: <http://pesquisarodovias.cnt.org.br/>.
- Ladeira RM, Malta DC, Moraes Neto OL, Montenegro MMS, Soares Filho MA, Vasconcelos CH, Mooney M, Naghavi M. Acidentes de transporte terrestre: estudo Carga Global de Doenças, Brasil e unidades federadas, 1990 e 2015. *Rev Bras Epidemiol*. 2017;20(1):157-70. doi: <https://doi.org/10.1590/1980-5497201700050013>.
- Moraes Neto OL, Andrade AL, Guimarães RA, Mandacará PMP, Tobias GC. Regional disparities in road traffic injuries and their determinants in Brazil, 2013. *Int J Equity Health*. 2016;15(1):142. doi: <https://doi.org/10.1186/s12939-016-0433-6>.
- Brasil. Ministério da Saúde. Departamento de Informática do SUS – DATASUS Informações em saúde. Brasília (DF); 2008 [citado 21 fev. 2010]. Disponível em: <http://www2.datasus.gov.br/DATASUS/index.php?area=02>.
- World Health Organization (WHO). Road traffic injuries. Fact sheet. Geneva: WHO; 2016 [cited 2018 Nov. 12]. Available from: <http://www.who.int/mediacentre/factsheets/fs358/en/>.
- Malta DC, Andrade SS, Gomes N, Silva MM, Moraes OL, Reis AA, et al. Injuries from traffic accidents and use of protection equipment in the Brazilian population, according to a population-based study. *Cien Saude Coletiva*. 2016;21(2):399-410. doi: 10.1590/1413-81232015212.23742015.
- Moyses SJ. Determinação sociocultural dos acidentes de transporte terrestre (ATT). *Cien Saude Coletiva*. 2012;17(9):2241-3. doi: 10.1590/S1413-81232012000900005.
- Cerqueira GL. Consumo de álcool e outras drogas por jovens condutores [citado 11 out. 2018]. Disponível em: <https://www.uniad.org.br/wp-content/uploads/2015/10/A0919.pdf>.
- Moraes OL, Montenegro MM, Monteiro RA, Siqueira JB, Silva MM, Lima CM. Mortalidade por acidentes de transporte terrestre no Brasil na última década: tendência e aglomerados de risco. *Cien Saude Coletiva*. 2012;17(9):2223-36. doi: 10.1590/S1413-81232012000900002.
- Franco MS, Lins AC, Lima AK, Araújo TL, Amaral RC. Caracterização de pacientes vítimas de acidentes de trânsito admitidos em hospital regional da Paraíba. *Rev Interdisciplinar*. 2015;8(2):123-29. Disponível em: <file:///C:/Users/User/Downloads/567-2963-1-PB.pdf>.

16. Silva JK, Rios MA, Amaral TF, Silva PL. Profile of road transport accidents met by the mobile urgency attendance service. *Rev Enfermagem UFPE*. 2016;10(1):9-17. doi: 10.5205/reuol.8423-73529-1-RV1001201602.
17. World Health Organization (WHO). Global status report on alcohol and health. Geneva; 2011. Available from: [http://www.who.int/substance\\_abuse/publications/global\\_alcohol\\_report/msbgsruprofiles.pdf](http://www.who.int/substance_abuse/publications/global_alcohol_report/msbgsruprofiles.pdf).
18. World Health Organization (WHO). Action needed to reduce health impact of harmful alcohol use. Geneva; 2013. Available from: [http://www.who.int/mediacentre/news/releases/2011/alcohol\\_20110211/en/index.html](http://www.who.int/mediacentre/news/releases/2011/alcohol_20110211/en/index.html).
19. Nunes MN, Nascimento LFC. Análise espacial de óbitos por acidentes de trânsito, antes e após a Lei Seca, nas microrregiões do estado de São Paulo. *Rev Assoc Med Bras*. 2012;58(6):685-90. doi: <https://doi.org/10.1590/S0104-42302012000600013>.
20. Campos VR, Salgado R, Rocha MC, Duailibi S, Laranjeira R. Beber e dirigir: características de condutores com bafômetro positivo. *Rev Psiquiatr Clin*. 2012;39(5):166-71. doi: <https://doi.org/10.1590/S0101-60832012000500004>.
21. Laranjeira R, Pinsky I, Zalesky M, Caetano RI. Levantamento nacional sobre os padrões de consumo de álcool na população brasileira. Brasília: Secretaria Nacional Antidrogas – SENAD; 2007. Disponível em: [http://bvsmms.saude.gov.br/bvsm/publicacoes/relatorio\\_padroes\\_consumo\\_alcool.pdf](http://bvsmms.saude.gov.br/bvsm/publicacoes/relatorio_padroes_consumo_alcool.pdf).
22. Brasil. Presidência da República. Secretaria Nacional de Políticas sobre Drogas. I Levantamento nacional sobre o uso de álcool, tabaco e outras drogas entre universitários das 27 capitais brasileiras. Brasília: SENAD; 2010.
23. Campos VR, Salgado RS, Rocha MC. Bafômetro positivo: correlatos do comportamento de beber e dirigir na cidade de Belo Horizonte, Minas Gerais, Brasil. *Cad Saúde Pública*. 2013;29(1):51-61. doi: <http://dx.doi.org/10.1590/S0102-311X2013000100007>.
24. Malta DC, Soares Filho AM, Montenegro MMS, Mascarenhas MDM, Silva MMA, Lima CM, Morais Neto OL, Temporão JG, Penna GO. Análise da mortalidade por acidentes de transporte terrestre antes e após a Lei Seca – Brasil, 2007-2009. *Epidemiol Serv Saude*. 2010;19(4):317-28. doi: <http://dx.doi.org/10.5123/S1679-49742010000400002>.
25. Klabunde FC, Ghizzo Filho J, Freitas PF, Nazário NO. Impacto da Lei Seca na Taxa de Mortalidade por acidentes de trânsito, Santa Catarina, entre 2005 e 2011. *Arq Catarin Med*. 2017;46(2):108-17. Disponível em: <http://www.acm.org.br/acm/seer/index.php/arquivos/article/view/274/160>.
26. Instituto de Pesquisa Econômica Aplicada; Departamento Nacional de Trânsito. Impactos sociais e econômicos dos acidentes de trânsito nas rodovias brasileiras: relatório executivo. Brasília (DF): IPEA; DENATRAN; 2006. Disponível em: [http://repositorio.ipea.gov.br/bitstream/11058/7456/1/RP\\_Estimativa\\_2015.pdf](http://repositorio.ipea.gov.br/bitstream/11058/7456/1/RP_Estimativa_2015.pdf).
27. Almeida LVC, Pignatti MG, Espinosa MM. Principais fatores associados à ocorrência de acidentes de trânsito na BR 163, Mato Grosso, Brasil, 2004. *Cad Saude Publica*. 2009;25(2):303-12. doi: <http://dx.doi.org/10.1590/S0102-311X2009000200008>.
28. Brasil. Ministério da Saúde. Sistema de Informações sobre Mortalidade. Mortes em acidentes rodoviários no ano de 2012. Disponível em: [http://repositorio.ipea.gov.br/bitstream/11058/6869/1/TD\\_2212.pdf](http://repositorio.ipea.gov.br/bitstream/11058/6869/1/TD_2212.pdf).
29. Brasil. Ministério da Saúde. Indicadores e dados básicos-Brasil- 2012. Brasília, DF; 2012. Disponível em: <http://tabnet.datasus.gov.br/cgi/idb2012/matriz.htm>.
30. Ferraz C, Raia Jr A, Bezerra B, Bastos T, Rodrigues K. Segurança viária. São Carlos: Suprema Gráfica e Editora; 2012.
31. Bethonico FC, Oliveira LK. Análise exploratória da relação entre a imprudência do condutor e os índices de acidentes. Disponível em: [https://www.researchgate.net/profile/felipe\\_bethonico/publication/268871122\\_analise\\_exploratoria\\_da\\_relacao\\_entre\\_a\\_imprudencia\\_do\\_condutor\\_e\\_os\\_indices\\_de\\_acidentes/links/5479d26c0cf293e2da2b5ac6/analise-exploratoria-da-relacao-entre-a-imprudencia-do-condutor-e-os-indices-de-acidentes.pdf](https://www.researchgate.net/profile/felipe_bethonico/publication/268871122_analise_exploratoria_da_relacao_entre_a_imprudencia_do_condutor_e_os_indices_de_acidentes/links/5479d26c0cf293e2da2b5ac6/analise-exploratoria-da-relacao-entre-a-imprudencia-do-condutor-e-os-indices-de-acidentes.pdf).
32. World Health Organization (WHO). Informe sobre la situación mundial de la seguridad vial: es hora de pasar a la acción. Geneva; 2009. Disponível em: <http://www.who.int/mediacentre/factsheets/fs310/en/index.html>.
33. Almeida RLF, Bezerra Filho JG, Braga JU, Magalhães FB, Macedo MCM, Silva KA. Via, homem e veículo: fatores de risco associados à gravidade dos acidentes de trânsito. *Rev Saúde Publica*. 2013;47(4):718-31. doi: 10.1590/S0034-8910.2013047003657.
34. Barros CS, Dias ML, Silva TFA, Fernandes FECV. Caracterização dos acidentes de transporte terrestre ocorridos em rodovias federais. *Arq Cien Saude*. 2018;25(1):35-40. doi: <https://doi.org/10.17696/2318-3691.25.1.2018.864>.
35. Instituto de Pesquisa Econômica Aplicada – IPEA. Relatório de pesquisa. Acidentes de trânsito nas rodovias federais brasileiras caracterização, tendências e custos para a sociedade [monografia]. Brasília (DF): IPEA; 2015 Disponível em: [http://www.ipea.gov.br/por-tal/images/stories/PDFs/relatoriopesquisa/150922\\_relatorio\\_acidentes\\_transito.pdf](http://www.ipea.gov.br/por-tal/images/stories/PDFs/relatoriopesquisa/150922_relatorio_acidentes_transito.pdf).
36. Brasil. Ministério da Saúde. DATASUS; 2015. Sistema de Informação sobre Mortalidade; Óbitos por Residência por Unidade da Federação segundo Região CID 10 Acidente de transporte Óbitos por Residência por Região de Saúde (CIR) segundo Município CID. Disponível em: <http://tabnet.datasus.gov.br/cgi/idb2015/matriz.htm>.
37. Malta DC, Bernal RTI, Mascarenhas MDM, Monteiro RA, Bandeira de Sá NN, Andrade SSCA, et al. Atendimentos por acidentes de transporte em serviços públicos de emergência em 23 capitais e no Distrito Federal – Brasil, 2009. *Epidemiol Serv Saude*. 2012;21(1):31-42. doi: <http://dx.doi.org/10.5123/S1679-49742012000100004>.
38. Instituto de Pesquisa Econômica Aplicada (IPEA); polícia (PRF). Acidentes de trânsito nas rodovias federais brasileiras: caracterização, tendências e custos para a sociedade. Relatório de pesquisa. Brasília, DF: Polícia Rodoviária Federal/IPEA; 2015. Disponível em: [http://www.ipea.gov.br/portal/index.php?option=com\\_content&view=article&id=26277](http://www.ipea.gov.br/portal/index.php?option=com_content&view=article&id=26277).
39. Mascarenhas MDM, Barros MBA. Evolução das internações hospitalares por causas externas no sistema público de saúde – Brasil, 2002 a 2011. *Epidemiol Serv Saude*. 2015;24(1):19-29. doi: <https://doi.org/10.5123/S1679-49742015000100003>.
40. Dias LKS. Caracterização dos Acidentes de Trânsito Atendidos pelo Serviço de Atendimento Móvel de Urgência. SANARE *Rev Políticas Publicas*. 2017;16(1):6-16. Disponível em: <https://sanare.emnuvens.com.br/sanare/article/view/1133/618>.

41. Balduino LS, Oliveira MHR, Balduino LS, Virgineo MS. Perfil das vítimas de acidentes de trânsito atendidas no hospital público de Florianópolis. *Rev Interdisciplinar*. 2018;11(1):41-50. Disponível em: <file:///C:/Users/User/Downloads/1256-3381-1-PB.pdf>.
42. Silva I, Monteiro R, Delgado J. Identificação dos trechos críticos para os acidentes de trânsito nas rodovias estaduais da Bahia mediante o uso de geotecnologias. In: *Workshop de Gestão, Tecnologia Industrial e Modelagem Computacional*. Disponível em: <https://www.revistas.uneb.br/index.php/gestecimc/article/view/1914/1360>.
43. Andrade WS, Santos KOB. Internações hospitalares por acidentes relacionadas ao trabalho notificadas na Bahia. *Rev Pesqui Fisioter*. 2018;8(2):71-8. doi: <http://dx.doi.org/10.17267/2238-2704rpf.v8i2.1903>.
44. Cardim A, Reis ALPP. Mortalidade por acidentes de trabalho na macrorregião extremo sul da Bahia. *Rev Enfermagem Contemporânea*. 2016;5(2):1-9. doi: <http://dx.doi.org/10.17267/2317-3378rec.v5i2.1098>.
45. Júnior RQS, Cardoso ACC, Carvalho SC, Oliveira ZC, Mazzei MPC. Saúde do homem na Bahia: a internação hospitalar de adultos nos anos 2000 e 2010. *Rev Enfermagem Contemporânea*. 2017;6(2):139-57. doi: <http://dx.doi.org/10.17267/2317-3378rec.v6i2.1630>.
46. Santos JJ, Santos KOB. Distribuição dos acidentes de transporte fatais entre trabalhadores do Estado da Bahia e no Brasil. *Saúde Com*. 2016;12(3):622-30. Disponível em: <https://www.researchgate.net/publication/308209743>.
47. Silva RA, Vieira CX, Nery AA, Abreu FS, Silva NA, Jesus LR. Mortality due to external causes in youth in state of Bahia. *Rev Online Pesqui Cuidado Fundamental*. 2018;10(1):46-51. doi: <http://dx.doi.org/10.9789/2175-5361.rpcfo.v10.5975>.
48. Ribeiro LS. Consumo abusivo de álcool e envolvimento em acidentes de trânsito: resultados da pesquisa nacional de saúde, Brasil, 2013 [doutorado]. Rio de Janeiro: Fundação Oswaldo Cruz; 2017. Disponível em: [https://www.arca.fiocruz.br/bitstream/icict/24843/2/lucas\\_ribeiro\\_icict\\_mest\\_2017.pdf](https://www.arca.fiocruz.br/bitstream/icict/24843/2/lucas_ribeiro_icict_mest_2017.pdf).
49. Brasil. Ministério do Planejamento, Orçamento e Gestão. IBGE Coordenação de Trabalho e Rendimento. Pesquisa nacional de saúde 2013: percepção do estado de saúde, estilos de vida e doenças crônicas: Brasil, grandes regiões e unidades da federação. Rio de Janeiro: IBGE; 2014. p.180. Disponível em: <file:///C:/Users/User/Downloads/pns2013.pdf>.
50. Confederação Nacional do Transporte - CNT. Pesquisa CNT de rodovias 2017: relatório gerencial. Brasília: CNT/SEST/SENAT; 2017. Disponível em: <http://pesquisarodovias.cnt.org.br/>.
51. Brasil. Ministério da Defesa. Ministério da Indústria e Comércio. Polícia Rodoviária Federal. Proteção das fronteiras. 2017. Disponível em: <https://www.defesa.gov.br/exercicios-e-operacoes/protecao-das-fronteiras>.
52. Andrade SM, Soares DA, Braga GP, Moreira JH, Botelho FMN. Comportamentos de risco para acidentes de trânsito: um inquérito entre estudantes de medicina na região sul do Brasil. *Rev Assoc Med Bras*. 2003;49(4):439-44. <http://dx.doi.org/10.1590/S0104-42302003000400038>.
53. Stutts JC, Reinfurt DW, Rodgman EA. The role of driver distraction in crashes: an analysis of 1995-1999 Crashworthiness Data System Data. *Annu Proc Assoc Adv Automot Med*. 2001;45:287-301. Available from: <https://europepmc.org/abstract/med/12214356>.
54. Bartholomeu D. Traços de personalidade e comportamentos de risco no trânsito: um estudo correlacional. *Psicol Argumento*. 2017;26(54):193-206. Disponível em: <https://periodicos.pucpr.br/index.php/psicologiaargumento/article/viewFile/19685/19013>.
55. Barros Aluísio JD, Amaral RL, Oliveira MS, B.; Lima SC, Gonçalves EV. Acidentes de trânsito com vítimas: sub-registro, caracterização e letalidade. *Cad Saude Publica*. 2003;19:979-86. doi: <http://dx.doi.org/10.1590/S0102-311X2003000400021>.

Received: May 17, 2019

Accepted: December 02, 2019