ORIGINAL ARTICLE

HOSPITAL ADMISSIONS OF INJURED MOTORCYCLISTS IN BRAZIL FROM 2012 TO 2022

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Highlights:

1. Increase in the number of hospitalizations due to motorcycle accidents between 2012 and 2022.
2. The number of men hospitalized for motorcycle accidents is higher than that of women.
3. Increase in spending on hospitalizations for injured motorcyclists in Brazil.

PRE-PROOF

(as accepted)

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ABSTRACT

Objective: To describe the costs to the Unified Health System (SUS) for hospital admissions of motorcyclists involved in accidents in Brazil between 2012 and 2022. Methods: This study was conducted by collecting secondary data made available in the "SUS Hospital Morbidity due to External Causes," focusing on the cause group V20–V29 (motorcyclists traumatized by traffic accidents) from the TABNET/DATASUS database. Data collection occurred in February 2023. The variables analyzed included: year of notification, region of notification, age group, color/race, education level, and cost of hospitalization. Population data was acquired from the Brazilian Institute of Geography and Statistics, based on the 2010 Census, and the motorcycle fleet data was sourced from the website of the said institution. Results: Hospitalizations resulting from motorcycle accidents were predominantly observed in men (n = 963,167) and young adults aged 20–29 (n = 402,729). The expenditure on hospitalizations during the study period amounted to BRL1,624,749,356.20. Most states experienced an increase in the rate of hospitalization due to motorcycle accidents over the study period, with Acre, Roraima, and Goiás being exceptions. When examining the costs of hospitalizations by age group, notable differences were found across states. In the age group with the highest number of hospitalizations, Mato Grosso do Sul, the average expenditure was BRL2,053.60. Conclusion: Healthcare costs for hospitalizations were higher for men than for women. There was an observed increase in spending on hospital admissions for motorcyclists involved in accidents between 2012 and 2022. Investment in the prevention of traffic accidents could not only save lives but also potentially reduce healthcare expenditures.

Keywords: Accidents; Traffic accidents; Medical care costs; Hospital costs.

INTRODUCTION

According to the World Health Organization (WHO),[1] road traffic injuries account for 1.35 million deaths and over 50 million injuries globally each year, and in Brazil, motorcycle accidents represent the majority of traffic accidents.[2] The motorcycle fleet in Brazil has been expanding by about 1 million units annually,[3] from 13 million motorcycles in 2010 to an estimated 22 million in 2018, with this increase primarily concentrated in less affluent regions. Evidence has shown that the lower acquisition and maintenance costs of motorcycles, along with their ability to navigate traffic jams more easily, have popularized them both for personal transport and professional use.

Both researchers[5] and the WHO[6] have indicated that motorcyclists are exposed to a greater risk of serious injuries and fatalities in accidents due to the lack of a protective metal structure found in other vehicles like cars and buses. In Brazil, accidents involving motorcycles lead to the highest number of compensations paid out by the Personal Injury Caused by Motor Vehicles insurance and account for half of all hospitalizations within the Unified Health System (SUS) for external causes related to traffic accidents, bringing significant costs to SUS and occupying hospital beds that could be used for other potentially preventable causes.[2]

Given the predominance of motorcycle accidents within Brazilian traffic accidents and their consequent toll on hospital admissions within SUS, this study aimed to delineate the expenses incurred by the health system for hospitalizations resulting from motorcycle accidents in Brazil from 2012 to 2022. Bringing attention to the health system's expenditure on these accidents may initiate discussions on preventive measures through investments in road safety, traffic education, and monitoring of risky behaviors in traffic.

METHODOLOGY

This study was conducted by collecting secondary data from the "SUS Hospital Morbidity due to External Causes," specifically cause group V20-V29 (motorcyclists traumatized by traffic accidents), as listed in the TABNET/DATASUSdatabase, covering the years 2012–2022. The data collection occurred in February 2023. The utilized variables were as follows: year of notification; region of notification; age group; color/race; education level; and the cost of hospitalization. Population data was obtained from the 2010 Census of the Brazilian Institute of Geography and Statistics (IBGE),[7] whereas the number of registered motorcycles was obtained from IBGE.[8] Given the descriptive nature of this study, both absolute and relative frequencies were calculated using Microsoft Excel. RStudio software facilitated the creation of a heat map. This study used publicly available secondary data and therefore did not require approval from the Research Ethics Committee.

[7] Data available at https://www.ibge.gov.br/home/estatistica/populacao/estimativa2014/default.shtm
[8] Available at: https://cidades.ibge.gov.br/brasil/pesquisa/22/28120

RESULTS

In 2012, there were 80,833 hospital admissions due to motorcycle accidents in Brazil, increasing to 128,153 admissions in 2022. Between 2012 and 2022, a total of 1,164,595 hospital admissions have been reported for motorcyclists injured in traffic accidents. Moreover, hospital admissions due to motorcycle accidents between 2012 and 2022 were more frequent among men (n = 963,167), people aged 20–29 (n = 402,729), and brown-skinned individuals (n = 478,002). SUS spending on hospital admissions during this period amounted to BRL1,624,749,356.20.

The cost of hospital admissions for men during this period was found to be BRL1,372,812,150.99, and BRL251,937,205.21 for women, which was an average expenditure of approximately BRL1,425.31 and BRL1,250.76, respectively, per male and female. As for the average cost per person according to skin color, white individuals incurred an average of BRL1,677.18, followed by BRL1,492.97 for black individuals, BRL1,341.39 for brown individuals, BRL1,255.59 for yellow individuals, BRL906.56 for indigenous peoples, and BRL1,221.24 for unknown or undisclosed individuals.

The state with the highest average number of hospitalization days was Amapá, with approximately 13.7 days. Paraná had the lowest number of hospitalization days per person, around 4.4 (Table 1). Mato Grosso do Sul was the state with the highest daily cost of hospitalization per injured person, at BRL414.45 per person, while Amapá spent approximately BRL62.83 per day on hospitalizing injured motorcyclists (Table 1).

Table 1 - Description of hospitalization costs for motorcycle accidents by state (2012–2022).

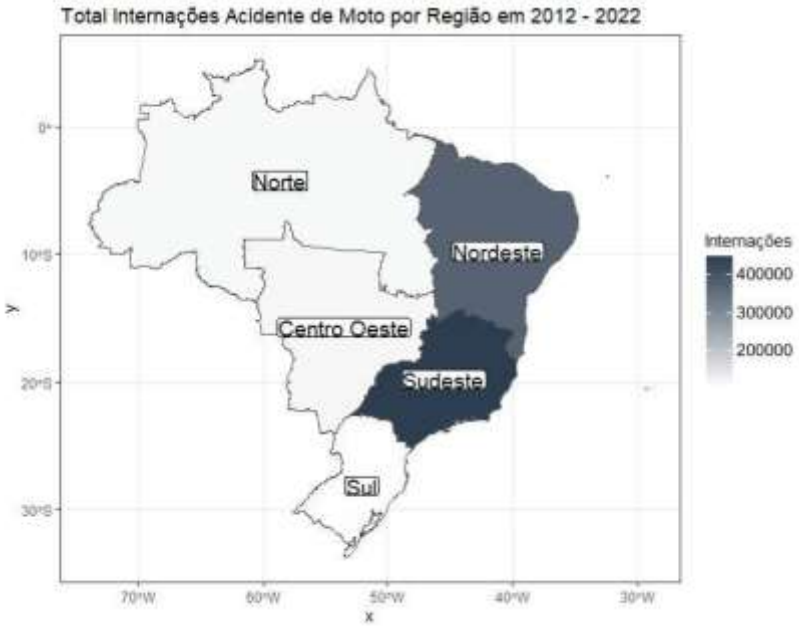
State	Total spending*	Number of hospitalizations	Avg. cost per hospitalization*	Avg. days of hospitalization	Daily hospitalization*
Rondônia	14,698,980.80	18,769	783.15	4.9	159.83
Acre	6,919,779.65	6126	1129.58	7.4	152.64
Amazonas	9,530,310.16	7595	1254.81	7.7	162.96
Roraima	5,865,011.12	6551	895.28	7.7	116.27
Pará	56,798,962.65	57,802	982.65	5.7	172.39
Amapá	2,288,708.05	2659	860.74	13.7	62.83
Tocantins	23,015,185.90	15,535	1481.50	10.1	146.68
Maranhão	18,333,701.07	30,797	595.31	4.7	126.66
Piauí	69,727,713.27	60,730	1148.16	4.7	244.29
Ceará	112,235,052.40	71,811	1562.92	8.2	190.60
Rio Grande do Norte	36,724,540.93	25,993	1412.86	6.8	207.77
Paraíba	50,907,690.11	37,811	1346.37	7.9	170.43
Pernambuco	45,733,360.30	44,627	1024.79	4.7	218.04
Alagoas	12,876,840.47	11,916	1080.63	7.4	146.03
Sergipe	25,247,093.15	18,781	1344.29	7.2	186.71
Bahia	83,382,067.30	73,267	1138.06	5.5	206.92
Minas Gerais	198,589,839.50	124,389	1596.52	5.3	301.23
Espírito Santo	21,970,023.33	19,818	1108.59	5.5	201.56
Rio de Janeiro	82,675,502.04	55,288	1495.36	7.2	207.69
São Paulo	388,002,513.40	250,037	1551.78	5.1	304.27
Paraná	75,309,216.49	46,846	1607.59	4.4	365.36
Santa Catarina	85,018,929.29	42,338	2008.10	5.4	371.87
Rio Grande do Sul	30,669,099.72	17,911	1712.30	6.8	251.81
Mato Grosso do Sul	44,691,221.81	22,465	1989.37	4.8	414.45

Mato Grosso	36,087,379.75	36,129	998.85	5.4	184.97
Goiás	66,579,178.62	43,983	1513.75	5.7	265.57
Distrito Federal	20,871,454.91	14,621	1427.50	9	158.61

*Values are given in Brazilian Real (BRL). Source: Brazilian Ministry of Health - SUS Hospital Information System (SIH/SUS).

Regarding the Brazilian region with the highest number of hospital admissions from 2012–2022, the Southeast stood out, followed by the Northeast (Figure 1).

Figure 1 - Heat map of the number of hospital admissions by Brazilian region between 2012–2022.



Source: Ministry of Health - SUS Hospital Information System (SIH/SUS).

Regarding the regional distribution and considering the population size based on the 2010 census data from IBGE for each region, it is evident how hospital admissions are spread out: North (0.77 admissions/inhabitant), Midwest (0.77 admissions/inhabitant), Northeast (0.74 admissions/inhabitant), Southeast (0.48 admissions/inhabitant), and South (0.39 admissions/inhabitant). When examining the study period on an annual basis, it becomes apparent that most states experienced an increase in the rate of hospital admissions due to motorcycle accidents from 2012 to 2022, with the notable exceptions of the states of Acre, Roraima, and Goiás (Table 2).

Table 2 - Hospitalization rate for accidents involving motorcyclists by state (2012–2022).

State	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Rondônia	0.89	1.21	1.09	0.95	1.03	1.17	1.15	0.90	1.00	1.38	1.20
Acre	0.66	0.63	0.66	0.69	0.77	1.02	1.17	0.71	0.77	0.69	0.53
Amazonas	0.12	0.07	0.05	0.16	0.25	0.27	0.21	0.23	0.21	0.25	0.31
Roraima	1.42	1.00	1.33	2.23	3.22	0.69	1.39	0.88	0.99	0.63	0.72
Pará	0.43	0.53	0.57	0.62	0.72	0.68	0.75	0.76	0.75	0.84	0.96
Amapá	0.39	0.27	0.25	0.30	0.27	0.44	0.38	0.38	0.42	0.40	0.45
Tocantins	0.11	0.11	0.63	0.92	1.37	1.16	1.02	1.35	1.47	1.61	1.48
Maranhão	0.29	0.32	0.43	0.44	0.41	0.50	0.50	0.53	0.40	0.48	0.37
Piauí	0.87	1.50	1.54	1.92	2.18	1.82	1.99	2.19	1.78	2.01	1.66
Ceará	0.65	0.69	0.76	0.68	0.82	0.64	0.74	0.78	0.84	0.99	0.90
Rio Grande do Norte	0.68	0.55	0.49	0.50	0.51	0.68	0.70	0.99	1.01	0.96	1.12
Paraíba	0.83	0.83	0.86	0.99	0.79	0.80	0.70	0.95	1.01	1.13	1.14
Pernambuco	0.38	0.43	0.48	0.42	0.44	0.49	0.48	0.48	0.45	0.47	0.54
Alagoas	0.20	0.28	0.30	0.41	0.42	0.32	0.46	0.37	0.39	0.33	0.32
Sergipe	0.48	0.67	0.67	1.01	0.96	0.83	0.90	0.98	0.71	0.73	1.12
Bahia	0.32	0.36	0.42	0.43	0.43	0.42	0.44	0.46	0.54	0.70	0.68
Minas Gerais	0.44	0.51	0.57	0.58	0.58	0.60	0.56	0.60	0.59	0.67	0.65
Espírito Santo	0.32	0.41	0.49	0.52	0.51	0.50	0.39	0.39	0.49	0.92	0.69
Rio de Janeiro	0.22	0.25	0.29	0.30	0.27	0.31	0.29	0.34	0.35	0.42	0.41
São Paulo	0.45	0.45	0.49	0.47	0.52	0.53	0.55	0.58	0.63	0.69	0.69
Paraná	0.33	0.34	0.35	0.33	0.34	0.39	0.41	0.41	0.52	0.50	0.55
Santa Catarina	0.43	0.47	0.53	0.66	0.67	0.66	0.66	0.65	0.61	0.69	0.73
Rio Grande do Sul	0.11	0.13	0.15	0.17	0.16	0.17	0.14	0.16	0.16	0.16	0.16
Mato Grosso do Sul	0.52	0.56	0.56	0.40	0.34	0.35	0.92	1.39	1.39	1.35	1.38
Mato Grosso	0.85	1.10	1.02	0.97	1.23	1.30	1.26	1.29	0.83	0.94	1.11
Goiás	0.86	0.69	0.73	0.70	0.64	0.72	0.69	0.82	0.53	0.43	0.50
Distrito Federal	0.38	0.35	0.29	0.72	0.53	0.44	0.49	0.46	0.64	0.66	0.72

Source: Brazilian Ministry of Health - SUS Hospital Information System (SIH/SUS) = (hospitalization rate for the year of the state/population from the 2010 census) * 1000

Regarding the expenses associated with hospital admissions by age group, there were noticeable differences between the states. In the age group that experienced the highest number of admissions, 20–29 years, Mato Grosso do Sul reported an average expense of BRL2,053.60, whereas Maranhão reported approximately BRL630.05 (Table 3).

Table 3 - Spending on hospital admissions by age group* per state for motorcycle accidents (2012–2022)

Region/state	≤ 1	1–4	5–9	10–14	15–19	20–29	30–39	40–49	50–59	60–69	70–79	80 >
Rondônia	442.6	382.0	388.5	557.8	765.4	803.2	754.1	803.3	820.2	789.4	1357.6	481.9
Acre	610.1	820.1	837.2	785.8	1206.5	1176.4	1181.3	1008.0	953.2	1330.9	1712.5	1282.5
Amazonas	228.4	344.4	349.8	425.1	1048.6	1352.4	1377.4	1397.3	1413.7	1255.6	1195.9	749.9
Roraima	1137.6	289.2	717.2	795.1	968.9	907.9	860.3	900.7	848.8	879.6	1318.0	577.7
Pará	647.4	776.8	741.5	703.1	918.3	1046.3	1016.0	974.0	944.8	1003.5	1074.8	1163.4
Amapá	398.1	364.3	679.7	432.5	794.8	894.5	861.8	893.5	876.2	711.3	827.1	1003.8
Tocantins	875.6	1210.8	1230.1	1297.6	1605.9	1489.4	1454.1	1428.7	1425.3	1700.6	1664.5	1858.0
Maranhão	565.6	402.2	346.7	452.6	622.6	630.0	629.4	617.2	608.4	530.7	480.7	461.7
Piauí	944.0	900.7	951.3	1011.4	1182.5	1166.0	1155.8	1130.7	1118.9	1194.2	1112.9	872.2
Ceará	1046.0	1322.6	1144.4	1421.7	1689.2	1544.9	1515.3	1561.	1563.1	1734.0	1742.2	1841.5
Rio Grande do Norte	671.8	1120.2	1116.8	1321.9	1411.6	1374.4	1416.4	1409.2	1444.3	1710.2	1663.6	1237.5
Paraíba	1242.7	1040.3	1023.9	1087.5	1371.9	1376.8	1340.3	1328.4	1266.1	1546.5	1424.5	1426.5
Pernambuco	870.1	502.7	635.2	798.5	1035.2	1024.1	1010.6	1001.4	1084.4	1193.8	1210.5	996.0
Alagoas	656.8	539.9	619.3	929.9	1037.3	1096.7	1098.2	1080.7	1110.1	1150.5	1247.4	1320.2
Sergipe	735.5	557.0	580.5	934.2	1318.2	1366.2	1331.0	1310.1	1303.4	1504.7	1644.5	2253.1
Bahia	824.7	540.0	709.8	806.2	1130.9	1183.4	1152.4	1111.0	1120.4	1149.9	1196.9	1144.0
Minas Gerais	1766.3	937.7	1030.7	1427.7	1713.0	1594.4	1572.1	1545.5	1579.4	1755.3	1787.9	1740.2
Espírito Santo	398.3	522.5	954.7	1207.6	1196.0	1130.9	1063.6	1087.8	1118.5	1017.4	1137.6	987.9
Rio de Janeiro	802.7	632.4	926.1	1315.7	1543.2	1531.8	1451.3	1424.6	1529.0	1551.0	1720.1	1303.7
São Paulo	935.7	1026.9	1265.5	1491.4	1587.6	1565.1	1521.7	1514.9	1547.4	1668.4	1898.2	2296.2
Paraná	827.5	817.8	1234.4	1381.5	1695.2	1665.0	1540.3	1512.0	1577.6	1628.0	1825.7	1806.0

Santa Catarina	1470.4	974.1	1508.2	1466.7	2053.8	1989.4	1944.7	2014.1	2041.4	2379.3	2550.0	2932.0
Rio Grande do Sul	577.3	2587.5	1253.3	1630.6	1905.5	1691.4	1591.9	1743.3	1746.7	1780.1	2503.8	1807.7
Mato Grosso do Sul	473.5	914.6	986.7	1517.1	2009.5	2053.6	2029.6	1846.2	1997.0	2068.5	2074.2	1133.0
Mato Grosso	678.8	603.1	750.0	852.2	1054.3	1025.8	975.3	995.5	965.9	1006.3	1076.0	1222.5
Goiás	787.1	655.3	973.7	1215.8	1624.1	1603.5	1498.2	1425.2	1448.2	1416.4	1247.9	1485.0
Distrito Federal	953.5	989.5	974.2	965.0	1612.4	1478.5	1397.2	1417.3	1307.6	1489.9	1159.2	601.5
Total	834.7	784.8	838.7	1074.9	1448.5	1438.5	1372.2	1360.2	1375.6	1440.6	1462.8	1414.9

*Total spending in the age group per state/number of people injured in motorcycle accidents in the age group

DISCUSSION

There was a 58.54% increase in the number of hospitalizations due to motorcycle accidents between 2012 and 2022. This increase may possibly be attributed to the growth of the vehicle fleet. According to IBGE, in 2012, there were 16,910,473 registered motorcycles and in 2022, there were 25,746,762, representing an increase of 52.26% in the registered vehicle fleet.

The number of men hospitalized due to motorcycle accidents in all of Brazil's states was higher than the number of women, corresponding to 82.70% of the total. The distribution of age groups revealed that the largest proportion of hospitalized individuals were adults aged between 20 and 39. Other studies by have shown that the male population in this age group is most affected.[2,7,8] However, when examining the cost of hospitalization by age group, it is observed that it is higher among the elderly (ages 70–79), possibly due to the severity of the trauma caused by the accident.

The Southeast, followed by the Northeast, had the highest number of hospitalizations due to motorcycle accidents. According to the IBGE,[9] this may be explained by the fact that these regions have the largest motorcycle fleets, respectively. The increase in the number of accidents can only be partly explained by the growth of the motorcycle fleet. In one study, in addition to the increased number of motorcycles, it was possible to identify other causes associated with traffic accidents involving motorcyclists, such as the individual characteristics of the drivers, local traffic conditions, and traffic education.[10]

In relation to the number of hospitalizations per inhabitant between 2012 and 2022, considering the 2010 population census, the two regions that had the highest hospitalizations in this period were the North and Midwest, followed by the Northeast.[11] This observation may be related to the significant economic rise observed, especially in the aforementioned regions, driven by the emergence of new agricultural frontiers and agribusiness.[12] The increase in income in these regions was likely accompanied by the purchasing of a first vehicle, often a motorcycle.

The average cost per hospitalization varied significantly between the different states in Brazil, with Santa Catarina incurring the highest costs (roughly BRL2,008.10) and Maranhão the lowest (BRL595.31). The lowest average daily hospitalization rate was in Amapá (BRL62.83), which, in turn, has the highest average number of hospitalization days. It is possible that this relationship between the lowest daily rate and the longest length of stay is due to issues related to the quality of care provided. The state of Mato Grosso do Sul has a difference

in daily rate of more than 400% in relation to the least expensive state, spending approximately BRL414.45. Notably, evidence has also shown that the use of alcohol and non-use of personal protective equipment also increase hospital costs.[13]

Given that this study utilized secondary data, it is not possible to provide detailed information on the characteristics of the accidents or the victims. Accidents that did not lead to hospitalization but resulted in removal and urgent/emergency care were not included, nor were accidents treated in non-SUS facilities. Another limitation is that the data were all calculated based on the 2010 population census, since the 2022 census data were not yet available with consolidated figures.

It is also worth mentioning that the COVID-19 pandemic may have contributed to the increased number of accidents involving motorcyclists in most Brazilian states in 2020, 2021, and 2022, a period in which growth in app-based delivery services was observed.

The direct and indirect costs of accidents extend beyond the cost of hospitalizations by the SUS, and loss of productivity, time off work, and the need for third-party care have been reported as relevant factors.[14] Moreover, the costs associated with minor traffic accidents, before hospital admission to after discharge, also considering loss of production and removal from the accident site, has been reported as BRL8,469.44.[15] In cases of severe accidents, the total has been reported to reach BRL123,133.91. This underscores the need for effective discussions on implementing measures to reduce accidents, as recommended in the National Plan for Reducing Traffic Deaths and Injuries.

CONCLUSION

The study demonstrated an increase in spending on hospital admissions for injured motorcyclists in Brazil between 2012 and 2022. It was also possible to observe differences between the states in the values of daily expenses per hospitalization in Brazil. Investing in the prevention of traffic accidents not only saves lives but could also have a significant impact on reducing healthcare costs.

REFERENCES

1. WHO - World Health Organization. Road traffic injuries. Geneva: WHO. 2022. [Accessed on August 2 2022]. Available from: https://www.who.int/health-topics/road-safety#tab=tab_1

2. Scaramussa FS, Sá EC. Indenizações pagas pelo seguro DPVAT: perfil epidemiológico dos acidentes envolvendo motocicletas no Brasil, contextualização das internações hospitalares e ônus ao Sistema Único de Saúde (SUS), no período de 2015 a 2018. Saúde, Ética & Justiça. 2020 [Accessed on August 2 2022]; 25(1): 10-14. Available from: https://www.revistas.usp.br/sej/article/view/171466/163510

3. Azevedo GR, Gonçalves SJ da, Coelho, L da S, Guimarães Júnior JP. Uma Análise Temporal dos Acidentes de Transporte Terrestre no Brasil, de 2010 a 2018. Revista Ibero-Americana de Humanidades, Ciências e Educação. 2023 [Accessed on April 5 2023]; 9(3): 799–814. Available from: https://doi.org/10.51891/rease.v9i3.8816

4. Corgozinho MM, Montagner MÂ, Rodrigues MAC. Vulnerabilidade sobre duas rodas: tendência e perfil demográfico da mortalidade decorrente da violência no trânsito motociclístico no Brasil, 2004-2014. Cadernos de Saúde Coletiva. 2018 [Accessed on: April 5 2023]; 26(1):92-99. Available from: scielo.br/j/cadsc/a/5RP6XmWR7T3RQVJW5PSvXgK/?format=pdf&lang=pt

5. Rissanen R, Berg HY, Hasselberg M. Quality of life following road traffic injury: a systematic literature review. In: Anais do Accident Analysis & Prevention. 2017; Flórida: ScienceDirect; 2017; [Accessed on April 5 2023]; 108: 308-320. Available from: https://doi.org/10.1016/j.aap.2017.09.013

6. WHO - World Health Organization. World health statistics. Geneva: WHO. 2015. [Accessed on 06 de outubro de 2022]. Available from: https://apps.who.int/iris/bitstream/handle/10665/170250/9789240694439_eng.pdf?sequence=1&isAllowed=y

7. Beceiro MF, Matos RH, Martinez GPP, Bochini GT, Bertolini, DR, Freitas CB de, et al. Motociclistas acidentados: caracterização, perfil comportamental e sintomas de transtornos mentais. Archives of Health Sciences. 2019 [Accessed on April 5 2023]; 26(2): 125-129. Available from: https://docs.bvsalud.org/biblioref/2019/12/1045948/artigo9.pdf#:~:text=Impulsividade%2C%20Transtorno%20de%20D%C3%A9fict%20de,AT%2010%2C14%2D15.

8. Santos WJ dos, Coêlho VM da S, Santos GB, Ceballos AG da C de. Caracterização dos acidentes de trânsito envolvendo trabalhadores motociclistas em Pernambuco - 2016. J Health Biol Sci; [revista em Internet]. 2018 [Accessed on April 5 2023]; 6(4): 431-436. Available from: https://periodicos.unichristus.edu.br/jhbs/article/view/2113/759

9. Instituto Brasileiro de Geografia e Estatística - IBGE. Frota de veículos. 2022 [Accessed on April 5 2023]; Available from: https://cidades.ibge.gov.br/brasil/pesquisa/22/28120

10. Jesus VF de, Rocha FC, Ferreira AS de S, Alves AB de ON, Siqueira L das G. Causas associadas aos acidentes de trânsito envolvendo motociclistas: revisão integrativa. Revista de Enfermagem do Centro- Oeste Mineiro. 2017 [Accessed on April 5 2023]; 7(1514). Available from: http://www.seer.ufsj.edu.br/recom/article/view/1514/1733

11. Instituto Brasileiro de Geografia e Estatística - IBGE. Frota de veículos. 2012 [Accessed on April 5 2023]; Available from: https://cidades.ibge.gov.br/brasil/pesquisa/22/0?ano=2012

12. Martins ET, Boing AF, Peres MA. Mortalidade por acidentes de motocicleta no Brasil: análise de tendência temporal, 1996-2009. Rev Saúde Pública. 2013 [Accessed on April 5 2023]; 47(5): 931-941. Available from: scielo.br/j/rsp/a/Y7bnvngHXZWL5MN74SW8vKL/?format=pdf&lang=pt

13. Porto DE, Araújo JM do N, Lira Júnior C, Andrade ES de S. Pattern of Maxillofacial Trauma and Associated Factors in Traffic Accident Victims. Journal of Craniofacial Surgery. 2021 [Accessed on April 5 2023]; 32(3): 1010-1013. Available from: https://pubmed.ncbi.nlm.nih.gov/32956302/

14. Faleiro TB, Ladeia AMA, Pinto Júnior AM, Schulz R da S, Rosário DAV, Franco BAFM, et al. Acidentes com motocicletas na Bahia: análise de uma década de internações hospitalares. Revista Eletrônica Acervo Saúde. 2019 [Accessed on April 5 2023]; 24(24): e1135. Available from: https://doi.org/10.25248/reas.e1135.2019

15. Carvalho CHR de, Custos dos Acidentes de Trânsito no Brasil: Estimativa Simplificada com Base na Atualização das Pesquisas do IPEA Sobre Custos de Acidentes nos Aglomerados Urbanos e Rodovias. IPEA. 2020 [Accessed on April 5 2023]; Available from: https://repositorio.ipea.gov.br/bitstream/11058/10075/1/td_2565.pdf

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