ORIGINAL ARTICLE

Clinical-epidemiological profile of traumatic brain injury associated with traffic accidents in southeastern Pará, in the Brazilian Amazon

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ABSTRACT

Introduction: In Brazil, traumatic brain injury (TBI) represents about two thirds of all causes of death and are often associated with traffic accidents, causing overload of medium and high complexity services. **Objectives:** To describe the occurrence and clinical-epidemiological profile of TBIs associated with traffic accidents in a regional hospital in the southeast of the state of Pará. Materials and Methods: This is a cross-sectional analytical study. It was based on data from the medical and statistical archives service of a regional hospital, through the analysis of electronic medical records of patients treated with TBI resulting from traffic accidents in the period from 2016 to 2020. **Results:** Of the 20,077 overall hospitalizations recorded, 4.0% were associated with the occurrence of TBI, of which, 75.3% were directly caused by traffic accidents involving motorcycles. The cases were concentrated in individuals of mixed race, male, aged between 18 and 29 years, with percentages of 92.5%, 86% and 39%, respectively. **Conclusions:** The occurrence of TBIs associated with automobile accidents is a problem that requires attention in the region. Moreover, there were several gaps in the completion of the medical records, which made it difficult to determine the association of the outcome, alcohol consumption and the use of PPE. However, considering all the information presented, assertive local public policies aimed at prevention can be implemented. And this can be the starting point for promoting changes aimed at mitigating traffic accidents and bed occupations due to preventable causes, impacting the quality of health care and economic factors.

Keywords: Brain injuries traumatic, Epidemiology descriptive, Traffic accidents, Neurology.

INTRODUCTION

Traumatic Brain Injury (TBI) according to the International Classification of Diseases, ICD-11, is defined as any traumatic injury, with anatomical lesion that may result in impairment of the functionalities of the skull, scalp, meninges and encephalon[1,2]. The various types of TBIs are often associated with high mortality rates. A study in South Korea showed that about 415 people died every year (2010 to 2014) in accidents involving motorcycles, and most deaths involved TBI due to the absence of a helmet. In the United States, the incidence occurred at a rate of 538.2 per 100,000 inhabitants, approximately 1.5 million new cases each year. It is noteworthy that TBI is a serious health problem that directly impacts the social and economic spheres[3,4].

Thus, in Brazil, TBIs have a notorious influence on morbidity and mortality rates. In 2019, 31,945 deaths were registered in traffic accidents, TBIs represented approximately one third of all cases and almost two thirds of all deaths, evidencing a higher mortality rate among patients diagnosed with TBI when compared to those without TBI[5,6]. In Belém, in the state of Pará, from 2015 to 2019, 2,103 cases of TBI were recorded, of these, 75.3% were males[7]. Despite these high rates, studies on this topic are still scarce in the scientific literature, especially in the northern region of Brazil[8].

Besides the high mortality rate and the impact on patients' quality of life, the costs to public health are high. In 2012, the total amount provided by SUS for external causes including TBI was more than one billion reais in hospitalizations,

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excluding outpatient and rehabilitation costs. These expenses could be mitigated if measures for safety and accident prevention were followed; however, what prevails is the exacerbated occupation of medium and high complexity beds for preventable causes[9].

Therefore, considering the lack of scientific evidence on the clinical and epidemiological data about TBI in the southeastern region of the state of Pará, the damage described to the health of patients who suffer these accidents, besides the social and economic losses associated with the overload of medium and high complexity health services, this research is of great value. It presents data for the implementation of preventive strategies and awareness policies, through health education, in a dynamic and assertive way based on local evidence. In addition to contributing data to the national literature. Thus, the aim of this research was to describe the occurrence and clinical-epidemiological profile of traumatic brain injury associated with traffic accidents in a regional hospital in the southeast of the state of Pará.

METHODS

This is a cross-sectional analytical observational study. It was based on data from the medical and statistical archives service of a regional hospital, through the analysis of electronic medical records of patients diagnosed with TBI resulting from traffic accidents in the period from 2016 to 2020.

This hospital provides medium and high complexity services to patients from 15 municipalities in the southeast of the state of Pará (Brazil); these municipalities belong to the 12th Regional Health Center (Araguaia Region), which has an estimated population of 541,347 inhabitants, demographic density of 83.46 inhabitants/km² and an extensive territorial area of 174,174.655 km², which corresponds to 14.0% of the total territorial area of the state[10]. The hospital is located at 1,018 km from the capital Belém. Currently, it has 98 beds, distributed among medical clinic, surgical clinic, pediatric clinic, obstetric clinic, day bed, adult, neonatal and pediatric intensive care units and hemodialysis[11].

All data of patients diagnosed with TBI associated with traffic accidents and other causes, aged ≥ 18 years, of both genders and registered in the period from 2016 to 2020 were included in the research. Medical records that did not present information necessary for the research, as well as inaccurate information, were excluded from the study.

The information collected consisted of clinical characteristics such as the cause of TBI, the classification of TBI according to the description given by the attending physician, the length of hospitalization, and the clinical outcome. In addition, sociodemographic variables such as race, gender, education, housing (rural/urban), municipality of origin, and age group were analyzed. And to promote discussion about the impact on the health service, the proportion of this cause of hospitalization compared to other pathologies was calculated.

The analysis was carried out in a reserved, well-lit, and quiet room. In the first moment, the medical records were organized chronologically from January to December. In the second moment, the data collection itself, approximately 10 records per day were evaluated.

The data were tabulated and highlighted in Excel tables (Microsoft 2019) and consolidated according to the appropriate coding for each of the variables studied. Statistical analysis was performed using the Bioestat 5.0 program, through absolute distributions, percentages, means, and standard error (descriptive analysis).

Regarding the epidemiological and clinical variables, descriptive statistics tests were performed; thus, the data were presented by measures of central tendency (means) and variation (standard error). The G test or Chi-square test of independence, followed by residual analysis, was used to test the association between different categories of a variable in two independent groups with p-value <0.05, using Bioestat 5.3 software. To prepare the scale associated with the distribution of TBI occurrence presented in Table 1, descriptive statistics expressed as mean ± standard error of the mean (S.E.P.M.) were applied.

To understand the association between the variables race (white, brown and black), age (in classes: 18 to 29; 30 to 49; 50 to 69; 70 to 80 and over 80 years old), gender (male and female), length of hospitalization (in classes: 1 to 15 days; 16 to 20; 21 to 30 and more than 30 days) and case evolution (discharge; evasion and death) with the clinical classifications of TBI (Diffuse; Focal; Moderate; Hemorrhagic; Severe and unspecified) the Spearman rank correlation coefficient was calculated. The COR procedure of SAS (version 9.0) was used for this, and the results were described only in the text of the results.

This study was approved by the Research Ethics Committee of the Faculdade de Ensino Superior da Amazônia Reunida (Certificate of Submission for Appreciation Ethics Review number 50704421.6.0000.8104 and approval opinion number 4,952,935), in accordance with Resolution number 466 of the National Health Council of December 12, 2012.

RESULTS

For the period analyzed (2016-2020), 20,077 hospitalizations for various causes were recorded in the hospital under study. Of these, 4.0% (798/20,077) were associated with the occurrence of TBI, of which 75.3% (601/798) were directly caused by traffic accidents (Figure 1). The temporal analysis revealed that the year 2018 showed the highest rate of hospitalizations associated with TBI with 22.1% (176/798) and the year with the lowest percentage of cases was 2020 with 15.9% (127/798). However, 2020 was the second year with the highest number of hospitalizations for general causes 19.9% (3992/20,077), second only to 2019 with 22.2% (4464/20,077) (Figure 1). The municipalities that had the highest rates among the years analyzed were Redenção, Xinguara and Conceição do Araguaia, presenting 30.1% (240/798), 11.4% (91/798) and 10.8% (86/798), respectively.

The analyses of the sociodemographic variables revealed that the cases were concentrated with a significant difference, among individuals who were brown 92.5% (738/798; p=<0.001), male 86% (687/798; p= 0.006) and with age range between 18 and 29 years 39% (311/798) (Table 1). Some variables such as education and housing were sometimes not reported in the medical records.

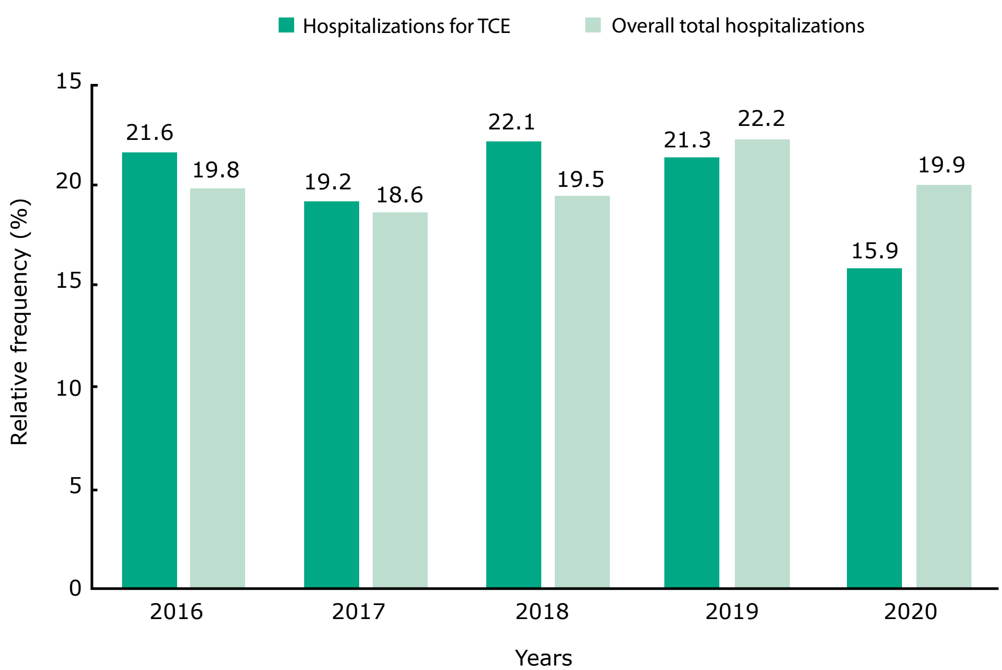

Figure 1: Temporal distribution of hospitalizations caused by Traumatic Brain Injuries associated with traffic and general accidents in a health region in the state of Pará, Brazil, from 2016 to 2020. Presentation of relative frequency (%).

As for the clinical characteristics, it was evidenced that most of the TBI cases evolved to discharge 66.4% (530/798), followed by death 32.1% (256/798) and evasion 1.5% (12/798). The variation described for causes of TBI occurrence was statistically significant (p=0.001), highlighting motorcycle accidents with 69.3% (553/798), cars 3.1% (25/798), hit by a car 2.9% (23/798) and others such as stabbing, firearm and falls with 24.7% (197/798) (Table 1).

The main classification observed among the TBI cases were unspecified intracranial trauma 33.6% (268/798), diffuse brain injury 28.6% (228/798), focal brain injury 18.3% (146/798) and severe brain injury with 13.7% (109/798) (Table 1). The overall (for all counties) mean hospital stay of patients who suffered TBI was 10.3 days (± 0.3) and the mean ICU stay was 8.6 days (± 0.4).

Table 1

Clinical-epidemiological profile of TBI cases in a health region from 2016 to 2020 in southeastern Pará, Brazil.

Analyzed Variables	Municipalities n (%)							
	AAN n=20	B n=3	CA n=86	CN n=11	FA n=29	ON n=42	PD n=24	R n=240
Gender (p= 0.006)*								
Female	1 (5)	-	11 (12.8)	3 (27.2)	-	7 (16.7)	6 (25)	39 (16.2)
Male	19 (95)	3 (100)	75 (87.2)	8 (72.8)	29 (100)	35(83.3)	18 (75)	201(83.8)
Age group (p=0.234)*								
18-29 years old	11 (55)	-	28 (32.5)	1 (9.1)	9 (31)	21 (50)	9 (37.5)	103 (42.9)
30-49	6 (30)	-	41 (47.6)	4 (36.4)	12 (41.4)	14 (33.3)	9 (37.5)	86 (35.8)
50-69	2 (10)	3 (100)	14 (16.3)	5 (45.4)	8 (27.6)	7 (16.7)	5 (20.8)	42 (17.5)
70-80	1 (5)	-	-	1 (9.1)	-	-	-	4 (1.7)
>80	-	-	1 (1.2)	-	-	-	-	2 (0.8)
Ignored	-	-	2 (2.3)	-	-	-	1 (4.2)	3 (1.2)
Raça (p=<0.001)*								
White	-	-	-	-	-	-	-	-
Balck	-	3 (100)	4 (4.7)	2 (18.2)	2 (6.9)	1 (2.4)	-	10 (4.2)
Brown	20 (100)	-	82 (95.3)	8 (72.7)	25 (86.2)	41 (97.6)	24(100)	229 (95.4)
Indigenous	-	-	-	-	-	-	-	-
Ignored	-	-	-	1 (9.1)	2 (6.9)	-	-	1 (0.4)
Evidência de álcool (p= 0.318)*								
Ignored	20(100)	3 (100)	86 (100)	11(100)	29 (100)	41 (97.6)	24(100)	240 (100)
Registered	-	-	-	-	-	1 (2.4)	-	-
Cause (p= 0.001)*								
Car	-	-	3 (3.5)	-	1 (3.4)	-	-	5 (2.1)
Moto	13 (65)	-	60 (69.8)	6 (54.5)	25 (86.2)	32 (76.2)	15 (62)	167 (69.6)
Hit by a car	-	-	-	-	-	-	-	17 (7.1)
Outros	7 (35)	3 (100)	23 (26.7)	5 (45.4)	3 (10)	10 (23.8)	9 (38)	51 (21.2)
Clinical Classification (p=0.001)*								
Difuse TBI	4 (20)	-	23 (26.7)	4 (36.4)	4 (13.8)	11 (26.2)	5 (20.9)	74 (30.8)
Focal TBI	5 (25)	-	14 (16.3)	2 (18.2)	4 (13.8)	9 (21.4)	1 (4.2)	43 (17.9)
Moderate TBI	1 (5)	-	3 (3.5)	-	-	-	1 (4.2)	7 (2.9)
Hemorrhagic TBI	-	-	1 (1.2)	-	-	-	-	-
Severe TBI	2 (10)	-	6 (6.9)	2 (18.2)	4 (13.8)	3 (7.1)	6 (25)	33 (13.7)
TBI not specified	8 (40)	3 (10)	39 (45.3)	3 (27.3)	17 (58.6)	19 (45.2)	11(45.8)	83 (34.6)
Evolution (p= 0.663)*								
High	15 (75)	2 (66.7)	63 (73.2)	6 (54.6)	13 (44.8)	27 (64.3)	15(62.5)	159 (66.2)
Death	5 (25)	1 (33.3)	23 (26.8)	5 (45.4)	15 (51.7)	15 (35.7)	9 (37.5)	76 (31.6)
Evasion	-	-	-	-	1 (3.4)	-	-	5 (2.1)

Continue...

Table 1
Continuation.

Analyzed Variables	Municipalities n (%)						
	RM n=36	SMB n=25	SA n=65	SFX n=55	S n=10	T n=61	X n=91
Gender (p= 0.006)*							
Female	6 (16.7)	6 (24)	7 (10.8)	1 (1.8)	1 (10)	12 (19.7)	11 (12.1)
Male	30(83.3)	19 (76)	58(89.2)	54 (98.1)	9 (90)	49 (80.3)	80 (87.9)
Age group (p=0.234)*							
18-29 years old	10(27.8)	8 (32)	20(30.8)	21 (38.2)	4 (40)	25 (5)	41 (45)
30-49	15(41.7)	10 (40)	32(49.2)	22 (40)	2 (20)	20 (32.8)	32 (35.2)
50-69	9 (25)	6 (24)	11(16.9)	9 (16.4)	2 (20)	13 (21.3)	13 (14.3)
70-80	-	-	-	2 (3.6)	2 (20)	3 (4.9)	3 (3.3)
>80	1 (2.8)	1 (4)	2 (3,1)	1 (1.8)	-	-	1 (1.1)
Ignored	1 (2.8)	-	-	-	-	-	1 (1.1)
Raça (p=<0.001)*							
White	-	-	-	-	-	5 (8.2)	7 (7.7)
Balck	-	-	6 (9.2)	7 (12.7)	-	2 (3.3)	7 (7.7)
Brown	36 (100)	25(100)	59(90.8)	48 (87.3)	10 (100)	54 (88.5)	77 (84.6)
Indigenous	-	-	-	-	-	-	-
Ignored	-	-	-	-	-	-	-
Evidência de álcool (p= 0.318)*							
Ignored	36 (100)	25 (100)	62 (95.4)	55 (100)	10(100)	61 (100)	90 (98.9)
Registered	-	-	3 (4.6)	-	-	-	1 (1.1)
Cause (p= 0.001)*							
Car	1 (28)	2 (8)	4 (6.1)	4 (7.3)	-	-	5 (5.5)
Moto	24(66.7)	17 (68)	47 (72.3)	38 (69.1)	5 (50)	48 (78.1)	56 (61.5)
Hit by a car	-	-	2 (3.1)	-	-	-	4 (4.4)
Outros	11 (30.5)	6 (24)	12 (18.5)	13 (23.6)	5 (50)	13 (21.3)	26 (28.6)
Clinical Classification (p=0.001)*							
Difuse TBI	19 (52.8)	5 (20)	16 (24.6)	13 (23.6)	3 (30)	21 (34.4)	26 (28.6)
Focal TBI	3 (8.3)	7 (28)	12 (18.5)	8 (14.5)	5 (50)	15 (24.6)	18 (19.8)
Moderate TBI	-	-	3 (4.6)	6 (10.9)	-	1 (1.6)	4 (4.4)
Hemorrhagic TBI	-	-	1 (1.5)	2 (3.6)	-	-	-
Severe TBI	8 (22.2)	6 (24)	6 (9.2)	9 (16.4)	-	4 (6.5)	20 (21.9)
TBI not specified	6 (16.7)	7 (28)	27 (41.6)	17 (30.9)	2 (20)	20 (32.8)	23 (25.2)
Evolution (p= 0.663)*							
High	22 (61.1)	15 (60)	43 (66.1)	41 (74.5)	7 (70)	42 (68.8)	60 (65.9)
Death	13 (36.1)	9 (36)	22 (33.8)	13 (23.6)	3 (30)	19 (31.1)	28 (30.8)
Evasion	1 (2.8)	1 (4)	-	1 (1.8)	-	-	3(3.2)

Source: Research authors. () Numerical data shown in percentages. *The G-test or Chi-square test of independence, followed by residual analysis, was used to test the association between different categories of a variable in two independent groups whose p-value is <0.05. AAN= Água Azul do Norte B= Bannach CA= Conceição do Araguaia CN= Cumaru do Norte ON= Ourilândia do Norte PD= Pau D'arco R= Redenção RM= Rio Maria SMB= Santa Maria das Barreiras SA= Santana do Araguaia SFX= São Félix do Xingu S= Sapucaia T= Tucumã X= Xinguara FA= Floresta do Araguaia. - Numeric data equal to zero.

The proportion of deaths varied according to the type of TBI, revealing frequencies of 39.5% (90/228) among patients with diffuse TBI, 29.5% (84/285) in unspecified TBI, 28.4% (31/109) in severe TBI and 28.1% (41/146) for focal TBI. It is noteworthy that the number of unspecified TBI in the analyzed medical records was high 35.7% (285/798). Other relevant data were ignored when filling out the charts, such as the evidence of alcohol that was detected in only 0.7% (5/798) of the records, and in 99.3% (793/798) it was ignored.

Analyzing globally (the data from all the municipalities), it was possible to observe a low (0.07) and significant ($p= 0.04$) correlation between the age classes and the clinical classifications of TBI. Indicating that the higher the age, the worse the TBI severity. When analyzing the association between the TBI classes and the time of hospitalization, a low, negative (-0.08) and significant ($p = 0.02$) correlation was evidenced, which means, the longer the time of hospitalization, the lower the TBI severity. This is possibly explained by the evolution of severe cases to death.

DISCUSSION

Most studies on TBI focus on clarifying clinical characteristics; however, this study shows that the highest proportion of TBI was inherent to the occurrence of traffic accidents, that is, an external cause associated with social factors such as the level of education, going beyond biological issues, which means the relevance of conducting epidemiological studies is clear[12].

Thus, it is important to emphasize that the use of safety equipment can reduce the occurrence and severity of injuries[13]. In addition to this aspect, a survey showed that 30% to 50% of TBI patients were alcoholic at the time of injury. This highlights the need to raise awareness concerning the association of alcohol consumption and driving motor vehicles, as well as the importance of using safety equipment and complying with traffic laws in order to reduce the severity of these accidents and the occupation of hospital beds due to preventable causes[14, 15].

However, failure to comply with laws is frequent, resulting in an alarming concentration of accidents; therefore, to better understand this reality, it is necessary to consider some of the victims' social, cultural, and economic attributes. And once the problem is identified, it is necessary to act more effectively with public policies that consider each attribute in a biopsychosocial way and with local approaches[16].

Regarding the temporal analysis performed in this study, it was possible to observe that the year 2020 had the second highest number of general hospitalizations; however, the number of TBI cases decreased. This fact can be explained by the advent of the COVID-19 pandemic, in which social isolation may have contributed to the mitigation of car accidents and numerical reduction in the incidence of trauma[17].

This was corroborated in a study conducted in the city of Tyrol, Austria, which showed that in 2020, the average number of TBIs associated with traffic accidents was 4.3 during the pandemic, and in the previous years, 2018 and 2019, averages were around 10.3 and 9.3, respectively[18]. Furthermore, it is paramount to note that alcohol consumption is an important factor regarding the occurrence of TBIs. As described in a study, even though hospitalizations for severe TBIs reduced about 33% during social isolation, there were changes in the etiology, with more TBIs occurring related to other causes, such as alcohol consumption[19-21].

Another analysis showed that alcohol sales were significant predictors of the number of TBI cases; an increase in alcohol sales of 1,000 units resulted in a 0.07% increase in TBI cases[22]. Reinforcing the importance of the correct registration about the evidence of alcohol, which was highly ignored in the medical records of the current research (99.3%). Moreover, the high rate of TBIs without a specific diagnosis also stands out. This same problem was found in other studies conducted in Brazil, revealing that in traumatic events, many variables were not available for a high percentage of patients, emphasizing that this is a recurrent problem that needs attention[23,24].

Despite these obstacles, it was possible to characterize the sociodemographic profile, revealing a predominance of TBIs in young men, aged between 18 and 29 years and who were on motorcycles. This fact can be confirmed by analyzing the literature, with a higher frequency affecting motorcyclists (88.9%) and who were not wearing helmets at the time of the accident[25,26].

In this perspective, it is noteworthy that motorcyclists present about 30 times more risk of death when compared to other drivers, due to noncompliance with traffic laws, especially when associated with the non-use of protective items. As for the damage caused by accidents, TBI is in first place among the injuries that leave the victims incapacitated or lead them to death; thus, trauma can be considered not only a fatality, but a preventable disease[26].

Thus, considering the global inferential analysis for the length of hospitalization and classification of TBIs in this study, it was observed that the longer the length of hospitalization, the lower the severity of TBI, which can possibly be explained by the evolution of severe cases more often leading to death. A similar fact was described in a research conducted in Nigeria, which, when evaluating the trauma severity and hospital stay, revealed that of the 182 total TBI cases admitted to the ICU, 76.4% stayed between 1 and 7 days and were 4 times more likely to die when compared to those who stayed for more than a week[27].

Therefore, reducing the number of accidents that result in TBI and improving prevention strategies is an urgent governmental need; for this, it is necessary to implement effective traffic education and strategies based on assertive local clinical and epidemiological indices. However, there are still many cultural and social barriers in Brazil that hinder the holistic resolution of this problem with biopsychosocial nuances[26,28].

The limitations of this study are associated with its retrospective nature, not allowing data control. Moreover, this work is not a multicenter study, since it was restricted to a single hospital, thus being able to present an epidemiological profile specific to this place.

CONCLUSION

Based on the data presented, it was possible to determine the epidemiological profile of the distribution of TBI cases in the Araguaia health region. We emphasize that the occurrence of TBIs associated with automobile accidents is a notable health problem that requires attention. It is evident that young men and those who ride motorcycles were the most affected during the study period. Moreover, it was possible to bring up the possibility of restrictive measures and enforcement impacting the rates of this problem.

However, there were some gaps regarding the filling out of medical records, which made it difficult to determine the association between the outcome (occurrence of TBI) and the variables (use of PPE and alcohol consumption). Revealing the need to improve the filling out of these documents. Nevertheless, based on the information presented, assertive local public policies aimed at prevention can be implemented. And this may be the starting point to promote changes aimed at mitigating traffic accidents and occupation of beds due to preventable causes, impacting the quality of health care and economic factors.

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