Epidemiological and deontological aspects of traffic mortality in Roraima

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Abstract

This is a longitudinal and descriptive study evaluating epidemiological and deontological aspects of traffic mortality in Roraima by comparing data from the Legal Medical Institute of Roraima, the Violence and Accident Surveillance System and the Mortality Information System. Most of the victims were men (85.2%), brown-skinned (81.5%), living in an urban area (81.5%), single (66.7%), between 15 and 34 years old (54.9%). The most common injuries were contusion (96.2%) and fracture (75.5%). The body parts most affected were the head (69.8%), lower limbs (66%) and face (54.7%). The main cause of death was head trauma (43.4%). The comparison of data evidenced underreporting of traffic mortality in Roraima. Constant reflection is essential to establish ethical parameters for the professionals involved, and the integration between health agencies and the Legal Medical Institute is recommended to create a database to support policies adapted to the local reality.

Keywords: Traffic accidents. Epidemiology. Ethic.

Resumo

Aspectos epidemiológicos e deontológicos da mortalidade no trânsito em Roraima

Este estudo avalia a mortalidade no trânsito em Roraima sob os aspectos da epidemiologia e da deontologia. Trata-se de pesquisa longitudinal e descritiva, que comparou dados do Instituto Médico Legal de Roraima, do Sistema de Vigilância de Violências e Acidentes e do Sistema de Informações sobre Mortalidade. A maioria das vítimas era homens (85,2%), pardos (81,5%), residentes em área urbana (81,5%), solteiros (66,7%), com entre 15 e 34 anos (54,9%). As lesões mais comuns foram contusão (96,2%) e fratura (75,5%). As partes mais atingidas foram cabeça (69,8%), membros inferiores (66%) e face (54,7%). A principal *causa mortis* foi trauma na cabeça (43,4%). Comparando os dados, constatou-se subnotificação da mortalidade no trânsito em Roraima. A reflexão constante é fundamental para estabelecer parâmetros éticos para os profissionais envolvidos, e recomenda-se integrar órgãos da saúde com o Instituto Médico Legal para criar banco de dados que subsidie políticas adaptadas à realidade local.

Palavras-chave: Acidentes de trânsito. Epidemiologia. Ética.

Resumen

Aspectos epidemiológicos y deontológicos de la mortalidad en el tránsito en Roraima

Este estudio objetivó evaluar la mortalidad en el tránsito en Roraima bajo los aspectos de la epidemiología y deontología. La investigación longitudinal y descriptiva comparó datos del Instituto Médico Legal de Roraima, del Sistema de Vigilancia de Violencias y de Accidentes y del Sistema de Información sobre Mortalidad. La mayoría de las víctimas fueron hombres (85,2%), pardos (81,5%), residentes en área urbana (81,5%), solteros (66,7%), en el grupo de edad 15-34 años (54,9%). Las lesiones más frecuentes fueron contusión (96,2%) y fractura (75,5%). Las partes afectadas fueron cabeza (69,8%), miembros inferiores (66%) y cara (54,7%). La principal *mortis causa* fue trauma en la cabeza (43,4%). La comparación entre los datos obtenidos permitió cuantificar la subnotificación de mortalidad en el tránsito en Roraima. Es fundamental la reflexión constante con el fin de establecer parámetros éticos a los profesionales, y se recomienda integrar organismos de la salud pública con el Instituto Médico Legal, para crear un banco de datos orientado a subsidiar políticas adaptadas a la realidad local.

Palabras clave: Accidentes de tránsito. Epidemiología. Ética.

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Research

Traffic accidents are a serious public health problem, with high morbidity and mortality rates. Data indicate that 50 million people suffer injuries – many of them with sequelae – and 1.2 million die every year in the world due to traffic accidents, which causes social and humanitarian problems, in addition to significant damage to the economy [1-6].

Global projections of mortality from traffic accidents indicate an increase from 1.2 million in 2002 to 2.1 million in 2030 [7], which represents an increase of 75% in the number of lives violently taken. Considering 178 countries, 90% of traffic-related morbidity and mortality occurs in low- and middle-income countries, which hold only 48% of vehicles in the world [8]. Although preventable, these early deaths reach alarming levels in these countries [9].

In the Americas, Brazil is the third country with the highest traffic mortality, second only to Belize and the Dominican Republic, while Canada is the one with the lowest prevalence of this aggravation [10]. Worldwide, Brazil ranks fifth in road accidents [11]. In fact, the number of injuries and deaths from this cause in the country is alarming, accounting for more than 40 thousand deaths per year [12], a higher number than the victims of recent wars and AIDS [13]. The Second Global High Level Conference on Road Safety pointed to data deficiency and lack of inspection and coordination between federal and state programs as explanations for the problem [14].

The Violence and Accident Surveillance System (Viva) was implemented in 2006 in the Unified Health System (SUS) to enable knowledge of the epidemiological profile of violence and accidents, including traffic-related ones. However, traffic victims not attended by SUS are invisible in Viva, so the magnitude of deaths and injuries is still underestimated [15].

The databases of the Ministry of Health (MH) report limitations for the North and Northeast regions of the country, which have unsatisfactory coverage and significant underreporting of deaths [16,17]. The Pan American Health Organization (PAHO) ratifies that many countries suffer from underreporting problems, with traffic deaths recorded as "other or unspecified" [10].

Studies on the profile of victims hospitalized for injuries resulting from land transport accidents (LTA) in Brazil between 2000 and 2013 show 1,747,191 hospitalizations, of which 410,448 were people with physical sequelae (23.5%). Of these, 77.7% were male; 26.5% in the 20–29 years age group; 46.4% residing in the Southeast region; 32.5% pedestrians and 31.1% motorcyclists. With a diagnosis of probable physical sequelae, there were 359,259 hospitalizations, 43.3% of motorcyclists [1].

In a survey with three different sources of information about traffic accidents in Belo Horizonte, Minas Gerais, Brazil, inadequate filling was found in all of them, highlighting the lack of data on safety equipment use and driver alcohol consumption. A comparison of the three sources showed the same profile of those involved in accidents: men, young, motorcyclists and motorcycle passengers or pedestrians. In addition to the high mortality rate in Belo Horizonte in the period (19.4 per 100 thousand inhabitants), there was an increase in accidents and non-fatal victims, with an increase in the hospitalization rate (34%) and hospital costs (53%) and greater involvement of motorcycles in proportion to the fleet. Despite the gaps in the records, it is possible to point out some recurrences: older pedestrians, motorcyclists, alcohol use and speeding [4].

As for bicycles, a study based on data from the Mortality Information System (MIS) found that the majority of cyclist deaths in traffic accidents in Brazil, from 2000 to 2010, occurred due to head injuries. Most victims were male (85.4%). The survey also pointed out an increase in these deaths in the North and Northeast, and a reduction in the South and Southeast [5].

Data from 2000 indicated Boa Vista, Roraima, Brazil, as the capital with the highest mortality in this context, with 47.9 deaths per 100 thousand inhabitants [13]. And according to the MH, from 2000 to 2004 the municipality had an increase of 43% in traffic mortality, reaching 111.6 deaths per 100 thousand inhabitants [18]. Even with the so-called "Dry Law", mortality from land transport accidents did not decrease in Roraima, since MIS numbers allow us to conclude that deaths increased in the biennia of 2008 and 2009, 2011 and 2012, and 2014 and 2015 [19]. These statistics are of great relevance, as they help to develop and improve public policies [20-22].

The present study describes traffic mortality in Roraima, in the Brazilian Legal Amazon, based on dental and medical reports of forensic examinations and autopsies of the Legal Medical Institute of Roraima (IML/RR) – the only one in the state – [23-25], thus providing an epidemiological profile in order to relate it to official data from Viva Survey and MIS, both of the MS. In addition, this study seeks to reflect on traffic mortality by considering the ethical norms of the professional councils of medicine [26] and

dentistry[27] (since the specialty takes part in expert work) and the current legislation.

Methods

The research project was approved by the Research Ethics Committee of Faculdade São Leopoldo Mandic, in Campinas, São Paulo, Brazil, and submitted to Plataforma Brasil of the MH. The IML/RR[28] management authorized, by means of a document, researchers' access to medical and dental reports of forensic examinations related to traffic accidents.

With a quantitative, transversal, descriptive and exploratory design, the study covers the state of Roraima, which belongs to the Brazilian Legal Amazon[29,30]. The criteria of the Viva Survey 2011[31] were adopted , which used a probabilistic sample of September 2011 as a national parameter. In the present study, however, the 2011-2015 period was considered.

In the analysis of the reports, the variables (detailed in the Appendix) were: 1) general data from the forensic examination; 2) data of the person examined; 3) residence of the person examined; 4) information about injuries. The source of the survey was the archives of IML/RR, which exclusively carries out the forensic examinations provided for in §§ 3 and 5 of article 5 of Law 6.194/1974[32], which deals with personal injuries caused by motor vehicles on land. Data from the Viva Survey 2011[33] and MIS (2011-2015)[34] were also consulted.

It should be clarified that in order to have a legal interment (burial), a declaration and, consequently, a death certificate is required[35]. The declaration, also known as "death declaration", is issued by the doctor – when present on the spot – or by two qualified persons who have witnessed or verified the death. The certificate, on the other hand, is issued by a civil registry office[36].

The study compared said IML/RR forensic reports with the sources of the MH in order to verify if there is in fact the underreporting of mortality described in the literature[10,16,17]. Through absolute and relative frequencies, an exploratory analysis of all the data obtained was carried out[37].

Results

In the period considered, IML/RR recorded 859 deaths related to traffic accidents, 66% of which occurred in the state capital. Most of the victims were male (85.2%), brown-skinned (81.5%), living in urban areas (81.5%), and single (66.7%). As for age group, in 18.5% of the cases the victims were between 30 and 34 years old, in 16.6% between 20 and 24, and in 10.4% between 15 and 19. The most common cause of death was traumatic brain injury (28.3%), followed by polytrauma (16.9%) and intracranial hemorrhage (9.4%).

Table 1 shows data on the nature of the injuries, considering the diagnosis and the affected body part. It is important to note that the same victim can present with several injuries, of different types and in different body parts. Contusion was the most common, followed by fracture, excoriation and traumatic brain injury. The most affected body part is the head, followed by the lower limbs, face, chest, multiple organs/regions, abdomen/hips and upper limbs.

Table 1. Epidemiological profile of traffic mortality, nature of injury and body part affected

Feature	n	%
Nature of injury		
Amputation	33	3.8%
Contusion	826	96.2%
Cutting/laceration	308	35.9%
Sprain/dislocation	33	3.8%
Excoriation	632	73.6%
Fracture	649	75.5%
Polytrauma	297	34.6%
Abdominal trauma	347	40.4%
Traumatic brain injury	519	60.4%
Dental trauma	16	1.9%
Thoracic trauma	373	43.4%
Body part affected		
Abdomen/hip	389	45.3%
Mouth/teeth	65	7.6%
Head	600	69.8%
Spine/cord	132	15.4%
Back	194	22.6%
Face	470	54.7%
Genitals/anus	17	2%
Lower limbs	567	66%
Upper limbs	389	45.3%
Multiple organs/regions	413	48.1%
Neck	146	17%
Chest	438	51%

Source: Medical and dental reports of forensic examinations of IML/RR autopsies, 2011-2015.

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Tables 2 and 3 compare the results of IML/RR surveys with data from the MH, Viva Survey and MIS. It should be noted that Viva used a probabilistic sample of September 2011 as a national parameter and, until the writing of this article, it only made available mortality data for that year, even with Ordinance MS 708/2014 [38], which released financial resources for a new survey – already carried out, according to the MH [39]. The comparison between IML/RR reports and Viva Survey and MIS data provide evidence of underreporting of traffic mortality in Roraima.

Table 2. Traffic mortality in Roraima (comparison between IML/RR and Viva Survey data)

Month/year	Source	n	Underreporting (n)	Underreporting (%)	Accumulated underreporting (%)
September/2011	IML/RR	14	8	57.1%	57.1%
	Viva	6			
September/2014	IML/RR	12	-	-	-
	Viva	UN			

IML/RR: Legal Medical Institute of Roraima; UN: unavailable; Viva: Violence and Accident Surveillance System

Source: Medical and dental reports of forensic examinations of IML/RR and Viva Survey autopsies

Table 3. Traffic mortality in Roraima (comparison between IML/RR and MIS data)

Year	Source	n	Underreporting (n)	Underreporting (%)	Accumulated underreporting (%)
2011	IML/RR	146	9	6.2%	6.2%
	MIS	137			
2012	IML/RR	164	13	7.9%	7.1%
	MIS	151			
2013	IML/RR	188	33	17.6%	11%
	MIS	155			
2014	IML/RR	174	22	12.6%	11.5%
	MIS	152			
2015	IML/RR	187	15	8%	10.7%
	MIS	172			

IML/RR: Legal Medical Institute of Roraima; MIS: Mortality Information System

Source: Medical and dental reports of forensic examinations of IML/RR and Viva Survey autopsies

Discussion

Age and gender

According to IML/RR data, traffic mortality mainly affects males (85.2%) between 15 and 34 years of age (54.9%). The age group is consistent with that of other studies, but the percentage of male victims is high [1,5,6,40]. The difference can be explained by the fact that, in the state of Roraima, unlike the rest of the country, men outnumber women [41].

Skin color

Brown-skinned people are the most affected by traffic mortality (81.5%), considering that individuals who claim to be of mixed-race (*mulatos*, *caboclos*, *cafuzos* or *mamelucos*) all fall into the classification. In Roraima, most of the population is brown-skinned (65.6%) [42]. The state has the highest percentage of indigenous people in the country [43], with more than half of its schools geared to this population segment (53%) [44]. This demographic profile contributes to interbreeding.

Profile for planning

In addition to age and gender, the study found that the majority of traffic victims are single (66.7%) and residents of the capital (66%), in urban areas (81.5%). These findings favor the planning of targeted preventive actions.

Cause of death

The most common cause of death in IML/RR reports were head trauma (traumatic brain injury, intracranial hemorrhage, cranial hemorrhage trauma and cerebral edema) (43.4%), coinciding with the

results of other studies [6,45]. The sources, however, are incomplete, including regarding information about safety equipment use [4].

For example, cyclists are not required to wear a helmet in Brazil, although there has been a significant reduction in mortality and head and face trauma in countries that oblige the use of this equipment [5]. In order to change this scenario, the Bicycle Brazil Program, which encourages cycling to improve urban mobility conditions, recommends governmental and non-governmental actions to develop and disseminate educational campaigns on the safe use of bicycles and its benefits [46].

A survey mapped the body regions most affected in traffic accidents, concluding that motorcyclists usually injure upper and lower limbs and pelvic girdle, while victims of being run over and drivers and passengers of other types of car are more often injured in the head, neck and face [47]. In a study with motorcycle taxi drivers in Feira de Santana, Bahia, Brazil, the most affected parts were the lower and upper limbs [6].

Time to start autopsy

The Federal Council of Medicine [48] and the Brazilian criminal law [49] determine that the autopsy must be started six hours after death, unless the experts, finding that the death is evident, consider that the procedure can be done before this period. The planning to perform the autopsy for a traffic accident can be changed due to logistical contingencies and human resource allocation. In any case, the coroner must record in the report the exact date of death and post-mortem examination.

Invisibility of cases not attended by SUS

The comparison of IML/RR autopsy reports with Viva Survey numbers showed underreporting of traffic mortality in Roraima, with 57.1% of deaths not registered by the MH survey [31]. Therefore, cases of lethal outcome that go to IML/RR without going through health services remain invisible.

In comparison with MIS data from 2011 to 2015, unreported cases reached 10.37%, considering the entire period. The Mortality Qualification Sheets of the MH [16,17] themselves have limitations, with significant underreporting of deaths in the North and Northeast of the country. Declarations of deaths from traffic accidents, classified as "external cause", are always issued by IML after the autopsy, even if death occurs in an emergency room [20-22].

Underreporting of deaths

It is estimated that 21% of traffic deaths in the Americas are underreported [10]. In the case of Roraima, as seen, the percentage reaches 57.1% when considering Viva Survey (Table 2), and 10.7% when considering MIS (Table 3).

Measuring underreporting is important to design and improve public policy programs and strategies, since the lack of accurate information on the mortality rate prevents knowledge of the local epidemiological reality, limiting the system's actions and decreasing the effectiveness of health surveillance [50].

Epidemiological integration strategy

It is important to establish partnerships in the planning of health surveys, integrating epidemiological agencies with other institutions – such as the IML, which belongs to the Public Security porfolio – in order to obtain a unified, complete and reliable database [4]. This collaboration would help to comply with the guidelines of the National Policy for the Reduction of Morbidity and Mortality due to Accidents and Violence, producing reliable data to support managers in the creation of public policies aimed at the local reality, with actions for the prevention, promotion and protection of health, as well as health rehabilitation of injured people [2,3,14].

Ethics

The essence of medical ethics is action on behalf of the patient, taken as an end – not as a means – of professional performance, always through free and informed consent [51]. By establishing a relationship of mutual trust, the doctor must seek beneficence and avoid harm, respecting patient autonomy and treating him/her with fairness and respect, according to the principles of principlist bioethics.

As regards autopsy – since patient autonomy and beneficence is not at issue –, professionals must correctly apply the relevant legislation [52]. However, in addition to complying with the law, Costa Filho and Abdalla-Filho [53] draw attention to the need for establishing specific ethical references for criminal forensics, especially for dealing with the body of the deceased and the relationship with family members.

The starting point for this effort should be the 1988 Constitution [54] and the *Universal Declaration on*

Bioethics and Human Rights (DUBDH)[55], documents that guide the pursuit of a more egalitarian, fraternal, just and solidary society[56-58]. Based on these fundamental texts, one can start with the more specific problem of ensuring scientific and functional autonomy in the exercise of forensic examination, respecting the different areas of expertise involved[23,52,53,59,60].

Collective health and environment

Safe spaces should be provided for pedestrians and cyclists, so as to encourage walking and cycling and favor the coexistence of different types of transport, transforming the city into a health-promoting environment. In short, mobility must be safe and sustainable.

For this, it is necessary to adjust the speed limits of each road and way – reaching, at the most, 50 kilometers per hour –, as well as ensure ample and adequate road signs and adopt 3D zebra crossings. Together with an emphasis on safety education, measures like these can reduce traffic morbidity and mortality. In addition, by encouraging walking and cycling, one can motivate the practice of physical activity and increase general well being, reducing obesity and non-communicable diseases. The benefits would even extend to the environment, as the reduction of vehicles powered by fossil fuels would attenuate fine particles pollution, associated with a higher risk of mortality from respiratory and cardiovascular problems[61].

Final considerations

The study described traffic mortality in Roraima from ethical, legal and epidemiological considerations, comparing IML/RR reports with data of the Ministry of Health (Viva Survey and MIS). This comparison evidenced underreporting of deaths caused by traffic accidents.

To solve the problem, health agencies should be integrated with institutions like the IML, linked to public security, in order to form a unified, complete and reliable database that supports policies geared to the local reality. This will allow to implement actions of health prevention, promotion and protection, as well as rehabilitation of accident victims.

As measures to minimize the impact of traffic morbidity and mortality, safe spaces for pedestrians and cyclists are also recommended; adaptation of the speed limit to the different roads, respecting the speed limit of 50 kilometers per hour; emphasis on education for traffic safety, with broad mobilization of society; adequate signaling and adoption of 3D zebra crossings.

Finally, with regard to deontology, the survey highlights the importance of constant reflection to guide behaviors that guarantee respect for the dignity of the human person.

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Research

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Participation of the authors

Antonio Alberto de Medeiros Ferreira undertook the research and prepared the article, which is part of his doctoral thesis. Flávia Martão Flório guided the conception, design and development of the research and reviewed the article. Luciane Zanin de Souza participated in the design, development and review of the article.

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Research

Appendix

Variables distributed in blocks to collect information:

1. General data of IML/RR traffic accident forensic autopsy: month, year and day of the week.

2. Profile of the person examined: age (under 1, 1-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45 -49, 50-54, 55-59, 60-64, 70-74, 75-79, 80-84 and unknown), sex (male, female or unknown); skin color or race (white, black, yellow, brown, indigenous or unknown), marital status (married, divorced or separated, divorced, single, common-law marriage, widowed or unknown), education (no education, 1st to incomplete 4th grade of elementary school, 4th grade of elementary school, 5th to incomplete 8th grade of elementary school, complete elementary school, incomplete high school, complete high school, incomplete higher education, complete higher education or unknown).

3. Residence data of the person examined: country, federation unit, municipality, neighborhood, and area of residence (urban, rural, peri-urban or unknown).

4. Injury data: nature of injury (contusion; cut/laceration; sprain/dislocation; fracture; amputation; dental trauma; brain trauma; polytrauma; other, which one?); affected body part (mouth/teeth; head; face; neck; spine/spine; chest/back; abdomen/hip; upper limbs; lower limbs; genitals/anus; multiple organs/regions; other, which one?); and cause of death described in the report (hypovolemic shock; hypovolemic shock from abdominal vascular injury; hypovolemic shock from thoracoabdominal trauma; mixed hemorrhagic and cardiogenic shock from trauma; cerebral edema; cervical spine fracture; intracranial hemorrhage; multiple organ failure due to multiple trauma; respiratory failure; polytraumatism; septicemia as a result of polytraumatism; posttraumatic septicemia; cranioencephalic trauma; cranial hemorrhage trauma; spinal cord injury; impaired).