Factors associated with land transport accidents in the State of Espírito Santo


Abstract

Objective: Verify the factors associated with the land transport accidents victims assisted by the Mobile Urgency Care Service in the state of Espírito Santo.

Methods: Cross-sectional study with retrospective data collection from a sample of 2,502 pre-hospital printed care reports from Mobile Urgency Care Service in 2015, of these, 438 were victims of land transport accidents. Information was collected regarding: sex, age, life cycle, ethyl breath, vehicle involved, severity of trauma and outcome of the occurrence. Severity was established using the Revised Trauma Scale. Chi-square test was performed.

Results: Land transport accidents represented 50.2% of the external causes victims assisted. Most of the victims were male (73.7%), adults (81.9%), had no ethyl breath (88.8%) and victims of minor trauma (95.3%). The Motorcycle was the vehicle most frequently involved (56.1%). It was found as factors associated (p <0.05) with the type of land transport accident: life cycle (adult and collision; elderly and run overs), vehicle (automobile - run over and collision; motorcycle and bicycle - falling) and severity of trauma (major and run over; minor and fall).

Conclusion: The data reveals the main factors associated with land transport accidents, guiding the pre-hospital care to these occurrences. It is necessary to intensify specific educational measures for each risk group.

Keywords: Emergencies. Emergency Medical Services. External Causes. Trauma. Accident Traffic.
INTRODUCTION

External causes are events that cause health problems as a result of accidents and violence. Currently, they occupy third place among the main reasons for death worldwide, representing a serious social problem, due to high mortality rates and sequelae, which culminate in high relevance in the economic, psychological, organic and cultural aspects of the victims and your family members. Therefore, establishing pre-hospital medical care is extremely important to guarantee a better prognosis for victims and avoid secondary damage to injuries. In order to provide such assistance, Brazil has the Mobile Emergency Care Service (SAMU 192), a component of the public health system of pre-hospital care, implemented after the establishment of the National Emergency Care Policy.

Among the types of external causes, land transport accidents stand out, considered a true epidemic, given their high incidence. It is also noteworthy that this type of accident triggers several traumas for society and social relations, and also brings high costs to health services and the country’s economy. In this sense, according to data from the Institute of Applied Economic Research – IPEA, in 2015, land transport accidents on Brazilian federal highways generated a cost to society of R$ 12.8 billion, of which 62% were associated to accident victims. Of these, 42% refer to people’s loss of production, and 20% relate to hospital costs.

In developing countries, injuries and deaths from land transport accidents are a major problem, as the number of occurrences exceeds 85% of total deaths and 90% of disability-adjusted life years were lost due to injuries caused in the traffic. In Brazil, epidemiological data from 2012 demonstrate that land transport accidents ranked second in the ranking of mortality from external causes, accounting for 30.3% of these deaths. In Espírito Santo, as of 2015, deaths from external causes began to occupy third place in the ranking of general mortality. Furthermore, data from 2018 showed that deaths caused by transport accidents account for 23% of the total due to external causes. According to IPEA (2016), Espírito Santo stands out negatively, with high mortality rates from land transport accidents (ATTs), especially considering the coastal region of the state.

Studies indicate that around 15% of hospitalizations for external causes in public hospitals in Brazil between 2002 and 2011 were diagnosed with injuries caused by land transport accidents. Among the hospital admissions generated by this scenario in the Unified Health System (SUS), between 2000 and 2013, 410,448 people (23.5%) were identified with a diagnosis suggestive of physical sequelae, predominantly in young men aged 20 to 29, mainly pedestrians and motorcyclists.

Therefore, it can be seen that land transport accidents can be considered a major public health problem on a global scale, deserving close attention from official traffic management and public health bodies, so that they can promote measures that help to reverse this reality. From this perspective, this work aims to verify the factors associated with the types of ATTs in victims assisted by the Mobile Emergency Care Service (SAMU 192) in the state of Espírito Santo, Brazil.

METHODS

This is a cross-sectional study, with retrospective data collection from Printed Occurrence Reports of primary care from SAMU 192 in the state of Espírito Santo, in the year 2015. The data were extracted from the primary research database called “Rede de Urgência e Emergência: Study of SAMU 192 in the Metropolitan Region of Espírito Santo”, the present study being one of the objectives of this project, which was approved by the Research Ethics Committee, through No. 1,748,503.

In 2015, SAMU 192 provided 51,555 consultations in Espírito Santo. To define the number of research participants, the following formula was considered: \[ n_0 = \frac{Z^2 \cdot \delta^2}{e^2} \]
where \( n_0 \) is the minimum sample number, \( Z \) the value corresponding to the 95% confidence interval (1.96), \( \delta = 0.5 \), is 0.5 the proportion expected to be found and \( E \) the tolerated sampling error (0.05). Thus, the minimum sample number obtained was 2,401, which was rounded to 2,500 at the end, in order to minimize the risks of error and sample loss. For selection, the systematic sampling method was applied with a pre-established selection interval, in which every twenty occurrences of the twentieth was selected to compose the research. The sample collected contains a total of 2,502 primary care incident reports made by SAMU 192.

Out of the total sample, it was identified that 35.3% (883 individuals) were victims of some type of external cause. Land transport accidents were observed as the cause of injury in 443 participants, which represented 50.2% of all external causes of health problems. However, data regarding the type of land transport accident was not found in five participants and, for convenience, they were excluded from the study. Therefore, it consisted of a total of 438 participants.

As for the variables, those included in the study were: type of traffic accident (run over, collision, fall from a moving vehicle); Sex (male; female), Life cycle (child/adolescent - 0 to 19 years old; adults - 20 to 59 years old; elderly people - over 60 years old), Ethyl breath (yes; no), Vehicle involved (car; motorcycle; bicycle; truck/bus); Outcome of occurrence (transport to health service; released on site; death, whether on site or during transport to health service) and severity (major trauma, minor trauma).

To assign severity, the Revised Trauma Scale (RTS) was used, the score of which is determined by obtaining data on the victim’s physiological parameters, which consist of: Glasgow Coma Scale (GCS), Systolic Blood Pressure (SBP) and Respiratory Rate (RR). These indices are scored between zero (worst state) and four (best state), allowing a score ranging from 0 - 12 points. Patients with a final result of 12 points are classified as minor trauma, while those with a score lower than 12 points are categorized as major trauma.

The information obtained was analyzed using simple descriptive statistics and univariate analysis, using the Chi-Square Test or, in the event of an expected frequency of less than five, Fisher’s Exact. The 95%
participants) were related to some type of land transport accident, of which 60.9% were victims of collision, 23.6% fell from a moving vehicle and 15.6% were run over. Among these, an average of 34.0 ± 14.3 years of age was identified, with the youngest being 6 and the oldest being 85 years old. The majority of victims were male (73.7%), adults (81.9%), did not have alcoholic breath (88.8%) and suffered from minor trauma (95.3%). On these occasions, the vehicle involved most frequently was the motorcycle (56.1%). Table 01 presents information obtained from the service reports of victims assisted by SAMU 192.

RESULTS

Of the total number of victims of external causes assisted by SAMU 192, during 2015, 50.2% (438

Table 1: Distribution of victims assisted by SAMU 192, according to type of land transport accident, during 2015

<table>
<thead>
<tr>
<th>Variables</th>
<th>Type of Land Transport Accident</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Run over</td>
<td>Collision</td>
</tr>
<tr>
<td></td>
<td>n = 68 (%)</td>
<td>n = 266 (%)</td>
</tr>
<tr>
<td>Sex</td>
<td>Feminine</td>
<td>23 (33.8)</td>
</tr>
<tr>
<td></td>
<td>Masculine</td>
<td>45 (66.2)</td>
</tr>
<tr>
<td>Life cycle</td>
<td>Child/Teen</td>
<td>8 (11.8)</td>
</tr>
<tr>
<td></td>
<td>Adult</td>
<td>48 (70.6)</td>
</tr>
<tr>
<td></td>
<td>Elderly</td>
<td>12 (17.6)</td>
</tr>
<tr>
<td>Ethyl Breath</td>
<td>No</td>
<td>59 (86.8)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>9 (13.2)</td>
</tr>
<tr>
<td>Vehicle Involved</td>
<td>Car</td>
<td>26 (38.2)</td>
</tr>
<tr>
<td></td>
<td>Bicycle 2</td>
<td>22 (8.3)</td>
</tr>
<tr>
<td></td>
<td>Truck/Bus</td>
<td>8 (3.8)</td>
</tr>
<tr>
<td></td>
<td>Motorcycle</td>
<td>29 (42.6)</td>
</tr>
<tr>
<td></td>
<td>Omitted*</td>
<td>3 (4.4)</td>
</tr>
<tr>
<td>Gravity</td>
<td>Major Trauma</td>
<td>6 (8.8)</td>
</tr>
<tr>
<td></td>
<td>Minor Trauma</td>
<td>56 (82.4)</td>
</tr>
<tr>
<td></td>
<td>Omitted*</td>
<td>6 (8.8)</td>
</tr>
</tbody>
</table>

Univariate statistical analysis; Source: table prepared by the authors.

Table 02 presents the Chi Square residual (adjusted residual) calculated for the variables that had a significant association (p<0.05), with a significant association being considered between two categories when the adjusted residual was greater than 1.96 and the higher the adjusted residual value, the greater the association between categories.

Table 2: Chi -square residual referring to the variables that showed association: Life Cycle, Vehicle Involved and Severity

<table>
<thead>
<tr>
<th>Variables</th>
<th>Types of Land Transport Accident</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Run over</td>
<td>Collision</td>
<td>Fall from Moving Vehicle</td>
</tr>
<tr>
<td>Life cycle</td>
<td>Child/Teen</td>
<td>-0.3</td>
<td>-0.5</td>
</tr>
<tr>
<td></td>
<td>Adult</td>
<td>-2.6</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Older adult</td>
<td>5.2</td>
<td>-2.9</td>
</tr>
</tbody>
</table>
Continuation - Table 2: Chi-square residual referring to the variables that showed association: Life Cycle, Vehicle Involved and Severity

<table>
<thead>
<tr>
<th>Variables</th>
<th>Run over</th>
<th>Collision</th>
<th>Fall from Moving Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Involved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car</td>
<td>2.2</td>
<td>2.7</td>
<td>-5.0</td>
</tr>
<tr>
<td>Bicycle</td>
<td>-2.2</td>
<td>-2.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Truck/Bus</td>
<td>3.3</td>
<td>-0.8</td>
<td>-1.9</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>-2.0</td>
<td>-0.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Gravity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Trauma</td>
<td>2.0</td>
<td>0.3</td>
<td>-2.0</td>
</tr>
<tr>
<td>Minor Trauma</td>
<td>-2.0</td>
<td>-0.3</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Source: table prepared by the authors.

Regarding the outcome of the incidents, 89.1% of the participants were transported to a hospital, 9.0% were released on site and, in 1.9% of cases, the victims died at the location of the accident.

**DISCUSSION**

Land transport accidents are important causes of morbidity and mortality within the group of external causes. Understanding this phenomenon requires a comprehensive analysis based on political and socio-environmental determinants and conditions, with a strong association with social inequalities that constitute a global problem, resulting in social, psychological, economic and social security impacts, which overload health and affect millions of people and communities around the world. It is a multicausal and complex phenomenon, to which all people are susceptible, especially young men in urban centers. In this work, it was possible to verify relevant factors that were associated with land transport accidents in Espirito Santo, such as life cycle, the type of vehicle involved and the severity of trauma.

When considering the general profile of victims of land transport accidents, it was found that presence of males predominated in all types of traffic accidents in the period studied. The highest proportion of this type was also found in two studies involving pedestrians who were victims of land transport accidents in the city of São Paulo in the years 2016 and 2017 and in a work on victims of traumatic events with motorcycles in the city of Sorocaba in 2016. Although there was no statistical significance between the types of land transport accidents and gender, a high frequency of male individuals in these events was observed. The justification for this comes from characteristics more common to these people, for example, greater access to motor vehicles, exposure to violence, alcoholism, use of illicit substances, behavior that poses a risk to physical integrity, recklessness and non-compliance with laws.

There was also a predominance of victims aged between 20 and 59 years old, with a higher prevalence of adults in car collisions. This situation is similar to other research, whose data indicate that adults, especially younger ones, are frequently identified as the main victims of traffic violence, which can be explained by the following factors: search for risky situations for personal satisfaction, impulsivity, lifestyle, alcohol and psychoactive substance abuse.

Older adults were associated with being run over, similar to the results of the research by Santos, et al., (2017), which showed that elderly people are victims of traffic accidents when they are pedestrians in 42.2% of episodes. Vieira and collaborators (2019), in preliminary research carried out among the elderly population who were victims of accidents and violence assisted by SAMU 192 in Espirito Santo, had already identified a higher prevalence of pedestrian accidents in the elderly population. According to the aforementioned authors, the greater prevalence of pedestrian accidents in the elderly population is due to their reduced functional capacity, resulting from physical changes that are natural during this period of life, such as decreased visual acuity, muscular strength, gait speed, reflexes and balance. Therefore, the elderly are more vulnerable to external causes in general.

It is noteworthy that the research by Azami-Aghdash (2018) showed that, in 17 countries, the car is the main vehicle involved in traffic accidents whose victims are the elderly. Furthermore, in a meta-analysis carried out by Ang and collaborators (2017), it was possible to identify that mortality from land transport accidents involving the elderly represented approximately 14%. This high mortality rate reinforces the need to improve signaling devices on urban streets and lanes, in addition to educational campaigns with the aim of reducing the occurrence of pedestrian collisions in this portion of the population.

It was also possible to verify that the type of land transport accident in which children/adolescents are most frequently involved is collisions. In the study carried out by Souto et al., (2018), in which the risk factors for traffic accidents on school transport in Brazilian capitals were analyzed, it was identified that 30.7% of passengers were traveling without a seat belt in the back seat of motor vehicles. Another aggravating factor highlighted by the research is that 32.4% reported having driven a motor vehicle. These behaviors contribute to greater vulnerability of children in the face of an accident.

Furthermore, the type of vehicle involved was associated with the type of accident, namely: cars and
large vehicles (truck/bus) are more present in collisions, with the former still being related to the collision; the motorcycle and bicycle were associated with the fall of a moving vehicle.

Regarding the involvement of bicycles, studies have been carried out to identify how behavioral and personality factors can influence the occurrence of a traffic accident. In this context, aggressiveness and risk behavior were presented as direct predictors of the probability of this event\(^7\).

Motorcycles were more frequent in all types of accidents, converging with studies carried out in Goiânia, during 2013, which identified that 62.2\% of accidents involved this type of vehicle\(^9\). Furthermore, it is relevant to comment that, in the period from 2012 to 2014, in the city of Pernambuco, fast delivery motorcyclists accounted for 55.4\% of victims of work-related land transport accidents, which corroborates the impact not only on health area, but also in the economic and labor sector\(^9\).

There has been an upward trend in the number of motorcycle accidents in Brazil in the last decade, which can be explained by many factors. In this context, the increase in the fleet of this type of vehicle is cited, in addition to the inadequate structure of many highways, the improper use of protective equipment and the consumption of alcohol\(^9\).

Regarding the severity of the victim, it was possible to observe an association between major trauma and being run over. This can be explained by the trauma mechanism itself, given that the energy exchange is directly between the victim’s body and the aggressor\(^9\).

It was also seen that, in cases of collision between vehicles, the severity of the victim resulted in minimal risk. However, the IPEA report (2015) draws attention to the lethality of collisions when carrying out a survey of land transport accidents on federal highways, as frontal collisions, bicycle collisions and transverse collisions were identified as the first, the third and fifth types of accidents that cause the most deaths on federal highways\(^8\).

Parreira and collaborators (2017), when comparing different blunt trauma mechanisms and diagnosed injuries, found an association between motorcycle accidents and higher RTS scores\(^9\). In this study, falling from a moving vehicle was related to minor trauma. In accidents involving motorcycles in the city of Sorocaba, almost all victims had an RTS score of 12\(^3\).

Mortality linked to traffic accidents, analyzed in this study, was 1.9\% of victims assisted by SAMU in 2015. Other studies linked to pre-hospital care in Brazilian cities show similar proportions\(^8,10,11,14\). In this context, the use of safety equipment is a preventive measure of great importance to reduce the lethality and fatality of events linked to land transport accidents. It is noteworthy that, according to the IPEA report (2015), each accident cost Brazilian society BRL 261,689 on average, while an accident involving a fatal victim had an average cost of BRL 664,821. This type of accident accounted for less than 5\% of total occurrences, but represented around 35\% of total costs, indicating the need to intensify public policies to reduce not only the number of accidents, but also their severity\(^5\).

Therefore, implementing measures to prevent these types of accidents is essential. Symons and collaborators (2019) used data from 75 countries to evaluate the impact of measures to prevent land transport accidents\(^15\). Among them, there is the strengthening of laws related to speed limits, alcohol use and driving licenses; improving the quality of road and road infrastructure and encouraging the use of safety equipment, such as helmets and seat belts.

Veira and collaborators (2019) present in the results of their study a sharp statistical decline in land transport accidents after the implementation of the Brazilian traffic code, which took place in 1997\(^21\). Likewise, the implementation of the “Dry Law”, that is forbidden to consume alcohol before driving, was also a highly relevant measure in the fight to reduce land transport accidents and is believed to have had a major impact on reducing mortality from land transport accidents\(^23,24\).

It is necessary to understand that transit is essential for national development, as it facilitates the movement of people and goods, improves access to education, health services, employment and development. At the same time, Road Safety involves responsibility for the mobility of people and vehicles on the road, as well as the complex dynamics of sharing space, up to the establishment of circulation standards, with the aim of protecting users and avoiding negative impacts on the entire road. state apparatus\(^*\). It is also noteworthy, based on the occurrence of land transport accidents, the need to have an effective response to the accident, which includes adequate pre-hospital and hospital care, as providing adequate assistance to the victim has favored important in minimizing morbidity and mortality from such events.

The main limitation of the study refers to the methodology adopted, because the retrospective cross-sectional examination with data collection from medical records makes it impossible to guarantee the fidelity of the information, considering that it was completed by third parties. However, knowing the profile of victims of land transport accidents rescued by SAMU 192 in Espirito Santo is an initial step towards understanding the spatial distribution of these events, which will allow for the improvement of the management of material and human resources, in addition to supporting the planning of service improvement actions.

This study identified the factors associated with land transport accidents in victims assisted by SAMU 192 in Espirito Santo and highlighted the serious consequences for the health of specific age groups. It was found that men suffer land transport accidents more frequently. Of these, adults are more predisposed to collisions, while older adults are more prone to being run over, which mostly involves cars and large vehicles. Collisions were associated with cars and falling from moving vehicles, such as bicycles and motorcycles. In comparison, victims of being run over suffer more serious injuries.

**CONCLUSION**

With the study it was possible to verify that from the total of 438 victims of external causes assisted by SAMU 192 during 2015, the majority were victims of
collisions, followed, respectively, by falls from a moving vehicle and being run over. The most frequently involved vehicle was the motorcycle.

Among the other characteristics analyzed by the study, there was a predominance of males, the adult population of individuals who did not have ethyl alcohol and individuals who suffered minor trauma.

Furthermore, it was possible to observe the factors associated with traffic accidents. Among them, adults were more involved in collisions, while the older adults were more involved in being run over. Victims of being run over resulted in more serious injuries, and collisions were associated with automobiles and falls from moving vehicles, in turn, were associated with bicycles and motorcycles.

Given the above, it is concluded that knowing the characteristics of traffic accidents allows for precise and targeted intervention for the most vulnerable groups. Data presented here reveal the main associated factors, guiding and directing pre-hospital care for these occurrences. It is essential to strengthen and enforce current legislation, as well as intensify specific educational measures for each risk group.

Thanks

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Conflict of interest
We declare the absence of conflict of interest.

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Abstract

Objetivo: verificar fatores associados aos tipos de acidentes de transporte terrestre (ATT) em vítimas assistidas pelo Serviço de Atendimento Móvel de Urgência (SAMU) no estado do Espírito Santo (ES).


Resultados: os acidentes de transporte terrestre representam 50,2% das vítimas de causas externas, cuja maioria era do sexo masculino (73,7%), adultas (81,9%), não apresentavam hálito etílico (88,8%) e vítimas de trauma menor (95,3%). A motocicleta foi o veículo envolvido com mais frequência (56,1%). Verificou-se como fatores associados (p<0,05) ao tipo de acidente: ciclo de vida (adulto e colisão; idoso e atropelamento), veículo (automóvel - atropelamento e colisão; motocicleta e bicicleta - queda), gravidade do trauma (maior e atropelamento; menor e queda).

Conclusão: verificou que o atropelamento apresentou associação com o idoso, sendo o automóvel e o caminhão os veículos envolvidos, culminando em uma maior gravidade das lesões. Por outro lado, os adultos estiveram associados ao evento colisão, sendo o automóvel o principal meio de transporte envolvido. Já na queda de veículo em movimento prevaleceu a bicicleta e a motocicleta, resultando em lesões menos graves.

Palavras-chave: emergências, serviços médicos de emergência, causas externas, trauma, acidentes de trânsito.