

Trajectory of the Victims of Overland Transport Accidents: From Prehospital to Hospital Care

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Abstract

Objective: The aim is to evaluate the trajectory of the victims of ground transportation accidents from the prehospital care to the hospital.

Methods: The sample consisted of 1,264 patients collected from the prehospital care, from June 2015 to June 2016. The trajectory was analyzed by the difference in the average time elapsed between the call and the hospital entrance. The Mann–Whitney and Kruskal–Wallis tests were used, adopting a significance level of 5% and 95% confidence.

Results: Patients had a mean age of 31.2 years, Glasgow Coma Scale of 14.8 points, and 24.8 days of hospitalization. It is characterized predominantly masculine, conductive of the vehicle, being the motorcycle prevalent; most of them wore a helmet/seat belt and no alcohol. The association between the average time of care and the characteristics related to the victim was significant: the use of the belt/helmet, alcoholism, and type of discharge and relative to the accident: area of occurrence, period of the week, shift of occurrence, type of prehospital care, and other party involved.

Conclusion: The characteristics related to ground transportation accident interfere in the time of prehospital care to the hospital, which can influence the prognosis.

Keywords

traffic accident, victim, prehospital care, time

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The ground transportation accident (GTA) is defined as any trauma between vehicles, pedestrians, and animals in a fixed obstacle or not and may occur on public or private roads, constituting a public health problem (Ministry of Health, 2017), in the face of the negative consequences these events make possible. Brazil disburses approximately R\$50 billion per year with traffic accidents from hospitalizations, recovery periods, and events related to social security (Carvalho, 2016).

In this context, GTA rates result in approximately 1.2 million deaths and cause 50 million injuries globally (Ministry of Health, 2017). In Brazil, GTA has killed 43,000 people annually and approximately 170,000 hospitalizations are financed by the *Sistema Único de Saúde*

(Unified Health System; Carvalho, 2015). In 2017, the number of deaths for GTA was 36,430 all over the country, 30.5% in the Northeast, with the State of Pernambuco being the eighth among the Brazilian states, with 1,704

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reported deaths, with Petrolina, Pernambuco; second in the ranking of municipalities in the state, with 104 deaths for GTA (Ministry of Health & DATASUS, 2017).

GTA should be viewed as a problem of social magnitude, as traumatic injuries are the leading cause of death in the world, especially in young people accounting for 10% of all deaths. Depending on the severity of the injury, the victim may have temporary or permanent difficulty or disability, which may directly interfere with the performance of social and work life. Among the factors that may influence the prognosis of the victim are the type of injury, the affected body region, and the other part involved in the event (Albuquerque et al., 2016).

In Brazil, prehospital care, within the scope of the Sistema Único de Saúde, is carried out by the Mobile Emergency Care Service (MECS) and rescue services such as rescue of the Fire Department (FD) being in Pernambuco the Military Fire Department of Pernambuco (MFDPE). Such services are activated and provide relief to victims who have suffered health problems or situations with imminent death risk (Soares et al., 2018). MECS is the reference service in advanced event support, serving 75% of the Brazilian population (Mendonça et al., 2017). The FD acts through Basic Life Support with execution of the primary sequence of care during the initial minutes of an occurrence (Ferreira Júnior et al., 2018).

This reality brings to the fore the need to recognize GTA as a priority, since from the provision of data that identify the scenario of occurrence, as well as the population profile affected; it is possible to plan actions aimed at reducing risks and consequences. Some strategies are mentioned, such as those focused on permanent education and public policies that reduce the number of such events (Sanfelice & Siquelli, 2016).

Identification of the trajectory, including the outcome of the GTA victim, is essential for assessing the type, form, and efficacy of treatment to the patient. Although it is a regional study, the follow-up of this trajectory in more than one level of care makes the study different and allows us to perceive factors that would not be possible to analyze them in isolation. In addition, the results may help prehospital care services, providing greater agility, effectiveness and improving the quality of care which are directly related to the victim's prognosis. Thus, this research had the objective of evaluating the trajectory of GTA accident victims from mobile prehospital care to the hospital.

Methods

This is a descriptive, analytical, and documental study of a quantitative nature. The information was obtained from secondary data of patient records and patient

records admitted to the University Hospital of the Federal University of the São Francisco Valley.

This hospital is located in the municipality of Petrolina, Pernambuco, being the gateway to the inter-state macroregion between the states of Pernambuco and Bahia. The service is a reference in the attention to emergencies that include polytrauma, neurology and neurosurgery, traumatology-orthopedics, surgery (general, vascular, and bucomaxillofacial), and medical clinic (Ministry of Education, 2018).

The data collection was performed in two steps. The first was based on the analysis of the prehospital care request (MECS and FD). The second occurred at the hospital level based on information provided by the medical and statistical archiving service (SAME). Inclusion criteria for the first stage were prehospital care that was caused by GTA. For the second stage, the medical records of patients treated exclusively by the MECS and FD prehospital care between June 2015 and June 2016 were included.

The sample consisted of 1,264 patients from the prehospital care. Of these, 723 were not located in University Hospital of the Federal University of the São Francisco Valley for the following reasons: identification data of incomplete patients or homonyms, missing registration in the system, and incompatible information that made the identification of the patient unfeasible. Finally, 541 patients were found in SAME; however, all GTA records were maintained at the time of analysis of this study.

For that, the following variables were analyzed: (a) sociodemographic information; (b) clinical characteristic, organic system involved in the accident, and type of discharge; (c) temporary characteristics: week period (week—from Monday to Thursday and weekend—Friday to Sunday), recorded event time, recorded time at the request of attendance, recorded time of arrival of the unit mobile at the event site, recorded hospital admission time; spatial characteristics: area of occurrence of the accident; and type of vehicle used by the victim and the other party involved in the accident.

For the temporal characterization of the variables, the shift was categorized as follows: morning (from 6 a.m. to 12 p.m.), afternoon (from 12 p.m. to 6 p.m.), evening (from 6 p.m. to midnight), and dawn (from .01 to .59 a.m.).

Initially, descriptive statistics were performed through frequency distribution and measures of central tendency and dispersion. The evaluation of the trajectory, from the prehospital care, was verified by means of the difference in the average of the time elapsed between the call until the entrance in the hospital unit. Considering the nonnormality of distribution by the Shapiro–Wilk test, the Mann–Whitney, and Kruskal–Wallis tests was used. The significance level of 5% and 95% confidence was adopted for all tests.

The research complied with the terms established by Resolution 466/2012 of the National Health Council and approved by the Research Ethics Committee of the University of Pernambuco, opinion no. 1.680.141. As these were secondary data from medical records, it was not necessary to use the term of free and informed consent.

Results

The mean age of GTA victims was 31.2 years (standard deviation [SD] 12.4, 95% confidence interval [CI] = [30.5, 31.9]), mean of the Glasgow Scale score of 14.8 (SD 1.4, 95% CI [14.6, 14.9]), and mean hospital stay of 24.8 days (SD 8.2, 95% CI [17.5, 32]).

The characteristics of GTA victims in the analyzed period are described in Table 1. The prevalence was male, the driver being the driver at the time of the accident, wearing a helmet, seat belt, and using alcohol. On the type of discharge, the prevalence was for improvement and the type of vehicle involved was the motorcycle.

In relation to the association of the characteristics related to the characteristics related to the victim and the average of the time of attendance of the prehospital care call until arrival at the hospital, there was no significant difference in time between the sexes, the victim as a conduit, and the involved organ system ($p > .05$). The variables that present significant difference were use of belt/helmet, alcohol, and the type of discharge. Regarding the use of helmets and seat belts, GTA victims who did not use such equipment were prevalent (Table 2).

For the alcoholic beverage intake variable, the mean waiting time was equivalent for nonalcoholic and alcoholized victims at the time of GTA. Among the systems involved, there was a prevalence of the musculoskeletal in the average waiting time from prehospital care to hospital arrival. Regarding the type of discharge, the average waiting time was higher for those who were discharged by transfer in relation to the others.

Regarding the association of the characteristics related to the accident and the average length of service from call to hospital arrival, they are described in Table 3. The mean length of service was prevalent for the patients served in the rural area, for occurrences at the end during the dawn, with assistance from MECS and in which the car was the other party involved, regardless of the make or model. All variables analyzed showed a significant difference.

Discussion

In this study, the mean age of the victims was within the age range of young adults. Such a scenario has also been

Table 1. Characteristics of Ground Transportation Accident Victims From June 2015 to 2016, Petrolina, Pernambuco.

Variables	n (%)	95% CI ^a
Gender		
Female	356 (28.23)	[25.8, 30.8]
Male	905 (71.77)	[69.2, 74.2]
Victim as a driver (female)		
No	122 (23.11)	[19.7, 26.9]
Yes	406 (76.89)	[73.1, 80.3]
Belt/helmet use		
No	97 (17.38)	[14.5, 20.8]
Yes	461 (82.62)	[14.5, 20.8]
Alcoholic beverage intake		
No	1.113 (88.05)	[86.1, 89.7]
Yes	151 (11.95)	[10.3, 13.7]
Type of discharge		
Death	11 (2.72)	[0.1, 04.9]
Improvement	359 (2.72)	[85.4, 91.6]
Transfer	2 (0.50)	[0.1, 1.9]
Evasion	32 (7.92)	[5.6, 11]
Motorcycle as vehicle involved		
No	205 (16.48)	[14.5, 18.7]
Yes	1.039 (83.52)	[81.4, 85.5]

Note. There has been a loss of data due to the lack of fulfillment of some questions. CI = confidence interval.

^a95% CI for proportion assuming binomial distribution.

found in other national LTA studies with young people being the main victims (Biffe et al., 2017).

The mean of the Glasgow Coma Scale score in this study presented a score in agreement with the index that classified the trauma as mild. Thus, it is understood that most GTAs were not considered potentially serious. The use of the scale, as well as its correct registration, assists in the evaluation of the level of consciousness and the severity of the injury, besides the possibility of estimating the clinical prognosis of the victim (Gomes et al., 2016).

Regarding the average length of hospital stay, it was higher than the results found in a study conducted using the data available on the website of the Department of Information Technology of the Health Unic System in the year 2013, where the length of hospital stay ranged from 4.8 to 9.7 days (Andrade & Jorge, 2017). Hospitalization time is related to the severity of the injury and the clinical characteristics of the victim. In addition, the patient's stay in the hospital service resulting from prolonged treatment results in high costs for the Health Unic System (Pai et al., 2018).

In the occurrences recorded in this study, there was a predominance of males in GTA. This result corroborates with national and international research on the subject, in which the causes of this prevalence are commonly associated with the reckless driving behavior of the

Table 2. Association of Characteristics Related to the Victim and the Average of the Time of Attendance of the Prehospital Care Call Until Arrival at the Hospital From June 2015 to June 2016, Petrolina, Pernambuco.

Variables	Average time (minutes)	95% CI	<i>p</i>
Gender			
Female	72.7	[52.7, 92.8]	.071 ^a
Male	52.8	[46.0, 59.6]	
Victim as a driver (female)			
Yes	43.5	[33.7, 53.3]	.217 ^a
No	38.8	[34.1, 43.6]	
Belt/helmet use			
Yes	40.9	[33.7, 53.4]	<.001 ^a
No	71.3	[41.4, 101.3]	
Alcoholic beverage intake			
Yes	58.7	[42.4, 75.3]	<.001 ^a
No	58.8	[50.4, 67.0]	
System involved			
Neurological	32.5	[2.0, 5.2]	.098 ^b
Respiratory	31.6	[1.9, 5.1]	
Skeletal muscle	83.6	[80, 86.6]	
Gastrointestinal	12.2	[0.5, 2.7]	
Heart	11.9	[9.4, 15.1]	
More than one system	56.9	[33, 81]	
Type of discharge			
Death	50.5	[20.8, 80.2]	.002 ^b
Improvement	57.4	[43.7, 71.1]	
Transfer	118.5	[52.6, 184.4]	
Evasion	23.6	[17.1, 30.2]	

Note. There has been a loss of data due to the lack of fulfillment of some questions. CI = confidence interval.

^aMann-Whitney.

^bKruskal-Wallis.

vehicle, in addition to demonstrating more self-confidence in performing risky maneuvers generally reinforced by cultural and gender issues (Biffe et al., 2017; L. B. Oliveira et al., 2010). Most of the records evidenced the victim as the driver of the vehicle at the time of the accident (Souto et al., 2016). This predominance may be associated with the individual characteristics of drivers, such as deficits in training and educational upgrading for traffic (Silva et al., 2017).

The results related to the use of helmets/safety belts and alcoholic beverage intake in the records of the analyzed cases were divergent from most of the investigations carried out (Carfora et al., 2018; Gomes et al., 2016; Souto et al., 2016). A possible underreporting of this information in the records could be inferred, thus generating data that would not reflect the reality of cases. Regarding the discharge records in this study, there was a predominance of the high category for improvement, suggesting that the types of accidents were considered nonserious.

Table 3. Association of the Characteristics Related to the Accident and the Mean of the Time of Service of the Call Until the Arrival at the Hospital in the Period From June 2015 to June 2016, Petrolina, Pernambuco.

Variables	Average time (minutes)	95% CI	<i>p</i>
Occurrence zone			
Urban	51.3	[42.6, 60.1]	<.001 ^a
Rural	85.3	[70.4, 100.3]	
Period of the week			
Week	54.3	[44.4, 64.2]	<.001 ^a
Weekend	62.8	[51.5, 74.1]	
Occurrence time			
Morning	38.7	[36.2, 41.2]	<.001 ^b
Afternoon	49.0	[42.2, 55.9]	
Night	43.9	[41.1, 46.7]	
Down	80.0	[43.1, 117.0]	
Type of prehospital care			
FD	27.0	[25.4, 28.8]	<.001 ^a
MECS	27.0	[61.4, 82.7]	
Other part involved			
Motorcycle	43.7	[36.7, 50.7]	<.001 ^b
Car	59.9	[44.7, 75.1]	
Pedestrian	47.2	[31.8, 62.6]	
Bicycle	34.8	[23.5, 46.1]	
Animal	48.2	[43.9, 52.5]	
Others	21.6	[18.4, 24.9]	

Note. There has been a loss of data due to the lack of fulfillment of some questions. CI = confidence interval; MECS = Mobile Emergency Care Service; FD = Fire Department.

^aMann-Whitney.

^bKruskal-Wallis.

The motorcycle was the vehicle involved in most of the occurrences of this research (L. B. Oliveira et al., 2010; Petenuti et al., 2016). Usually the use of this type of vehicle is greater because it is a fast, low-cost transportation for acquisition and maintenance, and frequently used for transportation of work (Petenuti et al., 2016). In the association of the characteristics related to the victim and the average of the time of attendance of the call of prehospital care until the arrival at the hospital, the variables that presented significant difference were belt/helmet, alcohol, and type of discharge.

In this study, the average length of service between victims who did not use the helmet/seat belt at the time of the injury was almost twice as high as those using these safety devices. This result may be related to the clinical picture of the victim in which the longest duration of care is proportional to severity (Gariazzo et al., 2018).

In addition, in this study, it can be inferred that the wait for prehospital care for victims without a helmet/seat belt was also greater due to the need for care to be performed exclusively by an advanced mobile support unit.

Regarding the presence of alcohol at the time of care, there was an equivalence in the average length of service for all victims, regardless of alcohol intake, although it did not present a statistically significant difference. Alcoholism is one of the main causes of GTA because it directly interferes with the psychomotor condition of drivers, increasing the degree of individual and collective danger (Mascarenhas et al., 2016).

The care provided to patients in emergency situations governed by Ministerial Order 1600 of 2011, of the Ministry of Health, provides the principles of guarantee of qualified initial care, independent of the behavioral conditions of the driver (Ministry of Health, 2011). Regarding the type of discharge, the prehospital care time was significantly higher for those patients who were transferred from the emergency room to another part of the hospital. This result may be associated to the clinical condition of the victim, with probable involvement of organic systems that require some therapeutic intervention in another hospital sector, such as surgical ward and intensive care unit.

Although the variable system involved did not present a significant association with the time of care, the musculoskeletal system was the one that demanded more time in the prehospital care. An international study identified that the most affected body parts as well as their severity depended on the vehicle and the victim's condition and classification at the time of admission. The importance of this knowledge provides improvement in the quality of care provided (Leon et al., 2018).

The association of the characteristics related to the accident and the mean of the time of service of the call, until the arrival at the hospital, all variables analyzed presented a significant difference.

In this study, the time of service in the prehospital care was higher for the GTA occurring in the rural area (Soares et al., 2018), justifying such a significant association, since the base of the services that provide prehospital care of the analyzed region is located in the urban zone. In addition, the rural area has different characteristics in relation to the victim's exposure to the event, being conducive to risk behavior by the driver, such as not using protective equipment, driving without a national driver's license, use of alcoholic beverages, and insufficient traffic control in those localities (Denti et al., 2017; Tinoco et al., 2016).

The prehospital care time in this study was higher for the events recorded during the weekend (Souto et al., 2016). The higher prevalence of GTA during this time of the week may be related to the occurrence of festive events, higher alcohol consumption, traffic recklessness, and reduction of surveillance (Mascarenhas et al., 2016). The occurrence shift in this study showed a significant relationship with the highest prehospital care time during the night. Studies bring other factors related to

GTA during this shift, such as neuromotor condition associated with less attention, false perception of speed, less visibility, use of psychoactive substances, and sleepiness, in addition to environmental factors such as lower luminosity and road infrastructure (Coêlho et al., 2014; Gomes et al., 2016).

The association between the mean length of service and the prehospital care type variable was similar, which was 27.0 minutes for both FD and MECS. This result may be related to the location of the bases of both prehospital care services, as they are located in strategic points of the urban zone. Although the type of support offered by FD to victims is basic and MECS is basic and advanced (Ministry of Health, 2011), it can be inferred that, regardless of the type of GTA severity, the mobile units would arrive at similar time in the GTA locations.

Even if the motorcycle is the vehicle most observed in the GTA of this research as well as in others on the subject (Mendonça et al., 2017); when there is car involvement, it is assumed that the victim's rescue is more prolonged compared with the condition of the same inside the vehicle. Thus, this temporal increase is supposedly related to the severity of the GTA, demanding prehospital care aptitude (M. E. H. Oliveira, 2015).

Conclusions

From the analysis of the trajectory of the victims of GTA, it can be concluded that the time of prehospital care suffers interference from variables related to the clinical condition of the victim as well as to the event.

The variables that showed a significant association with the average time of service were the use of belt/helmet, alcoholic beverage intake, discharge type, zone of occurrence, period of the week, shift of occurrence, type of prehospital care, and the other party involved.

Given the results, it can be said that the implications of this study are relevant as they configure the trajectory of the LTA, especially in relation to the temporal issue involving the pre-hospital care, and these data are scarce in the current literature on the subject. In addition, the data from this research may assist in better targeting prevention and management actions related to these types of events.

This study also highlights the importance of wearing safety equipment such as a helmet and feeling safe, as well as not using alcoholic beverages, because their use can minimize the time between the occurrence and the care at the hospital level.

Some limitations should be mentioned when conducting this study, such as the impossibility of describing some variables of interest, which were absent and incomplete in the attendance forms. Another aspect is the fact that the sample is specific to an interior region of Pernambuco, and it cannot be inferred that the

conclusions are extrapolated to other Brazilian regions or worldwide.

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