

# Trauma in Curitiba: multifactorial assessment of victims admitted to a university hospital

## Trauma em Curitiba: avaliação multifatorial de vítimas admitidas em um hospital universitário

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### ABSTRACT

**Objective:** to describe the epidemiological profile of trauma patients admitted to a referral hospital in Curitiba (PR). Also, to investigate trauma mechanisms and to evaluate trauma severity scores. **Methods:** descriptive observational cross-sectional study. Data were collected by applying a questionnaire to victims admitted in the emergency room from December 2016 to February 2018. **Results:** a total of 1354 trauma victims were included in the study, of which 60% were transported by SIATE and 40% by SAMU. Regarding gender, 70% of the patients were male. The mean age was 39.48 years. About the time and day of the calls, the largest proportion was concentrated on Friday night. In relation to the mechanism of trauma, in patients transported by SIATE, the most frequent in men was motorcycle collision (34.3%), while in women was same-level fall (21.42%). In SAMU, the most frequent mechanism regardless of gender was same-level fall (20.06% and 40.66%, respectively). Analyzing the severity scores, it was observed that 95.5% of the patients were classified as mild by the Glasgow Coma Scale. **Conclusion:** the profile of trauma victims analyzed in this large study is quite similar to what other national smaller studies have already described: young men victims of traffic accidents. Therefore, the economically active population is the most affected, reflecting in high cost to society.

**Headings:** Epidemiology. Traumatology. Trauma Centers. Trauma Severity Indices.

### INTRODUCTION

Trauma is a worldwide public health problem<sup>1</sup>, with high incidence and severity. The morbidity and mortality are incredibly significant, especially in underdeveloped and developing countries, where 90% of trauma deaths are seen. The related costs are a major challenge, and various authors have shown that trauma corresponds to 12% of all disease expenses<sup>1,2</sup>.

Mortality due to trauma mostly related to traffic accidents and physical aggressions is the leading external causes of death<sup>3</sup>. Data from the Department of Informatics of the Unified Health System (DATASUS) show that in Brazil, in 2017, traffic accidents and physical aggressions were responsible for 36,430 and

63,748 deaths, respectively (out of 158,657 registered deaths from external causes). In the state of Paraná, 2,563 deaths from traffic accidents were registered in 2017 (among 8,603 deaths from external causes), being 220 in the city of Curitiba. Physical aggressions in the state of Paraná were the cause of 2,663 deaths in 2017 (424 in Curitiba)<sup>4</sup>.

It is interesting to highlight that it was only in 1997 that medical care data from the Unified Health System started to include the codes related to trauma<sup>3</sup>. Thus, there is a lack of historical trauma data series in Brazil. Based on this scenario, the permanent data collection of trauma information is essential both for monitoring and establishing public policies to prevent, to take care of the patients and help their recovery<sup>3</sup>.

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A peculiarity in treating trauma victims is the prehospital care service. In the city of Curitiba (PR), two services perform such care: the Mobile Emergency Care Service (known in Brazil by the Portuguese acronym SAMU) and the Integrated Service of Emergency Trauma Care (SIATE). SIATE was created in 1990, in Curitiba (PR), as a partnership between the State Department of Public Safety (SESP), the Paraná State Health Institute (ISEP) and the Curitiba City Hall. It was the first system of its kind implemented in Brazil, serving as a reference for the other states of the Federation. It is a service linked to the Paraná Fire Department<sup>5</sup>. SAMU, in Brazil, was created in 1995, in the city of Campinas (SP), and is currently administered by the municipal governments<sup>6</sup>. Currently, such services coexist in the city of Curitiba and act differently, but complementarily: while the first is exclusively focused on trauma care, the second responds to all types of medical emergencies, including trauma.

Therefore, this study aims to draw the epidemiological characteristics of trauma patients treated at a referral hospital in the city of Curitiba (PR), as well as to investigate the characteristics of the trauma and evaluate its severity scores. As a specific objective, it is also intended to compare the characteristics of victims according to the called prehospital care service (SIATE versus SAMU).

## **METHODS**

This is a descriptive cross-sectional study. Data collection was performed in the multiple trauma room of the Cajuru University Hospital (HUC) (between December of 2016 and February of 2018). A questionnaire was filled in for every admitted trauma patient, respecting the inclusion and exclusion criteria.

The inclusion criteria were: patients over 18 years old; prehospital care provided by either SIATE or SAMU; hospital admission in the multiple trauma room. Therefore, underage victims were excluded, as well as those who sought care by other means than those above.

The following data were collected: date and time of trauma; rescue care arrival time; day of the week; patients' education; mechanisms and characteristics of trauma; the type of weapon if it was a penetrating trauma; the sex of the perpetrator; the type of patient-perpetrator relationship, and the reason that triggered the trauma; type of road where the accident occurred; if an accident at work, what type and if there was the use and type of protective equipment at the time of trauma. Data on admission parameters were: systolic blood pressure; airway flow; respiratory frequency; cardiorespiratory arrest; heart rate; eye, verbal and motor responses; procedures performed at the trauma scenario; transport to the hospital; procedures performed in the emergency room; use of massive transfusion protocol; injured anatomical part; trauma characteristic (orthopedic or neurological); presence of open fracture and reports on the use of alcohol or other drugs.

The following scores were also calculated and evaluated: Glasgow Coma Scale, RTS (Revised Trauma Score), GAP (Glasgow Coma Scale, Age, and Systolic Blood Pressure) and MGAP (Mechanism, Glasgow Coma Scale, Age, and Systolic Blood Pressure). The Glasgow coma scale encompasses the assessment of eye-opening, motor and verbal responses, ranging from 3 to 15 scores<sup>7</sup>.

The RTS was calculated based on the Glasgow Coma Scale, systolic blood pressure, and respiratory rate, ranging from zero to approximately eight, and the higher the final value, the better the prognosis<sup>7</sup>. The GAP was obtained through the Glasgow Coma Scale, age and systolic blood pressure, ranging from 6 to 25<sup>8</sup>. Finally, MGAP was calculated with the following variables: mechanism of trauma, Glasgow Coma Scale, age and systolic blood pressure, ranging from 6 to 29<sup>8</sup>. For both scales (GAP and MGAP), lower scores are associated with higher risk<sup>8</sup>.

After tabulating the data in Excel for Windows version 2016, qualitative variables were described by frequencies and percentages. The results of quantitative variables, on the other hand, were described by means and standard deviations. To compare the mean ages, we used Student's t-test for independent samples, and  $p < 0.05$  was considered statistically significant. Data were analyzed using the GraphPad Prism® software.

The research project was approved by the Research Ethics Committee under protocol no. CAAE 61820816.8.0000.0020, opinion no. 1,825,081, on November 18, 2016.

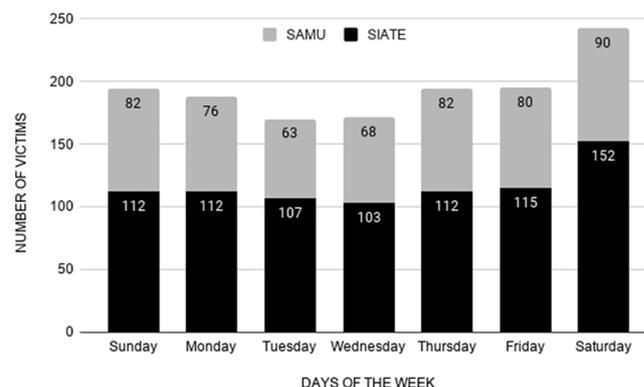
## RESULT(S)

There were 1,354 trauma patients admitted to the emergency room of Cajuru University Hospital, of whom 813 (60%) were brought in by SIATE and 541 (40%) by SAMU. 70% of the patients (n = 948) were male and 30% female (n = 406).

The average age (Table 1) was 39.48 years old (minimum 18 and maximum of 94 years old), with the average female age higher than the male ( $p < 0.0001$ ). There was also a statistically significant difference in the average age between patients initially taken care by SIATE compared to those by SAMU ( $p < 0.0001$ ), with the highest mean age for both men and women treated by SAMU. The most prevalent patients' ages ranged from 25 to 34 years old (24.29%).

The majority of patients had high school education (33.3%), both for men (32.49%) and women (35.14%), followed by incomplete elementary school (24.3%, for both sexes). Alcohol consumption was reported by 26.7% of the patients, being higher among men - 31%. Other drugs were reported by 5.4% of patients, especially crack (2.1%).

Most trauma patients were admitted between 6 PM and 12 PM (56.6%), on Saturdays (17.87%) and Fridays (14.4%) (Figure 1).



**Figure 1.** Number of victims according to the weekday and the type of pre-hospital care.

**Table 1.** Average age (in years) of patients according to sex and type of prehospital care.

Transport	Sex		Total
	Men	Women	
SIATE	35.96	40.69	37.26
SAMU	39.74	48.87	42.8
TOTAL	37.39	44.36	39.48

Those patients were brought in to the hospital by SIATE (Figure 2) were mostly male victims of motorcycle collision (34.3%), while women

suffered falls (21.42%). As for SAMU (Figure 3), the most common mechanism for both men and women was falls (20.06% and 40.66%, respectively).

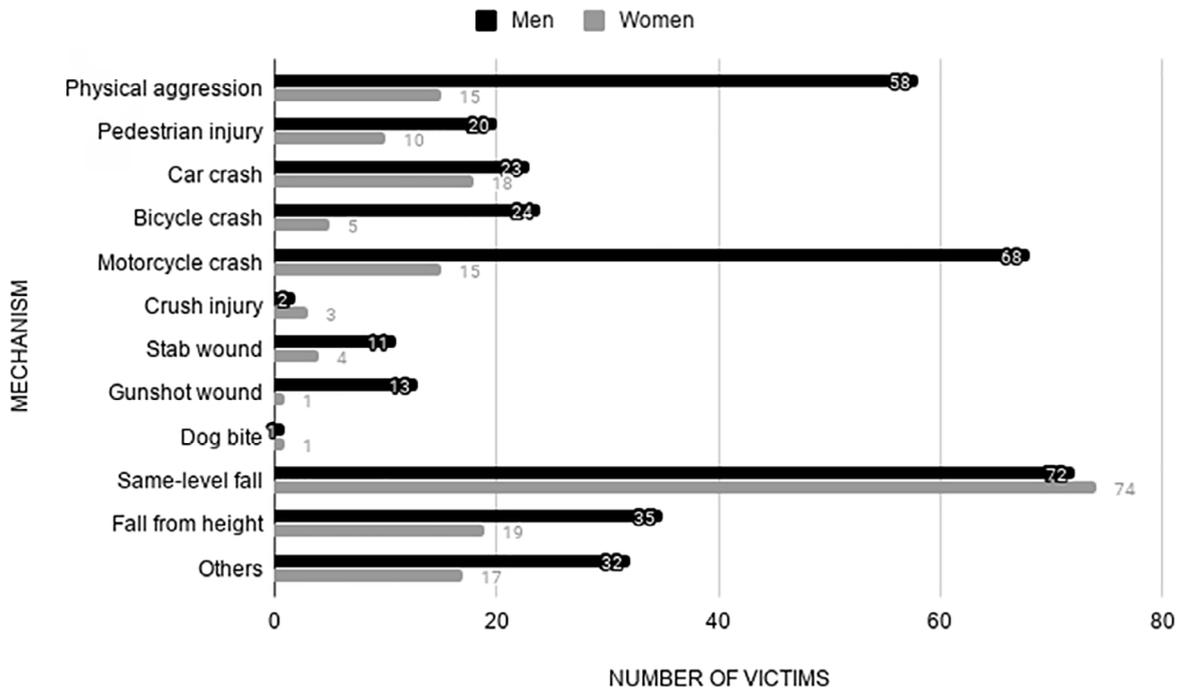


Figura 2. Physical aggression refers to aggression by the use of physical force, only.

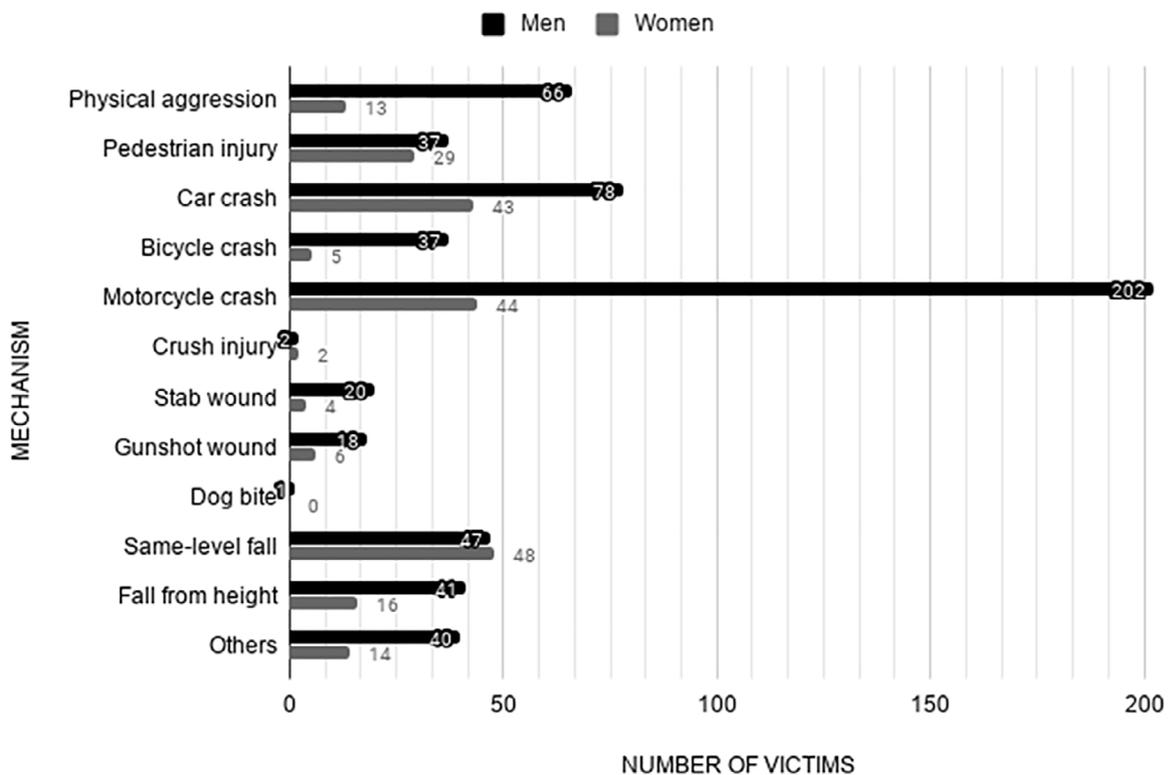


Figura 3. Physical aggression refers to aggression by the use of physical force, only.

Falls were the primarily trauma mechanism among the elderly (60 years or older), representing 51.58% of cases. As for motorcycle crashes (the most common mechanism when considering the sample as a whole - 24.3%), helmet use was reported by 95.1% of the victims. There were 14.16% of occupational accidents.

Trauma related to physical aggressions was predominantly in men, and it was found that both the aggressor and the victim were males (88.88% and 81.57%, respectively). The described main reason triggering the physical aggression was a personal discussion (47.36%), followed by robbery (17.76%). In 6.5% of cases, the companion was responsible for the physical aggression. Alcohol use was described by 57.24% of the patients. Finally, regarding the victims' education, the most frequent category was an incomplete elementary school (38.14%).

It was observed that the Glasgow Coma Scale classified 95.5% of the patients as mild trauma (score from 13 to 15). Severe trauma (score 3 to 8) corresponded to 2.6% of the patients, being more frequent in the evenings (47.1% of severe trauma happened between 6 PM and 12 PM), on Sundays (26.47%) and Fridays (23.52%). We also evaluated the RTS, GAP and MGAP scores (Table 2).

The most prevalent injured body part (Table 3) was the lower limbs (41.95%), followed by the upper limbs (34.78%). Most patients had lesions in only one body part (50%). Orthopedic trauma was seen in 49.8% of the patients, and an open fracture was found in 13% of these patients. Neurological trauma occurred in 17.1% of the patients.

**Table 2.** Mean and standard deviation of RTS, GAP and MGAP severity scores.

	RTS	GAP	MGAP
SIATE	7.644 (0,715695)	22.43 (2.62)	26.64 (3.27)
Men	7.628 (0.720547)	22.35 (2.76)	26.48 (3.42)
Women	7.685 (0.703124)	22.64 (2.23)	27.08 (2.82)
SAMU	7.685 (0.542947)	22.25 (2.20)	26.38 (2.97)
Men	7.653 (0.633067)	22.32 (2.39)	26.47 (3.09)
Women	7.747 (0.293051)	22.11 (1.77)	26.21 (2.71)

**Table 3.** Injury body part.

Injured part	n	%
Face	295	21.78%
Head and neck	366	27.03%
Upper limbs	471	34.78%
Thorax	177	13.07%
Abdomen	67	4.94%
Back	111	8.20%
Pelvis and hips	94	6.94%
Lower limbs	568	41.95%
Outer surface	113	8.35%

Observation: "n" represents the number of victims with such injured part.

The most often procedure carried out at the trauma scene was peripheral venous catheterization (8.12%). Orotracheal intubation at the scene was performed in 1.1% of the cases. Regarding hospital care, six orotracheal intubations were performed in the emergency room, as well as two cricothyroidostomies and two thoracenteses. Mass transfusion protocol was triggered in 2.4% of patients.

## **DISCUSSION**

Our results showed that young male patients, victims of motorcycle crashes, were the majority of the cases. This characteristic is similar to what has been described by other national authors, such as a study on the characteristics of patients treated by SAMU in the city of Novo Hamburgo - RS<sup>9</sup>, where 61.94% of the victims were male. In the same study, the average age was 37.83 years, with the older being 93 years, again very similar to what we found in the present study. Interestingly, the same characteristics were also seen in the Northeastern region, where in the second half of 2013 there was a predominance of males (76.5%) among the victims treated by SAMU in the city of Teresina (PI), with young patients between the ages of 20 to 39 years the most affected group<sup>10</sup>. In the southeastern region, a study conducted in Minas Gerais<sup>3</sup>, the characteristics were once again similar, with 73.9% of the victims being male. In the city of Curitiba, a 2009 study<sup>11</sup> showed a prevalence of 78% males and the predominant age from 15 to 44 years old, rather similar to what we have found. The difference in the mean age when comparing SIATE and SAMU care is similar with the reported by Gonsaga et al., who indicated that those patients treated by SAMU were older<sup>12</sup>.

Our study confirms previous data on trauma in Brazil, by showing that the economically active population is the most affected, further contributing to the financial costs associated with it. Also, the data corroborate that the leading causes of mortality from an external cause, in 2017, for the age groups between 20 to 29 years and 30 to 39 years, both in the state of Paraná and in Brazil, are physical aggressions and traffic accidents<sup>13</sup>. It should be highlighted the importance of acknowledging violence against young people in order to trigger public policies to fight this problem<sup>14</sup>.

Education was also assessed by us. In a study conducted with 2,379 trauma victims in the city of Paraíba, 42.1% of patients had only attended primary education<sup>15</sup>, which is different from the present study, in which the most prevalent educational level was high school. However, in the Paraíba study, the primary mechanism of trauma was physical aggression, and in our study, considering only this type of trauma, incomplete primary education was also the main educational level. In another study that evaluated the epidemiological characteristics of trauma in public emergency services in Brazilian capitals, 54% of the victims had education levels between 0 and 8 years<sup>16</sup>. Thus, although trauma affects all social and educational strata, the relationship between physical aggression and low educational level is direct<sup>16</sup>.

Regarding the prehospital care, a study conducted in the city of Catanduva (SP) showed that 61.2% of trauma care had been provided by SAMU and the remaining by a service linked to the Fire Department, similar to SIATE<sup>12</sup>. These findings contrast with the results found in the present study, as 60% of victims were taken to the trauma center by SIATE.

Comparing with another study conducted in Curitiba<sup>11</sup>, a more similar characteristic is observed, as SIATE performed 75 % of the initial medical care. This observed trend may be related to the fact that SIATE has been structured for a longer time in the city of Curitiba<sup>5</sup>. Furthermore, SIATE is specifically focused on trauma care, while SAMU responds to all emergencies.

Most traumas occurred between 6 and 12 PM (56.6%). This is in agreement with what was described by Silva (2018)<sup>9</sup>, who reported that 32.66% of their patients had their trauma within the same time frame. This was also observed by D'Ávila et al., in 35.1% of the patients<sup>15</sup>. Saturdays and Fridays were the days when most traumas happened, and the same characteristics were observed in a study conducted in Novo Hamburgo, RS<sup>9</sup>. Moreover, in another study conducted in the city of Curitiba with 200 patients, Saturday was also the day with the highest number of trauma<sup>7</sup>. In contrast, in a study carried out in the Federal District, the most prevalent days were Thursdays and Fridays in the afternoons<sup>17</sup>.

The main trauma mechanisms were motorcycle collisions, followed by falls and physical aggressions. A large number of motorcycle crash injuries may be related, in part, to the number of motorcycles circulating in the country<sup>18</sup>. Data from 2018 show a fleet of 26.4 million motorcycles in Brazil, with more motorcycles than cars in 45% of cities<sup>19</sup>. Among men, the most prevalent mechanism was motorcycle collision, followed by physical aggressions. Among women, falls and automobile collisions predominated.

It was observed that among the elderly, falls were the primary mechanism. In this regard, countless factors contribute to the latter, such as visual and neurological problems, the decline in mental function, muscle and skeletal weakness as well as the use of psychotropic substances<sup>11</sup>.

SIATE was responsible for the transportation of motorcycle collisions while SAMU was in charge of transporting patients victims of falls. In a study comparing a prehospital care service organized by the fire brigade with the service provided by SAMU, the same pattern was observed<sup>12</sup>. This fact may even help explain the difference in the average age observed since falls (the primary mechanism in patients transported by SAMU) are more frequent in the elderly.

Physical aggressions were mostly prevalent in males (88.88%). It is known that "men and boys, through the masculine universe of symbolism and power, are the most exposed and susceptible to other types of violence such as physics"<sup>14</sup>. In a survey that analyzed violence in Brazilian capitals, 91.3% of the victims of aggression were male<sup>14</sup>. Also, in this same study, alcohol consumption was reported by 32.7%<sup>13</sup>, and this was even higher in our sample (57.24%). The high percentage of alcohol consumption reinforces that this is a significant risk factor for violence, especially related with physical aggression<sup>14,20</sup>.

Orthopedic trauma was very prevalent - 49.8% of the patients. Upper (34.78%) and lower limb trauma (41.95%) were predominant. The limbs were also the most injured (58.2%) in a study conducted by Ibiapino et al.<sup>21</sup>.

In another sample of 544 trauma victims treated at a general hospital, orthopedic trauma was also prevalent, corresponding to 77% of cases<sup>3</sup>. Similar data were reported by other authors<sup>11</sup>.

It was observed that the Glasgow Coma Scale classified 95.5% as mild trauma patients (score from 13 to 15). Such pattern was also observed by Gonsaga et al.<sup>12</sup>, who reported the average Glasgow Coma Scale score of 14.7. For RTS, most patients were admitted with values above seven (mean for SIATE of 7.644, and SAMU of 7.685), predicting a reasonable probability of survival. The same data were found by other authors from Curitiba that evaluated the RTS in trauma victims by different mechanisms<sup>7</sup>. Other authors who compared the prehospital care provided by the fire department (equivalent to SIATE) to that provided by SAMU, the average RTS values were 7.7 and 7.8, respectively<sup>12</sup>.

The averages for both GAP and MGAP, in our sample, indicated a low mortality risk. However, it is important to address that there is a data collection bias, which impacts on the trauma severity since some severely sick patients were intubated when admitted to the trauma center, which prevented further data collection. These victims were upfront taken care of by the emergency physician and surgeon on duty, which again affected the collection.

## CONCLUSION

In conclusion, trauma patients' characteristics are very similar to other national data: young men, victims of traffic accidents. This implies that the economically active population is the most affected, impacting on high costs to society. Epidemiological studies that characterize these patients in regards to trauma mechanisms and characteristics are fundamental to support public policies and educational actions, which should be adapted to local particularities.

## R E S U M O

**Objetivo:** descrever o perfil epidemiológico das vítimas de trauma atendidas em um hospital de referência no município de Curitiba (PR), bem como investigar os mecanismos do trauma, além de avaliar os escores de gravidade. **Métodos:** estudo descritivo observacional transversal, cujos dados foram obtidos através da aplicação de questionário em vítimas atendidas na sala de emergência, entre dezembro de 2016 e fevereiro de 2018. **Resultados:** Foram incluídos no estudo 1354 vítimas de trauma, das quais 60% tiveram como transporte pré-hospitalar o Serviço Integrado de Atendimento ao Trauma em Emergência (SIATE), e 40%, o Serviço de Atendimento Móvel de Urgência (SAMU). Quanto ao sexo, 70% dos pacientes eram do sexo masculino. A média de idade foi de 39,48 anos. Sobre o horário e dia dos atendimentos, a maior proporção se concentrou no período noturno na sexta-feira. Quanto ao mecanismo do trauma, nos pacientes atendidos pelo SIATE, o mais frequente em homens foi a colisão de motocicleta (34,3%), enquanto que em mulheres foi a queda de mesmo nível (21,42%). Já no SAMU, o mecanismo mais frequente independentemente do sexo foi queda de mesmo nível (20,06% e 40,66%, respectivamente). Analisando-se os escores de gravidade, observou-se que 95,5% dos pacientes eram classificados como leves pela escala de coma de Glasgow. **Conclusões:** o perfil das vítimas analisadas neste grande estudo muito se assemelha a outros estudos nacionais menores: homens, jovens, vítimas de acidentes de trânsito. A população economicamente ativa, portanto, é a mais afetada, refletindo em alto custo para a sociedade.

**Descritores:** Epidemiologia. Traumatologia. Centros de Traumatologia. Índices de Gravidade do Trauma.

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