



## Characterization of motorcycle accident victims attended by the mobile emergency service (SAMU-192), Recife, Pernambuco State, Brazil

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**ABSTRACT.** This study described the epidemiological characteristics of victims of accidents involving motorcycles, attended by the Mobile Emergency Service (SAMU-192) in the city of Recife (PE) in 2006. This is a descriptive cross-sectional study that analyzed a sample of 703 cases. The results showed that 81.8% were male, aged 20 to 29 years. It was noted that 406 of them were wearing a helmet at the time of the accident. The accidents occurred most frequently on Sundays (19.3%) between 18:00 and 24:00 hours (0.28%). The extremities were the most affected body segment, with 341 occurrences. Regarding the severity of injuries, it was found that 37.6% were superficial or mild (scrapes, cuts and bruises). These results demonstrate the need for educational campaigns to encourage the use of personal protective equipment among motorcyclists. The best way to reduce the risks and damages from motorcycle accidents is through primary prevention. For this, are needed integrated intersectoral actions aimed at reducing the incidence and severity of injuries.

**Keywords:** external causes, violence, traffic accidents, motorcycle, prehospital emergency care, wounds and injuries.

## Caracterização das vítimas de acidentes de motocicleta atendidas pelo serviço de atendimento móvel de urgência (SAMU-192), Recife, Estado de Pernambuco, Brasil

**RESUMO.** Descrevem-se as características epidemiológicas das vítimas de acidentes envolvendo motocicletas atendidas pelo Serviço de Atendimento Móvel de Urgência (SAMU-192), da cidade do Recife (PE), no ano de 2006. Trata-se de um estudo descritivo de corte transversal, no qual foi analisada uma amostra de 703 atendimentos. Os resultados mostraram que 81,8% eram do sexo masculino, na faixa etária entre 20 e 29 anos. Observou-se que 406 motociclistas utilizavam o capacete no momento do acidente. Os acidentes ocorreram com maior frequência no domingo (19,3%), no horário compreendido entre as 18h e 24h (0,28%). As extremidades foram o segmento do corpo mais atingidos com 341 ocorrências. Quanto à gravidade das lesões, verificou-se que 37,6% eram superficiais ou de baixa gravidade (escoriações, cortes e contusões). Esses resultados são importantes para demonstrar a necessidade de campanhas educativas incentivando o uso dos equipamentos individuais de proteção para motociclistas. Reconhecidamente, a melhor forma de reduzir os riscos e os danos decorrentes dos acidentes com motocicletas é pela prevenção primária. Para tanto, são necessárias ações intersectoriais integradas que visem à redução da incidência e da gravidade das lesões.

**Palavras-chave:** causas externas, violência, acidentes de trânsito, motocicletas, atendimento de emergência pré-hospitalar, ferimentos e lesões.

### Introduction

The transport accidents and the resulting trauma represent an important public health problem worldwide. According to the World Health Organization (WHO), the land transport accidents account for about 25% of all deaths for external causes in the world (PEDEN, 2004). It is estimated that 1.2

million people in the world die each year victims of land transport accident, and 50 million people are wounded. The projections indicate that these numbers will increase by almost 65% over the next 20 years (PEDEN, 2004).

In Brazil, the external causes represent not only the third cause of death in the general population, but also an important reason for admission by the Brazilian

public health system - SUS (SOUZA et al., 2007; VERONESE et al., 2006). In 2003, the land transport accidents resulted in 33,620 deaths and 114,189 hospitalizations. The evolution of mortality rates (1980-2003) from land transport accidents showed that the death rates by motorcycle accidents, which were close to zero during the 1980s, increased up to 4.0 per 100 thousand inhabitants for male (SOUZA et al., 2007). A recent study analyzed the motorcycle accident deaths in the State of Pernambuco, and identified coefficients of death ranging from 5.66 to 11.66/100 thousand inhabitants per municipality (SILVA et al., 2011).

Over the recent years, there has been a growing use of motorcycles due to their low maintenance and purchase cost when compared to automobiles; their agility and speed to cross the traffic congestions of urban roads, being utilized, mainly, in delivery services (ANDRADE; MELLO-JORGE, 2001). Currently, it is observed an inversion in the traffic accident patterns. Previously, there was a predominance of accidents involving automobiles, which is currently verified for motorcycles (OLIVEIRA; SOUSA, 2004).

The motorcycles are pointed out as relatively unsafe vehicles, and the riders must be considered unprotected (ZAMBON; HASSELBERG, 2006). The risk of death of motorcyclists involved in accident is up to 34 times greater per km covered, when compared to occupants of motor vehicle, and the risk of being seriously injured is ten times greater (NHTSA, 2007; AARE; VON HOLST, 1999). Study carried out in Malaysia identified that the motorcyclists represented the main group of fatal victims in transport accidents on the roads of the country (PANG et al., 2001).

The motorcycling can be considered as a system including three elements: the machine (motorcycle), the environment (traffic conditions, roadway factors, meteorological conditions, among others) and the human (rider) (HAQUE et al., 2010). There are many researches focused on the understanding of the first two elements, analyzing risks and the seriousness of accidents involving motorcycles caused by the traffic, road width, and luminosity; however few studies were conducted to recognize the human factors that influence the motorcycle safety (HAQUE et al., 2010). The risk of accidents involving motorcycles is associated with demographic characteristics (age and gender), with the driving experience and the socioeconomic and cultural factors (ZAMBON; HASSELBERG, 2006).

Studies carried out in Europe and Australia reveal that male during late adolescence are more prone to accidents; however the risk of accidents decreases with age (ZAMBON; HASSELBERG, 2006; HARRISON; CHRISTIE, 2005). Zambon and Hasselberg (2006), analyzing socioeconomic differences among young

motorcycle drivers (16 to 25 years) involved with accidents have identified that, at the age of 18, the individuals belonging to a lower socioeconomic class present a risk of 2.5-fold higher to suffer accidents when compared to a higher socioeconomic class. Harrison and Cristie (2005) found that older motorcyclists tend to use the motorcycle as recreation during the weekends, and this low frequency of utilization increases the risk of accidents.

The trauma caused by injuries related to the motorcycle accidents is very extensive, expensive and is becoming even greater. Besides, the motorcycle accidents present a social and economic cost fairly high, not only by the number of premature deaths and hospitalizations, but also by the physical rehabilitation and the psychosocial consequences (MAYOU; BRYANT, 2003; WELLS et al., 2004).

The qualified assistance at the accident scene, the safe transport and the fast arrival at the hospital are essential factors for the reduction of deaths by trauma (MARSON; THOMSON, 2001). The treatment established during the first hour 'golden hour' after the occurrence of the traumatic injury, is a decisive factor for the prognosis (LIBERMAN; ROUDSARI, 2007). So the assistance to the victim during this period of time demands an organized health service network, which involves the pre-hospital care articulated with hospitals of different levels of complexity (WHITAKER et al., 1998).

With the purpose of offering early care to victims of traumatic injuries and their adequate transport to a health service hierarchically integrated to the SUS, the Brazilian Ministry of Health, through the Ordinance No. 1.864, created on September 29, 2003, the Mobile Emergency Care Service (SAMU-192) (BRASIL, 2003). In 2005, the SAMU-192 was already working in 784 municipalities of 25 States in the country, with 101 regulatory centers, acting with specialized staff, along with control centers of beds in the hospitals (FREITAS, 2007).

The service is operated by teams consisting of doctors, nurses, and nursing technicians, assistants of medical regulations, teledigiphone operators and drivers, working 24h. In Recife, the SAMU-192 has available 18 ambulances; three of them possess mobile ICU. It attends approximately 1,300 calls a month. In 2006, was created the Metropolitan SAMU-192, a proposal for integrating the SAMU-192 of Recife and others from municipalities that form the Metropolitan Region. As a consequence, Recife became regulator of the Metropolitan SAMU-192 (RECIFE, 2010).

The present study intends to describe the epidemiological profile of victims of motorcycle accidents attended by SAMU-192, in the municipality of Recife (Pernambuco State), during 2006.

## Material and methods

The study area covers the city of Recife, capital of the Pernambuco State, located in the Brazilian Northeast region. Its population consists of 1,533,580 inhabitants distributed in a surface area of 217 km<sup>2</sup> (IBGE, 2009).

This is an epidemiological cross-sectional study, whose population was constituted by the victims of motorcycle accidents attended by the SAMU-192 from the city of Recife (Pernambuco State), during the period from July to December 2006. It was defined motorcycle accident as injury in motorcycle driver or passenger resulting from a collision, loss of control, impact, or other event involving a vehicle, object, or pedestrian (VYROSTEK et al., 2004). In this way, were included in the study only the motorcycle accidents, in which the victims were involved as motorcyclist or passenger.

In order to collect data, it was used a research form, which was based on the standard entry form of the register of occurrence filled by the SAMU-192 first aiders, containing information about the victims characteristics (gender and age range) and the circumstances of the accident (use of helmet, injury type and location, weekday and daytime of occurrence).

The Abbreviated Injury Scale – AIS (AAAM, 2008) was proposed by the AAAM-Association for the Advancement of Automotive Medicine and specifically designed for coding various types of injuries and for their classification based on the severity. It consists of an assessment system, of anatomical basis that classifies each injury resulting from a trauma, by body region and establishes an ordinal scale of six points in agreement with the type and the severity of the trauma (AAAM, 2008). The injuries can receive the following scores: 1 mild severity, 2 moderate, 3 severe without threats to life, 4 severe with threats to life, but with great probability of survival, 5 critical, with uncertain survival, and the 6 almost always fatal (GENNARI; KOIZUMI, 1995; SOUSA et al., 1998).

The AIS, by being a complex system (more than 2,000 descriptions of injuries make difficult its current usage, particularly when is desired to score the patient in an Emergency Unit), several authors idealized abbreviated or simplified instruments from the AIS manual (SOUSA et al., 1998). Among these instruments, the Condensed Abbreviated Injury Scale (CAIS), elaborated by Civil and Schwab (1988) is the most developed.

The CAIS, is a map organized into a single page with the descriptions of injuries separately for the six body regions according to the severity score AIS (SOUSA et al., 1998). In this classification, the injury is considered: mild, moderate, severe without threats to

life, severe with threats to life and critical, of uncertain survival.

Pinto and Witt (2008) proposed an adaptation of CAIS, joining the severe injuries. In this study, injuries were classified according to the severity, in conformity with CAIS adaptation, made by Pinto and Witt (2008), into three types: superficial are those which include the excoriations, cuts, contusions and all other injuries which do not implicate in incapacity or risk of life; the second type is composed by intermediaries injuries in which are included the limb fractures and other injuries that lead to temporary incapacity; and in the third group, are found the injuries which implicate in risk of life and permanent physical disability. In the present study was considered only the limb amputations as permanent physical disability, by the limited period of the study.

The obtained data were coded, categorized and typed by double data entry in the software EpiInfo version 6.04d (Centers for Disease Control and Prevention – CDC, Atlanta, United States of America). The analyses were made in descriptive manner by frequency and relative frequency distribution, measures of central tendency and dispersion.

The project was approved by the Research Ethics Committee of the University of Pernambuco (CAEE 0008.0.097.000-07).

## Results

During the study period, were attended by the SAMU-192 of the city of Recife, 703 victims of motorcycle accidents. The Table 1 presents the characteristics of these motorcyclists. Of the total of attendances, 575 (81.8%) were male and 103 were female (14.7%). The ratio male: female was 5.6. The average age was 29.1 (DP = 8.7), ranging between 3 and 62 years of age. The age group 20 to 29 years concentrated a majority of cases (45.4%).

The Table 2 shows the motorcyclists distribution in relation to the variables associated with the accident. As for the victim position on the motorcycle, it was observed that 423 (60.2%) were in the condition of driver, however this information is compromised by the proportion of non-specified (26%). Concerning the helmet usage, 406 motorcyclists were using at the time of the accident. For 250 (35.6%) attendances, this information was not recognized. The accidents occurred most frequently on Sundays (19.3%), between 6 p.m. and 12 a.m. (0.28%). The suspicious of alcoholic drinks use among victims was 20.8%, however this variable present a significant percentage (15.6%) of information without filling (Table 1).

**Table 1.** Distribution of victims of motorcycle accidents attended by the SAMU-192, according to gender and age range, Recife, Pernambuco State, Brazil.

| Variable          | N   | %    |
|-------------------|-----|------|
| Gender            |     |      |
| Female            | 103 | 14.7 |
| Male              | 575 | 81.8 |
| Ignored           | 25  | 3.6  |
| Age range (years) |     |      |
| 0 to 9            | 3   | 0.4  |
| 10 to 19          | 77  | 11.0 |
| 20 to 29          | 319 | 45.4 |
| 30 to 39          | 149 | 21.2 |
| 40 to 49          | 59  | 8.4  |
| ≥ 50              | 16  | 2.3  |
| Ignored           | 80  | 11.4 |

In relation to the trauma location, the extremities were the most affected body segment with 341 occurrences (Table 2). The injuries were classified according to the severity, being identified 264 (37.6%) superficial injuries or of low severity (excoriations, cuts and contusions), 124 (17.6%) were intermediate and 148 (21.1%) were severe (brain injuries) (Table 2).

**Table 2.** Distribution of victims of motorcycle accidents attended by the SAMU-192, according to the accident characteristics, Recife, Pernambuco State, Brazil.

| Variable        | N   | %    |
|-----------------|-----|------|
| Victim position |     |      |
| Driver          | 423 | 60.2 |
| Passenger       | 97  | 13.8 |
| Ignored         | 183 | 26.0 |
| Helmet use      |     |      |
| Yes             | 406 | 57.8 |
| No              | 47  | 6.7  |
| Ignored         | 250 | 35.6 |
| Day of the week |     |      |
| Sunday          | 136 | 19.3 |
| Monday          | 74  | 10.5 |
| Tuesday         | 92  | 13.1 |
| Wednesday       | 72  | 10.2 |
| Thursday        | 69  | 9.8  |
| Friday          | 122 | 17.4 |
| Saturday        | 127 | 18.1 |
| Ignored         | 11  | 1.6  |
| Time            |     |      |
| 12 AM – 06 AM   | 101 | 14.4 |
| 06 AM – 12 PM   | 171 | 24.3 |
| 12 PM – 06 PM   | 176 | 25.0 |
| 06 PM – 12 AM   | 195 | 27.7 |
| Ignored         | 60  | 8.5  |
| Alcohol use     |     |      |
| Yes             | 146 | 20.8 |
| No              | 447 | 63.6 |
| Ignored         | 110 | 15.6 |
| Trauma          |     |      |
| Head/ neck      | 63  | 9.0  |
| Extremities     | 341 | 48.5 |
| Polytrauma      | 126 | 17.9 |
| Ignored         | 173 | 24.6 |
| Injury severity |     |      |
| Superficial     | 264 | 37.6 |
| Intermediate    | 124 | 17.6 |
| Severe          | 148 | 21.1 |
| Ignored         | 167 | 23.8 |

## Discussion

The results enabled the understanding of important information about the characteristics of accidents involving motorcycles in the city of Recife, although describes solely the victims attended by SAMU-192. It was verified the predominance of male, age range between 20 and 29 years in these accidents. This result is compatible with the profile described in other studies carried out in Brazil (KOIZUMI, 1992; OLIVEIRA; SOUSA, 2006; CAIXETA et al., 2010; GAWRYSZEWSKI et al., 2009; CABRAL et al., 2011).

Some studies suggest that the predominance of young men can be credited to sociocultural factors, to the use of alcohol and the increase in the number of workers with motorcycles (ORSATI et al., 2004; ANDRADE; MELLO-JORGE, 2000; SANTOS et al., 2008). Andrade and Mello-Jorge (2000) affirm that, probably, the greatest exposure of males and the young people in the traffic is related to social and cultural behaviors that make them to assume more risks when driving vehicles (excessive speed, use of alcohol, risky maneuvers, among others).

A research carried out in the city of Porto Alegre, state of Rio Grande do Sul, with motorcyclists victims of traffic accidents, suggests the relationship of these accidents with the characteristics of the work performed by the motoboys that contribute to their increased risk in the traffic : excessive working time, incentives to productivity, and the demand for speedy deliveries (VERONESE et al., 2006). Silva et al. (2008), analyzing the motoboys perception about the aspects related to their work and the occurrence of accidents, identified that the pressure exerted by the companies and the customers concerning the urgency in deliveries is the determinant factor for the adoption of risk behaviors in the traffic.

Regarding the accident situation, it was observed that the majority of the victims were in the condition of motorcycle drivers at the moment of the accident. Similar results were found in the city of Maringá (Paraná State) and Teresina (Piauí State) (OLIVEIRA; SOUSA, 2004; SANTOS et al., 2008).

According to the weekday of their occurrence, there was an increase in the proportion of victims since Friday, with a large concentration on Sunday. There is unanimity in the studies concerning the increase of accidents involving motorcyclists during the weekends (SANTOS et al., 2008; BASTOS et al., 2005; ANDRADE et al., 2009). In the State of Piauí, were verified three times more chances of motorcyclists to be involved in accidents between Thursday and Sunday, when increases the consumption of alcoholic drink (SANTOS et al., 2008).

In relation to the time of occurrence, the night period (6 p.m. to 12 a.m.) was the period with the highest frequency. Factors related to the increased consumption of alcohol, reduction in visibility and the fatigue at the end of the day are elements which contribute to the great occurrence of accidents in this period (OLIVEIRA; SOUSA, 2004; SANTOS et al., 2008; ANDRADE et al., 2009; CABRAL et al., 2011).

Several researches associate the use of alcoholic drinks with the occurrence of accidents (ANDRADE; MELLO-JORGE, 2000; SANTOS et al., 2008; MASCARENHAS et al., 2009). A study made by the National Highway Traffic Safety Administration (NHTSA, 2007) reported that in recent years (1983-2003), there was an increase in the number of deaths in the context of motorcycles conducted by drunk drivers, particularly, among people over 40 years (SHANKAR, 2003).

Moreover, the main factors of risk for accidents involving motorcycles are: drunk driving and excessive speed. The use of alcohol leads to carelessness and loss of attention, speeding and negligence in the use of protective equipment (ZAMBON; HASSELBERG, 2006).

In Brazil, a research analyzing the consumption of alcohol among victims of accidents and violence attended by emergency services, identified that among the accidents, the highest proportions of suspected alcohol use were observed among the patients involved in transport accidents (MASCARENHAS et al., 2009). In São Paulo (São Paulo State), the prevalence of positive alcoholemia was identified in 24.2% of the transport accident victims attended in a trauma care center (GAZAL-CARVALHO et al., 2002).

Santos et al. (2008) observed that drunk drivers have four times more chances to not use the helmet, incurring in two traffic infractions that need to be more policed. Our results indicate that approximately 20% of the motorcycle accident victims presented suspected alcohol use. In this way, it is recommended a great emphasis in educational programs focusing the risks of driving drunk, particularly, among young people.

In general, even the mildest motorcycle accident is more severe than a simple car collision, due to higher vulnerability of motorcyclists (KOIZUMI, 1992). Usually in motorcycle accidents, there is uneven collision, with a larger size vehicle, and the motorcyclist does not have the vehicle structure to protect him/her, absorbing all the impact energy and, in most times, being ejected far away (OLIVEIRA; SOUSA, 2004).

The results of this study confirm previous observations that the extremities are the most

commonly affected anatomical location in motorcycle accidents, highlighting the lower limbs fractures (VERONESE et al., 2006; PINTO; WITT, 2008; ANDRADE et al., 2009; OLIVEIRA; SOUSA, 2003). In Brazil, for the motorcyclist, the only protective equipment of compulsory use is the helmet. In this sense, the head is the most protected body segment during the impact of an accident, and the other body regions remain exposed to injuries (SADO et al., 2009).

Batista et al. (2006) affirm that higher frequency of injuries on lower limbs and pelvis can be explained by how the motorcycles collide. With a frontal collision, the motorcycle inclines forward throwing the motorcyclist against the handlebar. If the feet and the legs remain fixed in the pedal; the thigh will be thrown against the handlebar, resulting in possible bilateral injuries of the lower limbs. As for the lateral collision, the injuries occur through the compression of legs and/or the pelvic waist against the object or other vehicle.

Although the limb fractures can be interpreted as being of low or intermediate severity, these injuries demand long periods of immobilization and recovery, with possible locomotor system damage (SADO et al., 2009). There is little information in literature about the effects, in long term, of motorcycle accidents on people lives. A study undertaken in Miami (USA) identified that more than 50% of the victims still presented some degree of physical disability after one year of injury and reported significant changes in their quality of life (HOTZ et al., 2004). In Brazil, a research carried out in the city of Maringá (Paraná State), analyzed the return to productive activities of motorcyclists victims of accidents, and identified that, during the period between nine and twelve months post trauma, 20.4% of the victims still reported alterations in productivity as a consequence of the accident (OLIVEIRA; SOUSA, 2006).

In turn, the head injuries due to motorcycle accidents present lower frequency and constitute an important cause of severe morbidity and mortality (CRANDON et al., 2009). The helmet is the most important safety measure to protect the motorcyclists involved in collisions (LIU et al., 2008; KENG, 2005; BROWN et al., 2011). A recent review study concluded that the helmet use can reduce by 72% the risk of head trauma (LIU et al., 2008). In the present study, based on the available information, the use of helmet was quite frequent.

In China, a research that determined the prevalence of the correct use of helmet among motorcyclists showed that 72.6% of the riders were

wearing helmet, among them 43.2% were using correctly. Regarding the passengers, 34.1% were wearing but only 20.9% were using it correctly (XUEQUN et al., 2011). The motorcyclists and the passengers wearing the helmet loosely attached had two times more probabilities to have brain injuries when compared with those using the helmets tightly attached (YU et al., 2011). Besides, open-face helmets presented lower protection against head wounds (YU et al., 2011).

In 1998, came into force the new Brazilian Traffic Code that establishes more severe punishments for motorcycle users who do not wear the helmet. A study carried out in the city of Londrina, Paraná State, investigating the characteristics of the victims of traffic accidents before and after the new code implementation, identified increases in the helmet use rate and reduction in the number of wounded during the period after the implementation of this legislation (LIBERATTI et al., 2001).

Our results evidence the need for educational campaigns encouraging the use of individual protective equipments for motorcyclists. The Brazilian Association of Motorcyclists (ABRAM, 2010) elaborated a list containing the "12 Commandments" for the motorcyclists safety in Brazilian traffic, which recommends the use of helmet approved by the National Institute of Metrology, Standardization and Industrial Quality (Inmetro), the use of overpants and jacket made of resistant fabric, reinforced shoes or boots, legs protector. Additionally, is recommended the use of light clothes and with reflective material during night time (ABRAM, 2010).

Other aspect to be highlighted consists in the relevance of the data derived from the urgency and emergency of the health services for the elaboration of the epidemiological profiles (BRASIL, 2003). In the SAMU-192 attendance form, was observed significant proportion of variables without filling. Considering that the attendance to the traumatized patient must be performed quickly, it is predictable a proportion of missing information, however, the quality of the produced data has a key role in planning strategies of accidents prevention. Cabral and Souza (2008), studying the epidemiological profile of the occurrences attended by the SAMU-192 in the municipality of Olinda, Pernambuco State, stressed the need to orientate the team about the importance of data for the monitoring the attendances profile.

## Conclusion

The epidemiological characterization of population victim of motorcycle accidents can

contribute to the implementation of strategies on prevention. This study describes the victims profile providing information that can support preventive actions in the city of Recife. The adult men within the productive age were the most affected. The injuries of the extremities were the most common type of wound. Considering that the majority of the accidents are preventable, a set of preventive actions can be adopted, such as: individual protective equipments; restriction to alcohol consumption before driving the motorcycle.

A way to reduce the damages resulting from motorcycles accidents is through primary prevention. For this purpose, are required integrated intersectoral actions aiming the reduction of injuries incidence and severity. In addition, it is possible to reduce the morbidity and mortality by means of efficient actions of pre-hospital attendance, emergency and hospital attendance, specialized in trauma.

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