# Injuries associated with motorcycle accidents in the Meta department in Colombia between 2017 and 2018

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**Abstract**

**Introduction:** according to the WHO, approximately 1.35 million people die every year in the world as a result of road accidents. This cause, specifically motorcycle riding, can cause secondary injuries of public health importance given the affections in occupational, social, and family performance, becoming a burden for the health system due to the progression to a chronic condition. **Objective:** to describe the most frequent physical injuries in the Meta population involved in motorcycle accidents in 2017 and 2018. **Materials and methods:** quantitative, descriptive, cross-sectional study based on data sources available in 2017 and 2018 records of the Meta Regional Disability Rating Board. **Results:** 1114 records of motorcycle road accident history during the period 2017-2018 were reviewed. 78.46% of the injured and accidents were in male population, of which 61.58% presented single marital status, with an academic level of secondary education 60.95%. The most frequent injury was fracture (79.98%), the area most affected was the lower limbs (40.48%) and the most injured bone was the tibia (17.24%). **Conclusions:** the study agrees with what has been found in other national and international studies. There was

evidence of a higher accident rate in the male population, and the need for research that includes epidemiological indicators, risk factors, hospitalization time, intensity of therapeutic interventions, in order to characterize the population in a broader manner.

**Key words:** traffic accidents, motorcycles, injuries and trauma, accidental injuries.

**Resumen**

**Introducción:** acorde con la OMS, cada año mueren por siniestros viales aproximadamente 1,35 millones de personas en el mundo. Esta causa, específicamente el manejo de motocicleta puede provocar lesiones secundarias de importancia para la salud pública dadas las afecciones en el desempeño ocupacional, social y familiar, convirtiéndose en una carga para el sistema de salud por la progresión a condición crónica. **Objetivo:** describir las lesiones físicas más frecuentes en la población del Meta accidentada en moto en los años 2017 y 2018. **Materiales y métodos:** estudio cuantitativo, descriptivo, de corte transversal basado en fuentes de datos disponibles en registros de 2017 y 2018 de la Junta Regional de Calificación de Invalidez del Meta. **Resultados:** se revisaron 1114 registros de historias de siniestros viales en motocicleta durante el periodo 2017-2018. El 78,46% de los lesionados y siniestros fueron en población masculina, del cual el 61,58% presentó estado civil soltero, con un nivel académico de educación secundaria el 60,95%. El 75,22% de los accidentes se produjo en zona urbana, la lesión más frecuente fractura con 79,98%, zona con mayor afectación miembros inferiores 40,48% y el hueso más lesionado tibia 17,24%. **Conclusiones:** el estudio coincide con lo encontrado en otros a nivel nacional e internacional. Se evidenció mayor accidentalidad en la población masculina, y la necesidad de investigaciones que incluya indicadores epidemiológicos, factores de riesgo, tiempo de hospitalización, intensidad de intervenciones terapéutica, con el fin de caracterizar de una manera más amplia la población.

**Palabras clave:** accidentes de tránsito, motocicletas, heridas y traumatismos, lesiones accidentales. (Fuente: DeCS, 2020)

**Introduction**

The World Health Organization (WHO) refers in its 2018 State of the World's Road Safety Report that each year approximately 1.35 million people die from road crashes worldwide, making it the eighth leading cause of death in people of all ages and the leading cause of death for children and young adults aged 5 to 29 years old. Such crashes have a mortality rate

3 times higher in low-income countries, which exceeds the figures for HIV/AIDS, tuberculosis, and diarrheal diseases, making them a public health issue (1). By 2015, in the Sustainable Development Goals (hereafter SDGs), two specific targets related to road safety were included (SDG 3.6 and SDG 11.2) that seek to reduce by half the global number of deaths and injuries from road traffic crashes; by providing access to safe, affordable, accessible, and sustainable transportation that improves road safety for all (2). Although many countries have shown reductions in these rates, even in regions such as Latin America, deaths and injuries caused by road traffic crashes are still on the rise (3).

In Colombia, according to the National Institute of Legal Medicine and Forensic Sciences for 2018 there were 21,453 traffic accident injuries of which 16,901 (78.78%) were motorcycle drivers and 5,156 (50.17%) were passengers. The injured were mostly between 20-24 (15.47%) and 25-29 (14.06%) years old, where higher mortality was also evidenced, with a fatality rate of 77.84% for drivers and 50.13% for passengers, figures that registered an increase of 1.85% compared to 2017 (4,5). Likewise, the department of Meta for 2018 ranked eighth in those with the highest rate of deaths in transport accidents and non-fatal injuries per 100,000 inhabitants in Colombia, with 1,094 injuries corresponding to a rate of 107.60 x 100,000 inhabitants and 206 fatalities, that is, a rate of 20.26 x 100. In particular, Villavicencio ranked sixth in the municipalities with the highest rate of deaths in transport accidents and non-fatal injuries per 100,000 inhabitants in Colombia, with 582 injuries (112.62 x 100,000 inhabitants) and 92 deaths (17.80 x 100,000 inhabitants) (5).

Traffic accidents and the injuries resulting from these accidents, especially those involving motorcycles, are not only a risk to the driver's health and life, but also to those of passengers and pedestrians. As for the causes of accidents, multiple human, environmental and vehicle-specific factors have been identified, such as road anomalies, weather conditions, loss of motorcycle control, use of mobile devices, inadequate use of personal safety equipment, driving under the influence of psychoactive substances and/or alcohol, speeding and the lack of adherence to traffic regulations, situations that lead to an increase in road accidents and the impact on the quality of life of those involved, even when there are road safety policies that promote a certain type of culture in this regard (6,7).

In Colombia, the current panorama of traffic accidents and their con-

sequences is unknown. In this regard, Trujillo et al (8), in a review of 460 clinical histories of cases reported in the SOAT in Pereira - Colombia 2014-2017, found higher accident and injury rates in the male population (64.1%); health regime registered in SOAT (86.5%), subsidized (8.5%), contributory (4.1%) and special (0.9%); marital status single (90.9%); type of injury presented contusion (64.3%), fracture (20.9%); distribution of injuries lower extremities (27.8%) and upper extremities (25.2%), head and skull (18%). Other national studies were conducted in different periods or more than 8 years prior to the period of interest and did not contribute with updated information to support the analysis and discussion of results, in addition, no formal studies were found in the department of Meta or in the Orinoco region, therefore the study is perceived as a current need and an original contribution to the literature.

According to the scenario presented, the high impact of secondary injuries caused by motorcycle crashes on the health of users and public health can be observed. The literature review also showed the importance of conducting studies aimed at describing the injuries resulting from these accidents and the characterization of their users in the Colombian context, since in the country there is little research in this area and the studies found are focused on describing the clinical management of trauma, not on the characterization of injuries and variables that allow the modification of lifestyles and behaviors that prevent accidents and therefore injuries, especially in the Orinoco region where no official study was found. The objective of this study was to describe the most frequent physical injuries in the population involved in motorcycle accidents in the Meta region in 2017 and 2018.

## Materials y methods

### Type of study

A quantitative, descriptive, cross-sectional study was conducted based on data sources available at the Regional Disability Rating Board of Meta (hereinafter RDRBM), the information was collected from records of motorcycle accidents during the period 2017-2018.

### Sample

The sample was constituted by 1114 clinical histories of motorcycle road crashes qualified by the RDRBM during the periods 2017 - 2018. A purposive sampling was applied under the following inclusion criteria: medical records of motorcycle drivers involved in accidents that occurred in the territory of the department of Meta in the years 2017 and 2018, medical

records that include the RDRBM qualification; and exclusion criteria, motorcycle cargo accidents, motorcycle cab accidents, whether the accident was caused at the time of getting on or off the motorcycle and incomplete medical records.

**Variables and data collection**

Twenty variables recorded in the medical records of the sample were analyzed. These variables corresponded to three categories: 1. Sociodemographic characteristics such as age, sex, marital status, level of schooling, origin, affiliation to the General Social Security Health System (hereinafter GSSHS), Pension Fund Administrator (hereinafter PFA), Labor Risk Administrator (hereinafter LRA) and economic activity; 2. Related to the accident: year of the accident, year of qualification, month of the accident, etiology and cause; and, 3. Related to the area and part of the body affected, including the area of the body affected and the anatomical part affected. The variables were extracted from the medical records and entered into a database of the statistical software package IBM Statistics (hereinafter SPSS).

**Data processing and analysis**

The data were analyzed with SPSS version 23, licensed by the Los Llanos University, with which descriptive statistics such as frequency, relative frequency, mean, standard deviation (hereinafter SD) and 95% confidence intervals (hereinafter CI) were calculated).

**Ethical considerations**

The RDRBM was informed that the study was classified as minimal risk, in which the reserve, confidentiality and privacy of the data collected in the clinical histories was guaranteed by signing a confidentiality agreement provided by the board, considering the Declaration of Helsinki (9), Resolution 8430 of 1993 (10), law 266 of 1996 and 911 of 2004 (11,12). In turn, the protocol was approved and has the ethical endorsement of the Research Center of the Faculty of Health Sciences of the Los Llanos University and is ascribed to the GESI Research Group).

**Results**

1114 motorcycle accident histories presented in the department of Meta, Colombia and rated by the RDRBM in 2017-2018 were analyzed, where the following findings were found:

**Sociodemographic characterization**

In this study the average age for 2017 was 37.55 years (95% CI, 36.33-38.78) and 2018 was 34.86 years (95% CI, 33.91 - 35.81), with higher

accident rates in the age range 18-29 and 30-39 years. The data for the socio-demographic variables are shown in table 1.

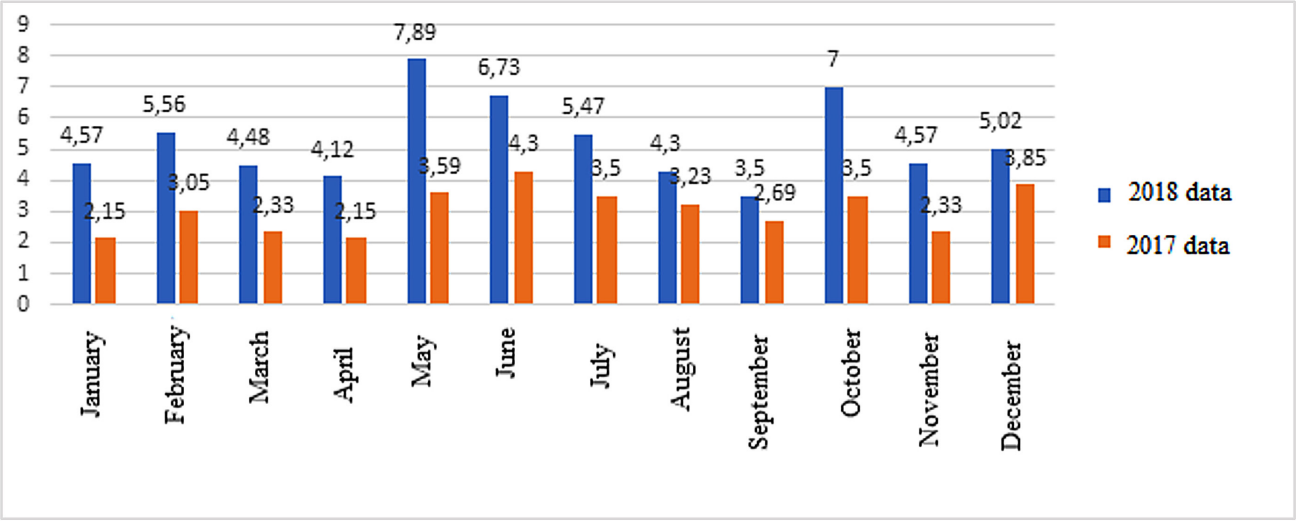
**Table 1.** Percentage distribution of socio-demographic variables.

| Variables | Count | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 873 | 78,37 |
| Female | 241 | 21,63 |
| **Age** | | |
| 18 - 29 | 376 | 33,75 |
| 30 - 39 | 331 | 29,71 |
| 40 - 49 | 220 | 19,75 |
| 50 -59 | 124 | 11,13 |
| ≥60 | 63 | 5,66 |
| **Marital status** | | |
| Single | 686 | 61,58 |
| Married/Unmarried partner | 410 | 36,8 |
| Widowed | 18 | 1,62 |
| **Educational level** | | |
| No education at all | 16 | 1,14 |
| Elementary school | 214 | 19,21 |
| Middle school | 679 | 60,95 |
| Higher education | 205 | 18,4 |
| **GSSHS affiliation** | | |
| Yes | 1043 | 93,63 |
| No | 71 | 6,37 |
| **LRA affiliation** | | |
| Yes | 159 | 14,27 |
| No | 955 | 85,73 |
| **PFA affiliation** | | |
| Yes | 1049 | 94,17 |
| No | 65 | 5,83 |

Note: GSSHS: General Social Security Health System, LRA: Labor Risks Administrator, PFA: Pension Fund Administrators.

### Accident frequency

The urban area of the Villavicencio municipality had the highest absolute frequency with 845 (75.85%) of road accidents, followed by Acacías 63 (5.66%) and Granada 54 (4.85%).




**Graphic 1.** Percentage distribution by month of accident.

Regarding the incidence of accidents by year and month according to the sample studied (see graphic 1), the year with the highest number of accidents was 2018, and the months (in descending order in terms of percentages) May 7.89%, October 7% and June 6.73% were those with the highest number of cases. The most predominant accident factors were human 73.25%, followed by environmental 23.61% and vehicle factors 3.14%.

**Type of injuries**

Fractures (79.98%) were the most common type of injury in motorcycle traffic accidents, followed by soft tissue injuries (9.87%), mostly skin abrasions due to friction against the asphalt, and craniofacial trauma (6.1%), which in turn were associated with a greater impact on the health of the injured with percentages of loss of working capacity ≥50%.

**Table 2.** Percentage distribution by type of injury and affected body area.

| Type of injury | Count | Percentage |
|---|---|---|
| Amputation | 12 | 1,08 |
| Fracture | 891 | 79,98 |
| Wound | 14 | 1,26 |
| Soft tissue injury | 110 | 9,87 |
| Abdominal trauma | 2 | 0,18 |
| Abdominal trauma | 17 | 1,53 |
| Craniofacial trauma | 68 | 6,10 |

### Affected area and body part.

According to the data recorded, there was a higher incidence of injuries in the lower (49.03%) and upper extremities (40.62%), with no significant distinction by gender (see Table 3). Amputations occurred in hand phalanges with 5 cases (0.44%), foot 4 cases (0.35%), leg 2 cases (0.18%) and thigh/leg 1 case (0.09). The most frequent soft tissue injuries were in the leg muscles 31 cases (2.74%), skin 22 cases (1.95%), acromioclavicular ligament 17 cases (1.5%) and anterior cruciate ligament 11 cases (0.97%). Figure 1 shows the percentage distribution of bone fractures.

**Table 3.** Percentage distribution by body area affected.

| Body area affected | Count | % Total table |
|---|---|---|
| Head | 82 | 7,36 |
| Spine | 17 | 1,53 |
| Chest and abdomen | 15 | 1,35 |
| Upper limbs | 451 | 40,48 |
| Lower limbs | 549 | 49,28 |

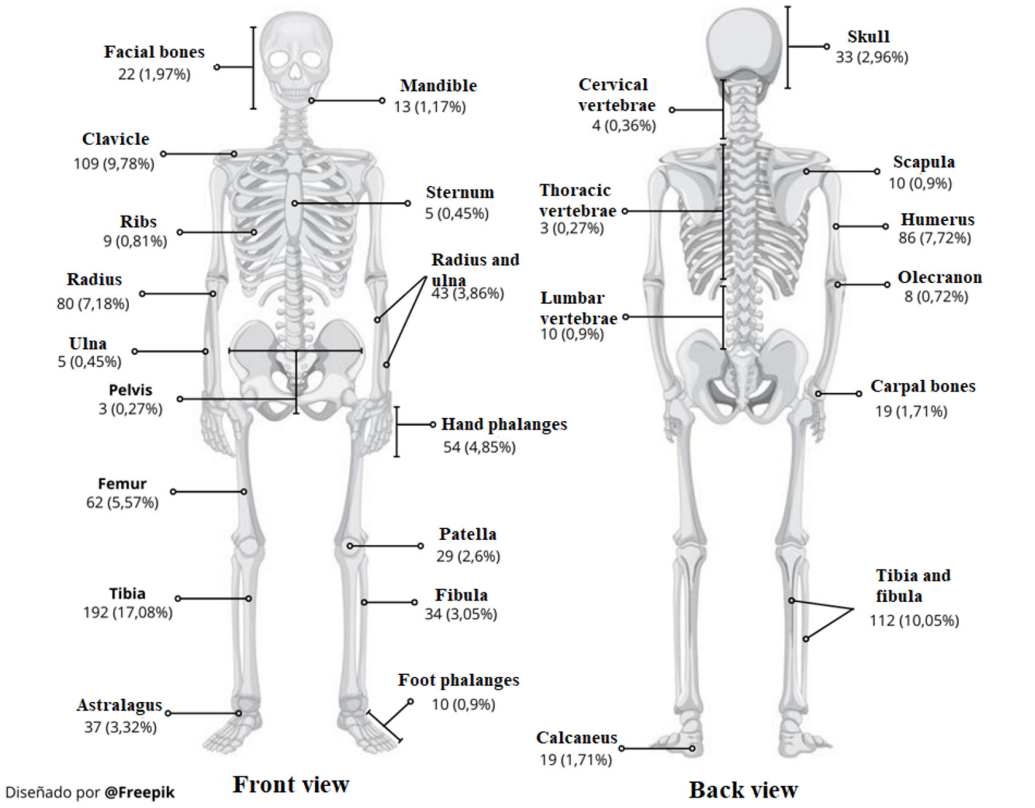



**Figure 1.** Percentage distribution of bone fractures.

Source: designed by @Freepik and adapted by authors according to data obtained from the study and analyzed in SPSS. 2021.

## Discussion

According to the objective of this study, it was determined that there are no precedents of this topic in the geographic area. Regarding the characterization of the sample, the male population registered a greater number of accident and injury cases, with an average age for 2017 of 37.55 years and 2018 of 34.86 years, single marital status and an academic level of at least high school or middle school education (see Table 1). These findings are consistent with those reported by previous studies (13 - 20); in this regard, Hidalgo et al. (21) argue that there is a direct relationship between accident rates and sociodemographic factors such as being male, young, and single. Men tend to use motorcycles more as a means of transportation for work and social activities; in addition, they tend to drive faster and under the influence of psychoactive substances or alcohol (22, 23). A study carried out in Spain highlights that men are riskier at the wheel, suffer more accidents and these are more serious than those caused by women, resulting in a mortality rate three times higher in men than in women in terms of traffic accidents per million inhabitants of each sex (24). Similarly, Barzegar et al. (25) reported a lower incidence of traffic accidents in women, because in addition to the reasons mentioned above, they pointed out that at a cultural level in the Eastern Mediterranean region, there are cultural and religious restrictions for the use of motorcycles by women, an aspect that can be considered for the Colombian culture, given the influences of the Judeo-Christian tradition. Finally, it is necessary to highlight the average academic level of the subjects involved in the accidents, which may make it difficult to understand and therefore comply with traffic regulations, as well as the possible relationship between youth and the possible lack of driving expertise.

In terms of frequency, there was evidence of greater accident rates in urban areas in 2018, between the months of May, July, and October; the municipality of Villavicencio reported the majority of cases. These findings are congruent with those reported by Ping-Ling et al. (16) in Taiwan, where the majority of accidents occurred in urban areas and were related to environmental factors such as road congestion, poor road conditions and poor adherence to traffic regulations, as well as human factors such as stress, anxiety and fatigue, resulting from the daily activities and responsibilities of those involved in the accident. The incidence per month is similar to that reported by Waseem et al. (26), who recorded a higher accident rate in that period due to climatic factors, an association that is relevant for this study,

since according to Caro et al. (27) the Meta is a region classified as a tropical humid zone with constant rains in the month of May, in addition to relative humidity in June and July, conditions that predispose a wet asphalt, which added to the poor condition of some of the roads is a risk factor in the accident rate. The presented reaffirms the statistics of the National Institute of Legal Medicine and Forensic Sciences in 2018 (5), which states that Villavicencio is the municipality with the highest numbers of deaths in transport accidents and non-fatal injuries per 100 thousand inhabitants in Colombia (see Graph 1).

The most common type of injury was fracture, followed by soft tissue injuries mostly related to skin abrasions due to friction against asphalt and craniofacial trauma, this last one having a greater impact on the health of the injured with percentages of loss of working capacity ≥ 50%; findings that were consistent with those presented in studies conducted at international level (28 - 31). Furthermore, these data are similar to those found by Elsemesmani et al. (32), in their study conducted with 28,821 accident patients in the United States where 83.1% of the injuries were fractures and were related to factors such as speeding, driving experience and the force of impact; soft tissue injuries were related to the type of impact against objects and surfaces, the distance of displacement on the asphalt and the use of personal protective equipment.

As for the area of the body most affected, it was found that the lower and upper extremities, respectively, were those that presented the greatest secondary injuries in motorcycle accidents; these data are similar to the study by Berrones et al (33), carried out in Mexico with 13,916 cases of accidents, where the lower and upper limbs were the areas that presented the highest incidence of injuries. In the study, no predisposing factors to fractures were found in relation to gender; however, associations were reported with the severity of the accident, the use of personal protective measures and the complexity or severity of the resulting injuries. In addition, Desmoulin et al. (34), in their study, report that injuries to the extremities are related to the fact that at the time of the accident the driver seeks stability by extending the lower limbs, bringing them closer to the impact surface and exposing them to possible injuries, and also to the fact that factors such as speed and the use of protective equipment in these areas increase or decrease the risk of injury and its severity.

With regard to fractures, which were the most common type of injury, the anatomical structure or body parts most affected (see Figure 1) were: individual fracture of the tibia, joint fracture of the tibia and fibula, clavicle, humerus and radius, with figures higher than those reported from a smaller sample taken by Dupaix et al. (35) in Hawaii, with 578 motorcyclist accidents with trauma, where these structures also had a greater number of fractures. In this regard, Bracali et al. (36) emphasize in their results the need for the development of protective equipment for legs and the importance of the use of this equipment to reduce the severity of injuries caused by road accidents on motorcycles. In addition, among the results, fractures suffered in vertebrae stand out, which although in percentage terms in the sample do not have a high incidence, were related to greater loss of work capacity and sequelae, as well as cranial and facial injuries, data that contrast with the findings of Dupaix et al. (35) who with a smaller sample than that of the present study, showed a greater number of vertebral fractures and with those indicated by Zulkipli et al. (37), who explain their occurrence by direct trauma on the vertebral prominences, which increases the probability of suffering serious spinal injuries or by the whip effect on the spine at the time of the crash in the accident, for this reason the vertebrae of the lumbar area are the most frequently with direct injuries, which agrees with the results of the study. Regarding the above, Afquir et al. (38) found in their research that, as a factor of injury severity, motorcyclists who did not use any type of back protection equipment had more severe thoracolumbar injuries compared to motorcyclists who did and reported that their limited use increased the probability of suffering serious injuries.

Despite the relevance of the results obtained, some limitations were considered. Given the nature of the study, data collection and tabulation were restricted due to the quarantine imposed because of COVID-19, which made it necessary to postpone data collection for a few months until the Disability Board could attend. There were also limitations in the collection of the information systems and the reduced sociodemographic characterization contained in many of the patients' medical records, since it was not possible to include some of them in the sample, as they did not have complete data or inconsistencies were found that did not allow clarification of the facts.

It is hoped that the present study will serve as a reference for further research that will make it possible to characterize the population in depth.

It is recommended the inclusion of variables such as specific risk factors for each accident, hospitalization time, intensity of therapeutic interventions and costs related to the care and rehabilitation of sequelae, in order to generate campaigns and programs for the promotion of road safety and accident prevention, developed in collaboration with the territorial entities of influence on the target population, thus contributing to the reduction of the rate of deaths and injuries in Colombia and the world.

## Conclusions

It was found that the highest number of motorcycle accidents was reported in the male population, and the age group with the highest concentration of people involved in accidents was the adult population, with a predominance of high school education. The most affected part of the body was the lower limbs, with the tibia and fibula being the most affected bones, either as a result of individual or joint fracture.

Villavicencio, rural area and capital of the department, was the municipality that reported the highest number of motorcycle accidents; the most frequent type of accident was related to collisions between vehicles and motorcycles. It is necessary to implement road safety education actions and consider intensifying it in the specific group of young men with unmarried marital status. It is also recommended that prevention alerts should be issued in months with rainy or humid periods, given the relationship between accidents and wet and deteriorated roads. In addition, more extensive studies are needed in order to identify characteristics, trends and correlations between variables such as driving attitude, consumption of psychoactive substances, level of knowledge of traffic regulations and road safety, and the incidence of traffic accidents involving motorcyclists.

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