Sociodemographic profile of motorcyclists and their vulnerabilities in traffic
Perfil sociodemográfico de motociclistas e suas vulnerabilidades no trânsito

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ABSTRACT | Introduction: Violence has acquired an endemic character in society; traffic violence stands out, particularly considering the upward trend in deaths among motorcyclists. Objectives: To describe the sociodemographic profile and analyze the vulnerabilities of motorcyclists from their experiences in traffic. Methods: This is an exploratory descriptive study with a quantitative approach, performed through interviews with three groups of motorcyclists: those who used motorcycles for recreation, transportation, and for work. Results: Most participants were male (> 80%), mainly young adults in the transportation and work groups (p < 0.001); with higher schooling and income levels in the recreation group (p < 0.001); and with lightweight motorcycles in the transportation and work groups (p < 0.001). Similar experiences fragilizing all three groups include alcohol consumption, disregard of traffic rules, and acts of aggression. With a different experience from the transportation and work groups, the recreation group experienced circumstances that were favorable to traffic safety. Overall, the pattern of answers in the transportation and work groups associated them with higher susceptibility; the work group, represented by motorcycle couriers, was marked by accidents and poor working conditions. Conclusions: Contextual variables inflict a higher traffic vulnerability on motorcyclists of the transportation and work groups. We advocate that further exploration of the analysis of road traffic accidents be a social construct, and advances in the knowledge of risks and margins for implementing safety measures will only be possible when the approaches consider social, economic, and cultural aspects.

Keywords | public health; traffic accident; motorcycles; health vulnerability.

RESUMO | Introdução: A violência adquiriu um caráter endêmico na sociedade, sendo destaque a violência no trânsito, em especial a tendência crescente de óbitos entre motociclistas. Objetivos: Descrever o perfil sociodemográfico e analisar as vulnerabilidades de motociclistas a partir de suas experiências no trânsito. Métodos: Trata-se de estudo exploratório-descritivo com abordagem quantitativa, a partir de entrevistas com três grupos de motociclistas: lazer, transporte e atividade laboral. Resultados: Constatou-se que a maioria dos participantes era homens (> 80%), com predominância de adultos jovens nos grupos transporte e trabalho (p < 0,001); maior escolaridade e renda no grupo lazer (p < 0,001); e veículos de baixa cilindrada no transporte e trabalho (p < 0,001). Como experiências similares que fragilizam os três grupos, destacam-se as seguintes: consumo de álcool, desrespeito às normas e agressões. Como experiência divergente dos grupos transporte e trabalho, o grupo lazer convivia em circunstâncias favoráveis à segurança no trânsito. No geral, o padrão de resposta dos grupos transporte e trabalho os associou com maior suscetibilidade, sendo que no grupo trabalho, representado por motoboys, destacaram-se o envolvimento em acidentes e as péssimas condições de trabalho. Conclusões: As variáveis contextuais impõem aos motociclistas dos grupos transporte e trabalho maior vulnerabilidade no trânsito sobre duas rodas. Advoga-se que o aprofundamento da análise dos acidentes de trânsito seja uma construção social, e o avanço do conhecimento sobre os riscos e as margens para implementação das medidas de segurança só será possível quando as abordagens considerarem os aspectos sociais, econômicos e culturais.

Palavras-chave | saúde coletiva; acidente de trânsito; motocicletas; vulnerabilidade em saúde.
INTRODUCTION

In modern society, violence has acquired an endemic character, as it produces numerous victims and deaths and results in psychophysical and socioeconomic sequelae. Considering traffic violence, the increase in deaths among motorcyclists is noteworthy, resulting from the development of the automotive industry and the disorderly growth of cities; these factors have had a negative impact on the traffic of large urban centers.

The Brazilian road traffic fatality rate is considered one of the highest worldwide. The increase in mortality among Brazilian motorcyclists is surrounded by a global increase in traffic violence, which prompted the United Nations to proclaim the Decade of Action for Road Safety, proposing to stabilize and then reduce statistics in 50% between 2011 and 2020.

In the Americas, except for the United States, the most vulnerable road users are pedestrians, motorcyclists, and cyclists; in Brazil, motorcyclists face the highest risk. A study states that some factors contribute to an increased fragility in the context of motorcycle traffic, which can be inferred by an upward trend of deaths in relation to transportation accidents in Brazil — from 14.2% to 27.9% in 10 years.

Motorcyclists are more prone to severe injuries to the head and body extremities associated with sequelae and sometimes to fatal injuries. Therefore, traumas resulting from accidents result in the occupation of surgical and intensive care beds, delaying the freeing of hospital beds to patients with other diseases.

Motorcycle accidents are categorized in the study of violence of external causes by the International Statistical Classification of Diseases and Related Health Problems, which is periodically revised by the World Health Organization (WHO). In public health, violence is treated as a social phenomenon, with various determinant factors associated with social processes grounded in the structure of an unequal society. It becomes a problem to public health because it affects individual and collective health, in addition to demanding particular policies and services for its prevention and treatment.

The relevance of this study is justified by the vulnerability of motorcyclists in face of the high mortality rates in the Brazilian scenario, since young citizens are the main affected population and their morbidity and mortality can burden the Unified Health System (SUS). We aimed to describe the sociodemographic profile and analyze the vulnerabilities of motorcyclists from their experiences in traffic.

METHODS

This is an exploratory descriptive study with a quantitative approach. The population consisted in motorcyclists living in the Federal District, Brazil, and the sample size was determined by theoretical saturation, that is, when the inclusion of new participants did not contribute with new data. Data collection was thus interrupted when new elements for subsidizing the theoretical framework sought by this study could not be extracted from the approached field.

Participants underwent selection through purposive sampling because they had relevant characteristics within the studied population. Convenience sampling — non-probability sampling — and group selection were performed according to the researchers’ experience, based on reasoning instructed by theoretical knowledge on the studied subject. Therefore, 75 motorcyclists answered the questionnaire and were divided into predefined groups according to the nature of their motorcycle use: group I: recreation (n = 25); group II: transportation (n = 25); and group III: work (n = 25). Inclusion criteria defined participants living in the Federal District and aged 18 years or older who belonged to the predefined groups.

A data collection instrument was constructed from a semistructured questionnaire with 17 questions on the possible experiences of motorcyclists, their sociodemographic profile, and their motorcycle profile. The mean time for applying the questionnaire was 15 minutes, and data collection took place in March 2018. The questionnaire was applied in strategic locations of Brasília, selected by convenience where different types of motorcyclists could be found, such as universities, pizza restaurants, drugstores, fast-food restaurants, and biker bars.
Data were analyzed in a Microsoft Excel spreadsheet and then organized so that the three groups of motorcyclists could be compared. The p-value indicates the behavior of variables between groups, where p < 0.05 indicates a significant change — our discussion was presented in theme sections. This research was approved by the Research Ethics Committee of the School of Health Sciences at Universidade de Brasília (CEP/FS/UnB), approval number 1,560,683 – CAAE 33517114100000030.

RESULTS

The questionnaire was applied to three groups of motorcyclists, according to the nature of their motorcycle use: group I: recreation; group II: transportation; and group III: work. Table 1 presents the sociodemographic profile of the participants and their motorcycle profile. Most participants were male (84% in the recreation group, 88% in the transportation group, and 96% in the work group). The recreation group had a median age of 46 years; the transportation group had a median age of 31 years; and the work group had a median age of 28 years.

Regarding schooling levels, 68% of those in the recreation group had higher education; 20% of them had finished high school, and 12% had a graduate degree. In the transportation group, 64% declared having finished high school; 24% had elementary education; 8% had higher education; and 4% were illiterate. In the work group, 48% had finished elementary school; 40% had a high school degree; 8% had higher education; and 4% were illiterate. As to their

Table 1. Demographic data and motorcycle profile of participants in this study, Brasília (Federal District), 2018

| Sociodemographic data                                    | Group I Recreation | Group II Transportation | Group III Work | p-value |
|----------------------------------------------------------|--------------------|-------------------------|----------------|---------|
| Total, n                                                 | 25                 | 25                      | 25             | -       |
| Male, n (%)                                              | 21 (84.0)          | 22 (88.0)               | 24 (96.0)      | 0.515   |
| Age (years)                                              | -                  | -                       | -              | -       |
| Median                                                   | 46.0               | 31.0                    | 28.0           | < 0.001 |
| Mean                                                     | 44.6               | 31.2                    | 29.5           |         |
| Amplitude (max-min.)                                     | 65-19              | 63-21                   | 52-20          | -       |
| Schooling, n (%)                                         | -                  | -                       | -              | -       |
| Illiterate or elementary education                       | 0 (0.0)            | 7 (28.0)                | 13 (52.0)      | < 0.001 |
| Secondary education                                      | 5 (20.0)           | 16 (64.0)               | 10 (40.0)      |         |
| Higher education or graduate education                   | 20 (80.0)          | 2 (8.0)                 | 2 (8.0)        |         |
| Monthly income (Brazilian Reais)                         | -                  | -                       | -              | -       |
| Median                                                   | 7,000              | 1,600                   | 1,500          | < 0.001 |
| Mean                                                     | 9,772              | 1,870                   | 1,701          |         |
| Amplitude (max-min.)                                     | 1,500-23,000       | 0-5,000                 | 937-3,200      | -       |
| Residence, n (%)                                         | -                  | -                       | -              | -       |
| Brasilia                                                 | 8 (32.0)           | 2 (8.0)                 | 0 (0.0)        | 0.003   |
| Administrative region                                    | 17 (68.0)          | 23 (92.0)               | 25 (100.0)     |         |
| Motorcycle characteristics                               | -                  | -                       | -              | -       |
| Engine capacity, n (%)                                   | -                  | -                       | -              | -       |
| Lightweight                                              | 0 (0.0)            | 17 (68.0)               | 24 (96.0)      | < 0.001 |
| Robust                                                   | 25 (100.0)         | 8 (32.0)                | 1 (4.0)        |         |
| ABS                                                      | 16 (64.0)          | 3 (12.0)                | 3 (12.0)       | < 0.001 |
| Traction control system                                  | 8 (32.0)           | 5 (20.0)                | 2 (8.0)        | 0.012   |

ABS = anti-lock braking system.
occupation, the recreation group included professions that required higher education, such as lawyers, systems analysts, economists, engineers, publicists, and accountants. In the transportation group, most professions required a high school degree, such as practical nurses, computer technicians, administrative assistants, salespeople, electricians, and drivers. In the work group, the participants were motorcycle couriers. Regarding the participants’ income, the recreation group presented a median income of R$ 7,000.00; the transportation group had a median income of R$ 1,600.00; and the work group, of R$ 1,500.00.

Regarding motorcycle engine capacity (in cubic centimeters [cc]), the recreation group had a median of 750 cc; the transportation group had a median of 150 cc; and the work group; of 125 cc. When considering the anti-lock braking system (ABS), 64% of the participants in the recreation group had this safety feature, whereas 84% of those in the transportation and work groups did not have it. Regarding traction control, 68% of the participants in the recreation group had this safety feature, whereas 80% of the transportation group and 92% of the work group did not have it.

Table 2 illustrates the main experiences of motorcyclists with their vehicles. As for the use of personal protective equipment, 36% of the participants in the recreation group wore a helmet, gloves, a heavy-duty jacket, and boots; 20% wore a helmet,

### Table 2. Motorcyclists’ experiences with traffic violence, Brasilia (Federal District), 2018

| Experiences                                         | Group I Recreation | Group II Transportation | Group III Work | p-value |
|-----------------------------------------------------|--------------------|-------------------------|----------------|---------|
| Total, n                                            | 25                 | 25                      | 25             | -       |
| Frequency using the motorcycle: 3 to 5 days, n (%)   | 10 (40.0)          | 5 (20.0)                | 1 (4.0)        |         |
| Frequency using the motorcycle: 6 to 7 days, n (%)   | 8 (32.0)           | 19 (76.0)               | 24 (96.0)      |         |
| Choice of motorcycle, n (%)                         | 0 (0.0)            | 11 (44.0)               | 2 (8.0)        | < 0.001 |
| Low price and fuel economy                          | 0 (0.0)            | 11 (44.0)               | 2 (8.0)        |         |
| Excitement and pleasure                             | 22 (88.0)          | 8 (32.0)                | 8 (32.0)       |         |
| Making a living                                      | 0 (0.0)            | 0 (0.0)                 | 11 (44.0)      |         |
| Speed                                               | 3 (12.0)           | 6 (24.0)                | 4 (16.0)       |         |
| Does not respect traffic rules, n (%)               | 16 (64.0)          | 18 (72.0)               | 20 (80.0)      | 0.505   |
| Acknowledges a higher risk in traffic, n (%)        | 20 (80)            | 25 (100.0)              | 25 (100.0)     | 0.009   |
| Wears personal protective equipment, n (%)          | 24 (96.0)          | 25 (100.0)              | 25 (100.0)     | 1.000   |
| Consumes alcohol, n (%)                             | 12 (48.0)          | 16 (64.0)               | 16 (64.0)      | 0.451   |
| Has a motorcycle license, n (%)                     | 25 (100.0)         | 19 (76.0)               | 19 (76.0)      | 0.018   |
| Suffers discrimination and/or aggression in traffic, n (%) | 14 (56.0)       | 16 (64.0)               | 18 (72.0)      | 0.548   |
| Aggressor: car driver*                               | 14 (100.0)         | 15 (93.8)               | 18 (100.0)     | 0.625   |
| Aggressor: motorcycle rider*                         | 0 (0.0)            | 1 (6.2)                 | 0 (0.0)        |         |
| Participated in lectures and/or courses, n (%)      | 9 (36.0)           | 5 (20.0)                | 4 (16.0)       | 0.319   |
| Suffered accidents in the previous 2 years, n (%)   | 4 (16.0)           | 13 (52.0)               | 17 (68.0)      | 0.001   |
| Did not require assistance†                         | 2 (50.0)           | 9 (69.2)                | 7 (41.2)       | 0.534   |
| Received assistance from firefighters†             | 1 (25.0)           | 2 (15.4)                | 4 (23.5)       |         |
| Received assistance from SAMU†                      | 0 (0.0)            | 2 (15.4)                | 3 (17.6)       |         |
| Received assistance from others†                    | 1 (25.0)           | 0 (0.0)                 | 3 (17.6)       |         |
| Was hospitalized after the accident, n (%)†         | 0 (0.0)            | 1 (7.7)                 | 1 (5.9)        | 1.000   |
| Required medical leaves of absence and INSS, n (%)† | 1 (25.0)           | 3 (23.1)                | 4 (23.5)       | 1.000   |
| Used DPVAT insurance, n (%)†                         | 0 (0.0)            | 1 (7.7)                 | 0 (0.0)        | 0.500   |

DPVAT = Personal Injuries Caused by Land-based Automotive Vehicles; INSS = National Social Institute for Social Security; SAMU = Mobile Emergency Medical Service.

* Percentage calculated in relation to those who suffered discrimination/aggression.
† Percentage calculated in relation to those who suffered an accident.
boots, and gloves; 16% wore a helmet, boots, and a reflective vest; 12% wore a helmet, gloves, and a heavy-duty jacket; 12% wore a helmet; and 4% did not use any equipment. In the transportation group, 48% of the participants wore a helmet; 28% wore a helmet, gloves, and a heavy-duty jacket; 16% wore a helmet and gloves; and 8% wore a helmet, gloves, a heavy-duty jacket, and boots. In the work group, 60% of the participants wore a helmet; 20% wore a helmet, boots, and a heavy-duty jacket; 12% wore a helmet, gloves, and a heavy-duty jacket; and 8% wore a helmet, gloves, a heavy-duty jacket, and a reflective vest. As for periodic maintenance checks, 96% of the participants in the recreation group said they had their motorcycle checked periodically, whereas 4% stated they did not. In the transportation group, 92% did maintenance checks and 8% did not. In the work group, 80% did periodic checks whereas 20% did not.

As for the reason for choosing the motorcycle, 88% of those in the recreation group chose it for the excitement/pleasure and 12%, for its speed. In the transportation group, 44% chose it for the low price/fuel economy; 32% chose it for the excitement/pleasure; and 24% chose it for the speed. In the work group, 44% chose it for the need to make a living; 32% chose it for the excitement/pleasure; 16% chose it for the speed; and 8% chose it for the low cost/fuel economy. As for their weekly use of the vehicle, 40% of those in the recreation group used it 3 to 5 days a week; 32% used it 6 or 7 days a week; and 28% used it 1 or 2 days a week. In the transportation group, 76% used the motorcycle 6 to 7 days a week; 20% used it 3 to 5 days a week; and 4% used it 1 or 2 days a week. In the work group, 96% used the motorcycle 6 to 7 days a week and 4% used it 3 to 5 days a week. On the matter of having a valid motorcycle license, 100% of those in the recreation group had a valid document, whereas in the transportation and work groups, 76% had it and 24% did not. As for the perception of a greater exposure in traffic, 80% of those in the recreation group and 100% of those in the transportation and work groups acknowledged this greater exposure.

When it comes to traffic rules, 64% of those in the recreation group did not follow them, and the reasons were alcohol consumption, speeding, and disregard for traffic signs. In the transportation group, 76% did not follow traffic rules, and the reasons were alcohol consumption and disregard for traffic signs. In the work group, 80% did not follow traffic rules, and the reasons were alcohol consumption, speeding, and disregard for traffic signs. On alcohol consumption associated with motorcycle riding, 48% of the recreation group, 64% of the transportation group, and 68% of the work group declared they had associated drinking and riding before. Alcohol consumption was the main reason why participants disrespected the rules in all three groups, especially transportation and work.

As for the occurrence of discrimination and/or aggression in traffic, 56% of the recreation group, 64% of the transportation group, and 72% of the work group reported this experience. Most participants (97.9%) stated that a car driver was the agent of the aggression. On the main agents responsible for traffic accidents, 60% of the recreation group stated they were caused by reckless driving by all those involved; 24% said they were caused by reckless driving by car drivers; and 16% said they were caused by reckless driving by motorcyclists. In the transportation group, 52% reported reckless driving by car drivers; 28% reported reckless driving by motorcyclists; and 20% said they were caused by reckless driving by all those involved. In the work group, 68% reported reckless driving by car drivers; 20% reported reckless driving by car drivers; 20% reported reckless driving by all those involved; and 12% reported reckless driving by motorcyclists.

When considering training and/or lectures on the use of motorcycles, 72% of those in the recreation group had never participated in one, whereas 28% had participated in lectures by the State Traffic Department (DETRAN), the Military Police, private concessionaires, motorcycle clubs, and in related events. In the transportation group, 80% had never participated in courses/lectures by the Military Police, concessionaires, or the National Training Service for the Transportation Sector (SENAT), whereas 20% had participated in these events. In the work group, 84% had never participated and 16% had participated in courses/lectures by DETRAN or SENAT.

Regarding traffic accidents in the previous 2 years, 84% of those in the recreation group had not been
involved in an accident, whereas 16% had been in one to two accidents. In the transportation group, 48% had not suffered accidents; 44% had suffered one to two accidents; and 8% had been in three to five accidents. In the work group, 44% had been in one to two accidents; 32% had not been in an accident in the previous 2 years, 16% had suffered three to five accidents; and 8% had been in six to eight accidents. As for the first responders, 25% of those from the recreation group who suffered accidents were rescued by firefighters and 75% did not need rescuing. In the transportation group, 15.4% were rescued by the Mobile Emergency Medical Service (SAMU); 15.4% were rescued by firefighters; and 69% did not need rescuing. In the work group, 23.5% were rescued by SAMU; 17.6% were rescued by firefighters; and 58.9% did not need rescuing. As for the need for medical leaves of absence and/or benefits from the National Institute for Social Security (INSS), those who suffered accidents in the recreation group did not present this requirement. In the transportation group, 52% used INSS benefits for 31 to 60 days and had medical leaves of absence of 1 to 5 days. In the work group, 68% used INSS benefits for more than 60 days and had medical leaves of absence of 6 to 15 days. None of the participants who suffered accidents used the insurance against Personal Injuries Caused by Land-based Automotive Vehicles (DPVAT)

Some questions were directed at the work group for describing their employment situation: 48% declared having a formal employment contract, whereas 52% declared they were self-employed. Among self-employed participants (52%), only 23% contributed to social security (INSS). Regarding their income, 69.2% reported that they received same day pay and a commission, while 15.4% reported being paid monthly in addition to a commission, and 15.4% were paid for each performed delivery.

DISCUSSION

HUMAN VULNERABILITY IN MOTORCYCLE TRAFFIC

This study allowed the deduction of a structure that contributes to an increase in human fragility in motorcycle traffic. Most participants in the transportation and work groups had low schooling and income levels, lightweight motorcycles, lived in peripheral areas of the Federal District, and had jobs that mostly required secondary education (transportation group) or elementary education (work group — motorcycle couriers). Vulnerability refers to the due protection of the most fragile citizens and, in public health, of fragile groups. This characteristic is attributed to persons or populations formed by particular or occasional characteristics, which is the case for motorcyclists.12,13

A study5 showed a high mortality among motorcyclists in vulnerable groups, with variations in deaths being more pronounced in the Northeast and North regions of the country. Moreover, 80% of motorcycles are acquired through monthly payments, which facilitates their purchase.7 Therefore, social vulnerability is a phenomenon determined by the life structure of individuals, affecting the increased exposure to risks.4

Except for motorcyclists in the recreation group, those in the transportation and work groups presented similar profiles to results shown by other studies10,14 — a predominance of young men with low schooling levels in accident and/or death statistics. The Brazilian Ministry of Health15 states that processes involved in socialization explain the male exposure to violence, usually in association with alcohol and drug use.

Similarly, the schooling level is also related to one’s health status and human vulnerability,16 and it is fair to assume that the sociocultural level influences the interpretation and recognition of risk situations.7 The low schooling level of participants, with illiterate participants in the transportation and work groups, was associated with the absence of a motorcycle license. However, participants in the recreation group reported having a higher education degree and a valid motorcycle license. When considering the complex social organization in Brazil, it is worth noting that the incorporation of changes does not only depend on the citizens but should also involve aspects such as schooling and access to communication, among others, which are required by analyses on health vulnerabilities.17

The disqualification of motorcycle riding, such as the lack of protective equipment, unsafe vehicles, lack of periodic checks, and disregard for traffic laws, results
in greater traffic vulnerability. This is exemplified by the work group, which is more exposed to violence and where most participants wore a helmet only, did less periodic checks, and were consequently more involved in accidents. A previous study demonstrated a similar situation, where professional motorcyclists understood the importance of wearing a helmet but did not know the other pieces of individual protective equipment.

The population is somewhat reluctant to comply with safety behaviors; however, the management bodies also fail to plan safe road environments. The answers in the transportation and work groups were representative of the predominance of lightweight motorcycles, with a lower engine capacity and less safety. These vehicles increase the susceptibility to accidents due to the lack of safety equipment — even more robust vehicles in the recreation group did not have all pieces of equipment. Regarding their risk perception, most of the participants in all three groups recognized a greater exposure to accidents, but also declared having infringed traffic rules — such as consuming alcohol and riding the motorcycle. Psychology theorizes that people construct their moral ideologies for justifying unsafe behaviors and softening self-reproach, that is, minimizing the perception of susceptibility on the road influences internal justifications that favor risk attitudes.

The reports of alcohol consumption in the work and transportation groups were representative. Moreover, all three groups pointed out the lack of awareness measures and training. Mainly in urban centers, safer behaviors are observed where Law No. 11,705 is enforced — the “dry Law.” Another initiative, Project Life in Traffic (Projeto Vida no Trânsito), aims to reduce health problems focusing on behavioral factors, but some drivers unfortunately evade the surveillance actions. Regarding this project, a study presented positive results regarding an increase in surveillance and alcohol testing, but reported no effective changes in drinking and driving practices in the state capitals where the project was implemented.

However, some individuals seem to be more vulnerable than others, being susceptible to health problems. Interventions focused only on behavioral changes are thus required, but if performed in an isolated manner, do not guarantee a decrease in traffic deaths.

### VULNERABILITY WORKING ON TWO WHEELS

Up until the 1980s, in Brazil, motorcycles were regarded as recreational vehicles, but their low cost and agility have turned them into transportation and work vehicles. Within the informal economy, professional motorcyclist is a growing profession (motorcycle couriers and motorcycle taxi drivers), representing an important survival option for making a living.

No motorcycle taxi drivers participated in this study, but it is known that some motorcycles are used as motorcycle taxis, whether legally or illegally. An important portion of the work group, comprising motorcycle couriers, declared not having an employment contract, and most of them did not contribute to Social Security and were paid through same day pay or a commission. A study describes a similar situation, where most of the 300 participants did not have another paid activity (89.5%) and did not contribute to Social Security (76.8%).

Most motorcycle couriers declared they did not participate in training sessions at work or at SENAT, an institution that offers courses required by Law No. 12,009/09. This legislation regulated the professions of motorcycle taxi driver and motorcycle courier, establishing a set of rules such as the need for engine guards, biannual inspection of safety items, safety antennas (against kite strings), a courier box, a helmet, protective clothes, and a reflective vest. Moreover, for working in these professions, one should be aged 21 years or older, have a valid license for at least 2 years, and pass a qualification course.

Differently from other professions where employers provide workers with their tools, motorcycle couriers are required to have their own protective equipment. Article 6 of Law No. 12,009 states that a person or entity that signs a contract for providing motorcycle courier services is responsible, by solidarity, for harms caused by disregard for the rules. In addition, motorcycles are authorized to perform the paid transportation of goods and/or passengers as a rental, and this legal instrument does not exclude the municipal or state levels of exerting their own demands. It is up to the cities to authorize professional activities and there is, therefore, a legal gap in the definition of inspection responsibilities.

The greatest exposure to accidents and hospitalizations was seen among motorcycle couriers. The literature
states that motorcycle couriers are more susceptible to accidents due to greater exposure in traffic. A study showed negligence in the reports of occupational accidents with deaths among motorcyclists, which further increases this group's vulnerability in the informal job market. We emphasize that motorcycle couriers are somewhat unable to say "no" within the asymmetrical relationships of power at work. This profession absorbs a section of the population that has low schooling levels and presents an attractive alternative of formal or informal work.

Experiences of aggression/discrimination in traffic were seen in all three groups, but mainly among motorcycle couriers, which reported car drivers as the agents of violence. Conflicts with drivers contribute to the occurrence of accidents (whether fatal or not), turning professional motorcyclists into the main victims of traffic. Violence makes motorcycle couriers resort to a form of social defense based on solidarity and a reactive concept of masculinity and social stigma, expressed as the formation of a social support network with colleagues involved in conflicts. In contrast, this social network makes motorcycle couriers relatively feared, because despite being fruitful in conflicts with drivers, it does not work against other violent attacks. However, these considerations relegate motorcyclists, especially motorcycle couriers, to the condition of susceptible drivers because they surpass the vulnerability inherent to human beings, that is, are in a disadvantaged situation and more prone to problems.

THE STRUCTURAL DIMENSION AS THE DRIVING FORCE OF HEALTH PROBLEMS

Traffic violence denotes unequal power relationships with constructed cultural meanings. These relationships symbolically express the strength of socioeconomic power as powerful and safe vehicles driven by overbearing individuals and efficient advertising that presents vehicles as a synonym of social status and power, among other aspects.

Most participants declared not having basic safety equipment. Here, we include the strength of the automotive market in the political and economic macrostructure that influences vehicles' lack of safety. Information from the Global Status Report on Road Safety shows that some of the vehicles sold in 80% of the world do not comply with basic safety rules, particularly in underdeveloped or developing countries. In addition, the subjectivities of advertising messages act on the individual's decision-making and influence vehicle purchases — the motorcycle was linked, with demagoguery, to the independence of more vulnerable citizens. There is a correlation between the expressive growth of the Brazilian car fleet and the increase in motorcyclist mortality in Brazil.

Contrarily to what happened in Brazil, the increase in the number of vehicles per inhabitant was followed by a reduction in deaths in developed countries. The reason is that these societies have investments and rigorous policies for providing the citizens with quality public transportation and safe fleets, among other aspects. Moreover, the abrupt introduction of new vehicles without investments in road safety is the nefarious side of the acritical motorization of the Brazilian society, which resulted in socioeconomic and emotional costs to the victims, their families, and the State. We advocate that the expected change should not be behavioral only.

SOCIAL HAZARDOUS OF MOTORCYCLE TRAFFIC

Most of the participants in the transportation and work groups had been involved in an accident in the previous 2 years, and the main first responders were SAMU and firefighters. Differently from the literature, most of those who suffered accidents did not require hospitalization, INSS benefits, or DPVAT insurance. A study reported that hospitalizations involving motorcyclists more than tripled from 2000 to 2011, increasing from 14.2% to 44.3%.

Most of the answers in the transportation and work groups elected reckless driving by car drivers as the cause of traffic violence, whereas participants in the recreation group mentioned reckless driving by all those involved. The pattern of answers in the recreation group, a socially privileged one, refers to the notion of citizenship by the recognition of everyone's obligations in road safety. Therefore, the scope of traffic violence should begin at irregular parking, such as the use of parking spaces for the elderly or people with disabilities, crosswalks, bike lanes, or sidewalks.

Although the harms resulting from accidents affect the victims and/or family members, all Brazilians fund the social costs of traffic violence, such as personal injury.
and property damage; early retirement; permanent disability; temporary leaves of absence; DPVAT medical expenses; losses related to traffic jams; legal costs; the economic impact to family members; and immeasurable costs such as the years of life lost and physical, psychological, and emotional sequelae.9

The responsibility of the State is mentioned in the Brazilian Traffic Code,27 which describes preventive measures linked to traffic safety; however, it faces major obstacles to its implementation.15 The WHO4 estimated that 90% of traffic fatalities happened in underdeveloped and developing countries, assessing that in these countries the situation will escalate due to motorization without concurrent investments in road safety — in developing countries, these investments do not happen in the same proportion as in developed countries.8,14

The social responsibility to face traffic accidents encompasses all citizens, but when duties stemming from fundamental law are considered, the responsibility is directed to the public-private sector.28 In this sense, an intersectoral approach is the path for tackling motorcycle crashes, and the focus of traffic safety interventions should widen its universe of analysis beyond prevention measures aimed at bikers and pedestrians.5 The primacy of the health care sector in solving problems related to noncommunicable health problems and mortality for external causes should also be questioned.29

**CONCLUSIONS**

When it comes to the sociodemographic profile of participants, we noticed a pattern that contributes to an increased vulnerability in motorcycle traffic, becoming clear with the profile of most of those in the work and transportation groups: young men, with low schooling and income levels, mostly with jobs that required secondary education, more fragile lightweight vehicles, and living in peripheral areas of the Federal District. On the other hand, most of the participants in the recreation group were men with higher schooling and income levels, in addition to more robust and safe vehicles.

Regarding the occupation of those who worked on two wheels, motorcycles have gained popularity due to their low cost and agility; the increase in professional motorcyclists within the informal economy, in particular, is associated with poor working conditions. Consequently, various social harms resulting from traffic violence take place, such as accidents, burdening of health care systems, early retirement, and disabilities.

Political and economic structures act as aggravating factors to traffic vulnerability when they do not regulate the requirement of basic safety equipment that influences the vehicles’ lack of safety. The promotion of an acritical massification of the motorcycle and the efficiency of advertising campaigns determine the consumption by more vulnerable citizens.

Various factors impose motorcyclists a greater disadvantage in traffic and place them in a vulnerable situation. We advocate that the further exploration of the analysis of road traffic accidents be a social construct considering social, economic, and cultural aspects. However, the multicausal complexity of traffic violence, especially in motorcycle traffic, justifies the need for intersectoral involvement. The coordination between different social sectors for facing complex problems represents a new way of working, governing, and constructing public policies — the sectoral power of the Ministry of Health is relativized and the policies, programs, and practices involving traffic surpass the health care domain.29

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**Author contributions**

MMC was responsible for conceptualization. MMC and MAM actively participated in data curation, formal analysis, and writing of the manuscript – original draft and review & editing. All authors read and approved the final submitted version of the manuscript and take public responsibility for all aspects of this work.
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