

Injuries from traffic accidents and use of protection equipment in the Brazilian population, according to a population-based study

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Abstract *The article aims to describe the injuries in traffic according to demographic characteristics, use of protective equipment, use of health services, activity limitations and disabilities. The percentage involvement in traffic accidents with injuries, the percentage of use of protective equipment, use of health services, limitation of daily activities, disability and sequelae, according to educational level, race, color, sex, age and region of residence it estimated. The use of safety belt in the adult population was 79.4% and 50.2% in the front seats and back, respectively; the helmet use among motorcycle drivers and passengers were respectively 83.4 and 80.1. Safety equipment are less used in the North and Northeast and in the countryside. Reported car accident last month 3.1%, being higher in males 4.5%, the people of complete primary schooling and School graduate, young adult and the brown race-color. Among the injured received some form of health care due to this accident 52.4%, were admitted 7.7%. They reported having had limitation of daily activities, disabilities and consequences arising from traffic accidents 14.1%. Car accidents are high in the country.*

Key words *Traffic accidents, Injuries, Epidemiological surveillance, Surveys*

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Introduction

Worldwide, traffic accidents were responsible for 3,400 deaths per day in 2012, according to the World Health Organization (WHO)¹. These events are also responsible for millions of injuries, and their consequent complications and disablements. Traffic injuries are showing a growing trend in the countries of average and low income²⁻⁴: more than half of the deaths worldwide take place in 10 countries. In absolute numbers Brazil is in the fifth position in this ranking, after India, China, the United States and Russia^{2,5}. The global loss of years of life due to disablement resulting from these traffic events in the year 2010 was 75,482,000 years⁶.

In 2013, 42,291 deaths due to Land-based Transport Accidents (*Acidentes de Transporte Terrestre*), were recorded in the Mortality Information System (*Sistema de Informação de Mortalidade – SIM*), and in 12,040 of these cases the victim's means of transport was a motorcycle. The Hospital Information System (*Sistema de Informações Hospitalares – SIH*) processed information on 170,805 hospitalizations in Brazil's Unified Health System (*Sistema Único de Saúde – SUS*) due to Land-based Transport Accidents in 2013, with expenditure of R\$ 231,469,333.13⁷.

The causality of traffic injuries and deaths is multiple and complex, but their occurrence has a high degree of association with risk factors such as: driving under the influence of alcohol; excessive or inappropriate speed; and non-use of protection equipment such as seatbelts, helmets, and child retention devices. And interventions focused on these factors can reduce their frequency and degree of severity^{8,9}.

Since these events constitute an important problem of public health, monitoring of their scale and tendency in terms of frequency and severity of injuries, of the characteristics of victims, and of risk and protection factors is of fundamental importance as support for public policies to prevent injuries and deaths. There are only a few sources of data on traffic injuries arising from population surveys based on household interviews. The first initiative on a national scale was the Health Supplement of the National Household Sample Survey (*Pesquisa Nacional por Amostra de Domicílios – PNAD*), carried out by the IBGE (*Brazilian Geography and Statistics Institute*), in 2008¹⁰. In 2013, the National Health Survey (*Pesquisa Nacional de Saúde – PNS*), increased the number of questions on the subject, making it possible to achieve numbers representing the whole of the Brazilian population¹¹.

The objective of this article is to describe traffic accidents according to demographic characteristics, use of protection equipment, use of health services, limitation of activity, and disablement, in the Brazilian population, based on the 2013 National Health Survey.

Method

This is a cross sectional study on the data of the Brazilian National Health Survey (*Pesquisa Nacional de Saúde – PNS*), a household-based, nationwide population survey carried out by the Brazilian Geography and Statistics Institute (*Instituto Brasileiro de Geografia e Estatística – IBGE*) in partnership with the Brazilian Health Ministry¹¹.

The sampling plan for PNS was by clusters in three stages of selection. In the first stage, the Primary Sampling Units (UPAs) in each stratum were selected. Within each UPA, a fixed number of permanent private households was selected, which varied from 10 to 14. In each household sampled, one resident aged 18 or more was selected. In all the stages, simple random sampling was used as the method of selection^{11,12}.

Initially, contact was made with the person responsible or with one of the people living at the household selected. The data collection agent described the study to the resident, and also its aims, procedures and the importance of taking part in it. After this a list of all the adult residents in the household was made, and the person who would be the respondent of the individual interview was selected, using a random selection system on the researcher's Personal Digital Assistant (PDA). The interviews were scheduled for the dates and times of day that were most convenient to the respondents, with two or more visits to each household being expected.

The sample was planned to be of 81,167 households. This was to include only households that are occupied, and a total of 69,994 households were found to be eligible after exclusion of non-household units, households outside the sector, those in ruins, demolished, or not found. A total of 64,348 replied to the survey; and 60,202 residents were selected for individual interview – resulting in a non-response rate of 8.1%.

Collection of data took place over the period August 2013 to February 2014. Other details on the process of sampling and waiting are available in the report of the PNS^{11,12}.

The PNS questionnaire included subjects related to: perception of state of health; risk factors;

protection factors; chronic diseases; women's and children's health; elderly people's health; dengue fever; accidents; and cases of violence – among others. In this present work the following indicators were selected:

Protection factors for traffic injuries

a) Proportion (%) of individuals over the age of 18 who always use a seatbelt in the front seat when they drive or are a passenger in a car/automobile, van or taxi;

b) Proportion (%) of individuals over the age of 18 who always use a seatbelt in the back seat when in a car/automobile, van or taxi;

c) Proportion (%) of individuals aged 18 or over who always use a helmet when driving a motorcycle;

d) Proportion (%) of individuals aged 18 or over who always use a helmet when they are a passenger on a motorcycle.

Average frequency of traffic injuries:

e) Proportion (%) of individuals aged 18 or more who have been involved in a traffic accident with bodily injuries in the last 12 months;

f) Proportion (%) of individuals aged 18 or more who have been involved in a traffic accident with bodily injuries in the last 12 months and who have, as a result of that accident, ceased any of their habitual activities;

g) Proportion (%) of individuals aged 18 or more who have been involved in a traffic accident with bodily injuries in the last 12 months and who have received some type of healthcare due to this accident;

h) Proportion (%) of individuals aged 18 or more who have been involved in a traffic accident with bodily injuries in the last 12 months and who received first aid at the location of the accident;

i) Proportion (%) of individuals aged 18 or over who have been involved in a traffic accident with bodily injuries in the last 12 months and who needed to be admitted to hospital as a result of the traffic accident;

j) Proportion (%) of individuals aged 18 or more who have been involved in a traffic accident with bodily injuries in the last 12 months and have had resulting complications and/or disability arising from a traffic accident.

For each one of the indicators, as well as the proportions, the respective 95% confidence interval (CI95%) was calculated. The proportions were estimated by gender (male, female), age group (18 to 25, 25 to 39, 40 to 59, and 60 or over), level of schooling (no schooling or incomplete primary education, primary complete

and secondary incomplete, secondary complete and higher education incomplete, higher education complete), race/color (white, black and mixed-race), and by the Brazilian macro-regions (North, Northeast, Center-West, Southeast and South), and area of residence (city, rural).

All the estimates were made taking into account the sample weightings. The statistical software used for the analyses was Stata, version 12.1. The plan of the National Health Survey was approved by the National Research Ethics Commission (Conep).

Results

The percentage of individuals aged 18 or over who always use seatbelts on the front seat was 79.6%, and was 50.2% for use of seatbelt on the back seat (CI95%: 49.2-51.3). The percentages for use of helmet by drivers of motorcycles, and their passengers, were respectively 83.4% (CI95%: 82.3-84.6), and 80.1% (CI95%: 79.1-81.1), respectively (Table 1). Adults with completed higher education showed the highest percentages for: use of seatbelt in the front seat (89.7%, with CI95%: 88.3-91.0); use of seatbelt in the back seat (55.6%, CI95%: 52.9-58.2); use of helmet as driver of motorcycle (91.4%, CI95%: 88.9-93.9); and use of helmet as motorcycle passenger (90.1%, CI95%: 88.1-92.1).

The lowest proportion of use of seatbelt in the back seat was found in individuals with completed primary education and incomplete secondary education: 48.1% (CI95%: 45.9-50.3) (Table 1). In relation to age group, the use of seatbelts was least frequent in the 18 to 29 age range, with percentages of: 72.6% (CI95%: 71.0-74.1) for use in the front seat; and 40.3% (CI95%: 38.6-42.0) for use in the back seat (Table 1).

Use of a helmet was lowest in the age range 18 to 29 – the percentage being 80.4% (CI95%: 78.4-82.4) for use as driver, and 78.8% (CI95%: 77.4-80.3) for use as passenger; and also in the oldest age group: 81.2% (CI95%: 74.5-88.0) for use as driver, and 72.1% (CI95%: 69.1-75.1) for use as passenger (Table 1).

In the itemization by race/skin color, white people reported higher percentages of use of safety belts than those self-reported as black or mixed-race when travelling by car, van or taxi: 84.5% (CI95%: 83.7-85.4) for use in the front seat; and 54.9% (CI95%: 53.4-56.4) for use in the back seat. In this race/color category, the percentage of habitual use of a helmet when

Table 1. Percentages of respondents reporting use of safety equipment in traffic, by demographic variables. Brazilian National Health Survey, Brazil, 2013.

Indicator	Always uses safety belt when in front seat of automobile, van or taxi % (IC 95%)	Always uses safety belt when in back seat of automobile, van or taxi % (IC 95%)	Always uses helmet when driving motorcycle % (IC 95%)	Always uses helmet when on motorcycle as passenger % (IC 95%)
Total	79.4 (78.7-80.1)	50.2 (49.2-51.3)	83.4 (82.3-84.6)	80.1 (79.1-81.1)
Gender				
Male	79.2 (78.3-80.1)	51.0 (49.7-52.3)	84.0 (82.7-85.3)	80.5 (79.4-81.7)
Female	79.6 (78.7-80.5)	49.5 (48.3-50.8)	81.4 (79.4-83.5)	79.7 (78.2-81.1)
Level of schooling				
No education / primary incomplete	75.3 (74.1-76.4)	51.4 (50.1-52.8)	78.9 (76.8-81.1)	73.7 (72.1-75.4)
Primary complete, secondary incomplete	75.7 (74.1-77.4)	48.1 (45.9-50.3)	81.4 (79.1-83.6)	79.7 (77.7-81.6)
Secondary complete, higher education incomplete	81.5 (80.4-82.7)	47.7 (46.2-49.3)	86.0 (84.5-87.6)	85.0 (83.8-86.3)
Higher education complete	89.7 (88.3-91.0)	55.6 (52.9-58.2)	91.4 (88.9-93.9)	90.1 (88.1-92.1)
Age group (years)				
18-29	72.6 (71.0-74.1)	40.3 (38.6-42.0)	80.4 (78.4-82.4)	78.8 (77.4-80.3)
30-39	79.7 (78.4-80.9)	49.8 (48.0-51.5)	85.4 (83.7-87.1)	82.4 (80.9-83.9)
40-49	82.6 (81.7-83.6)	54.3 (52.8-55.8)	86.4 (84.7-88.1)	82.0 (80.6-83.3)
60 and over	82.9 (81.6-84.1)	57.8 (55.9-59.6)	81.2 (74.5-88.0)	72.1 (69.1-75.1)
Skin color / racial grouping				
White	84.5 (83.7-85.4)	54.9 (53.4-56.4)	87.9 (86.5-89.3)	86.4 (85.2-87.6)
African	74.8 (72.4-77.1)	45.8 (42.9-48.7)	82.1 (78.5-85.8)	78.1 (75.1-81.1)
Mixed-race	74.3 (73.1-75.4)	45.9 (44.6-47.3)	80.0 (78.4-81.6)	76.0 (74.6-77.4)
Region of residence				
North	67.2 (64.7-69.7)	36.7 (34.2-39.2)	70.6 (67.1-74.2)	66.9 (63.6-70.1)
Northeast	66.0 (64.3-67.6)	39.5 (37.8-41.2)	72.9 (70.7-75.2)	69.5 (67.5-71.5)
Southeast	86.5 (85.5-87.6)	52.3 (50.4-54.2)	90.4 (88.3-92.5)	89.6 (88.0-91.1)
South	86.2 (84.5-87.8)	65.1 (62.6-67.6)	93.9 (92.0-95.7)	94.2 (92.6-95.9)
Center-West	81.5 (79.9-83.1)	61.7 (59.8-63.6)	94.5 (93.1-96.0)	97.1 (96.3-97.9)

driving a motorcycle was 87.9% (CI95%: 86.5-89.3); and the percentage of habitual use when passenger on a motorcycle was 86.4% (CI95%: 85.2-87.6) (Table 1).

Percentages were lower in the North and Northeast Regions for the following: use of seatbelt in the front seat: 67.2% (CI95%: 64.7-69.7) for the North, and 66.0% (CI95%: 64.3-67.6) for the Northeast; use of seatbelts in the back seat: 36.7% (CI95%: 34.2-39.2) for the North, and 39.5% (CI95%: 37.8-41.2) for the Northeast; habitual use of a helmet when driving a motorcycle: 70.6% (CI95%: 67.1-74.2) in the North, and 72.9% (CI95%: 70.7-75.2) in the Northeast; and use of a helmet when passenger: 66.9% (CI95%:

63.6-70.1), in the North, and 69.5% (CI95%: 67.6-71.5) in the Northeast (Table 1).

The percentage of involvement in a traffic accident with bodily injury in the 12 months prior to the interview was 3.1%. This percentage was larger among men: 4.5% (CI95%: 4.0-4.9) (Table 2). The percentage of adults that had been involved in a traffic accident with bodily injury and had received some type of healthcare due to that accident was 52.4% (CI95%: 48.2-56.6). The percentage of people involved in accidents who received first aid at the accident site was 13.0% (CI95%: 10.2-15.9). The percentage of people involved in an accident who needed to be admitted to hospital was 7.7% (CI95%: 5.7-9.8) (Table 2).

Table 2. Percentages of respondents involved in a traffic accident who used health services, by demographic variables. Brazilian National Health Survey, Brazil, 2013.

Indicator	Involved in traffic accident with bodily injury in last 12 months % (IC 95%)	... and received some type of healthcare due to the accident % (IC 95%)	... and received first aid at the accident location % (IC 95%)	... and needed to be admitted to hospital due to the accident % (IC 95%)
Total	3.1 (2.8-3.3)	52.4 (48.2-56.6)	13.0 (10.2-15.9)	7.7 (5.7-9.8)
Gender				
Male	4.5 (4.0-4.9)	52.6 (47.4-57.8)	12.5 (8.9-16.0)	7.6 (5.3-10.0)
Female	1.8 (1.6-2.0)	51.9 (45.5-58.2)	14.2 (9.2-19.2)	7.9 (3.5-12.2)
Level of schooling				
No education / primary incomplete	2.4 (2.1-2.8)	54.5 (47.0-61.9)	12.3 (8.3-16.4)	7.5 (4.7-10.3)
Primary complete and secondary incomplete	3.7 (3.1-4.3)	53.7 (45.2-62.3)	13.9 (6.1-21.7)	10.5 (5.2-15.7)
Secondary complete, higher education incomplete	3.6 (3.1-4.1)	50.9 (43.9-57.8)	13.0 (8.1-17.9)	6.3 (2.6-10.1)
Higher education complete	2.8 (2.1-3.5)	49.8 (37.1-62.4)	13.5 (3.3-23.7)	8.4 (3.0-13.8)
Age group (years)				
18-29	5.1 (4.4-5.8)	54.0 (47.1-61.0)	12.3 (7.2-17.4)	5.2 (2.3-8.0)
30-39	4.0 (3.5-4.6)	50.4 (43.2-57.5)	13.5 (8.8-18.3)	9.3 (5.0-13.6)
40-49	2.0 (1.7-2.3)	53.3 (45.4-61.3)	14.9 (8.7-21.1)	10.8 (6.3-15.2)
Over 60	1.0 (0.7-1.3)	46.3 (31.4-61.3)	8.5 (1.1-15.9)	7.1 (0.7-13.5)
Skin color / racial grouping				
White	2.7 (2.3-3.0)	47.9 (41.3-54.4)	11.1 (7.4-14.9)	8.3 (4.4-12.2)
African	3.6 (2.7-4.5)	54.8 (42.2-67.3)	11.2 (3.0-19.4)	8.3 (2.5-14.2)
Mixed-race	3.4 (3.0-3.8)	56.1 (50.4-61.7)	15.1 (10.2-20.0)	7.1 (4.8-9.4)
Region of residence				
North	4.8 (4.0-5.7)	49.2 (39.8-58.5)	6.3 (2.8-9.8)	5.7 (3.2-8.2)
Northeast	3.4 (3.0-3.8)	53.9 (48.2-59.6)	8.8 (5.7-11.9)	8.9 (4.4-13.3)
Southeast	2.4 (2.0-2.8)	53.6 (44.1-63.2)	15.9 (9.5-22.2)	6.6 (2.8-10.4)
South	2.9 (2.2-3.6)	45.3 (35.2-55.5)	17.6 (8.3-26.9)	7.2 (2.4-12.0)
Center-West	4.4 (3.7-5.1)	57.0 (48.5-65.5)	16.9 (11.0-22.8)	11.0 (6.6-15.4)

The percentage of those involved in accidents who presented a complication and/or disablement arising from a traffic accident was 15.1% (CI95%:12.4-17.9). The frequency of individuals over the age of 18 who had been involved in a traffic accident with bodily injury and as a result of the accident ceased to carry out an habitual activity was 47.2% (CI95%:43.1-51.3) (Table 3).

The analysis of frequency of involvement in traffic accidents according to level of schooling showed a higher involvement in traffic accidents with bodily injury among the people with complete primary schooling and incomplete secondary schooling – with a percentage of 3.7% (CI95%: 3.1-4.3); and those with secondary schooling complete and higher education incomplete – with 3.6% (CI95%: 3.1-4.1) – when

compared to those without education or with primary education incomplete – for whom the percentage was 2.4% (CI95%: 2.1-2.8) (Table 2). There were no statistically significant differences between the levels of schooling for the other indicators of frequency of involvement in traffic accidents (Table 2 and 3).

In the itemization by age group, the highest proportion of involvement in traffic accidents with bodily injury was found among adults aged 18 to 29, with a percentage of 5.1% (CI95%: 4.4-5.8) (Table 2). The proportion of individuals over the age of 18 who were involved in traffic accidents and had complications and/or disablement arising from the accident was different between the 18-29 age group, with 9.8% (CI95%: 6.0-13.6) and the 49-59 age group, with a per-

Table 3. Percentages of respondents involved in a traffic accident with bodily injury in the last 12 months who also had consequent adverse effects and/or disablement, or restriction of habitual activities, due to the accident – by demographic variables. Brazilian National Health Survey, Brazil, 2013.

Indicator	Involved in traffic accident with bodily injury in last 12 months	
	... and had to discontinue any of their habitual activities as a result of traffic accident % (IC 95%)	... and had consequent adverse effects and/or disablement due to traffic accident % (IC 95%)
Total	47.2 (43.1-51.3)	15.1 (12.4-17.9)
Gender		
Male	47.1 (42.0-52.2)	13.6 (10.5-16.7)
Female	47.5 (40.6-54.3)	18.6 (12.7-24.5)
Level of schooling		
No education, or primary incomplete	54.6 (47.1-62.0)	19.3 (14.2-24.3)
Primary complete and secondary incomplete	46.9 (38.3-55.5)	12.1 (7.2-16.9)
Secondary complete, higher education incomplete	44.1 (37.4-50.9)	13.3 (8.6-18.0)
Higher education complete	38.4 (26.2-50.5)	15.0 (4.6-25.4)
Age group (years)		
18-29	46.4 (40.0-52.7)	9.8 (6.0-13.6)
30-39	49.8 (42.7-57.0)	18.4 (12.9-23.9)
40-49	46.2 (38.4-53.9)	21.3 (14.5-28.1)
Over 60	44.4 (29.2-59.5)	15.3 (5.9-24.6)
Skin color / racial grouping		
White	45.5 (38.9-52.1)	13.5 (8.9-18.1)
Black	44.8 (32.1-57.5)	12.3 (4.9-19.7)
Mixed-race	49.7 (44.0-55.4)	17.3 (13.3-21.4)
Region of residence		
North	52.6 (44.3-60.9)	16.2 (10.2-22.2)
Northeast	57.2 (51.4-62.9)	18.8 (13.3-24.4)
Southeast	39.6 (31.2-48.0)	12.5 (7.3-17.7)
South	39.3 (27.6-51.1)	12.1 (6.1-18.1)
Center-West	48.5 (40.5-56.5)	16.2 (10.5-21.8)

centage of 21.3% (CI95%: 14.5-28.1) (Table 3).

In relation to race/color, the percentage of people involved in traffic accidents in the 12 months prior to the interview varied from 2.7% (CI95%: 2.3-3.0) in the White race/color group, to 3.4% (CI95%: 3.0-3.8) in the Mixed-race group (Table 2). The region with the highest frequency of adults who had been involved in traffic accidents with bodily injury in the 12 months prior to the interview was the North, with 4.8% (CI95%: 4.0-5.7) – higher than in the South, Southeast and North Regions. The second-highest percentage was in the Center-West Region, with 4.4% (CI95%: 3.7-5.1), higher than in the Southeast and South (Table 2).

There were statistically significant differences between the North and Center-West Regions between adults who had been involved in a traffic

accident and received first aid at the accident location: the percentage was 6.3% (CI95%: 2.8-9.8) for the Northern Region, and 16.9% (CI95%: 11.0-22.8) for the Center-West Region (Table 2). The percentages of those who had had accidents and ceased to carry out a habitual activity as a result of the accident in question were: 39.3% (CI95%: 31.2-48.0) in the South Region; and 37.2% in the North Region (CI95%: 27.6-51.1) (Table 3).

Discussion

The PNS is the second Brazilian countrywide household population survey, and included the theme of traffic in its 2013 survey, showing that four out of five adults aged over 18 reported use

of a seatbelt in the front seat, and only half of all adults in the back seat. For motorcycle riders, use of a helmet was above 80% for both drivers and passengers. Safety equipment was more used in the rural regions, and in the North and Northeast. Use of the safety belt on the front seat and back seat was more frequent in the population with complete higher education. Young people used seatbelt and helmet less frequently. 3.1% of all respondents reported traffic accidents: more among males, people with complete primary education and complete secondary education, young adults and people of self-declared mixed-race origin. Approximately half of those who suffered traffic accidents received some type of healthcare due to that accident, 7.7% were hospitalized, 15.1% reported having habitual activities limited, or disablements or other complications arising from that traffic injury.

Use of a seatbelt is an effective measure of reduction of serious injuries due to traffic accidents², but its use is still very low, especially in the back seat. There are studies that indicate the importance of inspection measures to increase use^{2,13,14}, and of educational messages to encourage the use of the seatbelt, directed to all the members of the family¹³.

The subject of safety equipment was covered in 2008 in the National Households Sample Survey (PNAD) and found an improvement in the use of seatbelts on the front seat (73%) and on the back seat (37.3%)^{10,15}. In the PNAD, the proportion of use of seatbelts in the front seat and the back seat was higher in males; but no differences were observed between the genders in the PNS^{10,15}.

In motorcyclists, use of the helmet reduces the chance of head injuries by a factor of up to four, and the chance of brain injuries by a factor of up to ten¹⁶. Ninety countries in the world, representing 77% of the population, have legislation on the use of helmets to protect people riding motorcycles, but the information on the use of this equipment comes from only 35 countries¹⁷. Use of helmets by people on motorcycles varies between 10% in Ghana and Jamaica, to almost 100% in Holland and Switzerland¹⁷. However, in spite of the evidence and the obligatory legal requirement to use the helmet in Brazil¹⁸, its use can still be considered to be low, and in rural areas, and the country's North and Northeast, its use is even lower.

Although studies indicate the increase in the prevalence of individuals who use helmets when they are either drivers or passengers of motorcy-

cles¹⁸⁻²⁰, a part of the total of all motorcycle users still do not use a helmet. This is a significant problem, considering the increase in the rates of hospitalization, complications and death among motorcyclists²¹⁻²². Deaths among motorcyclists have the highest rates in Brazil, affecting men, young people, in full productive activity^{21,22}. Also worth highlighting is the increase in the total number of motorcycles in use, especially in the North and Northeast of Brazil; the low level of inspection²²; and risky practices, such as non-use of helmets and safety equipment^{18,19}.

Traffic accidents were reported by 3.1% of respondents; calculation gives an estimate of estimate today, with population expansion, of approximately 4.4 million Brazilian citizens. The data of the PNS are of great importance and scope: this is the only population-based survey that enables monitoring of this subject in the country. The other information systems that exist present information on more serious events such as hospitalizations and deaths⁷, and the PNS includes information on all the events in the adult population¹¹.

The Health Supplement of the National Households Sample Survey (PNAD) in 2008 indicated a 2.5% rate of traffic accidents, or 4.7 million events. The comparison with the PNS has limitations, since the PNAD estimated traffic injuries for the whole of the population, and the PNS only for adults aged 18 or over¹⁰.

In the same way as in the 2008 PNAD, events in the 12 months prior to the survey were more frequent among young adults^{10,15}. The higher vulnerability of young adults (aged 18 to 29) for involvement in traffic accidents with bodily injury can also be seen in the studies on death and on hospital morbidity^{20,22}. The highest numbers of deaths due to traffic accidents in 2003 were found in the following three categories: young adults; individuals with low levels of schooling; and motorcyclists. In the whole of Brazil in 2013, more than one million potential years of life were lost due to traffic accidents, especially in the 20-29 age group²³. The higher occurrence of traffic accidents among young people can be attributed to the lower frequency of use of seatbelts in the front and back seats, lower use of helmets, higher consumption of alcohol while driving a vehicle, excess speed, less training and skill in driving, and the feeling that they are invulnerable^{2,24,25}.

The PNS also indicated that people of the African racial category had a higher percentage of involvement in traffic accidents with bodily injury in the 12 months prior to the survey. The high-

est percentages of death for external causes were found in the African Brazilian category of the population in the surveys of both 2000 (17.7%) and 2010 (17.6%), after taking into account the data for mortality corrected by sub-register of deaths from unclear causes²⁶. In 2013, more than half of the individuals who died due to traffic accidents in Brazil were either of the African-Brazilian or mixed racial type, indicating social-racial inequalities in mortality for this cause²².

According to data of the PNS, approximately 1/10 of the adults who were involved in a traffic accident with bodily injury in the 12 months prior to the survey received first aid healthcare at the location of the accident. The hypothesis is suggested that this means less severe events, without the need to request assistance at the location, the victims being able to move/travel on their own.

However, the Mobile Emergency Service (Samu), covers more than 150 million people of the Brazilian population, as well as local care services²⁷.

Among the adults interviewed in the PNS who reported involvement in a traffic accident in the 12 months prior to the interview, 7.7% needed to be hospitalized. According to the population projections by the IBGE, that would be approximately 345,000 people who reported hospitalization – indicating the extent of the phenomenon¹¹. According to the data from the Violence and Accidents Vigilance Survey (VIVA) carried out at the door of the country's emergency services in state capitals, approximately 30% of the individuals given care due to traffic accidents at emergency services of Brazil's 23 state capitals and the Federal District, in 2011, were attended by out-patient services, hospitalized, or sent to another health service in the first 24 hours after that care, indicating severity of their injuries²⁸.

In 2011, considering the data of the Hospital Information System of Brazil's Unified Health System (SIH/SUS), the coefficient of hospital admission was 79.6 hospitalizations per 100,000 inhabitants. Among adults, this coefficient varied from 172.1 (20-39 age group) to 399.1 hospitalizations per 100,000 inhabitants (aged 60 and over)²⁰. Some factors are associated with an increase of the risk of hospitalization – examples are: being a pedestrian, cyclist or motorcyclist, being over the age of 50, being the victim of a collision with heavy transport or a bus, and the accident taking place in the pre-dawn hours or in the afternoon²⁹.

Estimates of the PNS consider that approximately half of those who had accidents – approximately two million adults – made themselves

absent from their habitual activities as a result of the accident in the last 12 months, and an estimated 670,000 adults had some complication and/or disability arising from a traffic accident¹¹. The social context in which the individual lives has a close relationship with the definition of disablement. This could be related to some limitation of a physical or mental nature arising from disablement or consequence of illness or injury^{30,31}. The total of years lost due to disablement, throughout the world, was 10,363,000 in 1990 and 13,485,000 in 2010 – representing a growth of 30.1% in this indicator³². In Brazil, according to the data of the PNAD (2008), approximately 1/3 of the individuals involved in a traffic accident ceased carrying out routine activities due to the accident, generating a high socio-economic cost³³. In relation to the complications/consequences a study that analyzed the prevalence of physical consequences among people hospitalized for traffic accidents showed that, in the period 2000-2013, 23.5% (an estimated 400,000 people) presented some diagnosis suggesting a physical consequence²¹. A limitation of the PNS is that it does not have specified information about the type of consequence arising from the traffic accident.

Among the regions, the fragility of the North, Northeast and Center-West Regions was evident in: the frequency of involvement in traffic accidents with injuries; the use of protection equipment such as safety belts on the front and back seats, and helmets; and in access to care at the location of the accident. Other studies on occurrence of accidents, hospitalization and mortality in Brazil corroborate the data of the PNS^{15,20,22}. These results may be related to the small number of municipalities, in the three regions, that are included in the National Traffic System, have municipalized management of traffic, and actually possess the conditions to carry out actions of inspection and safety in traffic. Also, a major proportion of municipalities do not have an installed network of pre-hospital and hospital emergency services qualified to respond to the rapid increase in the total number of vehicles on the roads, and the effects of insufficiency of action for urban and road organization to deal with the occurrence of traffic accidents^{27,34,35}.

Due to the importance of the scale of the injuries and deaths caused by traffic in Brazil, measures have been taken to provide a response to the problem. Examples are: the Brazilian Traffic Code, as from 1998^{13,36}, which reduced the rates of mortality in traffic in the country; the *Lei Seca* (law against drinking while driving) in June

2008, and its updating in December 2012, which was also responsible for a reduction of approximately 2,300 traffic deaths³⁷; and the *Life in Traffic Project (Projeto Vida no Trânsito)*, put in place as from 2010 in five state capitals and expanded to all state capitals and the Federal District, which helped reduce mortality rates in the capital cities³⁸⁻⁴⁰. Another highlight was action to provide care for victims, through: pre-hospital attention, such as the Mobile Emergency Service (Samu 192); and initiatives including integrated inspection on the roads, the *Rodovida* project of the Federal Highway Police, and improvements in highways. However, the severity of traffic injuries calls for progress on integrated and coordinated actions, aiming for real effectiveness of actions to prevent traffic injuries^{40,41}.

Also necessary is continued and systematic implementation of actions of communication and education, coordinated and integrated between the various governmental and non-governmental sectors that have responsibility to arrange for safe and sustainable traffic for the population, investing in the promotion of safe environments for human mobility and quality of life⁴¹. These coordinated actions could avoid collisions, prevent injuries, and reduce adverse consequences and deaths in traffic.

Limits of this study include the following: the PNS is a cross-sectional study and uses self-referred information – and prior studies indicate that the validity of self-referred information var-

ies in accordance with the illness (or adverse effect) and/or social-demographic characteristics. In particular, information about disablements and adverse consequences may possibly not have been fully understood, since these were higher than the frequency of hospitalizations.

Conclusions

The data of the PNS indicates that although there had been an increase in the use of safety equipment (helmets and safety belts), the safety belt was still little used in the back seat of cars: progress should be made on measures of education and inspection. Traffic accidents were more frequent among young people, and among residents of the North, Northeast and Center-West of Brazil. The population estimates provided by the PNS contribute to a continuing overview of traffic accidents in the country, and are thus an important instrument for formulation and implementation of health promotion policies, full healthcare, and achievement of a healthier and more sustainable environment.

The subject of traffic is complex, and it is of fundamental importance that progress should be made in action for education, inspection, improvement of safety conditions of urban roads and highways, and expansion of the public transport modalities that reduce the number of individual journeys.

Collaborations

DC Malta worked on the conception of the study, analysis and interpretation of the data, and critical review of the study; and approved the version to be published. SSCA Andrade and OL Moraes Neto assisted in the review of literature, analysis of the data and formatting of the article. FV Santos, MMA Silva, ACF Nardi and AAC Reis helped with the analysis of the data and final review of the text, and approved the final version.

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