

Self-reported occupational accidents among Brazil's adult population based on data from the 2013 National Health Survey

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Abstract Objective: to provide an overview of occupational accidents among Brazil's adult population. Methods: descriptive study using data from the 2013 National Health Survey. Results: A total of 4.9 million workers mentioned having suffered some kind of work-related accident, which is equivalent to 3.4% (CI95% 4.6-5.6) of Brazil's adult population. Prevalence rates were higher among men, young adults aged between 18 and 39 years, and black people and in the North Region of the country. Prevalence was highest in the State of Para and lowest in the State of Rio de Janeiro State. Around one third of all accidents were commuting accidents, 50.4% (CI95% 45.3-55.5) of people who had suffered an occupational accident were prevented from carrying out some kind of routine activity due to the accident, 8.8% (CI95% 6.4-11.2) were hospitalized and 19% (CI95% 15.3-22.7) had sequelae resulting from occupational accidents. Conclusion: the data provided by the National Health Survey comprises an unprecedented and invaluable source of information on these issues in Brazil. The results of the survey confirm that occupational accidents are underreported, since official figures do not cover individuals working in the informal sector.

Key words Occupational accidents, Notification of occupational accidents, Work, Health surveys, Epidemiological surveillance

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Introduction

Approximately 2.3 million work-related fatalities occur annually worldwide, of which around 318,000 are due to accidents and two million due to work-related diseases, in addition to 317 million nonfatal occupational accidents. In low and middle-income countries, occupational accidents account for 18% of deaths, compared to 5% in high-income countries. This situation represents an enormous social and economic burden, particularly in low and middle-income countries where a large part of the population is involved in dangerous activities such as mining, agriculture, construction, and fishing¹.

Occupational accidents are those that occur in the course of work or on the way to work and while returning home after work in both the formal and informal sectors. They are acute events that can cause death or injury, the latter of which can lead to a temporary or permanent reduction in working capacity².

The International Labor Organization (ILO) estimates that the total cost of occupational accidents and work-related diseases is equivalent to around 4% of the world's gross domestic product (GDP)³. Occupational accidents generate a significant financial burden for health services in the form of initial emergency care, hospital costs, rehabilitation, medicines etc.⁴. They also result in social security costs, lay-offs, and retirement costs, 60% of which are paid by social insurance⁵.

The cost of work-related accidents and diseases in Brazil is around R\$71 billion per year, which is equivalent to almost 9% of the country's payroll of R\$ 800 billion, while the costs and damages to the workers' families is estimated at R\$ 16 billion. However, these figures underestimate the real situation, since they do not consider the costs of work-related accidents and diseases in the informal sector, which are borne by the Unified Health System (*Sistema Único de Saúde* - SUS)⁶.

A study conducted in Salvador, the capital of the State of Bahia⁷, found that 31.6% of cases treated in emergency departments were work-related. Studies carried out using data on the country's emergency services from the Violence and Accident Surveillance System (*Vigilância de Acidentes e Violências* - VIVA) collected in 2008 and 2011 showed that almost one third of cases from external causes were due to occupational accidents⁴.

Worldwide, occupational accidents account for the majority of deaths and severe disabilities

caused by work. However, the official statistics of many countries do not differentiate between work-related accidents and occupational illnesses⁷. The occupational accidents mortality rate is around 13.2/100,000 workers, while the annual cumulative incidence of nonfatal work-related accidents is between 3% and 6%⁵.

Occupational accidents account for a significant proportion of cases from external causes treated by health services. Data from the 2011 VIVA survey conducted in accident and emergency units in Brazil's state capitals showed that almost one third of cases from external causes were work-related. The majority of work-related accident victims were men, young people aged between 30 and 39 years, brown or black, and worked in the production of industrial goods and services, the agricultural sector or in repair and maintenance services⁸.

The Ministry of Social Security (*Ministério da Previdência Social* - MPS) confirms that occupational accidents account for around 7.3% of work benefits and that the largest proportion of benefits goes to workers in the manufacturing, construction, electricity and gas industries. The annual number of work days lost in Brazil due to occupational accidents is around 500,000, which causes production losses and adversely affects the industry, commerce and services sectors⁵.

The MPS gathers information on work accidents from the records of the Communication of Occupational Accidents (*Comunicação de Acidente de Trabalho* - CAT) and from information on the benefits granted to workers. However, these statistics only include employees with *carteira assinada* (a stamped and signed official workbook)⁹, excluding statutory employees, workers without a *carteira* and all those working in the informal sector. Official figures therefore account for only half of the country's workers and underestimate the real situation¹⁰.

In addition to official figures, other information on occupational accidents is currently available from the Mortality Information System (*Sistema de Informação sobre Mortalidade* - SIM), the Hospital Information System (*Sistema de Informações Hospitalares* - SIH), police incident reports, the National System of Information on Toxic-Pharmacological Substances (*Sistema Nacional de Informações Tóxico-Farmacológicas* - SINITOX), VIVA and local health surveys regarding this issue^{4,8,11-13}.

In 2013, the National Health Survey introduced a module concerning accidents and violence and included various questions about

work accidents, including commuting accidents. This was the first time that a national population-based study had included detailed information about work accidents that included all workers rather than just those working in the formal market^{14,15}.

The aim of this study is to provide an overview of occupational accidents among Brazil's adult population using data the 2013 National Health Survey.

The findings of this study provide useful input to inform national and state-level monitoring of occupational accidents and thus support measures designed to promote the health of workers, including those not included in the official statistics published by the MPS.

Methodology

This descriptive study used data from the National Health Survey (*National Health Study* - PNS), a household survey conducted by the Health Ministry in partnership with the Brazilian Institute of Geography and Statistics (*Fundação Instituto Brasileiro de Geografia e Estatística* - IBGE) between August 2013 and February 2014^{14,15}.

The survey used a cluster sampling procedure conducted in three stages: (i) census tracts (primary units), (ii) households (secondary units), and (iii) an adult living in the household (tertiary unit) selected using simple random sampling to respond an individual questionnaire. Sample weights were calculated for the primary sampling units (PSUs), households and all its residents, and the adult living in the household selected to respond the questionnaire^{14,15}.

The sample included 64,348 households, comprising 60,202 interviews. The household interview and individual interview sample loss rates were 20.8% and 25.9%, respectively, while the respective response rates were 91.9% and 86.0%. The sample size was determined considering the desired level of accuracy for estimating certain relevant indicators in order to estimate given parameters across different geographical levels: states, state capitals, and metropolitan regions^{14,15}.

Data collection was carried out by previously trained staff of the IBGE. Interviews were scheduled at the interviewees' convenience and information was recorded using personal digital assistants (PDAs). Two or more visits were anticipated for each household. Further details about the sampling process are available in publications concerning the results of the PNS¹⁴⁻¹⁶.

The following indicators associated with work accidents were considered by the present study:

1. Proportion (%) of individuals aged 18 years and over involved in occupational accidents over the last 12 months - calculated based on the number of individuals who mentioned they had been involved in some kind of work-related accident in the last 12 months divided by the total number of interviewees.

2. Proportion (%) of individuals aged 18 years and over involved in commuting accidents which led to bodily injury in the last 12 months - calculated based on the number of individuals who mentioned being involved in a commuting accident which led to bodily injury over the last 12 months divided by the total number of interviewees.

3. Proportion (%) of individuals aged 18 years and over involved in occupational accidents over the last 12 months and who were prevented from carrying out some kind of routine activity due to the accident - calculated based on the number of individuals who were prevented from carrying out some kind of routine activity due to the accident divided by the number of individuals who mentioned being involved in an occupational accident.

4. Proportion (%) of individuals aged 18 years and over involved in occupational accidents over the last 12 months and who were hospitalized due to the accident - calculated based on the number of individuals hospitalized due to a work-related accident divided by the number of individuals who mentioned being involved in an occupational accident.

5. Proportion (%) of individuals aged 18 years and over involved in occupational accidents over the last 12 months and who had a sequela or disability resulting from the accident - calculated based on the number of individuals who had a sequela or disability resulting from an accident divided by the number of individuals who mentioned being involved in an occupational accident.

Prevalence was calculated using a 95% confidence interval (CI95%) and stratified into the following categories: sex (male and female); age group (18 to 29, 30 to 39, 40 to 59, and 60 years and over); level of education (has not completed primary education, has completed primary education but has not completed secondary education, has completed secondary education but has not completed further education, has completed further education); race/skin color (white, black

and brown); place of residence (urban/rural, metropolitan regions, states and capitals).

The data was analyzed using the Stata version 11.0 software package survey module which takes into account the effect of the sampling plan. The study was approved by the National Research Ethics Committee (*Comissão Nacional de Ética em Pesquisa - CONEP*) in June 2013^{14,15}.

Results

Almost five million workers (4.9 million) mentioned having suffered some kind of work-related accident in Brazil, which is equivalent to 3.4% (CI95% 3.1-3.6) of Brazil's adult population. The

prevalence of the occurrence of occupational accidents was greater among men (5.1% CI95% 4.6-5.6 in men, compared to 1.9% CI95% 1.6-2.1 in women), which is equivalent to a ratio of 2.7 men for every woman. The results also show that around 60% of accidents occurred among people aged under 40 years, showing that younger people are more affected by this phenomenon (Table 1).

It was found that prevalence was highest among individuals who had completed primary education but not completed secondary education (4.4% CI95%: 3.6-5.3). In terms of absolute numbers, the largest number of occupational accidents occurred among the category of people who had not completed primary education (35%). Furthermore, prevalence of the occur-

Table 1. Proportion of adults (≥ 18 years) involved in work accidents by sociodemographic characteristics. National Health Study (Brazil 2013).

Sociodemographic characteristics	%	CI 95%*		N Expanded (x1,000)
		LI	LS	
Sex				
Male	5.1	4.6	5.6	3,493
Female	1.9	1.6	2.1	1,455
Age group (years)				
18-29	4.4	3.8	5.0	1,676
30-39	4.5	3.9	5.1	1,417
40-59	3.1	2.7	3.5	1,572
60 and over	1.1	0.7	1.4	283
Level of education				
Has not completed primary education	3.1	2.7	3.4	1,744
Has completed primary education but has not completed secondary education	4.4	3.6	5.3	1,006
Has completed secondary education but has not completed further education	3.7	3.2	4.3	1,791
Has completed further education	2.2	1.6	2.8	407
Color or race				
White	2.9	2.5	3.3	2,018
Black	4.6	3.5	5.8	625
Brown	3.7	3.3	4.1	2,256
Place of residence				
Urbana	3.3	3.0	3.6	4,182
Rural	3.8	3.2	4.4	766
Region				
North	4.9	4.0	5.7	530
Northeast	3.3	2.9	3.7	1,282
Southeast	2.8	2.3	3.3	1,798
South	4.2	3.5	4.9	907
Centerwest	4.0	3.4	4.6	431
Brazil	3.4	3.1	3.6	4,948

* 95% Confidence Interval.

rence of occupational accidents was greatest among black people (4.6% CI95%: 3.5-5.8) and among people from the country's North Region (4.9% CI95%: 4.0-5.7) (Table 1).

Figure 1 shows that prevalence of the occurrence of occupational accidents was highest in the North Region and lowest in the Southeast Region, while the states with the highest and lowest prevalence rates were Pará and Rio de Janeiro, respectively. With respect to state capitals, Figure 2 shows that the highest prevalence rate was in Boa Vista (5.6%), followed by Porto Velho (5.3%), and the lowest prevalence rate was in Vitória (1.7%), followed by Rio de Janeiro (1.9%).

Table 2 shows that 1.9 million workers in Brazil were involved in commuting accidents (1.3% CI95%:1.1-1.4), accounting for around one third of all accidents. This type of accident was more common among men aged up to 39 years and who had completed secondary education but had not completed further education.

Around 50.4% (CI95% 45.3-55.5) of people who had been involved in an accident were prevented from carrying out some kind of routine activity (work, domestic tasks, going to school etc.) as a result of accidents that are considered more serious. Individuals who had not complet-

ed primary education and those who lived in rural areas were most affected and prevalence was greatest in the South Region; however the latter result was not statistically significant. The prevalence of hospitalization for a period of 24 hours or over in the last 12 months was 8.8% (CI95% 6.4-11.2), while 19% (CI95%: 15.3-22.7) of those who suffered an occupational accident had a sequela or disability resulting from the accident (Table 3).

Discussion

The prevalence of occupational accidents among Brazil's adult population was 3.4%. Accidents were more likely to occur among young black males aged up to 39 years and less likely to occur among people who had completed further education and those living in the country's Southeast Region. Around a third of the work-related accidents were commuting accidents. Furthermore, around half of those who had suffered an occupational accident were prevented from carrying out some kind of routine activity, 8.8% were hospitalized and a fifth had a sequela as a result of the accident.

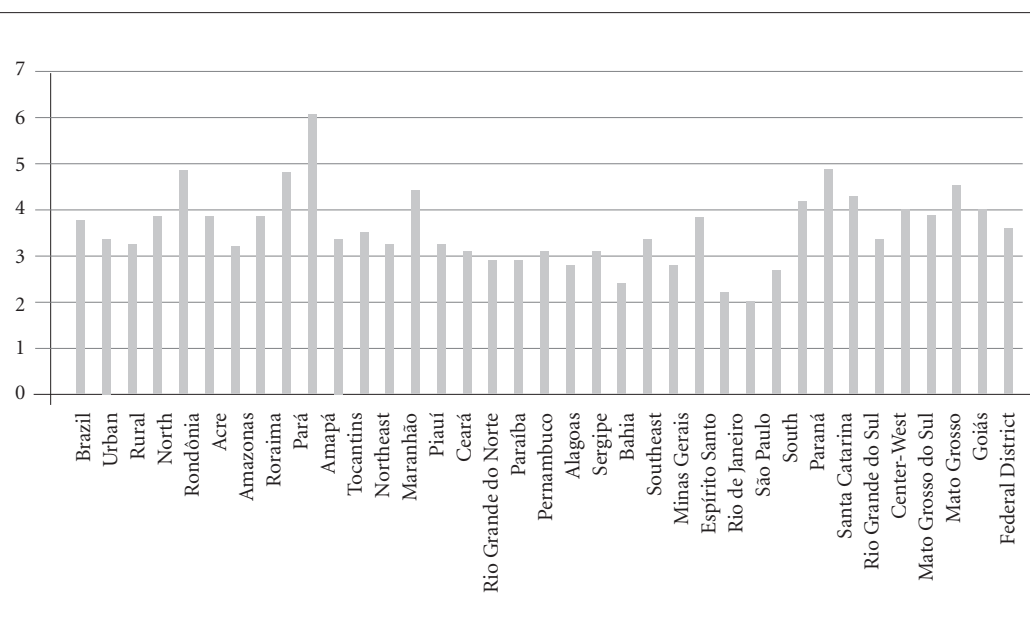


Figure 1. Proportion of adults (≥ 18 years) involved in work accidents by metropolitan region and state. National Health Study (Brazil, 2013).

Source: National Health Study (PNS), 2013; and Beneficiaries Information System of the National Supplementary Health Agency (ANS), 2013 December.

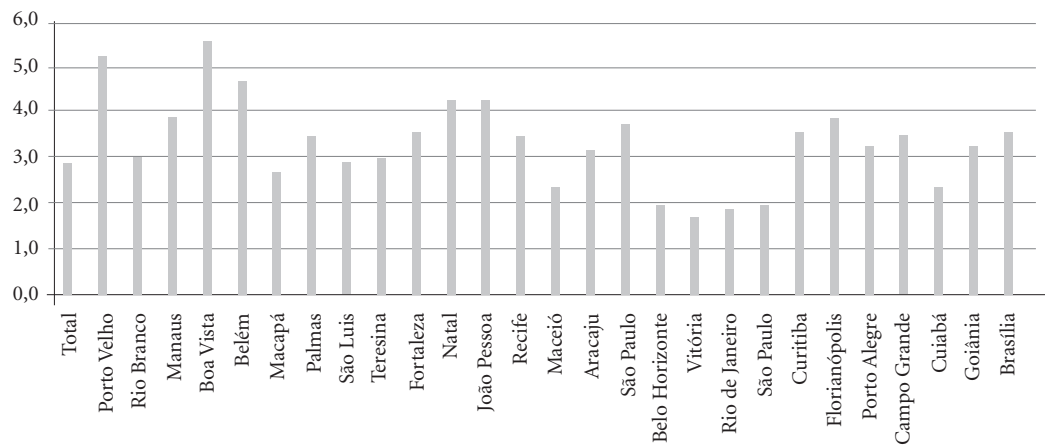


Figure 2. Proportion of adults (≥ 18 years) involved in work accidents by state capital. National Health Study (Brazil, 2013).

Source: National Health Study (PNS), 2013; and Beneficiaries Information System of the National Supplementary Health Agency (ANS), 2013 December.

The PNS provides unprecedented information about occupational accidents in Brazil and allows us to understand the scale of the problem and conclude that the official figures grossly underestimate the real situation in this country. These findings corroborate the conclusions of a report produced by the Jorge Duprat Figueiredo Occupational Safety and Health Foundation (*Fundação Jorge Duprat Figueiredo de Segurança e Medicina do Trabalho - FUNDACENTRO*), which shows that the number of people suffering occupational accidents according to the PNS is up to seven times greater than that suggested by the official MPS statistics¹⁷.

One of the main causes of this underestimation of the true level of occupational accidents is the lack of coverage of the social security system, which only includes workers contracted under the Consolidation of Labor Laws (*Consolidação das Leis do Trabalho - CLT*) and those with Occupational Accident Insurance (*Seguro de Acidente do Trabalho - SAT*), excluding individuals working in the informal sector^{9,17}.

The PNS investigated occupational accidents and commuting accidents. Occupational accidents are those that occur in the workplace, while commuting accidents are those that occur on the way to work and while returning home after work, and must occur on the normal and reasonable route to or from work⁴. According to Law 8.213/91¹⁸,

work-related accidents include: those which occur during work trips, including those paid for by the company to promote staff training and development, regardless of the type of transport used and including vehicles owned by the insured party; and accidents that occur on the way to work and while returning home after work, regardless of the type of transport used and including vehicles owned by the insured party. The PNS showed that 1.9 million workers in Brazil were involved in commuting accidents. This proportion is consistent with the literature: VIVA data shows that 31.3% of transport accidents were work-related⁴.

The PNS also showed that occupational accidents are more likely to occur among young black males (aged up to 39 years) with a lower level of education, which corroborates other studies that highlight the influence of socioeconomic status on the occurrence of occupational accidents, suggesting that young people aged between 30 and 39 years, black or brown men, and people with a lower level of education are more vulnerable to occupational accidents^{7,8}. This group is probably more vulnerable because its members are more likely to carry out activities that do not require qualification and which are therefore often more dangerous and have greater exposure to the risk of accidents⁸.

A cohort study with a sample of 2,512 individuals living in Salvador in the State of Bahia

Table 2. Proportion of adults (≥ 18 years) involved in commuting accidents in which they suffered a bodily injury over the last 12 months. National Health Study (Brazil 2013).

Sociodemographic characteristics	%	CI 95%*		N Expanded (x1,000)
		LI	LS	
Sex				
Male	2.1	1.8	2.4	1,441
Female	0.6	0.5	0.7	445
Age group (years)				
18-29	1.9	1.5	2.3	723
30-39	1.9	1.5	2.3	612
40-59	1.0	0.8	1.2	482
60 or over	0.3	0.1	0.4	70
Level of education				
Has not completed primary education	0.8	0.6	0.9	441
Has completed primary education but has not completed secondary education	1.5	1.1	1.9	341
Has completed secondary education but has not completed further education	1.8	1.4	2.1	849
Has completed further education	1.4	0.9	1.9	255
Color or race				
White	1.2	0.9	1.4	815
Black	1.7	1.0	2.3	225
Brown	1.3	1.1	1.6	823
Place of residence				
Urban	1.3	1.2	1.5	1,688
Rural	1.0	0.7	1.3	198
Region				
North	2.0	1.5	2.5	219
Northeast	1.2	1.0	1.5	486
Southeast	1.1	0.8	1.4	703
South	1.3	0.9	1.8	284
Centerwest	1.8	1.4	2.2	193
Brazil	1.3	1.1	1.4	1,886

* 95% Confidence Interval.

showed a similar situation, but among women. A total of 628 workers mentioned having suffered an occupational accident, most of whom were women (64%), young people between the age of 18 and 30 years (41.6%), black (66.4%), had a low level of education (51.4%) and socioeconomic status (55.1%), and did not have a formal work contract (54.3%)⁷.

Other studies that analyzed MPS data also found that level of education and income were predictors of occupational accidents, while variables such as age, race/color, and lifestyles lost their significance after weighting for level of education and income¹⁹, showing that socioeconomic status is a determinant of occupational acci-

dents, confirming the findings of the PNS related to the variable low level of education and black/brown skin color.

PNS data also shows that the prevalence of occupational accidents is lowest in the Southeast Region and that prevalence rates in the North Region are above the national average. No significant difference in prevalence rates was found between urban and rural areas, contrasting with VIVA data that found that prevalence was greater in urban areas in the South, Southeast and Centerwest regions and greater in rural areas in the North and Northeast Regions⁸.

The fact that prevalence rates in the Southeast Region are lower, despite the region having the

Table 3. Proportion of adults (≥ 18 years) involved in occupational accidents (excluding commuting accidents) in the last 12 months which prevented them from carrying out routine activities, involving hospitalization, or resulting in sequelae/disability, by sociodemographic characteristics. National Health Study (Brazil 2013).

Sociodemographic characteristics	Prevented from carrying out routine activities			Involving hospitalization			Resulting in sequela/disability		
	%	CI 95%*		%	CI 95%*		%	CI 95%*	
		LI	LS		LI	LS		LI	LS
Sex									
Male	52.8	46.6	59.1	10.4	7.1	13.7	19.8	15.1	24.6
Female	45.6	37.4	53.7	5.5	2.5	8.6	17.3	11.4	23.1
Age group (years)									
18-29	41.4	33.1	49.6	5.1	2.3	7.8	9.7	5.7	13.8
30-39	51.7	42	61.4	7.0	3.3	10.7	17.8	11.8	23.9
40-59	56.4	46.9	65.8	10.5	6.7	14.3	25.5	18.2	32.9
60 and over	56.3	39.0	73.6	24.4	8.7	40.1	31.7	12.3	51.1
Level of education									
Has not completed primary education	59.0	52.0	66.1	11.3	6.9	15.7	23.7	17.3	30.1
Has completed primary education but has not completed secondary education	43.9	31.9	55.8	9.4	4.2	14.6	11.4	6.1	16.7
Has completed secondary education but has not completed further education	44.5	36.1	52.8	5.6	2.6	8.6	16.7	11.3	22.2
Has completed further education	44.7	26.6	62.9	5.6	0.0	11.7	25.8	5.1	46.4
Color or race									
White	52.1	44.4	59.8	8.0	4.8	11.2	20.2	14.2	26.2
Black	38.1	24.0	52.3	7.7	1.3	14.0	15.0	6.6	23.4
Brown	52.5	45.5	59.6	10.0	6.0	14.0	19.4	14.0	24.8
Place of residence									
Urban	47.8	42.1	53.6	7.8	5.6	10.1	17.2	13.4	21.0
Rural	62.1	53.0	71.2	13.2	5.2	21.2	27.1	17.4	36.7
Region									
North	57.8	43.9	71.6	19.2	6.5	31.8	20.9	14.5	27.4
Northeast	47.1	37.5	56.7	7.9	4.0	11.8	15.0	10.2	19.8
Southeast	45.2	35.1	55.4	4.4	1.5	7.3	20.1	11.6	28.5
South	60.1	51.2	68.9	11.1	5.8	16.4	22.0	14.8	29.2
Centerwest	50.4	40.1	60.7	11.8	4.4	19.1	16.9	9.5	24.4
Brazil	50.4	45.3	55.5	8.8	6.4	11.2	19.0	15.3	22.7

* 95% Confidence Interval.

greatest proportion of jobs, industry and wealth, may be explained by stricter labor regulations and more effective enforcement in the region, which can lead to a reduction in the frequency and severity of occurrences. This hypothesis is also supported by the fact that the prevalence of hospitalizations is lowest in the Southeast Region, suggesting that accidents are generally less severe. Prevalence of hospitalization was 8.8% across the country as a whole and more common among older men without any education and among the population of the North Region. This rate is lower than that observed by Santana et al.²⁰, who found that 14.8% of

occupational accidents required emergency treatment and an average length of hospital stay of 3.2 days²⁰, and VIVA, which found a hospitalization prevalence rate of 15.3%⁸. The PNS also shows major regional differences in hospitalization prevalence rates, ranging from 4.4% in the Southeast to 19.2% in the North, representing an almost fivefold difference. Hospitalization is associated not only with the severity of the accident, but also the type of company, industry, occupation or service and level of risk, level of labor regulation, and union involvement. Further research is needed to better understand these regional differences.

According to Law 8.213/91¹⁸, occupational accidents occur during the course of work and may cause bodily injury or functional disorders that lead to death, or the temporary or permanent loss of working capacity.

The PNS shows that the prevalence of disabilities due to occupational accidents was almost double that of hospitalizations. Although it is not possible to compare this data due to the lack of previous studies, it is possible that with respect to the question regarding sequelae, the word sequela could have been understood not only as a physical disability, but also as emotional sequelae that do not necessarily result in hospitalization, including psychological sequelae such as post-traumatic stress disorder that have not been extensively studied in Brazil²¹.

The PNS also highlights the severity of occupational accidents in Brazil, which can be confirmed by comparing work-related accident mortality rates according to the MPS²² with data from the United States' comprehensive Census of Fatal Occupational Injuries²³. There were 4,405 fatal work-related accidents in the United States in 2013, equivalent to a rate of 3.2 per 100,000 full-time workers, while in Brazil there were 2,797 fatal accidents, equivalent to a rate of 6.53 per 100,000 insured workers²². This comparison reveals that, even with the gross underestimations, the situation in Brazil is considerably worse than in the United States, where mortality rates are less than half those of this country.

With respect to study limitations, the differences between the MPS's figures and the findings of the PNS are to be expected given that the latter is a population-based survey and MPS data only covers individuals working in the formal economy. Furthermore, PNS is a cross-sectional study that uses self-reported information. Previous studies show that the validity of self-reported data varies according to the disease/type of problem and sociodemographic characteristics, and therefore the fact that prevalence of disabilities and sequelae was higher than that of hospitalizations may show that interviewees misunderstood the question about this indicator.

Conclusion

The data on occurrences of occupational accidents provided by the PNS comprises an unprecedented and invaluable source of information on this issue. The fact that the PNS was population based means that it manages to cover the whole

population, including individuals working in the informal sector and not accounted for by the official information systems, thus providing a more accurate estimate of the real magnitude of the problem⁹.

Occupational accidents present a public health challenge that affects individuals, families, the community and the country's economy. It is therefore necessary to understand their causes and the circumstances under which they happen in order to promote their prevention²³.

The PNS is a fundamental tool for measuring the occurrence of occupational accidents across the entire working population, including informal groups, exploring sociodemographic and regional differences and raising public awareness and profile of these issues. The data provided by this survey allows a more realistic assessment of the situation and can serve to inform occupational safety and health strategies and help direct the activities of Workers' Health and Safety Centers (*Centros de Referência em Saúde do Trabalhador*), thus contributing to the implementation of the National Workers' Health Policy (*Política Nacional de Saúde do Trabalhador e da Trabalhadora*).

For the first time, the PNS has revealed the real magnitude of this problem and its regional dimensions and shortcomings, offering invaluable information to inform measures designed to prevent occupational accidents.

Collaborations

DC Malta was involved in study conception, data analysis and interpretation, and critically revised this article and approved the version to be published. EL Machado and SR Stopa helped carry out the literature review, the data analysis and in drafting the article. MMA Silva, CL Szwarcwald, MS Franco, FV Santos and C Minayo contributed to data analysis and the final revision of the text. All authors approved the final version of the text.

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