



# Epidemiological Profile of Fatal Work Accidents Reported in the State of São Paulo Between 2009 and 2020: An Observational Study

Anzai A<sup>1</sup>, Migueis GI<sup>1</sup>, Sekiya FS<sup>1</sup>, Silva-Junior JS<sup>2</sup>, Muniz de Andrade R<sup>2</sup>, Galego Miziara CSM<sup>2</sup> and Miziara ID<sup>3\*</sup>

<sup>1</sup>Internist, Occupational Health Discipline, São Paulo University, Brazil

<sup>2</sup>Department of Legal Medicine, Bioethics, Occupational Health, Physical Medicine, and Rehabilitation, Assistant Professor, São Paulo University, Brazil

<sup>3</sup>Head of Occupational Health Discipline, Full Professor, São Paulo University, Brazil

## Research Article

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\*Corresponding author: Ivan Dieb Miziara, Head of Occupational Health Discipline, Full Professor, São Paulo University, Sao Paulo, Brazil, Tel: 1991487678; Email: Ivan.miziara@usp.br

## Abstract

**Introduction:** Brazil, the world's fourth-largest country, is also a significant contributor to workplace accidents. Some estimates calculate that in Brazil, there is an average of one workplace accident every 49 seconds. Days of absence affect the social security system, leading to high costs for accident benefits. Understanding the epidemiological profile of fatal workplace accidents is crucial to ensure the accuracy and reliability of research and the effectiveness of public health policies regarding workplace safety.

**Objective:** This study aimed to describe the profile of fatal work accidents reported in the State of São Paulo. Methods: To achieve this, an ecological, quantitative, and descriptive epidemiological study was conducted. The study was based on information from the Notifiable Injuries Information System (SINAN) database provided by the State Department of Health of the São Paulo Government. The analysis included information on fatal work accidents that occurred in the State of São Paulo between 2009 and 2020. We used quantitative and descriptive statistics to analyze the data, and the variables analyzed were sex and age of the victims.

**Results and Discussion:** The total number of fatal work accidents reported in São Paulo from 2009 to 2020 was 4,741. Between 2009 and 2011, deadly accidents increased, followed by a subsequent decrease until 2016. A new increase occurred in 2017, followed by a progressive reduction until 2020. Regarding sociodemographic data, 93.0% of the participants were male. Approximately 1 in 4 were between 30 and 39 years old, with the occupation of bricklayer being the one that contributed most to fatal accidents (9.24%). Regarding ethnicity, most injured workers were caucasian (69.1%). Most had completed elementary school (50%) and were formal workers (65.5%). In the accident profile, 28.1% had head injuries, and whole-body injuries appeared at 27.9%.

**Conclusion:** This study reveals that the epidemiological profile of fatal work accidents underscores the importance of understanding and addressing this issue. In our series, the involvement of white men under 40 years of age with complete elementary education, bricklayers, and formal workers in accidents caused by various types of traumas mainly affecting the head and entire body was prevalent. These findings are crucial for planning and implementing measures to enhance worker safety and health, as most work-related accidents are not fortuitous and casual but are somewhat predictable and preventable.

**Keywords:** Work accidents; Notifiable Injuries Information System; Causes of Death

## Abbreviations

ILO: International Labor Organization; GDP: Gross Domestic Product.

## Introduction

While playing a vital role in social subsistence, health, and well-being, work can also lead to accidents, illnesses, suffering, and even deaths, particularly when associated with precarious working conditions and processes. Infortunistics, the branch of forensic medicine that studies work-related accidents, occupational diseases, and related issues, is of paramount importance [1]. According to the International Labor Organization (ILO), an estimated 2.78 million workers die each year due to work-related accidents or diseases, resulting in a loss of 4% of the Gross Domestic Product (GDP) annually [2].

Article 19 of Law No. 8,213 of July 24, 1991, defines an occupational accident as one that occurs during the performance of work for a company or domestic employer or during the performance of work by insured persons referred to in item VII of art. 11 of this Law [3], causing bodily injury or functional disturbance that causes death or the loss or reduction, permanent or temporary, of the capacity to work. Article 21 of the same Law also specifies that accidents occurring on the way from home to the workplace, or from the workplace to the former, are considered occupational accidents [3]. Among occupational accidents, the most serious, the fatal, is the one that leads to death immediately after its occurrence or that results in death later, at any time, in a hospital environment or not, as long as the fundamental, intermediate, or immediate cause of death is due to the accident [4].

According to data from the Digital Observatory for Health and Safety at Work of the Public Ministry of Labor (MPT), Brazil ranks fourth worldwide in workplace accidents. Between 2012 and 2018, 4,738,886 workplace accidents were reported, representing an estimated one incident every 49 seconds, of which 17,315 resulted in fatalities. During the same period, 370,174,000 days of social security absence were recorded, resulting in Social Security incurring approximately R\$83 billion in accident benefits [5].

São Paulo is the national economic center, and its population of approximately 46 million inhabitants includes around 21 million economically active individuals, representing one-fifth of the country's workforce. Work accidents are often predictable and preventable public health issues. This study presents the epidemiological profile of fatal work accidents in São Paulo.

## Methods

Our study is a quantitative, descriptive ecological epidemiological study based on data from the Notifiable Injuries Information System (SINAN) database, provided by the São Paulo State Health Department through a request to the Technical Division of Occupational Health Surveillance – Workers' Health Reference Center (DVST-CEREST). The analysis included information on fatal, typical, and commuting accidents identified from the "death due to serious work accident" records in the "case progress" section of the Work Accident Notification/Investigation Form, which occurred in the State of São Paulo between 2009 and 2020. The information came in a .xlsx file. We processed the data in Microsoft Excel 2010 and presented the results in tables, graphs, and frequency distributions. The socioeconomic variables studied included age, sex, pregnancy status, race or ethnicity, education, occupation, and labor-market status. The accident profile was composed by investigating the affected body parts and the type of accident (typical or commuting). We excluded data that was missing or incomplete from the analysis.

Based on secondary data from publicly available databases that do not pose a risk of identifying individuals, this study did not require approval from a Human Research Ethics Committee.

## Results and Discussion

The total number of fatal work accidents reported in São Paulo from 2009 to 2020 was 4,741. There was an annual increase between 2009 and 2011, with a peak in notifications in 2011. After this year, there was a decrease, more pronounced in 2015 and 2016, followed by an increase in 2017, but a new progressive decline continued until 2020. The characteristics of the Brazilian labor market can partly explain the distribution of fatal work accident notifications over the study period. According to the Brazilian Institute of Geography and Statistics (IBGE), the number of unemployed people in the country increased in 2009 as a result of a national and international scenario of declining economic activity due to the global economic and financial crisis of 2008 [6], which would explain the lower reporting of fatal work accidents in 2009. In turn, in 2015, the employed population decreased, accompanied by a further decline in reporting and due to economic disruptions caused by the SARS-CoV-2 pandemic, reported cases decreased in 2020.

Most fatal work accidents affected adult workers, with the predominant age group being 30 to 39 years (24.3%), followed by 40 to 49 years (22.5%), 20 to 29 years (21.9%), 50 to 59 years (18.4%), over 60 years (9.2%), and under 20 years (3.7%). There were thirty-two cases of fatal accidents

among children under 17 years of age. Many studies show that young adults experience more serious work accidents because they are highly productive and often employed in high-risk activities [7-12].

Men accounted for 93% of work-related accident deaths. There were 4,418 fatal cases in the male population and 323 in the female population, with a resulting sex ratio of 13.7 men for every woman. The predominance of men in this population is also evident in the literature [13-15], which suggests that the highest-risk jobs are still predominantly occupied by men [13]. The lower incidence of fatal accidents among women can be attributed to their more significant presence in the tertiary sector and industries that involve lower risk levels [14].

There were two deaths of pregnant workers during the period, one in the first trimester and the other in the second trimester of pregnancy. The low number of deaths at work involving pregnant women can be explained by the existence of legislation that protects them, such as Article 394-A of the Consolidation of Labor Laws [15-18], which determines that in cases of unhealthy activities, pregnant and lactating workers must be reassigned to another activity or, if this is not possible, must be removed from work.

The workers assessed comprised 69.07% white individuals, 23.88% mixed-race individuals, 6.33% black individuals, 0.69% Asian individuals, and 0.02% indigenous individuals. Notably, this proportion depends on the population distribution across states in the country. According to the 2010 census conducted by the IBGE, 63.9% of São Paulo's inhabitants identified as white, 29.1% as mixed-race, 5.5% as black, 1.4% as Asian, and 0.1% as indigenous. In all Brazilian states, this composition is distinct, with most of the population being black or brown (55.2%) [19]. Analyses carried out in the state of Bahia, for example, indicate that the majority of workers who suffered accidents are black [8,20].

Regarding education, 1,493 workers (50%) had completed elementary education, 1,235 (41%) had completed high school, 231 (8%) had completed higher education, and 25 (1%) had no education. Among the workers evaluated, the majority had completed elementary education, which varied from the literature of other regions in the country, where a predominance of high school completion was reported [17-19]. Our analysis also reveals an association between lower education and a higher incidence of fatal work-related events.

Bricklayers were the professional category that contributed most to fatal accidents in the study population (9.24%), followed by truck drivers (8.75%), construction workers (2.89%), installation electricians (2.46%), small-

volume motorcyclists (2.36%), construction painters (1.74%), agricultural workers (1.59%), driver's assistants (1.47%), agricultural tractor drivers (1.34%), and production line feeders (1.34%). The construction (20.85%), transportation (14.55%), services (5.88%), industry (3.82%), agriculture (3.7%), domestic services (0.87%), and security forces (0.7%) sectors accounted for 50% of all fatal work accidents. The high incidence of fatalities in the construction industry is typical of the presence of a wide variety of activities performed by workers, the hiring of low-skilled labor, and the operation of multiple contractors on the same project, which reduces the responsibilities of each individual [13]. The second most frequent category is that of truck drivers. The construction and transportation sectors are among the main sectors in other studies on fatal work accidents [7,20,21].

Regarding the situation in the labor market, the majority were registered employees (65.5%), followed by self-employed workers (18.7%), unregistered employees (5.1%), statutory public servants (4.1%), casual workers (1.2%), others (1.1%), retirees (1.0%), employers (0.9%), cooperative members (0.8%), temporary workers (0.7%), civil servants (0.7%) and unemployed (0.2%). The predominance of workers with a formal employment contract was also observed in other studies [20,22,23].

Fatal work accidents mostly involved head injuries, with 1,836 cases (28.1%), and injuries to the entire body, with 1,831 (27.9%). The other parts of the body were affected in less significant proportions: chest with 896 (13.7%), abdomen with 523 (8%), lower limb with 372 (5.7%), other with 343 (5.2%), upper limb with 315 (4.8%), neck with 267 (4.1%), hand with 67 (1%), eye with 61 (0.9%) and foot with 40 (0.6%). The most frequently affected body parts, which together account for 56% of the occurrences, were the head and multiple regions of the body, which would justify the severity of the event when it affects vital organs, in addition to the fact that trauma involving the entire body involves high-energy trauma.

Regarding the type of accident, typical accidents predominated, with 3,096 notifications (69%), while commuting accidents accounted for 1,397 occurrences (31%). The proportion varies according to the study considered, but always shows a predominance of typical accidents, ranging from 52% to 86.2% of the total [23-25].

There are some limitations in the data obtained, such as the existence of information filled out incorrectly or incompletely, which prevented the use of some variables, such as the economic activity sector according to the National Classification of Economic Activities (CNAE) of the company, time worked in the occupation, hours and minutes after the

start of the workday when the accident occurred. Therefore, it is necessary to train health professionals more effectively to complete the data submitted to SINAN and to monitor the quality of the information adequately. The adequate use of the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) in the coding of the underlying, subsequent, and immediate causes of death, in the notification of injuries and diseases and hospital records is also of fundamental importance for obtaining reliable information, monitoring the health situation and studying the morbidity and mortality profile of the population.

## Conclusion

The epidemiological profile of fatal work accidents reported to SINAN in the state of São Paulo between 2009 and 2020 is characterized by the involvement of white men, adults aged 30 to 39, with complete elementary education, bricklayers, registered employees under the CLT, in typical accidents caused by various types of trauma, mainly affecting the head and entire body.

Work accidents have a direct impact on both health and the economy. They entail significant healthcare and social security costs and prematurely shorten the productive period of the economically active population, incurring substantial costs for government and society. Highlighting the epidemiological profile of fatal work accidents is fundamental for obtaining subsidies to develop public policies and strategies organized by the Occupational Health Surveillance (VISAT) and the Ministry of Labor for their prevention and control.

## References

1. França GV (2017) Legal medicine. 11 ed., Guanabara Koogan, Brazil.
2. International Labour Organization (2018) Improving the safety and health of young workers. International Labour Organization, Portugal.
3. Brazil Presidency of the Republic (1991) Law 8.213 of June 24, 1991. Provides for the Social Security Benefit Plans and other provisions.
4. Brazil Ministry of Health Secretariat of Health Care Department of Strategic Programmatic Actions Technical Area of Workers' Health (2006) Notification of fatal, severe and child and adolescent occupational accidents. Ministry of Health Press, Brazil.
5. Brazil Public Ministry of Labor (2021) Smartlab - Digital Observatory of Occupational Health and Safety.
6. Brazilian Institute of Geography and Statistics (2016) Summary of social indicators: an analysis of the living conditions of the Brazilian population 2016. IBGE, Brazil.
7. Mangas RMN, Gómez CM, Thedim-Costa SMF (2008) Fatal occupational accidents and social protection gaps in the construction industry of Rio de Janeiro. *Rev Bras Saude Ocup* 33(118): 48-55.
8. Santana VS, Araújo Filho JB, Silva M, Albuquerque-Oliveira PR, Barbosa-Branco A, et al. (2007) Mortality, potential years of life lost and incidence of occupational accidents in Bahia, Brazil. *Cad Saude Publica* 23(11): 2643-2652.
9. Teixeira MLP, Fischer FM (2008) Occupational accidents and diseases reported among professional drivers in the state of São Paulo. *Sao Paulo Perspect* 22(1): 66-78.
10. Iwamoto HH, Camargo FC, Tavares LC, Miranzi SSC (2011) Fatal occupational accidents and the quality of their records in Uberaba, Minas Gerais and Brazil, 1997-2006. *Rev Bras Saude Ocup* 36(124): 208-215.
11. Legay LF, Santos SA, Lovisi GM, Aguiar JS, Borges JC, et al. (2012) Transport accidents involving motorcycles: epidemiological profile of victims in three Brazilian state capitals. *Epidemiol Serv Saude* 21(2): 283-292.
12. Faria MP, Silva AM (1986) Analysis of accidents occurring during part of the year 1983 in Greater Belo Horizonte (MG). *Rev Bras Saude Ocup* 12(53): 26-32.
13. De Lucca SR (1993) Epidemiology of fatal occupational accidents in a metropolitan area of southeastern Brazil, 1979-1989. *Rev Saude Publica* 27(3): 168-176.
14. Worker Health Surveillance Coordination (2008) Worker health surveillance: occupational accident. *Bulletin* 01/2008.
15. Waldvogel BC (2003) The working population of São Paulo and fatal occupational accidents. *Sao Paulo Perspec* 17(2).
16. Brazil (1943) Decree-Law No. 5.452 of May 1, 1943 approving the Consolidation of Labor Laws. *Lex: federal legislation collection*. São Paulo, Brazil.
17. Scussiato LA, Kirchhof ALC, Cruz EDA, Sarquis LMM, Miranda FMD, et al. (2013) Epidemiological profile of serious occupational accidents in the state of Paraná, Brazil, 2007-2010. *Epidemiol Serv Saude* 22(4): 621-630.
18. Nogueira JM (2017) Profile of occupational accidents occurring in the eastern region of the city of São Paulo.

- Arq Med Hosp Fac Cien Med Santa Casa Sao Paulo 62(2): 59-62.
19. Brazilian Institute of Geography and Statistics (2010) Demographic census 2010 preliminary results. Seade Foundation, Brazil.
  20. Santana VS, Xavier C, Moura MCP, Oliveira R, Espírito Santo JS, et al. (2009) Severity of occupational accidents treated in emergency services. *Rev Saude Publica* 43(5): 750-760.
  21. Kirchhof ALC, Capellari C (2004) Description of occupational accident reports recorded at the National Social Security Institute of Santa Maria, RS, in the year 2000. *Rev Gaucha Enferm* 25(2): 194-201.
  22. Amorim CR, Araujo EM, Araujo TM, Oliveira NF (2012) Occupational accidents among motorcycle taxi drivers. *Rev Bras Epidemiol* 15(1): 25-37.
  23. Cordeiro R, Prestes SCC, Clemente APG, Diniz CS, Sakate M, et al. (2006) Incidence of nonfatal occupational accidents in a locality of southeastern Brazil. *Cad Saude Publica* 22(2): 387-393.
  24. Miranda FMD, Scussiato LA, Kirchhof ALC, Cruz EDA, Sarquis LMM (2012) Characterization of victims and fatal occupational accidents. *Rev Gaucha Enferm* 33(2): 45-51.
  25. Conceição PSA, Nascimento IBO, Oliveira PS, Cerqueira MRM (2003) Occupational accidents treated in an emergency service. *Cad Saude Publica* 19(1): 111-117.