



Fatal work-related injuries and interpersonal violence in Brazil, 2000-2010

Accidentes de trabajo fatales y violencia interpersonal en Brasil, 2000-2010

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ABSTRACT In this study, we present estimates of the proportionate mortality of work injuries involving interpersonal violence in Brazil from 2000 to 2010. Data come from the Mortality Information System based on death certificates from the Health Ministry, which in Brazil include a field for recording work-related injuries that must be completed in all deaths due to external causes. There were 1,368,732 deaths due to external causes, 31,576 (2.3%) due to work injuries, and only 226 (0.02%) due to work injuries involving interpersonal violence. Nearly 80% of the death certificates did not include data in the work injury field. Most cases occurred among males (94.3%) 25-34 years of age with less than high school education in the Southeast and Northeast country regions, primarily in the manufacturing and agricultural industries. The majority of cases were caused by firearms, followed by sharp instruments, with a relative increase in this last category during the study period. Findings suggest underrecording of diagnoses that recognize the work-related nature of the death. Better training on death certificate completion and studies to quantify the underrecording of work injuries and work injuries involving interpersonal violence are needed.

KEY WORDS Accidents, Occupational; Occupational Accidents Registry; Violence; Aggression; Brazil.

RESUMEN En el presente estudio se estima la mortalidad proporcional por accidentes de trabajo provocados por violencia interpersonal en Brasil, entre 2000 y 2010. Se analizaron los datos del Sistema de Información sobre Mortalidad, basados en los informes estadísticos de defunción del Ministerio de Salud de Brasil, los cuales incluyen un campo para el registro de accidentes de trabajo que debe ser completado en toda defunción por causas externas. Se identificaron 1.368.732 casos de defunciones por causas externas, 31.576 (2,3%) por accidentes de trabajo y solo 226 (0,02%) por accidentes de trabajo con violencia interpersonal. Cerca del 80% de los informes estadísticos de defunción no tenían el campo "accidente de trabajo" completado. La mayor cantidad de casos ocurrió entre hombres (94,3%) de 25-34 años, con nivel de escolaridad medio, ubicados en la región sudeste y noreste, que trabajan principalmente en la producción de bienes y servicios industriales y la actividad agropecuaria. La mayoría de los casos fueron causados por armas de fuego, seguidos por armas blancas, con un aumento relativo de estos últimos en el período estudiado. Los resultados sugieren un gran subregistro de diagnósticos que reconocen la relación con el trabajo. Se hace necesaria una mejor capacitación en el llenado de los informes estadísticos, así como estudios que cuantifiquen el subregistro de accidentes de trabajo y accidentes de trabajo con violencia interpersonal.

PALABRAS CLAVES Accidentes de Trabajo; Notificación de Accidentes del Trabajo; Violencia; Agresión; Brasil.

INTRODUCTION

Occupational injuries include trauma, lesions, intoxication, and asphyxiation that occur during the workday, on site or in transit to or from the workplace. As they are generally preventable and may lead to disability, suffering, or even death, they represent a key public health issue. In spite of legislation related to best practices for the maintenance of safe environments for workers and adequate conditions in workplaces and adjacent areas, low levels of worker participation reduce their potential effectiveness, sustaining high rates of work-related deaths, particularly in developing countries (1). In countries like Brazil, where the number of violence-related deaths has been increasing, thereby gaining relevance in the political agenda on public health, it is possible that occupational injuries involving interpersonal violence are also on the rise. However, little is known about the magnitude, severity, and consequences of these phenomena.

Work activities are rarely carried out in isolation, but involve groups of individuals who relate to one another based on determined patterns of sociability, which can be defined by affinity or friendship, by the nature of the work itself, or by its particular structure and organization. For instance, this may encompass relationships with clients in the rendering of services, as is the case in areas such as retail, health care, education, sales, social services, cash handling and management, activities in isolated locations, and so on. With reference to social relationships, work-related aggressions can take place, although workers can also be victims of violent acts perpetrated by individuals external to the organization (2,3). Aggressions categorized as occupational hazards include sexual violence like rape, homicide during assaults, and suicide. Injuries stemming from intentional aggressions may be related to the specific activities of certain types of work (as in the case of police officers), work performed in isolation, interactions with the public or individuals in stressful situations, in conflictive or tense events, or while handling valuables and large amounts of money, and so on (2).

In a systematic review of literature, Wassel (3) classified work-related violence into four categories:

1. Type I: External/intrusive violence, including criminal acts such as robbery, rioting during protests, aggression related to alcohol consumption or drug use, or some cases of terrorism.
2. Type II: Consumer-related violence, where "consumer" is understood as the users of health care services or those accompanying them, students in educational establishments, restaurant and hotel clientele, among others.
3. Type III: Violence related to interpersonal relationships such as bullying, mobbing, sexual or psychological abuse, including violent acts in the workplace, or by men against their spouses.
4. Type IV: Violence related to organizations and institutions – that is, a violent act that originates in the organization or institution and is directed at clients, patients, or users, or as is the case of terrorist attacks, where there is no specific target and society as a whole is affected (with the exception of violent acts committed by criminal organizations).

Existing studies on workplace homicide are scarce and mainly focus on the United States. Generally, they quantify reported cases but do not consider rates or coefficients given that numbers are so small. According to the US Bureau of Labor Statistics (4), 780 deaths related to violent acts in the workplace were reported in 2011, accounting for 17% of the total number of fatal occupational injuries, 458 of which were homicides and 242 were suicides. Firearms were the most commonly used instruments in homicides, which only accounted for 9% of occupational injuries among males, with robbery being the most frequently reported cause (4). In North Carolina, United States, the highest proportion of workplace homicides occurred in retail (28%), service (26%) and manufacturing (22%) (5). Between 1999 and 2009, trends in the number of work-related deaths showed a 51% decline (6). Analysis of the data revealed that 81.6% of victims were males between ages 35 and 44, and in the majority of cases were involved in a robbery (70%). Furthermore, it is estimated that in the United States the mortality rate by homicides in businesses during hours of operation was 4.5 per 100,000 in 2003, which tended to decline through 2008 when it dropped to 3.2 per 100,000 (7).

In the case of Brazil, Hennington *et al.* (8) analyzed 27 occupational fatalities between 1999 and 2000 in the Campinas region (state of Sao Paulo), and were able to determine that 13 of those cases were homicides (48.1%). Based on a sample of 41 fatalities caused by occupational injuries taken from reports in the city of Sao Paulo, Carneiro (9) estimated that 34.1% of these cases were homicides. Also in Sao Paulo, Waldvogel (10) concluded that 21% of occupational fatalities were the result of homicide, constituting the most common cause of death for retail and service workers. In the state of Bahia, Nobre (11) analyzed 648 deaths by external causes and verified that occupational injuries accounted for 19.4%, out of which almost half were homicides (44.4%), followed closely by traffic accidents (39.4%). Among homicides classified as occupational injuries, firearms were used in 76.8% of cases.

Although instruments for statistical reporting on fatalities include a field to record occupational injuries, few studies aimed at understanding the nature of acts of violence in Brazilian workplaces have been carried out with these data. The most frequently utilized data obtained from the Ministry of Social Welfare do not include external causes, found in Chapter XX of the International Classification of Diseases, 10th Revision (ICD-10). As occupational injuries are identified strictly by the codes in Chapter XIX, it is not possible to identify cases of violence in this database. In this study, occupational injuries involving interpersonal violence in Brazil are described with a special focus on external causes. The analysis is restricted to estimates of proportional mortality and its description with reference to socio-demographic and occupational variables.

METHODS

This study is based on data obtained from the Mortality Information System (SIM) [*Sistema de Informação sobre Mortalidade*] in Brazil from 2000 to 2010. The study population was composed of fatalities in individuals aged 16 or above, whose immediate cause of death was reported as an external cause. The SIM is part of the Information

Technology Department of the Unified Health System of Brazil (DATASUS) and its data come from information recorded on death certificates. Databases can be consulted and extracted in electronic microdata format.

Codes V00 to Y35 from Chapter XX of the ICD-10 – as well as code Y96, specific to work-related causes – were used to define cases. Reports include a specific field <*acidtrab*> in which it is recorded whether cause of death was identified as an occupational injury in all cases with an external cause. For this study, all cases that were coded Y96 or categorized and registered under the previously mentioned field (OA=1) were considered occupational injuries, while the rest were considered “non-cases” (OA=0). Occupational injuries involving interpersonal violence coded as X85 and Y09 were analyzed on a yes/no basis with each ICD-10 code separately.

Descriptive variables included sex (adopted as a fundamental division due to the relevance of this variable in terms of occupational differences), age range (16-19, 20-24, 25-34, 35-44, 45-54, 55-64, and 65 or older), state, year of death, and occupational category: 1) public employees; 2) arts and sciences; 3) mid-level technicians; 4) administrative services; 5) retail and services; 6) agriculture, forestry, hunting, and fishing; 7) manufacturing; and 8) maintenance and repair. These occupational categories correspond to the largest groups in the Brazilian Classification of Occupations (CBO) version 2.0, developed from the Standard Occupational Classification (SOC). Based on recommendations of the US Centers for Disease Control and Prevention (CDC) (12), the variable *immediate circumstance of the accident* was considered and coded as follows: 0) cuts and lacerations; 1) drowning; 2) falls; 3) fires/flames; 4) contact with hot objects/substances; 5) firearms; 6) machinery/equipment; 7) traffic/motor vehicles; 8) other type of pedal-powered vehicle; 9) other type with pedestrians; 10) other type with ground transportation; 11) other type of transportation; 12) natural environment; 13) overexertion; 14) poisoning; 15) electrical shock; 16) suffocation; 17) other; 18) unclassified; and 19) unspecified.

The number of deaths caused by occupational injuries in general and those related to violence as well as their proportions over the

total number of deaths by external causes were analyzed in conjunction with these descriptive variables. It was impossible to maintain the stratification by sex throughout the analysis due to the scarcity of records on women. It was also impossible to estimate rates adjusted by age due to the small number of cases. Given that data were derived from national censuses in which hypotheses were not tested, no statistical inferences or tests were made. As the study was conducted with administrative data taken from public sources in which names were not identified, it was unnecessary to request approval of the Research Ethics Committee.

RESULTS

Records show 1,368,922 cases of death by external causes for the years 2000-2010, 190 of which were disregarded because of incomplete or inconsistent data, leaving 1,368,732 cases for analysis. There were a total of 31,756 occupational injuries, only 226 of which involved interpersonal

violence over the 11 years considered. Records of this type of incident begin to appear in 2002-2003 at a rate of one case per year, and increase to an average of 20 to 66 yearly cases, showing a 25% increase between 2000 and 2010 (Table 1). The proportional mortality rate for occupational injuries among external causes was 2.1% in 2000, increasing to 2.5% in 2010. A 19% increase was registered over the 11 years considered, with an average increase of 1.7% per year. Estimations of proportional mortality by occupational injuries involving interpersonal violence ranged from 0.02% in 2004 to a maximum of 0.05% in 2005, tending to level off at 0.02% in proceeding years. The number of deaths by external causes ranged from 113,519 cases in 2000 to 137,888 in 2010, while the number of deaths by occupational injuries in general grew from 2,417 in 2000 to 3,460 in 2010, a 30.6% increase.

Table 2 shows the demographic distribution of deaths by occupational injuries involving interpersonal violence disaggregated by sex. This analysis confirms that the majority of cases were males: 213 men (94.3%) and only 13 women (5.7%). Among men, the largest proportion of deaths were found in the 25-34 age range (28.2%), followed by

Table 1. Distribution of deaths by external causes and proportional mortality by occupational injuries in general and involving interpersonal violence. Brazil, 2000 to 2010.

| Year | Death by external causes | Death by occupational injuries recorded in the death certificates | | | |
|-------|--------------------------|---|------|----------------------------------|------|
| | | By occupational injuries | | Involving interpersonal violence | |
| | N | n | PM% | n | PM% |
| Total | 1,368,732 | 31,576 | 2.31 | 226 | 0.02 |
| 2000 | 113,519 | 2,417 | 2.13 | 0 | - |
| 2001 | 116,029 | 2,512 | 2.16 | 0 | - |
| 2002 | 121,064 | 2,794 | 2.31 | 1 | 0.00 |
| 2003 | 121,299 | 2,832 | 2.33 | 1 | 0.00 |
| 2004 | 122,365 | 2,986 | 2.44 | 20 | 0.02 |
| 2005 | 122,701 | 2,670 | 2.18 | 66 | 0.05 |
| 2006 | 123,676 | 2,744 | 2.22 | 23 | 0.02 |
| 2007 | 126,260 | 2,964 | 2.35 | 21 | 0.02 |
| 2008 | 130,673 | 3,041 | 2.33 | 36 | 0.03 |
| 2009 | 133,258 | 3,156 | 2.37 | 33 | 0.02 |
| 2010 | 137,888 | 3,460 | 2.51 | 25 | 0.02 |

Source: Own elaboration based on data from the Mortality Information System, DATASUS, Brazil.

PM=Proportional Mortality.

Table 2. Socio-demographic characteristics of occupational injuries involving interpersonal violence. Brazil, 2000-2010.

| Variables | Men | | Women | | Total | |
|---|-------|------|-------|------|-------|------|
| | n=213 | % | n=13 | % | n=226 | % |
| Age | | | | | | |
| 16-19 | 10 | 4.7 | 2 | 15.4 | 12 | 5.3 |
| 20-24 | 28 | 13.1 | 1 | 7.7 | 29 | 12.8 |
| 25-34 | 60 | 28.2 | 4 | 30.8 | 64 | 28.3 |
| 35-44 | 55 | 25.8 | 3 | 23.1 | 58 | 25.7 |
| 45-54 | 36 | 16.9 | 2 | 15.4 | 38 | 16.8 |
| 55-64 | 11 | 5.2 | 1 | 7.7 | 12 | 5.3 |
| 65 or above | 13 | 6.1 | 0 | - | 13 | 5.8 |
| Schooling | | | | | | |
| Incomplete primary school | 8 | 5.4 | 0 | - | 8 | 5.1 |
| Complete primary school | 37 | 24.8 | 1 | 14.3 | 38 | 24.4 |
| High school | 51 | 34.2 | 0 | - | 51 | 32.7 |
| Some college/university | 45 | 30.2 | 4 | 57.1 | 49 | 31.4 |
| College/university degree obtained | 8 | 5.4 | 2 | 28.6 | 10 | 6.4 |
| Region | | | | | | |
| North | 26 | 12.2 | 2 | 15.4 | 28 | 12.4 |
| Northeast | 78 | 36.6 | 3 | 23.1 | 81 | 35.8 |
| Southeast | 89 | 41.8 | 5 | 38.5 | 94 | 41.6 |
| South | 11 | 5.2 | 2 | 15.4 | 13 | 5.8 |
| Midwest | 9 | 4.2 | 1 | 7.6 | 10 | 4.4 |
| Occupational group | | | | | | |
| Public employees | 2 | 1.3 | 0 | - | 2 | 1.2 |
| Arts and sciences | 4 | 2.5 | 1 | 12.5 | 5 | 3.0 |
| Mid-level technicians | 12 | 7.5 | 3 | 37.5 | 15 | 9.0 |
| Administrative services | 17 | 10.7 | 3 | 37.5 | 20 | 12.0 |
| Retail and services | 31 | 19.5 | 1 | 12.5 | 32 | 19.2 |
| Agriculture, forestry, hunting, and fishing | 32 | 20.1 | 0 | - | 32 | 19.2 |
| Manufacturing | 38 | 22.9 | 0 | - | 38 | 22.8 |
| Maintenance and repair | 23 | 14.5 | 0 | - | 23 | 13.8 |

Source: Own elaboration based on data from the Mortality Information System, DATASUS, Brazil.

Note: Subtotals differ due to uninformed data for some variables.

35-44 (25.8%), which in total account for 54.0% of cases. Among women, the distribution of cases was similar, with 53.9% of cases in these age ranges combined. In cases where the level of education was recorded (mostly males), it was shown that they were mostly workers with an intermediate level of education, with less representation at extremes (primary school incomplete or university degree obtained). The region with the highest percentage

of cases was the Southeast (41.6%), both for males (41.8%) and females (38.5%). It should also be noted that much lower proportions were found in the Southern (5.8%) and Midwest (4.4%) regions. In occupational groups for which records existed, the greatest proportions of cases were males belonging to the following categories: manufacturing (22.9%), agriculture (20.1%), and retail and services (19.5%).

Table 3. Distribution of deaths due to occupational injuries involving interpersonal violence by ICD code (10th Revision) and period. Brazil, 2000-2010.

| ICD-10 Cause of assault | 2000-2006 | | 2007-2008 | | 2009-2010 | | Total | |
|---|-----------|------|-----------|------|-----------|------|-------|------|
| | n=111 | % | n=57 | % | n=58 | % | n=226 | % |
| X85-Assault by drugs, medicaments and biological substances | 1 | 0.9 | 0 | - | 0 | - | 1 | 0.4 |
| X87-Assault by agrotoxins ^a | 0 | - | 0 | - | 1 | 1.7 | 1 | 0.4 |
| X89-Assault by other specified chemicals and noxious substances | 0 | - | 0 | - | 1 | 1.7 | 1 | 0.4 |
| X90-Assault by unspecified chemical or noxious substance | 0 | - | 1 | 1.8 | 0 | - | 1 | 0.4 |
| X91-Assault by hanging, strangulation and suffocation | 0 | - | 0 | - | 0 | - | 0 | - |
| X92-Assault by drowning and submersion | 1 | 0.9 | 1 | 1.8 | 1 | 1.7 | 3 | 1.3 |
| X93-Assault by handgun discharge | 9 | 8.1 | 2 | 3.5 | 0 | - | 11 | 4.9 |
| X94-Assault by rifle, shotgun and larger firearm discharge | 2 | 1.8 | 0 | - | 2 | 3.4 | 4 | 1.8 |
| X95-Assault by other and unspecified firearm discharge | 70 | 63.1 | 9 | 15.8 | 7 | 12.1 | 86 | 38.1 |
| X96-Assault by explosive material | 0 | - | 0 | - | 0 | - | 0 | - |
| X97-Assault by smoke, fire and flames | 2 | 1.8 | 1 | 1.8 | 2 | 3.4 | 5 | 2.2 |
| X98-Assault by steam, hot vapours and hot objects | 1 | 0.9 | 0 | - | 0 | - | 1 | 0.4 |
| X99-Assault by sharp object | 8 | 7.2 | 9 | 15.8 | 10 | 17.2 | 27 | 11.9 |
| Y00-Assault by blunt object | 11 | 9.9 | 20 | 35.1 | 29 | 50.0 | 60 | 26.5 |
| Y01-Assault by pushing from high place | 0 | - | 1 | 1.8 | 0 | - | 1 | 0.4 |
| Y02-Assault by pushing or placing victim before moving object | 2 | 1.8 | 0 | - | 1 | 1.7 | 3 | 1.3 |
| Y03-Assault by crashing of motor vehicle | 3 | 2.7 | 10 | 17.5 | 4 | 6.9 | 17 | 7.5 |
| Y04-Assault by bodily force | 0 | - | 1 | 1.8 | 0 | - | 1 | 0.4 |
| Y05-Sexual assault by bodily force | 0 | - | 0 | - | 0 | - | 0 | - |
| Y08-Assault by other specified means | 1 | 0.9 | 2 | 3.5 | 0 | - | 3 | 1.3 |

Source: Own elaboration based on data from the Mortality Information System, DATASUS, Brazil

^aICD-10 nomenclature in Spanish refers to pesticides, although it was decided to keep denominations accepted by Brazilian law according to Federal Law 7802/1989, regulated by Executive Order 4074/2002.

Prior to 2006 occupational injuries involving interpersonal violence were infrequently reported, and the number of reported cases remained at 57 from 2007-2008 and 58 from 2009-2010 (Table 3). In general, although the rate decreased from the first period (2000-2006) until 2009-2010, most diagnoses of underlying cause of death were coded X95, referring to aggression with unspecified firearm (n=86; 38.1%), followed by the use of blunt objects (n=60; 26.5%), and sharp

and piercing instruments (n=27, 11.9%). Among the 13 female cases, 4 were homicides by firearms, 4 involved sharp instruments, 3 involved blunt objects, and 2 involved motor vehicle crashes.

The field <acidtrab> was incomplete on most death certificates. However, its rate of completion rose to 76.3% in 2006 and to 85.5% in 2010, showing a clear trend toward stability.

DISCUSSION

The results show that over one million individuals in Brazil died due to external causes over the last decade, out of which 31,576 deaths (2.3%) were attributed to work-related events and were recorded as occupational injuries on death certificates. Among work-related deaths, interpersonal violence was registered as the underlying cause of death in only 226 cases, accounting for between 0.02% and 0.05% of deaths with external causes. Almost all cases involved adult males between 25-44 years old, from the Southeast and Northeast regions, who worked in the manufacturing industry or in agricultural production. Homicides caused by firearms and those produced by sharp or blunt instruments were the most common in this category.

The findings of this study should be approached with caution, given the significant underreporting of work-related deaths, evident in the high proportion of deaths with external causes where the *<acidtrab>* field on death certificates was not completed, despite the fact that it is mandatory to record this information for all cases involving external causes. This suggests that the quality of records needs to be improved, as underreporting does not seem to diminish over time. It should also be mentioned that socio-demographic data such as level of education were not reported in many cases (31.0%). This supports the hypothesis that the SIM is far from reaching a level of improvement compatible with that of Brazilian health information systems in general. Therefore, the high level of underreporting of occupational injuries in Brazil's SIM is not surprising. This was confirmed by cross-referencing data from the Ministry of Social Welfare and the Occupational Accident Information System of Belo Horizonte, which revealed a rate of underreporting of 89% (13). In Campinas, Sao Paulo, Hennington *et al.* (8) estimated an underreporting of deaths of 83.4% in 1999-2000, higher than the 39% found by Waldvogel in the same state between 1991 and 1992 (10) and the 45% from 1997-1999 (14). By analyzing data on external causes in the metropolitan region of Salvador da Bahia in 2004, Nobre *et al.* (15) used verbal autopsy to estimate an underreporting of 93% by the

SIM, both for occupational injuries in general and those involving interpersonal violence. Thus, the data presented in this study represent only a small fraction of the total number of cases. As previously mentioned, the Ministry of Social Welfare does not provide these data and the Mandatory Disease Reporting Information System (SINAN) [*Sistema de Informação de Agravos de Notificação*] does not include reporting deaths among its main functions. Therefore, as no other source of information is available for studying occupational injuries involving interpersonal violence, the SIM represents the only possible alternative.

In this study based on SIM data, the proportionate mortality for cases involving interpersonal violence was estimated at 0.02% of deaths by external causes – much lower than the figure of 8.3% (56 out of 646 cases) reported by Nobre *et al.* (15). That figure is 415 times greater than the one found in this study is evidence of the fact that SIM records of cases of death by violence among occupational injuries in Brazil are practically nonexistent. This differs from the data analyzed by the Ministry of Health between 2000 and 2009, where it was found that aggressions constituted the main cause of death among external causes. This represents a proportionate mortality rate of 36.8% (out of cases with external causes) and a mortality rate of 50.8 per 100,000 for men and 4.4 per 100,000 for women, higher in the Northeast and the Midwest regions and among individuals between 15 and 39 years old. Between 2000 and 2009, there was tendency for the rate of mortality due to aggressions to increase (16). As workers compose 50% of the total population of Brazil, it is unlikely that the number of workplace homicides is so low. It is worth noting that in the analysis conducted by the Ministry of Health, specific data on occupational injuries in general and on those involving interpersonal violence are not cited, evidencing a lack of visibility at the institutional level.

The possible high levels of underreporting of violence and occupational injuries stem from a lack of existing knowledge of the fact that trauma derived from interpersonal aggressions can be considered occupational injuries, or from the fear of recording these cases on death certificates given the legal implications of doing so. In fact, according to Section 262 of the Criminal Code, all deaths by external causes are subject to necropsy,

with the medical examiner and forensic expert acting as sources of information. Death certificates include a field <tipo> to record whether the death was caused by an accident, suicide, homicide, or some other circumstance. It is unfortunate that such an important statistic on occupational injuries involving interpersonal violence is so underestimated, and consequently absent from official records. It is interesting to note that aside from occupational injuries involving interpersonal violence, no mention is made of occupational injuries in general. This reveals the invisibility of the issue and the subsequent fragility of arguments in favor of prevention programs headed by the Unified Health System aimed at this public health problem. However, it is worth mentioning that occupational injuries were included in employee questionnaires used in data collection for the Violence and Accident Surveillance Program (VIVA), an initiative of the Health Surveillance Bureau at the Ministry of Health (17).

Published Brazilian studies that have dealt with occupational injuries involving interpersonal violence have estimated much higher proportions of homicides among fatal occupational injuries in general. In this study, taking into account data from 2010, that proportion was only 0.7%, much lower than the 48.1% estimated elsewhere for Campinas (8) and the 34% for the city of Sao Paulo (9). The two studies referenced here were based on interviews obtained from an active search for cases using secondary databases. However, as the number of cases studied was quite low, conclusions are limited. Similarly, Carneiro (9) used police records, which account for only a fraction of the total number of occupational injuries, and which may produce distortions making it seem as if there were a greater number of aggressions.

A comparison of the results of this study with national estimates of the proportion of homicides among occupational injuries obtained from death certificates and the findings of studies with larger populations reveal significant differences. This is the case of the study by Waldgovel (10), who found a proportion of 21% for Sao Paulo, and a study on Salvador (15) that found 44.4%, which suggest the existence of a possible underestimation of the relationship between work and homicide based on SIM data. These local estimates of the proportion of homicides among occupational

injuries in Brazil are greater than those recorded in 2011 in the United States, which revealed 9% for men, 21% for women, and 18.2% for the total population (4). However, they are much lower than the proportions found by the other Brazilian authors cited (8,9,10). This suggests, once more, underreporting of occupational injuries involving interpersonal violence in Brazil. The significant differences among the results of Brazilian studies can be ascribed either to methodological differences or to the contexts in which they were carried out.

The difficulties in identifying the relationship between deaths caused by violence and the workplace are well known by emergency care units, in addition to the limitations encountered by municipal or state health surveillance teams in the investigation of cases (17). One such difficulty is that many car accidents and aggressions constitute an immediate cause of death, and are therefore handled by the institutes of legal medicine that receive the bodies rather than by emergency care units at hospitals (9). For instance, intentional aggressions tend to be more commonly reported due to legal liabilities implicit in the involvement of the police, who are required to keep extensive records of reports. This may also apply to the records kept in the institutes of legal medicine, as many cases of deaths involving institutional violence are referred to them.

The majority of work-related homicides had firearms as their immediate cause, consistent with other studies on Brazil and the United States in which specific findings were made. In this sense, it is worth mentioning that there was a reduction in the proportion of these cases that coincided with an increase in homicides involving sharp instruments. It should also be mentioned that in this study occupational injuries involving firearms occurred more frequently among workers in the service industry, while deaths by sharp instruments were more common among agricultural workers. Unfortunately, results for the occupation field of the SIM do not offer specific enough data to perform an analysis more detailed than the consideration of large groups. The predominance of firearms is consistent with the findings of other Brazilian studies that analyzed this type of data (9,11).

The intention of this study was to make a contribution to knowledge by analyzing data

for all workers throughout the country using a public and easily accessible DATASUS database, which can be used for generating epidemiological data on workers' health. Nonetheless, the perspective presented here is one that is rarely analyzed by the Unified Health System. This study revealed the poor quality of important pieces of information – such as the data meant to be collected by the <acidtrab>, <escolaridade>, and <ocupação> fields – especially in terms of underreporting. This highlights the need to improve training given to professionals working in the production of this information. Death certificate reporting and the SIM reflect the state of the country's health information system in general, and despite the fact that there have been clear improvements in quality there is still a lot of work to be done in the field of workers' health in Brazil. Another perspective on the development of the quality of these data can be gained from their connection with other national electronic databases such as the National System of Statistics on Public Safety and Criminal Justice (SINESP) [*Sistema Nacional de Informações de Segurança Pública*] (Law 12681, July 4, 2012). Such systems may be used for cross checking information reported on occupational injuries in general as well as those involving interpersonal violence. However, the ethical aspects of utilizing these databases should be taken into consideration, given that they were developed for different purposes. Many initiatives have been undertaken by the Ministry of Health with the aim of improving the quality of health information, particularly data on work-related events, such as the inclusion of a specific field for recording occupational injuries on death

certificates and the mandatory reporting of 11 diseases in the SINAN (18). However, the use of this information to produce epidemiological data is still in early stages in many Brazilian regions and municipalities (19). Given that deaths caused by occupational injuries must also be reported and investigated by the SINAN (serious occupational injuries), a promising direction would be to continue to strengthen interrelation and comparison of cases reported in the SINAN and the SIM in order to reduce underreporting, improve the quality of both systems, and increase the surveillance of workers' health and prevention in order to reduce the number of work-related deaths.

Workplace situations are potentially adequate for undertaking actions aimed at the promotion and protection of workers' health, given that work-related duties are performed within a fixed space, involve groups of people that share interests and values, and who coexist in a common and controlled environment. In this sense, the work environment is also favorable for making effective preventive actions feasible at a low cost. Prevention strategies are normally based on peer-participation, victims, alert systems, communication, establishing escape routes, and providing support during the occurrence of an event or psychological support after an event (20). Observational studies show that serious aggressions are preceded by milder acts of violence (3). Therefore, measures adopted for the identification of early signs of violence should be monitored and employed when implementing preventive actions.

ACKNOWLEDGEMENTS

This study was performed as part of an initiative from the *Rede Interagencial de Informações para a Saúde (RIPSA)*, Brazil. The first author is a scholarship holder of scientific productivity of the *Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)*, process No. 304108/2011-1.

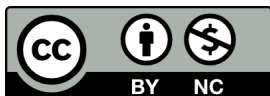
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CITATION

Santana VS, Dias EC, Oliveira GL, Moura MCP, Nobre LCC, Machado JMH. Fatal work-related injuries and interpersonal violence in Brazil, 2000-2010. *Salud Colectiva*. 2013;9(2):139-149.



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Received: 10 November 2012 | Revised: 15 February 2013 | Accepted: 29 March 2013

The translation of this article is part of an interdepartmental collaboration between the Undergraduate Program in Sworn Translation Studies (English < > Spanish) and the Institute of Collective Health at the Universidad Nacional de Lanús. This article was translated by Cristian Herrlein and Mariano Saab, reviewed by Mariela Santoro and modified for publication by Joseph Palumbo.