ORIGINAL ARTICLE

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Profile of healthcare workers involved in accidents with exposure to biological materials in Brazil from 2011 through 2015: surveillance aspects

Perfil dos trabalhadores de saúde com registros de acidentes com material biológico no Brasil entre 2011 e 2015: aspectos para vigilância

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ABSTRACT | Background: Accidents involving biological materials among healthcare providers represent a significant public health problem since they increase the risk of acquisition of viral infections considered to be risk factors for cancer. **Objective:** To describe the profile of workplace accidents involving biological materials for healthcare providers. **Method:** The profile of accidents for the period from 2011 to 2015 was described based on several sociodemographic, occupational and health variables. Specific incidence rates were stratified in three levels to categorize the Brazilian municipalities as a function of the frequency of events. **Results:** Victims were mainly female, nursing technicians and assistants, events mostly occurred during surgical procedures or intravenous medication administration, however, underreporting cannot be ruled out. **Conclusion:** The results point to the need for preventive programs to ensure the physical integrity of healthcare professionals, including continuous training, discussion and participation of the involved parties to achieve a positive impact.

Keywords | accidents, occupational; biocompatible materials; surveillance of the workers health.

RESUMO | Introdução: Os acidentes com material biológico decorrentes de processos de serviços e cuidados em saúde caracterizam relevante problema de saúde pública, pois aumentam o risco de aquisição de infecções virais consideradas fatores de risco para o desenvolvimento de câncer. **Objetivo:** Descrever o perfil dos acidentes com exposição a material biológico em profissionais da área da saúde durante o desenvolvimento do seu trabalho, fomentando a discussão sobre a importância dos determinantes desses acidentes para a vigilância em saúde do trabalhador. **Método:** Para traçar o perfil dos profissionais acidentados foram descritas variáveis sociodemográficas, ocupacionais e de saúde entre 2011 e 2015. As taxas de incidência específicas foram estratificadas em três níveis para classificação dos municípios segundo a magnitude da ocorrência do agravo. **Resultados:** Os acidentes ocorrem, em sua maioria, entre mulheres, técnicas e auxiliares de enfermagem, durante procedimento cirúrgico e administração de medicação endovenosa, porém pode haver subnotificação. **Conclusão:** Os achados ressaltam a necessidade de implementação de planos preventivos que garantam a integridade física dos cuidadores em saúde, nos quais sua construção englobe processos contínuos de formação, discussão e colaboração de todas as partes envolvidas visando ao impacto positivo dessa realidade.

Palavras-chave | acidentes de trabalho; material biológico; vigilância em saúde do trabalhador.

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INTRODUCTION

Work accidents involving biological materials must be mandatorily reported in Brazil since 2014. The reason is that they are considered an emergency requiring immediate prophylaxis as per need. This type of accident must also be reported to the National Social Security Institute (Instituto Nacional de Seguridade Social – INSS) through a Work Accident Report (WAR) form[1]. In 2011 the Ministry of Labor added Appendix III to the Regulatory Standard 32 which makes establishing a Sharps Injuries Risk Prevention Plan mandatory; non-compliance is liable to legal sanctions[2].

Accidents involving biological materials derived from the work process at healthcare facilities represent a considerable public health problem. Direct contact with the blood or other body fluids of patients increases the risk of acquisition of viral infections for some professional categories, particularly of infection with the human immunodeficiency (HVI), hepatitis B (HBV) and C (HCV) viruses[3,4], in addition to about 60 other pathogen species spread by needles, surgical instruments, broken glass or other contaminated objects[5].

According to a population-based survey conducted from 2005 through 2009 and published in 2010, the prevalence of HBV and HCV in Brazil was 7.4 and 1.4%, respectively[6]. The prevalence of HIV was 12.5 and 5.8/100,000 people for men and women, respectively, for the period from 2005 to 2015[7]. Data published by the Ministry of Health show that the prevalence of HIV in Brazil is 0.4% — 0.3% for women and 0.5% for men[8]. According to several studies, the risk of HIV transmission after exposure to infected blood is 0.3%, and 0.09% following mucosal exposure. The risk of HBV transmission varies from 6 to 30% and that of HCV from 3 to 10%. These infections have serious consequences, including chronic diseases, disability and death[4].

Infections are estimated to account for 15% of cancer cases worldwide and 20% in developing countries, being that 7.7 and 26.3%, respectively, of cancer cases related to infectious diseases are preventable[9]. In a study conducted in Brazil of the distribution of modifiable risk factors for cancer estimated for 2020, infectious agents ranked second after smoking only[10]. In a study on the global contribution of HBV and HCV to primary liver cancer, 78% of hepatocellular carcinoma was attributed to HBV (53%) or HCV (25%)[11].

It is believed that underreporting of accidents involving biological materials is a serious problem for the involved workers. Underreporting hinders the attempts at achieving accurate knowledge about the epidemiological situation of this population of workers, therefore also discussions on work accidents and their consequences and decision making in last instance. Acquired infections have significant social implications, as they are still associated with stigma and potential discrimination, with unfavorable occupational or economic impacts. For these reasons, studies on this subject are relevant for the purpose of implementing surveillance and prevention strategies[12,13].

The aim of the present study was to draw the profile of work accidents involving biological materials among healthcare workers to contribute to the discussions on the relevance of the determinants of such accidents for occupational health surveillance.

METHOD

The present cross-sectional study was based on data on work accidents involving biological materials relative to all the Brazilian municipalities.

According to the Ministry of Health, cases must be reported when "accidents involving blood or other body fluids occur among healthcare professionals in the workplace, where they are exposed to potentially contaminated biological materials"[8,14]. The population of the present study was exclusively represented by healthcare professionals as per the Brazilian Classification of Occupations 2002 available at the Ministry of Labor website[15].

We analyzed secondary data obtained from the System of Information for Notifiable Diseases (Sistema de Informação de Agravos de Notificação–SINAN) for the period from 2011 to 2015 through the Unified Health System Informatics Department (DATASUS) databases available at the website of the Environmental and Occupational Health Integrated Program (Programa Integrado em Saúde Ambiental e do Trabalhador–PISAT), Institute of Collective Health, Federal University of Bahia (ISC/UFBA)[16]. We included the cases categorized as chapter 21 code Z20.9 — contact with

and (suspected) exposure to unspecified communicable disease — in the International Classification of Diseases–10th revision (ICD-10).

The outcome of interest was accidents involving biological materials. The following variables representing sociodemographic and occupational characteristics were selected to draw the profile of the target population: age range, educational level, ethnicity, employment relationship, occupation, length in the job and use of personal protective equipment (PPE).

The description of the characteristics of work accidents was based on the analysis of the following variables: circumstances, involved agent, type of exposure, type of biological material, victims' hepatitis B vaccination status, positive serologic testing (baseline), known source patient, known source patient positive serologic testing, measures implemented at the time of the accident, case progression and WAR issuance.

Analysis corresponds to the period from 2011 through 2015. First the sociodemographic, occupational and accident-related variables were subjected to descriptive statistics. Groups were compared with the t-test at a significance level of 0.05 (5%).

In the calculation of specific incidence rates relative to work accidents involving biological materials, the numerator was the absolute number of records per municipality and the denominator the number of workers with formal employment relationship in 2013 according to the Ministry of Labor's Annual Social Information Report (Relação Anual de Informações Sociais–RAIS). On these grounds, the municipalities were categorized in three levels according to the frequency of reported work accidents involving biological materials. These categories were established based on natural breaks between coefficient values for all the Brazilian municipalities and served to draw a thematic map.

We collected cartographic information for 2015 from the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística–IBGE)[17]. The map and rates were obtained with software Quantum Gis version 2.12.3.

All the data analyzed are of public domain and open access. Open access to non-personal and/or non-sensitive data is considered in the Law of Access to Information, no. 9,527/11, regulated by Decree no. 7,724/12.

RESULTS

A total of 245,191 cases of work accidents involving biological materials were reported from 2011 to 2015 in Brazil. We excluded 66,720 (27.2%) cases due to inconsistencies or for corresponding to occupations other than health care. Therefore, 178,431 records were analyzed, corresponding to an incidence of 17.93/100,000 people.

SOCIODEMOGRAPHIC CHARACTERISTICS

According to the p value set to define statistical significance, most accident victims were white (59.7%) and female (82.3%). As Table 1 shows, accidents were most frequent among workers aged 30 to 49 years old (54.4%), with complete secondary school or incomplete higher education (50%), self-reported whites (53.2%) and with formal employment relationship (51.2%). Accidents were also common among workers with less than 5 years in the job (76.5%) and making inadequate use of PPE (78.7%). The professional categories most frequently involved were nursing technicians and assistants (63.5%) and nurses (10%), however, without statistical significance.

ACCIDENT CHARACTERISTICS

The largest proportion of accidents occurred during surgical procedures or intravenous medication administration, 10.5 and 10%, respectively (Table 2). Accidents involved hollow-bore needles in more than half of the cases (57.5%), percutaneous exposure (74.3%) and contact with blood (78.8%).

Positive serological testing for anti-HIV, HBsAg and anti-HCV was overall low at baseline. A high proportion of victims exhibited adequate hepatitis B vaccination status (87.3%) and 32.3% circulating antibodies against the virus. About 0.8% of discharges were reported as with serological conversion, which might have been an effect of vaccination. Most victims did not require chemoprophylaxis (62.8%). WAR was issued for little more than half of the events (51%).

The source patient was known in 77.5% of the cases, 5.4% of whom were HIV positive and 29.2% tested negative for anti-HBs.

Table 1. Sociodemographic and occupational characteristics of victims of accidents involving biological materials distributed per sex, Brazil, 2011 to 2015 (n=178,431).

	Female		Male		Total		p
	n	%	n	%	n	%	
Age range (years)							
18 to 29	53,496	30	11,043	6.2	64,539	36.2	0.00
30 to 49	81,035	45.4	15,971	9	97,006	54.4	
50 or over	13,871	7.8	3,015	1.7	16,886	9.4	
Total	148,402	83.2	30,029	16.9	178,431	100	
Educational level							
Illiterate/incomplete elementary school	1,391	0.8	360	0.2	1,751	1	0.00
Complete elementary school/incomplete secondary school	2,614	1.5	338	0.2	2,952	1.7	
Complete secondary school/incomplete higher education	84,155	47.2	10,702	6	94,857	53.2	
Complete higher education	32,974	18.5	13,221	7.4	46,195	25.9	
Not informed	27,268	15.3	5,408	3	32,676	18.3	
Total	148,402	83.3	30,029	16.8	178,431	100	
Ethnicity							
White	87,627	49.1	18,859	10.6	106,486	59.7	0.00
Black/brown skin	8,307	4.7	1,296	0.7	9,603	5.4	
Other	40,109	22.5	7,093	4	47,202	26.5	
Not informed	12,359	6.9	2,781	1.6	15,140	8.5	
Total	148,402	83.2	30,029	16.9	178,431	100	
Occupational status							
Employed	78,824	44.2	12,610	7.1	91,434	51.2	0.00
Civil servants	37,738	21.1	6,330	3.5	44,068	24.7	
Other	18,352	10.3	7,867	4.4	26,219	14.7	
Not informed	13,488	7.6	3,222	1.8	16,710	9.4	
Total	148,402	83.2	30,029	16.8	178,431	100	
Occupations most exposed to accidents involving biological materials							
Physicians	7,756	4.3	10,093	5.7	17,849	10	0.00
Dentists	4,958	2.8	1,901	1.1	6,859	3.8	
Nurses	16,921	9.5	2,284	1.3	19,205	10.8	

Continue...

Table 1. Continuation.

	Female		Male		Total		p
	n	%	n	%	n	%	
Nursing technicians and assistants	103,650	58.1	12,890	7.2	116,540	65.3	
Dental assistants	4,468	2.5	198	0.1	4,666	2.6	
Laboratory assistants	3,305	1.9	573	0.3	3,878	2.2	0.00
Other healthcare professionals	7,344	4.1	2,090	1.2	9,434	5.3	
Total	148,402	83.2	30,029	16.9	178,431	100	
Length in the job							
Less than 5 years	113,521	63.6	22,956	12.9	136,477	76.5	
5 to 15 years	22,167	12.4	4,431	2.5	26,598	14.9	
More than 15 years	10,503	5.9	2,196	1.2	12,699	7.1	0.47
Not informed	2,211	1.2	446	0.2	2,657	1.5	
Total	148,402	83.1	30,029	16.8	178,431	100	
PPE use							
No	23,579	13.2	3,161	1.8	26,740	15	
Incomplete	115,853	64.9	24,627	13.8	140,480	78.7	
Complete	1,454	0.9	594	0.3	2,048	1.1	0.00
Not informed	7,516	4.2	1,647	0.9	9,163	5.1	
Total	148,402	83.2	30,029	16.8	178,431	100	

PPE: personal protective equipment

GEOGRAPHICAL DISTRIBUTION OF ACCIDENTS

As Figure 1 shows, the largest number of municipalities with the highest specific rates of accidents involving biological materials corresponded to the Southeast, South and Central-West regions. In turn, the North and Northeast regions included the largest number of municipalities with the lowest rates.

It is worth observing that information on the accident report site was provided for 62%, and lacked for 38% of the Brazilian municipalities. Worthy of note, cases were reported in 45% of the municipalities in the North region. In turn, notification of the accident report site was best for the Southeast region, as information was provided for 77% of the events (Table 3).

DISCUSSION

The results of the present study agree with most reports in the literature[12,18-24] which indicate that most accident victims are female, nursing assistants or technicians, with short length in the job, medium-to-high educational level and making inadequate use of the recommended PPE. The results of serologic testing were overall favorable.

The vaccination status of victims deserves attention, as in most studies the percentage of duly vaccinated victims was lower than in ours, which points to the need for vaccination campaigns and orientation in the workplace[19,22]. A favorable

Table 2. Characteristics of accidents involving biological materials among healthcare workers distributed per sex, Brazil, 2011 to 2015 (n=178,431).

	Female		Male		Total		p
	n	%	n	%	n	%	
Circumstances							
Surgical procedure	10,862	6.1	7,804	4.4	18,666	10.5	0.00
Intravenous medication administration	15,681	8.8	2,098	1.2	17,779	10	
Inadequate sharps disposal on benches/beds/ floor, etc.	11,793	6.6	1,809	1	13,602	7.6	
Arterial/venous puncture for blood sample collection	10,707	6	1,571	0.9	12,278	6.9	
Unspecified arterial/venous puncture	8,625	4.8	1,489	0.8	10,114	5.7	
Subcutaneous medication administration	8,537	4.8	1,175	0.7	9,712	5.4	
Intramuscular medication administration	8,262	4.6	1,087	0.6	9,349	5.2	
Dextro-test	8,023	4.5	927	0.5	8,950	5	
Other	63,367	35.5	11,470	6.4	74,837	41.9	
Unknown/not informed	2,545	1.4	599	0.3	3,144	1.8	
Total	148,402	83.1	30,029	16.8	178,431	100	
Agents							
Hollow-bore needles	88,044	49.3	14,551	8.2	102,595	57.5	0,00
Non-hollow-bore needles	12,460	7	4,108	2.3	16,568	9.3	
Blades/lancets (any type)	10,685	6	2,527	1.4	13,212	7.4	
Other	31,102	17.4	7,383	4.1	38,485	21.6	
Unknown/not informed	6,111	3.4	1,460	0.8	7,571	4.2	
Total	148,402	83.1	30,029	16.8	178,431	100	
Exposure							
Percutaneous							
Yes	110,621	62	21,990	12.3	132,611	74.3	0.00
No	29,166	16.3	6,218	3.5	35,384	19.8	
Unknown/not informed	8,615	4.8	1,821	1	10,436	5.8	
Total	148,402	83.1	30,029	16.8	178,431	100	
Mucous							
Yes	18,501	11.9	4,326	2.8	22,827	14.7	0.00
No	106,539	68.6	21,042	13.5	127,581	82.1	
Unknown/not informed	4,086	2.6	863	0.6	4,949	3.2	
Total	129,126	83.1	26,231	16.9	155,357	100	
Intact skin							
Yes	39,734	22.3	7,674	4.3	47,408	26.6	0.00
No	85,853	48.1	17,685	9.9	103,538	58	
Unknown/not informed	22,815	12.8	4,670	2.6	27,485	15.4	
Total	148,402	83.2	30,029	16.8	178,431	100	

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Table 2. Continuation.

	Female		Male		Total		p
	n	%	n	%	n	%	
Non-intact skin							
Yes	6,390	3.6	1,302	0.7	7,692	4.3	0.88
No	115,811	64.9	23,396	13.1	139,207	78	
Unknown/not informed	26,201	14.7	5,331	3	31,532	17.7	
Total	148,402	83.2	30,029	16.8	178,431	100	
Organic materials							
Blood	116,618	65.4	24,027	13.5	140,645	78.8	0.00
Bloody fluid	6,419	3.6	1,238	0.7	7,657	4.3	
Other	14,011	7.9	2,603	1.5	16,614	9.3	
Unknown/not informed	11,354	6.4	2,161	1.2	13,515	7.6	
Total	148,402	83.3	30,029	16.9	178,431	100	
Serologic testing-baseline							
Anti-HIV							
Positive	747	0.4	202	0.1	949	0.5	0.00
Negative	96,501	54.1	19,038	10.7	115,539	64.8	
Inconclusive	1,387	0.8	264	0.1	1,651	0.9	
Not performed	14,681	8.2	3,534	2	18,215	10.2	
Unknown/not informed	35,086	19.7	6,991	3.9	42,077	23.6	
Total	148,402	83.2	30,029	16.8	178,431	100	
HBsAg							
Positive	820	0.5	196	0.1	1,016	0.6	0.00
Negative	81,961	45.9	16,310	9.1	98,271	55.1	
Inconclusive	1,903	1.1	351	0.2	2,254	1.3	
Not performed	24,054	13.5	5,236	2.9	29,290	16.4	
Unknown/not informed	39,664	22.2	7,936	4.4	47,600	26.7	
Total	148,402	83.2	30,029	16.7	178,431	100	
Anti-HBs							
Positive	47,709	26.7	9,905	5.6	57,614	32.3	0.00
Negative	28,239	15.8	5,437	3	33,676	18.9	
Inconclusive	2,062	1.2	405	0.2	2,467	1.4	
Not performed	29,898	16.8	8,019	3.5	48,517	20.3	
Unknown/not informed	40,498	22.7	8,019	4.5	48,517	27.2	
Total	148,406	83.2	31,785	16.8	190,791	100	
Anti-HCV							
Positive	612	0.4	143	0.1	755	0.5	0.00
Negative	84,751	56.7	16,779	11.2	101,530	67.9	
Inconclusive	1,899	1.3	360	0.2	2,259	1.5	

Continue...

Table 2. Continuation.

	Female		Male		Total		p
	n	%	n	%	n	%	
Not performed	21,206	14.2	4,760	3.2	25,966	17.4	
Unknown/not informed	15,707	10.5	3,233	2.2	18,940	12.7	0.00
Total	124,175	83.1	25,275	16.9	149,450	100	
Known source patient							
Yes	114,358	64.1	24,002	13.5	138,360	77.5	
No	26,269	14.7	4,494	2.5	30,763	17.2	
Not informed	7,775	4.4	1,533	0.9	9,308	5.2	
Total	148,402	83.2	30,029	16.9	178,431	100	
Known source patient serologic testing							
Anti-HIV							
Positive	7,454	4.2	2109	1.2	9,563	5.4	
Negative	84,228	47.2	17619	9.9	101,847	57.1	
Inconclusive	648	0.4	151	0.1	799	0.4	0.00
Not performed	8,330	4.7	0,8	0.8	9,820	5.5	
Unknown/not informed	47,742	26.8	8660	4.9	56,402	31.6	
Total	148,402	83.3	28,539,8	16.9	178,431	100	
HBsAg							
Positive	1,090	0.6	268	0.2	1,358	0.8	
Negative	63,410	35.5	13,800	7.7	77,210	43.3	0.00
Inconclusive	1,618	0.9	313	0.2	1,931	1.1	
Not performed	23,834	13.4	4,596	2.6	28,430	15.9	
Unknown/not informed	58,450	32.8	11,052	6.2	69,502	39	0.00
Total	148,402	83.2	30,029	16.9	178,431	100	
Anti-HBs							
Positive	2,434	1.4	582	0.3	3,016	1.7	
Negative	43,119	24.2	9,006	5	52,125	29.2	
Inconclusive	1,642	0.9	315	0.2	1,957	1.1	0.00
Not performed	40,257	22.6	8,530	4.8	48,787	27.3	
Unknown/not informed	60,950	34.2	11,596	6.5	72,546	40.7	
Total	148,402	83.3	30,029	16.8	178,431	100	
Anti-HCV							
Positive	2,430	1.4	630	0.4	3,060	1.7	
Negative	62,638	35.1	13,597	7.6	76,235	42.7	0.00
Inconclusive	1,655	0.9	330	0.2	1,985	1.1	

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Table 2. Continuation.

	Female		Male		Total		p
	n	%	n	%	n	%	
Not performed	22,991	12.9	4,392	2.5	27,383	15.3	
Unknown/not informed	58,688	32.9	11,080	6.2	69,768	39.1	0.00
Total	148,402	83.2	30,029	16.9	178,431	100	
Measures at the time of accident							
Indication of chemoprophylaxis							
Not indicated	93,142	52.2	18,853	10.6	111,995	62.8	
Indicated	26,186	14.7	5,320	3	31,506	17.7	0.91
Unknown	29,074	16.3	5,856	3.3	34,930	19.6	
Total	148,402	83.2	30,029	16.9	178,431	100	
Refusal							
Yes	1,096	0.6	216	0.1	1,312	0.7	
No	93,926	52.6	18,782	10.5	112,708	63.2	0.04
Unknown	53,380	29.9	11,031	6.2	64,411	36.1	
Total	148,402	83.1	30,029	16.8	178,431	100	
Victim's hepatitis B vaccination status (3 doses)							
Yes	130,119	72.9	25,704	14.4	155,823	87.3	0,00
No	7,294	4.1	1,643	0.9	8,937	5	
Unknown	10,989	6.2	2,682	1.5	13,671	7.7	0,00
Total	148,402	83.2	30,029	16.8	178,431	100	
Progression							
Discharge with serologic conversion	1,263	0.7	247	0.1	1,510	0.8	
Discharge without serologic conversion	31,263	17.5	5,534	3.1	36,797	20.6	
Discharge because source negative	48,242	27	10,484	5.9	58,726	32.9	
Dropout	14,790	8.3	3,276	1.8	18,066	10.1	0.00
Death by accident involving biological material	8	0	3	0	11	0	
Death by other cause	18	0	7	0	25	0	
Unknown/not informed	52,818	29.6	10,478	5.9	63,296	35.5	
Total	148,402	83.1	30,029	16.8	178,431	100	
WAR issuance							
Yes	77,471	43.4	13,600	7.6	91,071	51	
No	20,170	11.3	4,753	2.7	24,923	14	
Not applicable	4,454	2.5	1,607	0.9	6,061	3.4	0.00
Unknown/not informed	46,307	26	10,069	5.6	56,376	31.6	
Total	148,402	83.2	30,029	16.8	178,431	100	

HIV: human immunodeficiency virus; HBsAg: hepatitis B surface antigen; anti-HBs: hepatitis B surface antibody; HCV: hepatitis C virus; WAR: Work Accident Report form.

vaccination status might also be related to the quality of pre-employment and periodic medical examinations.

Also the number of source patients in conditions to spread HBV, HCV and HIV is particularly relevant as a function of the epidemiological significance of this aspect. In addition to acute and chronic hepatitis, these viruses are the main risk factors for severe forms of liver disease, such as hepatocellular carcinoma[25]. This tumor accounts for up to 85% of the primary liver neoplasms and is characterized by high aggressiveness and mortality,

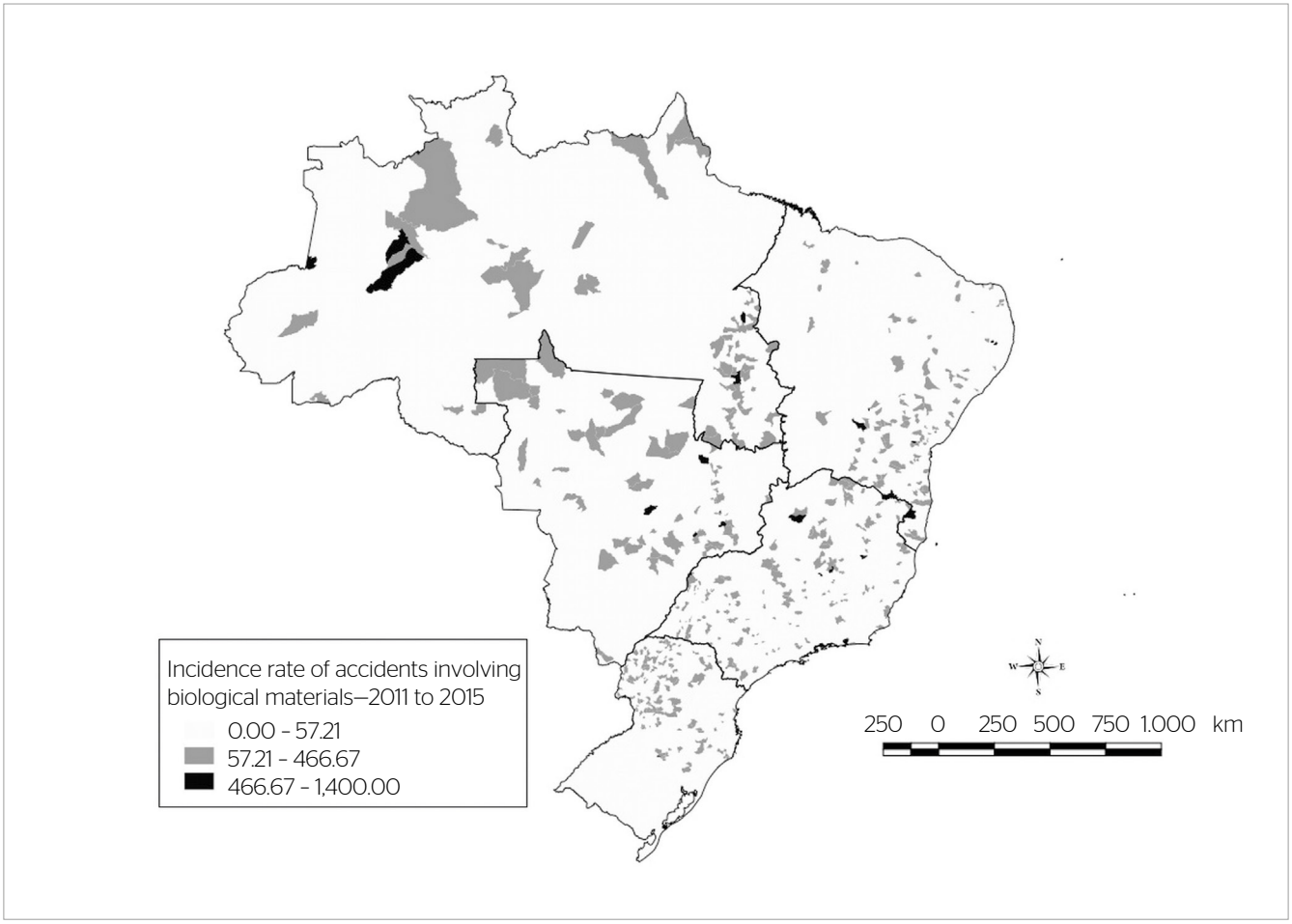

Figure 1. Incidence of accidents involving biological materials among healthcare workers, Brazil, 2011 to 2015 (n=178,431).

Table 3. Information on variable "municipalities where work accidents involving biological materials were reported" per Brazilian region, Brazil, 2011-2015 (n=178,431).

	Not informed	%	informed	%	Total
North	179	40	271	60	450
Northeast	993	55	801	45	1,794
Southeast	385	23	1,283	77	1,668
South	394	33	797	67	1,191
Central-West	144	31	323	69	467
Total	2,095	38	3,475	62	5,570

being described by the World Health Organization (WHO) as the second cause of death by cancer among humans worldwide[26].

The frequency of WAR issuance was low compared to that reported in other studies. However, one should bear in mind that WAR are only issued for employees under the Consolidation of Labor Laws regime and not for civil servants.

Aspects such as dismissal of minor injuries, knowledge of the serologic status of the source patient, excessive bureaucratic requirements to fill WAR forms or making merely verbal or informal reports of events[27] contribute to the underreporting of accidents[11]. Other factors which contribute to this situation are fear of losing the job or of criticism for failing to adopt adequate practices and lack of training[21,28].

Yet, reporting accidents has paramount importance, since high-quality information likely to enable identifying the most exposed groups, also geographically, is the basis for surveillance actions leading to the formulation of strategies to ensure the safety of workers[12-14,29]. Within this context, it is worth bearing in mind that in addition to victims, work accidents might be also reported at any time to the Social Security Administration by their family, trade unions, physicians or public authorities, and that employers are liable to fines in case of non-compliance[30].

One further aspect deserving of attention is the information on the municipality in which accidents were reported, which was provided for 60% of the events only. Given the current underreporting rate, the map we plotted should be seen cautiously[10,20]. Underreporting is further suggested by the small number of accidents reported all across Brazil along a period of five years.

Identifying the most exposed groups and the circumstances under which accidents involving biological materials occur is crucial from both the epidemiological and prevention perspectives. However, more thorough knowledge is needed about the determinants of such accidents for the purpose of strengthening occupational health surveillance.

According to Jackson Filho et al.[31] the vast majority of the analyses of work accidents in Brazil are based on the notions of "unsafe act" and "human error," which reproduce the hegemonic methods predominantly applied to their elucidation. As a result, judicialization evolves within the same framework as that of elucidation, with negative impact on the victims' lives.

Vilela et al.[29] observed that maintaining the model imposed *a priori* by authoritarian labor relations seeks to protect the employer — a condition also emphasized at the time of hiring the safety staff, which thus has no autonomy to influence the selection of protective measures for employees[29]. Still according these authors[29] this model suffices to "exculpate" employers and thus it contributes to law-protected impunity vis-à-vis work accidents.

This is context within which the Unified Health System (Sistema Único de Saúde–SUS) — here represented by occupational health surveillance — should consolidate its role of agency responsible for linking different sectors together for the surveillance of and interventions in healthcare processes and work environments to eradicate determinants of health problems among the working population. Strengthening occupational health surveillance is crucial to break the illness-disease cycle within the world of work. Much beyond merely collecting and systematizing information, occupational health surveillance should be understood as the integration of knowledge and practices relative to health problems derived from work-related processes, environments and conditions. As such, its actions should represent transforming interventions[32].

The participation of workers in the formulation of risk maps and workplace accident prevention and health promotion programs has paramount importance. Flor and Kirchhof[33] call the attention to the relevance of developing worker health protection instruments with consideration of all the involved factors, i.e. not only of the technical-scientific knowledge of experts, but also of the knowledge and experience of workers, in a way that from mere passive claimers they become active agents able to effectively interfere with their work environment[34].

CONCLUSION

In the present study, we were able to identify groups of workers at higher risk for accidents involving biological materials and to characterize such events. In regard to the quality of the information, data were missing for several relevant variables, such as site of notification, circumstances under which accidents took place, case progression and WAR issuance. This situation is the result of flaws in the surveillance mechanisms, which are responsible for the quality of the information from collection to divulgation. Poor quality

data mean incomplete or biased information and in last instance lead to wrong decisions and implementing inadequate measures.

In regard to the determinants of accidents, their origins need to be approached from a systemic perspective seeking to understand the functional characteristics of systems instead of a narrow focus on cause-effect relationships[35,36].

The results of the present study point to the need for institutional recognition of the relevance of the surveillance of accidents involving biological materials as grounds for effective changes in work processes through formative interventions[36]. In addition to mandatory, designing and implementing preventive programs to ensure the physical integrity of healthcare professionals is an urgent need. Effective formulation of such programs should include continuous training, discussion and participation of the involved parties to achieve a positive impact.

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