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ORIGINAL ARTICLE

Exposure to biological materials: work accidents among health professionals in the state of Pernambuco

Exposição a materiais biológicos: acidentes de trabalho entre os profissionais e saúde do estado de Pernambuco

Exposición a materiales biológicos: accidentes laborales entre profesionales de la salud en el estado de Pernambuco

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ABSTRACT

Justification and Objectives: The impacts of work accidents cause avoidable risks to workers' health. Thus, the aim of this study was to describe accidents caused by the exposure to biological materials that occur among health professionals. **Methods:** This is an epidemiological, cross-sectional and descriptive study, with bivariate distribution analysis of secondary data on personal characterization, accident characteristics and outcome, provided by the Information System for Notifiable Diseases of the state of Pernambuco, Brazil, from 2014 to 2016. The population consisted of all cases of work accidents involving health service professionals. The analysis was performed using descriptive statistics and chi-square test to compare the percentage proportions of each variable group, chi-square test was also used for independence, using the software Statistical Package for Social Science. **Results:** Among the 4,260 notifications, the prevalent profile of the analyzed sample was female professionals (83.53%), with technical training level (62.21%), whose predominant route of exposure to accidentswas percutaneous (75.0%) and the main causal agent was the lumen needle (56.1%). Regarding the outcome of the cases, 61.3% were closed without registering the information. Regarding bivariate distributions, percutaneous exposures and intact skin presented the worst outcome (seroconversion), 22 and 10 cases, respectively. **Conclusion**: Based on the obtained results, the flaws in the process of notification and monitoring of work accidents in Pernambuco are clear. The high and stable number of cases in all surveyed years indicates the need to improve strategies that involve accident prevention and continuous surveillance in health services.

Keywords:*Work accidents. Work hazards. Work exposure. Epidemiology.*

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RESUMO

Justificativa e Objetivos: Os impactos resultantes dos acidentes ocupacionais provocam riscos evitáveis à saúde dos trabalhadores. Dessa forma, o objetivo deste estudo foi descrever os acidentes de trabalho por exposição a materiais biológicos que ocorrem entre profissionais da área de saúde. **Métodos:** Trata-se de estudo epidemiológico, transversal e descritivo, com análise de distribuição bivariada dos dados secundários acerca da caracterização pessoal, das características do acidente e do desfecho, fornecidos pelo Sistema de Informação de Agravos de Notificação do estado de Pernambuco, Brasil, no período de 2014 a 2016. A população foi composta por todos os casos de acidente de trabalho envolvendo profissionais dos serviços de saúde. A análise foi realizada mediante estatística descritiva e teste qui-quadrado para comparar as proporções percentuais de cada grupo de variável, assim como por teste qui-quadrado para independência, por meio do software Statistical Package for Social Science. **Resultados:** Entre as 4.260 notificações, o perfil prevalente da amostra analisada foi o de profissionais do sexo feminino (83,53%), com nível de formação técnica (62,21%), cuja via preponderante de exposição aos acidentes foi a percutânea (75,0%) e o principal agente causal a agulha com lúmen (56,1%). Em relação ao desfecho dos casos, 61,3% foram fechados sem registro da informação. Quanto às distribuições bivariadas, as exposições por via percutânea e pele íntegra apresentaram pior desfecho (soroconversão), 22 e 10 casos, respectivamente. **Conclusão**: A partir dos resultados obtidos, evidenciam-se falhas no processo de notificação e acompanhamento dos acidentes de trabalho em Pernambuco, além de valores elevados e semelhantes de casos em todos os anos pesquisados, indicando a necessidade de aprimorar as estratégias que envolvem prevenção de acidentes e vigilância contínua nos serviços de saúde.

Descritores: *Acidentes de Trabalho. Riscos Ocupacionais. Exposição Ocupacional. Epidemiologia.*

RESUMEN

Justificación y objetivos: Los impactos derived de los accidentes laborales provoca riesgos evitables para la salud de los trabajadores. El objetivo de este estudio fue describir los accidentes laborales con exposición a materiales biológicos entre los profesionales de la salud. **Methods:** This is an estudio epidemiológico, transversal, descriptivo con análisis de distribución bivaria de datos secondary sobre caracterización personal, características del accidente y el denolace, proporcionado por el Sistema de Información de Enfermedades Notificables del estado de Pernambuco, Brasil, en el período 2014 a 2016. La población estuvo compuesta por todos los casos de accidentes laborales que involucraron a profesionales de los servicios de salud. El análisis se realizó using estadística descriptiva y la prueba de Chi-cuadrado para com com com las provideees porcentuales de cada grupo de variables, así como las pruebas de Chi-cuadrado para la independencia utilizing el software Statistical Package for Social Science. **Resultados:** De las 4.260 notificaciones, el perfil prevalente de la muestra analizada fue el de mujeres profesionales (83,53%), con nivel de formación técnica (62,21%), en las que la vía de exposición a accidentes prevalente fue la percutánea (75,0%), y el agente causal lumen aguja (56,1%). En relación al denolace de los casos, el 61.3% se cerraron sin registrar la información. En cuanto a las distribuciones bivarias, las exposiciones percutáneas y la piel intacta presentaron peor evolución (seroconversión), con 22 y 10 casos, respectively. **Conclusión:** Con base en los resultados obtenidos, se evidencian fallas en el proceso de notificación y seguimiento de accidentes laborales en Pernambuco, además de altos valores y similares casos en todos los años encuestados, lo que indica la necesidad de mejorar las estrategias de prevención de accidentes y vigilancia continua en los servicios de salud.

Palabras clave: *Accidentes of Trabajo. Riesgos laborales. Profesional Exposición. Epidemiología.*

INTRODUCTION

Work Accidents represent a public health problem with negative impact on the productivity of workers and health institutions, resulting in economic losses, in addition to personal, social and health repercussions for the injured professionals. Risk activity is characterized as being capable of causing damage, bodily injury, temporary or permanent changes in capacity, diseases or even the death of workers.[1,2]

Worldwide, the International Labour Organization (ILO) estimates that 317 million work accidents happen annually. Around 2.02 million deaths are caused by work-related illnesses. Work accidents alone cause 321 thousand deaths per year.[3]

According to the World Health Organization (WHO), health professionals suffer 3 million percutaneous exposures to pathogens that cause hepatitis and human immunodeficiency virus (HIV). After the exposure, the risk of acquiring HIV is approximately 0.3%, a higher rate when it comes to hepatitis B virus (40%) and hepatitis C (on average 1.8%).[4] The findings are reflected by the increase in the number of deaths, in the expenses with hospitalizations and in the granting of accident benefits.

In 2002, the National Network of Integrated attention to Workers' Health (Renast) was created in Brazil, which disseminates actions aimed at workers' health integrated into the service network of the Unified Health

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System (SUS), through Workers' Health Reference Centers (Cerest). It is a national network with the purpose of programming care actions, health surveillance, prevention and promotion for workers through health practices and information.[5] In the national scenario, from 2009 to 2018, 752,777 cases of severe and fatal work accidents were recorded in the Notifiable Diseases Information System(Sinan). The country ranks 4th in the world in fatal accidents.[6]

In health services, the risk of work accidents with contaminated biological material transmitted by organic fluids results from injuries caused by sharp materials or direct contact with the skin or mucous membranes. This is how workers – such as cleaning workers, interns, technical level professionals, residents, nurses and physicians – are exposed.[7, 8]

To prevent risk exposure, biosafety measures are established to avoid, control and minimize the consequences of these events, providing a comfortable and safe work environment.[9] Despite these efforts, work accidents are still a frequent and notifiable problem. Thus, health service professionals should know how to prevent accidents, which can be avoided usingcollective andPersonal Protective Equipment(PPE), as well as by complying with regulatory standards and precautions regarding risk exposure in the performed activities.

Work accidents cause avoidable risks to workers' health. So, the aim of this study was to describe accidents caused by the exposure to biological materials that occur among health professionals.

METHODS

This is an epidemiological and descriptive study, with cross-sectional design andusing secondary data, with bivariate distribution analysis and quantitative approach of the Sinan database, regarding the notified cases by the State Department of Health of Pernambuco.

The population of the study consisted of all reported cases of work accidents involving health service professionals, according to the Brazilian Classification of Occupations (CBO), between 2014 and 2016.

Data collection was performed in March and April 2018 with the sociodemographic characterization survey, characterization of the accident with biological material (type of exposure, organic material, circumstance of the accident, agent) and the outcome of the follow-up of each closed case in the system.

To analyze the data, a Microsoft Excel spreadsheet bank was built, which was exported to the SPSS software, version 20. For the sample profile data, the frequencies were calculated and the respective distributions of the percentages were constructed, as well as the comparisons between each variable using the chi-square test (X^2), in order to perform proportion comparison.

To evaluate the distribution between the variables, bivariate analysis was used to construct contingency tables (double-entry table), applying the chi-square test for independence, with a5% significance level for Pearson's and Fisher's exact tests.

This study was conducted in accordance with Resolution No. 466/2012 of the National Health Council and approved by the Research Ethics Committee of the Oswaldo Cruz/Procape Hospital Complex, with CAAE no. 87541618.9.0000.5192 and process no. 2,705,163, according to the guidelines and regulatory standards of research involving human beings.

RESULTS

Among the 4,260 notifications in Sinan of work accidents due to exposure to biological material that occurred between 2014 and 2016,the majority of them involved females (83.5%), with upper secondary education (51.2%) and professionals of technical level (66.7%), with significant difference between these variables (Table 1).

Table 1. Distribution of characterization variables of work accident cases with exposure to biological material among health professionals. Recife (PE), Brazil, 2014 to 2016.

Variables	N	%	p-value
Year of notification			
2014	1,416	33.2	0.482[1]
2015	1,390	32.6	
2016	1,454	34.1	
Sex			
Female	3,558	83.5	<0.001[1]
Male	702	16.5	
Education level			
Upper Secondary Education	2,182	51.2	<0.001[1]
Higher Education	1,187	27.9	
Unfinished higher education	216	5.1	
Omitted/ignored	675	15.8	
Instructional level			
Technician	2,842	66.7	<0.001[1]
Graduate	1,235	29.0	
Elementary/ High School	183	4.3	
Total	4,260	100.0	

[1]*p-value of chi-square test (X^2) for comparison of proportion.*

Most exposures occurred through lumen needles (56.1%), with skin perfusion (75%), without mucosal exposure (69.7%), intact skin (45.4%) and from negative source patients (27.4%), with significant difference between these variables (Table 2).

Table 3 shows the distribution of the predictor variables of the study, according to the evolution registered in the system, indicating that the highest prevalence of worse outcomes is related to cutting devices, such as lumen needles, slides, lancets and glasses. It also indicates that intact skin and percutaneous exposures are more frequent among the worst outcomes.

Schoolingwas statistically different in relation to mucosal and intact skin exposure, especially in the technical level. Regarding the causal agent of the accident, all exposures showed statistical difference for lumen needle

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Table 2. Distribution of variables related to work accidents among health professionals. Recife (PE), Brazil, 2014 to 2016.

Variables	N	%	p-value
Type of Exposure			
Lumen needle	2,390	56.1	<0.001[1]
Glass /blade/lancet /other	1,028	24.1	
Needle without lumen	474	11.1	
Intracath	30	0.7	
Omitted/ignored	338	7.9	
Percutaneous exposure			
Yes	3.195	75.0	<0.001[1]
No	705	16.5	
Omitted/ignored	360	8.5	
Mucous membrane exposure			
Yes	434	10.2	<0.001[1]
No	2,968	69.7	
Omitted/ignored	858	20.1	
Intact skin exposure			
Yes	1,933	45.4	<0.001[1]
No	1,558	36.6	
Omitted/ignored	769	18.1	
Non-intact skin exposure			
Yes	200	4.7	<0.001[1]
No	3,122	73.3	
Omitted/ignored	938	22.0	
Evolution			
Source patient negative	1,168	27.4	<0.001[1]
Medical release without serological conversion	441	10.4	
Medical release with serological conversion	26	0.6	
Abandonment	14	0.3	
Death from other cause	1	0.0	
Omitted/ignored	2.610	61.3	
Total	4,260	100.0%	

[1]p-value of chi-square test (X^2) for comparison of proportion.

(percutaneous, intact skin and non-intact skin) and lamina, lancet, glass and/or others with mucosal exposure (Table 4).

DISCUSSION

The data of this study indicate that exposure to contaminated biological materials in the work activities of health professionals is a worrying factor, whose higher records occur by percutaneous exposure, with 75% of occurrences, mainly at the technical level – 66.7% of the affected professionals, mainly females, 83.5%.

The professionals who were most exposed to biological accidents, according to this study, were those of technical level, similarly to other Brazilian regions,[10] as well as Serbia,[11] Tanzania[12] and Iran,[13] with emphasis on the greater exposure of females. Historically, nursing is linked to women due to the responsibility of care being usually related to the female figure.[14] Thus, the number of accidents in health service institutions is influenced by the sex factor, following, in this sense, the worldwide trend of feminization in health services.

Another relevant factor related to the high exposure of professionals of technical level is the fact that they are the most present in health services and assume a large part of the provision of direct care to patients.[2] The work process of this level of formation includes invasive procedures, with manipulation of objects that can cut and pierce, associated with the presence of blood and body fluids, justifying the great occurrence of accidents with organic material in the category.

The circumstances that may cause accidents are associated with unhealthy work environment, tiredness,

Table 3. Distribution of variables related to the evolution of cases of work accidents among health professionals. Recife (PE), Brazil, 2014 to 2016.

Variables	Medical release with conversion n (%)	Medical release without conversion n (%)	Patient source negative n (%)	Abandonment n (%)	p-value
Occupation					
Graduate	11(2.2)	122(24.8)	354(72)	5 (1)	0.070[1]
Technician	14(1.3)	299(27.3)	776(70.7)	8 (0.7)	
Elementary/ High School	1(1.6)	20(32.8)	38(62.3)	1(1.6)	
Agents					
Lumen needle	13(1.3)	250(25.4)	713(72.3)	10(1.0)	0.026[2]
Needle without lumen	5 (2.9)	40(23.4)	126(73.7)	0(0.0)	
Intracath	0 (0.0)	8 (66.7)	4 (33.3)	0 (0.0)	
Blade/Lancet/Glass/Others	7(1.8)	119 (30.1)	267(67.6)	2 (0.5)	
Percutaneous exposure					
Yes	22(1.8)	296(24.5)	877(72.7)	11(0.9)	0.020[1]
No	2(0.6)	107(32.2)	220(66.3)	3(0.9)	
Mucous membrane exposure					
Yes	2(1.1)	46(25.8)	128(71.8)	2(1.1)	0.814[2]
No	20(1.7)	289(24.0)	887(73.6)	9(0.7)	
Intact skin exposure					
Yes	10(1.2)	190(22.6)	635(75.7)	4(0.5)	0.007[1]
No	12(2.1)	165(28.7)	390(67.9)	7(1.2)	
Non-intact skin exposure					
Yes	0(0.0)	23(35.4)	42(64.6)	0(0.0)	0.201[2]
No	21(1.6%)	308(23.8)	954(73.3)	11(0.9)	

[1]p-value of the Pearson's chi-square test (X^2); [2]p-value of fisher's exact test.

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Table 4. Case distribution of work accidents according to type of exposure among health professionals. Recife (PE), Brazil, 2014 to 2016.

Evaluated Factor	Type of Exposure			
	Percutaneous n (%)	Mucous membrane n (%)	Intact skin n (%)	Non-intact skin n (%)
Occupation				
Graduate	910(28.5)	149(34.3)	536(27.7)	58(29.0)
Technician	2,154(67.4)	253(58.3)	1,323(68.4)	130(65.0)
Elementary/ High School	131(4.1)	32(7.4)	74(3.8)	12(6.0)
Total	3,195(100)	434(100)	1,933(100)	200(100)
p-value	<0.078[1]	<0.001[1]	<0.033[1]	<0.599[1]
Agent				
Lumen needle	2.122(70.4)	39(10.3)	1,165(63.9)	100(54.9)
Needle without lumen	361(12.0)	08(2.1)	243(13.3)	18(9.9)
Intracath	23(0.8)	02(0.5)	12(0.7)	00(0.0)
Blade/Lancet/Glass/Others	510(16.9)	329(87.0)	402(22.1)	64(35.2)
Total	3,016(100)	378(100)	1,822(100)	182(100)
p-value	<0.001[1]	<0.001[1]	<0.001[1]	<0.011[1]

[1]*p-value of the Pearson's Chi-square test.*

excessive workload, stress, lack of compliance with standards, malpractice, incorrect or insufficient instructions, failures in supervision and guidance, non-use of PPE, improper disposal of sharp materials, venous puncture, medication administration, blood collection, devices without safety guidelines, among others.[15,16]

Providing a healthy environment, with adequate furniture, equipment and physical areas that ensure the safety of professionals and patients helps the operationalization of the work process and, consequently, reduces the risks and exposure of the health team.[1]

Another point that deserves to be emphasized is the psychosocial organizational risk of working conditions, for example: interpersonal conflict, work stress, emotional exhaustion, conflict in job functions, overload and low pay. Publications on this theme show that these factors increase the probability of harm to professionals. Thus, psychological support helps reduce work accidents and, when present in the routine of professionals, has led to significantly less exhaustion, dissatisfaction and intention to leave the profession.[1,17,18]

In this context, it is necessary to adopt institutional strategies with the objective of offering better working conditions to the multidisciplinary team in the health system[1]. Therefore, strengthening educational actions in the work place is essential. These actions would be the foundation of injury prevention and reduction of new work accidents.

Regarding the type of exposure, data show that 75% of the professionals were exposed to percutaneous accidents, with a higher prevalence (73.4%) of blood contact. In agreement with our data, a study conducted in three public hospitals in Tanzania revealed a prevalence of work accidents caused by percutaneous exposure and, in cases involving biological material, blood presented a higher risk of exposure.[19] A similar study conducted in Ethiopia showed significant exposure of professionals through sharp materials, most of which were needle injuries.[20]

It is worth mentioning that needles are the causal agents of a relevant number of accidents and the instruments that most contribute to percutaneous accidents. Thus, an alternative to be implanted in health services is the use of devices with safety locks to reduce the risks involving sharp objects, to avoid or decrease the exposure of health professionals to pathogens transmitted by blood.[21]

In this scenario, we note the importance of PPE. They should be adequately and sufficiently provided by the health service to minimize the damage and suffering of health professionals when performing their duties, so that they represent a protective barrier to the worker and reduce risk exposure.[2]

In addition, in the field of health surveillance, incompleteness and inconsistencies in the data in the records are observed, which causes avoidable mistakes in the construction of epidemiological indicators to portray the health situation of injured workers. This is possibly justified by the inefficiency of protocols and insufficient training, as well as the impact of work accidents. Besides, the exposed professionals do not seekmedical care, due to personal guilt and the embarrassment of declaring the accident, as well as the fear of the direct or indirect negative consequences inherent to the exposure.[13, 22]

A relevant point for the discussion is the underreporting of work accidentswith biological materials in the health care scenario. Some professionals neglect the act of notifying: they believe that they "waste" time because of the bureaucratic and administrative process, which hinders the complete notification of this problem and the knowledge of the real dimension of the event in the worker's health.

Underreporting reflects latent errors in surveillance systems and poses threats to accident prevention in health environments. It occurs because of difficulties in filling out the form and in deepening epidemiological research, so it is necessary to change the values in the reports for organizational improvement of safety and greater awareness. Thus, the importance of strengthening the training processesis reinforced, through permanent health edu-

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cation actions.[23]

In registered notifications there is a gap that deserves a specialized evaluation, necessary to accomplish and qualify the registration process, so that it provides a situational panorama of labor events for better decision-making and consequent elaboration of public policies that ensure workers' rights and decent working conditions.

A limitation that can be pointed out in this study is related to the descriptive design that does not allow analyzing associations of cause and effect between the variables, even though it allows the identification of exposure risks of professionals to work accidents. Another obstacle of the study refers to underreporting, which negatively impacts the planning of strategic actions by managers.

We suggest, then, the implementation of permanent education programs in the health service environment, providing training to professionals, aiming at the effective practice of management and separation of sharp objects, the use of PPE, work accidents communication and registration documents related to them, such as medical records and notification forms.

Thus, we expect to contribute to the awareness of the need for control and prevention of these accidents, as well as the construction of knowledge in the area, inciting studies related to the quality of notifications records of work accidents.

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AUTHOR'S CONTRIBUITION

Evelyn Maria Braga Quirino e Izabella Karla Lopes deAndradeparticipated in the conception, planning, design, analysis and writing of the article; **Morgana Cristina Leôncio de Lima, Clarissa Mourão Pinho**, **Mônica Alice Santos da Silva e Cynthia Angelica Ramos de Oliveira Dourado** participated in the analysis and interpretation of the data, critical review and writing of the text; **Maria Sandra** participated in the design, conception, analysis and interpretation of the article and critical review.

All authors approved the final version of the manuscript and declared themselves responsible for all aspects of the work, guaranteeing their accuracy and integrity.

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