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Accidents with biological material: An analysis with Nursing professionals

Acidentes com material biológico: uma análise com profissionais de enfermagem

Accidentes con material biológico: un análisis con profesionales de Enfermería

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Abstract: Objective: to analyze the accidents involving biological material that occurred with Nursing professionals in Paraná in 2016. **Method:** a cross-sectional study carried out in October 2018 with data provided by the State Center for Workers' Health of Paraná. Descriptive analyses were used and, for the associations, the chi-square test ($p<0.05$) was employed. **Results:** a total of 2,436 cases of accidents in the Nursing team were analyzed, of which 1,974 were recorded among technicians and assistants. There was predominance of accidents in women, aged between 30 and 49 years old. The most frequent kind of exposure was percutaneous, the most reported circumstances were related to the puncture or administration of intravenous medication, and a significant reduction in the use of personal protective equipment was observed with increasing age among mid-level professionals. **Conclusion:** the need to develop strategies aimed at the permanent education of these professionals was evidenced to ensure prevention of accidents and/or occupational diseases.

Descriptors: Biological Accident; Occupational Accidents Registry; Biological Factors Occupational Health; Nursing

Resumo: Objetivo: analisar os acidentes com material biológico ocorridos com profissionais de enfermagem no Estado do Paraná em 2016. **Método:** estudo transversal realizado em outubro de 2018 com dados disponibilizados pelo Centro Estadual de Saúde do Trabalhador do Paraná. Utilizaram-se análises descritivas e, para as associações, o teste de qui-quadrado ($p<0,05$). **Resultados:** foram analisados 2.436 casos de acidentes na equipe de enfermagem, dos quais 1.974 registrados entre técnicos e auxiliares. Houve predomínio dos acidentes em mulheres, na faixa etária de 30 a 49 anos. A forma de exposição mais frequente foi a percutânea, as circunstâncias mais referidas foram relacionadas à punção ou administração de medicação endovenosa e observou-se redução significativa do uso de equipamento de proteção individual conforme o aumento da idade, entre profissionais do nível médio. **Conclusão:** evidenciou-se a necessidade de elaboração de estratégias voltadas à educação permanente desses profissionais para garantir a prevenção de acidentes e/ou doenças ocupacionais.

Descritores: Acidente biológico; Notificação de acidentes de trabalho; Fatores biológicos; Saúde do trabalhador; Enfermagem

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Resumen: **Objetivo:** analizar los accidentes con material biológico ocurridos con profesionales de Enfermería en el estado de Paraná en el año 2016. **Método:** estudio transversal realizado en octubre de 2018 con datos puestos a disposición por el Centro Estatal de Salud Laboral de Paraná. Se utilizaron análisis descriptivos y, para las asociaciones, la prueba de chi-cuadrado ($p<0,05$). **Resultados:** se analizaron 2436 casos de accidentes en el equipo de Enfermería, de los cuales 1974 se registraron entre técnicos e auxiliares. Hubo predominio de accidentes en mujeres, en el grupo etario de 30 a 49 años. La forma de exposición más frecuente fue la percutánea, las circunstancias más mencionadas estuvieron relacionadas con la punción o administración de medicación endovenosa y se observó una significativa reducción en el uso de equipos de protección personal a medida que aumentó la edad de los participantes, entre profesionales de nivel medio. **Conclusión:** se hizo evidente la necesidad de elaborar estrategias dirigidas a la educación permanente de estos profesionales para garantizar la prevención de accidentes y/o enfermedades laborales.
Descriptores: Accidente Biológico; Notificación de Accidentes del Trabajo; Factores Biológicos; Salud Laboral; Enfermería

Introduction

Occupational accidents encompass all events involving workers without an exact location and can occur in the company or during the commute. Accidents with biological material, in turn, are more frequently among health professionals, mainly in nurses and nursing technicians and assistants, due to their prolonged permanence in the health institutions.[1-2] It is an unexpected contact with organic fluids, among which blood, amniotic fluid and semen stand out, among others.[3]

The most common exposure routes are non-intact skin, mucosa or percutaneously. After contact with biological material, the individual is exposed to countless pathogens that present epidemiological relevance for causing serious diseases, mainly Hepatitis B, Hepatitis C and Acquired Human Immunodeficiency Syndrome (AIDS), transmitted by HIV.[1,4]

It is possible to identify that the most frequent types of accidents among Nursing professionals happen with sharps, followed by contact with the patient's blood. The most frequent moments for accidents to occur are during venous or arterial puncture and disposal of syringes and needles.[5]

Among the main prevention and control measures, the requirement to use Personal Protective Equipment (PPE) and Collective Protection Equipment (CPE) stands out, which must be employed according to the workplace and the function performed.[2] However, lack of knowledge about the real importance of using PPE is also a factor for the occurrence of accidents.[6]

Even in the face of negligence in the use of PPE by many professionals, it is possible to identify that gloves are still some of the equipment most frequently used by workers; however, adherence to practices that require their use does not reach all professionals. Another problem identified concerns other protective equipment, such as an apron, boots or adequate shoes, mask, glasses and face protection.[7]

Notification of the accident and proper completion of the Work Accident Communication (WAC) protocol are important so that the injured person is properly assisted and receives the rights that suit him at this time.[2] However, some factors contribute to underreporting of accidents, for example, not deeming it necessary to inform them, excessive bureaucracy, lack of knowledge and, often, considering the accident to be of low risk.[3-4]

As provided for in Ordinance No. 777, of April 28th, 2004, accidents with potentially contaminated biological material correspond to a compulsory notification problem, and the Compulsory Notification Instrument is the Notification Form, which is standardized by the Ministry of Health and made available in the Notification Disease Information System (*Sistema de Informação de Agravos de Notificação*, SINAN-NET).[8] The state of Paraná presents a growing number of accidents with biological material notified to the SINAN between 2006 and 2015,[9] so that it is relevant to know the profile of the professionals involved and the prevalence of the events.

The members that make up the Nursing team are constantly exposed to the occurrence of work accidents. One of the factors due to which accidents occur is high workload, which generates physical and mental wear out and makes workers vulnerable and susceptible to accidents.[4-5]

Lack of knowledge regarding the use of PPE causes harms to the worker's health. Thus, the choice of this topic is justified by the importance of characterizing the profile of the professionals who suffer accidents with biological material, thus making it possible to identify the main factors and materials that lead to the accident, which assists in the planning of strategies for

the prevention of injuries. In this aspect, the study aimed at analyzing the accidents involving biological material that occurred in 2016 with Nursing professionals in Paraná.

Method

This is an analytical and cross-sectional study with secondary data from the information and situation analysis section of the State Center for Occupational Health (*Centro Estadual de Saúde do Trabalhador*, CEST) of Paraná, which is organized in a statewide CEST, installed in Curitiba and in eight Macro-regional Reference Centers in Occupational Health (*Centros de Referência em Saúde do Trabalhador Macrorregionais,* CEREST-MR), distributed among the 22 Regional Health areas in the state.[9]

The material used to carry out this study comes from the SINAN and was provided by the General Coordination of Occupational Health and by the Health Surveillance Secretariat of the Ministry of Health (*Coordenação Geral de Saúde do Trabalhador/Secretaria de Vigilância em Saúde do Ministério da Saúde,* CGSAT/SVS/MS), through the Collaborating Center for the Surveillance of Work Accidents at the Collective Health Institute of the Federal University of Bahia.[10]

Initially, the file on accidents with biological materials that occurred in Paraná in 2016 was downloaded. Such collection took place in October 2018. Subsequently, the data were selected and saved in a Microsoft Excel® spreadsheet, in which the variables of interest for analysis were selected. In this study, the following variables were presented: gender, age, situation in the labor market, type of exposure suffered, organic material handled, circumstances of the accident, causative agent of the accident, use of PPE, indication of chemoprophylaxis, vaccination status, source patient, evolution and issuance of WAC.

To perform the statistical analyses, the available data were typed into the Microsoft Office Excel® program and later analyzed using the Statistical Package for Social

Sciences (SPSS) software, version 20.0. Descriptive analyses were performed with presentation of absolute and relative frequencies. For the association analyses, the chi-square test was used and a significance level of 5% ($p<0.05$) was adopted. As this is a research with secondary data available at an electronic address, approval by the Ethics Committee for Research with Human Beings was not required.

Results

A total of 2,436 cases of accidents involving biological material with Nursing professionals in Paraná, notified to the SINAN in 2016, were analyzed, with a total of 51.9% of the notified cases.

The distribution of these cases among Nursing professionals shows that there were 462 cases in nurses and 1,974 cases in nursing technicians/assistants. The nurses' mean age was 32.2 years old, and the standard deviation was 8.1. The mean age of the nursing technicians/assistants was 36.5 years old, with a standard deviation of 10.1. There was predominance of accidents in females, aged between 30 and 49 years old and in workers with a formal contract (Table 1).

Table 1 – Distribution of the sociodemographic variables and situation in the labor market among nurses and nursing technicians/assistants who had an accident with biological material notified to the SINAN in Paraná, 2016.

Variables	Nurses (N=462)		Nursing Technicians/ Assistants (N=1,974)	
	N	%	N	%
Gender				
Female	409	88.7	1,773	89.8
Male	52	11.3	201	10.2
Absent/Unknown	1	0.2	-	-
Age				
Up to 29 years old	207	44.8	552	28.0
30-49 years old	237	51.3	1,190	60.3
50 years old and older	18	3.9	232	11.8
Situation in the labor market				

Registered with formal contract	315	68.2	1,247	63.2
Statutory civil servant	94	20.3	503	25.9
Civil servant with formal contract	20	4.3	81	4.1
Temporary work	7	1.5	15	0.8
Not registered	4	0.9	13	0.7
Autonomous	3	0.6	11	0.6
Unemployed	1	0.2	1	0.1
Absent/Unknown	18	3.9	103	4.6

Source: SINAN (2016).

Percutaneous exposure among nurses and nursing technicians/assistants was the most frequent (68.6% and 75.8%, respectively), and the circumstance of the accident for nurses was greater in the unspecified arterial/venous puncture variable (13%), followed by administration of intravenous medication (12.8%), while for nursing technicians/assistants the situation was reversed, as shown in Table 2.

Table 2 – Type of Exposure and Circumstance of the Accident in nurses and nursing technicians/assistants who suffered an accident with biological material notified to the SINAN in Paraná, 2016.

Variables	Nurses (N=462)		Nursing Technicians/ Assistants (N=1,974)	
	N	%	N	%
Percutaneous Exposure				
Yes	317	68.6	1,497	75.8
No	136	29.4	440	22.3
Absent/Unknown	9	1.9	37	1.9
Mucosa Exposure (oral/ocular)				
Yes	81	17.5	291	14.7
No	366	79.2	1,626	82.4
Absent/Unknown	15	3.2	57	2.9
Intact Skin Exposure				
Yes	93	20.1	355	18.0
No	355	76.8	1,568	79.4
Absent/Unknown	14	2.7	51	2.6
Non-intact Skin Exposure				
Yes	25	5.4	79	4.0
No	427	92.4	1,847	93.6
Absent/Unknown	10	2.1	48	2.4
Circumstance of the Accident				
Unspecified arterial/venous puncture	60	13.0	191	9.7
Administration of Intravenous medication	59	12.8	265	13.4

Arterial/Venous puncture, blood collection	48	10.4	131	6.6
Administration of subcutaneous medication	31	6.7	162	8.2
Improper disposal of sharps on the bench	27	5.8	160	8.1
Administration of intramuscular medication	23	5.0	133	6.7
Surgical procedure	23	5.0	149	7.5
Handling box with material	20	4.3	86	4.4
Dextro	17	3.7	95	4.8
Recapping	13	2.8	44	2.2
Improper disposal of material in a garbage bag	8	1.7	52	2.6
Administration of intradermal medication	7	1.5	12	0.6
Material washing	7	1.5	83	4.2
Laboratory procedure	6	1.3	28	1.4
Laundry	1	0.2	4	0.2
Dental procedure	1	0.2	12	0.6
Others	105	22.7	345	17.5
Absent/Unknown	6	1.3	22	1.1

Source: SINAN (2016).

The organic material that nurses and nursing technicians/assistants had the most contact with in the accidents was blood (n=367; 79.4% and n=1,524; 77.2%, respectively). As for the type of agent with which the workers were injured, needle with lumen stands out in the two categories studied (n=258; 55.8% and n=1,192; 60.4%).

Regarding the use of PPE by the professionals, more than half of them used gloves and an apron at the time of the accident, but a very small number used glasses, mask, facial PPE and boots (Table 3).

Table 3 – Use of PPE in nurses and nursing technicians/assistants who had an accident with biological material notified to the SINAN in Paraná, 2016.

Variables	Nurses (N=462)		Nursing Technicians/ Assistants (N=1,974)	
	N	%	N	%
Use of gloves				
Yes	328	71	1,381	70.0
No	125	27.1	547	27.7
Unknown	9	1.9	46	2.3
Use of apron				
Yes	238	51.5	1,003	50.8
No	207	44.8	894	45.3
Unknown	17	3.7	77	3.9
Use of glasses				

Yes	53	11.5	189	9.6
No	390	84.4	1,710	86.6
Unknown	19	4.1	75	3.8
Use of mask				
Yes	85	18.4	304	15.4
No	360	77.9	1,591	80.6
Unknown	17	3.7	79	4.0
Face protection equipment				
Yes	15	3.2	42	2.1
No	426	92.2	1,835	93.0
Unknown	21	4.5	97	4.9
Use of boots				
Yes	52	11.3	302	15.3
No	388	84.0	1,565	79.3
Unknown	22	4.8	107	5.4

Source: SINAN (2016).

Regarding the tests performed at the time the accident occurred, defined as time zero, it is possible to identify a high percentage of negative results in the serological tests for the detection of HIV and Hepatitis B surface antigen (HbsAg). In all the tests performed, it is possible to identify a high number of professionals with missing data, defined as unknown, or who had blank cells.

Regarding the behaviors after the accident with biological material, most of the injured nurses and nursing technicians/assistants had no indication for chemoprophylaxis (n=349; 75.5% and n=1,443; 73.1%). A higher percentage of nursing technicians/assistants (2.1%) refused the indicated prophylaxis when compared to nurses (0.9%) (Table 4).

Table 4 - Initial behaviors and evolution of the cases in health professionals who suffered accidents with biological material notified to the SINAN in Paraná, 2016.

Variables	Nurses (N=462)		Nursing Technicians/ Assistants (N=1,974)	
	N	%	N	%
No indication for chemoprophylaxis				
Yes	349	75.5	1,443	73.1
No	83	18.0	361	18.3
Unknown	10	2.2	45	2.3
Blank	20	4.3	125	6.3
Refused indicated chemoprophylaxis				
Yes	4	0.9	41	2.1
No	411	89.0	1,685	85.4

Unknown	11	2.4	52	2.6
Blank	36	7.8	196	9.9
Hepatitis B vaccination status (3 doses)				
Vaccinated	442	95.7	1,839	93.2
Not vaccinated	7	1.5	49	2.5
Unknown	9	1.9	59	3.0
Blank	4	0.9	27	1.4
Case evolution				
Discharge with serological conversion	2	0.4	14	0.7
Discharge without serological conversion	94	20.3	341	17.3
Discharge of negative source patient	132	28.6	523	26.5
Abandonment	45	9.7	165	8.4
Unknown	18	3.9	106	5.4
Blank	171	37.0	825	41.8
Issuance of the Work Accident Communication				
Yes	347	75.1	1,435	72.7
No	64	13.9	292	14.8
Does not apply	6	1.3	23	1.2
Unknown	45	9.7	224	11.3

Source: SINAN (2016).

As for the monitoring and evolution of the injured professionals, it is identified that, between the two groups, there is a higher percentage of nurses who abandoned clinical monitoring. Regarding evolution, high number of blank cells is observed, both for nurses and for nursing technicians/assistants (n=171; 37% and n=825; 41.8%). No deaths resulting from exposure to biological material or due to other causes were recorded. It is noteworthy that, in the period analyzed, among the professionals who suffered accidents with biological material in Paraná, the WAC was issued in 75.1% of the accidents involving nurses, and in 72.7% in which those affected were nursing technicians/assistants.

In the association analysis, which sought to identify whether there was a significant difference between the use of PPE according to the professional category, although among nurses the use of PPE was slightly higher (82.9% versus 81.1%), this difference was not considered significant (p=0.371) (data not shown in the table). However, when separately analyzing the association between the use of PPE and sociodemographic characteristics among nurses and nursing technicians and assistants, age presented a significant difference (p=0.001)

between technicians and assistants, showing that, with increasing age, there was a significant reduction in the use of PPE (Table 5).

Table 5 – Distribution of the sociodemographic variables of nurses and nursing technicians/assistants who suffered accidents with biological material, according to the use of personal protective equipment, Paraná, 2016.

	Use of PPE				*p-value*
	Yes		No		
Professional category	**N**	**%**	**N**	**%**	
Nurses					
Gender					
Female	340	83.1	69	16.9	0.937
Male	43	82.7	9	17.3	
Age					
Up to 29 years old	178	86	29	14	
30-49 years old	188	79.3	49	20.7	0.073
50 years old and older	17	94.4	1	5.6	
Nursing Technicians and Assistants					
Gender					
Female	1,436	81	337	19	0.707
Male	165	82.1	36	17.9	
Age					
Up to 29 years old	472	85.5	80	14.5	
30-49 years old	956	80.3	234	19.3	0.001
50 years old and older	173	74.6	59	25.4	

Source: SINAN (2016).

Discussion

Accidents with biological material are frequent, mainly among professionals who work in health care environments. In years prior to 2016, the number of cases of occupational accidents with exposure to biological material in Paraná increased from 3,129 in 2010 to 4,250 in 2015.[11] In 2016, in addition to an increase in the number of occurrences (4,693), it was observed that 51.9% of these events occurred among nurses and nursing technicians/assistants, a result similar to that found in another Brazilian study.[11]

The most frequent age group of the professionals who suffered accidents with biological material was between 30 and 49 years old, a result similar to that found in a research study conducted in the state of Bahia.[2] However, different findings were identified in the literature,[4,12] in which the age group with the highest rate of records was up to 29 years old.

A higher number of accidents was also observed among female professionals, both in nurses (88.7%) and in nursing technicians/assistants (89.8%). These results were already expected, since the female gender is dominant in health care professions, especially in Nursing, corroborating the results found in the literature.[2-3,13-14]

With women adding a greater number of professionals in the field of Nursing, many of them reconcile work with household chores, which creates excess work for this group.[15] Thus, the quality of the assistance provided can be impaired, which can lead to greater susceptibility to accidents with biological material. The characterization of the evaluated accidents revealed that the majority occurred due to percutaneous exposure, confirming the results found in the literature.[14]

The circumstance of the accident for nurses was greater in the unspecified arterial/venous puncture variable (13%), followed by intravenous medication administration (12.8%), while for nursing technicians/assistants the situation was reversed. The administration of intravenous medication variable presented a frequency of 13.4%, while that of the unspecified arterial/venous puncture variable was 9.7%. These data corroborate the literature,[12] and it is possible to identify that such an event can be related to the work process developed by these professionals.

In this study, blood was the main body fluid involved in the occurrence of accidents, in line with the findings in the literature.[3,14] The contaminating potential of this fluid is highlighted, mainly with regard to the harms caused by the Hepatitis B virus, responsible for the occupational transmission of the virus.[1-2] Most of the accidents were caused by needles with

lumen (58.0%), followed by the category identified as others, with 22.0%, corroborating results found in the literature.[12]

Employers are required to provide PPE relevant to the risk to which the professional is exposed, in order to reduce contact with biological materials. The device is for individual use and includes gloves, glasses or facial PPE, masks, aprons and protection for the lower limbs, for example, boots. As in other studies, it was observed that, at the time of the accident, the professionals did not use all the protective equipment, which contributes to the occurrence of contact with biological material.[16-17]

It is verified that the work dynamics can influence the use of PPE, as professionals use the necessary protective equipment only when they believe that the practice may offer some risk.[6] However, the importance of using PPE in all procedures, mainly those with blood and secretions, must be emphasized, a situation in which all patients should be considered potentially contaminated.

With regard to the evolution of the professionals who have suffered accidents with biological material, it is observed that the record was absent in most cases, which reveals impairment of the patient's monitoring. Also in relation to the evolution of the case, a higher percentage of nurses who abandoned clinical monitoring was identified, when compared to nursing technicians and assistants. These results diverge from the reference found in the literature, which describes greater susceptibility to clinical abandonment among technical level workers, in addition to individuals aged over 30 years old.[12,18]

Considering the high number of individuals who fail to conduct clinical monitoring, the need to reinforce the guidelines for the professionals regarding the importance of the laboratory clinical segment is identified. In this aspect, it is essential to encourage workers, as the event can lead to feelings of fear and concern for the professionals involved and, although they are health professionals, they may be disoriented by what happened.[19]

In this study, most of the professionals involved in accidents with biological material had no indication for chemoprophylaxis. However, it was possible to identify a high number of records with missing or unknown information. Such data corroborate what was found in the national literature,[7] highlighting the need to improve information filling in.

Identification of the source patient in this study occurred in more than 80% of the cases, both in the accidents involving nurses and in those involving nursing technicians and assistants. Knowing the source patient and performing the tests to identify communicable infections can assist in the treatment of the injured professional, as well as in their evolution to discharge from the clinical-laboratory monitoring.

Lack of information is an important limitation of this study, since lack of knowledge about the patient's conditions, test results and clinical evolution can be detrimental in the long term for the individual who suffered the accident, as some pathologies may arise after certain period of time.

Analyzing the context of the information obtained, it is perceived that another important data exposed in the study refers to the underreporting resulting from not filling in and issuing the WAC after the accident with biological material. Thus, although the two professional categories studied mostly issued the WAC, a high percentage of nurses (24.9%) and nursing technicians/assistants (27.3%) did not complete and/or ignored the information inherent to the accident.

Underreporting the accident causes harms, as it makes it impossible to know the real prevalence of the accidents during the period. Underreporting can be related to the lack of knowledge about the importance of this record for epidemiological analysis, as well as to the excess of bureaucracy involved in the notification of an accident.[3-4]

When analyzing the association with the use of PPE, in this study it was identified that, with increasing age, there was a significant reduction in the use of PPE, especially among nursing technicians/assistants. Thus, the higher occurrence of accidents in the workplace and negligence regarding the use of PPE can be related to the overvaluation of the technique or

clinical practice by the health professionals, mainly among those who are older or have been working for a longer period of time.[6] In addition to that, it is important to highlight that health professionals work constantly with work overload and deficient structural and equipment conditions,[20] which can negatively favor non-use of PPE and, consequently, also favor accidents involving biological materials.

The importance of carrying out training on work accidents is highlighted, not only in environments in which the professionals are frequently exposed, but also where the primary care professionals work, since lack of knowledge can lead to an increase in the number of cases and, consequently, more underreported cases.[21]

Considering that this study was developed from secondary data, it is worth highlighting a possible limitation referring to the high percentage of unknown, absent or blank data recorded in the system, which sometimes prevents a reliable presentation of the results. In addition to that, there may have been underreporting of cases during the research period. This circumstance draws the attention to the need to improve the research method and strategies to enhance the quality of the information in the accident records.

However, the findings of this research allowed expanding knowledge about the accidents with biological material suffered by workers in the state of Paraná, especially those that occurred with Nursing professionals. Thus, strategies for the prevention of accidents with biological material are fundamental to promote the health of workers from Paraná.

Conclusion

Accidents with biological material involving Nursing professionals in Paraná occurred more frequently among female professionals, aged between 30 and 49 years old. The most frequent kind of exposure was percutaneous and the most reported circumstances related to the occurrence of events were situations involving arterial or venous puncture and administration of

intravenous medication. Among the nursing technicians and assistants, there was a significant reduction in the use of PPE with increasing age.

These findings allow broadening the understanding of this phenomenon and foster the need for strategies aimed at the permanent education of these professionals, highlighting risk situations and prevention actions through the proper use of PPE, as well as immediate event notification, which can contribute to reducing the rates of occupational accidents and/or diseases among these workers.

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