

Occupational accidents with biological material in a school hospital

Acidentes de trabalho com material biológico em um hospital escola

Accidentes de trabajo con material biológico en un hospital escuela

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ABSTRACT

Objective: to analyze occupational accidents with exposure of nursing technicians to biological material in a school hospital. **Method:** nursing technicians were invited to answer a questionnaire related to occupational accidents with biological material. **Results:** 275 professionals from 9 hospital units participated. 76% reported having suffered an accident and the variables "age group" and "employment regime" showed a significant association for accidents ($p < 0.05$). Those hired by the Consolidation of Labor Laws (CLT - *Consolidação das Leis do Trabalho*) employment regime were 3.5 times more likely to suffer accidents ($p = 0.04$) and institutional capacity building did not show statistical significance ($p > 0.05$). **Conclusion:** the increase in the number of training did not ensure the reduction of occupational accidents with biological material; and nursing technicians under the age of 30 were more vulnerable. Professionals with a CLT labor contract were more affected than the statutory employees.

Descriptors: Occupational Risks; Accidents, Occupational; Nursing; Public Hospitals; Containment of Biohazards.

RESUMO

Objetivo: analisar a ocorrência de acidentes de trabalho com exposição a material biológico de técnicos de enfermagem em um hospital escola. **Método:** técnicos de enfermagem foram convidados a responder um questionário relacionado à ocorrência de acidentes de trabalho com material biológico. **Resultados:** participaram 275 profissionais de 9 unidades do hospital. 76% declararam ter sofrido acidente e as variáveis "faixa etária" e "regime de trabalho" mostraram associação significativa para ocorrência de acidentes ($p < 0,05$). Os contratados pelo regime de trabalho pela Consolidação das Leis do Trabalho (CLT) apresentaram 3,5 mais chances de sofrerem acidentes ($p = 0,04$) e a capacitação institucional não demonstrou significância estatística ($p > 0,05$). **Conclusão:** o aumento do número de capacitações não assegurou a diminuição dos acidentes de trabalho com material biológico; e os técnicos de enfermagem com idade inferior a 30 anos foram mais vulneráveis. Os profissionais com vínculo trabalhista celetista acidentaram-se mais que os servidores estatutários.

Descritores: Riscos Ocupacionais; Acidentes de Trabalho; Enfermagem; Hospitais Públicos; Exposição a Agentes Biológicos.

RESUMEN

Objetivo: analizar la ocurrencia de accidentes de trabajo con la exposición de técnicos de enfermería a material biológico en un hospital escuela. **Método:** los profesionales fueron invitados a responder un cuestionario relacionado con la ocurrencia de accidentes de trabajo con material biológico. **Resultados:** participaron 275 profesionales de 9 unidades del hospital El 76% declaró haber sufrido algún accidente y las variables "grupo de edad" y "formas de trabajo" mostraron una asociación significativa para la ocurrencia de accidentes ($p < 0,05$). Los contratados por la forma de trabajo bajo la Consolidación de las Leyes del Trabajo (CLT) presentaron 3,5 más probabilidades de sufrir accidentes ($p = 0,04$) y la capacitación institucional no demostró significancia estadística ($p > 0,05$). **Conclusión:** el aumento del número de capacitaciones no ha asegurado la disminución de los accidentes de trabajo con material biológico; y los técnicos de enfermería menores de 30 años fueron más vulnerables. Los profesionales con vínculo laborista en la CLT se acidentaron más que los estatutarios.

Descriptorios: Riesgos Ocupacionales; Accidentes de Trabajo; Enfermería; Hospitales Públicos; Exposición a Agentes Biológicos.

INTRODUCTION

The International Labor Organization estimates that there are 317 million occupational accidents (OA) worldwide each year, resulting in 321,000 deaths⁽¹⁾.

Health professionals are constantly exposed to the risk of infection of innumerable pathogens after accidental occupational exposure through blood or body fluids, with human immunodeficiency virus, hepatitis B or C being considered the most relevant, given their prevalence among patients⁽²⁾.

Occupational exposure may occur percutaneously when there is contact with needles or sharps; mucosal, skin-non-integral with dermatitis or open sores⁽³⁾.

Among the health professionals, the nursing category is considered of great vulnerability, since they are involved in the direct and continuous care for the patients, with several procedures being performed⁽⁴⁻⁶⁾.

In Brazil, Nursing practice is regulated by the Federal Nursing Board (COFEN - *Conselho Federal de Enfermagem*) and has 2,032,143 million professional records. The category of nursing technicians is considered the most numerous, with 1,125,172. In São Paulo State, there are 190,208 records⁽⁷⁾.

OA with blood and other potentially contaminated fluids, the professional requires specialized medical attention, blood samples to assess the serological status of the source and injured patient, follow-up and treatment, if necessary⁽⁸⁾.

Although there is emotional damage to the worker⁽⁹⁾, there is also an economic loss and it is estimated that the mean total (direct and indirect) costs of a single accident is US\$ 861.00, ranging from US\$ 199 to US\$ 1,691⁽¹⁰⁾.

For containment of bodily fluids and the possibility of disease transmission, protective measures called Universal Precautions by the Centers for Disease Control and Prevention, adopted internationally, have been formulated and subsequently modified and called Standard Precautions^(11,12).

In Brazil, Regulatory Norm 32 (RN 32) defines guidelines for the protection and safety of health service workers, such as provision of personal protective equipment (PPE); in-service training; immunization against hepatitis B and suitable containers for disposing of sharps⁽¹³⁾, in addition to defining the *Plano de Prevenção de Riscos de Acidentes com Materiais Perfurocortantes* (Risk Prevention Plan for Accidents with Sharps), and recommending the use of safety devices⁽¹⁴⁾.

Although occupational exposure is a worrisome factor for professionals, often there is the worker's risk behavior and not compliance with the Standard Precautions, which may interfere in the prevention and predisposition to OA⁽¹⁵⁻¹⁸⁾.

Studies performed in institutions aimed at the care for the OA victims by biological material show that most of the occurrences were with health professionals, with the most affected being nursing technicians^(19,20).

Inadequacies of health services and precarious conditions, such as overload, prolonged work, fatigue, permanent education deficiency, unavailability / inadequacies of PPE and insufficient staffing size may be related to OA and culminate in the worker's illness⁽²¹⁻²³⁾.

Although there is similarity of the nursing praxis in different institutions, this study is relevant because it was carried out in a

large public school hospital, based on the promotion of teaching, research and health care, where nursing technicians perform a high number of invasive procedures in daily life.

Considering the possibility of occupational exposure of nursing professionals, studies and reflections on the possible variables related to OA with biological material.

OBJECTIVE

This study aims to analyze the occurrence of occupational accidents with exposure of nursing technicians to biological material in a school hospital.

METHODS

Ethical aspects

Ethical procedures were followed according to Resolution 466/2012 and the research was approved by the Research Ethics Committee of the University under Opinion 2,242,789 / 2017.

Design, place of study and period

Cross-sectional study of a quantitative nature carried out in a Public State Public School Hospital, located in São Paulo State countryside, with data collected from September to December 2017.

Sample, inclusion and exclusion criteria

It was obtained, together with the Human Resources Division of the Institution, the nominal relation of the professionals belonging to the Nursing Department (N=1,022). The sample size was calculated using a sample proportion of 0.25, resulting in 275 nursing technicians. Participants were randomly selected, maintaining the proportion (0.25) of the number of technicians in the units: Adult (ACU), Pediatric (Pediatric), ICU Adult (ADU-ICU) and Pediatric (PED-ICU), Imaging (IMA), Ambulatory Service and Specialized Procedures (SEAMPE), Surgical Center (SC) and Central of Material and Sterilization (CMS).

Nursing technicians who were working at the hospital during data collection period, of both genders, who provided direct or indirect care for patients in the morning, afternoon, evening and administrative work shifts, were included. Professionals who were on leave, medical leave, maternity leave, retired due to health problems or enjoying leisure time were excluded, and those who only performed patient transports.

Study protocol

The researcher developed a tool for data collection that, after the pre-test with 20 subjects, was adequate in the semantics for a better understanding of the questions.

Participants were invited to answer the questionnaire composed of objective questions that addressed aspects related to socioeconomic characterization, functional status and OA with biological material.

Analysis of results and statistics

After data collection, data were inserted into Excel 2016 (Microsoft). Statistical analysis was performed using the BioEstat 5.3 program. The Kruskal-Wallis Test was used to compare means; Chi-Square Test and Fisher's Exact Test were used for analysis of contingency tables; Simple Linear Regression was used to verify the degree of association between two quantitative variables. Comparison between two proportions was performed by Binomial test and the Meta Analysis for comparison between more than two proportions. The Multiple Logistic Regression Analysis was used for combined analysis of multiple variables. For all tests, $p < 0.05$ was considered statistically significant.

The variable "accident/year (OA/year)" was calculated by dividing the number of total accidents of each participant by the respective number of years of work in the institution. The calculation was performed for each participant within the respective age group; and from the individual result the mean was calculated with Standard Deviation.

RESULTS

275 nursing technicians from 9 hospital units participated in the study in morning, afternoon, evening and administrative work shifts. Table 1 shows data referring to the staff of the institution, as well as of the research participants, distributed in the respective work shifts.

Table 1 – Distribution of total nursing technicians and research participants according to units and work shifts (n=275), São Paulo State, Brazil, December, 2017

Units	Staff				Research participants			
	AD	M	A	E	AD	M	A	E
CMS		30	30	25		8	8	8
IMA		16	15	6		5	5	2
SC		56	50	23		13	14	7
SEAMPE	63				17			
PED		13	14	26		4	4	7
REU		23	23	43		6	6	10
PED-ICU		9	7	16		3	3	5
ADU-ICU		38	37	76		11	10	21
ACU		109	113	161		28	29	41
Subtotal	63	294	289	376	17	78	79	101
Total			1,022				275	

Note: Central of Material (CMS), Imaging (IMA), Surgical Center (SC), Ambulatory and Specialized Procedures Service (SEAMPE), Pediatrics (PED), Referral Emergency Unit (REU), Pediatric Intensive Care Unit (PED-ICU) and Adult (ADU-ICU), Adult Care Unit (ACU), Morning (M), Afternoon (A), Evening (E), Administrative Time (AD).

A sample proportion of 25% of participants from each unit was considered and the comparison between the proportions of the samples used was statistically the same ($p > 0.98$).

Participants' ages ranged from 22 to 66 years, with a mean of 41.0 ± 9.2 years (Mean \pm Standard Deviation), working time at the institution ranged from one to 34 years, with a mean of 10.4 ± 7.4 years. 230 female and 45 male nursing technicians participated in a 30-hour weekly work shift with established shifts.

Data analysis showed that 210 nursing professionals reported having undergone OA with biological material, and 65 reported never having suffered an accident at the institution ($p < 0.0001$).

Table 2 shows the distribution of nursing technicians who reported having or not having undergone OA in the institution by gender, number of jobs, schooling, employment regime and shift, age group and training.

Table 2 results showed statistical significance among people who reported OA with biological material and the variables age group and work regime ($p < 0.05$).

Table 2 – Participants characterization according to whether or not OA with biological material according to investigated variables (n=275), São Paulo State, Brazil, December, 2017

Variables	OA with biological material						p
	Yes (n=210)		No (n=65)		Total (n=275)		
	n	%	n	%	n	%	
Gender							
Female	175	76.1	55	23.9	230	83.6	0.85*
Male	35	77.8	10	22.2	45	16.4	
Number of jobs							
1	167	77.3	49	22.7	216	78.5	0.49*
>1	43	72.9	16	27.1	59	21.5	
Employment regime							
Statuary	45	60.0	30	40.0	75	27.3	0.0002**
CLT	165	83.5	35	17.5	200	72.7	
Schooling							
Complete High School	105	71.9	41	28.1	146	53.7	0.06*
Incomplete Higher Education	30	90.9	3	9.1	33	12.1	
Complete Higher Education	72	77.4	21	22.6	93	34.2	
Work shift							
Morning	65	83.3	13	16.7	78	28.4	0.39**
Afternoon	58	74.4	20	25.6	78	28.4	
Evening	75	73.5	27	26.5	102	37.1	
Administrative	12	70.6	5	29.4	17	6.2	
Age group							
< 30 years	22	88.0	3	12.0	25	9.1	0.03**
30 to 39 years	76	69.1	34	30.9	110	40.0	
40 to 49 years	63	75.0	21	25.0	84	30.5	
> 50 years	49	87.5	7	12.5	56	20.4	
Number of Trainings							
0	29	82.9	6	17.1	35	12.7	0.1**
1	76	77.6	22	22.4	98	35.6	
2	49	70.0	21	30.0	70	25.5	
3	27	67.5	13	32.5	40	14.5	
4 or more	29	90.6	3	9.4	32	11.6	

Note: Consolidation of Labor Laws (CLT- Consolidação das Leis do Trabalho), Occupational Accident (OA), ** Chi-Square, * Fischer's Exact Test.

The variables "gender", "number of jobs", "schooling", "work shift" and "number of trainings" did not present statistical significance ($p > 0.05$).

It was observed that nursing professionals with occupational regime presented greater number of accidents (83.5%).

The highest proportions of OA occurred in workers aged less than 30 years (88.0%) and over 50 years (87.5%), being the same (<30 and >50) statistically equal ($p > 0.87$).

The mean working time in the institution for professionals aged > 50 years was 17.9 ± 7.4 years (Mean \pm Standard Deviation) and for age <30 years was 4.4 ± 2.1 years, with statistical differences significant ($p < 0.0001$).

It should be noted that the reported accidents were influenced by the time of institution according to the age group. Older workers tended to have more accidents. Therefore, the result of the Chi-Square's Test for the age group may not represent reality.

Table 3 shows the mean age, OA number and mean number of accidents per year, by age group.

The mean rate of accidents per year for the age group <30 years (0.748 ± 1.064) was statistically higher than the other age groups ($p < 0.03$) and the Linear Regression Analysis showed no association between age means (within each age group) and the number of accidents per year (OA/year) ($p > 0.12$).

Workers aged over 50 years had a mean of 0.243 ± 0.258 OA/year. The statistical comparison showed equality between them ($p > 0.80$), although numerically smaller than age groups between 30-39 years (0.380 ± 0.621) and 40-49 years (0.306 ± 0.462).

Table 3 – Mean age, number of accidents and accident rate per year, by age group, São Paulo State, Brazil, December, 2017. Data as Mean \pm Standard Deviation

Age group	Age mean	Nº of OA	OA/year
< 30 years	27.0 ± 1.8	72	0.748 ± 1.064
30 - 39 years	34.8 ± 2.8	224	0.380 ± 0.621
40 - 49 years	44.0 ± 2.9	246	0.306 ± 0.462
> 50 years	54.9 ± 4.2	205	0.243 ± 0.258

Note: Occupational Accident (OA).

Table 2 shows the influence of variables on OA in isolation. Table 4 shows the Multiple Logistic Regression and influence of the main factors. For variables selection, $p < 0.2$ (Employment regime, schooling and number of trainings) were considered. The variable "age group" was not considered for reasons previously explained.

It can be observed in Table 4 that nursing technicians hired by the CLT employment regime presented 3.5 times more chances of suffering accidents than the statutory ones. The chance of professionals with incomplete higher education suffering OA was 3.6 times higher than those who had a different schooling. There was no influence of the variable "number of trainings" on the chances of suffering accidents ($p > 0.05$).

The mean trained people was 1.89 ± 1.5 , and those who did not report accidents were 1.80 ± 1.11 . The comparison between means did not show significant difference ($p = 0.70$).

Table 4 – The Multiple Logistic Regression of the variables associated with OA with exposure to biological material, São Paulo State, Brazil, December, 2017

Variable	P value	OR	CI 95%
CLT employment regime	<0.0001	3.54	1.92 a 6.52
Schooling: Incomplete Higher Education	0.041	3.67	1.05 a 12.79
4 or more trainings	0.14	--	--
No training	0.40	--	--

Note: Odds Ratio (OR), Confidence Interval of 95% (CI 95%), Consolidation of Labor Laws (CLT - Consolidação das Leis do Trabalho).

DISCUSSION

It was found that younger professionals presented higher proportions of OA and higher mean OA/year, suggesting that nursing technicians presented more accidents in the first years of working life, and these results are corroborated by the literature⁽⁵⁾.

Nursing workers are dedicated to care, and may encounter numerous hospitalized patients in critical condition, with aggressive

and agitated behavior, which may hinder their practice and the safe conduct of procedures^(24,25).

Several studies indicate that the age of less than 35 years has been significantly associated with sharps injuries and blood or body fluids on the mucosa or skin, which may mean that young, enthusiastic, less skilled workers may incur more of these types of OA^(5,26,27). It was observed a high number of people injured in the present study, being indicative of the need for greater follow-up of the young workers for orientation and adequacy in the work activities, with emphasis on the content on biosafety.

Although professionals over 50 years of age were more able to deal with adversity, greater seniority did not ensure a reduction in OA with biological material. These may have underestimated compliance with the Standard Precautions and offered resistance to the use of safety devices because of increased confidence.

The hospital where the investigation was carried out is a state institution that has servers with two contracting regimes: 1) Statutory legal regime, with labor relationship governed by statute composed of norms of public order. 2) Public employees hired by the scheme governed by the CLT^(28,29). Statutory public employees have more assured rights such as prediction of paid absences, premium leave for attendance and labor relations based on job stability, offering greater security for the worker⁽³⁰⁻³²⁾.

Studies in university hospitals have identified that workers with a higher number of OA, while statutory employees had a high rate of absenteeism in nursing^(33,30). CLT workers presented higher proportions of OA, which may be related to lower fruition of slacks, resulting in greater fatigue and stress. These allies with worker dissatisfaction due to differences in treatment due to the existence of different labor regimes may have affected the practice and generated more occupational accidents.

Changes in the labor market demanded the expansion of the education system in Brazil with higher education courses, mostly in private institutions, several of them in the night, allowing the entry of people who work⁽³⁴⁾. Despite the broadening of access to education, there is the wear and tear of the worker who often performs a double journey to reconcile his professional and academic life. It was observed in the present study that the highest proportion of workers with OA had incomplete higher education.

In nursing, there is a predominance of women who need to reconcile the profession with household chores and child care^(35,36). This excess of activities and high mental load of work can cause fatigue and compromise the safe development of activities, resulting in OA in health professionals^(22,37). Therefore, in this context, it is probable that the overload caused by the double journey caused fatigue, lack of attention during procedures and favored increase of accidents.

In order to minimize OA, it is important to emphasize the importance of practices aimed at lifelong education and the proposal of strategies aimed at complying with safety standards that make prevention possible in institutions^(23,38,39,40, 41).

Professionals who reported having received zero and 4 or more training had equal proportions of OA with biological material, so the increase in the number of training did not ensure a decrease in accidents, and it is fundamental to review the current model in the institution.

A study carried out in public hospitals identified that training with biosafety content did not reduce the accident rate of

health professionals and did not provide greater compliance with protection barriers⁽⁴²⁾.

Institutional investment in training is important as recommended in RN32, but not only to obtain numerical indices. Learning only occurs if there is motivation, valorization and use of scientific knowledge, which are dependent on the preparation and receptivity of the individuals, aspects that need to be rethought during the training planning⁽³⁸⁾.

PISA Test⁽⁴³⁾, which evaluates high school students, ranked Brazil in the 50th place compared to other countries and only 17% of the active population are considered to be literate with a reading ability and understanding of texts⁽⁴⁴⁾.

This nonconformity in Brazilian education may have affected the nursing professionals' learning and the current institutional capacity building model may not be effective and fulfilling its role to the satisfaction. Therefore, the introduction of new ways of thinking and acting is a challenge in the teaching-learning process.

University hospitals perform many invasive procedures and require trained nursing staff. Evidence indicates that actions are needed that contemplate proper planning of in-service education and efforts to minimize the influence of possible distortions of learning in practice.

Innovations in practice models can be beneficial, with adaptations that ensure a new paradigm of knowledge empowerment by workers, using active methodologies⁽⁴⁵⁾ applied in education activities.

Study limitations

This study was carried out in a Public School Hospital, at the tertiary level, with specific management characteristics and specific characteristics of nursing care. Although there may be similarity of nursing practice, the comparison of results should

be carried out with care, taking into account the specificities of each institution.

Contributions to the fields of Nursing, Health or Public Policy

The research presents relevant contributions to the fields of Nursing, Health or Public Policy by giving visibility to the OA phenomenon of nursing technicians with biological material. The study provides subsidies for health professionals, especially nurses, to improve the planning of preventive actions aimed at workers' health and to implement in-service education methodology, with a view to integrating professionals into the teaching-learning process. In addition, it enables health professionals to reflect on the environment and working conditions of nursing and develop intervention strategies that allow them to overcome the current challenges.

CONCLUSION

The increase in the number of training did not ensure the reduction of OA with biological material, and nursing technicians under the age of 30 were more vulnerable.

CLT professionals suffered more than statutory employees, and those who reported having incomplete higher education had a greater proportion of accidents than those with other degrees of education.

Double journey resulting from the exercise and undergraduate courses in the after/before course hours can lead to overload and fatigue, resulting in a probable increase in the number of accidents, which could compromise the safety and health of the worker.

These results point to the need to review the teaching-learning model and the programmatic content of the training offered to the nursing professionals of the health institution.

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