

FACTORS ASSOCIATED WITH APPROPRIATE HEALTH-CARE WASTE MANAGEMENT AMONG NURSING PROFESSIONALS

FATORES ASSOCIADOS AO MANEJO ADEQUADO DE RESÍDUOS DE SERVIÇOS DE SAÚDE ENTRE PROFISSIONAIS DE ENFERMAGEM

FACTORES ASOCIADOS AL MANEJO ADECUADO DE RESIDUOS DE SERVICIOS DE SALUD ENTRE PROFESIONALES DE ENFERMERÍA

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Objective: investigate the factors associated with appropriate Health-Care Waste (HCW) management among Nursing professionals. **Method:** cross-sectional, analytic study involving 461 professionals at a public, state-owned hospital in São Luís, Maranhão, Brazil, between June 2014 and January 2016. **Results:** 40.13% were between 30 and 39 years, 92.84% were women, 63.99% had <12 years of education, 50,3% possessed 1-5 years of experience on the job, 63,99% performed the HCW management appropriately, 27,99% used all PPE during the waste segregation. Improper HCW management was associated with ages between 30 and 39 years ($p=0.010$), the category nursing technician ($p=0.013$) and the inappropriate definition of HCW ($p<0.001$). **Conclusion:** professionals between 30 and 39 years of age, nursing technicians and professionals unable to define HCW were associated with inappropriate HCW management.

Descriptors: Health-care waste. Nursing team. Waste management.

Objetivo: investigar os fatores associados ao manejo adequado de Resíduos de Serviços de Saúde (RSS) entre profissionais da Equipe de Enfermagem. Método: estudo analítico transversal com 461 profissionais, em hospital público estadual em São Luís, Maranhão, Brasil, entre junho 2014 e janeiro 2016. Resultados: 40,13% tinham de 30 a 39 anos, 92,84% eram mulheres, 63,99% tinham <12 anos de estudo, 50,3% com 1-5 anos de tempo de serviço, 63,99% realizavam o manejo dos RSS de maneira adequada, 27,99% faziam uso de todos os EPIs durante a segregação dos resíduos. Verificou-se associação do manejo não adequado de RSS com a idade de 30 a 39 anos ($p=0,010$), a categoria técnico de enfermagem ($p=0,013$) e definição inadequada dos RSS ($p<0,001$). Conclusão: os

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profissionais com idade de 30-39 anos, técnicos de enfermagem e aqueles que não souberam definir o que são os RSS apresentaram-se associados a um manejo não adequado dos RSS.

Descritores: Resíduos de serviços de saúde. Equipe de enfermagem. Manejo de resíduos.

Objetivo: investigar los factores asociados al manejo adecuado de Residuos de Servicios de Salud (RSS) entre profesionales del Equipo de Enfermería. Método: estudio analítico transversal, con 461 profesionales, en hospital público estatal, en São Luís, Maranhão, Brasil, entre junio/2014 y enero/2016. Resultados: 40,13% tenían de 30 a 39 años, 92,84% mujeres, 63,8% tenían <12 años de estudio, 50,3% con 1-5 años de tiempo de servicio, 63,99% realizaban el manejo de los RSS de manera adecuada, 27,99% hacían uso de todos los EPI durante la segregación de los residuos. Hubo asociación del manejo no adecuado de RSS con edad de 30 a 39 años ($p=0,010$), la categoría técnico de enfermería ($p=0,013$) y definición inadecuada de los RSS ($p<0,001$). Conclusión: los profesionales con edad de 30-39 años, técnicos de enfermería y aquellos que no supieron definir lo que son los RSS se presentaron asociados a un manejo no adecuado de estos.

Descriptorios: Residuos de servicios de salud. Equipo de enfermería. Manejo de residuos.

Introduction

Health-Care Waste (HCW) is all waste produced in health facilities, such as laboratories, hospitals, medical clinics, dental practices, pharmacies, veterinary clinics as well as health education and research institutions, among others⁽¹⁾.

To guide the National Health Surveillance Agency (ANVISA) and the National Environment Council (CONAMA), with the purpose of instructing the health services, articulated and simultaneously published regulatory, operational and supervisory actions to regulate the management of HCW, from production to final destination, with a view to preserving human and environmental health⁽²⁾. For that purpose, the Board Resolutions 306/2004⁽¹⁾ and 358/2005⁽³⁾ were created, which set rules for the management of HCW.

Thus, we can define HCW management as all the actions taken to manage the waste inside and outside the health facilities, from the moment they are generated until the final disposal. Therefore, all the employees and employees who carry out actions related to waste management are responsible for these actions^(1,3). Identification, segregation, packaging, intermediate treatment, internal transport, temporary storage, external storage, final treatment, final disposal (destination) are stages of waste management.

In Brazil, HCW, popularly known as hospital waste, represents 2% of the total waste produced daily in the country. When improperly managed, they generate biological risks for public health and environmental destruction, as well as water and soil pollution, modifying biological and chemical ecosystem factors, reducing material recycling, and increasing occupational accident risks⁽⁴⁾.

In view of the complexity of HCWM, due to the diversity of waste and the professionals who generate and handle the waste, the nursing team stands out in the hospital environment because of the activities it carries out, such as direct patient care and the execution of most invasive procedures. In addition, its tasks include the elaboration of health promotion and prevention activities, both individually and collectively. It is part of the team's duty, as a waste generator, to carry out the correct management of this material, aiming to reduce the risks of infections, occupational accidents and preservation of the environment⁽⁵⁻⁶⁾.

A study carried out in Piauí⁽⁷⁾ shows that 45.83% of HCW derives from products used by the nursing team. Nevertheless, most nursing team professionals are unaware of the classification and stages of waste management and only consider infectious waste as HCW.

This fact directly reflects in errors in the waste segregation process^(4,8-9).

For this study, the definition of appropriate and inappropriate management of HCW was adopted. For the nursing professionals, appropriate management was considered as knowledge on the classification of the HCW (radioactive, chemical, biological, common residues and sharps) and its correct segregation according to the aspect of the HCW (black or blue bag, white bag and sharps box). Management was considered inappropriate when the classification and / or segregation did not meet RDC 306/2004⁽¹⁾ by ANVISA.

Thus, the question is: What factors are associated with the appropriate management of HCW among nursing staff? Knowing these factors is of fundamental importance to support the understanding about the management of HCW among the nursing team professionals. Therefore, this study aims to investigate the factors associated to the appropriate management of HCW among nursing team professionals.

Method

This cross-sectional, analytical study was carried out from June 2014 to January 2016 in the city of São Luís, capital of the state of Maranhão, Brazil. The study was carried out in a large general hospital, drawn among medium and large establishments in the National Register of Health Establishments (CNES) in São Luís (MA), in view of the greater diversity and amount of waste produced.

The population consisted of the nursing professionals at the hospital under study. Out of 513 professionals, nine (1.75%) refused to participate, one (0.19%) was not met during the research period, six (1.17%) were on medical leave, five (0.97%) of maternity leave and 21 (4.09%) worked only in administrative activities. Thus, the final population consisted of 103 (21.96%) nurses and 358 (78.04%) nursing technicians, with a loss of 10%, totaling 461 (89.86%) professionals.

The inclusion criterion was: professionals working directly in the medical clinic, surgical clinic, surgical center, intensive care unit (ICU), day hospital and outpatient clinic; being a nurse or nursing technician; and working in patient care during the data collection period.

For the data collection, the hospital manager (director) was initially asked for permission to execute the study. Next, a meeting was scheduled to present the research proposal, as well as to set a schedule for the activities planned during data collection. The list of nursing team professionals was also requested.

In the data collection, a structured form was used, divided in two parts: the first contained sociodemographic data and the second knowledge about the production, segregation, legislation, risks and occurrence of accidents in the management of HCW. Those who confirmed their participation signed two copies of the Free and Informed Consent Form (FICF): one for the respondent and the other for the researcher. Previously trained undergraduate and graduate students applied the form.

Initially, a descriptive analysis of the data was carried out by calculating the absolute and percentage frequencies to represent the characteristics of the study population, as well as the management of HCW.

The management of HCW was considered as the response variable (dependent), which is the action of managing the waste inside and beyond the establishment, from generation to final disposal⁽¹⁾. The variables of demographic, occupational and accident-related characteristics were considered as explanatory (independent).

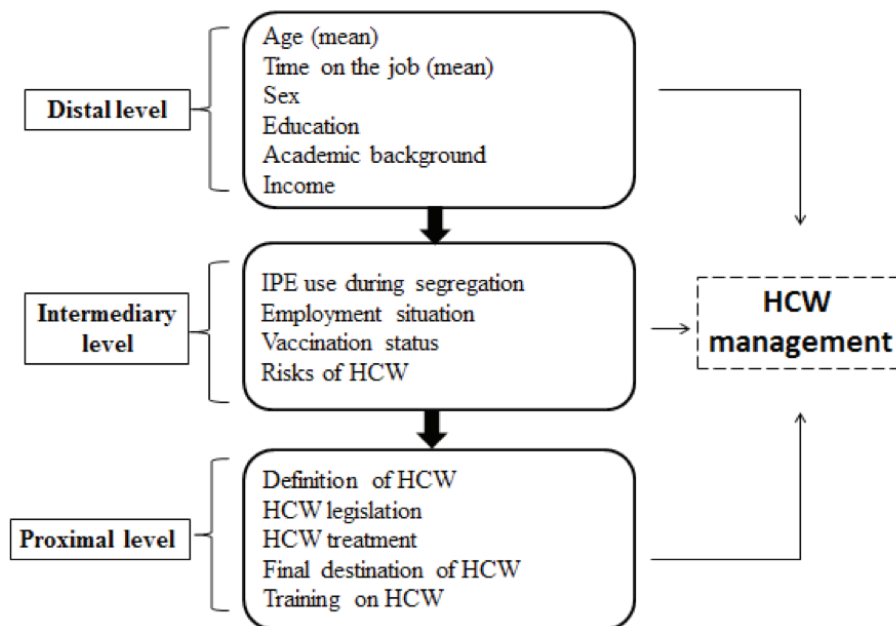
First, a univariate analysis was performed to test the association of all variables in relation to the outcome. To identify the associated factors, we used the Poisson regression model with robust variance to mitigate a possible overestimation of the standard error, as the dependent variable is binary and its frequency (or prevalence) was higher than 10 %⁽¹⁰⁾. The values of the prevalence ratios (PR) were estimated, using as a reference category PR = 1, the 95% confidence intervals were constructed and the p-values

were determined. For the adjusted analysis, the variables with p -value <0.20 were maintained.

For the second phase, Poisson regression analyses with robust variance and hierarchical modeling of the data were used to estimate prevalence ratios (PR) between the independent variables and the outcome⁽¹¹⁾. The hierarchical analysis proposes grouping the variables into levels according to the influence on the outcome. Then, the demographic variables were classified

at the distal level, the variables related to occupational characteristics at the intermediary level, and the variables related to the management of HCW at the proximal level, according to the flowchart (Figure 1). The association estimates were adjusted for the variables of the same hierarchical level and previous levels, so that the variables more intensely associated with the outcome of interest could be maintained⁽¹²⁾.

Figure 1 – Flowchart of hierarchical relation among the variables and their relation with the outcome



Source: Created by the authors.

The variables were ranked at three levels, according to the influence on the outcome. First, the variables of the distal level which presented $p < 0.20$ in the unadjusted analysis were included at the same time. In the model adjusted for this level, only those variables with a significance level of 0.05 remained. If the variables of the distal level were maintained, the next step was to include intermediate level variables, which presented $p < 0.20$ in the unadjusted analysis. These were introduced into the model simultaneously, irrespective of the level of statistical significance of the distal-level variables in the model, so that the intermediary-level variables remained that maintained significance at 0.05.

Finally, we introduced the variables of the proximal level that presented $p < 0.20$ along with the variables of the previous levels that were significant in their respective hierarchical levels. In the model adjusted for the proximal level, only those variables that were significant at 0.05 remained, without removing any of the distal and intermediary-level variables, regardless of their level of significance. The final adjusted analysis model contained three hierarchical levels.

In compliance with the requirements of National Health Council Resolution 466/12, the project was submitted to the Ethics and Research Committee of the University Hospital of the Federal University of Maranhão (HUUFMA) and approved by Opinion 327.795/2013.

Results

The 461 nursing team professionals included in this study had a mean age of 35.84 years; 92.84% were female; 63.99% had <12 years of education; 54.88% were single; 63.12% had a family income of up to two minimum wages; the average time on the job was 7.86 years; and the majority (78.04%) were nursing technicians. Of these, 63.99% managed HCW properly. Regarding the hospital routines, 27.98% used all the personal protection equipment recommended by ANVISA during the waste segregation. On the other hand, 62.47% reported never having suffered any type of accident in the workplace. The majority (86.98%) had an updated immunization schedule. As to the knowledge of the risks inherent to HCW, 92.84% of the professionals reported having this knowledge. When questioned about their knowledge on HCW, 63.00% demonstrated knowing the definition and 72.89% knew the

entire legislation about HCW. Nevertheless, 60.52% reported not knowing the existence of HCW treatment. Of these, 80.48% did not know the final destination. Regarding the professionals' training to manage HCW, 80.69% said they did not get any. In the unadjusted analysis at the distal level, the following were associated with HCW management: female sex (PR = 1.10, $p < 0.120$), education <12 years of study (PR = 1.14, $p < 0.001$), being a nursing technician (RP = 1.17, $p < 0.001$), gaining a family income ≤ 2 minimum wages (PR = 1.13, $p < 0.001$) or 3 to 5 minimum wages (PR = 0.90, $p < 0.06$) and being divorced (PR = 0.82, $p < 0.067$). At the proximal level, the variables were identified as follows: inappropriate definition of HCW (PR = 1.80, $p < 0.001$), partially knowing the legislation (PR = 1.10, $p < 0.200$), and not knowing the final destination of the HCW (PR = 1.11, $p < 0.007$) (Table 1).

Table 1 – Non-adjusted analysis of the distal, intermediary and proximal variables on Health-Care Waste management by the nursing team. São Luís, Maranhão, Brazil – 2015 (to be continued)

Variables	Health-Care Waste Management				
	Appropriate	Inappropriate	Prevalence Ratio	95% Confidence Interval	p-value
	n=295(63.99%)	n=166(33,01%)			
Distal variables					
Sex					
Male	25(8.47)	08(4.82)	1		
Female	270(91.53)	158(95.18)	1.10	0.97-1.24	0.120
Education					
<12 years	200(67.80)	95(32.20)	1.14	1.06-1.23	<0.001
>12 years	138(83.13)	28(16.87)	1		
Academic background					
Nurse	81(27.46)	20(12.05)	1		
Nursing technician	214(72.54)	146(87.95)	1.17	1.08-1.26	<0.001
Family income					
≤ 2 wages	168(57.73)	123(42.27)	1.13	1.06-1.21	<0.001
3 to 5 wages	86(74.14)	30(25.86)	0.90	0.83-0.97	0.006
6 to 7 wages	21(70.00)	9(30.00)	0.95	0.83-1.08	0.469
> 8 wages	20(83.33)	4(16.67)	1		
Marital status					
Single	162(64.03)	91(35.97)	0.99	0.93-1.06	0.984
Married/Fixed partner	126 (63.00)	74 (37.00)	1		
Divorced	7(87.50)	1(12.50)	0.82	0.67-1.01	0.067

Table 1 – Non-adjusted analysis of the distal, intermediary and proximal variables on Health-Care Waste management by the nursing team. São Luís, Maranhão, Brazil – 2015 (conclusion)

Variables	Health-Care Waste Management				
	Appropriate	Inappropriate	Prevalence Ratio	95% Confidence Interval	p-value
	n=295(63.99%)	n=166(33.01%)			
Intermediary variables					
Use of Individual Protection Equipment during segregation					
Yes	89(68.99)	40(31.01)	1		
No	206 (62.05)	126(37.95)	1.05	0.98-1.13	0.159
Occupational accidents					
No	187(64.93)	101(35.07)	1		
Yes	108(62.43)	65(37.57)	0.98	0.91-1.04	0.589
Vaccination status					
Yes	257(64.09)	144(35.91)	1		
No	38(63.33)	22(36.67)	1.00	0.91-1.10	0.910
Health-Care Waste Risks					
Yes	277(64.80)	151(35.28)	1		
No	18(54.55)	15(45.45)	1.07	0.95-1.21	0.243
Proximal variables					
Definition of Health-Care Waste					
Yes	294(100.0)	0(0.00)	1		
No	1 (8.00)	166(92.0)	1.80	1.75-1.86	<0.001
Legislation					
Complete knowledge	231(68.75)	105(31.25)	1		
Partial knowledge	64(51.40)	61(48.60)	1.10	0.94-1.29	0.200
Treatment					
Yes	66(62.86)	39 (37.14)	1		
No	239(64.33)	127(35.67)	0.98	0.91-1.06	0.784
Final destination					
Yes	68(75.56)	22(24.44)	1		
No	227(61.19)	144(38.81)	1.11	1.02-1.20	0.007
Health-Care Waste Training					
Yes	55(61.80)	34(38.20)	1.0		
No	240(64.52)	132(35.48)	0.98	0.98-1.06	0.633

Source: Created by the authors.

Obs.: p-value calculated based on the Poisson Regression Model with robust variance.

On the other hand, in the adjusted analysis, associations were found between distal-level HCW management and the following variables: nursing technician (PR=1.13; p<0.013) and mean age of 35.84 years (PR=1.0; p<0.010) (Table 2).

Table 2 – Adjusted analysis of distal variables in HCW management by the nursing team. São Luís, Maranhão, Brazil – 2015 (to be continued)

Variables	Prevalence Ratio	95% Confidence Interval	p-value
Sex			
Female	0.94	0.82-1.07	0.308
Age (mean)	1.0	1.00-1.01	0.010

Table 2 – Adjusted analysis of distal variables in HCW management by the nursing team. São Luís, Maranhão, Brazil – 2015 (conclusion)

Variables	Prevalence Ratio	95% Confidence Interval	p-value
Academic background			
Nursing technician	1.13	1.02-1.25	0.013
Marital status			
Divorced	0.85	0.72-1.07	0.334
Family income (minimum wages)			
≤ 2 wages	1.00	0.87-1.15	0.925
3 to 5 wages	0.93	0.82-1.05	0.275

Source: Created by the authors.

Obs.: p-value calculated based on the Poisson Regression Model with robust variance.

None of the variables was associated with the outcome. In the adjusted analysis of the distal and proximal variables, age (PR=1.0; $p<0.007$) and not knowing the definition of HCW (PR=1.30,

$p<0.001$) were associated with the outcome, while being a nursing technician lost statistical significance (Table 3).

Table 3 – Adjusted analysis of distal + proximal variables in HCW management by the nursing team. São Luís, Maranhão, Brazil – 2015

Variables	Prevalence Ratio	95% Confidence Interval	p-value
Age (mean)	1.0	1.0-1.02	0.007
Academic background			
Nursing technician	1.03	0.99-1.09	0.117
Definition of Health-Care Waste			
No	1.29	1.26-1.33	<0.001
Legislation of Health-Care Waste			
Knows partially	1.00	0.97-1.03	0.809
Final destination of Health-Care Waste			
No	0.99	0.93-1.04	0.929

Source: Created by the authors.

Obs.: p-value calculated based on the Poisson Regression Model with robust variance.

In the final hierarchical analysis model, the variables that remained associated with HCW management and were associated with risk of the outcome were: mean age of 35.84 years (PR=1.0; $p<0.101$), academic background

nursing technician (PR=1.13, $p<0.013$) and not knowing the definition of HCW (PR=1.30; $p<0.001$) (Table 4).

Table 4 – Final model of HCW management by the nursing team. São Luís, Maranhão, Brazil – 2015

Variables	Prevalence Ratio	95% Confidence Interval	p-value
Age (mean)	1.0	1.0-1.01	0.010
Academic background			
Nursing technician	1.13	1.02-1.25	0.013
Definition of Health-Care Waste			
No	1.29	1.26-1.33	<0.001

Source: Created by the authors.

Obs.: p-value calculated based on the Poisson Regression Model with robust variance.

Discussion

The results showed 63.99% of appropriate HCW management by the nursing team. A study carried out at a public hospital in Belo Horizonte (MG)⁽¹³⁾ supports the present findings, as the professionals analyzed presented knowledge and commitment to HCW management. Other studies^(7,14) counteract this information though, revealing improper management in a large part of the nursing team, a fact related to the ignorance or fragmentation of this knowledge, especially in relation to the definition and composition of HCW.

It has to be made clear that the management of HCW needs special attention because, when there is no organization and systematization of such waste, the inherent risks can spread not only to the workers, but also to society and the environment.

In both the unadjusted and adjusted analyses, the mean age of 35.84 years was associated with HCW management. This finding seems to be related to the knowledge, ability and technical skill required for professional practice. Health professionals' knowledge about HCW management is fundamental to favor the first stage of management: segregation, and also contributes to professional and environmental protection. Considering that all professionals generate waste, this theme needs to be problematized from the beginning of undergraduate courses⁽¹⁵⁾. HCW has been recently introduced in the nursing curricula, whether at a technical or higher level, influencing

the appropriate practice during management, mainly in the segregation of HCW⁽¹⁶⁾.

Another finding pointed out in this analysis as a risk factor for HCW management was the professional category of nursing technician. In a study carried out on the implementation of the HCW theme in technical training courses, it was verified that the content approach is insufficiently addressed in the curricular composition, in the course plan, and that bibliography on the subject is lacking⁽¹⁷⁾.

A study involving nursing technicians and their knowledge about HCW revealed that, in general, these professionals experience difficulty to present a comprehensive view on the subject, leaving gaps in the knowledge, mainly in the segregation stage of these residues and in the identification of residues only as infectious, which makes proper management difficult⁽²⁾.

The variables use of PPE in segregation, occupational accident and immunization situation were not associated with the management of HCW. It is worth mentioning, however, that knowledge about the risks deriving from HCW favors appropriate management.

Exposure to occupational hazards involving biological materials is constant amidst the unhealthy environment in hospitals, due to exposure to large amounts of body fluids, together with the difficulty to properly handle and dispose of sharps^(14,18).

Studies show that, although health professionals are potentially at risk of contamination by residues, it is commonplace to find a scenario

of non-concern among workers^(2,9). It is worth mentioning that knowledge on the risks arising from HCW favors appropriate management, in view of the direct relationship between HCW management and occupational health, due to the possible occurrence of work accidents during the management of this waste.

Among the proximal variables, only an improper definition of HCW remained associated with the outcome. Recognizing HCW is fundamental in the proper implementation of existing standards and positively reflects the basic actions that protect both the individuals involved in the process and minimizes the problems in public health⁽⁹⁾.

Knowing the mechanisms involved in the proper management of HCW is fundamental to reduce the potential agent of dissemination and contamination of the diseases, as well as knowing how to recognize them. Therefore, it is the duty of the professionals who work in the hospitals to excel through proper conduct in managing this waste so as to avoid any adverse effect. Lack of knowledge can cause errors during the management stages, pointing to the nonchalance of the professionals involved and the health service⁽¹⁹⁾. Responding to the deficiencies of the nursing team is possible with information about the HCW⁽¹³⁾. Thus, although it has not been shown as a factor associated with management, training is fundamental for the recognition and revision of the theme.

According to RDC 306/04^(1:12), it is the duty of health institutions "... to carry out initial qualification and ongoing training for personnel involved in waste management". Continuing education is the cornerstone in the development and qualification of the professionals involved in the process, as it enables the transformation of actions in daily activities⁽²⁰⁾.

The occupational risks HCW cause can be indicated as minimal or even non-existent, provided that there is proper control and execution in its management. This premise, according to some studies^(4,9,13-14,21), is related to the services that offer training to their employees who correctly classify and dispose of waste.

In view of the above, it is highlighted that changing this picture of ignorance and concern should start as early as in student education, developing critical thinking and reflexive actions in the future professional, associating theory with practice. Unfortunately, this does not seem to be the view found in the courses that prepare the nursing team. The fragmentation of knowledge ends up favoring inappropriate practices in waste management, a picture that directly affects the professionals when they start in the job market^(16,22).

The study presents strong points, evidencing that the management of HCW in the hospital environment, among Nursing professionals, remains a challenge, mainly related to the factors that were strongly associated in this study (age of 30-39 years, being a nursing technician and not being able to define what HCW is). In addition, the findings suggest that fragmented knowledge about HCW may be influencing inappropriate management, and that it is necessary to adopt measures that emphasize the importance of continuing education and curricular changes to suit the reality found. The proper management of HCW, as recommended by ANVISA Resolutions 306/2004⁽¹⁾ and 358/2005⁽³⁾, is still a challenge for the responsible managers and professionals involved in the process.

Thus, considering the robustness of the results found in this study, it is worth highlighting some limitations that may contribute to compromise the consistency of the results: the issue of HCW management was based on memories (memory bias); being a cross-sectional study, the analysis of the prevalent cases of the outcome and the collection of data on exposure and outcome was performed at a single moment in time.

Conclusion

The results of this study allowed us to conclude that the nursing professionals aged 30-39 years, nursing technicians and those who did not know how to define what HCW is were associated with inappropriate management of these residues. These variables, associated

with sociodemographic and occupational characteristics, such as education > 12 years of study (in the case of nursing technicians) and the lack of in-service training, may favor improper management and interfere in the professionals' continuing education process.

Collaborations:

1. conception, design, analysis and interpretation of data: Luana Pontes Oliveira, Isabela Vieira dos Santos Mendonça, Sâmea Cristina Santos Gomes and Arlene de Jesus Mendes Caldas;

2. writing of the article and relevant critical review of the intellectual content: Luana Pontes Oliveira and Sâmea Cristina Santos Gomes;

3. final approval of the version to be published: Luana Pontes Oliveira, Isabela Vieira dos Santos Mendonça, Sâmea Cristina Santos Gomes and Arlene de Jesus Mendes Caldas.

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