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RESEARCH

Health-Care Waste: Knowledge of Primary Care nurses

Resíduos de Serviços de Saúde: conhecimento de enfermeiros da Atenção Básica

Residuos de los Servicios de Salud: el conocimiento de enfermeros de la Atención Básica

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ABSTRACT

Objective: to describe the knowledge of nurses on Health-Care Waste Management (HCW) in Family Health Units (FHU) of São Carlos city, São Paulo State. **Method:** exploratory, descriptive and quantitative approach. The research was carried out with nurses of 16 FHU of the municipality of São Carlos-SP. Data were collected through an interview using a tool validated and analyzed using descriptive statistics. **Results:** it is noteworthy that 68.7% (11) of the nurses did not know how to describe how chemical waste was sorted. In addition, regarding the treatment of HCW, 50.0% (8) of the nurses did not know if the general waste were subjected to some type of treatment. **Conclusion:** the HCW management can be considered a challenge in the nurses' agenda inserted in the Primary Care services, which refers to the need to implement periodic training on the management of this waste.
Descriptors: Health-Care Waste; Waste Management; Primary Health Care; Nursing; Public Health.

RESUMO

Objetivo: descrever o conhecimento dos enfermeiros sobre o gerenciamento dos Resíduos de Serviços de Saúde (RSS) em Unidades de Saúde da Família (USF) de São Carlos, Estado de São Paulo. **Método:** estudo exploratório, descritivo e de abordagem quantitativa. A pesquisa foi realizada com os enfermeiros de 16 USF do município de São Carlos-SP. Os dados foram coletados por meio de entrevista, utilizando um instrumento validado e foram analisados por meio da estatística descritiva. **Resultados:** destaca-se que 68,7% (11) dos enfermeiros não souberam descrever como os resíduos químicos eram segregados. Além disso, quanto ao tratamento de RSS, 50,0% (8) dos enfermeiros não souberam informar se os resíduos comuns eram submetidos a algum tipo de tratamento. **Conclusão:** o gerenciamento dos RSS pode ser considerado um desafio na agenda dos enfermeiros inseridos nos serviços da Atenção Básica, o que remete à necessidade da implementação de capacitação periódica sobre o manejo desses resíduos.
Descritores: Resíduos de Serviços de Saúde; Gerenciamento de Resíduos; Atenção Primária à Saúde; Enfermagem; Saúde Pública.

RESUMEN

Objetivo: describir el conocimiento de los enfermeros sobre la gestión de los Residuos de Servicios de Salud (RSS) en Unidades de Salud de la Familia (USF) de São Carlos, Estado de São Paulo. **Método:** estudio exploratorio, descriptivo y de abordaje cuantitativo. La investigación fue realizada con los enfermeros de 16 USF del municipio de São Carlos-SP. Los datos se recogieron mediante entrevista, utilizando un instrumento validado y que fueron analizados usando la estadística descriptiva. **Resultados:** se destaca que 68,7% (11) de los enfermeros no supieron describir cómo los residuos químicos eran segregados. Además, en cuanto al tratamiento de RSS, 50,0% (8) de los enfermeros no supieron informar si los residuos comunes eran sometidos a algún tipo de tratamiento. **Conclusión:** la gestión de los RSS puede ser considerada un desafío en la agenda de los enfermeros insertados en los servicios de Atención Básica, lo que remite a la necesidad de la implementación de capacitación periódica sobre el manejo de esos residuos.
Descriptores: Residuos de Servicios de Salud; Gestión de Residuos; Atención Primaria a la Salud; Enfermería; Salud Pública.

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INTRODUCTION

In the current context of human development, there is a growing production of waste, which triggers serious problems related to its final disposal, requiring efforts of public managers in different areas, such as health, environment, planning and sanitation, to achieve management[1-3].

Municipal Solid Waste (MSW) is the result of industrial, domestic, hospital, commercial, agricultural and sweeping activities[4]. The National Solid Waste Policy (*PNRS*) also classifies MSW as waste originating from domestic activities in urban households, sweeping, patio and street cleaning and other urban cleaning services[5].

PNRS determines actions aimed at reducing the volume of waste in the country and mitigating risks to health and the environment, with a view to integrated management and environmentally sound management of solid waste. In this setting, we highlight the Health-Care Waste (HCW), which follow the principles and objectives of *PNRS*. However, it should be pointed out that the HCW is regulated by the National Agency for Sanitary Vigilance (*Anvisa*), through the Collegiate Board Resolution (*RDC*) 306/2004, and by the National Environment Council-*Conama* 358/2005, and are characterized as waste produced in medical and health services, hospitals, health units, clinics, medical and dental offices, pharmacies and laboratories[5-7].

RDC of *Anvisa* 306/2004 classifies the HCW into five groups, namely: Group A: pathological waste; Group B: chemical waste; Group C: radioactive waste; Group D: general waste; and Group E: sharps waste[6-7].

HCWs account for about 1 to 2% of total MSW; However, despite this small percentage of production, HCW is considered a challenge for managers, since they need adequate management due to the possibility of environmental contamination by pathological, chemical and radioactive agents and the risks they pose to public health[3].

According to *RDC* of *Anvisa* 306/2004 and Conama Resolution 358/2005, it is incumbent upon every HCW generator to prepare its Health-Care Waste Management Planning (HCWMP), which consists of a document that describes the relative actions HCW management, and should include the steps related to production, sorting, packaging, identification, internal collection, storage, treatment, external collection and transportation, final disposal and environmental protection actions[6-7].

Primary Care (PC) services generate a small share of hazardous waste; however, this production is significantly expanded when considering all the Units distributed throughout the country[8]. According to August 2016 data from the Department of Informatics of the Brazilian Unified Health System (SUS)[9], in Brazil there are 34,706 Health Centers/Basic Health Units (BHU) in operation, resulting in a high production of HCW.

In Brazil, important studies were carried out in relation to HCW management, and among these, the studies of Takayanagui (2005) and André (2014), in the hospital setting[3-10], Mendes (2015), Mobile Prehospital Care (APHM)[11], and Alves (2014), in units of Primary Health Care (PHC)[8]. These studies point to the need for proper management of HCW in several settings.

However, this topic presents a gap regarding the management of HCW produced in PC throughout the country, since the studies carried out in UBS and Family Health Units (FHU) only address some aspects of this management, such as production and some stages of the management. They do not, therefore, exploit the totality of HCW management, that is, from its production to its final disposal.

Thus, this study aims to investigate the literature gap regarding the knowledge of FHU nurses on the management of HCW, especially the steps that cover HCW management. It is also worth noting that, regarding the management of HCW, Federal Nursing Council (*Cofen*) Resolution 303/2005 defines that the duly registered nurse with a regular ethical and professional situation in the respective Regional Nursing Council (*Coren*) and the Annotation of Technical Responsibility (ART) is empowered to design and implement the HCWMP[12].

OBJECTIVE

To describe the knowledge of nurses on the management of Health-Care Waste in Family Health Units from São Carlos city, São Paulo State.

METHOD

Ethical aspects

This study was performed after authorization by the Municipal Health Department of the city of São Carlos and approved by the Research Ethics Committee of the *Universidade Federal de São Carlos*. All subjects signed the Informed Consent Term, pursuant to Resolution 466/2012 of the National Health Council[13].

Design, place of study and period

It is a descriptive and exploratory study, using quantitative variables to gather data about the object of the study. The study was performed in 16 FHU of the city of São Carlos-SP and data were collected from March to June 2016.

Population and criteria for inclusion and exclusion

The study was attended by 16 nurses from 16 FHU in the city of São Carlos-SP. In the municipality there are 17 FHU, with one nurse in each FHU; however, one of the Units was without a nurse during the period of data collection. São Carlos has 221,950 inhabitants (Brazilian Institute of Geography and Statistics, 2010) and the coverage of the FHU in the municipality is 30.6% of the population (67,916 inhabitants).

The inclusion criteria refer to the Health Units registered in the *Conselho Nacional de Estabelecimentos de Saúde* (*CNES*) and the Municipal Sanitary Surveillance of São Carlos-SP, whose administrators agreed to participate in the research. Waste managers who worked for the FHU for more than two months were included and the exclusion criterion was to be on vacation or leave.

Study protocol

The data were collected through an interview, using an instrument called Health Services Waste Management - Rapid Assessment Tool, Brazilian version (HCWM-RAT - of the World

Health Organization or Instrument World Health Organization), validated by Silva[1]. The HCWM-RAT is composed of 12 sections, and for this investigation, the section called "Questionnaires to collect data on health-care institutions personnel".

Data analysis

The data were typed twice in a database in the Excel program, aiming at the minimization of typing errors, and were analyzed through the descriptive statistics.

RESULTS

The results on nurses' knowledge about HCW management in the FHU of the city of São Carlos-SP were subdivided according to the management stages: production; sorting; packaging and identification; internal collection and storage; transportation to external shelter; external storage; external collection; treatment; and final disposal of HCW.

1. Health-Care Waste production

Daily production of HCW, according to 31.2% (5) of the interviewees, was 3 to 6 kg. Regarding pathological waste, 31.2% (5) of the interviewees reported that daily production ranged between 10 and 20 liters. The lack of knowledge regarding the production of chemical waste is highlighted, since 81.2% (13) of the respondents did not know how to report (Table 1).

Regarding the general waste, 37.5% (6) of the nurses answered that 1 to 2 liters are produced daily, and 31.2% (5) did not know to inform. Finally, 25% (4) of the interviewees reported that 0.2 to 1 kg per day of sharps were produced (Table 1).

In the light of the information that the FHU did not produce radioactive waste, the following results refer to pathological, chemical, general and sharps waste.

2. Sorting

Regarding sorting, all respondents stated that the HCWs were sorted according to their group. As for the sorting of pathological waste, 56.2% (9) of the respondents stated that material with blood and bodily fluids were added to this group (Table 2).

It is noteworthy that 68.7% (11) of the nurses did not know how to describe how chemical waste was sorted and 43.7% (7) of the respondents reported that general waste was disposed of in black bags. In addition, 50% (8) of the nurses reported that needles, scalpels and lancets were sorted as sharps waste (Table 2).

Table 1 – Amount of Health-Care Waste produced per day in Family Health Units of São Carlos, according to the nurses, São Paulo, Brazil, 2016

Characteristics	Amount	Number of nurses	% of nurses
Amount of HCW Per Day	3 kg – 6 kg	5	31.2
	30 l – 50 l	3	18.7
	50 l – 70 l	1	6.2
	70 l – 90 l	1	6.2
	Above 100 l	2	12.5
	Did know to inform	4	25
Pathological Waste	1 kg – 3 kg	4	25
	10 l – 20 l	5	31.2
	21 l – 30 l	1	6.2
	Above 30 l	1	6.2
	Did not know to inform	5	31.2
Chemical Waste	1 kg – 3 kg	3	18.7
	Did not know to inform	13	81.2
Radioactive Waste	Do not produce	16	100
General Waste	1 kg – 4 kg	4	25
	1 l – 2 l	6	37.5
	Above 2 l	1	6.2
	Did not know to inform	5	31.2
Sharps Waste	0,2 kg – 1 kg	4	25
	1 l – 2 l	6	37.5
	Above 2 l	1	6.2
	Did not know to inform	5	31.2

Note: HCW - Health-Care Waste

Table 2 – Sorting of Health-Care Waste produced in Family Health Units of the municipality of São Carlos, according to the nurses, São Paulo, Brazil, 2016

Waste	Sorting	Number of nurses	% of nurses
Pathological	Waste disposed in the white bag	6	37.5
	Waste contaminated with blood and other bodily fluids	9	56.2
	Professional who handles and sorts the waste	1	6.2
Chemical	Hypochlorite and detergent waste	2	12.5
	X-ray developer and amalgam waste	1	6.2
	Waste disposed in the black bag	1	6.2
	Did not know to inform	11	68.7
	Professional who handles and sorts the waste	1	6.2
General	Paper, packaging, food waste and material without bodily fluids	8	50.0
	Waste disposed in black bags	7	43.8
	Professional who handles and sorts the waste	1	6.2
Sharps	Waste like needles, scalpels and lancets	8	50.0
	Waste disposed in the descarpack (waste disposal brand)	7	43.7
	Professional who handles and sorts the waste	1	6.2

2.1 Packaging and identification

Regarding the HCW packaging, 81.2% (13) of the nurses reported that the pathological waste were packed in a waste-basket with pedal and lid, 75% (12) did not know to inform about the chemical waste packaging, 31.2% (5) stated that the general waste was packed in open trash cans, without pedal and in bags (Table 3).

Regarding the identification of pathological waste, 93.7% (15) of the nurses reported that Group A waste was identified by the white package and only 6.2% (1) of the nurses reported that the identification of these was by means of white package and symbol.

Regarding the identification of chemical waste, 81.2% (13) of the interviewees did not know to inform. In addition, 93.7% (15) of the professionals reported that general waste was identified by the black package. It was also noted that 100% (16) of the nurses stated that the sharps were packed in specific boxes and the identification was in the box itself (Table 3).

2.2 Internal collection and storage, transportation to external shelter and external collection

Of the interviewees, 68.7% (11) of the interviewees had HCW internal collection, and 50% (8) of the nurses reported that the internal collection was performed twice a day (Table 4).

Regarding HCW storage, 81.2% (13) of the respondents stated that the service did not have a place for the internal storage of the waste, being led directly to external storage. In this context, 100% (16) of the nurses reported that HCW were manually transported to the external shelter and 43.7% (7) reported that the external collection of pathological waste and puncture was performed once a week and, in general, three times a week (Table 4).

Table 3 – Packaging and identification of Health-Care Waste produced in Family Health Units of São Carlos, according to the nurses, São Paulo, Brazil, 2016

Characteristics	Waste	Description	Number of nurses	% of nurses
Packaging	Pathological	Trash cans with pedal and lid	13	81.2
		White bags	3	18.7
	Chemical	Common trash can	2	12.5
		Launched into the sewer	1	6.2
		Non-specific plastic packaging	1	6.2
		Did not know to inform	12	75.0
	General	Open trash cans without pedal and black bag	5	31.2
		Trash cans with pedal and lid	8	50.0
		Black bags	3	18.7
	Sharps	Box with sharps	16	100
Identification	Pathological	White package	15	93.7
		White package and symbol	1	6.2
	Chemical	Black package	2	12.5
		Transparent Gallon	1	6.2
		Did not know to inform	13	81.2
	General	Black package	15	93.7
		Black package and symbol	1	6.2
	Sharps	Own package	16	100

Table 4 – Internal collection and storage, transportation to the external shelter and external collection of Health-Care Waste produced in Family Health Units of São Carlos, according to the nurses, São Paulo, Brazil, 2016

Characteristics	Description	Number of nurses	% of nurses
Internal collection (Routine)	There are routes and schedules set	11	68.7
	No routes and times set	5	31.2
Internal collection (Frequency)	Once a day	5	31.2
	Twice a day	8	50.0
	Three times a day	2	12.5
	According to the Unit flow	1	6.2
Internal storage place	Yes	3	18.7
	No	13	81.2
Transportation to external shelter	Carried out manually	16	100
External collection (Frequency)	Once a week (all waste groups)	2	12.5
	Three times a week (all waste groups)	1	6.2
	Once a week (GA/GE) and three times a week (GD)	7	43.7
	Twice a week (GA/GE) and three times a week (GD)	3	18.7
	Once a week (GA/GE) and twice a week week (GD)	3	18.7

Note: GA = Group A (pathological waste); GD = Group D (general waste); GE = Group E (sharps waste)

Table 5 – Treatment and final disposal of Health-Care Waste produced in Family Health Units of São Carlos, according to the nurses, São Paulo, Brazil, 2016

Characteristics	Waste	Description	Number of nurses	% of nurses
Treatment	Pathological	Autoclave	1	6.2
		Incineration	11	68.7
		Did not know to inform	4	25
	Cheminal	Did not know to inform	16	100
	General	Recycling	2	12.5
		Composting	2	12.5
		Incineration	1	6.2
		Sanitary landfill	1	6.2
		Landfill sites	2	12.5
		Did not know to inform	8	50
	Sharps	Incineration	10	62.5
		Did not receive treatment	1	6.2
		Did not know to inform	5	31.2
Final disposal		Sanitary landfill	5	31.2
		Controlled landfill	1	6.2
		Waste is biodegradable	1	6.2
		Did not know to inform	9	56.2

2.3 Treatment and final disposal of Health-Care Waste

For 100% (16) of the nurses, the HCW were not subjected to any type of treatment at the Unit itself. Regarding the type of treatment offered to pathological waste, 68.7% (11) of the respondents stated that waste was incinerated and 100% (16) of the nurses did not know to inform the type of treatment offered to chemical waste. In addition, 50% (8) of the nurses did not know to inform if the general waste was subjected to some type of treatment and 62.5% (10) of the professionals reported that the waste sharps were incinerated (Table 5).

Finally, 56.2% (9) of the interviewees did not know to inform the type of final disposal offered to the HCW and 31.2% (5) of the nurses stated that HCW were sent to sanitary landfills (Table 5).

DISCUSSION

The results obtained in this research show that the problem of HCW management is relevant and requires interventions. This is because the knowledge of the FHU nurses on the subject was unsatisfactory, especially regarding the stages of HCW management, inferring the lack of knowledge of these professionals regarding the health impacts of workers, the community and the environment.

The HCW production reported by the nurses showed a predominance of waste of Groups A (pathological) and D (general). In this context, nurses are not aware of the production of chemical waste, since all health services produce chemical waste and these may be being discarded inappropriately, offering risks, especially for the environment.

In addition to the amount of HCW produced daily, it was possible to observe the high production of waste of group A, to the detriment of group D. According to the literature, infective waste represent 10 to 20% of the total HCW produced[3], thus the amount of pathological waste reported by the majority of respondents is high in relation to the amount of general waste and divergent results found in the literature. This can demonstrate an inadequate sorting that, consequently, increases the costs of the management, due to the greater volume of pathological waste to be submitted to some type of treatment.

In a study conducted at a University Hospital in the northeastern region of Rio Grande do Sul State, the treatment of infectious waste was carried out by its incineration at a cost of R$ 0.16 a liter. The hospital compared HCW treatment costs from inadequate and adequate sorting and it was possible to show that the institution saved R$ 1,600 per month with treatment of infectious waste sorted correctly, implying a reduction of 18, 4% of the cost per month[14].

Chemical waste is produced in large volumes in hospitals due to the use of drugs, sterilants, human tissue preservatives and clinical analysis reagents. According to current regulations, chemical waste must be managed properly in order to avoid workplace accidents and reduce environmental pollution by hazardous products[6-7,15]. However, it should be noted that chemical waste, such as hypochlorites, are also produced in the services included in the PC and, likewise, must follow the current regulations.

The data of this study brings concern on the management of chemical waste, since, although these are produced in the FHU, the management of this group of waste is unknown by the nurses. Improper management of chemical waste increases the risk of contamination of health service workers, the community and the environment due to their flammability, corrosivity and toxicity characteristics. Thus, despite these consequences, the Brazilian legislation has not been efficient in its application[16].

The production of radioactive waste is allowed only to institutions authorized by the Resolution of the National Commission of Nuclear Energy (*CNEN*) 6.05[6], so that the FHU are not characterized as generators of waste of Group C. However, the interviewees did not know to inform about the production of this group of waste, revealing ignorance about the management of HCW.

Regarding HCW sorting, the *RDC* of *Anvisa* 306/2004 states that HCW must be sorted at the time and place of their production, according to the physical, chemical and pathological characteristics, the physical state and the risks involved[6]. HCW sorting is the first step towards adequate management, and it is considered the most important and determining step for subsequent stages and is the responsibility of all health workers[17]. The nursing professional, considered one of the main HCW producers, besides being directly related to waste sorting, plays an important role in the development of an appropriate HCW management and in the implementation of the HCWMP, collaborating with structural changes, vocational training and policies for the management of waste[18].

In this study, all the nurses participating in the research stated that the professionals sorted HCW. However, it was possible to perceive the incomprehension of the interviewees about the sorting of the HCW, since they understood sorting and packaging as a same step and did not inform if the sorting occurred at the moment or after the production of the waste.

In a study carried out in hospitals in the city of Vitória-ES, the average rate of production of non-sorting waste containing Group D waste mixed with Group A was 2.68 kg per bed occupied per day. The authors found that, by properly sorting the waste in their respective groups, the amount of Group A waste reduced from 2.68 to 1.15 kg per bed occupied per day, corresponding to a reduction of costs with Incineration of 57.71%[19].

A study on HCW management of a Mobile Prehospital Care (APHM) in the countryside of São Paulo during the analyzed period of eight days presented a production of 48.74 kg of waste packed in white bags, Group A. Subsequently, HCW characterization was performed and a predominance of Group D waste (54.19%) discarded together with Group A waste was found. The authors pointed out that the inadequate packaging of HCWs is related to the absence of sorting at the time of production of waste[11].

The type of HCW packaging mentioned by the interviewees presented misunderstandings, such as the chemical waste disposed in a common trash can and the general waste disposed in open trash cans and without a pedal. These data reaffirm the lack of knowledge of the nurses about the HCW management stages, especially about the chemical waste packaging, as well as the precarious infrastructure such as the presence of uncovered trash cans and pedals.

The identification of the HCW referred by the interviewees presented inadequacy, since all the nurses reported that the identification of the different HCW groups was performed only by color standard, which could compromise the identification of the groups of waste and, consequently, the other steps management.

The assessment of HCW management in non-hospital emergency and emergency service units in Brazil[18] showed that only containers for eliminating waste sharps were identified. However, the authors pointed out that this was due not to the mandatory but to the standardization of disposal containers by the technical standard of the Brazilian National Standards Organization named *Associação Brasileira de Normas Técnicas* (*ABNT*) *NBR* (*Norma Brasileira Regulamentadora*) 7,500/2013[20], which consists of the symbol of infectious substance plus inscription "sharps waste".

The results of a study on HCW management in PHC services in Brazil showed that the identification of containers for the storage of waste is a determining factor between errors and correctness in the sorting stage, since the *RDC* of *Anvisa* 306/2004 states that an adequate identification contributes to sorting at the time of production of such waste. In addition, the authors pointed out that the inadequate management of chemical waste was related to the lack of identification of the containers for their storage[6,8].

According to the *RDC* of *Anvisa* 306/2004, all health professionals who are directly involved in HCW management activities should know the system adopted for HCW management of the institution, especially issues such as waste sorting and shelter location, besides of the knowledge of symbols, expressions, color patterns and phrases adopted to identify the different groups of HCW[6].

The management of HCW represents a challenge not only for Brazil, but for many developing countries. A study conducted in hospitals in Tanzania revealed that there was no sorting between infectious and non-infectious waste, contributing to the potential for increased risk to the general public. In addition, most respondents from Shinyanga (97%), Kolandoto (83%) and Kambarage (91%) hospitals were unaware of the existence of different collecting vessels for the storage of each type of HCW[21].

Regarding internal collection and transportation to the external shelter, most of the nurses classified as adequate, since the internal collection occurred at least once a day and had a route and time set. According to the *RDC* of *Anvisa* 306/2004, the transportation of waste in hospitals to the outside should be carried out by means of an itinerary set and at a time not coinciding with the distribution of clothing, food and medication, visits or greater periods flow of people[6]. It should be noted that this HCW legislation does not determine how HCW collection and transportation should be in FHU; however, it is believed that these Units must have a time and route set for the collection of waste and that such collection should be carried out at a lower flow of people.

The problem of HCW management still present in developing countries shows similar settings in these places. In a survey carried out in 11 hospitals in Iran, the results found that eight hospitals had adequately protected and sanitized temporary storage, while three hospitals had temporary shelters protected but inadequately sanitized. In addition, in the eight hospitals initially referred to, storage time was 24 hours, while in the other three hospitals the storage period was up to 48 hours, which is considered an excessive time and could result in odor problems, in addition to presence of insects[22].

With regard to internal storage, the *RDC* of *Anvisa* 306/2004[6] provides that the waste storage room must have smooth, washable floors and walls, as well as an artificial lighting point and a sufficient area to store, at least, two collecting vessels. Temporary storage may be dispensed with in cases where the distance between the production point and external storage and the quantity of waste justify it. In the case of FHU, the short distance mentioned and the small amount of HCW justify that there is no place for the internal storage of the waste.

In relation to transport to the external shelter, according to *NBR ABNT* 12809/2013, manual disposal of HCW is allowed;

however, the volume should not exceed 20 liters. Thus, transport of HCWs to the external shelter manually carried out in the investigated FHUs is not inadequate, provided that the cargo limit for transportation by the workers is respected[23].

Failures in the management of HCWs favor exposure to environmental risks and associated costs. Appropriate management of waste depends on the involvement of each individual and a waste management plan, which must be developed in a collaborative way, giving co-responsibility to health professionals and managers[8].

The level of adherence to waste guidelines remains a key challenge in a number of countries, especially developing and underdeveloped countries. In a study conducted in Thika (Kenya), adherence to the guidelines was considered low (16.3%), and there was no difference in adherence among nurses and waste handlers, revealing that health professionals and population are exposed to risks to associated with waste[24].

HCW management in Ethiopia's health centers was analyzed in one study and the results showed that waste management does not receive sufficient attention in all health centers. The authors considered that the management was inefficient and needed to be improved, as well as pointed out that the observed failures were mainly related to sorting and treatment of HCW[25].

Regarding HCW treatment, all interviewees in this study reported that HCW were not subjected to any type of treatment at the place of production. Considering the results, it was possible to observe misunderstandings such as the consideration of landfill sites and sanitary landfills as alternatives for treatment.

Regarding the final disposal of the HCW produced by the FHU, most interviewees were not able to inform the final disposal of each Waste Group, even in relation to general waste. In this context, it can be inferred that the interviewees considered that outside institution stages are not the responsibility of the Unit, contradicting the *RDC* of *Anvisa* 306/2004, which determines that health services are responsible for the management of HCW from the production to the final disposal[6].

It should be emphasized that among the health professionals trained to act in the management of HCW, the nurse stands out, which, according to *Cofen* Resolution 303/2005, besides being responsible for the coordination of the nursing team, is also considered able to assume the role of waste manager[12].

The nursing team plays a fundamental role in the management of HCW, since it is directly involved in its production[18]. In this context, the FHU nurse should train the nursing team and other professionals for the proper management of HCW, emphasizing the implications of managing HCW on costs and risks to human and environmental health[26].

The educative action of nurses in the process of raising awareness among health professionals about HCW management contributes to changes in the short term in relation to the health team and, in the medium term, can reach managers of institutions in relation to improvement of infrastructure conditions for HCW management[27].

In this way, the nurse, besides being considered a professional qualified to exercise the function of manager of HCW, also plays an essential role in the articulation and orientation of the health team for an effective and adequate implementation of HCWMP. Thus, in view of the results of this study, the deficiencies in nurses' knowledge about the management of HCW become evident, which is a concern about inadequate practices, reinforcing the need for training to promote proper HCW management.

Study limitations

The study presented as a limitation the difficulties encountered by the researchers for the data collection, since the scheduled interviews were remarked countless times, being necessary the extension of the period of data collection. It is emphasized that the nurses' unavailability to participate in the research may be related to the work overload, since these professionals perform assistance, educational and managerial functions in the FHU.

Contributions to the area of nursing, health or public policy

This study aims to contribute to the public health area by revealing the knowledge and practice of nurses in the management of HCW in FHU and inserting in the agenda of health professionals and managers the discussion on the management of this waste in these Units. It also aims to contribute to the advancement of scientific knowledge of the subject, especially in this setting of study. It should be emphasized that the results of this study contribute to present to the scientific community the need for reflection and decision-making of managers and health professionals regarding the importance of adapting HCW management, especially in the services included in Primary Care. In addition, this study reflects on the importance of nurses in the management of this waste, since it is considered a professional qualified to perform the role of waste manager, especially in the FHU.

The adequacy of management of HCW in FHU depends on management and health professionals, that is, management should promote training activities of the entire FHU regarding the management of HCWs, especially the nurses of those units, who assume the management of this waste. In addition, it is necessary to address HCW management in undergraduate courses in the health area, directly contributing to adequate management and management.

This research is also committed to contribute to the improvement of HCW management at the sites participating in the study. In this context, the results were presented to the Municipal Health Department of São Carlos to serve as a subsidy for the implementation of measures aimed at the adequacy of HCW management.

CONCLUSION

The results of this study reveal that knowledge about the management of HCW by nurses is unsatisfactory in relation to all stages of HCW management produced by FHU, which leads to the commitment of the whole process regarding the management of HCW, since it does not meets the requirements of the *RDC* of *Anvisa* 306/2004. However, it is worth emphasizing the merit of the Brazilian nursing in the management of sharps waste, since all the participants of the study reported that these waste were sorted and adequately conditioned, contributing to the minimization of the risk of accidents.

Proper HCW management is presented as a challenge in the nurses' agenda because, faced with so many duties

and responsibilities, HCW management does not receive the necessary attention. However, the nurse is also involved in the management of the Unit, being considered the reference professional within the FHU, and therefore has a fundamental role in the management of HCW, especially in the planning and organization of actions for the facing this challenge.

It is important to emphasize the importance of the commitment and involvement of the entire FHU health team in the execution of an appropriate HCW management, in addition to the need for the participation of municipal management as a promoter of permanent educational actions in all FHU, which aim to train the professionals involved directly and indirectly with HCW management.

The management of HCWs should not be limited to compliance with legislation, but must involve the change of pipelines related to waste management. Thus, with the results of this study, nurses are expected to reflect on the scale of the consequences caused by inadequate management of HCWs, so that management of HCWs is not only treated as a function to be fulfilled but as a designated responsibility to a professional able to plan and implement the HCWMP in the FHU in an efficient and safe manner.

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