Original Article

Disposal of infective waste: demonstrated information and actions taken by nursing and medical students

Descarte de resíduos infectantes: informações demonstradas e ações praticadas por estudantes de enfermagem e medicina

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ABSTRACT

The inappropriate disposal of infectious waste generates occupational and environmental risks, representing the main cause of accidents with biological material. The aim of the present study was to verify the knowledge and the practice regarding the disposal of infectious waste among nursing and medical undergraduate students at a public university in the state of Goiás. Data were collected with the application of a questionnaire. The respondent students were observed in their practice and data were recorded in a checklist. Nursing students presented greater knowledge than medical students on the disposal of contaminated gloves (x^2; $p<0.001$), as well as on the disposal of sharp cutting instruments ($p=0.001$). Contaminated gloves were disposed of into bags for common waste both by the nursing and the medical students. Results evidenced that the knowledge of students on the disposal of infectious waste was poor and insufficient to ensure its application to practice.

Descriptors: Medical Waste; Waste Management; Students, Nursing; Students, Medical; Occupational Exposure.

RESUMO

O descarte inadequado de resíduos infectantes gera riscos ocupacionais e ambientais e representa a principal causa de acidentes com material biológico. O presente estudo objetivou verificar o conhecimento sobre o descarte de resíduos infectantes e a prática dele entre acadêmicos dos cursos de enfermagem e de medicina de uma universidade pública de Goiás. Os dados foram coletados por meio da aplicação de um questionário. Os estudantes respondentes foram observados na prática e os dados registrados em check list. Os acadêmicos de enfermagem apresentaram maior conhecimento que os de medicina sobre o descarte de luvas contaminadas (x^2; $p<0,001$), bem como sobre o descarte de perfurocortantes ($p=0,001$). O descarte de luvas contaminadas foi feito em saco para resíduos comum, tanto pelos graduandos de enfermagem quanto pelos de medicina. Os resultados evidenciaram que o conhecimento dos estudantes sobre descarte de resíduos infectantes mostrou-se frágil e insuficiente para garantir a sua aplicabilidade na prática.

Descritores: Resíduos de Serviços de Saúde; Gerenciamento de Resíduos; Estudantes de Enfermagem; Estudantes de Medicina; Exposição Ocupacional.

INTRODUCTION

Health care waste (RSS) can be generated in every environment where health care is provided[1]. Due to its danger, these wastes are classified, in accordance to the Brazilian law, in five groups: A – infectious (subdivided as: A1, A2, A3, A4 and A5), B – chemical, C – radioactive, D – common, E – sharps[1-2].

This classification allows segregation, which consists in the separation of waste when it is generated, so that it can be packaged, treated and have a final destination in accordance with the risks that they represent[3].

Despite segregation being decisive in waste management, many studies pointed out to flaws in this step[3-5]. These mistakes can happen due to lack of knowledge and/or awareness[6-9] and/or precariousness of adequate inputs, as containers for packaging waste in the right places and the deficiency of physical structure[3-4].

Mistakes caused by segregation occur in waste disposal of all groups. There are common wastes in bags designated to infective or in boxes with rigid walls. There are sharps in bags and infective with common waste[3-4].

These flaws can cause occupational risks, especially when disposing sharps in inappropriate places, it can trigger environmental damage when disposing waste into the environment without prior treatment and elevate economic costs when sending for treatment materials that do not request such process.

It is noteworthy that inadequate sharps disposal represents one of the most common causes for accident with biological material. From March 2012 to October 2013, 10.088 accidents with biological material were notified in Brazilian health services and, from those, more than 1.400 (14,7%) occurred due to inadequate waste disposal[10]. Studies conducted with specific populations also confirmed these findings, being inadequate sharp disposal responsible for 15,6% to 21,0% of occupational accidents causes with exposure to biological material[11-14].

The responsibility for waste disposal is from whoever generated it[1]. Thus, all social actors involved in this process - health professionals, health related students, caregivers and users – need to know and to be aware of their important role in waste management.

The knowledge of RSS management by health professionals is fundamental to favor adequate segregation and the consequent professional and environmental protection. Considering that all professionals generate waste, this issue needs to be problematic since the beginning of undergraduate courses, anticipating the initiation of student's practical activities, aimed to raise awareness and behavior change.

In this context, the present work was developed with nursing and medical undergraduate students, as they develop practical activities which generate infective waste. These students, in a course conclusion phase, will be inserted in the job market in a near future, therefore, they are responsible for the segregation of materials; some will possibly be facing the planning and waste management in their work places.

Nevertheless, there are few national studies addressing this theme[15-16] and a lack of recent international studies addressing the nursing and medical student's knowledge about waste disposal[17].

Thus, our objective was to verify knowledge and practice of nursing and medical students regarding infective waste disposal and sharps. We believe that results from this study will bring subsides to forming institutions to reassess the approach context of this theme during undergraduate level.

METHOD

A cross-sectional descriptive and observational study, conducted with students from the last year/period of nursing and medical undergraduate in a public university in Goiás.

Data collection occurred in two steps. First, a questionnaire was answered by students from the two courses, with closed and open ended questions, aimed to

verify knowledge about disposal of infective and sharp wastes. All nursing and medical students from the last year of courses who were present in the data collection day participated in this step. This phase of data collection was conducted by the principal investigator after observation of the ethical aspects.

Instruments were submitted to the judgement of seven judges, four professionals considered experts in teaching, research and assistance, and also other three professionals with large experience in assistance, in terms related to infectious diseases, more precisely with preventive infections measures in health related establishments. After analysis, discussion of suggestions from judges and a pilot test, the instruments were adjusted. The first part of the questionnaire had questions aimed to characterize the studied population: course, date of birth, gender and others. Other questions were elaborated in accordance with the ANVISA 306/2004 resolution[1] and addressed aspects about segregation of infective and sharp waste.

In the second step, data was collected by direct observation of students in hospital care facilities (medical, surgical, tropical, pediatrics, gynecological clinics, emergency rooms, clinic and surgical ICU) and registered in a verification list with items that allowed identifying how students disposed infective and sharp wastes.

All students who answered the questionnaire, developed practical activities or performed an internship in care units at the teaching hospital during their last year of course, and they could be observed in their practice, constituting the study population in the second step of the investigation.

Students were observed at least once during their caregiving activities that involved waste disposal. To avoid interference in results, the researcher who applied the questionnaire did not participate in this phase of data collection. Ten research assistants participated in this step and they were previously oriented and qualified, aiming data uniformity. They were positioned strategically in care units to facilitate observation of students during the execution of investigated procedures. We opted to observe one student from beginning to end of a procedure, and then start the observation of another one. Discretion of research assistants during data collection was cautiously planned.

Data was analyzed with descriptive statistics using simple frequencies. After, data was processed using the program Sigma Stat®, version 2.03®. To verify the categorical variables, we used Chi-Square tests and Fisher's exact test, considering $p<0.05$.

The research project was approved by the Ethics in Research Committee from the Clinical Hospital of the Federal University of Goiás, nº 043/07. Data was collected after participants signed the Free and Informed Consent Term, when the questionnaire was conducted.

RESULTS

Forty-eight nursing (100,0%) and 93 medical students (83,0%) answered the questionnaire. We observed 26 nursing (54,2%) and 78 (69,6%) medical students. There was no significant statistical difference between the expected and the studied population, p= 0,333.

Nursing and medical students were observed in practical situations and had 45 to 20 opportunities, respectively, to dispose infective waste. The disposal occurred in a common waste bag by nursing students in 37 opportunities, while medical students disposed in only 16. Within the disposed infective waste, dressing materials and gloves contaminated with biological agents stood out (Table 1).

Table 1: The practice of infective waste disposal in common disposal bags by nursing (n= 37)* and medical students (n= 16)*. Goiânia, GO, Brazil, 2007.

Type of infective material	Nursing students		Medical students	
	n	%	n	%
Gloves	12	32,4	06	37,5
Dressing material	19	51,3	04	25,0
Tongue-depressor	00	0,0	03	18,0
Syringe	02	5,4	00	0,0
Probe	02	5,4	00	0,0
Others	02	5,4	03	18,7

* Referred to the number of waste observations by student groups.

Nursing students had 44 opportunities to dispose gloves contaminated with biological material while medical students had 16 (Table 2).

In total, 43 nursing (89,6%) and 49 (52,6%) answered that gloves contaminated with biological material should be disposed in milky white bags. In practice, in 32 (72,7%) and in 10 (62,5%) opportunities, the nursing and medical students, respectively, disposed gloves in the appropriate bag, in accordance with Table 2.

Table 3 presents answers provided by students from the two courses about disposal of sharp waste.

Table 2: Answers and actions of nursing and medical students regarding the disposal place for gloves contaminated with biological material. Goiânia, GO, Brazil, 2007.

Disposal place	Nursing students		Medical students		Test	p
	n	%	n	%		
Knowledge	(n=48)		(n=93)		x^2	
Milky white bag	43	89,6	49	52,7	19,176	<0,001
Common waste	3	6,2	10	10,7	0,284	0,594
Unaware of the type	1	2,1	34	36,6	17,947	<0,001
Not informed	1	2,1	0	0	-	-
Practice	(n= 44)*		(n= 16)*		Fisher's Exact	
Milky white bag	32	72,7	10	62,5	-0,53	
Common waste	12	27,3	6	37,5		

* Refers to the number of waste observation by student groups.

Table 3: Answers of nursing (n = 48) and medical students (n = 93) regarding the disposal of sharp waste after use. Goiânia, GO, Brazil, 2007.

Variables	Nursing students		Medical students		x^2	p
	n	%	n	%		
Sharp waste recipient should have rigid walls.						
True	47	97,9	90	96,8	0,393	0,531
False	0	0,0	03	3,2		
Not informed	01	2,1	00	0,0		
Sharps should be left on a tray after use						
True	05	10,4	78	83,9	66,368	0,001
False	42	87,5	15	16,1		
Not informed	01	2,1	00	0,0		
Waste recipient should be close to the procedure place.						
True	36	75,0	79	84,9	0,970	0,325
False	11	22,9	14	15,0		
Not informed	01	2,1	0	0,0		

In practical situations, 12/12 (100,0%) of the nursing students who disposed sharps, did it in an appropriate recipient. Also, 06/07 (85,7%) of medical students did it correctly. We highlight that 01/07 (14,3%) of medical students left the material on the tray.

DISCUSSION

All professionals should be worried about the waste generated during their activities with the goal of minimizing risks to the environment and to the workers' health, as well as the whole population[3,18].

In this study, we opt to verify the knowledge and the practice of gloves contaminated with biological material and sharps, as we understand that those are the ones most used by students, which would facilitate observation of waste and the comparison between knowledge and practice, making the analysis more reliable.

We observed a difference statistically significant regarding the demonstration of possessing information about the disposal of gloves contaminated with biological material presented by the nursing students in relation to the medical students (Table 2). We verified that 34 (36,6%) of medical students affirmed to not know the recommended bag type to dispose gloves contaminated with biological material. A study conducted in Minas Gerais found 62,2% of undergraduate students from basic cycles of biology and health fields not knowing the color of the bag recommended for infectious waste package[16]. We highlight that knowledge of adequate recipient for this disposal is one of the basic requirements for an adequate segregation.

Observation data from practical situations show a dichotomy between knowledge (43, equivalent to 89,6%) and practice (12, the equivalent to 27,3%) of contaminated gloves disposal by nursing students, and it confirms the little knowledge (49, which represents 52,7%) demonstrated by medical students about this disposal.

In a similar study conducted with students and professors of medicine, veterinary and nursing, it was demonstrated that medical students do not get involved with the generation of waste. Results still revealed more involvement of nurses managing RSS, as they assume management roles for services, a fact that lead other professionals to feel released from this function[19]. Students perceive the lack of knowledge and interest from the professor while addressing the RSS theme, as there is no specific discipline for this matter, leaving the discussion as punctual, restricted to few hours and marked by education fragmentation, which does not articulate theory with practice[19].

The same authors emphasized that problematization of waste management since the beginning of training would give a possibility to future professionals to have more comprehension and to give tools to face this relevant socio-environmental[19] and economic matter.

Our results suggest that waste management is not a content learned in undergraduate medicine. Probably, professors understand this theme as not being part of their professional competency and, therefore, not addressing it in the educational process. Studies need to be developed to expose this reality. Although it have been evident the knowledge of nursing students about this theme, it was not built in an awareness way, once it did not generate changes in practice.

There is a need to emphasize the waste management matter in health services during the training of health professionals, once they are relegated to the garbage and the waste receives little importance. However, awareness and effective management will reflect into environmental sustainability and occupational safety beyond health professionals.

Although they do not act into waste management, all professionals who generate them should know how to dispose it, as they are responsible for the first step of management (the segregation) that, in turn, interferes in the others.

Segregation is the fundamental point of all discussion about the dangers or not of waste in health services. Only one parcel is potentially infective, still, if it is not adequately segregated, all waste mixed with it will also be treated as potentially infective. That requires special procedures for packaging, collection, transportation and final disposition, which elevates costs and occupational risks[3-4].

In a survey conducted in a dental school, potentially infective waste were weighted after being segregated by professionals and after segregated by researchers. There was a reduction of 80% of potentially infective waste and, within those mistakenly disposed, there were materials that could be recycled. The annual generation of waste from this college had been estimated in three tons and 80,0% of what was disposed as group A belonged, with the correct segregation, to group D (common). Data showed that 2,4 tons of garbage/year are being sent to unnecessary treatment to the landfill site[20]. We highlight that the origin of this problem is in the segregation.

A study developed in urgent care shows a similar reality, where approximately 70,0% of segregated infective waste were, in fact, common waste[3]. The same reality was also found in nine basic health units in Brazil, in which only 34,1% of waste disposed as infective really belonged to this group. The rest were common or sharp waste disposed as infective[21].

Adequate waste management in health services can significantly contribute to the reduction of accidents at work, especially those caused by sharps. Studies[22-24] have shown that most of accidents with sharps happen during disposal and, in special, by inappropriate disposal.

We found that nursing students presented more consistent knowledge, with a significant statistical difference (p= 0,001) regarding the knowledge about disposal of sharps. Study[16] developed with students from basic cycles of biological sciences and health found that 75,5% were not enough knowledgeable to deal with sharps and waste generated in laboratory practices.

Waste disposal practice from group E happened adequately by all nursing students. Medical students, besides confirming that used sharps should be left on a tray 78 (83,9%) representing a difference statistically significant (p=0,001), where those that in practice (14,3%) disposed it on a tray. Contrary to the findings from our study, a research developed in the Provence of Mazandaran, in Iran, regarding the knowledge and practice of health professionals and medical students about standard precautions, found good practices in the disposal of sharps[17].

We did not find more studies showing this type of disposal by medical students in other locations. However, inadequate disposal is a common practice of medical staff in the researched locus, an evidence of the importance of professional model while solidifying student's knowledge.

This data is concerning, because as much as it reflects the lack of knowledge about this theme among students, it also alerts us to the fact that when thinking and acting this way, they are exposing themselves and others to risks of accidents with biological material.

Adequate practice of sharps' management and segregation of infective waste in the generating source constitutes urgent and fundamental needs for the management of risks and resources. Authors[25] attribute that knowledge of costs associated to use of materials and supplies, and to treatment after its use, can reduce the uncontrolled and inadequate use of hospital materials. The expectation is that professionals from all classes and fields, aware of the importance of correct segregation of generated waste in health services, will be more active in the process, sending to treatment only those that really need to be treated.

Waste disposal is a responsibility of whoever generates it; thus, lack of knowledge about the theme by students, becomes a challenge for the education establishments as well as for the health establishments, with dangerous reflexes for workers and the environment.

We stress as limitation of this study the fact that questions regarding infrastructure related to waste disposal were not observed and that not all students who answered the questionnaire could be observed in practice, what prevented a paired comparison between knowledge and practice. Besides that, in function of the data collection locations, it was not possible to observe infective waste disposal belonging to all subgroups.

CONCLUSION

Nursing students presented more consistent knowledge than medical students (p= 0,001) about the indication of disposal place for contaminated gloves and in what it is referred to the recommendation of not leaving sharps on trays after its use.

Knowledge of nursing and medical students regarding infective waste disposal revealed to be fragile due to its inconsistency, as seen that it was not enough built up to guarantee its applicability in practice.

It is necessary to revise the content and how the question of management of waste in health services has been treated during undergraduate years, especially in medical school. The understanding that waste management is a responsibility of all and a public health matter is fundamental to train professionals compromised with occupational health, patient's safety, public health and environment.

REFERENCES

1. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. Resolução da Diretoria Colegiada da Anvisa número 306 de 7 de dezembro de 2004 (BR). Dispõe sobre o tratamento e disposição final dos resíduos de serviços de saúde. Diário Oficial da União (Brasília). 2004 dez 10.
2. Ministério do Meio Ambiente. Resolução do Conselho Nacional do Meio Ambiente número 358 de 29 de abril de 2004. Dispõe sobre o tratamento e a disposição final dos resíduos de serviços de saúde e dá outras providências. Diário Oficial da União (Brasília). 2005 mai 04.
3. Pereira MS, Alves SB, Souza ACS, Tipple AFV, Rezende FR, Rodrigues EG. Waste management in non-hospital emergency units. Rev Lat Am Enfermagem.2013; 21(spe): 259-66.
4. Alves SB, Souza ACS, Tipple AFV, Rezende KCD, Rezende FR, Rodrigues EG. Manejo de resíduos gerados na assistência domiciliar pela estratégia saúde da família. Rev Bras Enferm. 2012; 65(1):128-34.
5. Mazrui, N. Medical waste management in Kenya: opportunities for improvement. Tropical resources. Tropical resources. 2010;29 (s/n):66-70.
6. Tenglikar PV, Kumar GA, Kapate R, Reddy S, Vijayanath V. Knowledge attitude and practices of health care waste management amongst staff of nursing homes of Gulbarga city. J Pharm Biomed Sci. 2012; 19(12):1-3.
7. Archisman M, Gupta Manoj K, Shivalli S, Mishra CP, Mohapatra SC. Biomedical waste management practices of doctors: an online snapshot. National Journal of Community Medicine. 2012; 3(2):227-31.
8. Atif ML, Brenet A, Hageaux S, Fave MH, Cochet C, Baticle E et al. Awareness of standart precautions for 4439 health care professionals in 34 institutions in France. Medecine et maladies infectieuses. 2013;43:10-16.
9. Sharma A, Sharma V, Sharma S, Singh P. Awareness of biomedical waste management among health care personnel in Jaipur, India. Oral Health Dent Manag. 2013;12(1):32-40.
10. Risco Biológico. Relatório PSBIO - Sistema de Vigilância de Acidentes de Trabalho com material biológico em serviços de saúde brasileiros. Rio de Janeiro, 2013.
11. Ramos CM, Santos RIM. Acidente de trabalho com exposição à material biológico e o anti-hbs como resposta imunológica à vacina contra hepatite B. Omnia Saúde. 2009:6(2):15-28.
12. Valim MD, Marziale MHP. Avaliação da exposição ocupacional a material biológico em serviços de saúde. Texto Contexto Enferm. Florianópolis. 2011;20(Esp):138-46.
13. Dias MAC, Machado AA, Santos BMO. Acidente ocupacional com exposição à material biológico: retrato de uma realidade. Medicina (Ribeirão Preto). 2012;5(1):12-22.
14. Araujo TM, Caetano JA, Barros LM, Lima ACF, Costa RM, Monteiro VA. Acidentes de trabalho com exposição a material biológico entre profissionais de enfermagem. Rev Enf Ref. 2012;III(7):7-14.
15. Moreschi C, Rempel C, Backes DS, Carreno I, Siqueira DF, Marina B. A importância dos resíduos de serviços de saúde para docentes, discentes e egressos da área da saúde. Rev Gaucha Enferm. 2014;35(2):20-6.
16. Stehling MC, Cunha LM, Louredo LM, Camargo CG, Haddad JPA, Silva IJ, et al. Gestão de resíduos com risco biológico e perfurocortantes: conhecimento de estudantes de graduação das áreas biológicas e da saúde da Universidade Federal de Minas Gerais. Rev Min Enferm. 2013;17(3):594-600.
17. Motamed N, BabaMahmoodi F, Khalilian A, Peykanheirati M, Nozari M. Knowledge and practices of health care workers and medical students towards universal precautions in hospitals in Mazandaran Province. East Mediterr Health J. 2006;12(5):653-61.
18. Costa TF, Felli VE, Baptista PCP. A percepção dos trabalhadores de enfermagem sobre o manejo dos resíduos químicos perigosos. Rev Esc Enferm USP. 2012;46:1453-1461.
19. Corrêa LB, Lunardi VL, De Conto SM. O processo de formação em saúde: o saber resíduos sólidos de saúde em vivências práticas. Rev Bras Enferm. 2007; 60(1):21-5.
20. Paiva EMM, Tipple AFV, Sasamoto SA. Plano de Gerenciamento de resíduos de serviços de saúde PGRSS-2007 da Faculdade de Odontologia da UFG. 2007; Goiânia: UFG/Faculdade de Odontologia; 2007.
21. Alves SB, Souza ACS, Tipple AFV, Rezende KCAD, Resende FR, Rodrigues EG, Pereira MS. The reality of waste

management in primary health care units in Brazil. WM&R. 2014; spe:1-8.
22. Oliveira AC, Paiva MHRS. Analysis of occupational accidents with biological material among professionals in pre-hospital services. Rev Lat Am Enfermagem. 2013; 21(1):309-15.
23. Vieira M, Padilha MI, Pinheiro RDC. Analysis of Accidents with Organic Material in Health Workers. Rev Lat Am Enfermagem. 2011;19(2):332-39.
24. Lopes LP, Toffano SEM, Hayashida M, Canini SRMS, Cruz EDA, Reinato LAF et al. Exposições acidentais com material biológico potencialmente contaminado envolvendo graduandos de enfermagem do último ano. Rev. Eletr. Enf. [Internet]. 2011 [acesso em: 18 junho 2013] out/dez;13(4):751-7. Disponível em: http://www.fen.ufg.br/revista/v13/n4/v13n4a21.htm.
25. Macedo LC, Larocca LM, Chaves MMN, Perna PO, Muntsch SMA, Damaceno EFC, et al. Segregação de resíduos nos serviços de saúde: a educação ambiental em um hospital-escola. Cogitare Enferm. 2007;12(2):183-8.

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