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Disposal of Waste in Dentistry and its Environmental and Financial Impact

Descarte de Resíduos em Odontologia e seu Impacto Ambiental e Financeiro

Augusto Henrique Alves de Oliveira*[a]; Andreza Soares da Silva[b]; Caroline Aparecida de Sousa[b]

[a]Dental Research Center São Leopoldo Mandic, Stricto Sensu Graduate Program in Dentistry. SP, Brazil.
[b]University Center, Department of Dentistry. CE, Brazil.
*E-mail: augustohenrique@leaosampaio.edu.br
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Abstract

Health Care Waste (HCW) is generated during health care and has potential for contamination. Incorrect disposal results in environmental, population and financial implications. This research aimed to evaluate the disposal of health care waste in a dentistry college and the damages generated by the discard. Data were collected by weighing and were analyzed by descriptive statistics. Three types of weighing of infectious and common residues were carried out. The first type of weighing analyzes the total volume; the second one refers to the error, in which non-appropriate items were weighed separately; and the third weighed the wastes that could not be accurately classified. The sharps and chemical residues were evaluated for the volume produced in the period. The health care generated 50.141 kg of residues in 12 days of collection. 26.426 kg (52.6%) of infectious residues, 2.008 kg (7.5%) were common waste discarded erroneously and 2.227 kg (8.4%) were undetermined residue; and in 23.715 kg (47.2%) of common residues, 8.396 kg (35,40%) were infectious residues discarded erroneously and 6.184 kg (26,07%) were undetermined residue. The data obtained showed the generation of 2.416 kg of sharp objects waste; 2.875 L and 2.478 L of residues related to the X-ray developer and X-ray fixative, respectively. It is concluded that the disposal made by the students of a Faculty of Dentistry is flawed, needing a bigger appreciation on the subject in the academic scope, in order to avoid risks of contamination by accidents, to promote the preservation of the environment and to reduce costs associated with the treatment of infectious waste.

Keywords: Dentistry. Waste Management. Environmental Health.

Resumo

Resíduos de Serviço de Saúde (RSS) são gerados no atendimento à saúde e possuem potencial de contaminação. O descarte incorreto gera implicações ambientais, populacionais e financeiras. Esta pesquisa objetivou avaliar a dispensação de RSS em uma faculdade de Odontologia e os prejuízos gerados. Os dados foram coletados por meio de pesagem e analisados por estatística descritiva. Foram realizados três tipos de pesagem dos resíduos Infectantes e Resíduos Comuns: A primeira para analisar o volume total; a segunda referente ao erro, onde foram pesados artigos não condizentes a que se destinava; e a terceira pesagem, dos resíduos que não puderam ser classificados de forma precisa. Os resíduos perfurocortantes e químicos foram avaliados quanto ao volume produzido no período. Os atendimentos geraram 50,141 kg de resíduos em 12 dias de coleta. Dos 26,426 kg (52,6%) de resíduos infectantes 2,008 kg (7,5%) se tratavam de lixo comum descartado erroneamente e 2,227 kg (8,4%) de resíduo indeterminado; Dos 23,715 kg (47,2%) de resíduos comuns 8,396 kg (35,40%) se tratavam de resíduos infectantes descartados erroneamente e 6,184 kg (26,07%) de resíduo indeterminado. Os dados obtidos mostraram a geração de 2,416 kg de resíduos perfurocortante; 2,875L e 2,478L de resíduos referentes ao revelador e fixador radiográfico respectivamente. Conclui-se que o descarte feito pelos discentes é falho, necessitando uma maior apreciação sobre o tema no âmbito acadêmico, a fim de evitar riscos de contaminação por acidentes, promover a preservação do meio ambiente e reduzir custos associados ao tratamento dos resíduos infectantes.

Palavras-chave: Odontologia. Gerenciamento de Resíduos. Saúde Ambiental.

1 Introduction

Waste of Health Services (RSS) are those generated in any service provider of medical , health assistance or similar counterparts[1]. RSS comprise an important part of the total waste, not only by the volume generated, but by the collective and environmental health risks [2]. Tons of residential and commercial wastes are produced daily and only 2% of these are RSS. Dental activities generate a wide variety of waste[3.4]. These wastes can be classified as: Group A - possibly infected, Group B - chemical substances, Group C - radioactive wastes, Group D - common wastes and GROUP E - cutting and piercing materials. The classes of residues of higher volume are the groups A, D and chemical residues (Type B) relating to the content used in the processing of radiographs (developer and fixative) and other substances[5.6].

Each type of waste obeys to a given system of management, from the generation to final disposal. The management refers to: segregation, packaging, identification, internal transport, temporary storage, treatment, external storage, collection, transportation and final disposal[6]. The possibly infected wastes must be disposed of in landfills with white bag of specific identification and require special treatment since the segregation until the final disposal. The type D

wastes are stored in black or blue bag and disposed of in municipal landfills. The cutting and piercing wastes must be packaged in rigid containers and their final disposal consists of incineration[3].

The environmental risk can vary according to type of activity; instantaneous or chronic exposure; probability of occurrence; severity; Reversibility; Visibility; duration and possibility of occurrence of their effects in multiple locations at the same time[7]. The possible contamination by pathogenic microorganisms makes the RSS offer serious risks to health and the environment and may compromise the soil and water if handled improperly[3,8-10]. In this context, the failures in the management of RSS can happen through the inadequate segregation which generates a larger amount of contaminated volume. The common waste into contact with contaminated waste will also be infected generating risks[11].

In addition to servicing the patients, scholars and professionals must be able to manage the waste in a correct way, possess knowledge in relation to the manipulation of drugs, biological and chemical wastes[12]. It is important that the graduation itself develop a technical scientific knowledge, which empower the future health care professional in relation to the understanding of the process of production and management[13].

The objective of this study was to evaluate the discard of RSS produced at the clinic of a Faculty of Dentistry, estimating that the discard is being done properly and also, understand the financial and environmental impact that is caused when there is improper disposal of these.

2 Material and Methods

The study was characterized as descriptive, using quantitative variables for data collection. This research evaluated the wastes produced in the clinic of a Faculty of Dentistry where integrated treatments of several specialties are performed (dentistry, periodontics, endodontics, dental prosthesis and oral surgery). The stages with the largest number of visits weekly, and that were contemplating a greater diversity of procedures were selected as samples, seeking to bring most of the reality of production of a private practice where a general practitioner dental surgeon operates.

The study was carried out in the period of 12 days at University Center Doutor Leão Sampaio - Unileão, Lagoa Seca campus, in clinical school. Each of the units called "box" has two bins, containing a milky white bag identified as infectious, and the other containing black or blue bag for disposal of contaminated wastes and common wastes respectively.

After the service, each bag of each bin was sealed still in the clinical environment and received identification of tis box of origin and the date on which it was discarded. Transported to specific room of the institution, the bags were opened and analyzed individually by the researchers. During the process of evaluation of the bags content for evaluation individual protection equipment was used appropriate to the hazards to which the researchers would be exposed.

A digital scale was used brand C&F computadora, São Paulo - SP - Brazil, model C15 No.59546-06, with precision in grams and a plastic container that had its weight disregarded in reading (tare) to receive the waste at the time of weighing that followed the ascending order of box. There were three weights for each bag. The first weighing was performed to obtain the total volume of waste. Articles not consistent with the type of waste to which this was intended, were removed and weighed separately for error evaluation (second weighing). The waste that could not be classified precisely if common or potentially infected were considered and recorded in a third weighing.

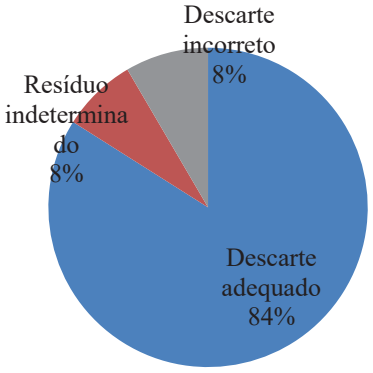
The cutting and perforating wastes (Group E) and chemical wastes (Group B) were weighed at the beginning of the experiment and the end for evaluation of the total volume produced in the period and had as a sample all the Supervised Stages that worked in clinical school. The effluent from the processing of radiographs (developer and fixative) are regarded as chemical waste. For the evaluation of these, the wastes of developer were weighed in Group 1 and in group B2 the fixative ones. The weight (Kg) was transformed into a volume (L) through the data density of each one provided by the own manufacturer.

The researchers alternated the activities of transport and manual weighing, in addition to the compilation of data in specific worksheet of the program Microsoft Office Excel 2007. The collected data were processed by means of descriptive statistics with the use of SPSS software.

3 Results and Discussion

50.14 kg were collected between common and infective wastes. Of the total number of RSS collected, 26.426 kg (52.6%) were stored in milky white bag identified as potentially infectious waste. Of these, 22.191 kg (83.97%) were actually contaminated material; 2.008 kg (7.59%) were identified as common waste that had been discarded erroneously; and 2.227 kg (8.42%) could not be definitively classified as common or contaminated waste.

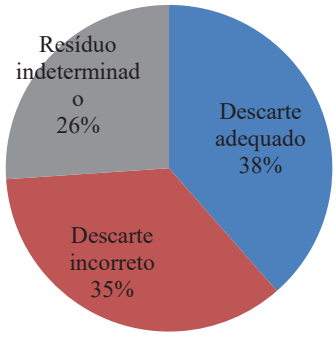
Figure 1 - Percentage of discard - Group A



Source: Research data.

23.715 kg (47.2%) were collected of waste discarded in black bags of common waste. Of these, 9.135 kg (only 38%) were actually common trash 8.396 kg (35.40%) were identified as contaminating wastes that had been discarded erroneously; and 6.184 kg (26.07%) could not be definitively classified as common or contaminated waste.

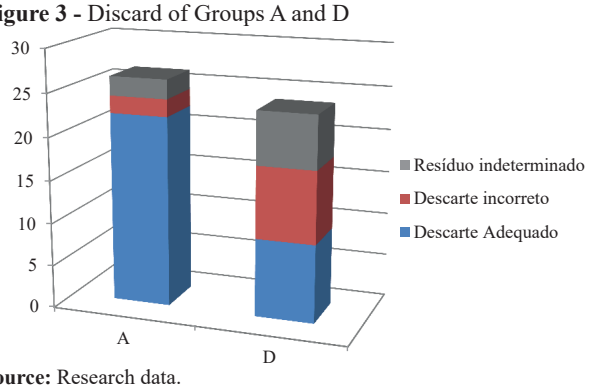
Figure 2 - Percentage of discard - Group D



Source: Research data.

Higher volume of waste from Group A was collected, in which the incidence of error in the discard is less associated. RSS from Group D despite lower volume generated, it has a higher incidence of error in relation to discard.

Figure 3 - Discard of Groups A and D



Source: Research data.

Weighing of cutting and perforating RSS totaled the volume of 2.416 kg in the analyzed period, at all stages of the college. The effluent from the processing of radiographs (Developer and fixative) classified as chemical residues were weighed at the end of the period of analysis and their weight (Kg) was transformed into volume (L) through the data density of each one provided by the own manufacturer. L = weight/ density. Totaling 2.875 L of Developer and 2.478 L fixative.

Table 1 - Chemical and cutting and perforating wastes

RSS	Type E	B1 Developer	B2 Fixative
Density	-	1.098	1.079
KG	2.416	3,157	2,674
L:	-	2.875	2.478

Source: Research data.

The scholars did not perform the segregation adequately. Common trash (Group D) and even cutting and perforating trash (Group E) were found discarded in white bag as infectious (Group A) totaling the volume of 2.008 kg in 12 days of collection. This means that they contaminated unnecessarily common wastes that were referred for treatment by maximizing the costs and damages to the environment. Similar results were found by analyzing the waste management in health services in non-hospital units of emergency care and emergencies[14]. The common wastes disposal along to the infectious ones constitutes a routine practice among dental establishments, thus, segregation is important to reduce the volume of infectious waste, because once mixed, the common waste are also considered to be infecting[15].

The waste segregation and the infective source is an extremely important step of management, both by the risk that the infecting substances present as well as the raising the price of the process, once the treatment of infection is 55 times more expensive than the common[16]. It is necessary to encourage the minimization of waste generation considering segregation of these at the time and place of their generation, allows to reduce the volume generated. It is also considered that the preventive actions are less costly than the corrective actions and reduce the damages caused to the environment and to public health[17].

Cutting and perforating wastes (Group E) totaled the volume of 2.416 kg, among them are articles such as needles, syringes, scalpels, glass plates and anesthetics tubes . The analysis showed that sometimes articles of Type E were discharged with infective wastes instead of being stored in the container for disposal of group E. These results reveal the breach of an important step in the management, which neglects the safety of health staff, users, officials of collection and others, since these articles are the main causes of accidents with biological material[18]. The majority of accidents involving workers exposed to biological material were caused by improperly discarded syringes[19]. The significant increase in production of RSS is associated to the increase of cases of AIDS and Hepatitis B has caused increased concern regarding the risks associated with the handling of the same[20].

The chemical residues (Group B), referring to the effluents of the radiographic processing, totaled the net volume 2,875L of developer and 2,478L fixative, being that its disposal is done by following guidelines established by environmental agencies. Developers must be subjected to the neutralization process to obtain a pH between 7 and 9, and then thrown into sewage system or collector staff provided that they meet the established guidelines. The fixative should be subjected to the method of recovery of silver[3]. Studies with dentists suggest that 22% of respondents were unaware of the ideal way of disposing the developer and fixative[21] and that the most despised these wastes directly into sewage networks, which presents a substantial threat to the environment[6].

The volume of infectious waste in dumps of common residues was 8.396 Kg, 45 grams per box per service. This means that 35.4% of the volume of waste generated were segregated erroneously. The infective residues contaminate areas that are collected by public service, do not receive the

treatment, causing damages to the environment and risks to the involved workers. The inadequate segregation has a direct impact on subsequent steps of management such as recycling and minimization of damages to the environment. Similar results are reported in the literature[14].

On the basis of the precarious conditions of management of RSS in Brazil, various problems occur that affect public health such as the contamination of water and soil; and the health of workers who have a relationship with such waste[22]. RSS can present microorganisms with capacity of environmental persistence[23]. Improper disposal has generated risks capable of compromising the natural resources and the quality of life of the population[3].

The rates of generation of RSS have relationship with the size of the establishment, the type of care that is offered and the complexity of the same. The establishments of great waste generation have greater awareness in relation to the essential planning to the management, however, those of small generation, generally do not have the required knowledge or adequate infrastructure for the realization of the conscious management[22.24].

The Waste Management Plan in Health (PGRSS) is a document that describes actions related to the management of solid waste since the segregation until the final destination[24] and seeks the reduction and organization of RSS in the location of origin, minimizing risks to the population health created by inadequate management[4]. However, studies show that more than half of the professionals of clinics and medical offices are unaware of the existence or did not possess PGRSS. This is worrying because its implementation is mandatory to guide the management of waste[6]. Until 2005 of the 54 basic health units of the municipal network of Belo Horizonte, none of them possessed PGRSS. For implementation and effectiveness of management it is necessary not only possess the PGRSS, but it is also necessary that the health units are equipped properly and that employees are instructed in relation to the management[15.25]. In Brazil, due to the precarious conditions of management system, there is no accurate statistics on the quantity of wastes generated daily or the number of generator establishments[22] associated to the scarcity of studies published in this sense[26].

Several factors have contributed to the increase in the generation of RSS in developed countries, such as technological development, the growing use of disposable materials, increasing the complexity of health assistance, in addition to the inadequate segregation of wastes[27]. The subject of the disposal and management of dental waste has been widely discussed due to its magnitude of risks. knowledge about this problem is necessary to the extent that the improper disposal affects environmental and collective health due to professional misconduct[28]. It is worth stressing the relevance of this issue with the purpose of preventing health injuries and unnecessary expense upon disposing the waste in an incorrect manner[25].

In the field of education, students and health professionals should be educated/ trained with a perception compromised with the issues related to RSS, since they deal with such waste in their daily lives. This knowledge should be enjoyed with pretensions to preservation of health and the environment[28].

The objective of health establishments is to provide quality care. The service processes generate a variety of wastes which require proper management, since they are sources of contamination. The minimization of the amount of RSS generated will result in lower costs for treatment/disposal and problems associated with the environment. However, the alternatives that go hand in hand with the reduction of these volumes are still low[27]

4 Conclusion

Based on this study, it is possible to conclude that the discard of RSS performed by scholars of Dentistry is flawed. The segregation of common wastes with infective ones generates costs once the residues of Group A require specific treatment. However, the segregation of infectious waste with common ones presented high discrepancy, alerting them to the risks to environmental and collective health. It is necessary to implement methodologies that will strengthen the technical-scientific knowledge of undergraduate students. It is necessary to perform further studies on the subject, which contribute to the appropriation on the theme on the part of health professionals.

References

1. Brasil, Ministério da Saúde, Agência Nacional de Vigilância Sanitária. Resolução da Diretoria Colegiada Nº 306/2004. Diário Oficial da União nº 23; 2004.
2. Ramos YS, Pessoa YSRQ, Ramos YS, Araújo Netto FB, Pessoa CEQ. Vulnerabilidade no manejo dos resíduos de serviços de saúde de João Pessoa (PB, Brasil). Cienc Saude Coletiva 2011;16(8):3553-60.
3. Brasil, Ministério da Saúde, Agência Nacional de Vigilância Sanitária. Resolução da Diretoria Colegiada RDC nº222, de 28 de março de 2018. Brasília: MS; 2018.
4. Ferreira DDM, Gorges J, Silva LE. Plano de gerenciamento de resíduos de saúde: o caso do setor odontológico de uma entidade sindical. Int Sci J 2009;2(9):1-18.
5. Brasil, Ministério da Saúde, Agência Nacional de Vigilância Sanitária. Serviços Odontológicos: Prevenção e Controle de Riscos. Série A: Normas e Manuais Técnicos. Brasília: MS; 2006.
6. Oliveira MC, Moreira ACA. Gerenciamento dos resíduos produzidos em consultórios odontológicos de Salvador, Bahia. Rev Ciênc Méd Biol 2012;11(2):194-200.
7. Schneider VE, Stedile NLR. Resíduos de serviços de saúde : um olhar interdisciplinar sobre o fenômeno. Caxias do Sul: Educs; 2015.
8. Dias SMF, Figueiredo LC. A educação ambiental como estratégia para a redução da geração de resíduos de serviços de saúde em hospital de Feira de Santana. Anais do 20º Congresso Brasilerio de Egenharia Sanitária e Ambientais 1999;3608-17.

9. Colesantil NF, Castro MCAA. Subsídios para o gerenciamento de resíduos de serviços de saúde em municípios de médio porte: estudo de caso de Araraquara - SP. Universidade Estadual Paulista; 2008.

10. Shanmugasundaram J, Soulalay V, Chettiyappan V. Geographic information system-based healthcare waste management planning for treatment site location and optimal transportation routeing. Waste Manag Res 2012;30(6):587-95.

11. André SC da S, Veiga TB, Takayanagui AMM. Geração de Resíduos de Serviços de Saúde em hospitais do município de Ribeirão Preto (SP), Brasil. Eng Sanit Amb 2016;21(1):123-30. doi: 10.1590/S1413-41520201600100140092

12. Gomes LC, Miguel YD, Rocha TC, Gomes EC. Biossegurança e resíduos de serviços de saúde no cotidiano academic. Rev Cienc Farm Basica Apl 2014;35(3):443-50.

13. Gessner R, Piosiadlo LCM, Fonseca RMGS, Larocca LM. O manejo dos resíduos dos serviços de saúde: um problema a ser enfrentado. Cogitare Enferm 2013;18(1):117-23. doi: http://dx.doi.org/10.5380/ce.v18i1.31316

14. Pereira MS, Alves SB, Souza ACS, Tipple AFV, Rezende FR, Rodrigues ÉG. Gerenciamento de resíduos em unidades não hospitalares de urgência e emergência. Rev Latinoam Enferm 2013;21:259-66. doi: http://dx.doi.org/10.1590/S0104-11692013000700032

15. Nazar MW, Pordeus IA, Werneck MAF. Gerenciamento de resíduos sólidos de odontologia em postos de saúde da rede municipal de Belo Horizonte, Brasil. Rev Panam Salud Pública 2005;17(4):237-42.

16. Silva A de SF, Ribeiro MC, Risso M. Biossegurança em odontologia e ambientes de saúde. São Paulo: Ícone; 2009.

17. Brasil, Ministério do Meio Ambiente, CONAMA. Resolução Nº 358, de 29 De Abril De 2005 [Internet]. Diário oficial da União 2005 p. 9. Available from: http://www.mma.gov.br/port/conama/res/res05/res35805.pdf

18. Gold K. Analysis: the impact of needle, syringe, and lancet disposal on the community. J Diabetes Sci Technol 2011;5(4):848-50. doi: 10.1177/193229681100500404

19. Marino CGG, El-Far F, Wey SB, Medeiros EAS. Cut and puncture accidents involving health care workers exposed to biological materials. Braz J Infect Dis 2001;5(5):235-42.

20. Chaves LC. Acondionamento Inadequado de Materiais Perfurocortantes: risco potencial à saúde humana e ambiental. Acta Paul Enferm 2002;26(3):44-50.

21. Garbin AJÍ, Wakayama B, de Brito CP, Garbin CAS. A imperícia no gerenciamento dos Resíduos de Serviços de Saúde nos consultórios odontológicos privados. Arch Heal Investig 2015;4(5):1-5.

22. Garcia LP, Zanetti-Ramos BG. Gerenciamento dos resíduos de serviços de saúde: uma questão de biossegurança. Cad Saúde Pública 2004;20(3):744-52.

23. Silva ACDN, Bernardes RS, Moraes LRS, Reis JDP Dos. Critérios adotados para seleção de indicadores de contaminação ambiental relacionados aos resíduos sólidos de serviços de saúde: uma proposta de avaliação. Cad Saude Publica 2002;18(5):1401-9.

24. Lemos KIL, Silva MGC da, Pinto FJM. Produção de resíduos em hospitais públicos e filantrópicos no município de Fortaleza (CE). Rev Baiana Saúde Pública 2010;34(2):321-32.

25. Hidalgo LR da C, Garbin AJÍ, Rodiva TAS, Garbin CAS. Gerenciamento de resíduos odontológicos no serviço público. Rev Odontol UNESP 2013;42(4):243-50.

26. Guedes W de A. Gerenciamento de resíduos de serviços de saúde: Aspectos legais, técnicos e de conformidade de produtos relacionados com os mesmos. Niterói: Universidade Federal Fluminense; 2006.

27. Sisinno CLS, Moreira JC. Ecoeficiência: um instrumento para a redução da geração de resíduos e desperdícios em estabelecimentos de saúde. Cad Saude Publica 2005;21(6):1893-900.

28. Moreschi C. Resíduos de serviços de saúde: percepção de docentes, discentes e egressos da área da saúde de duas instituições comunitárias de ensino superior do RS. Lajeado: Centro Universitário Univates; 2013