

Medical waste in mobile prehospital care

Resíduos de serviços de saúde em serviço de atendimento pré-hospitalar móvel

Residuos de servicios de salud en servicio móvil prehospitalario

**Adriana Aparecida Mendes¹, Tatiane Bonametti Veiga¹, Tânia Márcia Lopes Ribeiro¹,
Silvia Carla da Silva André¹, Juice Ishie Macedo^{II},
Juliana Trebi Penatti^I, Angela Maria Magosso Takayanagui^{III}**

^I Universidade de São Paulo, Ribeirão Preto College of Nursing,
Posgraduate Program in Public Health Nursing. Ribeirão Preto, São Paulo, Brazil.

^{II} Universidade Estadual do Norte do Paraná, Materials and Sterilization Center. Bandeirantes, Paraná, Brazil.

^{III} Universidade de São Paulo, Ribeirão Preto College of Nursing,
Environmental Health Laboratory. Ribeirão Preto, São Paulo, Brazil.

How to cite this article:

Mendes AA, Veiga TB, Ribeiro TML, André SCS, Macedo JI, Penatti JT, Takayanagui AMM. Medical waste in mobile prehospital care. Rev Bras Enferm. 2015;68(6):812-8. DOI: <http://dx.doi.org/10.1590/0034-7167.2015680618i>

Submission: 12-13-2014

Approval: 08-16-2015

ABSTRACT

Objective: the objective of this study is to identify how Medical Waste (MW) is managed in Mobile Prehospital Care (MPC) services in the state of São Paulo as well as characterize and quantify this waste. **Method:** exploratory and descriptive field study with data collection based on the methodology proposed by the Pan American Health Organization (PAHO), which was conducted over eight consecutive days to identify the production and characteristics of generated waste. **Results:** it was found that the MW management of the MPC is not yet in line with the requirements of RDC 306/04, which could affect the occupational safety of workers, patients, the community, and the environment. **Conclusion:** it is recommended for the health managers to focus on this issue. The lack of studies with regard to MPC also indicates the need for further studies on the waste management.

Key words: Medical Waste; Waste Management; Prehospital Care.

RESUMO

Objetivo: identificar o tipo de manejo de Resíduos de Serviços de Saúde (RSS) de um serviço de Atendimento Pré-Hospitalar Móvel (APHM) do interior paulista, além de caracterizar e quantificar esses resíduos. **Método:** estudo de campo de caráter exploratório e descritivo, com coleta de dados baseada em metodologia proposta pela Organização Pan-Americana da Saúde (OPAS) realizada em oito dias consecutivos para identificar a produção e as características dos resíduos gerados. **Resultados:** verificou-se que o manejo dos RSS no serviço de APHM ainda não está adequado às exigências da RDC 306/04, o que pode comprometer a segurança ocupacional dos trabalhadores, dos pacientes, comunidade e ambiente. **Conclusão:** recomenda-se atenção dos gestores de saúde para essa problemática. A ausência de estudos em serviço de APHM remete também à necessidade da continuidade de novas pesquisas relacionadas ao manejo de resíduos gerados.

Descritores: Resíduos de Serviços de Saúde; Gerenciamento de Resíduos; Assistência Pré-Hospitalar.

RESUMEN

Objetivo: identificar el tipo de gestión de Residuos de Servicios de Salud (RSS) de un servicio de Atención Prehospitalaria Móvil (APM) en interior paulista, además de caracterizar y cuantificar esos residuos. **Método:** estudio de campo de carácter exploratorio y descriptivo, con colecta de los datos basados en la metodología propuesta por la Guía de Organización Panamericana de Salud (OPS) y se llevó a cabo en ocho días consecutivos para identificar la producción y características de residuos generados. **Resultados:** se encontró, el manejo de RSS en servicio APM todavía no es adecuada para los requisitos de la legislación brasileña (RDC 306/04), posible peligro a la seguridad de los trabajadores, los pacientes, la comunidad y el

ambiente. **Conclusión:** atención a administradores de salud para este problema. La falta de estudios en el servicio APM remite también a la necesidad de continuidad de investigación relacionada con la gestión de residuos generados.

Palabras clave: Residuos Sanitarios; Administración de Residuos; Atención Prehospitalaria.

CORRESPONDING AUTHOR Adriana Aparecida Mendes E-mail: adrianaapmendes@yahoo.com.br

INTRODUCTION

Conducted studies illustrate the persistent pursuit of human beings to come up with technologies that bring comfort to the daily lives of people. However, this process of development has resulted in serious modifications to ecosystems due to over-extraction of natural resources as well as due to the disposal of materials being deemed useless, unleashing often irreversible environmental problems such as waste and air pollution, which have repercussions on people's lives⁽¹⁾.

Among the various environmental issues afflicting modern society, one is the Urban Solid Waste or the category of waste, which is classified as hazardous. This is the Medical Waste (MW) which constitutes a risk to public health and the environment due to the possible presence of biological, chemical and radioactive agents in its composition as well as sharps waste. It is noteworthy that such types of waste correspond to around 1% to 2% of total urban solid waste. If this waste is not handled properly, then it can expose the community and environment to substantial risk⁽²⁾.

According to Collegiate Board Resolution (RDC) under No. 306/04 of the National Health Surveillance Agency (Anvisa) and Resolution under No. 358/05 of the National Environment Council (Conama), MW is conceptualized as a waste resulting from all the establishments that involve human and animal health care including mobile prehospital care services, among other services.

RDC 306/04 lays down the technical MW regulations to be followed in all the establishments that generate such waste^(2,3), which is classified into five groups as follows: Group A (biological waste) implying the presence of biological materials which can result in a type of contamination risk due to their characteristics; Group B (chemical waste) which contains chemical substance that can represent a risk to the environment and public health due to its characteristics of inflammability, corrosiveness, toxicity and reactivity; Group C (radioactive waste) implies the waste containing radionuclides in concentrations exceeding those established by the National Nuclear Energy Commission (CNEN), where reuse is not possible; Group D (common waste) that has none of the characteristics presented above; Group E (sharps) that encompasses all types of sharps⁽³⁾.

Handling procedure of the MW falls under management as a whole and includes segregation, packing, identification, collection, transport and internal storage, which are the stages performed within the health facility. Outside pickup and transport are the stages carried out by other parties which do not belong to the health facility, and so the treatment and final disposal are. These handling stages can be divided into the

steps, which are completed inside and outside the health facility, where this waste is generated⁽³⁾.

In Brazil, MW has a significant socio-environmental context. According to data obtained from the Brazilian Association of Public Cleaning and Special Waste Companies (Abrelpe), 245,000 tons of waste resulting from the health care services in different types of establishments have been collected in 2012⁽⁵⁾.

It is important to note that the generation of MW has increased in the last few decades due to the complexity of health care. Another relevant factor, which took a start in the 1980s, was the advent of the Human Immunodeficiency Virus (HIV) and the Acquired Immune Deficiency Syndrome (AIDS) that resulted in the use of disposables and increased volume of generated waste^(2,6) besides introduction of the culture of use of such products of this nature.

It can be observed that the amount of generated MW is directly related to the type of care provided in terms of the primary, secondary or tertiary care. These levels of care include Mobile Prehospital Care (MPC) and they are also considered in distinct locations as a major generator of waste, where the victim who suffered some sort of health problem receives care.

It is also noteworthy that only few studies addressed the MW management and handling issue in mobile prehospital care services. Even the National Emergency Care Policy, which restructured this type of care, does not include MW-related problems⁽⁷⁾.

The waste stemming from different activities carried out in the area of health represents serious problem when being improperly managed while contributing to environmental degradation and posing risks to public health. Actions should be taken in order to raise awareness of the individuals and society of the responsibility toward human life and the environment. It is possible that humans and animals have suffered from biological contamination and its effects due to exposure to waste from Groups A, B, C, D and E, and that water, soil and air have been contaminated as well^(2,8).

In order to contribute to the development of knowledge related to the problem of medical waste in mobile prehospital care services, this study aimed at identifying the type and management of waste generated in this kind of service as well as at distinguishing the medical waste in accordance with weight and the group to which it belongs.

METHOD

This was the exploratory descriptive field study with quantitative approach due to the nature of the data, which was directed toward examination of the individuals, groups, communities or institutions with the intent to understand the different aspects of the selected group, and it also involved

observing situations that occur in an unplanned manner or result from daily activities⁽⁹⁾.

A literature review was performed about the MW in mobile prehospital care services by means of conducting a search in the LILACS and PubMed databases. The reviewing period covered seven years starting from September 2007 and up to August 2014. The keywords used were Medical Waste and Mobile Prehospital Care.

For the data collection, the Guide to the Internal Management of Solid Hospital Waste by the Pan American Health Organization was used. Such guide advised to collect data during eight days in order to define the production and characteristics of the waste generated⁽¹⁰⁾.

The characterization and quantification of the waste was performed in September 2012. It was done in an MPC of a city that was located in the southeast region of Brazil, in the center of the state of São Paulo.

The MW generated during eight consecutive days in the Dispatch Center and Basic Support Units (BSU) and Advanced Support Units (ASU) were characterized and quantified in a room of the Dispatch Center. An electronic scale (DIGIPESO brand, DP-15 plus model) was used during conduct of such procedures with a maximum and minimum capacity of 15 kg and 100 g, and at intervals of 5 g, respectively. A camera was also used to record the procedures as well as personal protective equipment and a plastic tarp were employed by the researcher in order to protect the ground in the site, where the waste was segregated.

The obtained data were recorded on a previously prepared spreadsheet using RDC 306/04 as the reference material as well as employing an instrument applied by Takayanagui⁽²⁾ in a similar study. The data analysis was performed by means of descriptive statistics, which was used to describe and summarize the data through the calculation of means and percentages⁽¹¹⁾.

The study was approved by the Research Ethics Committee of the Ribeirão Preto College of Nursing, at the University of São Paulo (EERP/USP).

RESULTS

The data collection in this study took place after preparation of the research field and literature review of the object of study, which revealed a lack of scientific studies that has been on the MW in mobile prehospital care services during the seven years reviewed. Only one study was found in this field, which noted that all the stages related to management of medical waste generated in urgency or emergency situations were inadequate⁽¹²⁾.

The data collected in this study corresponded to a selected period of operation of the service during which time it responded to 805 requests for ambulances after emergency dispatch. 92.05% (741) of these prehospital services were performed by the BSUs on weekdays, weekends and holidays, and

7.95% (64) of them were done by the ASUs according to the information supplied by the manager of such a service. The investigated period included weekdays, weekends and holidays.

In the examined MPC service, waste was found from Groups A, D and E. No waste from Groups B and C was detected during the period of the study.

The waste from Groups D and E was only quantified after which it was weighed. The waste stored in white bags was classified as Group A. It was characterized and quantified according to the methodology proposed by the Pan American Health Organization⁽¹⁰⁾.

The bags from Group D waste were opened, photographed, quantified and, then they were taken to the outdoor shelter by the cleaning team of the unit. It can be noted from viewing and observing their contents that there was food and bathroom waste inside the black bags in addition to plastic and some recyclable material (Figure 1).

A total of 112.48 kg of Group D waste was registered within the weighing and characterization period, which took eight consecutive days. For the waste from Group E, it was generated from three sharps containers during the collection period and then it was weighed. The weight of this waste comprised 0.65 kg. It was observed that the containers for storing this type of waste comply with the technical guidelines in NBR 13853/97 of the Brazilian Association of Technical Standards (ABNT) in terms of safety of the collectors, which were made out of a sturdy, waterproof material in order to avoid leakage, perforations and possible accidents during their handling and transportation⁽¹³⁾.

When viewing the content from the sharps container, other types of waste such as gauze and packaging were found. The waste was not directly handled during the data collection, but it was only viewed upon opening the containers using long tongs, and then it was photographed.

The white bags used solely for discarding Group A waste from areas inside and outside the Dispatch Center and from inside the BSU and ASU ambulances were characterized and classified according to the type of material contained inside them. Latex gloves, fabrics, plastic, paper, a flow meter, food waste, syringes with protected needles and blood glucose piercing devices were found besides other types of waste improperly discarded in the white bags while revealing a mixture of waste from Groups A, D and E (Figure 3).

A total of 48.74 kg of waste was generated and stored in white bags during the analyzed period. It was presumed that



Figure 1 - Group D waste generated in a city in the state of São Paulo, Brazil by the MPC service

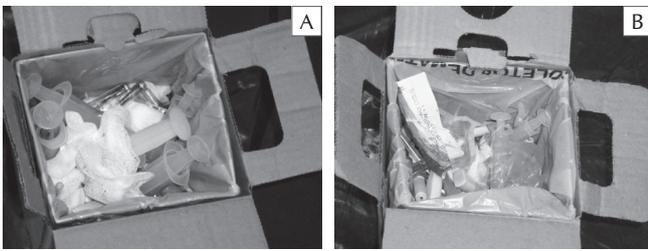


Figure 2 - Improper segregation and disposal of waste in sharps containers generated by mobile prehospital care services in a city in the state of São Paulo, Brazil

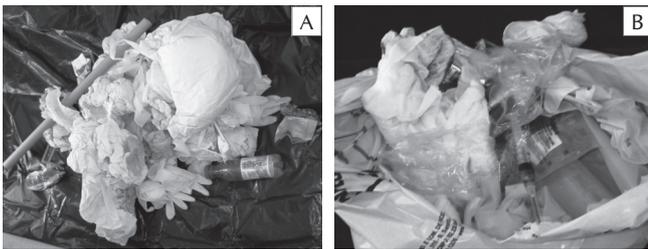


Figure 3 - Improper disposal of waste in white bags, generated by mobile prehospital care services in a city in the state of São Paulo, Brazil

this waste was belonging to Group A. After characterizing it, the presence of waste from other groups was detected, mainly Group D waste (54.19%) was found and discarded together with the waste from Group A (45.44%), Group E (0.21%) and other types of waste (0.16%) (Table 1).

Among the 26.41 kg of waste from Group D mixed with waste from Group A, 19.15 kg (39.29%) of paper and 6.98 kg (14.32%) of plastic were quantified in addition to other types of materials (Table 1).

Two places for internal waste storage were found inside the ambulances. From them, one place was corresponding to the foot of the folding wheelchair, where white bags with the infectious symbol, which contained biological and common waste, were being tied and the other place was used for sharps containers, which were attached to the inside wall of the ambulance with adhesive tape over the internal cabinet counter (Figure 4).

This situation related to the MW being placed inside the BSU and ASU ambulances constitutes an accident risk for patients and medical teams, particularly during transportation since there is no appropriate and safe place inside these vehicles to store the bags or containers packed primarily with Group A and E waste.

There is the temporary storage place for all MPC waste, which is located outside the Dispatch Center. The MPC waste is temporarily kept in three white plastic containers with a pedal activated lid (two containers are used to store waste from Group A and one container is used to store the waste from Group D and all other unidentified waste). These containers are under an awning of the building without the proper protection stipulated in RDC 306/04⁽³⁾.

Table 1 - Characterization of waste discarded in white bags and generated by mobile prehospital care services in a city in the state of São Paulo according to the type of material, composition, group and quantification, and in compliance with RDC 306/04, 2012

Type of material	Waste composition	Group	Amount (kg/8 days*)	%
Latex	Gloves / Extension	A	12.02	24.66
Fabric	Gauze / Pads / Bandages	A	2.47	5.07
PPE	Apron / Mask / Cap (non-woven fabric) after use	A	0.51	1.05
Contaminated materials	Organic material mixed with different kinds of waste	A	5.11	10.48
Probes	Aspiration catheter / Endotracheal tube	A	0.08	0.16
Restraints	Cervical collar / Splints / Seat belt	A	1.96	4.02
Paper	Paper / Wrapping from medical and hospital articles	D	19.15	39.29
Plastic	Packaging of materials / Pen / Safety glasses / Saline container	D	6.98	14.32
Cleaning materials	Sponge / Steel wool	D	0.15	0.31
Food	Food waste	D	0.13	0.27
Sharps	Needles / Syringes with needle	E	0.10	0.21
Other	Flow meter / Kitchen knife	Other	0.08	0.16
Total			48.74	100.0

Note: * Amounts in reference to waste generated in September 2012 during eight consecutive days.



Source: The Figure is adapted from the Ministry of Health (2013)

Figure 4 - Vehicle used by Mobile Emergency Health Services (A); (B): inner view of the places for storing containers or bags for discarding waste from Groups A, D and E.

The cleaning staff transports this waste daily to a closed brick shelter either in carts or by hand. The shelter was specifically designed for the purpose of holding Group A and E waste for outside pickup, which is identified and shut with a padlock. This shelter has washable walls and a drain, in accordance with RDC 306/04⁽³⁾. There is also another shelter next to it, which resembles the first one but is being used specifically for storing the waste from Group D.

The MPC service in this study does not have a Medical Waste Management Plan (MWMP), or waste management protocols, standards or routines as per RDC 306/04⁽³⁾.

DISCUSSION

Characterization of waste is essential for efficient MW management. It is important to determine first the type and amount of waste generated during planning process of such management. This process is defined as a physical characterization resulting in the gravimetric composition of the waste, an essential stage used to select specific technologies for its treatment and final disposal⁽¹⁴⁾.

The characterization and quantification performed in this study in the MPC found predominantly the waste from Groups D and A. It was also noted during the characterization of the waste discarded due to its presence in Group A that there was a large percentage of the waste from Group D considered as a Common Waste, which could represent a significant difference in the treatment and final disposal costs of this waste besides indication of improper handling of medical waste.

The fact that no waste from Group B was detected during the data collection period does not mean that the mobile prehospital care service does not produce this type of waste. This finding could be related to different disposal methods of chemical waste being employed in the service or even the lack of a disposal protocol for this type of material upon its use.

RDC 306/04 (from Anvisa), which is a set of national MW management regulations, stipulates that the waste generated in any type of health facility and the like, must be segregated at the place and time of its generation according to its physical, chemical and biological characteristics and physical state as well as taking into account the risks involved⁽³⁾.

In this study, inadequacies were found in every stage of the MW management process, starting with segregation, a step considered to be one of the main indicators of success and quality in the management of this type of waste.

It is known that improperly performed MW segregation affects all the other management stages and affects not only occupational exposure risk and patients, but also the quality of the care provided as well as the environment since it can result in contamination of soil, water and air if discarded incorrectly or without prior treatment⁽²⁾.

In terms of packing the waste, that is, the stage following segregation, inadequacies were also detected as it can be seen in the mixture of different types of waste such as the waste from Group A contaminated with biological agents, discarded along with the waste from Groups D and E, which can cause work-related accidents among health professionals and cleaning staff as well as outside workers who pick up this waste.

In the literature review performed during this research, the only study found also reported inadequacies in the MW management stages in urgency or emergency situations in non-hospital units called comprehensive health care centers and located in the city of Goiânia, in the state of Goiás⁽¹²⁾. The study revealed inadequate segregation of the MW with mixed waste from Groups A, D and E. Along the same lines, the mixture of waste from Groups A and D, stored in the same bag was also noted in another study conducted on the MW management in the Family Health Strategy Units located in the city of Goiânia⁽¹⁵⁾.

Another study was conducted in the veterinary hospital located in Rio Grande do Sul. The aim of this study was to qualitatively and quantitatively characterization of the waste that was generated. This study has found that the waste from Groups A, B and D was stored in the same bags which were used to store the waste from Groups A and D⁽¹⁶⁾.

Improper packaging of MW is often related to lack of segregation at the time when the waste is being generated in health facilities. A similar situation was noted in a study which was conducted in hospital located in the state of São Paulo, where flaws were also detected in the MW management since chemical and recyclable waste were mixed with biological waste. At that, the sharps containers with protected needles and bottles and vials were discarded in white bags⁽¹⁷⁾.

Although no bottles or vials were found in white bags during conduct of this study, it may also be the case that waste from Group B such as drugs and mercury thermometers was discarded in sharps containers (from Group E). The latter cannot be confirmed due to the fact that the objective of this study did not include characterization of this type of waste.

Apart from improper packing, this study also detected inadequate internal storage of waste inside ambulances. This situation was deemed as being rather serious due to the risks to which care teams and users can be potentially exposed.

It should be noted that although there is a bench used by the care team in the area designated for patient care, which contains a small drawer for storing MW, the size of this compartment is insufficient for this purpose. This aspect can be considered as one of the factors that contribute to improper handling of the waste generated in the service that was investigated.

However, this situation does not justify the improper waste storage that was detected, but rather it points out to the fact that some decisions have to be made in order to provide better internal storage of MW inside ambulances.

For this reason, it is suggested to prepare a safe place to pack the MW generated during the care process until it is possible to dispatch the waste to the temporary shelter, and, afterwards to the outside pickup location.

This study has also found some irregularities in such handling stages as internal transportation and temporary storage of MW compared to the shelters for storing waste for outside pickup, which complied with the national Technical Regulations for medical waste (RDC 306/04)⁽³⁾.

In this study, the average generated waste was totaling 6.09 kg/day and it comprised 48.74 kg/week. Based on these estimates, it can be concluded that selected MPC is a small generator since registered amounts do not exceed those suggested in NBR 12807/93⁽¹⁸⁾. To be considered a small-scale generator, the volume of waste generated daily cannot exceed 150 liters and weekly generation cannot exceed 700 liters.

Health care quality also depends on proper management of the waste generated in any type of service or health care level whether it is being inpatient or outpatient or whether it is being managed in urgency or emergency situations as it was managed during this study. It is necessary to highlight the specific nature of the activities carried out in mobile prehospital care services such as the one included in this study due to the characteristics of the work that is performed in situations which require skills, abilities and extreme agility due to the contingencies of the demands.

MW management requires preparation and implementation of the Medical Waste Management Plan in accordance with MW laws⁽³⁾, which also requires selection of an appropriate qualified and committed professional which is capable of carrying out this duty as a waste manager.

Possible qualified professionals for this duty include nurses who, according to Cofen Resolution No. 303/05, besides being responsible for coordinating the nursing team, may also be involved in MW management. In order to exercise this responsibility, the professional must be registered with the Regional Nursing Counsel (Coren) with a Technical Responsibility Notation, and should not be facing the charges involving professional ethics. Under these conditions, nurses are considered as the qualified professionals to assume the role of waste manager and to prepare and implement the MWMP in the health facilities⁽¹⁹⁾.

A study, which was conducted by Takayanagui in 1993 in order to analyze an employment of the nurses in the MW management, has shown that this professional can represent the short-term scope of changes, in relation to the health team

through on-the-job educational activities while addressing the issues related to the MW management. In the mid-term, they can reach the managers of the institutions with regard to improvement of the conditions established for the purpose of organizing an infrastructure in order to manage this type of waste^(2,20).

Therefore, it is suggested to implement ongoing educational activities in mobile prehospital care services that promote discussions and exchange of information and knowledge on the MW management, which is aimed at changing the current situation of inadequate segregation, packing, transport and temporary internal storage of medical waste.

Based on the situation that was detected, it is necessary to elaborate specific public policies which would focus on the proper handling of waste generated in mobile prehospital care services in order to ensure safety for the patients, workers and environment as well as avoid harm that could result in posing the risks to the environment-health relationship⁽²⁾.

CONCLUSION

The results of this study reveal inadequate MW management in terms of segregation, packing, identification, internal storage (in ambulances), temporary storage and internal transport of the waste generated in the MPC service investigated in this study.

Thus, MW management in the selected MPC service does not yet meet the requirements set forth in RDC 306/04, which undermines the internal management of this waste, with consequent implications for occupational health and safety as well as the safety of patients and directly or indirectly involved community, not to mention possible harm for the environment.

According to the Resolution that governs the MW process in Brazil, the management of this waste in addition to all the waste management stages should also include planning of physical and material resources and training of the human resources involved. These decisions should be clearly defined in the Medical Waste Management Plan, which should be formulated in every health facility that generates waste. This plan must be aligned with the types and characteristics of the waste as well as the context of the health service generating it.

There is also a need to promote and implement ongoing educational activities in all health establishments including mobile prehospital care services like the one examined in this study, which will instruct health professionals about the WM management, where proper handling is essential at each stage in order to minimize possible risks and harm posed to the health of workers, patients, community and environment.

A new outlook is needed on the part of the MPC administrators in this study with regard to the MW issues. They should promote interventions and make decisions with the intent to make the necessary adjustments in the physical realm such as a location for internal temporary storage of the MW as well as to improve physical resources and provide ongoing on-the-job training for the professionals which are directly involved in the management of this waste.

REFERENCES

1. Santos MA, Souza AO. [Knowledge of nurses of the Family Health Strategy on health services waste]. *Rev Bras Enferm* [Internet]. 2012[cited 2014 Dec 10];65(4):645-52. Available from: <http://www.scielo.br/pdf/reben/v65n4/a14v65n4.pdf> Portuguese.
2. Takayanagui AMM. Gerenciamento de resíduos de serviços de saúde. In: Philippi JA. (editor). *Saneamento, saúde e ambiente: fundamento para o desenvolvimento sustentável*. Barueri: Manole; 2005. p. 323-374. (Coleção Ambiental, 2).
3. Brasil. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. Resolução nº 306. de 7 de dezembro de 2004. Dispõe sobre o Regulamento Técnico para o gerenciamento de Resíduos de Serviços de Saúde. *Diário Oficial da União, Brasília - DF*; 10 dez. 2004. Seção 1. p. 49-55.
4. Brasil. Conselho Nacional do Meio Ambiente. Resolução nº 358. de 29 de abril de 2005. Dispõe sobre o tratamento e a disposição final dos resíduos dos serviços de saúde e dá outras providências. *Diário Oficial da União, Brasília - DF*; 4 maio 2005. Seção 1. p. 63-65.
5. Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais (Abrelpe). *Panorama dos Resíduos Sólidos no Brasil* [Internet]. 2012[cited 2014 Dec 10];1-116. Available from: <http://www.abrelpe.org.br/Panorama/panorama2012.pdf>
6. Ministério da Saúde (Brasil). *Recomendações para atendimento e acompanhamento de exposição ocupacional a material biológico: HIV e hepatites B e C* [Internet]. [cited 2014 Dec 10];1-57. Available from: http://bvsmms.saude.gov.br/bvs/publicacoes/04manual_acidentados.pdf
7. Ministério da Saúde (Brasil). *Política Nacional de Atenção às Urgências* [Internet]. 2006[cited 2009 Aug 10];1-256. Available from: http://bvsmms.saude.gov.br/bvs/publicacoes/politica_nacional_atencao_urgencias_3ed.pdf
8. Macedo JI, Ferreira MRMN, Bertolini DA, Mendes AA, Takayanagui AMM. Gerenciamento de resíduos de serviços de saúde em um hemocentro do estado do Paraná. *Rev Bras de Ciênc Ambientais* [Internet]. 2013[cited 2014 Dec 10];27:55-60. Available from: http://www.rbciamb.com.br/images/online/Materia_5_artigos344.pdf
9. GIL, A. C. *Métodos e técnicas de pesquisa social*. 6 ed. São Paulo: Atlas, 2010
10. Organização Pan-Americana da Saúde (OPAS). *Guia para o manejo de resíduo sólido em estabelecimentos de saúde*. Brasília: MMA [Internet]. 1997[cited 2009 Dec 10];1-59. Available from: <http://www.opas.org.br/sistema/arquivos/reshospi.pdf>
11. Polit DF, Beck CT. *Essentials of nursing research: methods, appraisal, and utilization*. 6 ed., Philadelphia (USA): Lippincott Williams & Wilkins; 2006.
12. Pereira MS, Alves SB, Souza ACS, Tipple AFV, Rezende FR, Rodrigues EG. [Waste management in non-hospital emergency units]. *Rev Latino-Am Enfermagem* [Internet]. 2013[cited 2014 Dec 10];21(especial):259-66. Available from: http://www.scielo.br/pdf/rlae/v21nspe/pt_32.pdf Portuguese.
13. Associação Brasileira de Normas Técnicas (ABNT). NBR 13.853: *Coletores para resíduos de serviços de saúde perfurantes ou cortantes - Requisitos e métodos de ensaio*. Rio de Janeiro, 1997.
14. Frésca FRC, Pugliesi E, Massukado LM, Schalch V. Determinação da composição gravimétrica dos resíduos sólidos domiciliares do município de São Carlos - SP. *Rev DAE* [Internet]. 2008[cited 2013 Mar 10];178:48-57. Available from: http://www.revistadae.com.br/downloads/Revista_DAE_Edicao_178.pdf
15. Alves SB, Souza ACS, Tipple AFV, Rezende KCD, Rezende FR, Rodrigues EG. [Management of waste generated in home care by the Family Health Strategy]. *Rev Bras Enferm* [Internet]. 2012[cited 2013 Mar 10];65(1):128-34. Available from: <http://www.scielo.br/pdf/reben/v65n1/19.pdf> Portuguese.
16. Pilger RR, Schenato F. *Classificação dos Resíduos de Serviços de Saúde de um hospital veterinário*. Engenharia Sanitária e Ambiental [Internet]. 2008[cited 2013 Dec 10];13(1):23-28. Available from: <http://www.scielo.br/pdf/esa/v13n1/a04v13n1.pdf>
17. Ribeiro AB, Pisani JR. Método de obter a geração de resíduos de serviços de saúde para monitorar a execução do plano de gerenciamento de resíduos em um hospital. *Rev AIDIS* [Internet]. 2012[cited 2014 Dec 10];5(2):11-27. Available from: <http://www.journals.unam.mx/index.php/aidis/article/view/32643>
18. Associação Brasileira de Normas Técnicas (ABNT). NBR 12.807: *Terminologia*. Rio de Janeiro, 1993.
19. Conselho Federal de Enfermagem (Cofen). Resolução 303 de 23 de junho de 2005. Dispõe sobre a autorização para o enfermeiro assumir a coordenação como responsável técnico do plano de gerenciamento de resíduos de serviços de saúde [Internet]. [cited 2013 Jun 10];1-2. Available from: http://novo.portalcofen.gov.br/resoluco-cofen-3032005_4338.html
20. Takayanagui AMM. *Trabalhadores da saúde e meio ambiente: ação educativa do enfermeiro na conscientização para gerenciamento de resíduos sólidos*. [Tese] Ribeirão Preto (SP). Escola de Enfermagem de Ribeirão Preto, Universidade de São Paulo; 1993.