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ENVIRONMENTAL MANAGEMENT: CHALLENGES AND SOLUTIONS IN THE SEGREGATION OF HEALTH SERVICE WASTE IN BELÉM

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ABSTRACT

Health service waste (HSW) refers to materials resulting from healthcare activities, both human and animal, that may present biological, chemical, or radiological risks, depending on their nature. This study aimed to investigate the problem-solving capacity of the segregation of waste from health services in the municipality of Belém, based on the evaluation of two large hospitals in the municipality, seeking to identify and mitigate the non-conformities observed about current regulations, as well as to propose solutions. This is a cross-sectional, descriptive, and exploratory research, with a quantitative and qualitative approach, carried out at the Ophir Loyola and Mário Pinotti hospitals, in the city of Belém. The investigation showed significant failures in the separation and management of waste in several sectors of these units, compromising environmental safety and the effectiveness of public policies. The analysis was guided by the regulations of Resolution RDC No. 222/2018, of the National Health Surveillance Agency (Anvisa), and Resolution No. 358/2005, of the National Council for the Environment (Conama). The results indicate the existence of structural and operational gaps that hinder compliance with regulatory guidelines, revealing the need for urgent corrective measures to ensure efficient and safe management of HSW. The survey highlights the importance of strengthening staff training, improving segregation processes, and encouraging the implementation of sustainable practices, thus ensuring the protection of public health and the environment.

Keywords: Health Services Waste. Hazardous Waste. Medical Waste. Biomedical Waste.

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INTRODUCTION

Health service waste (HSW) is intended for sediments from exercises arising from health care practices used on human beings or animals, within generating establishments such as hospitals, pathological laboratories for clinical analysis, research centers, pharmacies, medical and dental offices, veterinary clinics, blood centers and any other related products, arising from susceptible contamination to the environment or living beings, putting their health at risk or harm (Santos, et al. 2022).

The segregation of waste is an important process to ensure the safety of all, and it is the duty of the public authorities and the community to provide due care, as established by Ordinary Law No. 7,341/86. HSW has been a matter of concern for health managers for a long time, proving that management models should be based on decision-making based on RDC No. 222/18, following characterizations of the waste generated (Mehl et al. 2022).

Due to this criticality in the hospital environment, it is necessary to comply with safety standards, given the aforementioned Resolution, which establishes that HCW must be separated, packaged and collected by their classifications: Group A - Potentially infectious; Group B - Chemicals; Group C - Radioactive; Group D - Commons; Group E - Sharps. Given the above, it is convenient to be concerned with the responsibilities related to the health of the entire population, because under the influence of the growing attendance, it favors the production of waste, requiring greater care and attention (Silva et al. 2024).

In Brazil, according to Santos et al. (2022), health service waste (HSW) corresponds to approximately 2% of the total solid waste generated daily in the country and is often disposed of inappropriately by health service providers. The inefficient management of this waste entails significant risks to public health, enhancing the spread of biological agents and contributing to negative environmental impacts. In addition, inadequate management practices increase the occurrence of occupational accidents, putting the safety of the professionals involved at risk. In this context, it is essential that those responsible for the generation and management of HSW adopt correct procedures and strictly follow all stages of the management process, by current regulations, in order to ensure environmental protection, public safety and occupational health.

According to the Solid Waste Management Plan (PGRS - 2022), in 2022 alone, urban solid waste in Brazil generated 82 million tons. Such a quantity, for the most part, is a mixture of mixtures that could be reused for recycling and composting, which would

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generate income and benefits for both institutions and collectors, and could generate employment and possible income if they were correctly disposed of.

From an observational technical visit, several irregularities were identified in the management of health service waste (HSW) at the Mário Pinotti and Ophir Loyola hospitals, located in the municipality of Belém. It was observed that both institutions are conducting the handling and disposal of this waste inadequately, resulting in more than 50% of the disposals carried out in a manner inconsistent with current regulations. These management failures can compromise the safety of workers, increase public health risks, and intensify damage to the environment, highlighting the need for corrective measures and greater rigor in the implementation of safe and sustainable practices.

Given this scenario, the present research aims to investigate the problem-solving capacity of the segregation of waste from health services in the municipality of Belém, based on the evaluation of two large hospitals in the municipality; seeking to identify and mitigate the non-conformities observed about the current regulations. The investigation aims to understand the gaps in compliance with the guidelines established by the Resolution of the Collegiate Board (RDC) No. 222/2018, of the National Health Surveillance Agency (Anvisa), and by Resolution No. 358/2005, of the National Council for the Environment (Conama). From this analysis, it is expected to propose solutions that promote the adequacy of institutional practices to the regulatory framework, ensuring a safer and more sustainable management of waste, in line with public health and environmental protection standards.

METHODOLOGY

The present observational research did not require approval by the Research Ethics Committee (CEP), considering that the data used came from the observation of hospital environments, with no application of a questionnaire, nor involvement with human beings.

This study adopted a descriptive and exploratory approach, with a cross-sectional observational design, divided into two stages. The research was carried out at the Mário Pinotti and Ophir Loyola hospitals, in the municipality of Belém.

In the first stage, a systematic observation of the HSW management routines was conducted, ranging from segregation at the source to final disposal. The researcher followed, in a non-intrusive way, how the waste was handled by the professionals at each stage of the process. Aspects such as the initial segregation in the generating units, the

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packaging and identification of waste, its internal transport to the collection points and the procedures adopted for final disposal and external disposal were observed. The data were recorded in field diaries for later analysis, seeking to identify patterns, inappropriate practices and possible deviations from current regulations.

In the second stage, a critical analysis of the effectiveness of HCW segregation programs implemented in the institutions was carried out. This evaluation included a comparison between the practices observed and the guidelines established by Resolution RDC No. 222/2018 of the National Health Surveillance Agency (Anvisa) and Resolution No. 358/2005 of the National Council for the Environment (Conama). In addition, possible variations in the implementation of segregation policies, the adherence of professionals to the guidelines and compliance with municipal waste management regulations were verified.

Based on observation and critical analysis, gaps and obstacles were identified in the application of HCW management practices in the hospitals investigated. The data analysis followed the content analysis technique, allowing an in-depth comparison between institutional practices and current regulations, identifying operational weaknesses and opportunities for improvement for a safer and more sustainable management of HCW.

RESULTS

The analysis carried out on the management of hospital waste identified a series of challenges and opportunities for improvement in different sectors evaluated (Tables 1 and 2). During the research, it was possible to observe that some of the sectors presented a mixture of waste from different categories, such as common waste (group D), infectious waste (group A), chemical waste (group C) and sharps waste (group E). This type of separation failure can lead to risks to public health and the environment, in addition to compromising compliance with current regulations, such as RDC No. 222/2018 and Conama Resolution 358/2005.

In addition, trash cans without proper identification or broken were detected, impairing efficiency in the separation and correct disposal of waste. The lack of clear signage contributed to confusion among professionals and increased the risk of cross-contamination. In several sectors, there was a need to implement labeling systems and standardization of the colors of the trash cans, as well as the replacement of domestic trash cans with hospital models with lids.

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Another recurring failure was the irregular disposal of sharps. In several units, the detachments were incorrectly positioned (on furniture or the floor) and many exceeded the safe limit of use, indicating the need for more frequent and adequate monitoring.

The overcrowding of the dumpsters was another problem identified in sectors such as the Immediate Care Unit, which required the temporary relocation of waste to avoid accumulations in the

In response to these challenges, the proposed solutions include carrying out environmental education campaigns aimed at the correct separation of waste, the installation of appropriate signage, and structural adjustments in hospital units. These measures are essential to ensure compliance with regulatory standards and ensure a safe environment for professionals and patients.

Table 01: Waste Management by Sector: Typology, Challenges and Solutions at the Ophir Loyola hospital.

SECTOR	WASTE FROM THAT SECTOR	CHALLENGES	SOLUTIONS
Chemotherapy Division	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A, chemical residues from group C and sharps residues from group E.	Unmarked trash cans;	Implement an identification system (labels, colors, etc.) in trash cans (according to RDC n. 222/2018, art. 22).
		Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
		Controversial identifications;	Review and standardize the identification system (according to Conama Res. 358/2005).
		Descarbox over limit; and unsupported.	Removal of the discarbox from the top of the trash can and adaptation of the support according to resolution; Request the team responsible for changing the decarbox as soon as it reaches the proposed limit.
Immediate Care Unit	In this environment, the residues observed were: common waste, belonging to group D, infectious waste from group A and sharps waste from group E.	Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage on waste separation, punctuating the classifications.
		Descarbox over limit;	Removal of the decarbox or adaptation of the support according to resolution;
		Dumpsters opened due to overcrowding of waste;	Monitor waste volumes to avoid overcrowding; Relocation of waste for temporary storage.
Division of Diagnostic Imaging	In this environment, the residues observed were: common waste,	Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage on waste separation, punctuating the classifications.

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	belonging to group D, infectious residues from group A and sharps residues from group E.	Descarbox over limit; and unsupported.	Removal of the discard of improper height also from (floor, on top of box or sink) and adaptation of the support according to resolution; Request the team responsible for changing the decarbox as soon as it reaches the proposed limit.
		Unidentified trash can;	Implement an identification system (labels, colors, etc.) in trash cans (according to RDC n. 222/2018, art. 22).
Division of Radiotherapy	In this environment, the residues observed were: common waste, belonging to group D, infectious residues from group A and sharps residues from group E.	Irregular trash cans; and absence of a trash can;	Implement an identification system; Removal of garbage cans for domestic and hospital use without lids. Place enough trash cans to avoid bags with waste on the hospital floor.
		Descarbox without stand;	Remove the decarbox when it is in an inappropriate place (on top of furniture or short wall), as observed. In addition, adequacy of the support according to the resolution;
		Dumpsters opened due to overcrowding of waste;	Monitor waste volumes to avoid overcrowding; Relocation of waste for temporary storage.
		Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
Hemodialysis Division	In this environment, it should contain only the Infectious and Common waste, belonging to groups A and D.	Broken trash cans;	Change or maintain trash cans, specifically opening (pedal and lid);
		Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
Ambulatory Division	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A and sharps residues from group E.	Irregular trash cans; and Broken trash cans;	Implement an identification system; Removal of garbage cans for domestic and hospital use without lids. Changing or maintaining trash cans, specifically opening lids;
		Descarbox without stand;	Adequacy of the support according to the resolution.
		Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage on waste separation, punctuating the classifications; Make adhesion to a common trash can, since it was not observed any for this waste.

Source: Prepared by the authors, 2024.

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Table 02: Waste Management by Sector: Typology, Challenges and Solutions at the Mário Pinott hospital.

SECTOR	WASTE FROM THAT SECTOR	CHALLENGES	SOLUTIONS
Bathrooms	In this environment, it should contain only common waste, belonging to group D and food.	Irregular trash cans;	Remove buckets and domestic trash cans without lids for hospital profile trash cans, since the residual characteristic discarded is food waste attracting insects and odor to the place;
		Waste mixing;	
Rank 3	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A, chemical residues from group C. The residues of sharps from group E were found only in the wards.	Unmarked trash cans;	Implement an identification system (labels, colors, etc.) in trash cans (according to RDC n. 222/2018, art. 22).
		Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
		Broken trash cans;	Change or maintain trash cans, specifically opening (pedal and lid);
Rank 2	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A, chemical residues from group C. The residues of sharps from group E were found only in the wards.	Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
		Descarbox over limit;	Request the team responsible for changing the decarbox as soon as it reaches the proposed limit.
		Irregular trash cans; and Broken trash cans.	Implement an identification system; removal of garbage cans for domestic and hospital use without lids; Changing or maintaining trash cans, specifically opening lids.
Rank 1	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A, chemical residues from group C. The residues of sharps from group E were found only in the wards.	Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
		Irregular descarbox.	Remove the discard when it is in an inappropriate place as observed. In addition, adequacy of the support according to the resolution.
CME	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A and chemical residues from group C.	Irregular trash can;	Implement an identification system; removal of household trash cans
Small. Surgery	In this environment, the residues observed were: common	Descarbox without stand;	Removal of the decarbox when it is in an inappropriate place (removal from the floor), as observed. In

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	residues, belonging to group D, and sharps residues from group E.		addition, adequacy of the support according to the resolution;
Red Room	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A and sharps residues from group E.	Unmarked trash cans; and Broken trash cans;	Implement an identification system (labels, colors, etc.) in trash cans (according to RDC n. 222/2018). Changing or maintaining trash cans, specifically opening lids;
		Waste mixing.	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14). Install clear signage about waste separation and place common waste bins.
Orange room	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A and sharps residues from group E.	Irregular trash cans; and Broken trash cans.	Implement an identification system; removal of garbage cans for domestic and hospital use without lids; Changing or maintaining trash cans, specifically opening lids.
RX	In this environment, the waste observed was: trash cans only for common waste, belonging to group D, which facilitated the mixing of waste. Group E sharps residues were identified.	Descarbox without stand;	Remove the discarbox when it is in an inappropriate place (on the floor), as observed. In addition, adequacy of the support according to the resolution;
		Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
Ult. And ECG	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A.	Unmarked trash cans; and Broken trash cans.	Implement an identification system (labels, colors, etc.) in trash cans (according to RDC n. 222/2018). Changing or maintaining trash cans, specifically opening lids.
Traumatology	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A and sharps residues from group E.	Unmarked trash cans; and Broken trash cans.	Implement an identification system (labels, colors, etc.) in trash cans (according to RDC n. 222/2018). Changing or maintaining trash cans, specifically opening lids.
		Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
Paediatrics	In this environment, the residues observed were: common residues, belonging to group D, infectious residues from group A and sharps residues from group E.	Descarbox over limit;	Request the team responsible for changing the decarbox as soon as it reaches the proposed limit.
		Unmarked trash cans; and Broken trash cans.	Implement an identification system (labels, colors, etc.) in trash cans (according to RDC n. 222/2018). Changing or maintaining trash cans, specifically opening lids.

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		Waste mixing;	Carry out environmental education campaigns on waste separation (according to Conama Res. 358/2005, art. 14); Install clear signage about waste separation.
Inter Post 1 & 2	In this environment, the residues observed were: common residues, belonging to group D.	Irregular trash cans; Waste mixing;	Remove buckets and domestic trash cans without lids for hospital profile trash cans, since the residual characteristic discarded is food waste attracting insects and odor to the place;
Reception	In this environment, the residues observed were: common residues, belonging to group D.	Unmarked trash cans; and Broken trash cans.	Implement an identification system (labels, colors, etc.) in trash cans (according to RDC n. 222/2018). Changing or maintaining trash cans, specifically opening lids.
Triage	In this environment, the residues observed were: common residues, belonging to group D.	Irregular trash cans; and Broken trash cans.	Implement an identification system; removal of garbage cans for domestic and hospital use without lids; Changing or maintaining trash cans, specifically opening lids.

Source: Prepared by the authors, 2024.

DISCUSSION

The Covid-19 pandemic has generated a significant transformation in solid waste management, imposing substantial challenges in the management of these materials. The proliferation of Personal Protective Equipment (PPE) and hospital waste has brought exacerbated environmental and health concerns, especially in developing countries, where inadequate disposal practices and scarcity of treatment options aggravate environmental impacts (Massuga et al., 2022).

During the pandemic period, the volume of waste from health services increased, reflecting the growth of hospital care. In countries with already fragile management systems, the inadequacy in the disposal of this waste has been intensified, highlighting the urgency of more rigorous management strategies and the appreciation of education and awareness of all those involved to ensure sustainable management (Galdino et al., 2023).

Silva et al. (2024) highlight that the pandemic has also intensified awareness of the importance of proper waste management, highlighting the need for continuous training on segregation to avoid mixtures that could compromise safe disposal. Although pre-existing management systems have mitigated some impacts, the high turnover of teams imposes frequent updating of correct practices, reinforcing the importance of training to maintain effective and sustainable practices.

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The consequences of the pandemic for environmental sustainability will be long-lasting, largely due to the increase in the volume of hospital waste. It is essential to intensify scientific research, especially in the national context, to develop strategies that mitigate the environmental and health impacts of this crisis, ensuring the protection of public health and the environment (Veras, Moita & Iwata, 2022).

In a large hospital in the interior of São Paulo, critical points were identified in the disposal of solid waste, which include the inadequate disposal of garbage bins and the need for training for correct segregation. The implementation of an effective Health Services Waste Management Plan (PGRSS) is essential, addressing specific characteristics of different types of waste, in addition to infectious waste, and reinforcing practices such as selective collection and sectorized weighing for better diagnosis and intervention (Patrício, Amorim, & Borges, 2022).

Waste segregation in health services is an essential process for public safety and environmental protection, ensuring compliance with legislation. At the Ophir Loyola Hospital, visits to six sectors (Chemotherapy Division, Immediate Care Unit, Diagnostic Imaging Division, Radiotherapy, Hemodialysis and Outpatient Clinic) revealed recurrent problems, such as the mixing of waste from different categories and the absence of adequate labeling. These failures violate regulatory standards, such as RDC No. 222/2018 and Conama Resolution 358/2005, compromising the efficiency of segregation. Proposed measures include environmental education campaigns and the standardization of labeling and signaling systems.

At the Mário Pinotti Municipal Emergency Room (PSM), visits to 15 sectors identified similar problems, including overcrowding of trash cans and inadequate disposal of boxes for infectious waste, reflecting the absence of an effective PGRSS and adequate infrastructure. The only intervention recorded was an inspection by the Sanitary Surveillance, which pointed out necessary improvements in the temporary storage of waste.

In addition to operational challenges, the lack of continuous training of professionals and limited financial resources make it difficult to implement appropriate practices. Resistance to change and the prioritization of other hospital demands were pointed out as important obstacles, reinforcing the need for educational programs, technical support, and constant monitoring for the effectiveness of hospital waste management policies.

Belém's public policies, including Municipal Law No. 8,655/2008 and Law No. 14,026/2020, establish guidelines for environmental and sanitary management with a focus

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on safety and sustainability. However, the implementation of these guidelines faces challenges, such as the lack of financial resources and the need for greater engagement of hospital teams. Law No. 9,656/2020, which establishes the Municipal Basic Sanitation Plan (PMSB) and the Integrated Solid Waste Management Plan (PGIRS), emphasizes integrated management between hospitals and the government.

Thus, the analysis of segregation practices in the Ophir Loyola and PSM Mário Pinotti hospitals shows that, despite regulations and initiatives, waste management needs improvements in infrastructure, training and monitoring. The effectiveness of these practices requires not only compliance with current standards, but also institutional commitment, government support, and active participation of the hospital community.

CONCLUSION

Given the above, it is concluded that there are structural and operational gaps that hinder compliance with regulatory guidelines, revealing the need for urgent corrective measures to ensure efficient and safe management of HSW. The survey highlights the importance of strengthening staff training, improving segregation processes, and encouraging the implementation of sustainable practices, thus ensuring the protection of public health and the environment.

Overcoming these challenges is essential to protect public health and the environment while minimizing the negative impacts associated with improper waste management. The continuity of monitoring and evaluation actions will enable adjustments in segregation practices, promoting a more sustainable organizational culture in Belém's hospitals.

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