



## Healthcare service waste: knowledge of university laboratory users

### *Resíduos de serviços de saúde: conhecimento de usuários de laboratórios de uma universidade*

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#### ABSTRACT

This study aimed to characterize the users of teaching and research laboratories in the health sciences at a public university in the southern part of the country. Additionally, it sought to identify potential strengths and weaknesses in managing Healthcare Service Waste (HSW). An exploratory, descriptive, cross-sectional study using a quantitative approach was conducted involving 197 users of teaching and research laboratories. The findings, analyzed through descriptive statistics, highlighted significant issues: a widespread lack of awareness about current legislation concerning healthcare service waste, inadequate training, and the insufficient integration of this topic into academic curricula. Furthermore, there was a notable deficiency in knowledge regarding the laboratories' Health Service Waste Management Plan. It is crucial to incorporate this subject into the students' educational processes and to offer targeted training for faculty and administrative technicians. This approach aims to cultivate professionals who are critically aware of their roles in managing healthcare service waste effectively.

**KEYWORDS:** Healthcare Service Waste. Waste management. Laboratories. Universities. Nursing.

#### RESUMO

Este estudo teve como objetivo caracterizar usuários dos laboratórios de ensino e pesquisa da área da saúde de uma universidade pública do sul do país, bem como, identificar potencialidades e fragilidades sobre o tema Resíduos de Serviços de Saúde e seu manejo. Estudo exploratório descritivo transversal, de abordagem quantitativa, realizado mediante aplicação de questionário com 197 usuários de laboratórios de ensino e pesquisa. Os resultados foram analisados por meio de estatística descritiva. Entre os problemas identificados destaca-se o desconhecimento da legislação vigente acerca dos Resíduos de Serviços de Saúde, a falta de capacitações e da abordagem do tema em disciplinas da grade curricular dos cursos, além da falta de conhecimento do Plano de Gerenciamento de Resíduos de Serviços de Saúde dos laboratórios. É necessário incluir a temática no processo de formação dos estudantes e capacitar professores e técnicos administrativos, a fim de formar profissionais críticos e conscientes de seu papel.

**PALAVRAS-CHAVE:** Resíduos de serviços de saúde. Gerenciamento de resíduos. Laboratórios. Universidades. Enfermagem.

## INTRODUCTION

From 1900 to 2000, waste production increased tenfold and is projected to double again by 2025. This rapid growth can be attributed to several potential factors: population increase, urbanization, enhanced purchasing power, shifts in consumer behavior, a rise in packaging needs, and extensive plastic use<sup>1</sup>.

Healthcare facilities generate a significant portion of this waste, termed Healthcare Service Waste (HSW). HSW encompasses all waste from services related to human or animal healthcare, including home care, hospitals, medical and veterinary clinics, laboratories, forensic services, pharmacies, and educational and research institutions in health. To be a generator of HSW, activities must involve any stage of HSW management. Entities generating HSW can be public or private, philanthropic, civil or military, and include those involved in teaching and research activities<sup>2</sup>.

The World Health Organization (WHO) has consistently issued alerts on the repercussions of poor waste management. According to the WHO report, "Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks," a healthy environment could prevent 23% of global deaths and 26% of deaths among children under 5, often linked to environmental factors. This report also notes numerous contaminations resulting from inadequate waste management practices<sup>1</sup>.

In Africa, health services often do not differentiate HSW from other wastes. Studies in these countries suggest that many healthcare professionals and those responsible for HSW are unaware of the policies related to waste handling and final disposal. Another interesting finding is that most African countries lack legislation related to HSW management, and not all health institutions have bags of different colors and symbols to classify HSW, making segregation impractical<sup>3</sup>.

In Brazil, the National Health Surveillance Agency (Anvisa) and the National Environment Council (Conama) instruct health services regarding HSW through two main resolutions. The Resolution of the Collegiate

Board (RDC) of Anvisa No. 222/2018 regulates good practices for managing HSW, and the Conama Resolution No. 358/2005 deals with the treatment and final disposal of HSW. These resolutions define normative, operational, and fiscal actions that regulate the handling of HSW from production to final destination, aiming to preserve human and environmental health<sup>4,5</sup>.

HSWs are a source of concern for health managers, primarily because of their infectious aspects, encompassing a wide variety of wastes with different characteristics and classifications. The RDC No. 222/2018 of Anvisa and Conama Resolution No. 358/2005 classify HSWs into five groups: Group A (infectious); Group B (chemical); Group C (radioactive); Group D (common); and Group E (sharps)<sup>2,4</sup>.

The management of HSWs is essential to ensure the safe handling of waste, thereby protecting the health of workers, public health, natural resources, and the environment, thus promoting health and preventing diseases resulting from occupational and environmental exposure to these improperly managed wastes. For this purpose, health professionals need to be trained to correctly act at every stage of HSW management<sup>7</sup>.

HSW management is defined as all necessary actions to handle the waste within and outside health facilities, from the moment of their generation to their final disposition. Thus, everyone involved in the waste management process is responsible for their actions, influencing the final outcome<sup>5</sup>. The stages of HSW management include segregation, packaging, identification, internal transport, temporary storage, external storage, internal collection, external transportation, and environmentally appropriate disposal and final destination of HSWs<sup>4</sup>.

All citizens are responsible for the proper segregation and safe disposal of HSWs. In this regard, institutions are particularly accountable for providing regular training that guides and supports everyone involved. Moreover, the quality of HSW management should be routinely assessed within institutions<sup>8</sup>.

Waste production is one form of environmental degradation, thus being one of the environmental issues that plague humanity.

Health-related professions are among the most admired because they aim to protect humans against diseases, restore health, and save lives. However, these professionals are also waste generators, and when discarded incorrectly, this waste can threaten the environment and human and animal health<sup>9</sup>.

In this context, health professionals should be concerned about the waste generated by their activities, aiming to minimize the risks to workers' health, the general population, and the environment. These professionals should address this issue by developing specific competencies and skills from their undergraduate education onward, demonstrating a conscious and proactive stance in seeking solutions<sup>10</sup>.

There is a possibility of failure in the higher education process regarding the training of health professionals. Not including the topic of HSW in the curricular matrix of health area courses may explain the issues currently faced concerning the waste generated in both health establishments and the environment. Numerous studies emphasize that solutions depend on a series of decisions made at different levels of the system, such as changing the existing health professional training at universities<sup>10</sup>.

Higher Education Institutions (HEIs) in Brazil have shown increasing concern about HSW management, particularly because of the growth in the number of research projects and the diversity of waste generated in these settings<sup>11</sup>. HEIs are responsible for producing and disseminating knowledge, as well as training human resources. Therefore, they must lead by example in addressing HSW issues and training skilled professionals who are aware of their roles in managing the waste they produce<sup>12</sup>. Within the context of HEIs, teaching and research laboratories are notable because they are the primary sources of highly hazardous wastes, necessitating specialized management<sup>13</sup>.

The need to gather more information on the actual state of HSW and its management in the laboratories of a HEI supports the development of educational technologies on this topic. This requirement justifies conducting a situational diagnosis as part of a methodological research carried out in four phases, developed in a professional master's program in nursing.

Consequently, this study aims to characterize the users of teaching and research laboratories in the health area of a public university in the southern part of the country. It also seeks to identify potential strengths and weaknesses in managing Healthcare Service Waste.

## METHODS

This study employed an exploratory, descriptive, and cross-sectional approach with a quantitative design to analyze the users of teaching and research laboratories in the health area of a public university in the southern part of Brazil. The target population included undergraduate and postgraduate students, faculty, and administrative technicians registered as users of these laboratories during the data collection semester, all of whom were over 18 years old. External users, such as students or staff from other educational institutions conducting research in the university's laboratories, were excluded.

Data collection was carried out from November 2022 to February 2023 using a semi-structured questionnaire administered through Google Forms. The questionnaire consisted of 26 questions, blending open-ended and multiple-choice formats, organized into sections that covered sociodemographic data (four questions), general information about HSW (10 closed questions, three of them using a 3-item Likert scale, one dichotomous, and the rest multiple-choice); knowledge about HSW and its management (10 multiple-choice questions); and final questions (two multiple-choice questions).

The initial part of the questionnaire aimed to characterize the participants. Subsequently, questions were designed to ascertain how much the participants believed they knew about HSW (classifications, disposal methods, and whether they had participated in any training or curriculum component that addressed the subject). Further questions sought to assess the users' understanding of the topic through queries about concepts, classifications, examples of waste, and their respective disposal groups, responsibilities for segregation, packaging, symbols, and the importance of

proper HSW management. The final questions of the questionnaire aimed to gather participants' opinions about integrating technologies related to HSW into the university environment under study and to determine which technology users found most appropriate for this purpose.

The distribution and completion of the questionnaires were initially done electronically (via email) with addresses obtained from the academic secretary of the campus. A blind carbon copy ensured the protection of participants' data. After three unsuccessful attempts to obtain the minimum number of responses, one researcher went into the field to invite potential participants in classrooms to participate in the study. During this time, the researcher provided a QR code that gave access to the questionnaire, and all professors allowed students to respond during class time, which significantly increased participation.

The final sample comprised 197 consenting participants who completed the Informed Consent Form (ICF). The potential total number of participants was 342 users. Of the 173 student participants, there were 300 potential students; and of the 24 faculty and administrative technician participants, there were 42 potential ones.

The collected data were tabulated and analyzed using descriptive statistics with Microsoft Excel, and the results were presented in graphs and tables to enable comparison with the scientific literature and synthesis of the primary findings.

The university's campus director authorized the conduction of this study, and the Research Ethics Committee (REC) of the State University of Santa Catarina (UDESC) approved it under opinion number 5.716.053, dated October 21, 2022. To protect privacy, participant identities were anonymized using initials (e.g., G1, G2 for undergraduates; PG1, PG2 for postgraduates; PR1, PR2 for professors; T1, T2 for technicians; and R1, R2 for researchers).

## RESULTS E DISCUSSION

The study engaged 197 participants, including 173 undergraduate and postgraduate students (five of whom are master's students), 20 faculty members, and 4 administrative technicians. The average age of the students was  $22 \pm 4.23$  years, with 114 (65.90%) being female. For the faculty and technicians, the average age was  $38 \pm 6.93$  years, with 13 (54.17%) female.

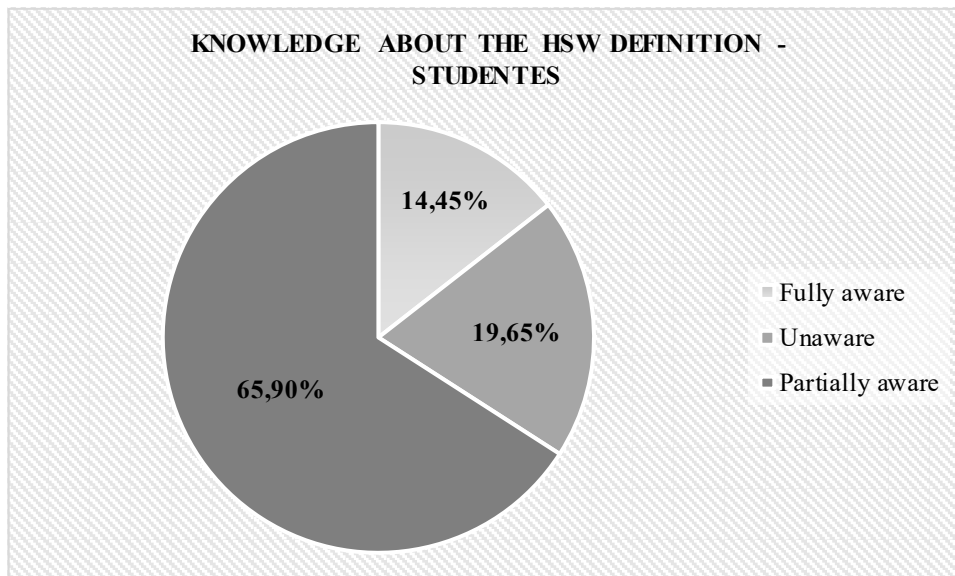
Regarding academic disciplines, 78.04% of student respondents were from the Nursing and Medicine programs. Similarly, 41.67% of faculty and technicians were involved in the Nursing program, and 29.17% in Medicine (Table 1).

**Table 1:** Courses to which the laboratory users are affiliated. Chapecó-SC, 2023.

Course	Students (undergraduate and postgraduate)		Professors and Technicians	
	n	%	n	%
Nursing	67	38.73	10	41.67
Medicine	68	39.31	7	29.17
Agronomy	21	12.14	1	4.17
Environmental engineering	12	6.93	1	4.17
Master's in biomedical sciences	5	2.89	0	0
Works in more than one course	0	0	5	20.82

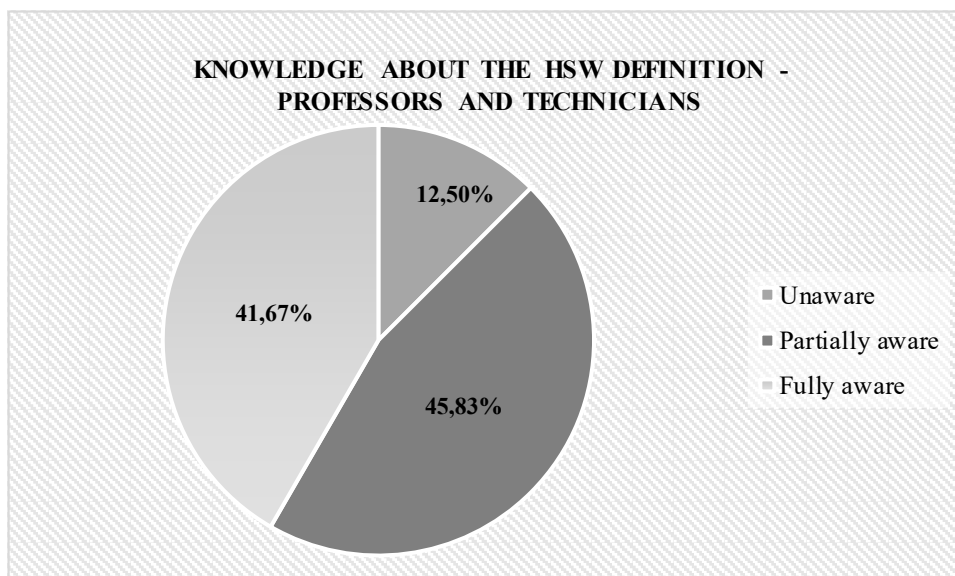
n = sample size. Source: Prepared by the authors, 2023.

In assessing the participants' understanding of HSW, 25 students (14.45%) are fully aware of this definition, 114 (65.90%) are partially aware of it, and 34 (19.65%) are unaware (Graph 1).



**Graph 1.** Student knowledge about the HSW definition.  
Source: Prepared by the authors, 2023.

Among faculty and technicians, 10 (41.67%) are fully aware of the HSW definition, 11 (45.83%) are partially aware of it, and three (12.50%) are unaware (Graph 2).



**Graph 2.** Professors and technicians knowledge about the HSW definition.  
Source: Prepared by the authors, 2023.

A related study in Campos de Goytacazes, RJ, by Ataíde and Ferreira<sup>6</sup> revealed that 67 of 117 undergraduate health sciences students (66%) understood what HSW was. In the hospitality sector of the institution, 73% reported being knowledgeable, with responsibilities including the daily removal, packaging, and transportation

of waste from multidisciplinary and anatomical laboratories to designated storage areas.

Research by Silva, Silva, and Ferreira<sup>14</sup> in Recife, state of Pernambuco, indicated 86% of 87 nursing undergraduates are aware of the HSW definition. Confirming this, another study by Silva

*et al.*<sup>15</sup> in Teresina, state of Piauí, found that 87% of dental students were familiar with HSW.

At the researched HEI, administrative technicians in laboratories are tasked with removing, identifying, and transporting waste from groups A, B, and E to external storage sites. Therefore, a thorough understanding of HSW management is indispensable for these professionals to execute process stages correctly. Faculty members, who guide students in both teaching and research activities within health area laboratories, also bear the responsibility of ensuring proper execution of tasks such as segregation and packaging. This makes their familiarity with HSW and its management essential.

When queried about their knowledge of HSW management legislation, 93 students (53.75%) reported partial awareness, and 73 (42.20%) were unaware. Among faculty and technicians, 14 (58.33%) had partial awareness, and seven (29.17%) were unaware (Table 2).

In Salvador, state of Bahia, a study by Geitenes and Marchi<sup>10</sup> among final-year physiotherapy students at a private HEI found that 88.7% were unaware of the legislation related to HSW at national, state, or municipal levels. Further inquiries about this topic confirmed this knowledge gap. Similarly, research by Silva *et al.*<sup>15</sup>

asked dental students about their knowledge of current legislation on HSW and the Healthcare Service Waste Management Plan (PGRSS), with 82.9% unaware of Conama Resolutions and 95.1% unfamiliar with the Anvisa resolution.

Proper adherence to HSW legislation has the potential to significantly reduce or even eliminate the adverse effects caused by this type of waste. The behavior of professionals working in health service establishments plays a crucial role in minimizing these effects<sup>12</sup>.

When asked about their knowledge of the potential risks associated with HSW, 56 students (32.37%) indicated complete awareness, while among faculty and technicians, nine (37.50%) claimed full knowledge (Table 2).

In another study by Geitenes and Marchi<sup>10</sup>, 52.8% of students recognized the risk potential of HSW, expressing concern over occupational hazards and socio-environmental health issues related to the lack of knowledge about HSW management stages and improper waste disposal. A study in Ceará by Almeida, Santos, and Sousa<sup>7</sup> found that among nursing graduates and professors, 34.48% had an intermediate understanding of the risks involved in handling HSW, and 37.04% had advanced knowledge, respectively.

**Table 2:** Knowledge about legislation and potential risks of HSW.

Questions	Students (undergraduate and postgraduate)						Professors and Technicians					
	Fully		Partially		Unaware		Fully		Partially		Unaware	
	n	%	n	%	n	%	n	%	n	%	n	%
Are you familiar with the legislation regarding the management of Healthcare Service Waste?	7	4.05	93	53.75	73	42.2	3	12.5	14	58.33	7	29.17
Are you aware of the potential risks posed by Healthcare Service Waste?	56	32.37	97	56.07	20	11.56	9	37.5	15	62.5	0	0

n = sample size. Source: Prepared by the authors, 2023.

Regarding participation in training, courses, or training on HSW and its management, 158 students (91.33%) reported not having participated (Table 3). This lack of participation

suggests the students' lack of knowledge about HSW and its management is related to the absence of educational opportunities on this topic during their academic training.

There is a clear need for health-related curricula to include program content concerning the management of HSW, or at least address this topic in some courses or during internships. By doing so, it is expected that professionals will be equipped to manage HSW in their workplaces effectively, thus preventing contamination and protecting the environment, patients, and workers<sup>7</sup>.

In their study, Ataíde and Ferreira<sup>6</sup> found that 85% of students from a health-related course reported not having participated in any courses, lectures, or training on HSW management. Among faculty and technicians, 17 (70.83%) had not participated in any training or courses (Table

3). RDC No. 222/2018 mandates that waste-generating services must maintain a continuous education program for workers and all involved in waste management activities, even if they are temporary<sup>4</sup>.

A study by Oliveira *et al.*<sup>11</sup> with administrative technicians and professors at a public HEI in Montes Claros, state of Minas Gerais, revealed that 45.83% of respondents had not received training to perform their duties at the institution. In contrast, Ataíde and Ferreira's research<sup>6</sup> showed that 81% of collaborators stated they had undergone some form of training on HSW management.

**Table 3.** Training completion and knowledge about PGRSS and HSW management. Chapecó-SC, 2023.

Questions	Students (undergraduate and postgraduate)						Professors and Technicians					
	Yes		No		Partially		Yes		No		Partially	
	n	%	n	%	n	%	n	%	n	%	n	%
Have you participated in training, courses, or workshops about HSW and its management?	15	8.67	158	91.33	0	0	7	29.17	17	70.83	0	0
Has the topic of HSW and its management been covered in any course you study/teach at the university?	51	29.48	73	42.2	49	28.32	5	20.83	12	50	7	29.17
Are you familiar with the Healthcare Service Waste Management Plan of the university's laboratories?	9	5.2	126	72.83	38	21.97	8	33.34	11	45.83	5	20.83
Are you familiar with the types of waste generated in the health area laboratories of the university?	31	17.92	48	27.75	94	54.34	10	41.67	4	16.66	10	41.67
Do you know the classification of HSW?	44	25.44	60	34.68	69	39.88	15	62.5	3	12.5	6	25
Can you correctly identify the symbols and packaging for disposing of HSW?	66	38.15	36	20.81	71	41.04	13	54.17	1	4.17	10	41.67

n = sample size. Source: Prepared by the authors, 2023.

When queried about the inclusion of HSW and its management in their course curricula, 51 (29.48%) students responded affirmatively, while 73 (42.20%) answered “no”. Among faculty and technicians, five (20.83%) reported the topic had been addressed, and 12 (50.00%) responded negatively (Table 3).

In the research by Monteiro, Costa, and Moraes<sup>16</sup>, veterinary doctors and students in the 9th and 10th semesters of the veterinary medicine course from the Southeast, South, and Central West regions of Brazil were surveyed on how they first learned about HSW Management Systems (GRSS). Among the students, 47.5% stated they were introduced to the topic during biosafety class sessions. However, the majority of veterinarians (31.4%) reported acquiring this information only after graduation, with 29.7% admitting to not knowing the subject until then. Notably, the biosafety course is often optional, potentially leading students to complete their veterinary medicine education without encountering this crucial topic. Among the undergraduates and graduates, 81% expressed the content provided during classes was insufficient to resolve their doubts.

Corroborating these findings, a study by Guimarães, Vilela, and Silva<sup>17</sup> at a public university in the Northeast of Brazil revealed that no specific course addresses HSW management within the nursing undergraduate program. Students noted that the topic was addressed only occasionally and superficially, emphasizing the need for more in-depth discussions and attention to promote behavioral changes.

In some cases, there is no commitment from professors to train future healthcare professionals in HSW management, nor are there positive examples for students to emulate. This deficiency can compromise the development of proper professional training and appropriate practices related to HSW management. Therefore, this topic must be integrated throughout the undergraduate programs at various points in the course, with increasing complexity, always linked to the core principles of biosafety<sup>17</sup>.

Another issue highlighted by the study was the participants' familiarity with the PGRSS of the university's laboratories. Among the students, 126 (72.83%) stated they were unaware of it.

Similarly, 11 faculty and technicians (45.83%) also reported not knowing the plan (Table 3).

In Monteiro, Costa, and Moraes' study<sup>16</sup>, when veterinary medicine students were asked if they had ever heard of the PGRSS, 32.5% were unfamiliar with the document. Furthermore, 90% reported not having access to the PGRSS at their workplace. Conversely, a survey by Almeida, Santos, and Sousa<sup>5</sup> on the discussion of PGRSS in classroom settings and during practical internships found that 88.37% of nursing graduates either fully or partially agreed that the topic had been addressed during their training. In research by Ataíde and Ferreira<sup>6</sup>, 64% of students acknowledged knowing what the PGRSS was.

Monteiro, Costa, and Moraes<sup>16</sup> also inquired whether veterinary medical professionals had access to the PGRSS at their workplaces, with 84.7% indicating they had not. Almeida, Santos, and Sousa<sup>5</sup> asked nursing professors if the PGRSS had been discussed in classroom settings or during practical internships and 88.89% responded it had been addressed either fully or partially. In the study by Ataíde and Ferreira<sup>6</sup>, all employees of the HEI reported knowing what the PGRSS was. This awareness can largely be attributed to the institution providing training to these professionals.

The PGRSS is a document that outlines and describes all actions related to the management of healthcare service waste, tailored to the specifics of each institution. Its preparation must consider the characteristics and risks of the generated waste, and the document should cover all stages of HSW management, in addition to actions for protecting public health, worker safety, and the environment. Every waste-generating service must have a PGRSS that complies with federal, state, and municipal regulations and is available for consultation by health or environmental surveillance agencies, employees, patients, or the general public<sup>4</sup>.

When asked about their knowledge of the types of waste generated in the health area laboratories of the university, 54.34% of students indicated partial knowledge. Among faculty and technicians, 41.67% confirmed their knowledge, and another 41.67% had partial knowledge (Table 3). No comparable studies were found in the literature that could be matched with the results of this question.



Participants were also queried on whether they performed segregation of the waste generated during activities in the laboratories. Among the students, 105 (60.47%) stated they did, 26 (15.75%) did so partially, 20 (11.31%) said they did not, and 22 (12.47%) did not know. Among faculty and technicians, 20 (86.95%) reported performing segregation, one (4.35%) did so partially, one (4.35%) did not segregate, and one (4.35%) was unsure.

In a study by Silva, Silva, and Ferreira<sup>14</sup>, when nursing students were asked which step the nursing team most commonly performs during the proper disposal of used materials, 45.3% of the students correctly identified segregation. The proportion of participants who answered correctly was considered moderate, reflecting the critical role these professionals play in the segregation stage of HSW.

Geitenes and Marchi<sup>10</sup> found that 62.3% of participants were unaware of the correct methods to segregate HSW, indicating a significant lack of preparedness among future physiotherapists. Another study by Graniska<sup>18</sup> in dental courses at two different institutions in Francisco Beltrão, state of Paraná, revealed that 17% of students at Institution A and 31% at Institution B had trouble in correctly separating and disposing of HSW.

Regarding the knowledge of HSW classification, 69 students (39.88%) reported partial knowledge. Among faculty and technicians, 15 (62.50%) claimed to understand the classification of HSW (Table 3). Almeida, Santos, and Sousa<sup>5</sup> noted that participants had varying skills related to HSW management for different categories of healthcare waste according to the then-current Anvisa resolution, with nursing course graduates mostly showing basic knowledge or skills (51.16%), a finding echoed by the faculty's responses (55.55% having basic level knowledge). Similarly, Geitenes and Marchi<sup>8</sup> reported that 62.3% of students were not familiar with HSW classifications.

Terres *et al.*<sup>12</sup> identified major flaws in HSW management at a dental college in the southern part of the country, primarily during the segregation stage, involving incorrect classification of generated waste. The researchers noted that these easily solvable failures and omissions resulted in high social, environmental,

and economic costs. Consequently, HSW management should be integrated into the ongoing training of faculty, technicians, and other professionals involved in managing HSW at the college, encompassing teaching, research, and extension activities. The topic should become a routine part of the academic community, including in the training of future health professionals.

Participants were also asked if they could correctly identify the symbols and packaging for disposing of HSW. Among the students, 66 (38.15%) said they knew how. Among faculty and technicians, 13 (54.17%) reported that they could correctly identify the symbols and packaging for HSW disposal (Table 3).

Almeida, Santos, and Sousa<sup>7</sup> inquired whether nursing graduates were familiar with the color-coding standards set by current regulations for different types of waste, finding that 51.16% had basic knowledge. In contrast, 48.15% of nursing professors had an intermediate level of understanding of the color standards for different waste types.

Regarding educational technology preferences for learning about HSW segregation, participants were given options like video, manual, Standard Operating Procedure (POP), infographic, and an open choice to suggest other technologies not listed or to select more than one. The aim was to gather participants' opinions to determine which educational technology to develop. Infographics were chosen by 57 (28.79%) participants, videos by 56 (28.28%), POP by 37 (18.69%), manuals by 33 (16.67%), and the "other" option by 14 (7.07%), with 10 of those expressing a preference for a combination of video and infographic technologies.

Considering the audience's preferences, the two most popular educational technologies (video and infographic) were selected for development. This decision was guided by the goal of aligning the educational tools with the real-world context of those experiencing the challenges of improper HSW management. It is believed that these technologies, once implemented, will increase usage rates since the users themselves chose them. This user-driven approach to content creation gives voice to the participants, considering their knowledge and practices as evidence in addition to scientific

findings<sup>19</sup>. The developed technologies are expected to spread knowledge about HSW among the users of health area laboratories at the studied university, potentially leading to positive changes in practice, especially in the accurate classification and segregation of HSW. The training of professionals who will use these technologies is expected to be significantly affected, making them more sensitive to this important yet often overlooked issue.

## CONCLUSIONS

Healthcare Service Waste remains a significant challenge for both public health and the environment. HEIs play an essential role in this context, as they not only generate substantial amounts of this type of waste but also are instrumental in training the future workforce of healthcare professionals.

The study exposed significant gaps and deficiencies in participants' understanding of HSW and its proper management. It also highlighted a widespread lack of awareness about relevant legislation, the institution's PGRSS, and a general deficiency in training, courses, and educational offerings related to the topic. Furthermore, it was observed that the issue is infrequently addressed in the institution's curricula.

Results indicated that faculty and administrative technicians working in the HEI's laboratories possess a deeper knowledge of HSW and its management compared to students, across all evaluated areas. This disparity may be attributed to the greater professional experience of these staff categories.

By comparing these findings with other studies, it becomes clear that the information deficiency regarding HSW is not exclusive to the studied HEI, thereby reinforcing the need for a heightened focus on the subject. This includes integrating it into student training and promoting training for faculty and administrative staff to cultivate professionals who are critical and responsible toward public health and the environment.

The situational diagnosis provided insights into the current reality of the HEI's laboratories concerning HSW. This knowledge

will support the development of educational technologies aimed at enhancing the training of users in the teaching and research laboratories in the health area of the institution on HSW and its management.

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