

Accidents Involving Biological Material in the Center-North Mesoregion of Goiás, Brazil: Epidemiological Profile and Preventive Challenges

Acidentes com Material Biológico na Mesorregião Centro-Norte de Goiás, Brasil: Perfil Epidemiológico e Desafios Preventivos

Accidentes con Material Biológico en la Mesorregión Centro-Norte de Goiás, Brasil: Perfil Epidemiológico y Desafíos Preventivos

RESUMO

Objetivo: traçar o perfil epidemiológico dos acidentes ocupacionais com material biológico entre trabalhadores das unidades de saúde da rede SUS na mesorregião Centro-Norte de Goiás, Brasil. **Métodos:** estudo descritivo, transversal e quantitativo, conduzido entre 2022 e 2023, conforme as diretrizes STROBE. Parecer no CEP, Nº 6.152.181. **Resultados:** idade média de 40 anos, com predominância de ensino superior completo. Prevalência de acidentes com material perfurocortante / biológico: 44,6%. Entre os casos, 74,2% eram mulheres e 38,7% técnicas de enfermagem. Predominaram agulha com bisel (48,7%) e sangue (79,2%). Realizaram sorologia 66,1% e quimioprofilaxia 77,1%; 25,8% não notificaram. Observou-se descarte inadequado de perfurocortantes, prevenível com recipientes apropriados em pontos estratégicos. **Conclusão:** as subnotificações resultaram de omissão profissional e falhas gerenciais no registro. A prevenção exige educação permanente, capacitação para manejo e descarte seguro, cultura institucional de segurança e estímulo à notificação, com impacto na proteção ocupacional.

DESCRIPTORIOS: Acidentes de Trabalho, Acidentes Biológicos, Profissionais de Saúde, Ferimentos Penetrantes Produzidos por Agulha.

ABSTRACT

Objective: To outline the epidemiological profile of occupational accidents involving biological material among workers in SUS healthcare units in the Center-North mesoregion of Goiás, Brazil. **Methods:** A descriptive, cross-sectional, and quantitative study conducted between 2022 and 2023, in accordance with STROBE guidelines. Ethics Committee approval No. 6,152,181. **Results:** The mean age was 40 years, with a predominance of individuals with higher education. The prevalence of accidents involving sharps/biological material was 44.6%. Among the cases, 74.2% were women and 38.7% were nursing technicians. Beveled needles (48.7%) and blood (79.2%) predominated. Serological testing was performed in 66.1% of cases and chemoprophylaxis in 77.1%; 25.8% were not reported. Inadequate disposal of sharps was observed, which is preventable with appropriate containers at strategic points. **Conclusion:** Underreporting resulted from professional omission and managerial failures in record-keeping. Prevention requires continuing education, training in safe handling and disposal, an institutional safety culture, and encouragement of reporting, with an impact on occupational protection.

DESCRIPTORS: Occupational Accidents; Biological Accidents; Health Personnel; Needle Stick Injuries.

RESUMEN

Objetivo: Trazar el perfil epidemiológico de los accidentes ocupacionales con material biológico entre trabajadores de unidades de salud de la red SUS en la mesorregión Centro-Norte de Goiás, Brasil.

Métodos: Estudio descriptivo, transversal y cuantitativo, realizado entre 2022 y 2023, de acuerdo con las directrices STROBE. Dictamen del Comité de Ética Nº 6.152.181.

Resultados: La edad media fue de 40 años, con predominio de educación superior completa. La prevalencia de accidentes con material punzocortante/biológico fue del 44,6%. Entre los casos, el 74,2% fueron mujeres y el 38,7% técnicas de enfermería. Predominaron las agujas con bisel (48,7%) y la sangre (79,2%). El 66,1%

realizó serología y el 77,1% quimioprofilaxis; el 25,8% no notificó. Se observó eliminación inadecuada de objetos punzocortantes, prevenible con recipientes adecuados en puntos estratégicos. **Conclusión:** La subnotificación resultó de la omisión profesional y de fallas en la gestión de los registros. La prevención requiere educación continua, capacitación para el manejo y la eliminación segura, cultura institucional de seguridad y estímulo a la notificación, con impacto en la protección ocupacional.

DESCRIPTORES: Accidentes de Trabajo; Accidentes Biológicos; Personal de Salud; Lesiones por Pinchazo de Aguja.

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INTRODUCTION

Accidents involving biological material are exposures to infectious agents, such as viruses, bacteria, parasites, and fungi, during the handling of blood, saliva, urine, feces, tissues, among others¹. These accidents occur primarily through the handling of sharps, such as needles, scalpels, and scissors, or through skin exposure, including splashes on mucous membranes, damaged skin, or wounds^{1,2}. Such accidents can cause injuries, disabilities, or death, compromising the worker's functional capacity. They result in professional and personal impacts, such as time off work, prolonged treatments, stress, anxiety, and infections of varying severity³.

The care provided by healthcare professionals to patients may involve situa-

tions conducive to workplace accidents, in both direct and indirect care⁴. Due to the high demand for invasive procedures in healthcare facilities, there is a high risk of exposure to infectious diseases, such as Human Immunodeficiency Virus (HIV), Hepatitis B, and C⁵.

Lack of awareness regarding pathogenicity, failure to comply with biosafety protocols and standards, negligence in the use of personal protective equipment (PPE), and improper disposal of sharps increase the risk of biological accidents among healthcare professionals. These accidents generally result from improper handling and disposal, failures in the use of PPE, and a lack of training⁶.

In this regard, Brazil enacted Regulatory Standard No. 32 (Occupational Safety and Health in Health Services) with the aim of protecting the health

and safety of healthcare professionals. The standard mandates the provision of PPE, continuing education programs, hepatitis B vaccination, and appropriate sharps disposal containers, contributing to better working conditions and a lower risk of biological accidents and infections⁷.

In the event of an accident involving exposure to biological material, the professional must immediately inform the person in charge of the facility, who must submit the mandatory report to the Notifiable Diseases Information System (SINAN). It is the employer's responsibility to issue the Work Accident Report (CAT) and notify Social Security. This document may be used by the National Social Security Institute (INSS) and other public agencies⁸.

Lack of knowledge about biological risks, exhausting work schedules, the

absence of defined protocols, and the downplaying of accidents contribute to underreporting and failures in case referral⁹. Understanding epidemiological data is essential for formulating public strategies, promoting health education, and preventing accidents.

Accidents involving biological material have negative impacts on the healthcare system, such as increased costs, absenteeism, loss of productivity, risk of infectious outbreaks, and harm to the mental health of healthcare professionals. Despite advances in biosafety, training, and available materials, reports continue to rise, highlighting the urgent need for further scientific research on the topic. Thus, the study aimed to outline the epidemiological profile of occupational accidents involving biological materials among workers in healthcare facilities within the Unified Health System (SUS) in the Central-North mesoregion of Goiás, Brazil.

METHODS

This is a descriptive cross-sectional study with a quantitative approach, conducted from 2022 to 2023, in accordance with the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) guidelines¹⁰.

The sample consisted of 139 healthcare professionals from the following categories: dental assistants, general service assistants, drivers, dentists, nurses, orderlies, physicians, and nursing technicians. Inclusion criteria included: age over 18 years, permanent employment status, and preserved cognitive and communicative abilities. Exclusion criteria included: professionals on medical leave, maternity/paternity leave, vacation, or other absences during the data collection period; and professionals with an indirect relationship to the institution, such as outsourced service providers not directly involved in healthcare or administrative routines.

Data were collected using a semi-structured interview guide developed by the researchers and included information regarding sociodemographic profile (gender, age group, and education level); occupational and epidemiological characteristics (workplace, job function, and length of time in the occupation); and occupational accidents involving sharps and/or biological material (occurrence of a sharps injury, causative agent, circumstances of the event, contact with biological material, use of PPE, time of the accident, workload on the day of the event, length of time in the profession at the time, identification of the source, serological testing, chemoprophylaxis, notification, and referral of the notification).

The study was conducted in the municipality of Ceres, located in the north-central mesoregion of Goiás, Brazil. According to the latest census by the Brazilian Institute of Geography and Statistics (IBGE) from 2022, Ceres has a population of 22,046 inhabitants, spread across an area of approximately 214.322 km². The Human Development Index (HDI) is 0.775 according to the latest census from 2010¹¹. The

municipality's SUS network includes outpatient care (Family Health Strategy – ESF and Psychosocial Care Center – CAPS), inpatient care (São Pio X Hospital – HSPX), health surveillance, and urgent and emergency care services (Emergency Care Unit – UPA and Mobile Emergency Care Service – SAMU).

Data collected from medical records were tabulated in *Microsoft Excel* spreadsheets. Descriptive statistics were performed using absolute and relative frequency measures based on the database. The study complies with the guidelines established in Resolution 466/12 of the National Health Council (CNS)⁽¹²⁾ respecting the ethical principles of research involving human subjects. In addition, it was approved by the Research Ethics Committee of the State University of Goiás (UEG), with CAEE Research Number: 70263123.9.0000.811 and Opinion No. 6.152.181.

RESULTS AND DISCUSSION

A total of 139 healthcare professionals participated in the study (Table 1).

Tabela 1 - Caracterização das variáveis demográficas e ocupacionais participantes do estudo, n=139.

Variable	N	%
Sex		
Female	101	72,66
Male	38	27,34
Age		
20–30	10	7,19
31–40	45	32,37
41–50	56	40,29
51–60	25	17,99
61	03	2,16
Education Level		
Lato Sensu Postgraduate	18	12,95
Stricto Sensu Postgraduate	03	2,16
Completed Higher Education	68	48,92
Incomplete Higher Education	32	23,02
Completed High School	18	12,95

Workplace		
HSPX	18	12,95
SAMU	32	23,02
Primary Health Care Unit (UBS)	47	33,81
Emergency Care Unit (UPA)	42	30,22
Occupation		
Oral Health Assistants	04	2,88
General Services Assistants	16	11,51
Drivers	10	7,19
Dentists	05	3,60
Nurses	24	17,27
Stretcher Bearers	01	0,72
Physicians	29	20,86
Nursing Technicians	50	35,97
Time in Occupation		
1–5 years	59	42,45
6–10 years	48	34,53
11–15 years	32	23,02
Total	139	100

Caption: HSPX - São Pio X Hospital; SAMU - Mobile Emergency Care Service; UBS - Basic Health Unit; UPA - Emergency Care Unit.

Source: Oliveira AF, et al., 2025.

The findings indicate: a predominance of females at 72.66% (n=101/139), followed by males at 27.34% (n=38/139). The mean age was 40 years, with the high-

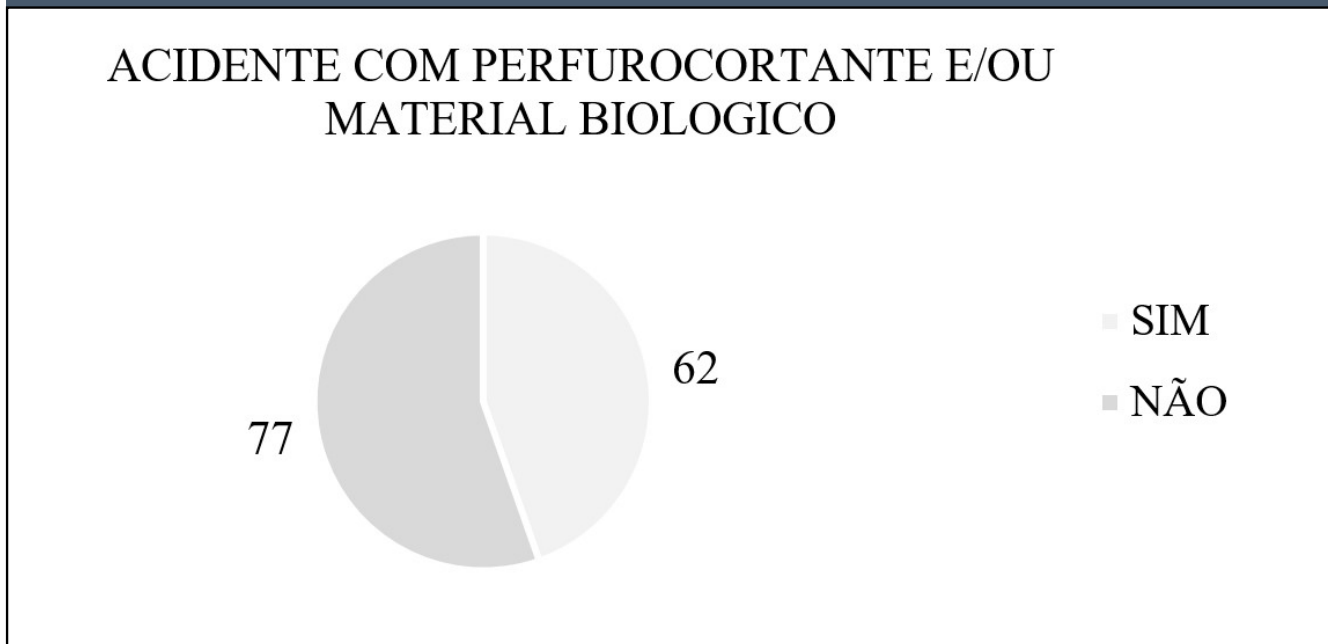
est concentration in the 41–50 age group (40.29%, n=56/139) and the lowest in the >60 age group (2.16%, n=3/139). Regarding education, the majority had completed higher education (48.92%, n=68/139).

Regarding work settings: the majority were assigned to Basic Health Units (UBS) 33.81% (n=47/139), Emergency Care Units (UPA) 30.22% (n=42/139), Mobile Emergency Care Service (SAMU) 23.02% (n=32/139), and State Psychiatric Hospitals (HSPX) 12.95% (n=18/139).

Most belong to the nursing technician category (5.7%, n=50/139), followed by physicians (20.86%); (n=29/139), nurses 17.27% (n=24), general service assistants 11.51% (n=16/139), drivers 7.19%; (n=10), dentists 3.60% (n=5), dental assistants 2.88% (n=4/139), and orderlies 0.72% (n=1/139). Regarding length of service in the position, the average is 9.4 years.

The occurrence of accidents involving sharps and/or biological material throughout the professional career is distributed as follows: 55.40% (n=77/139) for “no” and 44.60% (n=62/139) for “yes” (Graph 1).

Gráfico 1 – Ocorrência de acidente com perfurocortante e/ou material biológico, participantes do estudo, n=139.



Fonte: Oliveira AF, et al., 2025.

The sample was predominantly female (72.66%), with a mean age 40 years and a higher concentration in the 41–50 age group, a profile consistent with the feminization of the healthcare workforce, particularly in nursing. Nursing technicians constituted the largest category (35.97%), which is significant given the frequent performance of invasive procedures and the handling of sharps¹³.

A higher concentration of professionals was observed in Primary Health Care (PHC) and in urgent and emergency care services, settings characterized by high demand for care and continuous exposure to biological risks. The incidence of accidents involving sharps and/or biological materials over the course of their careers was 44.60%, a significant proportion considering an average of 9.4 years of professional practice, suggesting cumulative occupational risk.

Although 55.40% reported no accidents, the magnitude of the observed exposure indicates persistent vulnerability. Occupational distribution and care settings may influence this scenario, particularly in environments marked by time pressure, overload, and clinical unpredictability⁹. The possibility of underreporting should also be considered.

The findings reinforce the need for structured prevention strategies, including strengthening the safety culture, ongoing education on standard precautions, adoption of safety-engineered devices, and systematic monitoring of accidents^{9,14}. In the regional context investigated, such measures are essential to reduce occupational exposure and improve worker health surveillance.

Demographic and occupational characteristics of those involved in accidents

Accidents involving sharps or biological materials occurred in 62 of the interviewees. Females predominated at 74.2% (n=46/62), compared to males at 25.8% (n=16/62). Age ranged from 24 years, with a mean of 40 years. The majority were between 31 and 59 years old (77.4%,

n=48/62), followed by the 24–30 age group (19.4%, n=12/62), while individuals aged 60 or older accounted for 3.2% (n=2/62).

Regarding educational attainment, a completed higher education or postgraduate degree was most common (51.6%, n=32/62), followed by a completed high school education (33.9%, n=21/62). Lower percentages were observed for incomplete higher education (6.5%, n=4/62) and master's degrees (3.2%, n=2/62). Incomplete elementary school, completed elementary school, and incomplete high school each accounted for 1.6% (n=1/62).

Accidents occurred primarily at Basic Health Units (UBS) 37.0% (n=23/62), followed by Emergency Care Units (UPA) 35.4% (n=22/62), the Mobile Emergency Care Service (SAMU) 21.0% (n=13/62), and the HSPX 6.6% (n=4/62). Among the professionals involved in accidents, nursing technicians predominated at

38.7% (n=24/62), followed by nurses at 21.0% (n=13/62) and physicians at 21.0% (n=13/62). Drivers accounted for 6.5% (n=4/62), dental assistants 4.8% (n=3/62), dentists and general service assistants 3.2% (n=2/62) each, and orderlies 1.6% (n=1/62).

The most common length of service was 1 to 5 years (32.3%, n=20/62), followed by 11 to 20 years (25.8%, n=16/62) and 6 to 10 years (22.6%, n=14/62). Professionals with up to 11 months of experience accounted for 6.5% (n=4/62), those with 21 to 30 years of experience for 9.7% (n=6/62), and those with over 31 years of experience for 3.2% (n=2/62). The average time in the occupation was 10.7 years. Table 2 presents a summary of the demographic and occupational characteristics of participants who suffered an accident involving a sharp object or biological material.

Table 2 - Characteristics of demographic and occupational variables for all accident victims in the study (n=62) in the city of Ceres, Goiás, Brazil, 2023.

VARIÁVEIS		N*	%	IC 95%**
Sexo	Feminino	46	74,2	(62,26% - 83,91%)
	Masculino	16	25,8	
Idade	31-59 anos	48	77,4	(39,18 - 40,82)
	Média	40 anos	-	
	Desvio Padrão	3,345	-	
Escolaridade	Superior completo / Pós-graduação	32	51,6	(39,24% - 63,84%)
Local de trabalho	UBS	23	37,0	(25,79% - 49,59%)
	UPA	22	35,4	(24,35% - 47,94%)
	SAMU	13	21,0	(12,19% - 32,40%)
	HSPX	4	6,6	(2,08% - 14,83%)
Ocupação	Técnico de enfermagem	24	38,7	(27,23% - 51,22%)
	Outras	38	61,3	
Tempo na ocupação	1-5 anos	20	32,3	(9,48 - 11,92)
	Média	10,7 anos	-	
	Desvio Padrão	4,911	-	

Legend: * number of accident victims in the study; ** 95% Confidence Interval ($\alpha 0.005$).

Source: Oliveira AF, et al., 2025.

The confidence intervals presented in the table, especially for females (62.26%–83.91%) and nursing technicians (27.23%–51.22%), indicate

statistical consistency of the estimates, although the width of some CIs suggests caution in generalizing the results, due to the sample size (n=62).

Categorization of workplace acci-

dents

Table 3 presents the characteriza-

tion of workplace accidents involving sharps or biological materials among the study participants.

on the day of the accident was 14.5 hours (SD=8.1; 95% CI: 12.5–16.4), and 61.9% (n=39) of the professionals had worked between 7 and 12 hours. The average length of service was 5 years (SD=3.52; 95% CI: 5.86–4.14), with the highest concentration among those with 1 to 5 years of experience (49.2%; n=31).

Regarding post-exposure measures, 79.2% (n=42; 95% CI: 66.8%–88.57%) reported identifying the source. Serological testing was performed by 66.1% (n=41; 95% CI: 53.72%–77.06%). Chemoprophylaxis was not indicated in 77.1% (n=47; 95% CI: 65.28%–86.3%), which may reflect an assessment of low biological risk. The incident was reported in 74.2% (n=46; 95% CI: 62.26%–84.91%), but 25.8% did not report it. Among those who reported, 69.6% (n=32; 95% CI: 55.22%–81.52%) reported formal referral, while 30.4% stated they were unaware of this process.

The results corroborate the epidemiological pattern described in the literature, in which hollow needles are the primary vector of occupational exposure, due to their frequent use in venipuncture, medication administration, and blood collection^{9,15,16}. The high proportion of accidents related to improper disposal signals failures in biosafety processes and waste management, indicating a need to strengthen periodic training and institutional supervision^{9,17,19,20,21}.

The predominance of exposures involving blood reinforces the potential risk of transmission of pathogens such as HIV, HBV, and HCV. Although most reported using gloves, this PPE does not eliminate the risk of puncture, highlighting the importance of safety devices with retraction mechanisms or active needle protection.

The high average workload on the day of the accident suggests that occupational fatigue was a contributing factor. Long work shifts are associated with reduced attention, increased te-

Table 3 – Categorization of workplace accidents involving sharps or biological materials among research professionals, Ceres, Goiás, Brazil - 2023.

VARIABLES		%	IC 95%**	IC 95%**
Causative agent	Beveled needle	38	48,7	(37,77% - 59,76%)
Circumstances of the accident	Discard inadequate	12	16,9	(9,49% - 26,96%)
	Procedure surgical	Procedure surgical	16,9	(9,49% - 26,96%)
Contact with material biological	Yes	43	69,4	(57,09% - 79,85%)
What biological material	Blood	38	79,2	(66% - 88,9%)
	Glove	50	44,2	(35,29% - 53,49%)
What PPE were you wearing	None	None	10,6	(5,88% - 17,35%)
Time of the accident	Morning	27	39,7	(28,62% - 51,65%)
	7–12	39	61,9	
Hours worked on the day of accident	Average	Average	-	(12,5 - 16,4)
	Standard Deviation	8,1	-	
	1–5	31	49,2	
Working hours on the day of accident	Average	Average	-	(5,86 - 4,14)
	Standard Deviation	3,52	-	
Known source	Yes	42	79,2	(66,8% - 88,57%)
	Standard Deviation	3,52	-	
Serological tests performed	Yes	41	66,1	(53,72% - 77,06%)
Chemoprophylaxis performed	No indication		77,1	(65,28% - 86,3%)
Notification issued	No	46	74,2	(62,26% - 84,91%)
	Yes	16	25,8	(16,09% - 37,74%)
Notification was forwarded	Yes	32	69,6	(55,22% - 81,52%)
	Don't know	14	30,4	(18,48% - 44,78%)

Legend: * number of survey participants; ** 95% Confidence Interval ($\alpha 0.005$).

Source: Oliveira AF, et al., 2025

It was observed that the beveled needle was the main causative agent (48.7%; n=38; 95% CI: 37.77%–59.76%), highlighting the central role of sharps in the genesis of occupational accidents. Regarding the circumstances, improper disposal (16.9%; n=12; 95% CI: 9.49%–26.96%) and the performance of surgical procedures (16.9%; n=12; 95% CI: 9.49%–26.96%) had similar frequencies, suggesting vulnerabilities both in the post-procedure phase and during the performance of invasive

care practices.

Most accidents involved contact with biological material (69.4%; n=43; 95% CI: 57.09%–79.85%), with blood being the most frequently implicated fluid (79.2%; n=38; 95% CI: 66.0%–88.9%). Regarding the use of personal protective equipment (PPE), gloves were the most frequently mentioned item (44.2%; 95% CI: 35.29%–53.49%), although 10.6% (n=12; 95% CI: 5.88%–17.35%) reported not using any PPE at the time of the accident.

The events occurred predominantly in the morning (39.7%; n=27; 95% CI: 28.62%–51.65%). The average workday

chnical errors, and a higher probability of incidents, especially in high-demand care settings^{9,18}.

The percentage of unreported cases remains significant and indicates underreporting, which compromises epidemiological surveillance and the implementation of preventive measures. The lack of a recommendation for chemoprophylaxis in most cases may reflect less severe exposures; however, the failure to perform serological testing on some workers reveals gaps in post-exposure management^{19,20}.

The findings show that accidents involving biological materials remain associated with routine healthcare practices, weaknesses in the disposal of sharps, long work hours, and gaps in the safety culture. The results reinforce the need for structured institutional policies, with an emphasis on the adoption of safety devices, continuing education, adequate staffing levels, and strengthening of post-exposure reporting and

follow-up protocols, in order to reduce the occurrence and mitigate the impacts of these events in the occupational healthcare context.

Despite the contributions of this study, several limitations should be considered. The cross-sectional design does not allow for the establishment of causal relationships between the variables analyzed. Furthermore, the use of self-reported data may be subject to recall bias and possible underreporting of occupational accidents. It should also be noted that the study was conducted in a single municipality in the Central-Northern mesoregion of Goiás, which may limit the generalizability of the findings to other contexts. Nevertheless, the results provide relevant insights for planning surveillance and prevention measures regarding accidents involving biological materials.

CONCLUSION

The study identified a higher incidence of accidents involving biological material among women, particularly nursing technicians, with an average of 5 years of experience in the role. Improper disposal of sharps was observed, a practice that could be avoided by providing accessible sharps containers. The evidence also points to underreporting resulting from omissions by professionals or failure to report by managers.

The prevention of accidents involving biological materials is essential for the safety of healthcare professionals and infection control. Managers play a central role in promoting continuing education, the correct use of PPE, training in safe disposal, and encouraging reporting, reinforcing the importance of record-keeping and the risks of failing to take preventive measures. Research in this area contributes to scientific advancement, influencing professional training and practices, and strengthening the culture of workplace safety.

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