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Assessing the Impact of Biological Hazards on Occupational Safety in Healthcare Facilities: A Qualitative Analysis

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Abstract: Biological hazards poses a global threat to public health, harbouring poisonous, infectious, and hazardous materials that contribute significantly to the spread of diseases. This study focuses on assessing the detrimental effects of medical waste on the health of hospital cleaning personnel. Hospitals, laboratories, research facilities, blood banks and sample collecting services collectively generate substantial quantities of medical waste, which includes potentially biological hazards capable of infecting both hospital guests and medical staff. This research employs a comprehensive questionnaire distributed among cleaning staff members to gauge their level of awareness regarding the associated health risks posed by medical waste. The collected data undergoes thorough analysis and assessment to elucidate the prevailing awareness levels and understanding of risks among the personnel. Subsequently, the findings will inform the formulation of a targeted mitigation plan aimed at reducing the incidence and impact of these health risks, mitigating potential occurrences, whether major or minor. The ultimate objective is to enhance safety measures and promote a healthier work environment for cleaning staff within healthcare facilities. This study serves as a crucial step toward understanding the specific challenges faced by cleaning personnel in relation to medical waste, offering insights that can guide the development and implementation of effective risk reduction strategies within hospital settings.

Keywords: Health, Safety, Biological Hazard, Risk, Medical waste

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Introduction

Biological hazards within healthcare facilities represent a complex and persistent threat to the well-being of both patients and healthcare workers worldwide. These hazards encompass a

diverse array of microorganisms, infectious agents and biological materials capable of causing illness, injury or even death. The intricate nature of these hazards is rooted in the dynamic

interplay between healthcare settings and a multitude of pathogenic agents, including bacteria, viruses, fungi and other microbes. Their presence within hospitals, clinics, laboratories, and similar settings poses significant challenges in ensuring the safety and security of healthcare personnel, patients and the broader community (Adu *et al.*, 2020).

Healthcare facilities serve as critical hubs for the diagnosis, treatment and care of individuals, inevitably leading to the generation and handling of various biological materials. While these materials are integral to the practice of medicine, their inherent potential to harbor infectious pathogens necessitates stringent measures to mitigate associated risks. Moreover, the evolving landscape of infectious diseases and the emergence of antimicrobial resistance underscore the dynamic nature of biological hazards, requiring continuous vigilance and adaptable strategies within healthcare environments (Akkajit *et al.*, 2020). The intricate network of interactions between pathogens, hosts, and healthcare settings heightens the complexity of risk assessment and management in these settings, emphasizing the need for comprehensive approaches to safeguard public health (Alizadeh *et al.*, 2020).

The impact of biological hazards extends beyond immediate health concerns, encompassing broader implications for healthcare systems, resource allocation, and societal well-being. Outbreaks of infectious diseases within healthcare facilities not only compromise patient care but also strain healthcare infrastructure, disrupt services, and pose significant economic burdens. Addressing these challenges demands a multifaceted approach that integrates robust surveillance, effective infection control measures, training, and the implementation of evidence-based protocols to mitigate the risks posed by biological hazards in healthcare settings. India, a nation of rich cultural heritage and diverse landscapes, faces distinctive challenges concerning biological

hazards within its healthcare landscape (Cetinkaya *et al.*, 2020). Amidst its blend of traditional practices and modern healthcare systems, the country grapples with a spectrum of biological risks prevalent within healthcare facilities, clinics and community settings. The unique environmental factors, climatic conditions, and demographic patterns in India contribute to a distinct profile of biological hazards, encompassing infectious diseases, zoonotic infections and endemic pathogens. Understanding and addressing these hazards are imperative not only for safeguarding the health and safety of India's population but also for sustaining the efficiency and resilience of its healthcare infrastructure in the face of emerging biological threats (Che *et al.*, 2020).

Categories of medical waste:

Medical waste within healthcare facilities comprises a diverse array of materials that pose significant challenges in management, disposal, and containment. These facilities generate a complex spectrum of waste materials categorized into several distinct types, each presenting unique hazards to public health and the environment. Sharps, including needles, syringes, and scalpels, constitute a crucial category of medical waste, posing a substantial risk of injury and potential exposure to blood-borne pathogens (Chisholm *et al.*, 2021). Another prominent category encompasses infectious waste, encompassing materials contaminated with blood, bodily fluids or infectious agents, necessitating specialized handling and disposal protocols to prevent the transmission of diseases. Additionally, healthcare facilities produce pharmaceutical waste, comprising expired, unused or contaminated medications, posing risks of environmental contamination and potential harm if improperly disposed of or released into ecosystems. Hazardous chemicals, including disinfectants, solvents, and laboratory reagents, constitute yet another category, demanding stringent management protocols due to their toxic, corrosive or flammable nature.

Moreover, anatomical waste, such as tissues, organs or body parts from surgeries or autopsies, requires specialized handling and disposal to prevent biological hazards and ensure respect for ethical considerations surrounding human remains (Corvalan *et al.*, 2020).

The management of these diverse types of medical waste presents a multifaceted challenge, requiring comprehensive strategies and protocols to ensure the safety of healthcare workers, the public, and the environment. Understanding the distinct nature and hazards associated with each category of medical waste is paramount in formulating effective waste management practices within healthcare settings (Ilyas *et al.*, 2020).

Hazards associated to medical waste:

Sharp medical waste poses significant occupational and public health hazards within healthcare industries, presenting unique risks due to its potential for causing injuries and transmitting infectious diseases. Needles, scalpels, broken glass and other sharp objects used in medical procedures represent a critical category of waste that demands specialized handling and disposal protocols. The primary hazard associated with sharp medical waste revolves around the risk of accidental injuries, particularly needlestick injuries, which expose healthcare workers to bloodborne pathogens such as HIV, hepatitis B and hepatitis C (Narayanamoorthy *et al.*, 2020). These injuries not only compromise the safety and health of healthcare professionals but also pose a potential route for the transmission of infectious diseases to patients and the broader community. The hazards linked with sharp medical waste encompass not only the immediate risk of injury but also the potential long-term health consequences (Letho *et al.*, 2021). Needlestick injuries, can lead to severe infections, chronic illnesses and psychological distress among healthcare workers. Additionally, improper

disposal or handling of sharps can result in injuries to waste management personnel, further propagating the risk of pathogen transmission (Maalouf *et al.*, 2021). The indiscriminate disposal of sharps also poses environmental hazards, as improperly discarded needles and other sharp objects may end up in public spaces, increasing the risk of accidental injuries and potential disease transmission among the general population. Mitigating these risks necessitates comprehensive training, adherence to safety protocols, and the implementation of safe disposal methods to minimize the impact of sharp medical waste on both healthcare workers and the community at large. The amount of medical waste generated during the year 2020-2021 in various states is shown in Fig. 1.

Risks associated to health care personnel:

Healthcare workers are exposed to various occupational risks, including exposure to infectious diseases, chemical hazards from medications or cleaning agents, radiation and physical injuries from lifting patients or accidents involving medical equipment. Needlestick injuries, especially among nurses and physicians, pose a significant risk of contracting bloodborne infections, such as HIV, hepatitis B and hepatitis C (Padmanabhan *et al.*, 2019). The demanding nature of healthcare roles often leads to high levels of stress, burnout and emotional exhaustion among healthcare professionals. Witnessing patient suffering, high workload, long hours and the pressure to make critical decisions can contribute to mental health challenges, leading to anxiety, depression and compassion fatigue (Selvan *et al.*, 2021). Healthcare workers frequently engage in physically demanding tasks like lifting patients, transferring them between beds and standing for extended periods, which increases the risk of musculoskeletal injuries. These injuries, such as back strains or joint problems, can result in chronic pain and long-term physical disabilities.

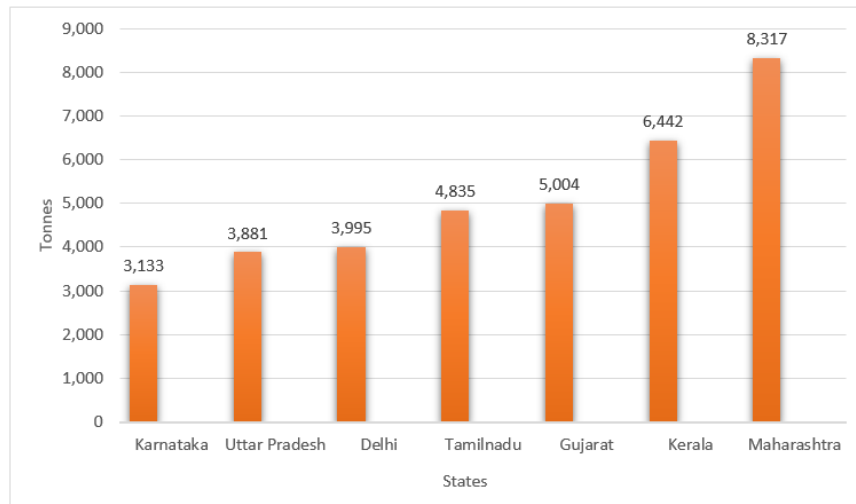


Fig. 1: Medical Waste Generated During (2020-2021).

Healthcare settings can be prone to violence, whether from patients, their families or even colleagues. Verbal abuse, physical assaults and threats pose significant risks to the safety and well-being of healthcare workers, affecting their mental health and job satisfaction (Shiferaw *et al.*, 2012).

Apart from needlestick injuries, healthcare workers are at risk of contracting infectious diseases through exposure to patients with contagious illnesses. Lack of adequate personal protective equipment or improper infection control measures can heighten this risk (Sing *et al.*, 2022).

Methodology:

Initial Phase:

Three approaches are used in this research: The first stage involved in gathering secondary data from books, periodicals, newspapers and scholarly journals for the literature review. The second phase includes in collection of basic details such as types of medical waste, the risks involved in handling sharp medical waste, disposal methods and consequences on healthcare workers. The third phase included in preparing questionnaires to find out the views and opinions of the target audience is the second stage of data collection. The final phase includes in processing the data the results are examined.

Questionnaire:

The study relies on the use of the qualitative research approach, which was founded in deductive reasoning and sought to comprehend, clarify, examine and explain the attitudes and feelings of a group of participants. In addition, a set of people were given questionnaires with formal, standardised questions to answer, together with information about their attitudes, opinions, and beliefs. The hospital is divided into several departments: the nurse's department, which covers internal medicine, surgery, obstetrics, gynaecology, ear, nose and throat and orthopaedics; the men's department; the maternity ward; the adult critical care unit; radiology; the department of physiotherapy; the laboratory; and the emergency room. It contained many people with a variety of positions, including nurses, doctors, x-ray technicians, chemists and cleaners. Utilising a contemporary research methodology, both goals were met. A week was spent designing the questionnaire using the Google Form link. then sent out to nurses and other healthcare professionals via WhatsApp to complete the form. Provide printed questionnaires to waste collectors on paper since it is hard to get in touch with them and pick them up after two days. By focusing on the group of hospital cleaners and nurses, the questionnaire assisted in providing answers to queries. The questionnaire asked questions about the staff's

knowledge, abilities, attitude towards the effects of medical waste, gender, designation and year of experience. Direct feedback was captured and data was gathered online. The project's key was found with the aid of the questionnaires. For instance, by recognising the dangers that medical waste poses to garbage collectors and medical personnel, the questionnaire assisted in gathering more data. The percentage of people who have been exposed to the negative health effects of medical waste from garbage collectors and medical personnel was also determined with the use of the questionnaire. After gathering all of the data from them, they received gratitude for their assistance and hard work. Ultimately, the search result was obtained by comparing, analysing and interpreting the responses.

Results and Discussion

The questionnaire survey data underwent rigorous analysis using both quantitative and qualitative methods to comprehensively explore the perceptions and experiences of respondents regarding medical waste exposure. Concurrently, qualitative analysis focused on thematic coding of open-ended responses, allowing for a nuanced understanding of the qualitative insights and emergent themes related to perceptions, attitudes, and specific challenges faced by healthcare workers concerning medical waste exposure. The integration of these analytical approaches offered a robust and holistic understanding of the survey findings, providing valuable insights into the varied dimensions of medical waste exposure experienced by healthcare personnel.

A questionnaire survey is done among 240 working personnel's and 21 cleaners in the healthcare facility. Almost all the respondents were responded to all questions. Employees with minimum number of experience (i.e., in the range of 0 to 5 years have responded on an average 61%, whereas those with 6–10 years of experience responded 39% on average.

The first axis's results assessed cleaners' and

employees' knowledge of the different kinds of medical waste generated in the healthcare industry. In order to address this question, frequencies and percentages were taken from the questions on the axis that assesses workers' knowledge and practices about the various categories of medical waste, as can be seen in the following axes that display the outcomes. The details of the questionnaire survey are shown in Figure 2.

Most employees are aware of the idea of medical waste, according to the level of awareness among cleaners and medical staff regarding the many types of medical waste in the field of care health. The findings also revealed that 97% of the staff members and 3% of those without any prior experience were aware of the risks associated with medical waste. According to the report, 88% of medical staff members are ignorant of the many categories of health waste. However, 12% of all samples did not know what kinds of medical waste were. 74% of respondents agreed that hospital staff members have received training and education on how to identify different sorts of trash and handle them, 4% disagreed, and 18% were unsure.

Furthermore, 92% of the sample said they were aware of the significant hazards that healthcare professionals face. Every participant in the sample agreed that gloves are worn by cleaning staff members prior to collecting rubbish. Furthermore, according to the poll, 83% of cleaners and healthcare professionals are aware of how different colours of trash are classified, whereas 17% of participants are unsure. In addition to the above, 86% of cleaners and healthcare workers said they had not been injured by medical waste; nevertheless, 14% of them had. The second section examines cleaners' and staff members' knowledge of medical waste management, collection, and transportation. A percentage of 13% of respondents said they were unsure, indicating a need for awareness. The sample, on the other hand, agreed that the

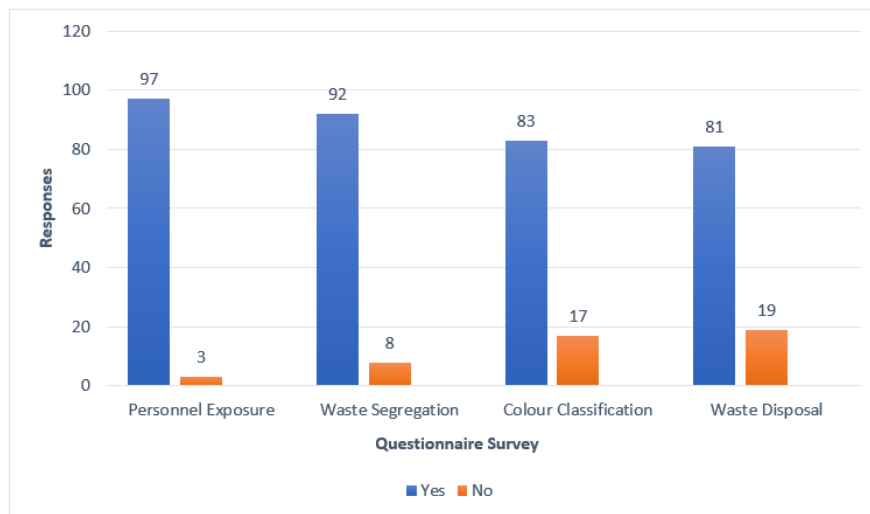


Fig. 2: Questionnaire Responses.

sorting and packing process should take place at the closest point in the location where the waste is generated in order to reduce the risk of injury to the cleaners. Additionally, 81% of the cleaners and staff agreed that the packing and sorting procedure should follow the colour scheme for the different categories of waste, compared to 17% who disagreed and 2% who were unsure of the response.

The study elucidated an array of preventive strategies aimed at minimizing exposure to sharp medical waste, encompassing multifaceted approaches to enhance safety within healthcare settings. Implementing safety-engineered devices emerged as a pivotal strategy, significantly reducing the risk of needlestick injuries and sharps-related accidents among healthcare workers. Moreover, comprehensive training programs focusing on proper handling, disposal techniques and the use of safety protocols demonstrated significant efficacy in minimizing exposure risks. The incorporation of organizational policies mandating the use of safer medical devices, coupled with regular safety audits and feedback mechanisms, fortified a culture of safety and compliance, further diminishing the likelihood of sharp medical waste exposure incidents. These multifaceted preventive strategies underscore the importance of a holistic approach toward risk reduction,

emphasizing the pivotal role of education, technology and organizational support in safeguarding healthcare workers from the hazards associated with sharp medical waste.

Furthermore, 92% of the samples indicated that they could identify the colour classification of sharp waste, compared to 8% who could not. 81% of health professionals said they disposed of broken glass in a bright yellow container; 19% disagreed, and 4% said they were unaware of the practice. This suggests that staff members need to participate in certain educational awareness campaigns and seminars. Ninety-three percent of the samples also agreed that, to ensure their safety, waste delivery workers should wear gloves and specific protective clothes. Additionally, 94 percent of the samples concurred that there is evidence in the storage facilities indicating the presence of medical waste.

In addressing the imperative to reduce exposure to medical waste, several strategic measures stand paramount. Implementing stringent waste segregation protocols, emphasizing the use of safety-engineered devices and promoting proper handling, containment and disposal methods significantly mitigate the risks associated with medical waste. Moreover, comprehensive training programs aimed at enhancing awareness among healthcare workers regarding the hazards posed by medical waste,

coupled with the provision of personal protective equipment, play a pivotal role in minimizing exposure risks. Embracing innovative technologies for waste treatment and disposal, alongside regular audits and continuous improvement of waste management practices, ensures a holistic approach toward reducing exposure to medical waste, safeguarding the health and safety of healthcare personnel, patients, and the broader community.

Conclusion

The multifaceted risks encountered by healthcare workers within healthcare facilities demand urgent attention and comprehensive strategies to ensure their safety, well-being and continued effectiveness in delivering quality care. Addressing these risks requires a multi-layered approach that integrates robust occupational safety measures, psychological support systems, adequate training in hazard management and the provision of appropriate protective equipment. Emphasizing a culture of safety, implementing stringent infection control protocols, promoting ergonomic practices and fostering a supportive work environment are essential components in mitigating these risks. Prioritizing the protection of healthcare workers not only preserves their individual health but also fortifies the resilience of healthcare systems, ensuring optimal patient care and sustaining the crucial role these professionals play in safeguarding public health.

The implementation of strategic measures holds immense potential in mitigating risks within healthcare facilities. Embracing a proactive stance toward risk reduction involves a combination of approaches, including the implementation of stringent infection control protocols, regular training on safety procedures, investment in advanced technology for hazard mitigation, fostering a culture of safety and open communication, and continuous evaluation and improvement of existing protocols. By integrating these strategic measures into healthcare facility policies and practices, stakeholders can

significantly diminish risks, fortify the safety of healthcare workers and patients, optimize resource allocation, and enhance the overall resilience of healthcare systems. Prioritizing risk reduction strategies in healthcare facilities not only ensures a safer environment for all stakeholders but also upholds the core principle of delivering high-quality care while mitigating potential adverse events.

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