



Received: 24-03-2025

Accepted: 04-05-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Awareness of Healthcare Workers Regarding Biomedical Waste Management (BMW) at Guru Gobind Singh Medical College, Faridkot (Punjab)

¹Dr. Rahul Srova, ²Dr. Trinjana Sachdeva, ³Dr. Lovedeep, ⁴Archana Shahi

^{1, 2, 3, 4} Department of Hospital and Healthcare Administration, UCER, BFUHS, Faridkot, Punjab, India

DOI: <https://doi.org/10.62225/2583049X.2025.5.3.4236>

Corresponding Author: Dr. Rahul Srova

Abstract

Introduction

Hospitals produce substantial amounts of biomedical waste during standard operations, and improper management of this waste can lead to significant public health hazards. Suboptimal management practices can promote the transmission of infectious diseases, including HIV and hepatitis, while insufficient handling may result in hospital-acquired infections affecting both patients and healthcare personnel. Additionally, increased public awareness of infectious diseases has intensified concerns regarding the safe disposal of biomedical waste. Effective waste management protocols in hospitals can reduce disease transmission risk within the community and lower medical costs related to hospital-acquired infections. Therefore, educating the community, staff, and patients on appropriate biomedical waste management practices is crucial for ensuring a safer healthcare environment.

Aim

This study aimed to evaluate healthcare personnel's awareness, attitudes, and practices of biomedical waste management at Guru Gobind Singh Medical College & Hospital, a tertiary care government facility in Faridkot, Punjab.

Methods

Guru Gobind Singh Medical College & Hospital is a 1200+

bedded tertiary care teaching hospital in the Faridkot district of Punjab, India. A cross-sectional study was performed using healthcare personnel, comprising physicians, nurses, and housekeeping staff. A systematic questionnaire was employed to assess their awareness of biomedical waste segregation, disposal techniques, utilization of color-coded bins, and adherence to the Biomedical Waste Management Rules, 2016. The data were examined employing descriptive statistics.

Results

It was found that among 110 participating health workers, only 96.6% have heard about BMW, and 75.4% have undergone any training regarding BMW management. About 93.63% of hospital health workers know the different colored bins required for collecting different types of waste. Also, only 55.4% and 58.1% of health workers received vaccines against hepatitis B and tetanus, respectively.

Conclusion

All healthcare providers must receive regular training in biomedical waste management for the appropriate handling and disposal of biomedical waste. There is also an urgency to provide vaccination among healthcare workers to protect them against the possible disease transmission due to BMW handling.

Keywords: Biomedical Waste, Healthcare Workers, Waste Segregation, Color-coded Bins, Tertiary Care Hospital

Introduction

In today's world, healthcare constitutes a vital element of our everyday lives. Medical knowledge has progressed considerably, facilitating the saving of lives. However, along with advancements, it brings several challenges to society as well as healthcare institutions, such as biomedical waste. Biomedical waste refers to the waste produced by healthcare facilities during the treatment of patients. **Kanyal et al. (2021)**^[1] referenced any waste generated during the evaluation, care, or immunization of either humans or animals, along with research activities, as biomedical waste. The **WHO (2020)** mentioned that fifteen percent of the total waste produced by healthcare activities is classified as hazardous material, which may be infectious, toxic, or radioactive. The United States produces around 15% of its overall healthcare waste as hazardous waste; however, in India, this figure may range from 15% to 35%, as noted by **Babu et al. (2009)**^[3]. The hazardous waste comprises human and animal tissues, needles, syringes, infusion sets, knives, scalpels, blades, pharmaceutical products, chemicals, radioactive materials, etc.

Kaur et al. (2023) ^[4] highlighted the risk of hospital-associated infections associated with medical waste due to the presence of various pathogens like *Salmonella*, *E. coli*, and viruses. **Patil et al. (2013)** ^[5] stated that healthcare workers, like doctors and nurses, general duty assistants, and persons associated with the transportation and handling of waste, are at greater risk of nosocomial infections. **Hirani et al. (2014)** ^[6] estimated the overall creation of BMW in India is 405,702 kg per day, out of which 28% of the waste remains untreated and is either dumped or enters water bodies, re-entering our ecosystem. Poor handling of medical waste can lead to typhoid, cholera, and hepatitis through injuries from blood-contaminated sharps, as well as environmental pollution, an unpleasant stench, and the development and proliferation of insects, rats, and worms, as **Babanyara et al. (2014)** ^[7] highlighted. **Manzoor et al. (2019)** ^[10] show that the open dumping and incorrect combustion of biomedical waste lead to the contamination of air, water, and soil, increasing environmental risks. These worries have led to the rise of biomedical waste management as a worldwide problem.

A government tertiary care hospital, like the one in Faridkot, Punjab, treats a lot of patients and produces a lot of biological waste every day. As a referral facility, it manages severe situations and offers specialized medical services, which makes waste management more difficult. In such institutions, managing biological waste effectively requires a multifaceted approach that includes adequate infrastructure, employee training, and rigorous adherence to legal requirements.

In such hospitals, there is a significant inflow of patients seeking medical attention on both outpatient and inpatient bases. Patients skip primary health clinics (PHCs) and seek treatment at bigger hospitals for minor diseases, therefore overloading facilities designated for specialist consultation healthcare, as shown by **Kumar et al. (2020)** ^[8]. **Sahoo et al. (2024)** ^[9] emphasized apprehensions on the excessive strain imposed on healthcare professionals in tertiary care facilities, associating it with inadequate biomedical waste (BMW) management.

In India, the government implemented the Biomedical Waste Management Rules in 2016, mandating compliance by healthcare establishments nationwide. Regardless of the presence of explicit biomedical waste management protocols, several problems endure in their proper execution. A major concern is the insufficient awareness of appropriate biological waste management practices among healthcare staff. The absence of a comprehensive understanding about biological waste management adversely affects effective waste disposal methods, as **Mathur et al. (2011)** ^[11] showed. Furthermore, the substantial workload and stressful circumstances at government hospitals, as previously mentioned by **Sahoo et al. (2024)** ^[9], often lead to non-adherence to biological waste management standards. Insufficient resources, inadequate oversight, and deficient infrastructure exacerbate the issue, as articulated by **Goswami et al. (2021)** ^[12].

This research seeks to evaluate healthcare professionals' understanding of biological waste management at a tertiary care government hospital in Faridkot, Punjab. This research aims to uncover deficiencies and areas for improvement by assessing their knowledge, attitudes, and behaviors. This study is crucial for public health, workplace safety, and environmental sustainability. It is essential that healthcare

staff have sufficient knowledge and awareness of biological waste management to fulfill the overarching objectives of infection control and environmental preservation. This research corresponds with several United Nations Sustainable Development Goals (UNSDGs), highlighting the essential function of biomedical waste management in promoting global sustainability. This initiative aligns with Goal 3: Good Health and Well-being by facilitating the proper disposal of biomedical waste, which mitigates infection risks for healthcare workers and the public, thus enhancing overall health outcomes. Furthermore, it supports Goal 6: Clean Water and Sanitation by mitigating water contamination from hazardous medical waste, thereby ensuring access to clean and safe water. The research emphasizes Goal 12: Responsible Consumption and Production, promoting sustainable waste management strategies to reduce the environmental impact of healthcare waste. This initiative supports Goal 13: Climate Action by advocating for environmentally sustainable disposal methods that reduce pollution and greenhouse gas emissions associated with improper incineration, thereby enhancing climate resilience. The research highlights the importance of responsible biomedical waste management as essential for global sustainability and environmental protection.

Need for Study

The management of biomedical waste is a critical aspect of healthcare services that is frequently neglected, especially in government hospitals, as highlighted by **Mohankumar et al. (2007)** ^[13], where patient volume and limited resources can hinder effective waste disposal practices. Healthcare worker awareness is essential for the safe and efficient management of biomedical waste, thus mitigating potential health risks to staff, patients, and the surrounding community. Awareness among healthcare workers plays a vital role in ensuring the safe and efficient handling of biomedical waste, thereby preventing potential health risks to staff, patients, and the surrounding community, as stressed by **Ajmera et al. (2017)**. As **Shahi et al. (2023)** explained, proper handling of biomedical waste is not only essential for managing physical contaminants but also acts as a supporting layer in the larger strategy to control airborne infections in clinical settings. Given the increasing volume of biomedical waste due to the growing healthcare demands, assessing the level of knowledge and compliance among healthcare workers is essential for improving waste management practices.

In India, despite the implementation of the Biomedical Waste Management Rules, 2016, studies like **Kenny et al. (2021)** ^[16] have shown that several healthcare staff are insufficiently educated about appropriate biomedical waste disposal techniques. The lack of consistent training programs, high workload, and limited resources in government hospitals contribute to gaps in compliance and adherence to established protocols. These challenges necessitate a focused study to evaluate the current awareness levels and identify specific areas requiring intervention.

The Guru Gobind Singh Medical College & Hospital, as a tertiary-level government hospital, serves as a major contributor to biomedical waste generation. The efficacy of waste management practices within an institution significantly influences public health, environmental sustainability, and occupational safety. An assessment of awareness levels among healthcare workers will yield

insights into existing gaps, facilitating the development of targeted educational programs, policy enhancements, and improved waste management strategies.

Objectives

This research intends to assess healthcare workers' understanding, perspectives, and behaviors concerning the management of biomedical waste. It evaluates their knowledge about the correct segregation, handling, and disposal of biomedical waste according to established guidelines. Additionally, the research investigates the attitudes of healthcare workers regarding the significance of waste management and their sense of accountability. Lastly, it analyzes actual practices to pinpoint any gaps or deviations from standard protocols and explores the underlying reasons for these inconsistencies. By concentrating on these three elements—understanding, perspectives, and behaviors—the research aims to shed light on the current status of biomedical waste management and to provide suggestions for enhancement.

Methods

Guru Gobind Singh Medical College & Hospital is a 1200+ bedded tertiary care teaching hospital in the Faridkot district of Punjab, India. A cross-sectional study was performed using healthcare personnel, comprising physicians, nurses, and housekeeping staff. A systematic questionnaire was employed to assess their awareness of biomedical waste segregation, disposal techniques, utilization of color-coded bins, and adherence to the Biomedical Waste Management Rules, 2016. 109 healthcare workers, including doctors, nurses, technicians, general duty assistants, etc, participated. The provided questionnaire includes the awareness and knowledge about biomedical waste, its color coding, vaccination status of health workers, and their safety measures while handling the biomedical waste. The purpose of this study was explained properly to all individuals before data collection.

Results

Among 110 healthcare workers, technicians made up the largest group with a count of 64%, followed by the doctors (17%), nurses (14%), general duty assistants (4%), and lastly leaders, which only counted to 0.90%.

Table 1: Profession-wise frequency of healthworkers

Profession	Frequency	Percentage
Doctor	19	17.2 %
Nurse	15	13.63 %
Technician	70	63.6%
General Duty Assistant	5	4.5%
Leader	1	0.9%

The findings indicated that the majority of healthcare workers belong to the age group <30 years, followed by 41-50 years and 31-40 years. Additionally, no staff member is

above 50 years old. The percentage of healthcare workers according to age is shown in Table 1. Also, among the participants, 44.5% of staff were males (49), and 55.4% were female staff. (61)

Table 2: Age-wise frequency of health workers

Age	Frequency	Percentage
<30 years	99	90 %
31-40 years	5	4.54 %
41-50 years	6	5.45 %
>50 years	0	0

Biomedical waste poses a serious risk to the environment and the staff handling that waste. Improper handling and management of biomedical waste increases the risk of disease transmission in society. So, proper knowledge about biomedical waste and its management is important for healthcare workers. Among the total participants, about 96% have heard about BMW, and only 6.36% of staff, including 1 nurse and 6 technicians, have not heard about it.

In total, only 83 participants (75.45%), including 15 doctors (78.94%), 12 nurses (80%), 51 technicians (72.8%), 4 general duty assistants (80%), and 1 leader, have received any training regarding proper waste management. About 27 participants have not received any training regarding the BMW management.

Regarding the knowledge of the correct number of color bags to be provided for BMW collection, only 93.63% of health workers knew about it. About 4 technicians, 2 staff nurses, and 1 doctor have inaccurate information about it.

In this study, it was found that out of 110 participants, only 74 staff (67.27%) had correct knowledge of general waste to be collected in a black-colored bin. The number of participants having incorrect knowledge about the black bin and the type of waste was highest among technicians i.e. 27 (38.5%).

In the question about the type of waste to be collected in a red bag, the number of participants giving incorrect answers was highest. About 70 participants (63.63%) answered that Infectious contaminated with body fluid/blood should be collected in a red bag. Only recyclable waste, like IV tubes, syringes without needles etc should be collected in a red bag. However, infected waste should be treated as non-recyclable and collected in a yellow bag for complete destruction. Only 40 staff (36.3%) answered other type of BMW or do not know.

It was also noted that about 90 participants (81.8%) of staff correctly answered the question regarding the type of waste collected in yellow containers i.e. body parts. Technicians (18) have the highest number of those who have incorrect knowledge about it.

103 healthcare workers (93.63%) have correct knowledge regarding the type of waste to be collected in the blue/white container, i.e. sharps. About 18 doctors, 14 nurses, 64 technicians, and 5 general duty assistants correctly replied to the question.

Table 3: Awareness of health workers regarding BMW

Awareness of Biomedical Waste Management	Occupation					Total
	Doctor (19)	Nurse (15)	Technician (70)	General Duty Assistants (5)	Leader (1)	
Heard About BMW	19 (100%)	14 (93.3%)	64 (91.4%)	5 (100%)	1 (100%)	96.63%
Undergone Training of BMW	15 (78.9%)	12 (80%)	51 (72.8%)	4 (80%)	1 (100%)	75.45%
Knowledge regarding the correct number of Colour Bags to be provided for BMW collection	18 (94.73%)	13 (86.6%)	66 (94.28%)	5 (100%)	1 (100%)	93.63%
Type of waste in Black Bag	15 (78.9%)	13 (86.6%)	43 (61.4%)	2 (40%)	1 (100%)	67.27%
Type of waste in Red Bag	5 (26.3%)	8 (53.3%)	24 (34.2%)	3 (60%)	0	36.36%
Type of waste in Yellow Bag	18 (94.73%)	15 (100%)	52 (74.2%)	4 (80%)	1 (100%)	81.81%
Type of waste collection in Blue / white container	19 (100%)	14 (93.3%)	64 (91.4%)	5 (100%)	1 (100%)	93.63%

Out of 110 participants, only 55.45% of staff are hepatitis B vaccinated, and 58.18% are tetanus vaccinated. Only 16 doctors (84.2%), 13 nurses (86.6%), 30 technicians (42.8%), and 2 general duty assistants (40%) were vaccinated with hepatitis B. Also, only 17 doctors (89.47%), 14 nurses

(93.3%), 30 technicians (42.8%), and 3 general duty assistants (60%) were vaccinated against tetanus. Mostly technicians (57.14%) and leaders were non-vaccinated for both hepatitis B and tetanus. Safety measures are adequately practiced by 99.09% of health workers.

Table 4: Immunization status of health workers

Immunization	Occupation					Total
	Doctor (19)	Nurse (15)	Technician (70)	General Duty Assistants (5)	Leader (1)	
Hepatitis B Vaccination	16 (84.2%)	13 (86.6%)	30 (42.8%)	2 (60%)	0	55.45%
Tetanus Toxoid Vaccination	17 (89.4%)	14 (93.3%)	69 (98.5%)	5 (100%)	1 (100%)	58.18%

Table 5: Safety measures practiced by health workers

Safety Measures	Occupation					Total
	Doctor (19)	Nurse (15)	Technician (70)	General Duty Assistants (5)	Leader (1)	
Safety Measures	19 (100%)	15 (100%)	69 (98.5%)	5 (100%)	1 (100%)	99%

Discussion

Healthcare workers are very important in the healthcare industry. They play a crucial role in the collection and management of biomedical waste generated during daily activities in hospitals. Therefore, there is a need for proper knowledge about biomedical waste among health workers. Improper knowledge and training lead to inadequate and improper practices during waste management, which in turn cause a serious risk to the environment and the health of workers handling that waste. This study tried to evaluate the level of knowledge about healthcare workers, including doctors, nurses, technicians, general duty assistants, and leaders. It is noted that the majority of the staff have heard about BMW. Only technicians have a large number who have not heard about BMW.

In order to manage biomedical waste properly, proper segregation of waste is very crucial. Waste should be

segregated at the point of generation itself. Improper segregation of waste will lead to mixing of hazardous and non-hazardous waste, which in turn will increase the risk of needle stick injury and disease transmission. Several studies, such as **Okechukwu et al. (2022)**^[18] and **Rao et al. (2004)**^[19], highlighted the importance of proper segregation of waste for maintaining a risk-free environment in healthcare settings; failure to which will cause several health and environmental issues. The Indian government introduced the Biomedical Waste Management Rules 2016 in the country to ensure proper waste management in hospitals. According to **BMW 2016**, separate colored bins should be used to collect different types of waste. Then, each type of waste will go for a different type of treatment, reducing the risk of contamination and mixing of hazardous and non-hazardous wastes.

Table 6: Guidelines about BMW management, according to BMW, 2016

Types of Bins	Types of Wastes
Red Bin	Recyclable waste such as catheter tubes, IV sets, urine bags, syringes without needles,
Yellow Bin	Human and animal anatomical wastes, cytotoxic waste, soiled wastes, cultures, etc
Blue	Glassware, broken vials, except cytotoxic wastes
White	Sharps, including knives, scalpels, needles, blades, etc

Although different-colored bins are provided in the Guru Gobind Singh Medical College & Hospital, Faridkot, the awareness and practices about collecting different types of waste in different-colored bins vary among healthcare workers. The majority of health workers have heard about BMW, but only 75% of health workers have received any training about its proper management. The lack of training among health workers leads to improper collection and segregation of waste in the hospital. It causes the variation

in the practice of collecting waste in appropriately colored bins, as shown in Table 3. The study shows the need for proper training about BMW management among health workers in the hospital.

Several studies also stressed the role of proper training for the proper management of biomedical waste in healthcare settings. **Mohan et al. (2012)**^[21] found in their study that training will improve the skills of workers regarding BMW management, further stressing the necessity of continuous

training programs among staff. **Alahmari et al. (2024)**^[22] mentioned the lack of training as a major causative factor for improper BMW management. **Singh et al. (2020)**^[23] also mentioned that proper training will cause an increase in knowledge and practice among healthcare workers regarding BMW management. Through raising awareness and ensuring good compliance towards rules regarding the biomedical waste management will not only promote safety, but also effect the reputation of the institution positively in the national rankings like NIRF, as emphasised by **Shahi et al. (2025)**^[24]

Our study found that the lack of training was highest among the technicians. Proper knowledge and training about the proper segregation of waste is a primary factor in the BMW management. Therefore, frequent training is required among hospital staff for proper management of BMW and to create a risk free environment in the hospital.

Also, there is a need for proper vaccination among healthcare workers to ensure the safety of staff while handling the BMW. It's found that only around 50% of participating staff were non-vaccinated against hepatitis B and tetanus. Due to improper segregation and management, the handling staff is prone to needle stick injuries. So, staff should be vaccinated properly against the common transmissible diseases. **Toohar et al. (2005)**^[25] also highlighted the importance of vaccination among health workers against hepatitis and tetanus to reduce the risk of occupational hazards among health workers.

Conclusion

The proper knowledge of BMW and its management is very crucial among hospital staff, including doctors, nurses, and other supportive staff. Inadequate awareness and training will cause its improper management, causing a risk of transmission of diseases. It is found that there is a lack of training among health workers, especially in supportive staff like technicians. As they are continuously involved in BMW handling, there is an urgent necessity for training among them. There is also an urgency to provide vaccination among healthcare workers to protect them against the possible disease transmission due to BMW handling.

References

1. Kanyal D, Butola LK, Ambad R. Biomedical waste management in India-a review. *Indian Journal of Forensic Medicine & Toxicology*. 2021; 15(2):108-113.
2. World Health Organization: WHO. Medical waste, July 27, 2020. <https://www.who.int/india/health-topics/medical-waste>
3. Babu BR, Parande AK, Rajalakshmi R, Suriyakala P, Volga M. Management of biomedical waste in India and other countries: A review. *Journal of International Environmental Application & Science*. 2009; 4(1):65-78.
4. Kaur P, Gupta S, Gupta V, Devgan S, Singh G, Monga S, Arora H. Impact of training on enhancement of knowledge, attitude and practices of bio medical waste management and handling among staff nurses of GGSMCH Faridkot: A before and after comparison study, 2023.
5. Patil SP, Tambe MP, Patil PJ, Bhagwat VR. Awareness Of Healthcare Workers Regarding Biomedical Waste Management (BMW) At Tertiary Care Government Hospital In Dhule (Maharashtra). *Natl J Integr Res Med*. 2013; 4(4):74-79.
6. Hirani DP, Villaitramani KR, Kumbhar SJ. Biomedical waste: An introduction to its management. *International Journal of Innovative Research in Advanced Engineering (IJIRAE)*. 2014; 1(8):82-87.
7. Babanyara YY, Ibrahim DB, Garba T, Bogoro AG, Abubakar MY. Poor Medical Waste Management (MWM) practices and its risks to human health and the environment: a literature review. *SSRN*, 2014.
8. Kumar K, Bardhan AK. A choice-based model to reduce primary care load on tertiary hospitals. *International Journal of Management Science and Engineering Management*. 2020; 15(3):155-164.
9. Sahoo MC, Pillai JSK, Sahoo B, Pillai JS, Sahoo B. Exploring Biomedical Waste Management Practices Among Healthcare Professionals: A Study From a Tertiary Care Teaching Hospital in Eastern India. *Cureus*. 2024; 16(6).
10. Manzoor J, Sharma M. Impact of biomedical waste on environment and human health. *Environmental Claims Journal*. 2019; 31(4):311-334.
11. Mathur V, Dwivedi S, Hassan MA, Misra RP. Knowledge, attitude, and practices about biomedical waste management among healthcare personnel: A cross-sectional study. *Indian Journal of Community Medicine*. 2011; 36(2):143-145.
12. Goswami M, Goswami PJ, Nautiyal S, Prakash S. Challenges and actions to the environmental management of Bio-Medical Waste during COVID-19 pandemic in India. *Heliyon*. 2021; 7(3).
13. Mohankumar S, Kottaiveeran K. Hospital waste management and environmental problems in India. *Framework*. 2007; 2:1621-1626.
14. Ajmera V. Effectiveness of an Orientation Programme on Knowledge and Practice Regarding BMW Management among Nurses Working in Selected Tertiary Level Hospitals of Udaipur District.
15. Archana S, Amit M. Optimization of Management Response Toward Airborne Infections. In *Computational Intelligence for Clinical Diagnosis*. Cham: Springer International Publishing, 2023, 47-55.
16. Kenny C, Priyadarshini A. Review of current healthcare waste management methods and their effect on global health. In *Healthcare*. MDPI. 2021; 9(3):p284.
17. Singh VP, Biswas G, Sharma JJ. Biomedical waste management: An emerging concern in Indian hospitals. *Indian Journal of Forensic Medicine & Toxicology*. 2007; 1(1):39-44.
18. Okechukwu EC, Oparah AC, Aguora SO, Soni JS. Segregation practices by health workers in urban hospitals-a step necessary to achieve minimization and effective biomedical waste management. *Texila International Journal of Public Health*. 2022; 10(2):290-297.
19. Rao SKM, Ranyal RK, Bhatia SS, Sharma VR. Biomedical waste management: an infrastructural survey of hospitals. *Medical Journal Armed Forces India*. 2004; 60(4):379-382.
20. Directorate General of Health Services, Ministry of Health & Family Welfare, Central Pollution Control Board, & Ministry of Environment, Forest & Climate Change. (n.d.). Guidelines for management of Healthcare waste as per Biomedical Waste Management Rules, 2016 [Book]. In *Guidelines for Management of*

- Healthcare Waste as per Biomedical Waste Management Rules, 2016. https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/Guidelines_healthcare_June_2018.pdf
21. Mohan DR, Prasad MV, Kumar KS. Impact of training on bio medical waste management: A study and analysis. EXCEL International Journal of Multidisciplinary Management Studies. 2012; 2(6):69-80.
 22. Alahmari MH, Alshagrawi S. Examining biomedical waste management knowledge and training level among health care professionals in Saudi Arabia. American Journal of Infection Control. 2024; 52(9):1012-1019.
 23. Singh S, Dhillon BS, Shrivastava AK, Kumar B, Bhattacharya S. Effectiveness of a training program about bio-medical waste management on the knowledge and practices of health-care professionals at a tertiary care teaching institute of North India. Journal of Education and Health Promotion. 2020; 9(1):127.
 24. Shahi A, Bansal C, Gupta V, Srova R, Bansal P. A deterrent or a determinant for the NIRF ranking. International Journal of Scientific Research and Reviews. 2025; 13(4):21-36. https://www.researchgate.net/publication/387754604_A_Deterrent_or_A_Determinant_For_The_NIRF_Ranking
 25. Tooher R, Griffin T, Shute E, Maddern G. Vaccinations for waste-handling workers. A review of the literature. Waste management & research. 2005; 23(1):79-86.