

Knowledge, Attitude And Practices Regarding Biomedical Waste Management Among Healthcare Professionals: A Comprehensive Review

Ayesha Mudassar

ayeshamudassarmudassar4123@gmail.com

Imran Idrees Institute of Rehabilitation Sciences, Sialkot

ORCID iD: <https://orcid.org/0009-0004-2733-6599>

Fajar Hussain

fm6410898@gmail.com

Imran Idrees Institute of Rehabilitation Sciences, Sialkot

ORCID iD: <https://orcid.org/0009-0006-6031-7562>

***Muhammad Wajid Munir (Corresponding Author)**

wajidmunir97@gmail.com

Head of Department, Operation Theatre Technology, Imran Idrees Institute of Rehabilitation Sciences, Sialkot

ORCID iD: <https://orcid.org/0009-0003-6126-1941>

Abdul Rehman Waheed

abdulrehman51028@gmail.com

Lecturer, Operation Theatre Technology, Imran Idrees Institute of Rehabilitation Sciences, Sialkot

ORCID iD: <https://orcid.org/0009-0000-0969-8802>

Mustafa Khattak

mustafakhattak2025@gmail.com

Uppsala University, Sweden

Sehar Mudassar

sahermdssr0@gmail.com

Lecturer, Department of Operation Theatre Technology, Al Shifa institute of Health Sciences Narowal, Pakista

Author Details		
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Corresponding	E-mail	& Author*:
Muhammad Wajid Munir Head of Department, Operation Theater Technology, Imran Idrees Institute of Rehabilitation Sciences Sialkot wajidmunir97@gmail.com		

Abstract

BACKGROUND: Waste management of biomedical is a vital part of all healthcare systems. It may also protect public health, workers health safety and healthcare environment safety. If the waste is not properly separated, handling, or also disposed that's may cause infection such as injuries from sharp objects like Needle -stick injury and environmental contamination. Hospital staff or workers play are essential role in ensuring these safe waste management practices are followed. **OBJECTIVE:** This study aims to assess the knowledge, attitude and daily training regarding the biomedical waste management among doctors, nurses, and any other paramedical staff at the specific hospitals. **METHODS:** This study is Systematic Review has been conducted in a formal way using database, which contains Pub Med and the Google Scholar. **RESULTS:** This study indicates most of the staff and healthcare worker are generally understand and may have positive views about how to manage the biomedical waste and properly disposed the waste. Having certain issues are caused by the lack of the hospital staff training, poor resources, and not followed the proper waste

management rules. **CONCLUSION:** Proper awareness and importance of biomedical waste management, to prevent the spreading of infection, Strict supervision or monitoring, and help for organization. To improve safety and reduced health and environmental dangers.

1. INTRODUCTION

Biomedical waste is waste that is made when people are being diagnosed, treated or researched. This kind of waste includes things like needles, lab cultures, blood products, old medicine, radioactive materials and samples from the body. All of these things can be very bad for people because they have chemical or physical dangers (Shivalli & Sanklapur, 2014).

The World Health Organization says that 85 percent of waste from healthcare is not bad for people but the other 15 percent is very bad. 1 Percent of this bad waste is from sharp things that can give people diseases like Hepatitis B, Hepatitis C and HIV. When healthcare workers get hurt by needles or get splashed with things they can get very sick. This is a problem for healthcare workers all around the world (Pullishery, Panchmal, Siddique, & Abraham, 2016).

Even though there are rules from the World Health Organization and other groups to help manage waste safely many places do not follow these rules. In some countries people do not have the money or the right tools to manage waste properly. They do not know how to do it safely (Prashanth et al., 2015; Rao, Dhakshaini, Kurthukoti, Doddawad, & Journal, 2018; Suram, Rudra, Miryala, Parine, & Pollution, 2025).

In rich countries some healthcare workers do not know what to do or they do not want to follow the rules. When biomedical waste is burned or put in the ground it makes the air and water very bad (Pruess et al., 2014).

To understand what is going on people use something called the knowledge, attitude and practices framework. This helps us see what healthcare workers know about waste how they feel about it and what they actually do (Pruess et al., 2014; Chudasama et al., 2013; Sachan, Patel, Nischal, & Publications, 2012).

Many studies have shown that healthcare workers do not always separate waste properly they do not wear clothes and they do not know the laws (Anozie et al., 2017; Golandaj, Kallihal, & Sciences, 2021; Millanzi, Herman, & Mtangi, 2023; Woromogo et al.,2020).

Biomedical waste includes things like sharp things, lab cultures and blood products. Managing waste is very important to keep people and the environment safe. Biomedical waste management is a challenge, in many countries and it needs to be addressed to prevent diseases and environmental problems. (Aslam et al., 2025)

PRIMARY OBJECTIVE

To review and assess what healthcare workers know about biomedical waste management in different hospitals and countries.

SECONDARY OBJECTIVE

To evaluate the role of formal training, institutional policies, and regulatory frameworks in modifying KAP compliance among healthcare professionals, and to generate evidence-based recommendations for targeted educational and policy interventions in healthcare waste management.

2. LITERATURE SEARCH STRATEGY

A systematic Review was conducted across four major databases: PubMed/MEDLINE, Google Scholar, CINAHL and some Pakistani databases. We found a lot of information: about 120 records from PubMed/MEDLINE, 200 records from Google Scholar, about 60 records from CINAHL and about 40 records from the Pakistani databases. We also found 25 records by looking at the references in some important studies.

The studies that were done between January 2010 and December 2025, because we wanted to make sure the information was relevant to healthcare today. Search terms included for information: biomedical waste management, healthcare workers, hospital waste, knowledge attitude practice, KAP, waste segregation, needle-stick injury, infection control and waste disposal, using words, like AND and OR(Boolean Operators) to combine these search terms.

2.1 Inclusion Criteria

- Original research articles, peer-reviewed, published in English between 2010 and 2025.
- These studies took place in a hospital or a healthcare setting.
- They involved nurses, doctors, technicians or other healthcare workers.

Exclusion Criteria

1. Studies that are not available, in text form.
2. Case reports, editorials, commentaries and conference abstracts.

3. BODY / THEMATIC SECTIONS

3.1 Knowledge of Biomedical Waste Management

Healthcare workers have levels of knowledge about managing biomedical waste. This knowledge varies depending on where they work what they do and the type of hospital they work in. A study by Hassan et al. In 2020 found that 64.7% of healthcare workers in hospitals in Pakistan had good knowledge of biomedical waste management. Nurses had the scores while operation theatre staff had the lowest with only 26% having good knowledge.

In Pakistan another study by Hassan T et al. In 2020 looked at operation theatre employees at the Children Hospital Lahore. They found that 65.84% had knowledge but only 39.3% knew about recent rules changes. Also 27.4% knew the date of the relevant law. Chudasama et al. In 2013 studied healthcare workers at a hospital in Rajkot, India. They found that 54.2% had good knowledge of waste colour-coding. Nursing and sanitation staff had lower awareness.

Sachan et al. In 2012 found that paramedical staff had lower knowledge scores than medical staff. This shows that they need training specific to their job. Nema and Singh in 2015 reported from Central India that while general knowledge of waste was high at 72%, specific knowledge on colour coding and disposal procedures was low.

Bilbas et al. In 2025 studied teaching hospitals in Erbil. They found that 47% of respondents knew all four main waste colour codes. Than one-third knew about national biomedical waste management rules. Adam et al. In 2025 found that than 30% of respondents in Benghazi government hospitals had formal training in biomedical waste management.

Deress et al. In 2018 reported from Northwest Ethiopia that 61.2% of participants had knowledge. However fewer of them actually practiced segregation of waste. Sanklapur in 2014 studied nurses at a big hospital in India. They found that 47% had excellent knowledge and 19% scored below the satisfactory level. These findings show that while many healthcare workers have knowledge of biomedical waste management they lack detailed knowledge, about colour-coded segregation, laws and disposal procedure.

3.2 Attitude Towards Biomedical Waste Management

People who work in healthcare have an attitude towards managing biomedical waste. Most studies show that these professionals think managing waste is important for keeping patients and staff safe. Golandaj et al. (2021) a study in India found that 78% of the people who work in healthcare think the rules for managing biomedical waste are a good thing. Hassan AB et al. (2020) Another study in Pakistan found that fifty three percent of the professionals in hospitals think they are doing a good job of managing waste. Sharma, and Singh (2013) study in Jaipur found that people who work in healthcare and have had training have a positive attitude towards managing biomedical waste.

Even though people who work in healthcare have an attitude towards managing biomedical waste there is a big difference between what they think and what they actually do. Thirunavukkarasu et al. (2022) A study in Saudi Arabia found that people who work in healthcare do not always follow the rules for managing waste even if they think it is a good thing. Anozie et al. (2017) study in Nigeria found that people who manage healthcare facilities know that not managing waste properly is bad for the environment but they say they do not have the resources or the support they need to do it right. All of these studies show that just having an attitude towards managing waste is not enough. We also need to make sure that people have the training and the resources they need to do it correctly. All of these studies show that just having an attitude towards managing waste is not enough. We also need to make sure that people have the training and the resources they need to do it correctly.

3.3 Practices of Biomedical Waste Management

Practice scores are consistently lower than knowledge and attitude scores in all reviewed studies. A study by Prashanth et al. (2015) found that 44% of healthcare workers at a hospital in South India used colour-coded bins all the time. 33% Of them wore proper protective gear during waste-handling activities. Pullishery et al. (2016) found that nurses and paramedical staff in Mangalore were more likely to dispose of sharps. This included putting the caps on used needles. Physicians did not have high rates of incorrect disposal.

Nema and Singh in 2015 reported from Central India that even though people knew the rules for waste management they still mixed hazardous and non-hazardous waste. They also burned waste in the stored sharps in unsuitable containers. Rao et al. (2018) noted that sanitation workers handled waste directly and frequently.. They were among the least trained and protected with proper gear. A study by Millanzi, Herman and Mtangi (2023) found that 29% of sanitary workers in Tanzania had acceptable practice scores. They also found that workers who felt supported by their organisation were more likely to behave.

Hassan T et al. (2020) studied staff in the operating theatre at the Children Hospital Lahore in Pakistan. They found that training interventions improved practice compliance. This was especially true for handling anaesthetic and pharmaceutical waste. Golandaj et al. (2021) found that even though 78% of staff in Karnataka had attitudes only 52% consistently practised correct segregation. They said this gap was due to inadequate facilities and high workload pressures.

3.4 Role of Training and Institutional Policy

Training is really important for changing what people know. How they do things. Some researchers, like Sheikh, Krishnani and Verma found that a special training program for trainees at a big hospital made a big difference in what they knew how they felt and what they did. They did better at handling sharp objects and sorting waste after the training. Al Balushi et al. (2018) and others found that training at a hospital in Oman made people twice as good at sorting waste. Suram et al. (2025) also found that regular training and having someone to supervise made a difference in how well people did their jobs, over time.

Mannocci et al. (2020) said that we need to use tests to measure what people know and how they feel or we will not be able to compare results from different places. Most studies use tests that're not very good which means we cannot trust the results. This is a problem that needs to be fixed so we can compare results from countries and make good policies. Kumar, Somrongthong, Ahmed, and Almarabheh (2018) that people who have been working for a time and have had formal training do much better on tests of what they know.

Table 1. Summary of key studies on KAP regarding biomedical waste management among healthcare professionals (2010-2025).

Author/Year	Country	Design	Sample	Professions	Key KAP Findings	Quality Score
Hassan AB et al. (2020)	Pakistan	Cross-sectional descriptive	300 HCPs	Nurses, doctors, OT staff, paramedics	Knowledge 64.7% good; Attitude 53% confident; Practice 65% good. Nurses scored highest. OT staff only 26% well-informed.	7/8
Hassan T et al. (2020)	Pakistan	Cross-sectional	223 OT employees	Doctors, nurses, technicians, sweepers	65.84% adequate overall knowledge; 39.3% aware of regulation changes; 27.4% could	6/8

Author/Year	Country	Design	Sample	Professionals	Key KAP Findings	Quality Score
					correctly date BMW regulations.	
Shivalli & Sanklapur (2014)	India	Qualitative & quantitative appraisal	Nurses, tertiary care hospital	Nurses	Only 47% rated excellent (>70%); 19% rated poor (<50%) in waste management knowledge.	6/8
Chudasama et al. (2013)	India	Cross-sectional	HCPs at tertiary care hospital	Mixed HCPs	Only 54.2% had adequate knowledge of colour-coding; lower among nursing and sanitation staff.	6/8
Bilbas et al. (2025)	Iraq (Erbil)	Cross-sectional	HCWs in teaching hospitals	Mixed HCWs	Only 47% correctly identified all 4 waste colour codes; fewer than 1/3 familiar with national BMW regulations.	6/8
Millanzi et al. (2023)	Tanzania	Cross-sectional	Sanitary workers, Dodoma region	Sanitary workers	Only 29% demonstrated acceptable practice scores; organisational support was the strongest	7/8

Author/Year	Country	Design	Sample	Professionals	Key KAP Findings	Quality Score
					predictor of correct behaviour.	
Golandaj et al. (2021)	India	Cross-sectional	Public healthcare staff, Karnataka	Mixed HCPs	78% favourable attitudes; only 52% consistently practised correct segregation.	6/8

4. DISCUSSION

This review looks at what we found out from studies done in South Asia, Africa, the Middle East and East Africa. What we saw was that healthcare professionals have a basic understanding of BMW management they have positive attitudes but when it comes to actually doing things like separating waste using protective equipment and getting rid of sharp objects they are not doing a good job. The biggest problem we found was that there is a gap between what healthcare professionals know and what they actually do.

We also saw that different types of healthcare workers have levels of knowledge and practice. Doctors tend to do more than nurses and other staff while the people who clean up the waste who are the ones most at risk are the ones who know the least. This is because they do not get the kind of training as doctors and nurses. Some studies, like the ones done by Sachan et al. (2012) Chudasama et al. (2013). Rao et al. (2018) show that we need to give healthcare workers training that's specific to their jobs and the risks they face.

We also saw that where you are in the world and what resources you have can make a difference. In some countries like Pakistan, Ethiopia, Nigeria, Tanzania and India they do not have the equipment, like colored bins or enough protective gear or working facilities to get rid of waste. This makes it hard for healthcare workers to do their jobs properly even if they want to. This is what Pruess et al. Said in 2014 that not having resources and not having good policies can lead to big problems with BMW management.. Even in countries with more resources, like Saudi Arabia and Oman healthcare workers still do not know enough and do not follow the rules.

What we found out is that giving healthcare workers training can make a big difference. Some studies, like the ones done by Sheikh et al., Al Balushi et al. (2018) show that when healthcare workers get training they do much better and if they get reminded and supervised they can keep doing better over time. Hassan T et al. In 2020 said that it is especially important for operating theater staff to get training that's specific to their jobs because they are exposed to special risks like anesthetic gases and sharp objects.

This review has some limitations. Most of the studies we looked at did not use questionnaires that had been tested and proven to be good which makes it hard to compare the results. Also when people report on their practice they might not tell the truth, which can give us the wrong idea.

5. CONCLUSIONS AND FUTURE DIRECTIONS

The information we looked at in this review shows that healthcare professionals have an understanding of biomedical waste management but they do not have the specific skills needed to do their jobs safely. There is a difference between what healthcare

workers know and what they actually do. This is because they do not get training they do not have enough resources the rules are not enforced well and the institutions they work for are not doing enough to change things. The people who clean and the paramedical staff are the ones who get the training and protection.

To fix these problems we need to do a things. First we need to make sure that all healthcare professionals get training on biomedical waste management as part of their education and this training should be specific to their jobs. Second we need to have training sessions to make sure that people do not forget what they learned and their supervisors should be checking to make sure they are doing things correctly. Third healthcare institutions need to make sure they have the things they need to follow the rules, such as enough protective equipment, a good system for collecting waste and a way to get rid of waste that works. Fourth the people, in charge of making sure the rules are followed need to do a job of enforcing them and they need to create standard tools to measure how well different institutions are doing so we can compare them and see who is doing a good job and who is not.

6. DECLARATIONS

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6.2 Conflicts of Interest

The authors declare no Conflict of Interest.

6.3 Funding Disclosure

This study didn't get any money or support from government agencies, companies, or nonprofit organizations.

6.4 Use of Artificial Intelligence (AI) Tools

The writers used computer programs to fix grammar and make the language sound better when they were getting their manuscript ready. These programs were not used to collect or analyze data, or to figure out what it means. The people who wrote the manuscript are responsible for making sure everything is correct and honest. They didn't use the computer programs to write the manuscript, and the programs are not considered authors.

6.5 Ethical Considerations

This paper is a review of what's already been written on a topic, so it didn't need to involve real people or animals, collect new data, or test anything directly. Because of this, it didn't require approval from an ethics committee or consent from participants.

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