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RESEARCH ARTICLE

KNOWLEDGE, ATTITUDE AND PRACTICE REGARDING BIOMEDICAL WASTE MANAGEMENT AMONG THE HEALTH CARE WORKERS IN HOSPITALS OF BIKANER, RAJASTHAN, INDIA

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ABSTRACT

OBJECTIVE:

To estimate the Knowledge, Attitude and Practice (KAP) with regarding to bio-medical waste management among the healthcare workers in hospitals of Bikaner district.

PLACE AND DURATION OF STUDY:

The study was carried out at the affiliated hospitals of S. P. Medical College, Bikaner and at the hospitals under C.M.H.O., Bikaner from October 2022 to December 2022.

METHOD:

The study employed a quantitative research methodology, specifically utilizing a descriptive research design and simple random sampling technique to evaluate the levels of knowledge, attitude, and practice (KAP). A self-designed questionnaire and checklist were created to gather data before and after the trial. A preliminary study was carried out to assess the knowledge, attitude and practice level of 120 healthcare professionals working in hospitals in the Bikaner district regarding the management of biomedical waste. Subsequently, they were educated on this topic using a self-instructional module. A follow-up study was then conducted to measure the improvement in their knowledge, attitude and practice level regarding biomedical waste management.

RESULT:

After providing healthcare personnel at Bikaner district hospitals with a Self-Instructional Module, it was noted that their knowledge and level of practice regarding biomedical waste management improved.

CONCLUSION:

The study's findings indicate that strict compliance with regulations and the implementation of an enhanced environmental management system are necessary for the proper handling, sorting, transportation, storage, and disposal of biomedical waste. Additionally, training is essential for garbage handlers, scavengers, sweepers, as well as higher authorities and nursing staff.

KEYWORDS

bio-medical waste, knowledge, attitude and practice, healthcare workers, common biomedical waste treatment facility, WHO, COVID-19.

INTRODUCTION

As per the regulations outlined in the Bio-Medical Waste (Management & Handling) Rules 2016, Bio-Medical Waste refers to any waste that is produced during the process of diagnosing, treating, or immunizing humans or animals, conducting research activities, or manufacturing and testing biological products in health camps. This waste falls into the categories mentioned in Schedule - I.[1] Efficient management of biomedical waste is crucial in the healthcare industry. The lack of proper waste management, limited awareness about the health risks associated with biomedical waste, inadequate financial and human resources, and ineffective waste disposal control pose significant challenges in healthcare waste management. [2]

India generates approximately 2 kg of biomedical waste per bed per day. This type of waste includes anatomical waste, cytotoxic waste, and sharps. Improper segregation of these wastes can lead to the spread of deadly infectious diseases such as HIV, Hepatitis C and B infections. It can also have negative effects on the environment and disrupt the ecological balance. [5, 6] Having a thorough understanding of the rules and regulations surrounding biomedical waste management is crucial for healthcare employees. This knowledge will enable them to effectively dispose of waste in their organizations.[7] Effective management of biomedical waste starts with proper waste generation, segregation, storage, disinfection, and transfer to the disposal site. These steps are crucial in ensuring the safe and appropriate disposal of waste. Therefore, the expertise, professionalism, and dedication of the staff at healthcare institutes are crucial. [8, 4, 9]

The classification of hazardous waste has been established by the World Health Organization (WHO) into the following categories: waste that may contain pathogens, such as lab cultures, swabs, and excreta, is considered infectious waste. Human tissues, including body parts, blood, and foetuses, fall under the category of pathological waste. Another type of waste to be cautious of is sharps. Medical supplies such as needles, infusion sets, scalpels, knives, blades, and broken glass; Pharmaceutical waste includes expired drugs. Genotoxic waste consists of cytotoxic drugs commonly used in cancer therapy. Chemical waste encompasses lab reagents, film developer, and disinfectants. Wastes with a high content of heavy metals include batteries, broken thermometers, and BP apparatus. Pressurized containers are also considered waste. Lastly, radioactive waste includes unused liquids from radiotherapy and excreta from patients treated with radionuclides.[10]

Biomedical waste is generated by a wide range of establishments, including hospitals, nursing homes, clinics, labs, physicians' offices, dentists and veterinary practices, home health care facilities, and funeral homes. [11]

Being exposed to hazardous health-care waste can result in the acquisition of diseases or physical injuries. The potential risks associated with health-care waste can be attributed to several factors. These include the presence of infectious agents, genotoxic properties, toxic or hazardous substances, pharmaceuticals, radioactive materials, and sharp objects. [12] Poor management of healthcare waste can put healthcare workers, waste handlers, patients, and the broader community at risk of infection, harm, and injuries. In addition, it poses a risk to environmental pollution. It is crucial to ensure the correct segregation, treatment, and safe disposal of medical waste products. [13]

Proper management of infectious waste is crucial to mitigate the potential health risks associated with hazardous pathogens. These risks can arise from different transmission routes, such as needle stick injuries. Effective management of medical waste is crucial in reducing the risk of blood-borne infections, particularly hepatitis B which poses a significant occupational hazard. Improper handling of chemical and pharmaceutical waste can have serious consequences for both human health and the environment, including the development of antibiotic resistance. Genotoxic waste, like cytotoxic drugs, carries significant risks through inhalation, skin absorption, and environmental contamination, which can have severe consequences for human health and aquatic ecosystems. Proper handling of radioactive waste is crucial to prevent serious health consequences, such as genetic damage and, in the worst scenarios, loss of life.[14]

Given the high stakes involved, it is crucial for MW management to maintain a high level of organization to avoid any potential errors with significant consequences. For biomedical waste (BMW), we adhere to the fundamental principle of implementing the 3Rs: Reduce, Reuse, and Recycle. BMW's management process consists of six steps: Surveying the waste produced; Segregating the waste; Collecting & categorizing the waste; Storing the waste; Transporting the waste; and treating the waste. [15]

Hospitals require waste management for various reasons. One of these reasons is the presence of biomedical waste, which, although it only makes up a small percentage of the overall waste, is considered one of the most hazardous types. Medical facility waste poses a significant risk due to its radioactive nature, the presence of hazardous medications, and the potential for harmful germs [16]. The adoption of protective gear like masks, gloves, goggles, boots, rubber long jackets, head coverings, PPE kits, etc. has seen a substantial increase due to the COVID-19 pandemic, leading to a rise in the generation of biological waste; There have been reports of certain hospitals in the Bikaner district engaging in improper practices due to a lack of awareness, for instance, saline bottles, which are mistakenly considered non-hazardous, are being sold to recycling agencies without being properly cleaned. There is a potential for air, water, and soil contamination due to waste, along with the risk of ash and emissions resulting from improper incineration. [17]

Certain hospitals in the Bikaner district may be engaging in incorrect practices due to a lack of awareness. To best of our knowledge no previous study has been conducted to assess the management of biomedical waste in the hospitals located in Bikaner, Rajasthan, India. Thus, the current study aimed to evaluate the knowledge, practice, and attitude towards bio-medical waste management among healthcare workers in hospitals located in the Bikaner district.

METHODOLOGY

PLACE AND DURATION OF STUDY:

The study was carried out at the affiliated hospitals of S. P. Medical College, Bikaner and at the hospitals under C.M.H.O., Bikaner from October 2022 to December 2022.

ETHICAL CONSIDERATIONS:

Permission was obtained from the Principal & Controller of S. P. Medical College & PBM AGH, Bikaner, Rajasthan to conduct a research study at the affiliated hospitals of S. P. Medical College, Bikaner. Approval was granted by the Chief Medical & Health Officer, Bikaner, Rajasthan to conduct a research study at the hospitals under C.M.H.O., Bikaner. Written consent was obtained from the study subjects and the data collection was kept confidential. The study subject was assured that the anonymity of each individual would be maintained.

PARTICIPANTS:

A sample of 120 healthcare personnel from various wards, including doctors, nursing staff, pharmacists, lab technicians, radiographers, and waste handlers, who met the criteria, were selected. A quantitative research approach was utilized to estimate the Knowledge, Attitude, and Practice (KAP) using a descriptive research design and Simple random sampling. A well-designed questionnaire and checklist were created to gather information before and after the study. The participants' details are provided in table 1.

DATA COLLECTION:

The data were collected at the hospitals affiliated with S. P. Medical College, Bikaner and the hospitals under C.M.H.O., Bikaner. Prior to the interview, the interviewer provided a clear explanation of the interview's purpose to all healthcare personnel, along with a brief self-introduction. Data were collected through interviews using a semi-structured questionnaire consisting of 40 questions. The questionnaire covered various aspects including knowledge, attitude, and practice related to biomedical waste management. Additionally, a checklist was used to assess the participants' knowledge, attitude, and practice in this area.

In the initial phase, a comprehensive assessment was carried out to evaluate the proficiency and implementation of biomedical waste management among healthcare professionals in hospitals situated in the Bikaner district. Healthcare personnel in hospitals located in Bikaner district received education on biomedical waste management through a self-instructional module prepared by the researcher. A post-study was conducted to assess the knowledge and practice of healthcare personnel in relation to biomedical waste management.

DATA ANALYSIS:

Collected data is tabulated and calculated using Microsoft excel. The data based on the objectives frequencies and percentage were computed for describing the samples characteristics. Karl Pearson's coefficient of correlation 'r' was computed to find out the relationship between knowledge and practice as well as between knowledge and attitude among healthcare personnel those who are working in hospitals of Bikaner district.

RESULT

Frequency and percentage distribution of the samples according to their selected demographic variables

TABLE 1: FREQUENCY AND PERCENTAGE DISTRIBUTION OF THE SAMPLES ACCORDING TO THEIR SELECTED DEMOGRAPHIC VARIABLES

S. No.	Demographic variable	Frequency (f) & %							
		Doctor	Nurse	Pharmacist	Radiographer	Lab Technician	Waste Handlers	Total	
								f	%
1.	***Age***								
	20 – Below 25 years	*3*	*0*	*0*	*4*	*2*	*3*	***12***	***10%***
	25 – 29 years	*6*	*0*	*0*	*8*	*3*	*2*	***19***	***15.83%***
	30 – 35 years	*9*	*11*	*13*	*1*	*2*	*7*	***43***	***35.83%***
	Above 35 years	*2*	*9*	*7*	*7*	*13*	*8*	***46***	***38.33%***
2.	***Gender***								
	Male	*10*	*10*	*10*	*10*	*10*	*12*	***62***	***51.66%***
	Female	*10*	*10*	*10*	*10*	*10*	*8*	***58***	***48.33%***
3.	***Professional qualification***								
	Diploma	*0*	*16*	*3*	*16*	*15*	*0*	***50***	***41.66%***
	Bachelor	*9*	*2*	*15*	*3*	*4*	*1*	***34***	***28.33%***
	Master	*11*	*2*	*2*	*1*	*1*	*0*	***17***	***14.16%***
	Doctorate	*0*	*0*	*0*	*0*	*0*	*0*	***0***	***0%***
	Others	*0*	*0*	*0*	*0*	*0*	*19*	***19***	***15.83%***
4.	***Professional Experience***								
	Below 6 years	*15*	*1*	*3*	*14*	*7*	*10*	***50***	***41.66%***
	6 – 10 years	*4*	*11*	*17*	*0*	*0*	*6*	***38***	***31.66%***
	11 – 15 years	*1*	*6*	*0*	*2*	*1*	*2*	***12***	***10%***
	Above 15 years	*0*	*2*	*0*	*4*	*12*	*2*	***20***	***16.66%***

Source: Researcher's calculation on primary data

First of all, a pre-study was conducted to test the knowledge, attitude and practice of healthcare personnel working in hospitals located in Bikaner district regarding biomedical waste management. Then the healthcare personnel working in hospitals located in Bikaner district were educated about biomedical waste management through a self-instructional module prepared by the researcher. After this, post-study was conducted to know the changes in the knowledge, attitude and practice of healthcare personnel regarding biomedical waste management.

Knowledge regarding Biomedical Waste Management

TABLE 2: KNOWLEDGE REGARDING BIOMEDICAL WASTE MANAGEMENT

Knowledge regarding Biomedical Waste Management	Pre-study f (%)	Post-study f (%)
Awareness about bags used for segregation of bio-medical waste	81 (67.5%)	98.4 (82%)
Awareness about disposal of Human Anatomical Waste	62 (51.66%)	96 (80%)
Awareness about disposal of Bandages, Dressing and cotton stained with blood or body fluids	69 (57.5%)	100 (83.33%)
Awareness about disposal of Used Personal protective equipment (PPE) and Masks	56 (46.66%)	83 (69.16%)
Awareness about disposal of Waste sharps such as Scalpels, Blades	56 (46.66%)	88 (73.33%)
Awareness about disposal of Disposable gloves, Goggles and Face shields	58 (48.33%)	87 (72.5%)
Awareness about Expired or discarded cytotoxic drugs	64 (53.33%)	96 (80%)
Awareness about disposal of Broken or Discarded Glass vials and Ampoules	55 (45.83%)	92 (76.66%)
Awareness about treatment of waste collected in yellow-colored bags at the plant	49 (40.83%)	80 (66.66%)
Awareness about treatment of waste collected in red colored bags at the plant	57 (47.5%)	80 (66.66%)
Awareness about biohazard symbol	84 (70%)	108 (90%)
Awareness about separate storage of Non-infectious waste and Infectious waste	78 (65%)	95 (79.16%)
Awareness and use of Common Waste Treatment Facility (CWTF) for Biomedical waste	53 (44.16%)	73 (60.83%)
Awareness about use of Personal Protective Equipment (PPE) and Clothing	70 (58.33%)	86.67 (72.22%)
Awareness about Immunisation (Hepatitis B Vaccination)	85 (70.83%)	114 (95%)
Awareness about any legislation applicable to bio-medical waste management	58 (48.33%)	114 (95%)
Awareness about maintaining waste-record	64 (53.33%)	88 (73.33%)

From the Comparative study of table 2, it is concluded that after educating the healthcare professionals working in the hospitals at Bikaner district through Self Instructional Module, their awareness about bags used for segregation of bio-medical waste increased from 67.5% to 82%; Awareness about disposal of Human Anatomical Waste increased from 51.66% to 80%; Awareness about disposal of Bandages, Dressing and cotton stained with blood or body fluids increased from 57.5% to 83.33%; Awareness about disposal of Used Personal protective equipment (PPE) and Masks increased from 46.66% to 69.16%; Awareness about disposal of Waste sharps such as Scalpels, Blades increased from 46.66% to 73.33%; Awareness about disposal of Disposable gloves, Goggles and Face shields increased from 48.33% to 72.5%; Awareness about Expired or discarded cytotoxic drugs increased from 53.33% to 80%; Awareness about disposal of Broken or Discarded Glass vials and Ampoules increased from 45.83% to 76.66%;

Awareness about treatment of waste collected in yellow colored bags at the plant increased from 40.83% to 66.66%; Awareness about treatment of waste collected in red colored bags at the plant increased from 47.5% to 66.66%; Awareness about bio hazard symbol increased from 70% to 90%; Awareness about separate storage of Non-infectious waste and Infectious waste increased from 65% to 79.16%; Awareness and use of Common Waste Treatment Facility (CWTF) for Biomedical waste increased from 44.16% to 60.83%; Awareness about use of Personal Protective Equipment (PPE) and Clothing increased from 58.33% to 72.22%; Awareness about Immunization (Hepatitis B Vaccination) increased from 70.83% to 95%; Awareness about any legislation applicable to bio-medical waste management increased from 48.33% to 95%; and Awareness about maintaining waste-record increased from 53.33% to 73.33%.

Distribution of samples based on level of knowledge regarding BMWM

TABLE 3: DISTRIBUTION OF SAMPLES BASED ON LEVEL OF KNOWLEDGE REGARDING BMWM

S. No.	Level of Knowledge	Pre-study f (%)	Post-study f (%)
1	Adequate level of knowledge above 75%	15 (12.50%)	68 (56.66%)
2	Moderately level of knowledge 50 -75%	48 (40%)	45 (37.50%)
3	Inadequate level of knowledge Below 50%	57 (47.50%)	7 (5.83%)

The data presented in table 3 provides information on the frequency and percentage distribution of samples based on the knowledge score of healthcare professionals working in hospitals in the Bikaner district, specifically regarding biomedical waste management. It is evident that a portion of healthcare workers possessed a satisfactory level of knowledge (12.5%), while a larger percentage had a moderate level of knowledge (40%). Unfortunately, a significant portion of healthcare professionals (47.5%) demonstrated an insufficient level of knowledge. After receiving education in this area through Self-Instructional Module it is evident that after the study, healthcare professionals working in hospitals at Bikaner district have shown an improvement in their knowledge score regarding biomedical waste management. According to the data collected after the study, a majority (56.66%) of healthcare professionals demonstrated a satisfactory level of knowledge, while a significant portion (37.5%) had a moderate level of knowledge. A small percentage (5.83%) of professionals, however, were found to have an insufficient level of knowledge.

Attitude regarding Biomedical Waste Management

TABLE 4: ATTITUDE REGARDING BIOMEDICAL WASTE MANAGEMENT

Attitude regarding Biomedical Waste Management	Pre-study f (%)	Post-study f (%)
Do you think segregation is important and it is not just a waste of time?	112 (93.33%)	120 (100%)
Do you think that emptying waste daily is important?	108 (90%)	114 (95%)
Do you feel that paramedical workers need more information regarding Biomedical Waste Management?	110 (91.67%)	112 (93.33%)
Do you monitor the Biomedical Waste Management regularly?	63 (52.50%)	88 (73.33%)

Do you conduct monthly meeting with staff to discuss the issues and best practices in Biomedical Waste?	42 (35%)	77 (64.17%)
Are there any audits with surprise checks?	68 (56.67%)	82 (68.33%)
Are the injuries due to improper disposal of hospital waste reported?	80 (66.67%)	101 (84.17%)

Table 4 shows that the healthcare professionals employed by the hospitals in the Bikaner district now have a more positive attitude toward a variety of aspects of biomedical waste management, such as the value placed on segregation. This is due to the education provided by the Self-Instructional Module grew from 93.33% to 100%, with daily waste removal: grew from 90% to 95%, need for more knowledge about biomedical waste management among paramedical staff grew from 91.67% to 93.33%, with frequent monitoring of the Biomedical Waste Management: grew from 52.50% to 73.33%, holding monthly staff meetings to address the issues: went from 35% to 64.17%; the attitude toward participating in audits with surprise inspections went from 56.67% to 68.33%; and the percentage of injuries reported as a result of inappropriate hospital waste disposal went from 66.67% to 84.17%. [Do not delete section break]

TABLE 5: DISTRIBUTION OF SAMPLES BASED ON LEVEL OF ATTITUDE REGARDING BIOMEDICAL WASTE MANAGEMENT

S. No.	Level of Attitude	Pre-study f (%)	Post-study f (%)
1	Satisfied level of attitude above 75%	47 (39.16%)	76 (63.33%)
2	Moderate level of attitude 50-75%	50 (41.66%)	41 (34.16%)
3	Inadequate level of attitude Below 50%	23 (19.16%)	03 (2.50%)

Distribution of samples based on Attitude regarding biomedical waste management

Pre-study data mentioned in table 5 shows the frequency and percentage distribution of samples according to the attitude score of healthcare professionals working in hospitals at Bikaner district regarding biomedical waste management. It reveals that 39.16% of healthcare professionals had Satisfied level of attitude, 41.66% of healthcare professionals had Moderate level of attitude and 19.16% of healthcare professionals had inadequate level of attitude. After education through self-instructional Module and post-study was done it is evident, there is an increase in the attitude score of healthcare professionals working in hospitals at Bikaner district regarding biomedical waste management. Post-study data reveals that 63.33% of healthcare professionals had Satisfied level of attitude, 34.16% of healthcare professionals had Moderate level of attitude and 2.5% of healthcare professionals had inadequate level of attitude.

Practice regarding Biomedical Waste Management

TABLE 6: PRACTICE REGARDING BIOMEDICAL WASTE MANAGEMENT

Practice regarding Biomedical Waste Management	Pre-study f (%)	Post-study f (%)
Disposal of anatomical waste in Yellow Bin	62 (51.67%)	96 (80%)
Disposal of plastic waste in Red Bin	58 (48.33%)	87 (72.50%)
Disposal of sharp material in White Container	56 (46.67%)	88 (73.33%)
Disposal of broken glass vials in Blue Container	55	92

	(45.83%)	(76.67%)
Wearing the Gloves while transporting the Biomedical Waste	98 (81.67%)	115 (95.83%)
Weighing the Biomedical Waste at the point of collection	57 (47.50%)	85 (70.83%)
Sealing the waste bag after collection of Biomedical Waste	75 (62.50%)	98 (81.67%)
Taking first-aid immediately after contact with hospital waste	101 (84.17%)	115 (95.83%)

From the Comparative study of table 6, it is observed that after educating the healthcare professionals, their level of practice on various aspects of Biomedical Waste Management is increased like practice of disposal of anatomical waste in Yellow Bin : increased from 51.67% to 80%, practice of disposal of plastic waste in Red Bin : increased from 48.33% to 72.50%, practice of disposal of sharp material in White Container : increased from 46.67% to 73.33%, practice of disposal of broken glass vials in Blue Container : increased from 45.83% to 76.67%, practice of wearing the Gloves while transporting the Biomedical Waste : increased from 81.67% to 95.83%, practice of weighing the Biomedical Waste at the point of collection : increased from 47.50% to 70.83%, practice of sealing the waste bag after collection of Biomedical Waste : increased from 62.50% to 81.67%, practice of taking first-aid immediately after contact with hospital waste : increased from 84.17% to 95.83%.

Distribution of samples based on level of practice regarding biomedical waste management

TABLE 7: DISTRIBUTION OF SAMPLES BASED ON LEVEL OF PRACTICE REGARDING BIOMEDICAL WASTE MANAGEMENT

S. No.	Level of Practice	Pre-study f (%)	Post-study f (%)
1	Satisfied level of practice above 75%	22 (18.33%)	67 (55.83%)
2	Moderate level of practice 50-75%	69 (57.50%)	49 (40.83%)
3	Inadequate level of practice Below 50%	29 (24.16%)	04 (3.33%)

Pre-study data mentioned in table 7 shows the frequency and percentage distribution of samples according to the practice score of healthcare professionals working in hospitals at Bikaner district regarding biomedical waste management. It reveals that 18.33% of healthcare professionals had satisfied level of practice, 57.50% of healthcare professionals had moderate level of practice and 24.16% of healthcare professionals had inadequate level of practice. After the educational intervention it is clear that there was an increase in the practice score of healthcare professionals working in hospitals at Bikaner district regarding biomedical waste management. Post-study data reveals that 55.83% of healthcare professionals had satisfied level of practice, 40.83% of healthcare professionals had moderate level of practice and 3.33% of healthcare professionals had inadequate level of practice.

Correlation co-efficient of Knowledge and practice regarding biomedical waste management among paramedical workers healthcare professionals working in hospitals at Bikaner district

TABLE 8: CORRELATION CO-EFFICIENT OF KNOWLEDGE AND PRACTICE; KNOWLEDGE AND ATTITUDE REGARDING BIOMEDICAL WASTE MANAGEMENT AMONG HEALTHCARE PROFESSIONALS WORKING IN HOSPITALS AT BIKANER DISTRICT

S. No.	Category	Correlation co-efficient 'r'
1.	Knowledge and practice	0.84
2.	Knowledge and Attitude	

To find out the relation between knowledge and practice, correlation was used. The computed 'r' value was found to be + 0.84, which reveals that there is a high positive correlation between knowledge and practice, knowledge and attitude. Hence, it was interpreted that the healthcare professionals who had adequate level of knowledge followed Satisfied level of attitude and practice.

DISCUSSION

Despite the efforts made by the government, there are still some areas of concern regarding the internal management of biomedical waste in healthcare facilities in Bikaner district. Therefore, it is essential to strictly follow legal regulations and implement an enhanced environmental management system for the proper handling of biomedical waste, including its collection, segregation, transportation, storage, and disposal. There is a noticeable absence of proper segregation of biomedical waste in hospitals of Bikaner. The waste from wards, which includes used cotton, dressing materials, blood, bottles, PVC drip sets, needles, syringes, and their covers, is not disposed of in the appropriate bin/box according to the Biomedical Waste Rules 2016.

KAP surveys have a long history, dating back to the 1950s, when they were first used in the areas of family planning and population research. Commonly referred to as knowledge, attitude, behavior, and practice surveys, these have gained significant recognition for studying health-related behaviors and health-seeking practices. A KAP survey is designed to be a comprehensive survey of a target population, aiming to gather information about their knowledge, attitudes, and practices related to the topic of interest. Data is gathered through the use of structured or semi-structured questionnaires, which can be self-administered or administered by interviewers. This allows for the collection of both qualitative and quantitative data. [18]

Medical waste management is a significant concern for healthcare facilities globally. The issue may be exacerbated by the absence of sufficient knowledge, attitudes, and practices, as well as inadequate waste management facilities. Healthcare workers, especially waste handlers, play a crucial role in managing waste and face potential risks in the process. [19]

Understanding is the ability to gain, retain, and apply knowledge; a blend of comprehension, expertise, perception, and proficiency [20] Having a strong foundation of knowledge is crucial in health science education. Without it, there is a risk of misapplying knowledge, which can have negative consequences for healthcare organizations. [21, 22, 23]

Our study found a notable improvement in knowledge following the intervention on the proper handling and disposal of various types of waste, including bio-medical waste, human anatomical waste, bandages, dressing and cotton stained with blood or body fluids, personal protective equipment (PPE) and masks, disposable gloves, goggles and face shields, expired or discarded cytotoxic drugs, broken or discarded glass vials and ampoules, treatment of waste collected in red coloured bags at the plant, and separate storage of non-infectious waste and infectious waste. This aligns with findings from similar studies. [24-28]

Attitude encompasses the inclination to respond in a specific manner to various situations, the ability to perceive and interpret events based on personal predispositions, and the capacity to organize opinions into cohesive and interconnected frameworks. [20]

Our study found that the healthcare professionals' attitude towards BMWM was moderate, and the intervention helped to improve it towards a more positive direction.
Through practice, we refer to the implementation of rules and knowledge that results in taking action. Excellence in practice is intricately tied to the advancement of knowledge and technology, and it is crucial to uphold ethical standards. [20]

The practice score of participants improved significantly after the intervention. A majority of 55.83% demonstrated a satisfactory level of practice, while 40.33% showed a moderate level. Only a small percentage of 3.33% of healthcare professionals had an inadequate level of practice.

This research study aims to enhance the understanding and implementation of bio-medical waste management among healthcare providers, ultimately improving the overall practices in this area. This research study aims to enhance the knowledge, attitude and practice of healthcare professionals involved in biomedical waste

management in the hospitals of Bikaner district. It will assess their current knowledge, attitude and practice in this area and provide education through a self-Instructional module.

CONCLUSION

Several knowledge gaps were identified among different categories of hospital employees. It was observed that the doctors' theoretical knowledge surpassed their practical understanding of BMW management. The nurses and paramedical personnel had a different perspective on BMW management compared to doctors. Although their theoretical knowledge might be less, their practical experience was exceptional. Healthcare professionals, including nurses and paramedical personnel, approach BMW management with a high level of thoroughness and attention to detail. Despite the nurses' exemplary attitudes and practice patterns, their knowledge regarding recent amendments in biomedical waste management rules, 2019, was unsatisfactory. It is important to focus on regular assessment, instruction, and practical training programs that highlight recent changes in regulations in order to effectively bridge the gap between knowledge, attitude, and practices. Effective biomedical waste management relies on healthcare professionals prioritizing the correct segregation, collection, treatment, and disposal of biomedical waste, as well as raising public awareness about these practices. Thus, to improve waste management practices in healthcare units of the Bikaner district, it is crucial to implement an effective bio-medical waste management strategy in the hospitals of Bikaner district.

References

1. Ministry of Environment, Forest, and Climate Change, Government of India, New Delhi, India. Biomedical Waste Management Rules, 2016. GSR. 343(E), Published in the Gazette of India: Extraordinary, Part II, Section 3, Sub-section (i). 28th March 2016, 1-63.
2. Plianbangchang S. A Report on Alternative Treatment and Non-Burn Disposal Practices. Safe Management of Bio-medical Sharps Waste in India. New Delhi: W.H.O. Publication; 2005.
3. Patil AD, Shekdar AV. Health-care waste management in India. Journal of Environmental Management. 2001; 63(2):211-220. doi: 10.1006/jema.2001.0453
4. Ananth AP, Prashanthini V, Visvanathan C. Healthcare waste management in Asia. Waste Management. 2010; 30(1): 154-61. doi: 10.1016/j.wasman.2009.07.018
5. Lakshmikantha H. Report on waste dump sites around Bangalore. Waste management. 2006; 26(6): 640- 650. doi: 10.1016/j.wasman.2005.06.009
6. Misra V, Pandey SD. Hazardous waste, impact on health and environment for the development of better waste management strategies in the future in India. Environment International. 2005; 31(3): 417-431. doi: 10.1016/j.envint.2004.08.005
7. Kini BS, Kumar A, Kumar S, Reddy M, Nabar AS, Kamath VG, Kamath A, Eshwari K, Knowledge, Attitudes and Practices regarding Biomedical Waste Management among staff of a tertiary healthcare centre in coastal Karnataka, Journal of Public Health and Medical Research. 2014; 2(1):20-24.
8. Pattnaik S, Reddy MV. Assessment of Municipal Solid Waste management in Puducherry (Pondicherry), India. Resources, Conservation and Recycling. 2010; 54(8):512-520. doi: 10.1016/j.resconrec.2009.10.008
9. Mathur V, Dwivedi S, Hassan MA and 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. doi: https://doi.org/10.4103/0970-0218.84135
10. Chartier V, Emmanuel J, Pieper U, Pruss A, Rushbrook P, Stringer R et al. Safe management of wastes from health-care activities. 2nd ed. Geneva: WHO Press; 2014. p. 3-189.
11. Mitiku G, Admasie A, Birara A, Yalew W. Biomedical waste management practices and associated factors among health care workers in the era of the covid-19 pandemic at metropolitan city private hospitals, Amhara region, Ethiopia, 2020. PLoS One. 2022 Apr 6;17(4):e0266037. doi: 10.1371/journal.pone.0266037. PMID: 35385508; PMCID: PMC8985930.
12. Padmanabhan KK, Barik D. Health Hazards of Medical Waste and its Disposal. Energy from Toxic Organic Waste for Heat and Power Generation. 2019:99–118. doi: 10.1016/B978-0-08-102528-4.00008-0. Epub 2018 Nov 9. PMCID: PMC7152398.
13. Chuks, N., Anayo, F., &Ugbogu, O. C. (2013). Health Care Waste Management – Public Health Benefits, and the Need for Effective Environmental Regulatory Surveillance in the Federal Republic of Nigeria. InTech. doi: 10.5772/53196

14. Janik-Karpinska E, Brancaleoni R, Niemcewicz M, Wojtas W, Foco M, Podogrocki M, Bijak M. Healthcare Waste-A Serious Problem for Global Health. Healthcare (Basel). 2023 Jan 13;11(2):242. doi: 10.3390/healthcare11020242. PMID: 36673610; PMCID: PMC9858835.
15. Bansod HS, Deshmukh P. Biomedical Waste Management and Its Importance: A Systematic Review. Cureus. 2023 Feb 3;15(2):e34589. doi: 10.7759/cureus.34589. PMID: 36874306; PMCID: PMC9981497.
16. United Nations Development Programme. Medical waste: why it is so important to dispose of it correctly. [Online] Available at: https://www.undp.org/kyrgyzstan/news/medical-waste-why-it-so-important-dispose-it-correctly . Accessed on: January 18, 2023.
17. Mathur P, Patan S, Shobhawat S. Need of Biomedical Waste Management System in Hospitals - An Emerging issue - A Review. Curr World Environ. 2012;7(1):117-124. doi: http://dx.doi.org/10.12944/CWE.7.1.18
18. Andrade C, Menon V, Ameen S, Kumar Praharaj S. Designing and Conducting Knowledge, Attitude, and Practice Surveys in Psychiatry: Practical Guidance. Indian J Psychol Med. 2020 Aug 27;42(5):478-481. doi: 10.1177/0253717620946111. PMID: 33414597; PMCID: PMC7750837.
19. Deress T, Jemal M, Girma M, et al. Knowledge, attitude, and practice of waste handlers about medical waste management in Debre Markos town healthcare facilities, northwest Ethiopia. BMC Res Notes. 2019;12:146. https://doi.org/10.1186/s13104-019-4174-7
20. Badran IG. Knowledge, attitude and practice: the three pillars of excellence and wisdom - a place in the medical profession. East Mediterr Health J. 1995;1(1):8–16. http://dx.doi.org/10.26719/1995.1.1.8
21. Karimi H, Hosseinian Z, Ahanchian M. Knowledge management in medical education. J Med Educ Dev. 2014;7(16):94–106.
22. Shahmoradi L, Safadari R, Jimma W. Knowledge management implementation and the tools utilized in healthcare for evidence-based decision making: a systematic review. Ethiop J Health Sci. 2017;27(5):541–558. doi: 10.4314/ejhs.v27i5.13. [PMC free article] [PubMed] [CrossRef]
23. Thirunavukkarasu A, Al-Hazmi AH, Dar UF, Alruwaili AM, Alsharari SD, Alazmi FA, Alruwaili SF, Alarjan AM. Knowledge, attitude and practice towards bio-medical waste management among healthcare workers: a northern Saudi study. PeerJ. 2022 Jul 20;10:e13773. doi: 10.7717/peerj.13773. PMID: 35880221; PMCID: PMC9308458.
24. Basavaraj TJ, Shashibhushan BL, Sreedevi A. To assess the knowledge, attitude and practices in biomedical waste management among health care workers in dedicated COVID hospital in Bangalore. Egypt J Intern Med. 2021;33:37. https://doi.org/10.1186/s43162-021-00066-9
25. Shekoohiyan S, Parsaee F, Ghayour S. Assessment of knowledge, attitude and practice about biomedical waste management among healthcare staff of Fasa educational hospitals in COVID-19 pandemic. Case Studies in Chemical and Environmental Engineering. 2022;6:100207. https://doi.org/10.1016/j.cscee.2022.100207
26. Anand P, Jain R, Dhyani A. Knowledge, attitude and practice of biomedical waste management among health care personnel in a teaching institution in Haryana, India. Int J Res Med Sci. 2016;4:4246–4250.
27. Malini A, Eshwar B. Knowledge, attitude and practice of biomedical waste management among health care personnel in a tertiary care hospital in Puducherry. Int J Biomed Res. 2015;6(3):172–176.
28. Mathur V, Dwivedi S, Hassan MA, Misra RP. Knowledge, attitude, and practices about biomedical waste management among healthcare personnel: a cross-sectional study. Indian J Community Med. 2011;36(2):143–145. https://doi.org/10.4103/0970-0218.84135