Section: Community Medicine

Original Research Article

ASSESSMENT OF BIOMEDICAL WASTE MANAGEMENT AWARENESS, PRACTICES, AND NEEDLE STICK INJURIES AMONG HEALTHCARE WORKERS IN GOVERNMENT HOSPITALS OF JABALPUR, MADHYA PRADESH

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ABSTRACT

Background: Inadequate biomedical waste management can directly impact health. As per ministry reports, India produces over 62 million tons of waste annually, of which 15% is biomedical waste. **Objectives:** To assess the awareness of healthcare staff regarding biomedical waste management practices in the selected government hospitals of Madhya Pradesh. To determine the current practices of biomedical waste management in the hospitals. To assess the needle stick injury rate.

Materials and Methods: Hospital-based cross-sectional study. The study conducted over a period of 2 months Feb 2024 to March 2024 across two randomly selected government hospitals in Madhya Pradesh. Healthcare staff (doctors, nurses, lab technicians and sanitary staff) involved in handling of biomedical waste were included. Simple random sampling was used to select the study participants in each hospital after allocating proportionate samples for the different staff categories. Data was collected using a pre-tested, semi-structured questionnaire.

Results: The assessment found that 52% had moderate knowledge of BMW management while 8% had poor knowledge. Most reported following safe practices with over 80% doing things like 92% wearing gloves and 88% separating BMW. However, sometimes only 63% followed correct hospital waste disposal. 10% reported a needlestick injury in the last year, with individual carelessness and poor needle disposal being the top causes each at 40%.

Conclusion: While over half demonstrated moderate knowledge of appropriate BMW procedures, there remains room for improvement as 8% exhibited poor knowledge.

Keywords: Biomedical waste; Awareness; Practices; Needlestick injuries; Healthcare workers.

INTRODUCTION

The Biomedical and Health Care waste management is very different from other house waste or industries waste management.[1] Improper management of waste generated in health care facilities causes a direct health impact.[2] Biomedical waste comprises of all liquid and solid wastes generated from medical establishments and activities involving biological materials.[3]

According to the World Health Organization (WHO), medical waste is defined as waste generated by health care activities, ranging from used needles and syringes to soiled dressings, body parts, diagnostic samples, blood, chemicals,

pharmaceuticals, medical devices and radioactive materials.[4]

Approximately 85% of the garbage produced by health care operations is normal, non-hazardous waste. The remaining 15% is regarded as hazardous material, which could be radioactive, poisonous, or contagious. Around the world, an estimated 16 billion injections are given each year; however, not all discarded needles and syringes are properly disposed of,[4] The World Health Organization (WHO) has categorized biomedical waste into eight categories. They are infectious waste, sharps, pathological waste, pharmaceutical waste, genotoxic waste, radioactive waste and chemical waste.[4]

The following are the main sources of waste in healthcare are laboratories and research centres, as well as hospitals and other healthcare facilities, autopsy and mortuary facilities, animal testing and research facilities, blood donation facilities and services, senior care facilities etc.[4]

In 2025, India's metropolitan areas would produce 0.7 kilogramme of waste per person each day, which is four to six times more waste than what it did in 1999. India now produces 62 million tons of garbage (both recyclable and non-recyclable) yearly with an average yearly growth rate of 4%, according to the Ministry of Environment, Forest, and Climate Change. The three primary categories of waste are solid waste, plastic waste, and electronic waste.[5]

India processed 73 percent of total waste generated in financial year 2022. This is a considerable increase when compared to financial year 2016, in which less than 20 percent of waste generated was processed.[6] There are several measures being taken to improve waste management in India. The use of emerging technologies such as automatic waste segregators, onsite waste processing like composting/bio methanation/bio CNG, gasifiers/pyrolysis, etc. can transform the current waste management scenario in India.[5]

In countries that are still developing, medical waste management has not gotten much attention. Typically, waste is not separated into risky and non-risky categories. Workers are not adequately informed about the risks involved, and erroneous disposal practices are used.[7,8]

MATERIAL AND METHODS

The present study was a cross sectional study conducted in Feb 2024 to March 2024 for a period of 2 months in the Government hospitals of Jabalpur city. The study subjects were the Doctors, Staff nurses, laboratory technicians and housekeeping staff.

Sample Size Calculation

Using the formula for sample size calculation "X = Zα/22 ¬*p*(1-p) / MOE2 "

Assuming that half of the study population possesses accurate knowledge, we anticipate a P = 50 %, and for a confidence level of 95%, α is 0.05 and the critical value- Z is 1.96 and considering the margin of error MOE 10 %, sample size came around 97≈100. So, a total 100 Participant were included in the study.

Sampling Method

Randomly two government hospital was selected from a list of all the government health facilities in the city. Simple random sampling was used to select the study participants in each hospital after allocating proportionate samples for the different staff categories. A list of all working staff with their categories was taken from the hospital and administrative office.

Inclusion Criteria

Healthcare staff who have been working in the selected government hospitals of Jabalpur, Madhya Pradesh, for at least six months and are directly involved in the handling and management of biomedical waste. This includes doctors, nurses, laboratory technicians, and cleaners.

Exclusion Criteria

Participants who have not given their consent during the study.

Study Tools and Data Collection

study was conducted with involving 100 healthcare staff members. A pre-tested, semi-structured questionnaire was utilized to gather information. The questionnaire has three parts - sociodemographic characteristics, knowledge regarding biomedical waste among healthcare workers and practices towards biomedical waste management.

Ethical Consideration

Ethical clearance for study was taken from Institutional Ethics committee of NSCB Medical College, Jabalpur. Anonymity of the participants was maintained by avoiding any information recording the identity of the participants in the questionnaire.

Data Analysis

Data was entered into excel sheet and was analyzed using SPSS. Descriptive statistics was used to summarize and present the data collected from the questionnaire to provide an overview of the participants' level of awareness and practices related to biomedical waste management. Odd ration and scattered plot were also used to depicts the data.

RESULTS

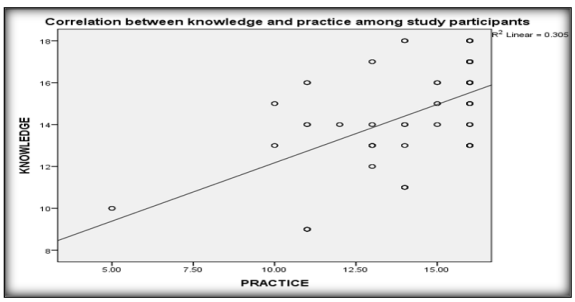

Figure 1: Correlation Between Knowledge and Practice among study Participants

The study included 100 participants. Half of the participants (50%) were between 25-29 years of age, while 18% were between 30-34 years, 10% between 35-39 years, 9% were less than 25 years and 13% were 40 years or older. Most of the participants were male (63%). Regarding education, more than half (53%) had a graduate degree, 44% had a postgraduate degree, and only 3% had an undergraduate degree. Nearly half (43%) had 1-2 years of experience, 30% had 3-4 years of experience, 10% had 5-10 years, and 17% had more than 10 years of experience. When considering occupation, half (50%) were doctors, 33% were nurses, and 17% were lab technicians.

The practice regarding needlestick injuries showed that 69% of participants had taken the HBV vaccine, while 10% had not completed the course and 21% had not taken it at all. Only 15% knew their HBV titer levels. In the last year, 10% reported having a needlestick injury. For those injuries, 40% reported it was due to individual carelessness, another 40% was due to poor needle disposal, and the remaining 20% were other unspecified causes. Out of the needlestick injuries that occurred, only 40% were reported to the authorities. [Table 1]

The assessment of participant's knowledge about biomedical waste (BMW) management showed that the majority (52%) had a moderate level of knowledge, scoring between 11-15 points. Forty percent demonstrated good knowledge, scoring between 16-22 points. However, 8% exhibited poor knowledge, scoring 10 points or less out of a possible 22 regarding BMW management. [Table 3]

The survey of practices regarding biomedical waste (BMW) management found that the vast majority followed safe practices. Near unanimous numbers wore gloves (92%) and followed color coding (92%) when handling BMW. High percentages also used designated sharps containers (87%), separated BMW during disposal (88%), properly sealed and labeled containers before transportation (82%), cleaned spills with disinfectants and PPE (77%), and followed needle stick injury protocols (81%). However, some respondents only sometimes engaged in correct waste disposal at the hospital (28%) or followed other protocols (ranging from 3-15%). [Table 4]

It was observed that older age and female sex was significantly associated with higher knowledge scores. On the other hand, doctors and lab technicians had significantly lower knowledge as compared to nurses. [Table 5]

It was observed that with one-year increase in age, the adjusted odds ratio of having satisfactory practice among the participants increased by 1.083 times, an association which was found to be statistically significant (p-value 0.036). All other sociodemographic factors were found to not be significantly associated with the level of practice among the study participants. [Table 6]

The table shows that out of the total 100 participants, 49 reported having satisfactory practice, which was 49%. 51 participants reported unsatisfactory practice, which was 51%. In total, the study included 100 healthcare staff members whose level of practice was assessed. [Table 7]

There was a moderately strong positive correlation between knowledge and practice among the participants, which was found to be statistically significant on analysis. [Table 8]

Table 1: Sociodemographic characteristics of study participants

Parameters	Frequency	Percentage
Age groups (years)		
<25	9	9
25-29	50	50
30-34	18	18
35-39	10	10
≥40	13	13
Male	63	63
Education		
Undergraduate	3	3
Graduate	53	53
Postgraduate	44	44
Experience		
1-2 years	43	43
3-4 years	30	30
5-10 years	10	10
>10 years	17	17
Occupation		
Doctor	50	50
Nurse	33	33
Lab technician	17	17

Table 2: Practice regarding needlestick injuries

Practice	Frequency	Percentage
HBV status		
Taken	69	69
Not completed course	10	10
Not taken	21	21
Knows their HBV titter	15	15

Had a needlestick injury in last 1 year	10	10
Cause of injury		
Individual carelessness	4	40
Poor needle disposal	4	40
Others	2	20
Reported to authorities	4	40

Table 3: Knowledge about BMW

Knowledge about BMW	Frequency	Percentage
Poor knowledge (0-10)	8	8
Moderate knowledge (11-15)	52	52
Good knowledge (16-22)	40	40

Table 4: Practice about BMW

Practice	Yes	Sometimes	No
Wear gloves when handling BMW	92	6	2
Follows color coding for BMW	92	6	2
Correct waste disposal practice at hospital	63	28	9
Use designated sharps containers for the disposal of needles and other sharps	87	6	7
Separates biomedical waste from other types of waste during disposal	88	3	9
Biomedical waste containers properly sealed and labelled before transportation	82	11	7
Clean and contain spills of blood or body fluids using appropriate disinfectants and personal protective equipment (PPE)	77	14	9
Follow proper protocol for needle stick injury	81	15	4

Table 5: Association between sociodemographic factors and knowledge of the participants

Parameters	Unstandardized coefficient	p-value
Age	0.076	0.009*
Sex		
Female	1.220	0.005*
Male	0	-
Occupation		
Doctor	-0.992	0.027*
Lab technician	-2.289	0.001*
Nurse	0	-
Education		
Undergraduate	-1.387	0.233
Graduate	-0.775	0.525
Postgraduate	0	-

***Statistically significant**

Table 6: Association between sociodemographic factors and practice of the participants

Parameters	AOR	p-value
Age	1.083	0.036*
Sex		
Female	1.711	0.288
Male	1	-
Occupation		
Doctor	1.442	0.490
Lab technician	2.257	0.251
Nurse	1	-
Education		
Undergraduate	0.161	0.997
Graduate	0.689	0.823
Postgraduate	0	-

***Statistically significant**

Table 7: Level of practice among the participants

Practice	Frequency	percentage
Satisfactory	49	49
Unsatisfactory	51	51
Total	**100**	**100**

Table 8: Correlation between knowledge and practice among study participants

Knowledge	Practice (r-value)	p-value
	0.546	<0.001*

***Statistically significant**

DISCUSSION

An effective biomedical waste management system is crucial for preventing hospital-acquired infections, protecting the environment and public health overall. It is also a key part of ensuring high-quality services in healthcare facilities. In recognition of the significance of this issue, the Government of India introduced the Biomedical Waste (Management and Handling) Rules in 1998, which were later updated in 2003. Practices aimed at curbing infections and waste disposal protocols within hospitals must be established to guarantee patients receive safe and reliable care.

The current study's sample is younger overall, with the largest group falling in the 25-29 years age bracket. In terms of experience, the current study reported most participants having 1-2 years' experience compared to study done in a tertiary care hospital in Delhi,[9] had sample with larger proportions in the 11-20 years category. This study also found that only 31.1% nurses had adequate knowledge about steps to prevent needle stick injuries, which is quite low. The current study shows somewhat better with around 50% nurses aware of key prevention steps. In a study done by dalui,[10] 43.2% of HCWs had excellent knowledge, 38.5% had good knowledge and 18.2% had poor knowledge, here majority (92%) of HCWs demonstrated sufficient knowledge and infection control measures. In a Study done in Central India,[11] majority of HCWs (62.67%) reported receiving all 3 doses of HBV vaccine and 69% completed the HBV course here as well.

Around 10.81% of the total healthcare providers in the teaching hospital in Nellore,[12] were exposed to NSIs and needle stick injury rate is 10% in the current study. The study by Shahna Ali et al,[13] found that recapping of needles was the most common reason for needlestick injury reported by 31.7% healthcare workers, followed by haste (28.8%) and lack of availability of sharps containers (15.4%). Other reasons cited included heavy patient load (10.5%) and handling uncooperative patients (9.6%). In the current study, among the 10% of respondents who reported a needlestick injury in the last year, individual carelessness and poor needle disposal were the main causes reported by 40% each. Both studies point towards the need for stricter adherence to safety protocols like proper disposal and not recapping needles to minimize needlestick injuries amongst healthcare workers.

The percentages reported for practices of wearing gloves (92%), following color coding (92%), and using designated sharps containers (87%) are higher than what is reported in the study in Uttarakhand,[14] found lower percentages of participants engaging in proper on-site segregation (43%) and proper disposal (18%) and percentage reported for correct waste disposal practice at the hospital is (63%) and Bhatt et al,[14] study showed only 18% disposed properly. The percentages reported for separating biomedical waste (88%) and properly sealing/labeling containers (82%) are slightly higher than what is reported by Bhatt et al.[14] for on-site segregation (43%).

In a study done in Mysuru,[15] the study respondents showed satisfactory knowledge regarding biomedical waste management. The knowledge about BMW among doctors was the distinctively better, followed by that of nurses, technicians, post graduates, interns and housekeeping staff but in the current study we saw that doctors and lab technicians had significantly lower knowledge as compared to nurses.

CONCLUSION

In summary, this study offers critical insights into healthcare workers' knowledge, behaviors, and injury rates related to biological waste management in Jabalpur, Madhya Pradesh's government hospitals. The findings show that although most participants had moderate to good understanding of biomedical waste management procedures, there is still space for improvement, particularly with regard to appropriately reporting needlestick injuries. Emphasizing rigorous adherence to safety protocols, such as avoiding recapping needles and using the right disposal techniques, should be the main focus of education programmes. It is also necessary to regularly assess procedures to make sure that guidelines are being adhered to consistently and reduce hazards to healthcare personnel. Overall, the study shows that in order to improve biomedical waste management systems and further lower the rates of needlestick injuries in this context, ongoing observation and training are required.

Conflict of Interest: none.

REFERENCES

1. Kalpana V, Prabhu D, Vinodhini S. Biomedical waste and its management. 2016;
2. Barar Dr M, Kulkhestha A. Biomedical Waste Management: Need of Today: A Review. 2015;
3. 3. Chandrappa R, Das DB. Biomedical Waste. Solid Waste Management [Internet]. 2012 [cited 2023 Jun 7] ;(9783642286803):147. Available from: /pmc/articles/PMC7122413/
4. Health-care waste [Internet]. [cited 2023 Jun 7]. Available from: https://www.who.int/news-room/fact-sheets/detail/health-care-waste
5. Waste to Wealth Mission | Invest India [Internet]. [cited 2023 Jun 7]. Available from: https://www.investindia.gov.in/waste-to-wealth

6. India: share of waste processed 2022 | Statista [Internet]. [cited 2023 Jun 7]. Available from: https://www.statista.com/statistics/1147662/india-share-of-waste-processed/
7. HOSPITAL WASTE MANAGEMENT. [cited 2023 Jun 7]; Available from: www.theprofesional.com
8. Abor PA, Bouwer A. Medical waste management practices in a Southern African hospital. Int J Health Care Qual Assur [Internet]. 2008 [cited 2023 Jun 7];21(4):356–64. Available from: https://pubmed.ncbi.nlm.nih.gov/18785461/
9. (PDF) Awareness and practices regarding needle stick injuries among nurses in a tertiary care hospital of Delhi [Internet]. [cited 2024 Feb 27]. Available from: https://www.researchgate.net/publication/274736162_Awareness_and_practices_regarding_needle_stick_injuries_among_nurses_in_a_tertiary_care_hospital_of_Delhi
10. Dalui A, Banerjee S, Roy R. Assessment of knowledge, attitude, and practice about biomedical waste management among healthcare workers during COVID-19 pandemic in a health district of West Bengal. Indian J Public Health [Internet]. 2021 Oct 1 [cited 2024 Feb 28];65(4):345–51. Available from: https://www.researchgate.net/publication/357424116_Assessment_of_knowledge_attitude_and_practice_about_biomedical_waste_management_among_healthcare_workers_during_COVID-19_pandemic_in_a_health_district_of_West_Bengal
11. Nema S, Saraf A, Ayer S, Singh A K, Biswas D. Awareness and vaccination status of Hepatitis B among health care workers in a tertiary care teaching hospital of Central India. Indian Journal of Microbiology Research. 2021 Jul 28;8(2):152–6.
12. Sriram S. Study of needle stick injuries among healthcare providers: Evidence from a teaching hospital in India. J Family Med Prim Care [Internet]. 2019 [cited 2024 Feb 28];8(2):599. Available from: /pmc/articles/PMC6436289/
13. Ali S, Athar M, Zafar L, Siddiqi OA. Knowledge, awareness, and practices regarding needlestick injury among health-care workers in a tertiary care hospital of India: Annual incidence versus reporting rate. International Journal of Health & Allied Sciences [Internet]. 2020 [cited 2024 Feb 28];9(1):45. Available from: https://www.ijhas.in/article.asp?issn=2278-344X;year=2020;volume=9;issue=1;spage=45;epage=50;aulast=Ali
14. (PDF) Knowledge, Attitude and Practice of Biomedical Waste (BMW) Management among Health Care Providers in a Tertiary Care Hospital: A Cross Sectional Study from Haldwani, Uttarakhand [Internet]. [cited 2024 Feb 28]. Available from: https://www.researchgate.net/publication/341179603_Knowledge_Attitude_and_Practice_of_Biomedical_Waste_BMW_Management_among_Health_Care_Providers_in_a_Tertiary_Care_Hospital_A_Cross_Sectional_Study_from_Haldwani_Uttarakhand
15. Rao D, Dhakshaini MR, Kurthukoti A, Doddawad VG. Biomedical waste management: A study on assessment of knowledge, attitude and practices among health care professionals in a tertiary care teaching hospital. Biomedical and Pharmacology Journal. 2018 Sep 1;11(3):1737–43.