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Bio-Medical Waste Management: Knowledge and Practice among Health Care Workers

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Abstract : *Biomedical waste (BMW) is a by-product of every healthcare facility, and improper disposal can pose risks to both health and the environment. The safe and scientific management of biomedical waste involves crucial steps such as handling, segregation, mutilation, disinfection, storage, transportation, and final disposal. To evaluate Bio-Medical Waste Management (BMWM) practices and knowledge in hospitals, a cross-sectional study was conducted in four selected hospitals in Patna, by using survey method.*

The analysis encompassed descriptive and inferential statistics methods, including tabulation and frequency distribution. The evaluation of the correlation between knowledge and practice levels among healthcare workers employed the Pearson correlation coefficient formula. Furthermore, the chi-square formula was applied to explore potential associations between the knowledge and practice of healthcare workers and various selected demographic variables. The survey found that 15% of paramedical workers had adequate knowledge, 34% demonstrated moderate understanding, and 51% had inadequate knowledge in biomedical waste management. In the 25-31 age groups, 65% of 161 respondents exhibit a "Moderate" practice level in biomedical waste management, with females dominating across all age groups. Analysis of data reveals a positive correlation (r=0.2383) between the knowledge and practice levels of healthcare workers. Healthcare workers in biomedical waste management show a significant correlation between knowledge and age, occupation, education, and experience. Examining healthcare workers in biomedical waste management reveals a noteworthy correlation between practice and sex, occupation, education, and experience, with calculated values surpassing the table values.

Keywords: *Biomedical waste, Biomedical Waste management, Healthcare workers, Knowledge, Practice.*

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Introduction:

Biomedical waste management holds a crucial role within the medical microbiology and infection control programs of healthcare institutions. The word 'Biomedical Waste' is any waste that is produced during analysis, treatment or vaccination of human beings or animals, or in the study activities applied to or in the invention or testing of biological and covers the classes mentioned in schedule- 1 of govt. of India rules 1998 (Acharya et.al., 2000). Biomedical waste management rules were introduced in 1998, requiring all healthcare professionals to possess knowledge, practice and the ability to guide others in waste collection, management, and proper handling techniques. The Bio-Medical Waste

management rules underwent amendments in 2011 and March 2016. The estimated quantity of solid waste generated in government hospitals ranges from half to one kilogram per bed. Regarding the safe management of biomedical waste management, there is role conflict among the generators, operators, decision-makers, and the general community due to a lack of awareness.

The World Health Organization (WHO) classifies biomedical waste into eight categories: infectious, pathological, sharp, chemical, pharmaceutical, cytotoxic, radioactive, and non-hazardous. Despite the increasing focus on solid waste management, biomedical waste, including categories like hospital waste remains a challenge for local governments. Biomedical waste arises from primary and secondary sources with hospitals being a major generator posing risks to patients, staff, and the environment. Major sources include health centres, medical colleges, hospitals, veterinary institutions, and production facilities. Minor sources encompass clinics, blood donation camps, slaughterhouses, immunization centres, cosmetic piercing establishments, mental clinics, funeral arrangements, and institutions for people with disabilities.

Effective biomedical waste management is crucial in daily medical operations, mass immunization campaigns, and emergencies to protect healthcare workers, patients, and the community from infections and toxic effects. Poor management may lead to environmental damage and the unsafe reuse of medical equipment contributing to a global burden of disease. Recognizing the integral role of biomedical waste management in healthcare is imperative as inadequate practices can diminish overall healthcare benefits. The study aims to assess healthcare worker's knowledge and practices in biomedical waste management, given its critical importance. The findings serve as foundational information for future research, offering essential insights to guide further studies on this crucial aspect of healthcare management.

Problem:

Biomedical waste legislation enforcement is inadequate, leading to improper and indiscriminate garbage disposal in some healthcare facilities, posing a significant risk to public and environmental health.All healthcare professionals (nurses, doctors, and lab technicians), service workers, rag pickers, and the general public are at danger of catching infections when handling storage and treatment due to poor waste management techniques. Incinerators that are not performing at their best provide an additional risk to the environment and human health.

Need:

Biomedical waste management aims to reduce waste production, ensure safe collection, handling, and disposal, preventing infection and enhancing public safety. Inadequate management in healthcare poses direct threats to public health, healthcare professionals, and the environment. Proper biomedical waste management is essential to minimize infection risks for handlers, scavengers, and nearby residents. It also addresses potential soil, water, and air contamination, improper incineration emissions, ash disposal, and facilitates the safe disposal of repackaged medications.

Objectives:

- To find out the level of knowledge regarding biomedical waste management among health care workers in selected hospitals.
- To find out the level of practice regarding biomedical waste management among health care workers in selected hospitals.
- To find out the relationship between knowledge and practice regarding biomedical waste management.
- To find out the association between the knowledge of healthcare workers and selected demographic variable like age, gender, educational qualification, occupation and years of experience.
- To find out the association between the practice on biomedical waste management of healthcare workers and selected demographic variables like age, gender, educational qualification, occupation and years of experience.

Hypotheses:

H_1: There is a significant relationship between knowledge and practice regarding biomedical waste management among healthcare workers.

H_2: There is a significant association between the knowledge and selected variable such as age, gender, educational qualification, occupation and years of experience.

H_3: There is a significant association between the practice and selected variable such as age, gender, educational qualification, occupation and years of experience.

Review of Literature:

Swathi C.M. et al. (2018) conducted a research study on Evaluation of Biomedical waste management practices in a Tertiary Health care Institute in Telangana, India. A cross -sectional survey was designed to conduct the study. Out of 174 respondents, there were 40 nurses, 20 technicians, 20 housekeeping and 94 doctors. The result of study shows that the Knowledge regarding BMW Management was high among doctors and nurses than the Para-medical staff.

Patel. G, Ravel. P. (2019) conducted a study on Assessment of level of knowledge regarding biomedical waste management among healthcare workers in tertiary care hospital in western India. A structured self-administered questionnaire serve as the study encompassed junior doctors, nursing staff, laboratory technicians and housekeeping staff. The majority of the participants demonstrated average to good knowledge regarding Biomedical waste Management.

Research Methodology:

Research design: A quantitative and descriptive survey design was used for the present study.

Sampling: The study used purposive sampling, selecting participants based on their availability and willingness to participate. This non-probability approach aimed to improve representation, ensuring the chosen samples reflected the broader target population.

Sample size: A purposive sample of 255 healthcare workers was selected for the study, comprising six groups including- 20 doctors, 35 postgraduates, 15 nurses, 50 interns, 45 lab technicians, and 90 sanitary workers (ward boys and sweepers working in the hospital and dealing with BMW).

Area of the study: This community- based research was done in the city of Patna located in the northern state of Bihar. Participants were selected from four different hospitals - IGIMS, AIIMS, Gardiner, and PMCH for a diverse sample.

Method of data collection: The study employed a survey method to evaluate participant's knowledge and practices in biomedical waste management. It aimed to establish correlations between knowledge and actual practices. The questionnaire, with close-ended questions tailored to the study's objectives, underwent refinement following a pilot study involving a limited sample size (N=15) across four hospitals.

Tools of data collection: The questionnaire was crafted with the aim of estimating and analyzing the respondents' knowledge, practices, and the relationships between them in the context of biomedical waste management. A total of 50 questions were posed, excluding inquiries related to the socio-demographic profile of the respondents. Among these, 30 questions pertained to knowledge regarding biomedical waste among healthcare workers, while the remaining 20 were focused on practical application.

Ethical consideration and consent to participate: Before conducting the survey, consent letters were sent to the directors of four chosen hospitals. Respondents were assured that the collected data would be kept confidential and used solely for research purposes.

Coding of responses: After completion of data collection the collected data were subjected to statistical analysis in alignment with the study's objectives. Subsequently, the gathered information underwent coding, tabulation, and compilation to facilitate result interpretation.

Data analysis: Data was statistically analyzed using the SPSS version 22.0 software. Variables were summarized and represented by relevant descriptive statistics absolute (n) and relative frequencies (%). The association between the categorized variables was evaluated by Chi-square test. In all the statistical analysis a 0.05 significance level was adopted.

Statistical analysis: The analysis employed descriptive and inferential statistics and including tabulation and frequency distribution. Pearson correlation coefficient assessed the correlation between

knowledge and practice levels in healthcare workers. The chi-square formula explored associations between healthcare workers' knowledge/practice and selected demographics.

Results and Discussion:

This chapter delves into the analysis of collected samples and the interpretation of data aimed at assessing the knowledge and practices of healthcare workers concerning biomedical waste management.

Table 1. Socio-Demographic Characteristics of study participants (N=255)

Sample Characteristics		Sample	
		Frequency (n)	Percentage (%)
Age	18-24 years	49	19.21
	25-31 years	161	63.13
	32 & above years	45	17.64
Gender	Male	121	47.45
	Female	134	52.54
Qualification	Below Metric	17	6.66
	Metric	38	14.90
	Intermediate	57	22.35
	Graduate & Above	143	56.07
Occupation	Doctor	20	7.84
	Post Graduate	35	13.72
	Nurse	15	5.88
	Intern	50	19.60
	Lab Technician	45	17.64
	Sanitary Workers	90	35.29
Years of experience	1> years or no exp	35	13.72
	1-5 years	180	70.58
	6-10 years	40	15.68

The study involves 255 participants, offering a diverse representation across age, gender, education, occupation, and experience. Predominantly, individuals aged 25-31 years constitute 63.13%, followed by those aged 18-24 years (19.21%) and 32 years and above (17.64%). The gender distribution is nearly balanced, with 47.45% male and 52.54% female participants. Educational qualifications are predominantly graduates and above (56.07%), followed by intermediate (22.35%), metric (14.90%), and below metric (6.66%). Occupationally, sanitary workers form the largest group (35.29%), succeeded by interns (19.60%), doctors (7.84%), postgraduates (13.72%), nurses (5.88%), and lab technicians (17.64%). Experience-wise, the majority has 1-5 years (70.58%), followed by 6-10 years (15.68%), and no experience (13.72%). This diverse sample provides a comprehensive foundation for the study's insights.

Objective 1. To find out the level of Knowledge regarding Bio-Medical Waste Management among healthcare workers in selected hospitals

Table 2. Distribution of frequency and Knowledge scores of healthcare workers regarding Bio-Medical Waste Management

Level of knowledge	Frequency (n)	Percentage (%)
Adequate level of knowledge	39	15
Moderate level of knowledge	86	34
Inadequate level of knowledge	130	51

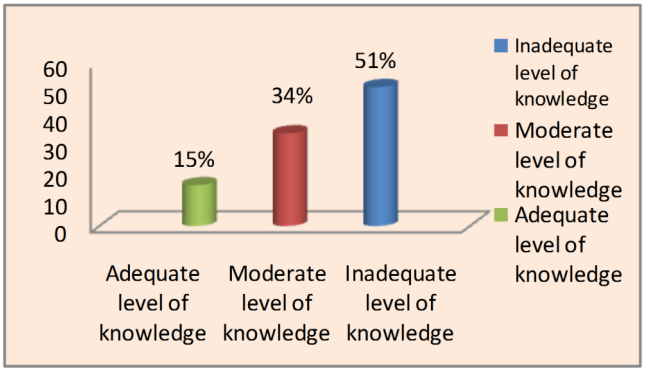

Fig. 1. Percentage Distribution of samples based on the level of Knowledge regarding Bio-Medical Waste Management

Interpretation: The data reveals varying levels of knowledge among the respondents. Among the participants, 15% demonstrated an adequate level of knowledge, while a larger portion, constituting 34%, exhibited a moderate level of knowledge. In contrast, a significant proportion of 51% had an inadequate level of knowledge regarding the subject under consideration. These findings highlight the need for targeted interventions and educational efforts to address knowledge gaps and promote a more comprehensive understanding within the studied population.

Objective 2. To find out the level of Practice regarding Bio-Medical Waste Management among healthcare workers in selected hospitals

Table 3. Distribution of samples based on various Socio-Demographic Factors

Age → / Indicators ↓	18-24 Years	25-31 Years	32 & Above Years
Total Respondents	49	161	45
Sex			
Male	18	80	23
Female	31	81	22
Educational Status			
Below Metric	0	12	5
Metric	10	19	9
Intermediate	12	35	10
Graduation & above	27	95	21
Occupation			
Doctor	0	8	12
Post-graduate	25	10	0
Nurse	0	9	6
Intern	0	50	0
Lab Techni cian	6	32	7
Sanitary workers	18	52	20

Interpretation: The table provides a comprehensive overview of study participants' demographic distribution. Age categories include 18-24 years, 25-31 years, and 32 years and above, with the largest group in the 25-31 years range (161 participants), followed by 18-24 years (49 participants) and 32 years and above (45 participants). Gender representation is balanced, with 121 male and 134 female participants. Educational diversity spans from below metric to graduate and above, with a majority holding higher qualifications. Occupational roles encompass doctors, post-graduates, nurses, interns, lab technicians, and sanitary workers. This detailed demographic analysis forms the basis for nuanced insights into biomedical waste management practices.

Table 4. Distribution of frequency and practice score of healthcare workers regarding Bio-Medical waste management

Level of Practice	Frequency (n)	Percentage (%)
Adequate level of Practice	28	11
Moderate level of Practice	167	65
Inadequate level of Practice	60	24

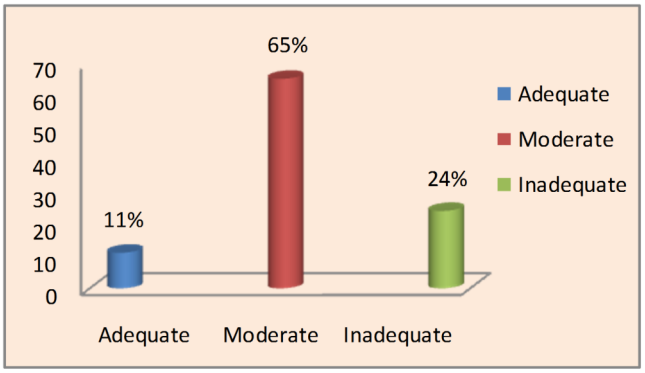

Fig. 2. Percentage distribution of samples according to the level of Practice regarding Bio-Medical Waste Management

Interpretation: The table presents the distribution of frequency and practice scores among healthcare workers regarding biomedical waste management. Notably, 65% of participants demonstrate a moderate level of practice, indicating satisfactory but suboptimal adherence to waste management protocols. Conversely, 24% exhibit an inadequate level of practice, highlighting areas for improvement. On a positive note, 11% display an adequate level of practice, reflecting commendable adherence to established biomedical waste management standards. This distribution provides insights for targeted interventions to enhance practices and overall improvement in biomedical waste management procedures.

Objective 3. To find out the relationship between knowledge and practice regarding Bio-Medical Waste Management

Parameter	Value
Pearson correlation coefficient (r)	0.2383
r^2	0.0568
P-value	0.8468

Results of the Pearson correlation indicated that there is a non-significant small positive relationship between X and Y, (r (1) = .238, p = .847).

Above Table 5 represents that there is a positive correlation between knowledge and practice (r = 0.2383). Hence it was interpreted that healthcare workers who had adequate knowledge followed satisfied level of practice.

Objective 4. To find out the association between the knowledge of healthcare workers and selected socio-demographic variable like age, gender, educational qualification, occupation and years of experience

Table 6. Association between Knowledge and Demographic variables of healthcare workers

Variables	Adequate level of knowledge	Moderate level of knowledge	Inadequate level of knowledge	X^2
Age				
18-24	8	18	23	The chi -square statistic is 10.5279. The p -value is .032414. The result is significant at p < .05.
25-31	22	46	93	
32 & Above	9	22	14	
Sex				
Male	19	45	57	The chi -square statistic is 1.5221. The p -value is .467169. The result is not significant at p < .05.
Female	20	41	73	
Occupation				
Doctor	8	10	2	The chi -square statistic is 92.118. The p -value is 0.001. The result is significant at p < .05.
Post-graduate	13	9	13	
Nurse	4	6	5	
Intern	0	0	50	
Lab Technician	10	16	19	
Sanitary workers	4	41	45	
Educational Qualification				
Below Metric	2	8	7	The chi -square statistic is 20.333. The p -value is .002416. The result is significant at p < .05.
Metric	1	13	24	
Intermediate	6	29	22	
Graduation & above	30	36	77	
Experience				
0 Years (No Exp.)	13	13	9	The chi -square statistic is 22.8542. The p -value is .000135. The result is significant at p < .05.
1-5 Years	18	57	105	
6-10 Years	8	16	16	

Table 6 reveals significant associations between healthcare worker's knowledge levels and various demographic variables. Age demonstrates a notable association, chi-square (χ^2) = 10.5279, p = .032414, indicating differing knowledge levels across age groups. Occupation exhibits a substantial association, χ^2 = 92.118, p = 0.001, implying significant variations in knowledge levels among different roles. Educational qualification shows a noteworthy association, χ^2 = 20.333, p = .002416, highlighting knowledge level differences based on education. Experience indicates a significant association, χ^2 = 22.8542, p = .000135, reflecting disparities in knowledge based on healthcare experience. However, the association between knowledge and sex is not significant, χ^2 = 1.5221, p = .467169. These findings stress the importance of demographic considerations in addressing knowledge levels in biomedical waste management among healthcare workers.

Objective 5. To find out the association between the practice of biomedical waste management of healthcare workers and selected socio-demographic variable like age, gender, educational qualification, occupation and years of experience

Table 7. Association between Practice and Demographic variables of healthcare workers

Variables	Adequate level of Practice	Moderate level of Practice	Inadequate level of Practice	X^2
Age				
18-24	13	25	11	The chi-square statistic is 6.3475. The p-value is .174656. The resul t is not significant at p < .05.
25-31	23	100	38	
32 & Above	12	22	11	
Sex				
Male	20	80	21	The chi-square statistic is 7.2391. The p-value is .026795. The result is significant at p < .05.
Female	28	67	39	
Occupation				
Doctor	17	3	0	The chi -square stat istic is 181.8591. The p -value is .0001. The result is significant at p < .05.
Post-graduate	20	15	0	
Nurse	1	5	9	
Intern	4	43	3	
Lab Technician	6	37	2	
Sanitary workers	0	44	46	
Educational Qualification				
Below Metric	0	14	3	The chi -square statistic is 75.12. The p-value is .0001. The result is significant at p < .05.
Metric	0	13	25	
Intermediate	4	34	19	
Graduation & above	44	86	13	
Experience				
0 Years (No Exp.)	18	2	15	The chi-square statistic is 48.675. The p -value is < 0.00001. The result is significant at p < .05.
1-5 Years	19	108	53	
6-10 Years	9	24	7	

Table 7 reveals the association between healthcare worker's practice levels and demographic variables. While age displays differences in practice levels without statistical significance ($\chi^2 = 6.3475$, $p = .174656$), sex exhibits a significant association ($\chi^2 = 7.2391$, $p = .026795$), highlighting variations between male and female healthcare workers. Occupation demonstrates a highly significant association ($\chi^2 = 181.8591$, $p = .0001$), indicating substantial differences in practice levels among occupational roles. Educational qualification also shows significance ($\chi^2 = 75.12$, $p = .0001$), emphasizing practice disparities based on education. Experience exhibits a highly significant association ($\chi^2 = 48.675$, $p < 0.00001$), emphasizing differences in practice levels based on healthcare experience. These findings underscore the impact of demographic factors on healthcare workers' practices in biomedical waste management.

Conclusion:

Biomedical waste management is an essential and intricate process that encompasses various stages,

including the proper handling, collection, transportation, treatment, and disposal of waste generated within healthcare activities. This study specifically focused on healthcare workers in Patna, directing its attention to hospitals such as IGIMS, AIIMS, Gardiner, and PMCH. Employing a quantitative approach, the research aimed to assess a diverse group of participants, including doctors, postgraduate students, interns, nurses, lab technicians, and sanitary workers (ward boys and sweepers working in the hospital and dealing with BMW).

The primary objective of the study was to evaluate the knowledge and practices of healthcare professionals concerning the health hazards associated with hospital waste and the appropriate disposal techniques. It emphasized the critical importance of adequate knowledge and strict adherence to safety measures to ensure the secure handling and disposal of hazardous hospital waste, ultimately safeguarding the community from potential adverse effects.

Among the 255 participants, the majority fell within the 20-40 age groups (64.70%), with a nearly equal gender distribution (48.62% males, 51.37% females). The occupational diversity was notable, with sanitary workers forming the largest group (35.29%), followed by interns (19.60%) and lab technicians (17.64%). Most participants reported 4-10 years of professional experience (82.35%).

Survey findings illuminated the existing knowledge gaps among paramedical workers, with 15% exhibiting adequate knowledge, 34% demonstrating a moderate understanding, and 51% displaying inadequate knowledge. This underscored the necessity for targeted training interventions. In terms of practices, the majority (65%) within the 25-31 age groups exhibited a "Moderate" practice level, while females dominated across all age groups. Higher education showed a positive correlation, with 95% demonstrating a "Moderate" practice level, emphasizing the importance of education in adherence to proper practices.

Data analysis revealed a positive correlation (r=0.2383) between knowledge and practice, supporting the study's third objective and validating Hypothesis number 1. Associations with demographic variables indicated significant correlations with age, occupation, educational qualification, and experience. However, no significant association was found between knowledge and gender or practice and age.

Recommendations:

1. A comparative study can be conducted to assess the level of awareness on bio medical waste management between healthcare workers of government and private hospitals.
2. A similar study can be organized on large samples to assess the knowledge and practice regarding BMWM.
3. Orientation programs for healthcare professionals, support staff should be essential to ensure a comprehensive understanding of hospital functions. .
4. Advanced technologies to minimize waste should be applied especially in hospital areas prone to generating hazardous wastes.
5. Every hospital producing any form of waste should be registered and subjected to regular monitoring by a government agency.

References:

Acharya R, Sharma G, Sethia R, Meena R. (2015). A cross sectional study amongst paramedical workers and nursing students regarding awareness of various aspects of biomedical waste (management and handling) rules, *Int J Community Med Public Health. 2016 Jan; 3(1):303-308. DOI:* http://dx.doi.org/10.18203/2394-6040.ijcmph20151581

Patel PG, Raval P. (2019). Assessment of level of knowledge regarding biomedical waste management among healthcare workers in tertiary care hospital in Western India, IP *International Journal of Medical Microbiology* and Tropical Diseases, April-June,2019; 5(2):103-106. https://doi.org/10.18231/j.ijmmtd.2019.022

Swathi, C.M., Shirisha K., Shyamala, Sunder A. and Rao A. (2018). Evaluation of Biomedical Waste Management Practices in a Tertiary Health Care Institute in Telangana, India. *Int.J.Curr.Microbiol.App.Sci.* 7(07): 3226-3230. https://doi.org/10.20546/ijcmas.2018.707.376

World Health Organization (WHO) from https://www.who.int retrieved on 2nd October 2023.