Knowledge, Awareness And Practices Regarding Bio-Medical Waste Management Among Senior Staff Nurses Of A Tertiary Level Medical Hospital, Chattogram, Bangladesh.

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Abstract:
Biomedical waste (BMW) management is an issue of major concern of all healthcare providers and healthcare establishments as the waste produced during the course of healthcare activities carries potential for infection and injury more than any other type of waste. The main aim of this study was to determine the knowledge, attitude and practices regarding Biohazard (Medical Waste) management among senior staff nurses of a tertiary level Medical Hospital, Chattogram, Bangladesh. A total of 200 samples have been taken through descriptive type of cross-sectional study. A pre-tested, structured and modified interview administered questionnaire had been followed to collect data properly. The study reveals that though the respondents had satisfactory knowledge and favorable attitude on Biohazard Medical Waste (BMW) management, the practice level is poor. The majority of the respondents did not have any training on Biomedical Waste Management. A huge number said that the transports and disposal facilities were not up to the mark for solid and liquid wastes. So it is a big concern in the BMW management system that could lead to continuous contamination and exposure with humans who handle the waste.
Keywords: *Biomedical waste, World Health Organization, Disposal, Management.*

I.   Introduction:

Health care waste is a unique category of waste by the quality of its composition, source of generation, its hazardous nature and the need for appropriate protection during handling, treatment and disposal. Mismanagement of the waste affects not only the generators, operators but also the common people too.[1]

'Bio-medical waste' (BMW) means any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research pertaining thereto or in the production or testing thereof.[2] Due to the increase in the procedures that are carried out at the various health care setups, excessive amounts of waste have been generated at the centers of care.

Bangladesh approximately generates 2 kg/bed/ day [3] and this biomedical waste encompasses wastes like anatomical waste, cytotoxic wastes, sharps, which when inadequately segregated could cause different kinds of deadly infectious diseases like Human immunodeficiency virus(HIV) hepatitis C and B infections, etc,[4] and also cause disruptions in the environment, and adverse impact on ecological balance.[5,6] Adequate knowledge amongst the health care employees about the biomedical waste management rules and regulations, and their understanding of segregation, will help in the competent disposal of the waste in their respective organizations.[7]

Acceptable management of biomedical waste management begins from the initial stage of generation of waste, segregation at the source, storage at the site, disinfection, and transfer to the terminal disposal site plays a critical role in the disposal of waste. Hence adequate knowledge, attitudes and practices of the staff of the health care institutes play a very important role.[8,4,9]

Teaching institutes play a critical role in the health care setup as it is from these places that the future health care professionals and all those persons involved in the care giving to the community are trained.[10] Studies documented from different parts of the country; still convey that there are gaps in the Knowledge,

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lacunae in the attitudinal component and inconsistency in the practice aspects which are matters of concern among the health care professionals.[8,11-15]

Biomedical waste (BMW) management is an issue of major concern of all healthcare providers and healthcare establishments as the waste produced during the course of healthcare activities carries potential for infection and injury more than any other type of waste. According to Biomedical waste (Management and handling) Rules, 1998 of India, "biomedical waste" means any waste that is generated during diagnosis, treatment, or immunization of human beings or animals, or in research activities pertaining thereto in the production or testing of biological, and including categories as mentioned in schedule I.[16]

These rules prescribe the appropriate methods of managing various categories of biomedical waste (BMW) and also provide the legal framework for the same in our country. Several studies have revealed the risk and impact of disorganized and improper BMW management on healthcare personnel, patients, and hospital environment.[17, 18, 19] World Health Organization (WHO) estimated that in 2000, 21 million people were infected with hepatitis B, 2 million people with hepatitis C, and at least 2600,000 people with human immunodeficiency virus due to injections with contaminated syringes.[20]

Appropriate waste management should be an integral feature of any healthcare facility. According to WHO, the generation of hazardous waste is about 0.5 and 0.2 kg per hospital bed per day for high-income and low-income countries, respectively.[20] Among the various departments in the hospital operation room is a place where large amounts of BMW are generated on a daily basis. It is estimated that operating rooms account for 20%–33% of the total hospital waste. Proper management of waste in the operating room may have a significant impact on the overall hospital waste management. Hence, this study aims to assess the knowledge, attitude, and practices of BMW among operating room personnel.

Biomedical waste or hospital waste is any kind of waste containing infectious (or potentially infectious) materials generated during the treatment of humans or animals as well as during research involving biologics.[21] The aim of the study is to determine the knowledge, attitude and practices regarding Biohazard (Medical Waste) management among senior staff nurses of a tertiary level Medical Hospital, Chattogram, Bangladesh.

II.   Materials & Methods:

Study Design: It is a descriptive type of cross sectional study.

Study Population:
Different senior staff nurses working in a tertiary level Medical Hospital, Chattogram, Bangladesh was the populations of the study.

Study Period: This study was conducted from September, 2023 till February, 2024.

Study Area: Selected tertiary level Medical Hospital, Chattogram were covered as study area.

Inclusion Criteria: Senior staff nurses with given consent who willingly joined or participated in the study.

Exclusion Criteria: Senior staff nurses who felt unwilling to participate and who were unable to provide information.

Data Collection Tools: A pre-tested, structured and modified interview administered questionnaire was followed to collect data properly.

Sampling Technique: Non - randomized, non-probability and purposive sampling methods were followed.

Data Collection Technique: By following a face to face interview of the participants.

Data Analysis & Management Plan: All interview questionnaires were checked for its completeness, accuracy and consistency to exclude missing or incomplete data. Then data was checked, cleaned and edited again before analysis. The data was analyzed by using Excel Spreadsheet. Descriptive statistics was used for the interpretation of the findings.

Sample Size Calculation: Due to financial constraint and time limitation the researchers took 200 samples according to the guide's decision.

Ethical Consideration: For conducting the study, Ethical approval was obtained from the ethical board of University. The personal identification, information of the subjects involved in the research were replaced by codes in the protected archived computer data files. The paper forms with the personal identification information were stored in a high security procedure. Data files for statistical analysis were prepared to ensure the confidentiality of any information about the study participants and did not include any personal identification.

Quality Control & Quality Assurance: Regular assistance and guidance from the supervisor was taken for conducting interviews. Data collection and analysis was performed by the researcher himself. Report were made with the respondents before data collection. Data was checked and rechecked for reliability. A semi-structured questionnaire was used. Questionnaire was explained in local languages for better understanding.

III.   Result:

Socio demographics characteristics:

In this study among all the respondents the majority were in 36-45 years of age groups. Maximum respondents were female and the majority found a diploma in nursing by education level. Majority of the respondents' monthly family income was 40K-50K in BDT and most were living in the nuclear family. It was seen that the majority of the respondents' no. of family members were 2-4 people and most were living in urban areas.

Sl. No.	Variables	Options	Frequency	Percentage
1.	Age group	20-25 years 26-35 years 36-45 years above 46 years	15 32 138 15	7.5% 16% 69% 7.5%
2.	Gender	Female Male	190 10	95% 5%
3.	Academic qualification	Undergraduate Graduate Post graduate	111 16 73	55.5% 8% 36.5%
4.	Monthly family income	10-20k 20-30k 30-40k above 40k	54 122 23 1	27% 61% 11.5% 0.5%
5.	Family type	Nuclear Joint	162 38	81% 19%
6.	Number of family members	2-4 person 5-7 person 8-10 person	155 40 5	77.5% 20% 2.5%
7.	Area of living	Urban Sun-urban	186 14	93% 7%

Knowledge based variable:

When the respondents were asked about having knowledge on BMW management, in the reply maximum (91.5%) mentioned positive. Majority of the respondents' (94.5%) organization has its own waste treatment and disposal mechanism. In this study the majority of the respondents (35.5%) did not have any training on Biomedical Waste Management. Maximum (89%) did know that inappropriate Biomedical waste disposal causes health hazards. Maximum (95%) did know that attending an awareness programme on Biomedical Waste Management is important. Maximum (81%) did know that Biomedical waste should be segregated into different categories.

SI. No.	Variables	Options		Frequency		Percentage	
1.	Do you know about Biomedical Waste?	a) Yes b) No		a. 183 b. 17		a) 91.5% b) 8.5%	
2.	If yes, what is Bio-Medical Waste?	a. Waste generated during clinical diagnosis b. Waste generated during doctor's check up c. Waste generated during OT d. Waste generated during immunization e. All the above		a. 23 b. 31 c. 28 d. 19 e. 82		a. 8% b. 11% c. 9% d. 6% e. 66%	
3.	Do you know your organization has its own waste treatment and disposal mechanism?	a. Yes b. No		a) 189 b) 11		a. 94.5% b. 5.5%	
4.	Do you know Bio-Medical wastes are in the form of solid and liquid?	a. Yes b. No		a) 188 b) 12		a. 94% b. 6%	
5.	Do you have any training on Biomedical Waste Management?	a. Yes b. No		a. 129 b. 71		a) 64.5% b) 35.5%	
6.	Do you know inappropriate Biomedical waste disposal causes health hazards?	a) Yes b) No c) Don't Know		a) 164 b) 31 c) 5		a. 89% b. 9% c. 2%	
7.	Do you know attending an awareness programme on Biomedical Waste Management is important?	a. Yes b. No		a) 180 b) 20		a. 95% b. 5%	
8.	Do you know Biomedical waste should be segregated into different categories?	a) Yes b) No		a) 162 b) 38		a. 81% b. 19%	

Awareness based variables:

Here the majority of the respondents (81%) were aware about any training course on BMW Management at their center. But a huge number (73%) said that the transports and disposal facilities were not up to the mark for solid and liquid waste. A big portion (72.5%) mentioned there is no proper record about the quantity & quality of liquid waste generated and their discharging measures. A big number (84.5%) said that liquid waste was directly discharged in the sewer system. Majority (91%) said that there is no mechanism to decrease the toxicity of the waste generated. Maximum (60%) did not provide treatment procedures to workers related to collecting and handling of Waste. A number of respondents (80%) said that they were not aware of and following the rules and regulations of BMW.

SI. No.	Variables	Options	Frequency		Percentage	
1.	Are you aware about any training course on BMW Management at your center?	a.Yes b.No	a. 162 b. 38		a. 81% b. 19%	
2.	Are the transports and disposal facilities up to the mark for solid and liquid waste?	a.Yes b.No	a. 54 b. 146		a. 27% b. 73%	
3.	Is there a proper record about the quantity & quality of liquid waste generated and their discharging measures?	a.Yes b.No	a. 55 b. 145		a. 27.5% b. 72.5%	
4.	Is liquid waste directly discharged in the sewer system?	a.Yes b.No	a. 169 b. 31		a. 84.5% b. 15.5%	
5.	Are there facilities of accumulation and segregation particularly of solid waste through colored (Red, Black Yellow, Green) and labeled containers?	a.Yes b.No	a. 189 b. 11		a. 95% b. 5%	
6.	Any mechanism to decrease the toxicity of the waste generated?	a.Yes b.No	a. 18 b. 182		a. 9% b. 91%	
7.	Do you provide treatment procedures to workers related to collecting and Handling of Waste?	a.Yes b.No	a. 80 b. 120		a. 40% b. 60%	
8.	Are you aware and following the rules and regulations of BMW?	a.Yes b.No	a. 159% b. 41%		a. 80% b. 20%	

Practice based variables:

Majority respondents (91%) did regularly check any leakage of waste during the collection and transportation from source level to target. Here many respondents (72%) said that the trained personnel do not regularly handle the waste disposal. When the respondents were asked how BMWs are handled, in the reply many (92.5%) replied about segregation. When the respondents were asked to provide PPE to the waste handling workers, in the reply maximum (98%) replied positive. Here the majority (84.5%) respondents told, they did not carry out monthly medical checkups which include blood tests and other related tests. Majority (97.5%) follow any prescribed environmental assessment mechanism as well as auditing. It was seen that the majority (92.5%) did not use off-site bio-medical waste treatment and disposal plants.

Sl. No.	Variables	Options	Frequency	Percentage
1.	Regular check any leakage of waste during the collection and transportation from source level to the target? (if using off-site disposal)	a.Yes b.No	a. 182 b. 18	a. 91% b. 9%
2.	Do the trained personnel regularly handle the waste disposal?	a.Yes b.No	a. 57 b. 143	a. 28% b. 72%
3.	How are bio medical wastes handled in your organization?	a. Segregation. b. Storage. c. Autoclaved. d. Incineration	a) 185 b) 11 c) 1 d) 3	a) 92.5% b) 5.5% c) 0.5% d) 1.5%
4.	Provide PPE such as gloves, apron, mask etc. to the workers during waste handling?	a. Yes b. No	a. 196 b. 4	a. 98% b. 2%
5.	Use of offsite bio-medical waste treatment and disposal plants?	a. Yes b. No	a. 185 b. 15	a. 92.5% b. 7.5%
6.	Carry out a monthly medical checkup which includes a blood test (HIV-HBSAg-HCV etc.) and other related tests?	a. Yes b. No	a. 29 b. 171	a. 14.5% b. 85.5%
7.	Follow any prescribed environmental assessment mechanism as well as auditing?	a. Yes b. No	a. 195 b. 5	a. 97.5% b. 2.5%

IV. Discussion:

The knowledge of healthcare providers is very important to the best practices of waste management that help them, community, and environment to be safe from hazardous [23]. Furthermore another study discovered that stakeholder knowledge and practice play an essential role in MWM [24]. The findings from this study reveal varying levels of knowledge among nurses regarding biomedical waste management. Majority of health workers (91.5%) stated that they know medical waste. But the rate of those who know the definition of medical waste was 66% (Table 1). A similar study stated that 98.5% of respondents had heard of medical waste and 69.7% were aware of medical waste legislation [25].

The majority of the nurses (64.5%) participating in the study stated that they attended training in BMW. Providing training for health workers for sufficient medical waste management is very important. In this study, the majority of the participants were trained on MWM. This result is higher than other studies conducted (36.8%, 61.6%, 46.9%, respectively) [26, 27, 28]. 81% agreed that biomedical waste should be segregated into different categories. Medical waste segregation at the point of generation is critical in the BMW process where medical waste should be separated according to their nature. All medical wastes should be segregated at the point of generation [28, 29].

While assessing the awareness of the participants, it is found that 81% are aware about any training course on BMW Management at their center. There are facilities of accumulation and segregation particularly of solid waste through colored (Red, Black Yellow, Green) and labeled containers. Study by Mathur and associates showed that knowledge regarding the color coding and waste segregation at source was found to be better among nurses and laboratory staff as compared to doctors [30]. 80% participants are aware and following the rules and regulations of BMW. Similar result was noted by Akther et al (1999) while performing a similar type of research among tertiary healthcare workers [31].

Regarding practice level, it found that only 28% trained personnel regularly handle the waste disposal contrasting with findings from other studies where a higher percentage (59%) adhered to these rules [32, 33]. This might be because of poor monitoring and regulation of healthcare activities, safe handling and disposal of hospital waste. In a nutshell, enhancing the practice of BMW management among nurses is crucial for

mitigating health risks associated with biomedical waste. Healthcare facilities can contribute significantly to creating a safer and healthier environment for healthcare workers and the broader community by addressing these challenges through targeted educational initiatives and policy reforms.

V.   Conclusion:

The main aim of this study was to determine the knowledge, attitude and practices regarding Biohazard (Medical Waste) management among senior staff nurses of Chattogram Medical College Hospital, Chattogram, Bangladesh. Though the respondents had satisfactory knowledge and favorable attitude on Biohazard Medical Waste (BMW) management, the practice level is poor. The majority of the respondents did not have any training on Biomedical Waste Management. A huge number said that the transports and disposal facilities were not up to the mark for solid and liquid wastes. So it is a big concern in the BMW management system that could lead to continuous contamination and exposure with humans who handle the waste. It was also seen that a big portion of the respondents mentioned there is no proper record about the quantity & quality of liquid waste generated and their discharging measures. So this miss-management will lead to total failure of BMW management properly. Though a small number of the respondents said that liquid waste is directly discharged in the sewer system. It is another blunder in BMW management. And the discharged BMW in the sewer system will contaminate other areas. Still, a maximum of the respondents did not provide treatment procedures to workers related to collecting and handling of Waste and the majority of the respondents told, they did not carry out monthly medical checkups which included blood tests and other related tests. So the handlers will suffer and will be affected by any contaminant during BMW handling and will carry infection frequently. As majority respondents did not follow any prescribed environmental assessment mechanism as well as auditing. This will lead to environmental pollution by BMW. Also only a few trained personnel regularly handle the waste disposal. This indicates significant gaps in translating knowledge into consistent, effective practices, emphasizing the importance of educational initiatives to bridge these gaps and ensure comprehensive BMW management practices. Thus, regular monitoring and training is required to manage these wastes in a proper way.

VI.   Recommendation:

❖ Authorities should provide more sufficient training for health workers and support personnel who deal with medical waste management in healthcare settings.
❖ Timely and effective monitoring is recommended for health workers and support staff for enhancing sensitization to medical waste management.
❖ Organizing continuous training programs in the form of symposium, seminars and workshops on medical waste management to develop awareness among health workers are required.
❖ It is recommended that the hospital's managers advance the supervision and control to the personnel for practicing the procedures on medical waste management.
❖ It is essential to identify nurses' training regarding safe waste management policies and guidelines through ongoing evaluation of nurses' proficiency with and understanding of waste management in healthcare settings.

Conflicts Of Interest:
There are no conflicts of interest among authors.

Ethical Approval:
The ethical approval had been issued and the recommendations had been followed accordingly.

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