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Factors associated with the current state of biomedical waste management knowledge, attitude, and practices among the healthcare professionals at a tertiary level hospital in Cumilla, Bangladesh

Md. Farhad Hossain [1], Afsana Afroz [2], Md. Shoaib Arifin [3], Mahmuda Begum [2], Md. Fahad Jubayer [4,*]

[1]Upazila Health Complex, Dharmapasha, Sunamganj-2450, Bangladesh
[2]Mymensingh Medical College Hospital, Mymensingh-2200, Bangladesh
[3]Department of Agricultural Chemistry, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[4]Department of Food Engineering and Technology, Sylhet Agricultural University, Sylhet-3100, Bangladesh

ABSTRACT: Aside from saving lives and restoring health, healthcare operations can result in the generation of hazardous biomedical wastes (BMW) that are harmful to humans and to the environment. The generation and disposal of BMW has emerged as a global issue. BMW management success is highly reliant on the knowledge, attitude, and practices (KAP) of healthcare individuals, and there is a scarcity of such works in the Bangladesh setting. This study was conducted to assess the KAP as well as the associated factors influencing knowledge on BMW management among hospital health care professionals (HCPs) in Cumilla, Bangladesh. This was a cross-sectional study. A total of 374 responses were collected for this study between January and April of 2019. The questionnaire was divided into four sections: socio-demographic data, BMW management knowledge and attitude, as well as an observational questionnaire evaluating HCPs' practice on BMW management. Among the 374 respondents, 168 HCPs used to have satisfactory knowledge with an overall mean score of 6.8±1.2. A high mean score (7.3 ± 1.4) was obtained by the doctors followed by the nurses (6.7 ± 1.6). The attitude was also positive, but the practice was found to be inadequate. A statistically significant ($p<0.05$) relationship was discovered between knowledge level and educational qualification, gender, work experience. The importance of educating and training all HCPs on proper BMW management should be emphasized.

1. INTRODUCTION

Biomedical waste (BMW) is a concern to public health worldwide, particularly in low- and middle-income countries like Bangladesh. Each year, at least 5.2 million people, including 4 million children, die from diseases linked to uncontrolled medical waste around the world (Rahman et al., 2020). During the course of providing healthcare, healthcare facilities usually and unavoidably generate harmful and hazardous biomedical wastes (BMWs). Because of the features of its constituents and the source of its generation, health care waste is a distinct kind of waste (Deress et al., 2018). Significant amounts of health-care waste, if not properly managed, might pose a global concern. Inadequate and improper BMW management not only increases the danger of infection from diseases such as HIV, Hepatitis B and C virus, but also increases the risk of water, air, and soil pollution, negatively impacting the environment and population at large (N.K. Gupta et al., 2016). Biomedical waste has the potential to transmit more than 30 dangerous blood-borne diseases (Deress et al., 2018).

In Bangladesh, BMW management is hampered by a scarcity of resources, including space, electricity, and funds. Furthermore, the lack of a skilled personnel and BMW management operators in Bangladesh can be viewed as a restriction (Shammi et al., 2021). There are about 654 public hospitals and 5055 private hospitals and clinics with almost 141K beds, as well as additional 9K diagnostic center beds, all of which generate tons and tons of biomedical waste (Rahman

* Corresponding author.
E-mail address: fahadbau21@hotmail.com (Md. Fahad Jubayer)

et al., 2020). Because of COVID-19, at least 14,500 tons of trash from health care were generated all over the country in April 2020 (Rahman et al., 2020), indicating that in severe conditions, there may be a surge of BMW. It is a matter of great concern that, waste produced within Bangladeshi hospitals is frequently retrieved without segregation by inexperienced, unprotected, and untrained cleaners and disposed of in inappropriate locations without suitable treatment (Syed et al., 2012).

A safe and dependable approach for treating biological waste is required wherever it is created. Effective biological waste management is not just a legal need, but also a social responsibility. Because of ineffective BMW management, lack of awareness, and insufficient expertise, health care facilities are currently becoming hotspots for the transmission of infections. Every member of the medical staff is supposed to be well-versed in the collecting, handling, and disposal of BMW (Basu et al., 2012). The primary goal of BMW management is to reduce waste generation, ensure effective waste collection, handling, and disposal, and to enhance infection control and worker safety. A concerted, planned, and cooperative effort from physicians to ward-boys is required for this to happen. There are not many studies of BMW relevant issues in Bangladesh. The unprecedented growth of hospitals, clinics, diagnostic centers, and other facilities in various cities throughout Bangladesh has a great impact on social healthcare ecology due to waste generation and production. BMW management is heavily reliant on the knowledge and practices of competent personnel who work closely with these waste produces in various hospitals. Unfortunately, little was provided on the degree of knowledge, attitude, practice (KAP) scores, or other characteristics among healthcare professionals (HCPs) in Bangladesh who play critical roles in ensuring successful BMW management. With the preceding context, the current study was conducted to assess HCPs knowledge, attitude, practice, and associated factors regarding various aspects of BMW management in a tertiary care hospital in Cumilla, Bangladesh, so that the current status of KAP can aid the authority in developing strategies to improve the situation in the future.

2. MATERIALS AND METHODS

2.1. Study area

The study was conducted in Cumilla Medical College Hospital, Bangladesh. The two-storied hospital structure contained 750 indoor patients and a trigonal engaged tower with spiral steps in the center of the north fa'ade. This is the 2nd largest hospital in the Chittagon Division and the only referral hospital (Level 3) in greater Cumilla and delivering health care services to about 60 million people. The hospital complex is approximately 2,70,000 square feet in size, with 35 departments in total. The hospital contains 21 inpatient wards and 500 beds. This hospital continues to admit between 950 and 1050 patients every day. The admission turnover is 450-650 patients each day, with outdoor patient attendance ranging from 2000 to 2500.

2.2. Study design and sampling technique

An institution-based cross-sectional study was conducted from January 2019 to April 2019. After excluding study participants who did not meet the eligibility requirements, a total of 374 HCPs participated in this research. For this study, an entire population sampling technique (survey) was used. This sample technique was used since the research population in the hospital was small enough to be manageable for data collection and analysis. All HCPs, including doctors, nurses, pharmacists, interns, laboratory technicians, X-ray technicians, and others, aged 21 and above, males and females, with a minimum of 6 months professional experiences, were eligible to participate in the study. Participants in the study who were available throughout the data collecting period and agreed to participate in the study were included.

2.3. Data collection tools and procedure

A structured and self-administered questionnaire and observational checklist were prepared to collect the data. For convenience, two versions (English and Bengali) of the questionnaire were prepared. For the data collection work, five trained data collectors were employed. Hard copies of written informed consent comprising questionnaires were provided to study participants. The data collection techniques were validated with 10% of the study population those were not included in the final study. The contents of data collection tools were somewhat updated based on the pilot survey. Cronbach's alpha for the questionnaire was 0.75, indicating that it is a valid and reliable instrument for assessment purposes. The practice questionnaire was filled out by the researcher after completing the tool using an observational method.

2.4. Methods of scoring

The knowledge questionnaire has 10 multiple-choice questions, each with four options. In the knowledge section, questions were scored with a 1 for a correct response and a 0 for a wrong response. The attitude section consisted of ten questions. In the attitude section the answering options were: a) agree, b) disagree, and c) not sure). The observation questionnaire was used to evaluate HCPs practice in the hospital. It had ten questions with answering options of "always," "occasionally," and "never." The researcher monitored HCPs in action and filled out the questionnaire firsthand. For analysis, the scores were summed together. The interpretations of the scores were graded as excellent if they were 75% or higher, good if they between 50% to 74%, and poor if they were less than 50%.

2.5. Statistical analysis

SPSS version 20.0 was used to analyze the data (SPSS Inc., Chicago, Illinois, USA). The frequency distribution was computed using descriptive analysis and expressed as 'mean $\pm$ standard' deviatio'n and median with range. The Chi-square test was performed to evaluate the relationship between knowledge and their demographic features. A p value of ≤ 0.05 was considered significant.

2.6. Ethical consideration

The institutional ethics committee provided ethical approval for the study. During the entire study, no personal and sensitive information was used. All data were stored on a password-protected computer to which only the research team had access. The respondents' participation in the study was entirely voluntary, and all provided informed consent.

3. RESULTS

3.1. Demographic characteristics

Among the 374 participants included in this study, 179 (47.9%) were below 30 years, and the majority of the participants were female (63.4%). The highest educational qualification held by more than 60% of the respondents (61.2%, n=229) was a bachelor's degree (MBBS or BSc). In terms of occupation, 99 (26.5%) of the HCPs were doctors, and 148 (39.6%) were nurses. In addition, 207 (55.3%t) of the study participants had at least 3 years of experience.

3.2. Knowledge, attitude, and practices

It was observed from that 44.9% (n=168) had excellent knowledge, 35.3% (n=132) had good knowledge and 19.8% (n=74) had poor knowledge. The average score was 6.8 ± 1.2. Doctors had the highest mean score (7.3 ± 1.4), followed by nurses (6.7 ± 1.6) (Table 1). The thematic area of the knowledge questions can be found in the 'supplementary information' section at the end of this article.

Table 1
Knowledge score ofthe healthcare professionals regarding BMW management

Categories	Knowledge score
Doctor	7.3 ± 1.4
Nurses	6.7 ± 1.6
Pharmacists	6.5 ± 1.2
Lab technicians	6.6 ± 1.6
Internee (medical students)	6.5 ± 1.8

In the attitude section, we discovered that a significant amount of people (68.2%) have a positive and desirable attitude toward BMW management, while the rest (31.8%) appear to have a negative attitude. As demonstrated in Table 2, 325 (86.9%) HCWs agree that proper BMW disposal is essential and necessary in hospital settings. A similar number of participants (80.5%, n=305) believe that effective team efforts are required for BMW management. Despite the fact that many of them (59.6%, n=223) regard this practice as an additional burden to their daily activities. We received excellent responses (>75%) regarding PPE use, the significance of color code, and the outlook to BMW management as a healthcare QA indicator. A considerable number of respondents (73.8%, n= 276) felt it was important to stay informed about BMW management.

Table 2
Attitude of the healthcare professionals regarding BMW management

Attitude questions	Positive, n (%)	Negative, n (%)
In the hospital setting, safe disposal of BMW is important	325 (86.9)	49 (13.1)
No infectious diseases are transmitted by BMWs	215 (57.5)	159 (42.5)
Safe management of BMW needs team efforts	301 (80.5)	73 (19.5)
BMW management places an additional burden on daily duties.	151 (40.4)	223 (59.6)
Personal protective equipment (PPEs) can help reduce the risk of infection	294 (76.6)	80 (21.4)
The use of a color code for waste segregation is compulsorily required	308 (82.4)	66 (17.6)
Infection can be reduced by decontamination and disinfection	275 (73.5)	99 (26.5)
BMW segregation promotes safe and reliable operation	115 (30.7)	259 (69.3)
BMW management improves the quality assurance of healthcare sectors	301 (80.5)	73 (19.5)
It is necessary to update one's knowledge of BMW management	276 (73.8)	98 (26.2)

Table 3 shows the pattern of BMW management practices of the participants.The majority of respondents were found to follow the guidelines for BMW management (78.3%) and the infection control policy (77.3%) while on duty. PPE wearing and removal habits were observed to be extremely poor during and after handling the BMW. Less than 40% of the respondents were used to it. Over half of those polled (53.7%) were aware of personal hygiene (hand washing) and the use of color-coded containers (52.1%) for BMW disposal. However, only 53.2% of participants demonstrated desirable BMW management practices. Table 4 shows that there was a significant relationship between the level of knowledge and the demographic factors such as gender ($P<0.05$), educational qualification ($P<0.05$), and professional experiences ($P<0.05$).

4. DISCUSSION

Statutory health care regulations of BMW management and careful supervision of their compliance cannot achieve the final goal unless they are supplemented by an approach of education, inspiration, and attitude change in all hierarchy of health practitioners (Aanandaswamy et al., 2019). Thus, an effective and successful BMW management program is primarily dependent on health care personnel' knowledge, attitude, and practices. (M. Kumar et al., 2015). According to the current study, 80% of respondents had sufficient knowledge of BMW management. According to a number of studies, knowledge of BMW management was high among doctors, nurses, and lab technicians but low among sanitary staffs (Mathur et al., 2011; Pandit et al., 2005; Saini et al., 2005). Despite the fact that no sanitary staffs were included in this study, there was no significant knowledge difference between the doctor, nurse, technicians, and interns.

Table 3
Practices of the healthcare professionals regarding BMW management

Practice questions	Desired, n (%)	Undesired, n (%)
Does she/he maintain BMW records?	162 (43.3)	212 (56.7)
Does she/he adhere to the Ministry of Health's guidelines for BMW management?	293 (78.3)	81 (21.7)
Is she/he following the infection control policy when dealing with patients?	289 (77.3)	85 (22.7)
Does she/he practice proper hand hygiene before and after every procedure, and on a regular basis?	201 (53.7)	173 (46.3)
Is she/he wearing PPE when handling biomedical waste?	148 (39.6)	226 (60.4)
Does she/he remove of all PPE after handling biomedical waste?	137 (36.6)	237 (63.4)
Does she/he use color-coded containers for different types of waste when disposing of BMW?	195 (52.1)	179 (47.9)
Does she/he dispose the sharps in puncture proof containers?	203 (74.3)	171 (45.7)
Does she/he follow policies that segregate BMW as nonhazardous, hazardous, and sharp waste?	186 (49.7)	188 (50.3)
Ever undergone training for BMW management?	176 (47.1)	198 (52.9)

Table 4
Association of the BMW management knowledge with demographic variables

Demographic variables	Performance			Significance
	Excellent	Good	Poor	
Age (years)				
21-30	74	64	40	χ2=11.281 p=0.0698
31-40	50	55	17	
41-50	36	9	4	
>51	12	8	5	
Gender				
Male	48	58	29	χ2=14.011 p=0.0006*
Female	122	79	38	
Education				
MSc	59	13	8	χ2=69.995 p=0.0001*
MBBS/BSc	93	99	39	
Diploma	3	14	20	
Others	10	12	4	
Field of work				
Doctor	56	25	9	χ2=13.146 p=0.3984
Nurses	63	66	20	
Pharmacists	5	7	4	
Lab technicians	16	10	8	
Internee (medical students)	32	30	23	
Professional experience (years)				
<3	88	78	40	χ2=19.120 p=0.0122*
3-6	34	33	21	
7-10	31	13	5	
>10	18	12	1	

Furthermore, many studies have mentioned that health care workers have adequate BMW management knowledge, which is consistent with the current findings (Dalui et al., 2021; V. Gupta et al., 2015; Sachan et al., 2012).

Mugabi et al. (Mugabi et al., 2018) performed a study at a tertiary hospital and discovered that there was significant agreement among the subjects on proper medical waste segregation to be carried out at the point of generation, with an average score of 4.43 out of 5, as well as on the color-coding system, with a mean score of 4.59 out of 5. In this current research, the mean score of the respondents in the knowledge section about BMW management was 13.6 $\pm$ 3.4. In this study, doctors appear to have higher knowledge scores than other healthcare workers. According to studies conducted at some institutes, doctors have a higher level of knowledge about BMW management than other personnel (Aanandaswamy et al., 2019; Jalal et al., 2021).

Different color-coding containers for segregation was among the most essential issues of the BMW management process, which was followed and practiced by 52.1% of our study's respondents. It was discovered in various studies that, despite having good knowledge on the color-code issue, participants had a low level of practice (Dalui et al., 2021; Pandey et al., 2016). According to the current study, more than 75% of HCWs always followed infection control regulations when dealing with patients, but have poor practices regarding the use and disposal of PPE. A poor level of understanding and practice regarding this issue was also observed in a study in Asser, KSA (Arbash et al., 2021).

Environmental and public health protection are the responsibility of healthcare facilities. As a result, training HCPs in effective BMW management is a critical step (Deress et al., 2018). Only 47.1% of the survey respondents were trained on BMW management in this study, which is comparatively lower than another study from Bangladesh (61.6%) (Uddin et al., 2014) and similar to another study from Gondar town (46.9%) (Muluken et al., 2013). Another study, however, found a very low percentage (35.4%) of trained respondents in BMW management (M. Kumar et al., 2015).

In our investigation, there was a significant ($p<0.05$) relationship between knowledge level and different demographic factors such as gender, academic background, and work experience. Kumar et al. (R. Kumar et al., 2013) also demonstrated that, when compared to the practices, socio-demographic information such as age, gender, level of education, and experience was statistically significant ($p<0.05$).

5. LIMITATIONS

This study had the potential for recall bias because it required recall for knowledge-related questions. The researcher observed the practice firsthand, which may have influenced his findings. Due to financial constraints, liquid BMWs were not evaluated in this study. The study could not be generalized at the national

level because it was conducted in a limited geographical area. This study could be replicated as an interventional study with larger samples of all types of HCPs from a larger geographic area.

6. CONCLUSION

In a densely populated country like Bangladesh, hospitals are expected to be overflowing with patients. As a result, the daily generation of BMW must be managed with great care, and respective individuals must have a thorough understanding of the issue. According to the current study, the healthcare professionals at Cumilla Medical College have strong knowledge and a positive attitude toward BMW management, but their regular practice falls short. Furthermore, gender, academic background, and work experience all played a significant role in BMW management knowledge. The remaining demographic variables had minimal impact on the BMW management knowledge level. Respondents having an MBBS or BSc degree, as well as doctors by profession, demonstrated a high level of expertise on this topic. Finally, the current findings highlight the importance of organizing continuous training programs on BMW management in the form of symposia, seminars, and workshops to raise awareness and improve practices among HCWs in all healthcare settings.

7. THEMATIC AREAS OF KNOWLEDGE RELATED QUESTIONS ON BMW MANAGEMENT

Primary sources of BMW
Concept of different BMW categories
BMW storage
Biohazard symbols
Color coding of different containers
Diseases types and transmission
Discarding the needles
Segregation of BMW
Universal precautions
BMW disposal

CONFLICTS OF INTEREST

We declare that there are no conflicts of interest.

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ORCID

Md. Farhad Hossain 0000-0001-9677-4497
Afsana Afroz 0000-0001-7180-5605
Md. Shoaib Arifin 0000-0003-0922-6228
Mahmuda Begum 0000-0001-8249-3715
Md. Fahad Jubayer 000-0003-4914-7284

AUTHOR CONTRIBUTIONS

MFH - Research concept and design; MFH, AA, MSA, MB - Collection and/or assembly of data; MFH, AA, MSA, MB, MFJ - Data analysis and interpretation; MFH, AA, MSA, MB, MFJ - Writing the article; MFH, MFJ - Critical revision of the article; MFH, MFJ - Final approval of the article.

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