

AWARENESS AND PRACTICE ON BIOMEDICAL WASTE MANAGEMENT AMONG HEALTHCARE PROVIDERS IN PILAKHUWA, HAPUR DISTRICT, INDIA

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ABSTRACT

Biomedical waste, otherwise called hospital or clinical waste, refers to all waste either biological or non-biological generated within healthcare institutions in the process of diagnosis, treatment or immunization of patients or in research activities which includes hospitals, clinics, medical laboratories, dispensaries, veterinary hospitals, blood banks and home healthcare. The main aim of this research was to assess awareness level and practice on biomedical waste management among healthcare workers in three sampled hospitals. Questionnaire was used in data collection. Four groups of healthcare workers from the three sampled hospitals were surveyed. A total of 120 respondents were randomly selected among doctors, nurses, medical lab scientists, and environmental health workers from the three hospitals selected for this study. Two-way and one-way chi-square tests of independence were employed to determine significant difference in awareness and practice among the respondents across the three hospitals. Results showed that 62% of the total respondents were males, 42.2% were between 21-30 years. Nurses account for 51% of the total population, medical doctors had comparatively higher level of awareness and practice on biomedical waste management. Results of chi-square tests revealed no significant difference in awareness on categories of biomedical waste, steps of medical waste management and use of Personal Protective Devices (PPD).

KEY WORDS: *Biomedical waste, healthcare providers, medical doctors India, waste management*

INTRODUCTION

Over the past two decades, healthcare waste has been identified as one of the major problems that negatively impacted both human health and the environment when improperly stored, transported and disposed. For many years, the World Health Organization has advocated that medical waste be regarded as special waste, and acknowledged that certain categories of healthcare waste are among the most hazardous and potentially dangerous. Many synonyms to medical waste exist and they are currently used interchangeably in different parts of the world and in different scientific journals.

According to Moritz (1995) some of the easily come across synonyms are clinical waste, hospital waste and biomedical waste. The WHO uses the term healthcare waste in reports and other official publications. There are many institutions which pollute the environments, but recently the ignored field which produces more pollution by way of healthcare waste disposal which also attracts the attention of environmentalists are the hospitals, dispensaries, medical shops, medical clinics of doctors and other paramedical institutions.

Phillips (1999), defines clinical waste as: - waste arising from investigation, treatment or in medical care of patient. According to Pruss et al. (1999) Healthcare waste is defined as the total waste generated in healthcare facilities and in addition to hospitals and clinics includes waste generated by blood banks, research facilities and laboratories irrespective of the volumes, characteristics and composition. Al-Mutair et al. (2004) define medical waste as any solid or liquid waste capable of causing infectious diseases generated as a result of patient's diagnosis and treatment or in related research through the immunization of human and animals. Hospital waste is not only hazardous but dangerous to human health, animals and plants in some other ways. Every day the country's numerous hospitals and other medical institutions generated millions of tons of waste. An alarming percentage of waste was disposed in an open space, creating environmental problems. Healthcare wastes are hazardous in nature, and damage the environment even in low concentration; hence it is necessary to take precautionary measures so that hazardous components in the waste are rendered harmless through proper treatment by technology and safe disposal methods. The generation of these wastes is an on-going phenomenon as long as human civilization persists.

The waste generated from the healthcare units are generally classified as infectious and non-infectious wastes, the infectious healthcare wastes are termed as hospital wastes and are considered to be potentially hazardous in nature. The disposal of untreated healthcare wastes along with non-infectious hospital wastes or other general wastes poses an environmental threat and public health risk. Indiscriminate disposal of untreated healthcare waste is often the cause for the spread of several infectious diseases. It was also

responsible for the nosocomial diseases (the hospital acquired diseases), to the health care personnel who handle these wastes at the point of generation. Moreover this is equally harmful to persons involved in the healthcare waste management (Segregation, Storage, Transportation, treatments and disposal). Apart from the above, a good amount of healthcare waste such as disposed syringes, saline bottles, IV fluids bottles etc. are usually picked up by waste pickers or scavengers and are recycled back into the market without any disinfection. It is imperative, therefore to adopt appropriate method for the disposal of health care waste.

This study conducted a comparative analysis to assess the professional awareness and practice on biomedical waste management among healthcare providers in Pilakhuwa, Hapur district, India.

MATERIALS AND METHODS

STUDY AREA

Pilakhuwa Nagar Palika Parishad, with population of about 84 thousand is Hapur sub district's the least populous Nagar Palika Parishad located in Hapur sub district of Ghaziabad district in the state Uttar Pradesh in India. Total geographical area of Pilakhuwa Nagar Palika Parishad is 5 km and it is the smallest city by area in the sub district. Population density of the city is 15799 persons per km. There are 25 wards in the city, among them Pilakhuwa Ward No 11 is the most populous ward with population of 6998 and Pilakhuwa Ward No 16 is the least populous ward with population of 1949. Hapur is the sub district head quarter and the distance from the city is 12 km. The district headquarter of the city is Ghaziabad which is 24 km away. Yearly average rainfall of the city is 547 mm. Maximum temperature here reaches up to 45°C and minimum temperature goes down to 3°C.

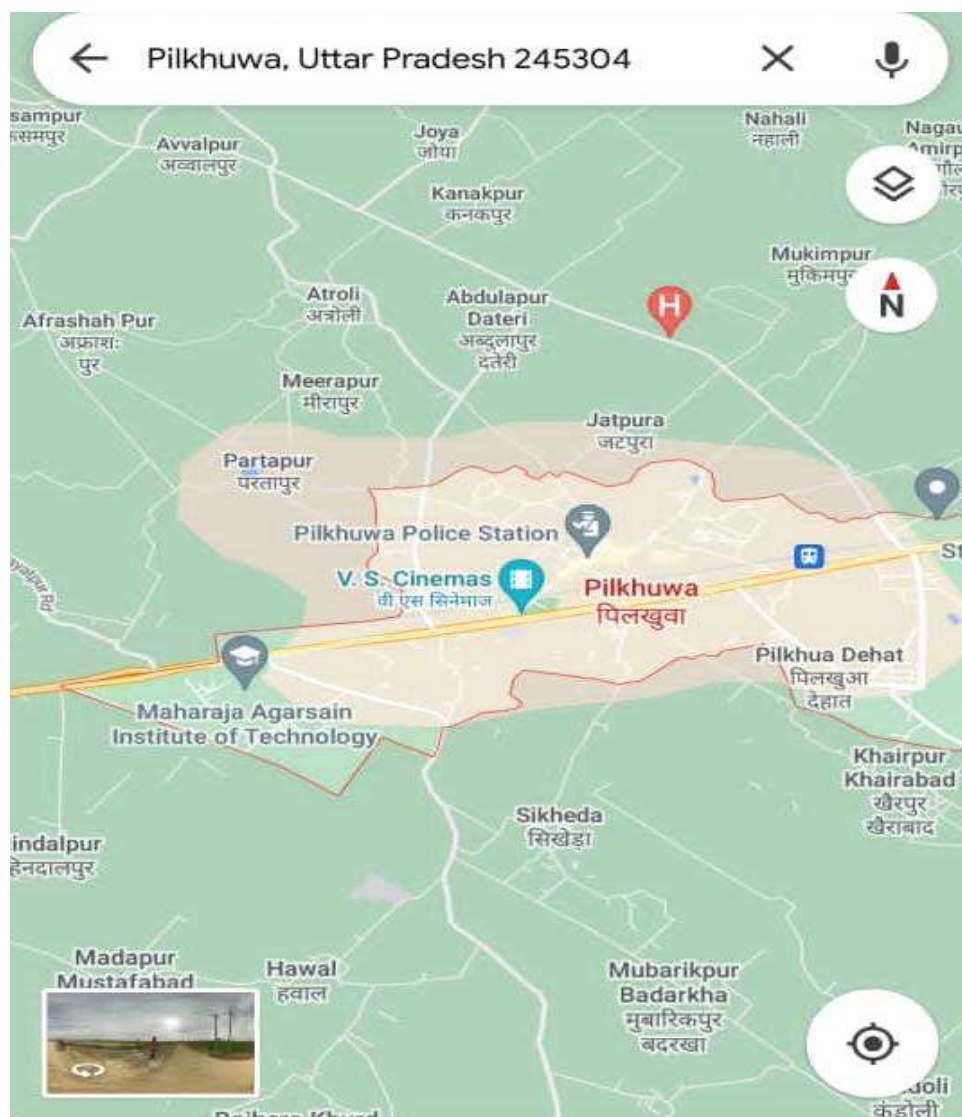


Figure 1: Study area

STUDY DESIGN AND PARTICIPANTS

A cross-sectional study was conducted among healthcare providers in three hospitals namely Saraswati Medical College, Rama Medical College and Government Hospital Pilakhuwa to assess the level of awareness and practice towards biomedical waste management. A total of 120 healthcare providers were recruited for the study. Twenty eight of them being doctors, fifty one are nurses; eighteen are laboratory scientist and twenty three of them are environmental health workers. Structured questionnaire was

the instrument used in the data collection. The instrument comprises of two sections. Section A invites responses on socio-demographic characteristics of the participant such as gender, age group and profession. Section B on the other hand focuses on issues related to biomedical waste and its management. The instrument was designed on a yes/no basis. Participant's overall awareness was judge using Boom's cut-off points as good if the percentage of yes answered is 80 and above, average if the percentage was between 60 and 79 and poor if the percentage was less than 60. Same procedure was used for practice level.

DATA ANALYSIS

Frequency table was used to summarized the results while one-way and two-way chi-square tests were employed assess the significance difference in the level of awareness and practice among the study participants. Statistical significance was set at $P < 0.05$.

ETHICAL CONSIDERATION

Prior to data collection, a written permission was obtained from the management of the hospitals, which enabled the direct access to respondents and other facilities of the hospitals for accurate collection of data. However the safety and privacy of the hospitals and the respondents was guaranteed. At the end of the research all the literature used was acknowledged, cited and fully referenced.

RESULTS

SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

From the 120 participants enrolled in the study, 61.7% were male and 38.3% were female (Table 1). Of the three sampled healthcare facilities, Rama medical college and hospital accounts for the largest proportion of male respondents while Saraswati medical college and hospital had the highest number of female respondents (Table 1). Majority of the respondents (44.2%) belonged to the age group 21-30 years, while few of them (5%) had their age higher than 50 years (Table 1). A chi-square test of independence revealed that all socio-demographic variables (Table 1) were significantly different in their distribution (calculated values are higher than critical values).

TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Variables	SMCH	RMCH	GHP	TOTAL	Chi-square	
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Calculated	Tabulated
Gender:						
Male	28 (56)	32 (64)	14 (70)	74 (61.7)	6.54	3.841
Female	22 (44)	18 (36)	6 (30)	46 (38.3)		
Total	50 (100)	50 (100)	20 (100)	120 (100)		
Age group (yrs):						
21-30	23 (46)	25 (50)	5 (25)	53 (44.2)	58.99	7.815
31-40	17 (34)	15 (30)	10 (50)	42 (35.0)		
41-50	7 (14)	8 (16)	4 (20)	19 (15.8)		
50+	3 (6)	2 (4)	1 (5)	6 (5.0)		
Total	50 (100)	50 (100)	20 (100)	120 (100)		
Profession:						
Doctors	10 (20)	12 (24)	6 (30)	28 (23.3)	21.26	7.815
Nurses	20 (40)	25 (50)	6 (30)	51 (42.5)		
Lab Scientists	10 (20)	6 (12)	2 (10)	18 (15.0)		
Environmental Health Workers	10 (20)	7 (14)	6 (30)	23 (19.2)		
Total	50 (100)	50 (100)	20 (100)	120 (100)		

Source: Field survey, 2016

NB: SMCH (Sarawati Medical College and Hospital), RMCH (Rama Medical College and Hospital), GHP (Government Hospital Pilakhuwa)

Respondent's Awareness on Biomedical Waste Management

Awareness of healthcare providers on medical waste was assessed across the three healthcare facilities in Pilakhuwa, Hapur district, India. The results were presented in Tables 2-4. Table 2 shows awareness on the categories of biomedical waste. From the table, the entire medical doctors indicate their awareness on the categories of biomedical waste. Nurses were ranked second with 84.3%

followed by medical lab scientists who scored 83.3%. Environmental health workers have the least level of awareness 34.8% in terms of biomedical waste classification. Of the three healthcare facilities assessed, Rama Medical College and Hospital, have the highest proportion of respondents who indicated awareness on this issue, while Government Hospital Pilakhuwa accounts for the least proportion (70%). The two-way chi-square test of statistics revealed that the differences in the level of awareness were not statistically significant (Table 2).

TABLE 2: RESPONDENT'S AWARENESS ON CATEGORIES OF BIOMEDICAL WASTE

Hospital	Doctors		Nurses		Medical Lab Scientists		Environmental Health Workers		Overall %
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)	
SMCH	10(20)	0(0)	18(36)	2(4)	8(16)	2(4)	2(4)	8(16)	76
RMCH	12(24)	0(0)	20(40)	5(10)	5(10)	1(2)	5(10)	2(4)	84
GHP	6(12)	0(0)	5(10)	1(2)	2(4)	0(0)	1(2)	5(10)	70
TOTAL	28(100)	0(0)	43(84.3)	8(15.7)	15(83.3)	3(16.7)	8(34.8)	15(65.2)	
X^2 Calculated = 3.627, X^2 Tabulated = 12.592, DF = (4-1)(3-1) = 6									

Source: Field survey, 2016

Regarding the steps of biomedical waste management, Table 3 shows that all the surveyed doctors identified their complete awareness compared to environmental health workers who scored only 21.74% awareness level. However, more than 60% of participating nurses and medical lab scientists are equally aware about the steps (Table 3). Hospital wise, Government Hospital Pilakhuwa reported the highest percentage (70%) of awareness followed by Rama Medical College and Hospital who scored 68%. As shown in Table 3, no statistically significant difference was observed between the respondents across the three hospitals.

TABLE 3: RESPONDENT'S AWARENESS ON STEPS OF BIOMEDICAL WASTE MANAGEMENT PRACTICE

Hospital	Doctors		Nurses		Medical Lab Scientists		Environmental Health Workers		Overall %
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)	
SMCH	10(20)	0(0)	15(30)	5(10)	5(10)	5(10)	0(0)	10(20)	60
RMCH	12(24)	0(0)	15(30)	10(20)	4(8)	2(4)	2(4)	3(6)	68
GHP	6(30)	0(0)	4(20)	2(10)	2(10)	0(0)	2(10)	4(20)	70
TOTAL	28(100)	0(0)	43(84.3)	8(15.7)	15(83.3)	3(16.7)	8(34.8)	15(65.2)	
X^2 Calculated = 2.338, X^2 Tabulated = 12.592, DF = (4-1)(3-1) = 6									

Source: Field survey, 2016

Study participants were asked to indicate their awareness or otherwise regarding the rules of biomedical waste disposal. From the result presented in table 4, most of the surveyed healthcare providers (51.7%) were aware of the set rules. Government Hospital Pilakhuwa recorded the greatest proportion of respondents who are aware with (53%). Table 4 further shows that the variation in the responses across different hospitals is statistically significant.

TABLE 4: AWARENESS ON RULES OF BIOMEDICAL WASTE DISPOSAL

Hospitals	No. of Respondents	Yes(%)	No(%)
SMCH	50	20(40)	30(60)
RMCH	50	27(54)	23(46)
GHP	20	15(75)	5(25)
TOTAL	150	62(51.7)	58(48.3)
X^2 Calculated = 27.96, X^2 Tabulated = 5.99, DF= 2			

Source: Fieldwork, 2016

Table 5 shows overall awareness level among respondents and across hospitals under investigation. From the results doctors had good level of awareness while nurses and medical lab scientist had average awareness. Environmental health workers on the other hand reported poor awareness level on biomedical waste management practice (Table 5). Based on healthcare facilities, Government

Hospital Pilakhuwa and Rama Medical College and Hospital showed average level of awareness, while Saraswati Medical College and Hospital fall under poor awareness level.

TABLE 5: OVERALL AWARENESS LEVEL ON MEDICAL WASTE MANAGEMENT

Work Designation	Mean %	overall awareness level
Doctors	100	Good
Nurses	75.5	Average
Medical lab Scientists	72.2	Average
Environmental Health Workers	28.3	Poor
Health Facilities:		
SMCH	58.7	Poor
RMCH	68.7	Average
GHP	71.7	Average

Source: Field Survey, 2016

ASSESSMENT PRACTICE

Responses on practice towards the use of personal protective devices during handling of biomedical waste were invited. Table 6 contained the result. From the Table, all the participating doctors indicate full use of personal protective device while handling biomedical waste. Environmental health workers were the group of healthcare providers that are associated with poor utilization of protective measures while handling biomedical waste. The differences in using protective measures were not statistically significant among the respondents and across the facilities (Table 6).

TABLE 6: RESPONDENT'S USE OF PPD WHILE HANDLING BIOMEDICAL WASTE

Hospital	Doctors		Nurses		Medical Lab Scientists		Environmental Health Workers		
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)	Overall %
SMCH	10(20)	0(0)	18(36)	2(4)	7(14)	3(6)	4(8)	6(12)	78
RMCH	12(24)	0(0)	20(40)	5(10)	4(8)	2(4)	6(12)	1(2)	84
GHP	6(30)	0(0)	4(20)	2(10)	2(10)	0(0)	2(10)	4(20)	70
TOTAL	28(100)	0(0)	42(82.4)	9(17.6)	14(72.2)	5(27.8)	12(52.2)	11(47.8)	

X^2 Calculated = 3.778, X^2 Tabulated = 12.592, DF = (4-1)(3-1) = 6

Source: Field survey, 2016

The overall practice as shown in Table 7 indicate that doctors and nurses had good practices regarding the use of Personal Protective Devices compared to other groups of healthcare workers. However, variation was also noted among the healthcare facilities. Rama Medical College and Hospital had good practice while Saraswati Medical College and Government Hospital Pilakhuwa on the other hand had average level of practice.

TABLE 7: OVERALL PRACTICE LEVEL ON THE USE OF PERSONAL PROTECTIVE DEVICES

Work Designation	Mean %	overall practice level
Doctors	100	Good
Nurses	82.4	Good
Medical lab Scientists	72.2	Average
Environmental Health Workers	52.2	Poor
Healthcare Facilities:		
SMCH	78.0	Average
RMCH	84.0	Good
GHP	70.0	Average

Source: Field Survey, 2016

DISCUSSION

This study was primarily conducted to assess the level of awareness and practice of biomedical waste management among some selected healthcare facilities. The study compares the level of awareness and practice among different professions in the healthcare delivery from the selected healthcare facilities. This was to discover if there is any gap among them so as to suggest for improvement.

The finding of the study shows that slightly more than half (51%) of the respondents were nurses. Their number is much higher compared to other professions because they are the most numerous group in the majority healthcare sector. Their services are very essential as they assist doctors in discharging their duties. The findings of this research are in line with the works of (Yenesew et al. 2012; Njiru et al. 2013; Sabageh et al. 2015; Letho et al. 2021) who reported high number of nurses compared to other professions in most healthcare facilities.

Directorate General of Health Services, Ministry of Health and Family welfare (DGHSMHF) in collaboration with Central Pollution Control Board, Ministry of Environment, Forest and Climate Change (WPCBMEFCC) in 2016 prepared healthcare waste guideline manual to provide a proper way of managing healthcare waste. The guideline categorizes biomedical waste generated from healthcare facilities into four classes based on the segregation mode and colour code. First, Yellow category, this group includes human anatomic waste (human tissues, organs, body parts and fetus), animal anatomic waste (experimental animal carcasses, body parts, organs, tissues), soiled waste (items contaminated with blood, body fluids like dressing plaster casts, cotton swabs and bags containing residual blood), chemical waste, chemical liquid waste and discarded linen, mattresses, beddings contaminated with blood or body fluids. The second group is the red consisting of waste generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringe without needles, and gloves. Third, is the white category comprises of waste sharp such as metals, needles, syringes with fixed needles, scalpels, blades or any other contaminated sharp object that cause injury. Last, is the blue colour category which includes broken or discarded and contaminated glass such as medicine vials and ampoules. The finding on categories of waste based on Indian healthcare waste guideline manuals discovered that 78.3% of the surveyed respondents are aware of the classification of biomedical waste as contained in the guideline manual. This result is lower than that of Ludhiana, India which indicates that 95.8% of healthcare workers knew classification of healthcare waste (Mathew et al. 2011). However, our result is much higher than the study conducted in Ethiopia by Yenesew et al. (2012) where only 11.2% participants knew about biomedical waste classification.

Based on the steps involved in biomedical waste management five steps were described in healthcare waste guideline manuals. These steps are 1) Waste segregation in colour coded and barcode labelled bags/containers at source of generation, 2) Pre-treatment of laboratory and highly infectious waste, 3) Intra-mural transportation of segregated waste to central storage area, 4) Temporary storage of biomedical waste in central storage and 5) Treatment and disposal of biomedical waste. In this study, majority of the respondents (62.5%) are aware of these steps. Our finding is similar to the work of Njiru et al. (2013) who also found more than two-third of their respondents were fully aware of the stages.

As per the provisions under biomedical waste management rules, 2016, responsibilities have been vested upon healthcare facilities in India. The responsibilities include legal compliance, submission of accidents and annual reports, ensuring occupational safety of employees, monitoring and reviewing of the activities related to biomedical waste handling, training of healthcare workers and implementation of rules. In our survey, 51.7% of the respondents are aware of these rules. In a similar survey conducted in Kenyatta National Hospital, Kenya 84% of the respondents were aware of the rules of biomedical waste management.

Our findings indicate that overall awareness level of biomedical waste was highest among doctors (100%) which are considered as good using Boom's cut off point. The possible reason could be due to the fact that the training they received regarding healthcare delivery is much more than that of other professions in the healthcare sectors. In contrast to our study Njiru et al. (2013) noted that the level of awareness on biomedical waste management for doctors was 51% which is the least among the surveyed workers.

Use of Personal Protective Device is highly essential to any healthcare worker, as he can come in contact with medical wastes. The assessment of practice of biomedical waste management revealed that, medical doctors and nurses had an overall good practice level for scoring 100% and 82.4% respectively. Considering the entire respondents, an overall average practice level was achieved with (79%). This finding was in line with the work of Nagaraju et al. (2013). Who reported an overall average practice among most of their respondents.

CONCLUSION

Awareness on biomedical waste management and use of Personal Protective Devices were found to be satisfactory among the participating healthcare providers. This reflects the commitment of government and other health agencies for ensuring maximum compliance of rules governing proper handling of biomedical waste. However, the study identified poor level of awareness and utilization Personal Protective Devices among some healthcare providers, especially medical lab scientists and environmental health workers. To improve this situation it is suggested that proper training should be provided to healthcare workers at all levels in the healthcare facilities on the modern system of segregation and handling of biomedical waste. This will reduce hazards associated with improper handling of medical wastes.

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