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KNOWLEDGE ATTITUDE AND PRACTICE (KAP) OF SELECTED HOSPITAL STAFF ON HEALTH CARE WASTE MANAGEMENT

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Abstract: *This cross-sectional study was carried out in 8 secondary and tertiary level hospitals of Dhaka and Rajshahi division to assess knowledge attitude and practice among health care waste handlers' combination of quantitative and qualitative research methods was used, and results were used for triangulation purposes. For quantitative data, a semi-structured questionnaire and observation checklists were developed. For qualitative data, 16 Key Informant Interview (KII) and 4 Focused Group Discussions (FGDs) were conducted. The intervention hospitals have waste storage area and waste management instruction materials are posted on the hospital wall, verbal communication is also maintained for waste management and plastic wastes are shredded. The waste handlers wear gowns during waste handling and use trolley or container to carry the hospital waste. The non-intervention hospitals have no such practices. Doctors of both the groups were aware of the waste management manual and Waste Management Law but they did not practice that law. Practice of maintaining documentation of waste management system was a problem for all the respondents. Respondents of both groups stressed regular monitoring and suggested arranging formal training on HCW management. The hospital Waste Management Team was functionally inactive and not visible. It was recommended that provide training to waste handlers, fill in manpower gap, supply of sufficient logistics, implement internal checklist for monitoring, control number of visitors in hospital and sincerity of the local management could vastly improve the hospital waste management system.*

Keywords: *Wastes, Hazardous wastes, Hospital wastes, Management of Wastes*

Introduction

Although the risks associated with hazardous medical waste and the importance of managing that waste are relatively well known, disposing different types of wastes safely and planning and setting priorities are not always straightforward, particularly in resource-poor situation like Bangladesh. Ever expanding health-care services in Bangladesh are geared towards protecting health and saving lives of its huge population size that generates "Health Care Waste (HCW)". The HCW can be either infectious or non-infectious and can pose bodily harm and injuries [1]. The HCW is a source of environmental degradation and constitutes a serious health hazard – it is considered the second most hazardous waste globally after radiation waste. Collection, processing, transport and disposal of HCW should, therefore, be an important management matter for the health care providing institutions in the context of health and environmental reasons [2].

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Mismanagement of HCW can expose health care staff, medical waste handlers, patients and their families, and the surrounding catchment population to grave danger. Improper disposal can also spread various hospital-acquired infections and cause occupational health hazards and food contamination [3,4]. In Bangladesh, like other developing countries, disposal of HCW has not attracted the much-needed attention that it warrants. This is mostly due to allocation of less resources for the disposal of HCW in these countries. Moreover, inadequate knowledge and unsafe management practices among the health care workers are major challenges in the management of HCWs. Evidence suggests that poor HCW management may be implied to lack of formal training, inadequate knowledge on HCW management, lower priority setting by the hospital administration. Some studies observed that the Waste Handlers have been playing a vital role in managing waste in both the intervention and non-intervention areas in urban hospitals [5].

There are over 500 clinics and hospitals in Dhaka city. Approximately 200 metric tons of medical wastes are generated in the city per day, 20% of these are hazardous [6]. There is also potential risk of spreading infection and some hazardous HCW consists primarily of chemicals and discarded cytotoxic drugs [7]. Directorate General of Health Services (DGHS) has taken an initiative and provided hospital waste management training to doctors, nurses, ayas, cleaners and ward boys in the selected hospitals, but still many hospitals did not receive any formal training.

Despite the fact that the health care workers are regularly participating in the management of HCW, there is limited data on the knowledge, attitude and practices (KAP) of health care workers in regard to proper HCW handling and disposal. There is paucity of studies conducted to assess the impacts of training of health workers in the hospital settings. We therefore designed and conducted a study to assess current level of KAP amongst health care workers and waste handlers of selected hospitals in Bangladesh, and to assess impact of previous training on HCW management conducted by DGHS.

Methodology

The study was carried out in 8 secondary and tertiary level hospitals, 4 (four) of them were situated in Dhaka and 4 (fours) were situated in Rajshahi. Selected hospital staff of Dhaka city received training on Health Care Waste Management while the hospital staff of Rajshahi did not receive any training.

We used a mixed methods design combining quantitative and qualitative research methods for data collection. The quantitative methods were focused on knowledge, attitude and practices of respondents, while the qualitative methods were used to gather more insights on waste collection, processing and disposal mechanisms. The quantitative and qualitative results were then used for triangulation purposes to complement and reinforce the overall analysis. Data were also collected from indoor patient department (IPD), outdoor patient department (OPD), accident and emergency (A&E), selected wards and hospital offices through face-to-face interviews by using checklist and questionnaire. For quantitative data, a semi-structured questionnaire and an observation checklists were developed based on key research areas of the study viz. Knowledge, Attitudeand Practices. Both open and close ended questions were included. The respondents were asked to indicate how far they agree or disagree with a statement on a certain predetermined scale (e.g. agree/disagree/strongly disagree etc). The tools were field tested before data collection.We used Key Informant Interview (KII) and Focused Group Discussions (FGDs) for qualitative data collection. A total of 120 respondents were selected for in-depth interview, taking equal number from trained and un-trained areas. In addition in-depth interviews were conducted among 16 Key Informants (KIs). The respondents were derived from hospitals' directors, clinical staff including professors, nursing supervisors, ward masters, ayas and waste handlers. Total 8 FGDs were conducted; 4 in the trained area and 4 in the untrained area. These 4 FGDs were conducted using pre-tested thematic guide and respondents were from 4 different groups; namely the doctors, the

nurses, the ayas and the waste handlers. Five (5) qualified enumerators were selected for data collection and were trained on conduction of FGD and KII. A supervisor was selected from same hospital for maintaining quality of data. Quantitative data were entered into the Windows SPSS program for analysis. Qualitative data were recorded and videoed. Collected data were checked,coded and analyzed by developing a thematic data analysis matrix. Issue based information was segmented according to study objectives. Ethical approval was obtained from NIPSOM, and permission was taken from the directors of the respective hospitals. A clearly understood informed consent form was developed and shared with the respondents before the interviews and FGDs.

Results

Sixty percent of doctors from both intervention and non-intervention groups are between 31-40 years old, majority of them were male. Seventy percent (70%) of respondents in the non-intervention group were working in the current hospital for less than 10 years. Majority of the nurses (80%) of both groups were female. Among the aya and cleaner group, 80% were female in non-intervention group compared to 67.5% in intervention group (Table – 1).

Table 1: Socio-demographic information of respondents of intervention and non-intervention area

Name of characteristic	**Response of doctors in Percent**		**Response of nurses in Percent**		**Response of Aya's in Percent**	
Sex	Non-intervention	Intervention	Non-intervention	Intervention	Non-intervention	Intervention
Male	30.0	80.0	20.0	20.0	20.0	32.5
Female	70.0	20.0	80.0	80.0	80.0	67.5
Age in years						
21-30	10.0	20.0	40.0	--	25.0	32.50
31-40	60.0	60.0	30.0	60.0	35.0	27.50
41-50	20.0	0.0	30.0	30.0	37.50	27.50
Above 50	10.0	20.0	----	10.0	2.5	12.50
Work duration in this hospital in year						
Less than one year	10.0	------	10.0	------	2.50	2.50
Less than 10 years	70.0	90.0	30.0	80.0	17.50	35.50
10-20 years	20.0	10.0	50.0	20.0	47.50	32.50
21 years and above	----	-----	10.0	--	32.50	30.0
Total	10	10	10	10	40	40

Almost all nurses (90%) and aya/cleaners (95%) from the intervention group did receive waste management training. While only 60% of doctors in intervention hospitals attended the training. Sixty percent of doctors from non-intervention group and 80% from intervention group know about health care waste management. While 100% nurses and aya/cleaners of intervention group know about health care waste management (HCWM). The majority of the respondents of all the intervention groups knew types of hospital waste while only 40% nurses and 45% aya/cleaner from non-intervention group knew it (Table 2).

Table 2: Distribution of respondents by knowledge on HCWM and types of hospital wastes

Name of indicator	Response of doctors in Percent		Response of Nurses in Percent		Response of Ayas Percent	
	Non-intervention	Intervention	Non-intervention	Intervention	Non – Intervention	Intervention
Received training on HCWM						
Yes	10.0	60.0	10.0	90.0	25.0	95.0
No	90.0	40.0	90.0	10.0	75.0	5.0
Do you know what Health Care Waste (HCW) is						
Yes	60.0	80.0	40.0	100.0	70.0	100.0
No	40.0	20.0	60.0	0.0	30.0	0.0
Do you know about types of health care waste						
Yes	70.0	80.0	40.0	100.0	45.0	95.0
No	30.0	20.0	60.0	0.0	55.0	5.0
Total	10	10	10	10	40	40

During FGDs, the participants emphasized on regular fresher and refresher waste management training and stated that training will help them to improve knowledge on systemic management of medical waste which will reduce of spreading infectious diseases in the hospitals. The aya/cleaners under intervention group were found to have more knowledge about the HCW management issues compared to that of non-intervention group. They stated that the waste management means keeping the hospital neat and clean and safeguarding people from getting infections. However, they were not aware of any waste management committee in their hospitals and said that workers from City Corporation used to collect waste from the hospitals regularly. They also mentioned that logistics supply for waste management was not regular and sufficient.

The data revealed that the nurses and aya/cleaner from intervention group could mention five topics that were discussed in the training whereas doctors from both non-intervention and intervention group could mention three topics. Responding to harm of HCW, all the doctors, nurses and aya/cleaner from intervention and non-intervention group mentioned about infectious waste. Regarding types of HCW, all respondents in intervention group could mention name of infectious and sharp waste. None of the groups could mention the name of pharmaceutical wastes as a type of HCW.

The key informants (KIs) of the intervention hospitals informed that the staff received a one day training program on waste management and acknowledged that the hospital has experienced a clear difference of cleaning status before and after the training. But the KIs of the non-intervention hospitals could not say anything about it.

Seventy percent of doctors, all the nurses (100%) and 62% from aya/cleaner from intervention group could mentioned about five color boxes for collecting hospital waste. While none of non-intervention group respondents could mention five different boxes. None of aya/cleaner from both intervention and non-intervention group could mention about the availability of waste management manual in their hospital. Only 60% of the doctors and 50% nurses from intervention group could mention about the availability of waste management manual in their hospitals.Irrespective of intervention or non-intervention group, ayas/cleaners did not have any idea about using the waste management manual (Table 3).

Table 3: Percent distribution of respondents by knowledge about different color waste boxes and HCW manual

Name of indicator	**Response of Doctors in Percent**		**Response of Nurses in Percent**		**Response of Aya's in Percent**	
	Non-intervention	Intervention	Non-intervention	Intervention	Non-intervention	Intervention
Know number of color boxes for Health Care Waste Management						
3 different color boxes	40.0	10.0	10.0	-	25.0	5.0
4 different color boxes	-	-	-	-		32.5
5 different color boxes	-	70.0		100.0		62.5
Do not know/do not remember	60.0	20.0	90.0	-		-
Hospital has waste management manual						
Yes	-	60.0	-	50.0	-	-
No	80.0	-	60.0	40.0	40.0	32.5
Do not know	20.0	40.0	40.0	10.0	60.0	67.5
Ever seen the manual						
Yes	-	60.0	-	30.0	-	-
No	20.0	40.0	100.0	30.0	60.0	67.5
N/A	80.0	-	-	40.0	40.0	32.5
Hospital has waste management handbook						
Yes	-	-	-	-	-	-
No	80.0	60.0	60.0	60.0	40.0	32.5
Do not know	20.0	40.0	40.0	40.0	60.0	67.5
Number	10	10	10	10	40	40

The doctors of FGDs mentioned that there was no visible waste management team in the hospitals, but service providers are managing the waste by their own initiative. However, they were aware of the waste management manual and found the manual useful. The nurses mentioned that the service providers do not follow the manual. They underscored to strengthen monitoring system.Intervention group respondents had more knowledge about protective equipment and could mention name of all five protective devices. None of the respondents from all three non-intervention groups had any knowledge about eye protection safety goggles and service boots.

All the respondents from the intervention group agreed that waste handlers should use protective devices only during waste collection, while 30% nurses and 65% aya/cleaner from non-intervention group agreed with this statement. The majority of the doctors from intervention (90%) and non-intervention (80%) groups agreed that hospitals should strictly follow the waste management system. Most respondents from intervention group mentioned that hospitals should have a documentation system for proper waste management. All the respondents, irrespective of groups, replied that regular monitoring was needed to ensure proper hospital waste management and suggested that formal training on HCW management is required for improvement of HCWM (Table 4).

Table 4: Percent distribution of respondents about knowledge on actions for proper HCWM

Name of indicators	**Response of Doctors in Percent**		**Response of Nurses in Percent**		**Response of Aya's in Percent**	
	Non-intervention	Intervention	Non-intervention	Intervention	Non-intervention	Intervention
Waste handlers should use all protective devices during waste collection						
Agree	70.0	100.0	20.0	100.0	65.0	100.0
Disagree	30.0	-	80.0	-	35.0	-
Waste handler should wear cap, mask and gloves						
Agree	100.0	100.0	30.0	100.0	65.0	100.0
Disagree	-	-	70.0	-	35.0	-
Hospital should follow the waste management system						
Agree	80.0	90.0	40.0	100.0	100.0	100.0
Disagree	20.0	10.0	60.0	-	-	-
Hospital should have documentation of waste management						
Agree	40.0	90.0	-	100.0	100.0	97.0
Disagree	60.0	10.0	100.0	-	-	3.0
Management committee should organize regular meetings for proper management of HCW						
Agree	100.0	100.0	100.0	100.0	100.0	100.0
Disagree	-	-	-	-	-	-
Management should take following action for proper management of HCW						
Provide regular training	50.0	20.0	-	30.0	33.3	50.0
Organize meeting with staff	20.0	-	30.0	70.0	12.5	27.5
Ensure logistic supply	40.0	70.0	100.0	20.0	37.5	-
Increase manpower	-	-	40.0	-	16.7	-
Monitor HCWM properly	100.0	100.0	100.0	100.0	-	82.5

The intervention group hospitals used specific color boxes for different waste collection. While the non-intervention group hospitals did not use color code boxes. Intervention group respondents reported that enough waste collection boxes were available in the hospitals. Most used color boxes were yellow, black and red color boxes. None of the respondents talked about silver color boxes. Recapping of used syringes was not practiced in any of the hospitals. Most of the informants did not have the opportunity to go through the training manual on health care waste management. All the hospitals have Waste Management Team, but they were functionally inactive and not visible. The doctors mentioned that they were aware of the Waste Management Law, but they did not practice that law. All the waste handlers mentioned that they wear gown/apron during waste handling. In addition to that, half of the waste handlers from the intervention group reported that they wear gloves during waste handling.

Most of the respondents from both non-intervention and intervention groups reported that trolley or container are used to carry the hospital waste. It was reported that the intervention hospitals have waste storage area but none of the non-intervention hospitals have any waste storage area. The doctors and nurses from intervention hospitals reported that they shred all the plastic waste but none of the hospitals from non-intervention group shred the plastic waste. All the doctors and nurses of intervention groups reported that waste management instruction materials are posted on the hospital wall and verbal communication is maintained as a part of waste management system (Table 5).

Table 5: Distribution of respondents by present waste management practice

Name of indicators	**Response of Doctors in Percent**		**Response of Nurses in Percent**		**Response of Aya's in Percent**	
	Non-intervention	Intervention	Non-intervention	Intervention	Non-intervention	Intervention
This hospital uses specific color boxes for different wastes						
Yes	-	100.0	-	100.0	-	92.5
No	90.0	-	100.0	-	100.0	2.50
Do not know	10.0	-	-	-	-	5.0
Enough waste container is available at all points						
Yes	60.0	100.0	30.0	100.0	40.0	100.0
No	40.0	-	70.0	-	60.0	-
Trolleys or containers are used to carry waste						
Yes	20.0	100.0	100.0	100.0	100.0	100.0
Do not know	80.0	-	-	-	-	-
Hospital has waste storage area						
Yes	-	100.0	-	100.0	-	67.5
No	10.0	-	40.0	-	100.0	32.5
Do not know	90.0	-	60.0	-	-	-
Plastic wastes are shred						
Yes	-	100.0	-	100.0	-	22.5
No	40.0	-	40.0	-	80.0	77.5
Do not know	60.0	-	60.0	-	20.0	-
Waste collecting containers remain covered						
Yes	-	100.0	-	100.0	-	100.0
No	20.0	-	100.0	-	100.0	-
Do not know	80.0	-	-	-	-	-
Number	10	10	10	10	40	40

Few respondents of intervention group reported to keep documentation of waste management. All of the respondents irrespective to groups reported that they face problems in maintaining documentation of waste management system. The majority of the respondents did not report this problem to their supervisors. The majority of respondents from intervention groups reported about meetings on HCWM but these meetings were irregular and mostly not documented (Table -6).

Table 6: Distribution of respondents by present documentation system for HCWM

Name of indicators	**Response of Doctors in Percent**		**Response of Nurses in Percent**		**Response of Aya's in Percent**	
	Non-intervention	Intervention	Non-intervention	Intervention	Non-intervention	Intervention
Hospital maintains documentation of waste management						
Yes	-	70.0	-	60.0	-	22.50
No	60.0	-	70.0	10.0	15.0	2.50
Do not know	40.0	30.0	30.0	30.0	85.0	75.0
Face problem in maintaining waste management properly						
Yes	100.0	100.0	100.0	100.0	100.0	95.0
No	-	-	-	-	-	5.0
Discuss the problem faced during waste management with supervisor						
Yes	40.0	60.0	50.0	80.0	20.0	57.50
No	60.0	40.0	50.0	20.0	80.0	42.50
Hospital management organizes regular meetings on waste management						
Yes	-	80.0	30.0	100.0	10.0	62.50
No	100.0	20.0	70.0	-	70.0	32.50
Do not know	-	-	-	-	20.0	5.0
Frequency of meeting						
Monthly	-	70.0	-	40.0	-	22.50
Not regularly	-	10.0	30.0	60.0	10.0	40.0
Not applicable	100.0	20.0	70.0	-	90.0	37.50

Most of the doctors (90%) of the intervention group opined that regular logistics supply will encourage hospital staff towards proper hospital waste management. A few doctors suggested that training would help to increase the staff's positive attitude. Sixty percent (60%) nurses and 32.5% aya/cleaners suggested that staff should be rewarded for positive attitude and practices. While few nurses suggested to practice of punishment for poor performance in HCWM (Table – 7). Responding to our query for suggestions to make the hospital waste management training more effective, the majority of the doctors (70%) and nurses (90%) suggested increasing the duration of the training. The waste handlers suggested regular refresher training, and the doctors and the nurses suggested on-site, hands on training. All of the doctors, half of the nurses and aya/cleaners thought proper monitoring will help to increase the practice level of staff about waste management (Table – 7).

Table 7: Distribution of respondents by ways and actions needed to increase attitude and practices about CWM.

Name of indicator	Response of doctors in %	Response of nurses in %	Response of Aya /cleaners in %
Action required to make the training more effective*			
Increase the duration of the training	70.0	88.90	37.50
Discuss the issue with staff	10.0	22.20	5.0
Organize fresh training	20.0	11.1	55.0
Provide hand on training	60.0	44.40	15.0
Demonstrate documentary film on HCWM	-	11.1	-
Do not know	10.0	-	20.0
Action required to increase knowledge of service providers*			
Supervision should be strengthened	-	-	43.60
Arrange refreshers training in regular interval	70.0	70.0	56.4
Provide hands on training	60.0	30.0	20.50
Supply waste management handbook	100.0	60.0	10.3
Action needed to increase the positive attitude of the service provider*			
Ensure regular logistics supply	90.0	50.0	37.50
Award for good work	-	60.0	32.50
Provide training and refreshers training	20.0	60.0	30.0
Organize regular meetings with staffs	10.0	-	5.0
Increase awareness among staffs	-	10.0	17.50
Provide punishment	-	30.0	-
Do not know	-	-	17.50
Action needed to increase the practice level of service providers*			
Proper monitoring	100.0	50.0	52.50
Give motivation and increase awareness	-	10.0	10.0
Organize regular meetings with staff	-	-	17.50
Award for good work	70.0	20.0	20.0
Ensure regular logistic supply	90.0	70.0	10.0
Do not know	-	-	15.0

*Multiple response

During FGD the participants stated that no central decision on HCWM had been implemented accurately due to insincerity of local authority. They opined that sincerity of the local management could vastly improve the hospital waste management system and HCW could be managed in a better way within the present capacity. Lack of manpower and lack of logistics and irregular logistics supply were common problem and they have to work with difficulties. Most of respondents of FGD reported that they don't have a copy of waste management manual. Doctors suggested to develop internal checklist for monitoring waste management system and recommended involving external team in the process. Control of visitors was also emphasized during FGD (Table – 8).

Proper use of protective devices was not a regular practice. They further mentioned that lack of proper information on waste management was a barrier for waste management. The monitoring system for HCWM did not work properly as the senior management staff did not get time to monitor the work. The hospitals had no visible posters, neon signs and photographic instructions on the wall on waste management instructions. Some hospitals have needle and syringe destroyers, but the informants were not trained about their use (Table – 8).

Table 8: Distribution of respondents by the problems faced during HCWM

Name of indicators	**Response of Doctors in Percent**		**Response of Nurses in Percent**		**Response of Aya's in Percent**	
	Non-intervention	Intervention	Non-intervention	Intervention	Non-intervention	Intervention
Problem faced during waste management						
WMT is not active	40.0	20.0	90.0	40.0	-	28.90
Supervisor is not cooperative	-	-	10.0	-	50.0	15.80
Lack of manpower	60.0	100.0	40.0	80.0	80.0	78.90
Lack/irregular logistics supply	50.0	50.0	100.0	60.0	35.0	55.3
Lack of proper monitoring	50.0	20.0	-	90.0	-	28.90
Lack of commitment of Waste handler	50.0	70.0	50.0	10.0	-	5.30
Obstacles to follow the waste management manual						
Do not have copy of the manual	-	100.0	-	100.0	-	-
Lack of logistics	-	100.0	-	-	-	-
Lack of manpower	-	100.0	100.0	-	-	-
Action to solve the problem*						
Do nothing	60.0	10.0	-	20.0	55.0	34.20
Talk with supervisor	10.0	10.0	30.0	60.0	15.0	55.3
Work with difficulty	70.0	80.0	100.0	70.0	45.0	28.9

*Multiple response

The observation's check list reveals that intervention hospitals practice better HCW management system (Table-9)

Table 9: Findings of observation's checklist

Indicators	No. of hospitals in non-intervention group	No. of hospitals in intervention group
The hospital floor found neat and clean	2	4
Hospital has neon sign of waste management instructions on the wall	None of the hospitals	1
Hospital has enough number of baskets in different place for collecting health waste	None of the hospitals	3
Health care waste baskets are neat and clean	1	4
Waste handlers collect health care waste in regular interval	None of the hospitals	4
Hospital use black color code waste box for collection of general waste	None of the hospitals	4
Hospital use yellow color code waste basket for collection of infectious waste	None of the hospitals	4
Hospital use red color code waste basket for collection of sharp waste	None of the hospitals	3
Hospital use silver color code waste basket for radioactive waste	None of the hospitals	3
Waste handlers use all protective devices while collecting health waste	None of the hospitals	3
Hospital staffs help patients and attendance to maintain the health care waste management rules	None of the hospitals	4
Designated staff maintains record of health care waste	None of the hospitals	4
Hospital management strictly control visitors flow	None of the hospitals	2
Health care waste management guideline is posted on wall	None of the hospitals	None of the hospitals
Hospital has needle and syringe destroyer	1	4
Hospital management uses the needle and syringe destroyer	1	4
Waste handlers use trolley while collect health waste	4	4

Discussion

In Bangladesh, wastes are disposed of by open dumping in either low depressions or higher grounds for natural degradation. The safe disposal of HCW has been ignored, which is a source of contamination and pollution to both humans and the environment [8]. Several hospitals left their HCW outside in open dustbins before a municipal truck would remove them [9]. In one of the hospitals in Bangladesh parts of human bodies were also found in the dustbin. Lack of knowledge and interest in safe waste disposal by most health workers and an absence of a budget to effectively implement safe waste disposal were identified as major problem from this study [9]. Other studies reported that unsafe HCW management and the disposal of HCW in open places caused stick injuries to 20% of waste handlers [10,12]. The study further stated that 39.3% of the injections were administered with reused equipment's and government has no concrete regulation for present HCWM system [10]. One needle stick injury from a needle used on an infected patient has risks of 30%, 1.8%, and 0.3% respectively of becoming infected with HBV, HCV and HIV [12].

In this study, we found that health workers who received training on HCWM had better knowledge on different aspects of safe HCW collection, segregation, and safe disposal. Most of them knew about colour coded waste bins and wore personal protective gear when handling HCWs. Quasi-experimental study report from Pakistan revealed that training of health workers on HCW management has positive and sustainable impact on proper management of hospital wastes [11]. The KAP survey report on HCW among trained and untrained health professionals reported that there was significant difference between intervention and non-intervention group's knowledge, attitude and practice. While there was no significant difference between the two groups in baseline survey [13].

In our study waste handlers of the intervention group used color boxes for waste collection but none of the non-intervention hospital used such color. The study report showed that previous training and level of education of waste handlers and those who thought HCWM was important were and more likely to have satisfactory practice of HCW management [14]. A case study report of Khulna reveals that 56% of the waste handlers did not receive training on handling of hazardous waste and 54% of them did not use any safety equipment during waste handling [15].

This study found that irregular supply of logistics and material for proper disposal of medical waste was a factor for not doing the job perfectly and regularly which relevant to report that supply of efficient logistics and balance in the link between waste generation units and treatment facilities is the framework for sustainable operation of medical waste management system [16]. Bangladesh lacks both effective waste management facilities and relevant government policy to guide health providers. In this connection it may be mentioned that until 2008 there was no health care waste disposal law in Bangladesh. In November 2008 Bangladesh, HCWM Rule was approved under Environmental protection Act. 1995. But the health care waste disposal system was likely to be non-functioning due to lack of law. Therefore, implementation of appropriate law was recommended by the authors [7].

Although the study revealed that the intervention was able to improve knowledge of waste management, the practice of proper waste management depends on factors related to collecting, segregate, and then disposal of wastes. So, proper monitoring is essential for proper HCW management. Internal monitoring is needed by the facility managers while monitoring from City Corporation is essential as it largely depends on the City Corporation's workers. In this connection it may be mentioned that in Bangladesh the health care-personals are responsible for in house management of HCW, while city corporation workers are responsible for the chain of HCW management outside the hospital. It was often observed that city corporation workers mix the hazardous and non-hazardous waste and dispose of them in the same place. Knowledge always does not ensure the practice level if the attitude finally is not in favor of behavior change. Therefore, it is very important to understand the attitude of the respondents whether it is in favor of proper waste management system. Knowledge and practice of health workers on HCW

management was poor and age of waste handlers was significantly associated with knowledge while only education was significantly associated with practice [17]. Training and duration of work experience were not significantly associated with knowledge, attitudes, and practices scores except for nurses with longer work experience [18]. The report further stated that house- keepers had significantly more knowledge than physician and nurses about system for waste disposal. The housekeepers also had the overall highest scores for attitude to waste disposal among the 3 groups and significantly more nurses had satisfactory practice scores than did physicians [18]. Our study revealed that doctors of intervention and non-intervention group are aware of infectious waste while nurses of both the groups are aware of sharp waste. The respondents of intervention group could mention the name of four types of hospital waste correctly.

This study revealed that color coded bins useful for facilities who received training. All the doctors from both non-intervention and intervention groups agreed that waste handlers should wear masks, gloves and all the respondents from three intervention groups agreed that waste handlers should use protective devices during waste collection. None of the respondents from all the non-intervention groups had any knowledge about eye protection safety goggles and service boots. On the other hand, all the respondents from the intervention groups could mention all five protection devices used for safety. Studies reported that hospital authorities are reluctant to train health professionals on Health Care Waste management and found a discrepancy between knowledge and practice on personal protective equipment (PPE) [19]. Another study found high prevalence of needle stick and sharp injuries and stated that there was a lack of supply of personal protective devices and 69.1% of the respondents did not get proper training on waste management [20].

Logistic supply, appropriate space and hospital infrastructure are very important for waste management, which was also revealed from the study. Doctors and nurses from the intervention group mentioned that hospitals have waste storage areas but none of the hospitals from non-intervention group have any waste storage area. It is also found that the majority of the doctors and nurses don't have any idea regarding the hospital waste storage area. All the doctors and nurses from intervention groups reported that hospital shred all the plastic waste but none of the hospitals from non-intervention group shred the plastic waste. All the respondents from intervention groups of doctor and nurse reported that waste management instruction materials are posted on the hospital wall as a part of waste management system. They have also mentioned verbal communication system regarding wastes management. The majority of the doctors and one third respondents from two other non-intervention groups mentioned that no communication system for waste management is prevailing in the hospitals they worked for.

Immediate action for improvement of HCWM can be taken locally and governments commitment is required for sustainability [21]. This study revealed that the local waste management committee was not functional irrespective of non-intervention and intervention areas and the respondents were concerned about the coordination with City Corporation and hospital management committee.

Health care waste may contain drug resistance microorganism which spread in the environment that may further infect hospital patients, health workers, and general public. The hazards like sharps-infected instrument, toxic pharmaceutical products, air pollution, thermal pollution during open burning of wastes and radiation burns may also cuase many severe health problems. A needle stick injury from a needle used on an infected patient has risks of becoming infected with HBV, HCV, and HIV. In Bangladesh the waste handlers are at immediate risk of needle injury and exposure to toxic infectious materials as manual sorting of hazardous wastes is their daily practice. It may be concluded that health workers with prior training in HCWM were more likely to have satisfactory practice. Refresher training on HCW management and adequate supply of HCWM related protective equipment's enhance performance. Enforcing and strict monitoring of implementation of regulations are considered to be the key to the success in proper management of health care waste in the hospitals.

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