



Research/Technical Note

Study of Clinical Waste Management at Rajshahi Medical College Hospital (RMCH) in Bangladesh

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To cite this article:

Md. Shamim Al Razib, Nazmul Hasan, Supriya Mondal. Study of Clinical Waste Management at Rajshahi Medical College Hospital (RMCH) in Bangladesh. *International Journal of Environmental Protection and Policy*. Vol. 5, No. 2, 2017, pp. 26-31.

doi: 10.11648/j.ijepp.20170502.12

Received: April 2, 2017; **Accepted:** April 12, 2017; **Published:** May 5, 2017

Abstract: The management of clinical waste is of great importance due to its infectious and hazardous nature that can cause risks on environment and public health. The study is conducted to evaluate clinical waste management practices and to determine the amount of waste generated at Rajshahi Medical College Hospital (RMCH) in Bangladesh. A survey is driven to collect information about the practices related to waste segregation, collection procedures, type of temporary storage containers, on-site transport and primary dumping point, treatment of wastes, off-site transport, and final disposal options. This study indicates that the quantity of medical waste generated by RMCH is 156 kg/day. Almost half of the waste was similar to domestic waste and 20% of the waste is considered to be hazardous waste. The survey result shows that segregation of all wastes is not conducted according to consistent rules and standards where some quantity of medical waste is disposed of with domestic wastes. The most frequently used treatment method for solid medical waste is incineration which is not done regularly at RMCH and the position of the incinerator is not acceptable. Clinical wastes pose a significant impact on health and environment. From this study it can be said that there is an urgent need for raising awareness and education on medical waste issues. For further study, it is needed to collect more information on impacts, disposal and management to draw a clear conclusion. Need to collect information and examples from developed country or the country which has sound medical waste management system.

Keywords: Solid Waste Management, Segregation, Incineration, Rajshahi Medical College Hospital (RMCH), Hazardous Waste, Domestic Waste, Clinical Waste

1. Introduction

The clinical waste management study covers the critical aspects in the process of clinical waste generation, separation, collection, transportation, storage, treatment and final disposal. Improper management of clinical waste can create many problems especially threats to the health, safety and environment [1]. No matter how small the quantity of waste (i.e. clinical waste) can be extremely dangerous to the health of the general public and the environment [2]. According to Akter (1997), 82.24 percent respondents described medical wastes as general waste, it is clear that most people are simply unaware of and unclear about what constitutes medical wastes [3]. Clinical waste is not attracted the same level of attention

as other types of wastes, particularly in developing countries, despite the fact that medical waste is labeled as hazardous because it poses serious and direct threat to human health [4]. In Bangladesh, as in many other developing countries, no proper and efficient rule has been compiled as yet and also there is no useful information about clinical waste management.

The report on "Clean Dhaka Master Plan" conducted by the Japan International Cooperation Agency (JICA) explained about the management pattern of solid waste in Dhaka City [5]. The Local Initiative Facility for the Urban Environment (LIFE) carried out a project on "In-house Hospital waste management" in aiming the waste management of 11 clinics in Dhaka City with the financial assistance of the UNDP released by the

global sources [6]. The project started on 2002 and finished by 2003. In 2004, Patil and Pokhrel described the biomedical solid waste management in an Indian hospital. They quantify the amount of non-infectious and infectious waste (ratio 5:1) generated in different wards/sections [7].

In 1999, Mato and Kaseva in their paper on "Critical review of industrial and medical waste practices in Dar es Salaam City" focused that there is a serious inadequacy in handling medical solid wastes in Dar es Salaam of Tanzania and improper waste deposition is increasingly becoming a potential public health risk and an environmental burden in Tanzania [8].

The use of landfills remains the most popular method for disposing clinical waste in both developed and developing countries. Diaz et al (2005) makes a distinction between controlled landfills and sanitary landfills [9]. In the absence of controlled and sanitary landfills, medical establishments, according to Pruss et al (1999) can prepare a small burial pit in a restricted area purposely for disposing only infectious clinical waste [10]. The depth of such a pit according to him should reach 2 m deep and the bottom should at least be 1.5 m away from ground water level.

In RMCH, it is observed that the solid hospital wastes are being disposed temporarily in the recycle bin. The recycle bins are kept in front of each ward. There is a waste collector for each ward who collects waste and transfers to the primary dumping station inside the Hospital area. There are 57 ward & 4 other (ICU, Postoperative, Dialysis-room, Engeogram-room) wards from where solid waste are transported to the primary dumping station. There are different kinds of solid hospital waste. It was not possible to disintegrate all types of waste as it takes so much time to disintegrate & some clinical waste (blood, needle) are very hazardous so it was not possible to weight those. We differentiated Solid Hospital waste into some basic types- Sharps, Pathological waste, Pharmaceutical waste and others waste. Sharps can be further divided into two types- Syringe and Needle. Pathological waste can be divided into four types- Cotton, blood bag, hand gloves and bandage, pharmaceutical waste can be divided into three types- glass bottle, drug shell and saline. This pathological waste is very dangerous for human [11].

The transportation systems of wastes are varied from country to country. In case of Libya, on-site clinical waste transportation as recounted by Sawalem [12], is done via uncovered trolleys while in Nigeria, Coker et al (2009) reported that clinical waste in health care facilities is transported on shoulders or with bare hands [13]. In case of RMCH, City Corporation waste collection vehicle comes at the primary station at a certain times in a day and transported to the final dumping station. Before dumping, in temporary storage no action is taken against microbial putrefaction and growth but it really important.

Our primary aim is to take weight of the solid waste generated from the Hospital for each ward which is transported to the primary dumping station. Then by knowing the number of bed present in each ward then we can determine

the amount of waste generated per bed. By analyzing the data we can also determine the peak waste producing day in a week. As most of the waste collection bins are not large enough to carry the waste and the number of waste collection bins are also very few, the data collected will help in further waste management work.

The objectives of this research are to collect information on the collection, treatment, handling, hauling, and disposal of medical wastes and quantify hospital wastes production in Rajshahi Medical College Hospital. Similarly determine the composition of generated clinical wastes in Rajshahi Medical College Hospital and also determine the level of knowledge and awareness of individuals involved in the medical waste management.

2. Methodology

2.1. Research Design

This study is mainly based on data collection. The relevant data for this study were mainly collected from the published and unpublished sources. The data were analyzed to address the central issues of hospital waste management with relation to the generation of wastes in different sources. In order to fulfill the aims and objectives, the project tasks were structured as data collection and data analysis. Sekaran (2009) defined a research design as a master plan specifying the methods and procedures which are used to guide and conduct a research [14]. It is a strategic plan for a research project including the methods of data collection and analysis to be employed and showing how the research strategy addresses specific aims and objectives of the study [15].

In this study we have just measured the amount of the waste is being generated in each ward. It was done by following a procedure. We have divided the hospital waste into some basic category. Then the waste transferred from ward to the primary disposal point is measured according to the category. After that by analyzing the data the waste production per bed is measured. It is also measured that what types of waste produced and quantity.

2.2. About Rajshahi Medical College Hospital (RMCH)

The public hospital RMCH is located in the northern part of Bangladesh. The capacity of the Rajshahi Medical College Hospital is 2148 beds. The total no of doctors, nurses and cleaners are 169, 349, and 137 respectively. The average no. of inpatients and outpatients per day are 200-220 and 200-210 respectively. Total amount of waste generated is 200-350 kg/day of which amount of hazardous waste is 50-60 kg/day. The toxic and hazardous waste of RMCH is incinerated in its own incinerator. The RMCH is directly connected with Rajshahi City Corporation (RCC) in regard to Solid waste disposal.

2.3. Segregation and Measurement of Hospital Waste

By asking question to the waste collector and during visiting each ward we have seen that segregation of waste is done before disposal. Although segregated waste is not

recycled, they use the separate bags for different types of waste and they use the separated plastic bins for infectious, sharp waste and general waste. But in general there is no systematic segregation of waste before disposal.

There are several types of solid Hospital waste. It is not possible to segregate all types of waste as it takes so much time to segregate & some clinical waste (blood, needle) are very hazardous so it is not possible to weight those. We have taken fifteen types of solid hospital waste in consideration further we differentiate Solid Hospital waste into some basic types- Sharps, Pathological waste, Pharmaceutical waste and others waste. Sharps can be further divided into two types- Syringe and Needle. Pathological waste can be divided into four types- Cotton, blood bag, hand gloves and bandage, pharmaceutical waste can be divided into three types- glass bottle, drug shell and saline.

After segregation process the waste is taken into a box or sometimes in polythene to measure the weight of the segregated waste. The weight is taken in kg up to two decimal. The weight of the box and the poly bag is taken for the accurate measurement of the weight. As the weight meter is an electric machine so first it is checked that if the machine is charged properly. If the machine is charged properly then the machine has been calibrated. In weight measuring machine weight is taken shown in figure 1 (a), (b) and (c). Weight meter have shown the exact reading of the weight of waste in the digital screen.



(a) Glass bottle



(b) Pharmaceutical waste



(c) Drag box or paper box

Figure 1. (a) (b) and (c) Showing weight measurement of the solid waste in electric.

2.4. Color Coding System of Sample Hospital

For effective waste separation, in addition to identifying its source and persons responsible, color coding system is needed. Normally wastes from all hospitals are collected in plastic containers in hospitals. In Rajshahli Medical College and Hospital the color coding container exists but it's not used properly. Generally three colors are used. Green or Black is used for general waste, yellow color is used for infectious waste and red color is used for sharp wastes which are shown in figure 2 below. The color coded container is used according to the international rules. But in RMCH the color code is used according to type of the waste.



Figure 2. Different types of container for different types of waste.



Figure 3. Incinerator in RMCH.

2.5. Waste Treatment and Disposal Method

There are many treatment methods for hospital waste as per WHO guideline. Hospital wastes include general waste and hazardous waste from health care facilities. The hazardous wastes include blood & sharps are separated from the hospital waste. The hazardous waste is incinerated inside the hospital in an incinerator two times in a week shown in figure 3 above. The incinerated residue is then dumped into the primary waste disposal point.

In Rajshahi Medical College the waste is dumped in the temporary waste storage bins inside the hospital compound. The primary waste collection point is inside the hospital. The Hospital use manual transportation to temporary storage bin by workers. There are many disposal methods for hospital waste. This includes open dumping by Rajshahi City Corporation. Recyclable materials are collected by workers and cleaners, but they do not separate this waste for sale. It is found that recyclable materials are syringes, plastic bags and bottles, urine bags, plastics accessories, glass bottles, glass accessories, plastic polythene, metal, rubber and paper.

3. Results and Discussion

3.1. Results

In this study, data is analyzed in three different formats. First of all data is analyzed for waste generation in each day of a week in kg. Then percentage of waste generated according to

the characteristics of waste is analyzed. Last of all data is analyzed for the daily waste generation rate per bed per day from which we can understand the waste generation for each bed. Everyday data is collected for each ward. After that total waste generation is measured by taking sum of all wards waste generation. Then average is taken to measure the average daily waste generation rate. The Average waste production is: 156.85 kg/ day.

Table 1. Daily and Average waste generation per day.

| Day | Date | Total Waste Generation per day |
|----------------------------------|----------|--------------------------------|
| Sunday | 25/10/15 | 372.69 Kg |
| Monday | 26/10/15 | 185.101 Kg |
| Tuesday | 27/10/15 | 187.551 Kg |
| Wednesday | 28/10/15 | 198.464 Kg |
| Thursday | 29/10/15 | 155.101 Kg |
| Total Waste Generation in a week | | 1098.907 Kg |

Data was taken for a week. The figure 4 below shows the waste generation per day. The amount of waste generated mainly depends on the total number of patient. Generally Sunday is the peak waste generation day in a week as Friday and Saturday is the govt. holiday.

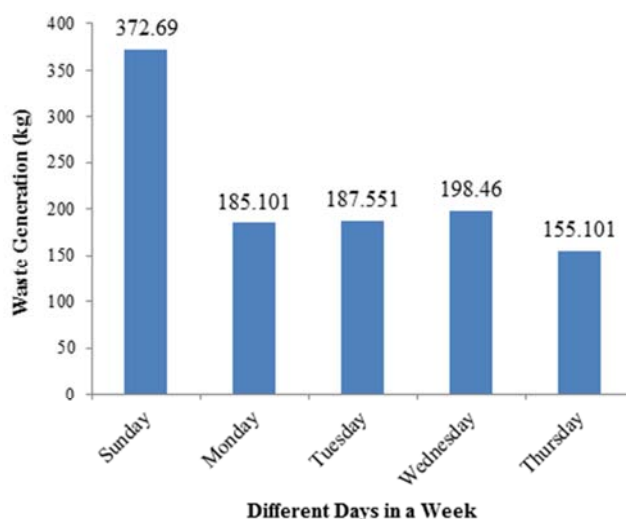


Figure 4. Waste generation at different day in a week.

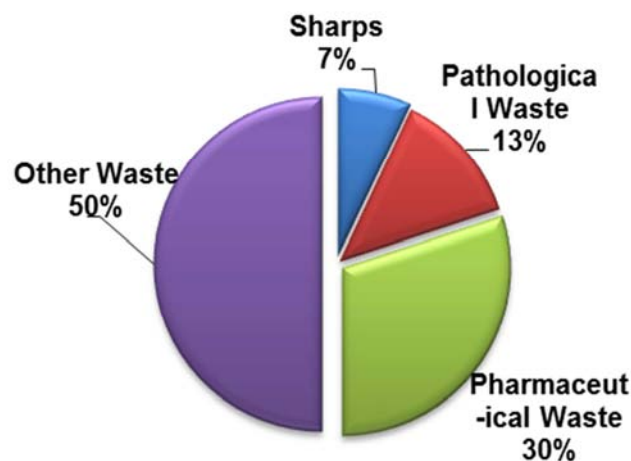


Figure 5. Average generation of waste in percentage.

After the collection of data according to the characteristics, it is just analyzed to get the result in percentage. The result is shown in the above pie chart (Figure 5). Production of the percentages of waste depends on the type of the hospital.

As RMCH is a public hospital the number of patient admits in hospital is very high. If the number of patient increases then the amount of waste generation also increases. Figure 6 shows waste generation for each bed. Though it depends on the types of ward and the nature of the patient.

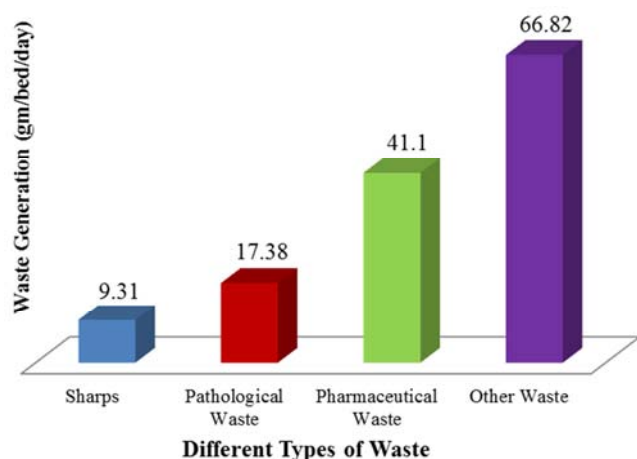


Figure 6. Waste generation per bed per day.

3.2. Discussion

From the field investigation, it is observed that Rajshahi Medical college Hospital is systematic for color coding and segregation. Though the hospital waste management authority tries to obey WHO standards, there is some deflection from the standard guideline. No recycling is done in RMCH. The Hospital staffs of Rajshahi Medical College Hospital have less awareness about the disposing method. Some of the waste collectors wear gloves but most of them do not wear the gloves. We have not seen any waste collector who wore safety mask, boot and safety clothes.

The waste collectors from all hospital should carry the waste with trolley but sometimes they carry and transport the waste in their own hand. It has also seen that some waste collector carrying waste in the bucket in lieu of color coded container.

The hospital staffs need more training and proper knowledge about the clinical waste and its management. Therefore, the efficient hospital waste management practice is essentially needed for Rajshahi Medical College Hospital (RMCH). It is a joint venture that the authorized person from RMCH and solid waste management organization should try for possible waste reduction way from the hospitals. The hospital should follow the WHO guideline in the case of color coding. Temporary storage is kept separate for the general waste and hazardous waste.

Rajshahi City Corporation manages treatment and disposal of hospital waste in Rajshahi City. They use incineration method for treatment. They cannot follow WHO guideline properly. General waste from hospital is sent to the open

dumping site. Therefore, the Rajshahi Medical College Hospital should try to improve their waste management practice.

4. Conclusion

Medical waste poses a great impact on human health and our environment. There is lack of proper technical support from the government in this sector and needs more investment. At a regular interval workshop might be arranged to increase awareness among the waste managing authority of the Hospital. It has been also seen from the study that there is a lack of man power, technical knowledge, and investment in the hospital. So it may say that, Proper waste management strategy is needed to ensure health and environmental safety.

The storage, collection, transportation, and disposal systems are improper. So authority should take special concern about this. And also Consideration needs to be given to the generation and minimization, source separation and segregation, identification and labeling, handling and storage, safe transportation and treatment.

Infectious waste, excluding sharps should be collected in no more than one day a week, unless the waste is refrigerated. The sharps receptacles are exchanged at regular intervals of three months. Arrangements should be made to routinely transport waste from ward level to a storage area pending collection by a waste contractor.

The problems confronting the hospitals include lack of instructions on the aspects of clinical waste segregation and practices by nurses and intermingling of clinical waste with general waste. It is no doubt that problem in improper segregation of clinical waste and general waste is a common problem in clinical waste management worldwide. However, it is still important to keep the segregation process according to the standard and guidelines as to ensure the safety and health of the people and environment.

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