

# **Medical Waste Management of Rangpur City in Bangladesh**

**BY**

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This Thesis Report Presented in Partial Fulfilment of the Requirements for the Degree of Bachelor of Science (B.Sc.) in Environmental Science and Disaster Management (ESDM)

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**Dhaka, Bangladesh**

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## Approval



This thesis titled “Medical Waste Management of Rangpur City in Bangladesh”, submitted by Tasnuva Hossain to the Department of Environmental Science and Disaster Management, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. Environmental Science and Disaster Management and approved as to its style and contents. The presentation has been held on 6 April of 2024.

A handwritten signature in black ink, appearing to read "Azharul", is written over a horizontal line.

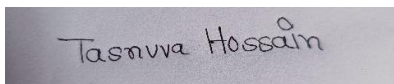
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## **Declaration**

I hereby declare that this research project has been done by me under the supervision of Mr. Md. Azharul Haque Chowdhury, Assistant Professor, Department of Environmental Science and Disaster Management (ESDM), Daffodil International University (DIU). I also declare that neither this research project nor any part of this research project has been submitted elsewhere for the award of any degree.



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## **DEDICATION**

To,

**My loving parents**

Md. Tahazud Hossain

Mst. Syedun Nessa

**My respected teacher**

Dr. A.B.M Kamal Pasha (Professor & Head)

Dr. Mahfuza Parveen (Associate Professor)

Mr. Md. Azharul Haque Chowdhury (Assistant Professor)

S M Mahmudur Rahman (Lecturer)

Sagar Mozumder (Lecturer)

**and**

*to the loving memory of my beloved seniors, juniors, coordination officers and staffs from the **Department of Environmental Science and Disaster Management (ESDM), Daffodil International University (DIU)** with whom I spent a single second of my undergrad life in last four years (1<sup>st</sup> January, 2020, to April 6, 2024).*

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## **ABSTRACT**

The purpose of the study was to know the current Medical Waste Management of Rangpur City. Eighty three people were selected through the survey from two hospitals and three diagnostic centers of Rangpur city, Bangladesh. The people were asked questions to find out the current management system, waste generation amount and the treatment method of medical waste. The findings of this study show that the average 2-3 kg /day medical wastes were generated in selected hospitals and diagnostic centers. Among them 1.5kg are non-infectious and 500gm are infectious. It was found from the survey that some hospitals and diagnostic center maintains the rules and regulations of medical waste management and maintain the proper disposal method to dispose the medical waste. But some of them has no systemic management system of medical waste. The study reveals that lack of awareness, financial support and willingness are responsible for improper management of medical waste. The authorities should maintain the rules and regulations of disposing the medical waste.

**Keywords:** Medical waste, Medical waste management, Medical waste management method, Medical waste disposal.

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## ABBREVIATIONS

WHO	World Health Organizations
HCE	Health Care Establishment
MW	Medical Waste
MCWC	Mother and Child Welfare Center
DH	District Hospital
AI	Artificial Intelligence
IOT	Internet of Things
PPE	Personal Protective Equipment
RCC	Rangpur City Corporation
JCNHR	Janata Clinic and Nursing Home Rangpur
IHR	International Hospital Rangpur
SLDCR	Science Laboratory and Diagnostic Center Rangpur
SDCR	Shithi Diagnostic Center Rangpur
HDCR	Habib Diagnostic Center Rangpur

## **CHAPTER 1: INTRODUCTION**

Medical waste is dangerous and contagious. It presents major risks to the environment's health and needs to be handled carefully before being disposed of in the end. Medical wastes are produced by diagnostic monitoring and procedures related to human and veterinary medicine that are preventive, curative, or palliative in nature. The latest advancements in healthcare facilities are specifically designed to prevent and safeguard community health. The number of procedures used to cure diseases is growing due to the use of advanced devices. Due to these advancements in science, healthcare facilities are producing more waste per patient on a per capita basis. In Bangladesh, the proper disposal of medical waste has received little attention. Humans and the environment are both contaminated and polluted by medical waste. People can become ill from medical waste either directly or indirectly by direct contact with contaminated soil, groundwater, surface water or air (Alam, M. 2013).

The hazardous and nonhazardous components of medical waste are estimated differently in the World Health Organization (WHO) report and research phase. Approximately 85% of hospital wastes are nonhazardous, 10% are hazardous (biologically infectious), and the remaining 5% are pharmaceuticals, toxic chemicals, and radioactive wastes. Medical waste poses a significant risk to individuals involved in its administrative handling, such as physicians, nurses, janitors, patients, hospital guests, and technicians. One of the main issues facing emerging nations like Bangladesh is access to healthcare. In Bangladesh, hospital garbage is not properly disposed of, and the administration is appalling. It appears that neither the organizational nor the governmental sectors are paying much attention to this issue. Therefore, the issue is becoming worse every day. One of the most important aspects of hospital management may be the safe disposal of medical waste (Hossain, R. 2021). One of the most important steps in preventing environmental contamination and reducing the risk of disease or harm from coming into touch with this potentially dangerous substance is the safe disposal of medical waste and its subsequent destruction. The environment and public health are greatly impacted by Rangpur City's expanding hospital, clinic, and diagnostic

laboratory population. Of the total solid waste created in Bangladesh, medical wastes make up a very small portion roughly 1%. But if this small quantity is not handled correctly, it mixes with household solid trash and makes the entire waste stream potentially hazardous. In Bangladesh, there was no system in place up until recently for the appropriate handling of medical waste in order to prevent environmental health risks (Hassan, M. 2008). Within this framework, this study represents a modest attempt to assess the state of medical waste management today and the degree of public awareness regarding the impact of medical waste and its management; to investigate the variables influencing medical waste management techniques and to assess the suitability and constraints of the laws and guidelines currently in place regarding medical waste management (Biswas, A. 2011).

Medical and clinical waste, or trash produced in medical facilities such as hospitals, clinics and nursing homes, is the subject of medical waste management, a subfield of waste management. Many governments have regulations especially dealing to Medical Waste that are intended to guarantee that it is properly regulated. These rules must be followed by the waste management agencies that handle Medical Waste since they present a number of unique challenges. Improving Bangladesh's current HCE waste management procedures will have a big long-term effect on reducing the spread of infectious diseases. There are two types of trash that are generated during the delivery of healthcare: hazardous waste and non-hazardous waste. While 75–90% of Medical Waste are not dangerous, the remaining 10–25% include hazardous chemicals and pathogenic bacteria that need to be treated carefully to reduce the dangers to human health and the environment. Individuals who produce, handle, or come into contact with this hazardous material are at risk of contracting severe illnesses like HIV, hepatitis B, hepatitis C, and other infections. Nine out of ten hospitals in Bangladesh and one out of every three hospitals worldwide lack basic MW management services (Hossain, L. 2014)

In Bangladesh, the Ministry of Health and Family Welfare oversees a Mother and Child Welfare Center (MCWC) and a District Hospital (DH) at the district level. The DHs offer every kind of secondary healthcare service; in contrast, the MCWCs solely offer family planning and maternity and child health services. Thus, these

two types of facilities differ greatly in terms of their structure, service offerings, and human resources. Nonetheless, referred patients from sub-district and lower levels are handled by both clinics. The Ministry of Health and Family Welfare has created a Medical Waste Management Guideline for Bangladeshi healthcare facilities, however its effective implementation has remained a significant source of worry. When it came to handling waste disposal or performing laboratory analyses of infectious or dangerous diseases, no safety precautions were followed. Both the environment and the laboratory operator may be harmed by the chemicals used to stain and preserve slides as well as to clean and sterilize surrounding surfaces and equipment. Hospital wastes have a big influence on the environment and public health. It is clear from this study that there is a pressing need for education and awareness-building regarding medical waste issues. To protect public health and the environment, waste management strategies must be implemented properly (Akter, N. 2000).

This study will demonstrate the state of the art and current methods in medical and healthcare waste management globally, with a focus on transitional economies. It will also highlight how different socioeconomic and environmental factors influence the pace at which medical waste is generated. Only 41% of employees received in-service training on how to properly dispose of medical waste, while an average of 38.9% of waste was separated for proper handling. About 35% of medical waste was made up of plastic materials, offering a chance for recycling and resource recovery that is sustainable. To avoid catastrophic infectious waste stockpiling during and after pandemics, all nations must implement environmentally sustainable medical waste management practices. Priority goals in waste management are to avoid or minimize waste generation and the level of its risk, as well as to reuse and recover trash through recycling, recovery, or any other process that yields secondary raw materials or the use of waste as a source of energy. Waste disposal procedures and techniques shouldn't put the environment or public health in risk (Brasovean, I. 2010).

### **1.1 Objectives of the study**

- To determine the amount of waste generated from the selected hospitals in Rangpur City.
- To know the current medical waste management practices in Rangpur City.
- To propose a better method of medical waste management in Rangpur city.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Medical Waste**

Medical waste is a subset of the wastes produced by health care institutions, including hospitals, clinics for doctors, dentists, blood banks, veterinary hospitals, and research and development centers. Medical waste, also known as regulated medical waste, is generally defined as healthcare waste that may have been tainted by bodily fluids, blood, or other potentially contagious items. Medical waste is defined by the World Health Organization as waste produced by health care activities. This includes bodily parts, chemicals, medications, radioactive materials, spent needles and syringes, soiled dressings, diagnostic samples, blood, and other items. An integral component of health care is waste management. Healthcare personnel, waste handlers, and the general public are all at risk for infections, harmful effects, injuries, and environmental pollution when medical waste is not properly managed. Fifteen percent of the waste produced by health care activities is classified as hazardous material, which could be radioactive, chemical, or pathogenic. As many as 33800 new HIV infections, 1.7 million hepatitis B infections, and 315000 hepatitis C infections were brought on by hazardous injecting practices in 2010 (WHO, 2023).

### **2.2 Medical Waste Management**

Everyone who works in the health services industry, from floor cleaners to senior administrators, must comprehend and solve the complicated issue of waste management if the program is to be effective. Activities related to health care are ways to preserve health, treat patients, and even save lives. However, they also produce waste, of which 20% poses a danger of injury, infection, or exposure to chemicals or radiation. Although hazardous medical waste poses certain concerns and can be managed in a variety of ways that are well-known and documented in manuals and other materials. Inadequate waste management practices can endanger patients and their families, caregivers, workers who handle medical waste, and the local community. Furthermore, improper handling or disposal of such trash may contaminate or pollute the environment. Hospitals are accountable for the garbage they generate (Sujon, H. 2022).



They have to guarantee that the waste will not be handled, treated, or disposed of in a way that will negatively impact the environment or public health. The inadequate treatment and disposal techniques of medical waste pose significant threats to human health and the environment, making medical waste management a global concern. Handling contaminated objects like bandages, syringes, and needles is a mismanagement that puts workers' health at risk for infections and other ailments. It also contaminates water supplies, produces air pollution, and adds to environmental contamination. Ecological equilibrium can be upset, public trust in healthcare institutions can be damaged, and governments and communities may incur long-term financial consequences as a result of poor management. Infections, illnesses, health concerns, environmental contamination, distrust, ecological imbalances, and long-term financial expenses can all result from improper medical waste handling. Bangladesh, a developing country that has similar challenges, now has the opportunity to improve its medical waste management system by embracing technological breakthroughs, particularly in artificial intelligence (AI) and the Internet of Things (IOT) (Hasan, M. 2021).

Investigating and promoting the integration of photo kineer technology initiatives from Asia and other developing regions can help tackle Bangladesh's medical waste issues. Bangladesh's absence of a waste management plan and insufficient regulation will have serious repercussions. A 2022 study states that Dhaka generates 1.63–1.99 kg of medical waste per bed per day, with a large increase following COVID-19. The nation has long had unsafe garbage transportation, treatment, and disposal practices, making its management appalling to put it mildly. This problem is also common in areas where the majority of the population is at risk. The management of medical waste in Bangladesh needs to be addressed right now. Bangladesh can transform trash management and safeguard the environment and public health by utilizing AI, IOT, and other technology. Governmental actions have the capacity to accelerate this transformation, encourage cooperation, and provide stakeholders the authority to accept and maintain these creative solutions. Bangladesh's sustainable medical waste

management is going to need to undergo a technological revolution (Hasan, M. 2023).

### **2.3 Medical Waste and Environmental Pollution**

One particular category of harmful pollutants is medical waste. Inadequate handling could result in secondary pollution of the environment, particularly during public health emergencies. Nonetheless, the production of medical waste has been the subject of comparatively few studies, and little is known about the spatial-temporal variability of this waste. The creation of medical waste has increased significantly in the last several decades as a result of the notable rise in medical care and ongoing advancements in medical technology. Medical waste that is improperly disposed of or dumped illegally can pollute the environment and have unintended negative effects on human health. Medical waste stored outside can emit a lot of toxic gasses including sulfide and methane, which greatly contaminates the atmosphere (Wei, Y. 2020).

Additionally, during burning, carcinogens such as dioxins and polychlorinated biphenyls are produced. Runoff and infiltration from medical waste that is not suitable for disposal can seriously contaminate surface and groundwater with pathogens, heavy metals, and organic pollutants. Leaching and washing by rainfall cause heavy metals in landfill leachate to permeate the soil, changing its characteristics and causing an accumulation of heavy metals that eventually threaten plant and animal life. Medical trash is more likely to contaminate the environment than regular waste due to its infectious and poisonous qualities. Medical waste contaminates the environment when it is left untreated or is handled incorrectly, harming everyone who lives nearby. Disinfectants and other chemicals, together with biomedical waste, contaminate streams and groundwater, putting aquatic life in jeopardy and harming agricultural irrigation systems. When exposed to medical waste, rodents, birds, and other animals are also more likely to contract and spread bacterial diseases and parasites. Medical waste can emit toxins into the air when improper or insufficient cremation procedures are followed. To be more precise, burning things that include heavy metals or chlorine releases hazardous metals into the atmosphere along with human carcinogens such as furans

and dioxins. Medical waste is one of the main sources of greenhouse gas emissions from the healthcare industry as a whole. According to a 2010 research, hospitals generate 33.8 pounds of trash each day for every staffed bed. In addition, hospitals discard over 2 million pounds of goods per year that are never used. When medical waste is properly treated and managed more effectively, waste and pollutants are reduced, which improves air quality and lessens environmental discomfort (Wei, Y. 2020 )

## **2.4 Health Risk**

There are serious health dangers associated with being around untreated medical waste. Microorganisms that are hazardous and can infect both humans and animals can be found in medical waste. Needles and sharp objects can injure people and spread illness. Pharmaceuticals have the potential to emit dioxins, mercury, cytotoxic medicines, and antibiotics into the environment. Medical waste improper disposal has been associated with the spread of parasite illnesses, TB, HIV, hepatitis B and C, lung infections, skin infections, cholera, and other infections. Premature death, higher hospitalization, cardiac problems, and stroke are all associated with air pollution. Waterborne infections such as salmonella, leptospirosis, and Giardiasis are caused by pathogenic bacteria that are dispersed by contaminated water. Inadequate waste handling training and a lack of suitable legislation or their implementation are the main causes of medical waste mismanagement. Your company can cut expenses and the dangers related to medical waste by promoting safe practices to limit waste volumes and adopting effective waste segregation. The use of steam treatments, autoclaving, and microwaving are examples of environmentally appropriate disposal methods that have to be chosen over hazardous incineration. Regarding waste minimization and safe disposal, WHO has created extensive guidelines and training modules. You can create and update your waste management plan with the aid of this and related resources (Islam, M. 2013).

## **2.5 Medical Waste Disposal**

Healthcare providers are the ones who should dispose of medical waste. Discipline needs to start right away. The proper containers should be used to identify and contain biohazardous waste. Pros can more easily recognize the kind of waste they are handling thanks to color codes. Prior to being picked up or transported to a waste disposal provider, containers must be correctly labeled and kept in a dry, secure location. Medical Waste Pros offers safe and efficient medical waste companies in your area. Every municipal, state, and federal regulation is followed by our disposal firms. To safeguard our communities and the health of coming generations, we employ ecologically responsible methods. We employ burning (with authorized emissions requirements), chemical disinfection, and autoclaving as techniques. Geographical location, waste volume, frequency of service, and other factors affect the cost of disposing of medical waste (Islam, M. 2013).

## **2.6 Plastic Waste in Healthcare**

Since Covid-19 has made the already serious problem of how to handle all the medical waste worse, plastics have become increasingly important to modern healthcare. Tens of thousands of tones more medical waste a large portion of which include single-use plastic have been produced as a result of the Covid-19 response, according to the World Health Organization (WHO). Systems for managing medical waste are under more stress due to the rapid manufacturing of personal protective equipment (PPE), testing kits, and vaccine packaging and containers. Without plastic, modern healthcare would not be feasible. It has shown to be one of the few adaptable materials that can keep up with the fast-paced nature of the healthcare sector, offering advantages including sterility, quality, durability, and above all safety for patients and healthcare personnel. Nevertheless, despite all of the advantages, single-use plastics and healthcare packaging have unanticipated environmental effects due to the waste they produce. Single-use plastics are justified in need, mainly to prevent infectious diseases, as plastics are vital to healthcare. However, data indicates that as global healthcare grows more urgent and sophisticated, plastic use in healthcare will only increase in the near future. The healthcare sector operates under the tenet of "do no harm," as it is dedicated to

promoting and restoring people's health. Thus, the "do no harm" maxim is contradicted by hospitals disposing of billions of pounds of plastic garbage in landfills or through incineration. Consequently, addressing the plastic trash problem in an ecologically friendly manner directly affects human health (Saltmarsh, A. 2022).

## **2.7 Recycling of Medical Waste**

Healthcare facilities worldwide generate a significant volume of non-infected plastic garbage. Only a tiny portion gets recycled, though. Traditionally, used plastics are burned insufficiently or dumped in landfills. These actions have a negative impact on the environment. Because of their extreme adaptability, plastics are an essential component of the medical industry. The COVID-19 pandemic amply demonstrated the rising desire for single-use plastics. Thus, it may be difficult to totally abstain from plastics during this time. Without a question, recycling plastics can help to address the plastic pollution problem. Recycling of medical plastic is hampered mostly by sorting and cleaning challenges. Recycling medical plastic wastes requires effective collaboration between the healthcare industry. Sustainable adoption of new recycling methods is required. Furthermore, it should be feasible to recycle the polymers used in medical applications. The drawbacks of medical wastes are emphasized in this paper, along with the possibility of recycling common medical polymers. The environment benefits from recycling medical waste, but it also lowers disposal costs and hazards. Nonetheless, in order to prevent contamination, infection, and harm, recycling medical waste necessitates meticulous planning, compliance, and safety procedures (Islam, M. 2013).

## **2.8 Medical Waste Recycling Steps:**

- Medical waste streams must first be identified and categorized based on their kind, amount, and possible risks. There are four primary categories for medical waste: sharps, infectious, pathological, and general. Because it is not harmful, general waste can be recycled or disposed of like ordinary garbage. Blood, bodily fluids, cultures, swabs, and other biological agents that can spread illness are all found in

infectious garbage. Animal or human tissues, organs, and bodily parts are considered pathological waste. Sharps trash include needles, syringes, scalpels, and other potentially piercing or cutting things. Recycling choices and requirements vary depending on the type of waste stream.

- Sorting medical waste based on the waste stream and recycling strategy is the second phase. Segregation is the process of separating garbage at the site of generation and putting it in the proper bins, bags, or containers. In addition to preventing cross-contamination and making recycling easier, segregation helps lower the volume of waste that needs to be processed.
- The third step is to properly and precisely mark medical waste, including the waste stream, the recycling process, and any possible risks.
- Until it's time for collection and recycling, the fourth step is to keep medical waste safely and hygienically. To store garbage is to keep it in a specific location that is bug-free, ventilated, and locked. In addition to avoiding leaks, spills, or damage, storage entails preserving the integrity and quality of the trash cans, bags, or bins.
- Selecting a trustworthy and qualified garbage contractor who can legally and safely collect, transport, and recycle the medical waste is the fifth step.
- Monitoring, assessing, and identifying opportunities for improvement in medical waste management and recycling performance constitute the sixth and final step.

## **2.9 Types of Healthcare Waste:**

There is a wide variety of materials that are considered medical waste, as this list shows:

- General waste
- Chemical waste
- Anatomical waste
- Pathological waste
- Radioactive waste
- Sharps

**Table 2.1: Previous studies**

<b>No</b>	<b>Authors</b>	<b>Place</b>	<b>method</b>	<b>Waste generation/day</b>	<b>Dumping system</b>
1.	Haque, A. B. 2021)	Rangpur	Questionnaire survey	Autoclaving/ Incineration	1.69 kg
2.	Rahman, M. 2015	Rangpur	Questionnaire survey	Autoclaving/ Incineration	1.7kg
3.	Emdadul, H. 2012	Dhaka	Questionnaire survey	Sell waste for recycling	1.58kg
4.	Rahman, M.M. 2018	Khulna	Questionnaire survey	Incineration	0.90kg
5.	Haque, M. 2021	Jessore	Questionnaire survey	Incineration	7.88kg
6.	Hossain, L. 2014	Jessore	Questionnaire survey	Landfill/ Incineration	1.90kg
7.	Haque, R. 2023	Cox's Bazar	Questionnaire survey	Landfill/ Incineration	0.56kg
8.	Islam, M. A. 2015	Mymensingh	Questionnaire survey	Autoclaving/ Micro-waving	1.68kg
9.	Rahman, M. 2020	Noakhali	Questionnaire survey	Landfill/ Incineration	2.55kg
10.	Hossain, R. 2021	Gopalganj Sadar	Questionnaire survey	Incineration	0.88kg

## CHAPTER 3: MATERIALS & METHOD

### 3.1 Study Area

The Rangpur region was the site of the study. One of the largest cities in Bangladesh is Rangpur. Rangpur is among the oldest municipalities in Bangladesh, having been designated as a district headquarters on December 16, 1769, and then as a municipality in 1869. Rangpur District, also known as the Rangpur Division, spans an area of 2400.56 square kilometers and is situated between latitudes 25°18' and 25°57' north and longitudes 88°56' and 89°32' east. Based on the 2011 census, the district has 2.9 million residents. Between 2001 and 2011, there was an annual population growth of 1.2%.

There are 1,200 people per km<sup>2</sup> in the area.

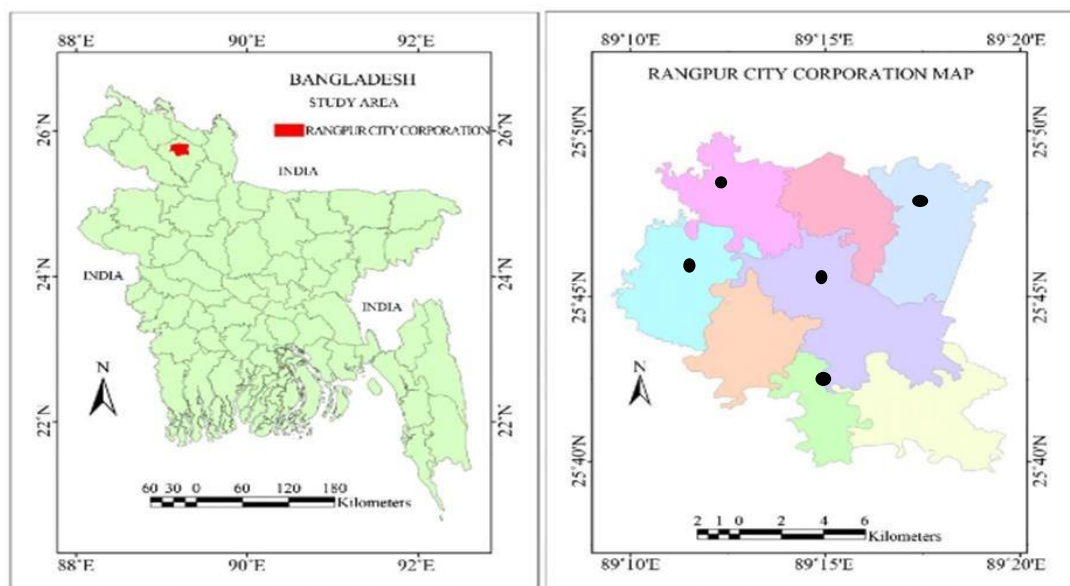


Figure 3.1: Study area map

### 3.2 Selection of Hospitals in Rangpur City

Across the districts of north Bengal, Rangpur is highly renowned for its medical services. There are several private clinics, hospitals, and diagnostic institutions in Rangpur city. I will visit 2 clinics and 3 diagnostic center out of them. The list of chosen medical facilities is shown below.



**Table 3.1: List of clinics and hospitals that will be surveyed:**

<b>SL</b>	<b>Hospital name</b>	<b>Hospital class</b>
1.	JCNHR	Private
2.	IHR	Private
3.	SLDCR	Private
4.	SDCR	Private
5.	HDCR	Private

### **3.3 Data Collection Method**

Information taken from:

- Field observation.
- Field level data collection through interviews.
- Questionnaire survey.
- Review Literature to collect information about quantity and quality of Medical waste.

### **3.4 Data analyzing tool**

- Microsoft Excel.
- SPSS

### **3.5 Data collection**

A questionnaire survey was conducted gather the primary data. Thirty questionnaire surveys total, mostly from competent people such as administrators, nurses, housekeeping staffs and technology operators, was used to gather primary data from ten healthcare facilities. Permission was obtained from the relevant authorities at each medical hospital and clinic before visiting. Secondary data was collected from websites, journals, and pertinent literature.



Figure 3.2: Collection of data



Figure 3.3: Collection of data



Figure 3.4: Collection of data

### 3.6 Categories of respondent

The figure shows the total amount of respondent. 15% of administrators, 28% of nurses, 30% of housekeeping staffs, 10% of technology operators.

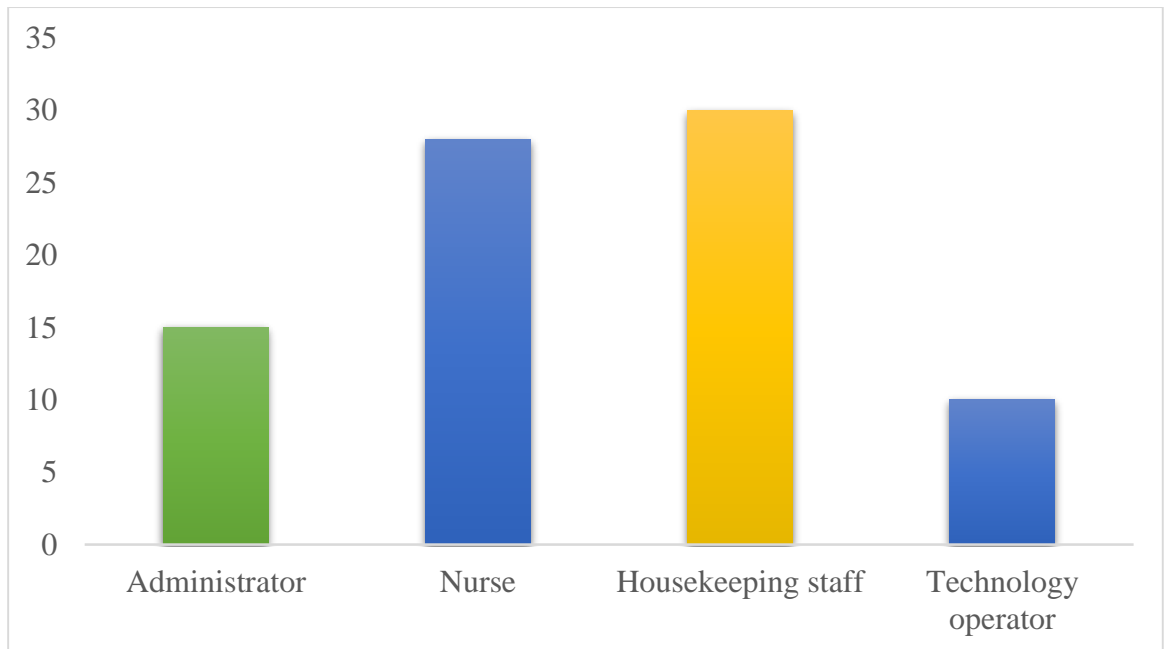


Figure 3.5: Percentage of respondents according to their profession

### 3.7 Age distribution of the respondent

The following table shows the four responder age categories that we had to categorize based on our survey:

**Table 3.2: Age distribution of the respondent:**

Age categories (year)	Percentage (%)
10-30	25%
31-50	30%
51-70	5%

## CHAPTER 4: RESULT AND DISSCUSSION

### 4.1 Percentage of Hospital waste

According to the study, waste materials of the selected hospitals and diagnostic centers in Rangpur city have been measured at a total of 1-2 kg per day. The table below show us the total amount of last four months of total waste generation of surveyed hospitals and diagnostic centers in Rangpur city.

**Table 4.1: Total amount of medical waste generation according to four months by hospitals and diagnostic center:**

Waste generation in four months (Kg)				
Name	September	October	November	December
JCNHR	25	28	24	27
SLDCR	30	31	26	26
IHR	27	26	30	23
SDCR	26	28	27	25
HDCR	24	26	25	24

### 4.2 Percentage of medical waste generated by surveyed hospitals and diagnostic centers

Various types of waste are generated by the medical centers under study and the respondent's answers to questionnaires were gathered. Medical centers under study produced paper or food waste, anatomic wastes or body parts (liquid, solid), pharmaceutical wastes, pathological, chemical waste and other types of waste (such as syringe, blades, etc.), Sharp wastes and cotton, bandages, saline bags, blood and urine bags etc.

**Table 4.2: Types of medical waste generated by Surveyed Hospitals and Diagnostic centers per day:**

Waste type (Count 100%)								
Name of hospitals	Food waste	Anatomic waste	Pathological waste	Chemical waste	Sharps	Saline bag	Urine bag	Other
JCNHR	17%	16%	9%	2%	22%	11%	12%	11%
SLDCR	15%	12%	6%	0.5%	21%	10%	10%	25.5%
IHR	12%	13%	7%	1%	23%	9%	13%	22%
SDCR	15%	15%	5%	1%	20%	10%	10%	24%
HDCR	11%	12%	8%	1.5%	21%	11%	11%	24.5%

**Table 4.3: Medical Waste Management Data of Surveyed Hospitals and Diagnostic Centers :**

Hospital name	Waste generation /day	Waste removal interval	Cost of removal BDT/month	Dumping system	Dumping site	Suggestion of better method
JCNHR	2	Daily	3000	Incineration	PRISM	Autoclaving, Incineration, process are cost effective and safe method for disposal.
SLDCR	1.5	Daily	3500	Landfill	PRISM	
IHR	3.8	Daily	4700	Landfill	PRISM	
SDCR	2	Daily	4500	Incineration	PRISM	
HDCR	3	Daily	3500	Landfill	PRISM	

After survey I found out that the surveyed hospitals and diagnostic centers manage their waste by doing incineration, landfill. The nonprofit organization PRISM collect their waste regularly and dispose them on PRISM dumping site.

**Table 4.4: Medical Waste Dumping System of Some hospital of Dhaka, United Kingdom and Japan:**

Hospital name	Waste disposal method	Reference
Dhaka Medical College Hospital	Autoclaving	Hasan, M. 2023
Square Hospitals Ltd.	Landfill	Saltmarsh, A. 2022

Sakura Hospital, Japan	Incineration	Brasovean, I. 2010
Fuji Medical Center, Japan	Recycling and Waste Segregation	Wei, Y. 2020
St. Thomas' Hospital, UK	Incineration, Recycling, Hazardous Waste Disposal	Hasan, M. 2021
Queen Elizabeth Hospital Birmingham, UK	Waste Segregation, Incineration, Recycling	WHO, 2023

After reviewed some literature of some other country like U.K , Japan I found out that they manage their medical waste by recycling, incineration, autoclaving etc.

#### 4.3 Present collection and transportation scenario of medical waste in Rangpur



Figure 4.1: Collection of waste waste



Figure 4.2: Transportation of



Figure 4.3: Disposal of Waste

PRISM Bangladesh has established a medical waste treatment plant to treatment and dispose medical waste properly. PRISM Bangladesh signed an agreement in 2018 to treat the medical waste generated from health care center. The waste generated from health care center is temporarily stored in separate containers according to its type and color arrangement. Trained staff collect the waste in red, yellow and green containers and weight it and record the amount of waste in data sheet and get the signature of person in charge of the health care center. After storage the waste is bought to the plant daily through covered vans. Final management and disposal is done differently according to the type of waste. Autoclaving is the sustainable method for treating and dispose the medical waste. Autoclaving is done by storing the waste in autoclave machine for 45 minutes at to 135°C to 140°C and 3 times atmospheric pressure. They use incineration method to treat the highly infectious wastes. They also use landfill system to dispose the liquid waste and incineration ash. They use the aeration method to purify the liquid waste in ETP plant with the help of many chemical elements.

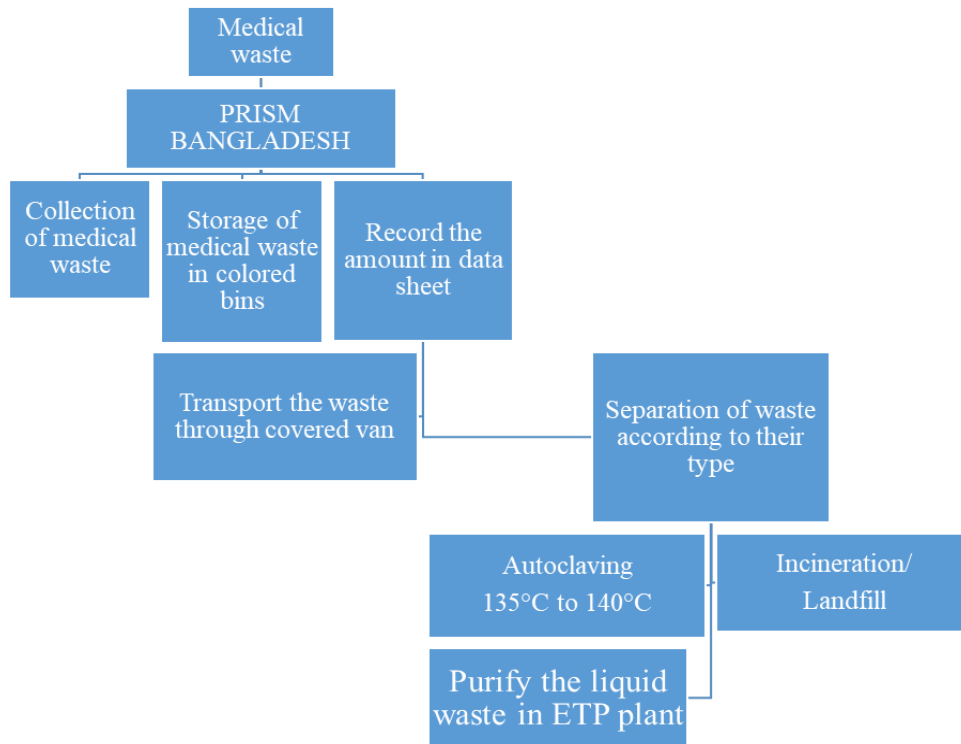


Figure 4.4: Diagram of PRISM Medical waste management in Rangpur city

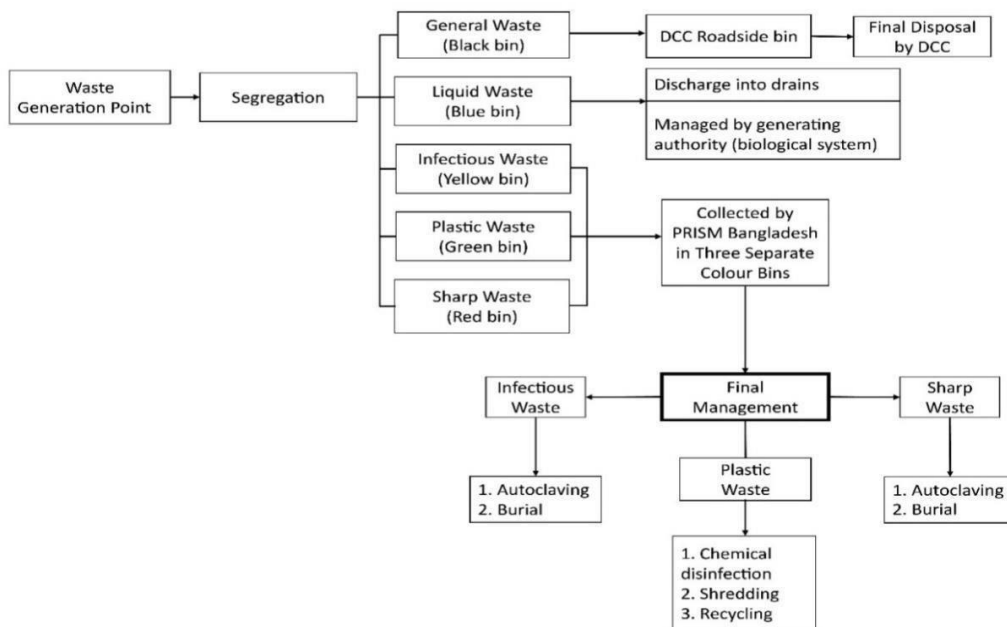


Figure 4.5: Diagram of PRISM Medical waste management in Dhaka city (Akter, N. 2000).



**Table 4.5: Cross Relation among the Age and the Knowledge in Managing of Medical Waste**

Age (Year)			Knowledge in management of medical waste		Total
			Yes	No	
10-30	Total respondent	Male/	20	3	23
		Female	16	1	17
31-50	Total respondent	Male/	10	2	12
		Female	12	1	13
51-70	Total respondent	Male/	10	2	12
		Female	5	1	6

Within the age of 10-30 about 21% of the respondent manage the medical waste properly. 3%of them don't manage the medical waste properly (Table 5.1s). Within the age of 31-50 12% of the respondents manage their medical waste properly. 10% of the respondents within the age of 51-70 manage their healthcare waste properly.

## **CHAPTER 5: CONCLUSION & RECOMMENDATION**

### **5.1 Conclusion**

This study was carried out to find out the medical waste management system and the amount of generated waste in selected hospitals in Rangpur city. It was investigated from our field survey that the medical authorities have lack of willingness to collect generation data of medical waste and proper management of those. So, it was quite difficult to manage proper information about waste generation and management. In the field survey it was tried to collect information about different types of waste generated in hospitals and diagnostic centers. The survey was conducted on 2 clinics and 3 diagnostic centers in Rangpur city and numbers of respondents especially administrators, nurses, housekeeping staffs and technology operators of different hospitals and diagnostic centers who helps us to get relevant information and data about medical wastes and its management techniques. The collected field data showed that all surveyed hospitals and diagnostic centers generated about 2-3 kg/day of wastes of which only about 1.5kg were infectious wastes and 500 gm are non infectious wastes. The average waste generation rate for the surveyed hospitals and diagnostic centers was 2 kg per/day. It was found from the field survey that some housekeeping staffs were engaged to mishandle the generated wastes. They did not segregate the infectious wastes from non-infectious wastes. Most of the wastes were taken by PRISM van for dumping at PRISM site and rest of it were burnt by incinerator. The level of medical waste was high but they were not able to manage the waste properly. Therefore, it becomes necessary for the RCC authorities, hospitals and diagnostic centers to maintain the medical waste management rules and regulations according to the guidelines World Health Organization (WHO) to avoid the enormous future cost of abating medical waste related problems.

### **5.2. Recommendations**

- Incineration and autoclaving method can be use for medical waste disposal.
- Transport system should be improved.

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# ANNEXURES: SURVEY QUESTIONS

Questionnaire for administrator:

---

Name:

Are you:

- Male
- Female

How old are you:

- 10-30
- 31-50
- 51-70

1. Do you aware of medical waste management?

- Yes
- No

2. Own treatment and disposal mechanism?

- Yes
- No

3. What agency regulates the wastes generated at the hospital?

- Govt.
- Private
- Do not know

4. What is the quantum of waste generated by the hospital?

- Kg
- Tons

5. Is the Solid Waste area or containers secured?

- Yes
- No

6. Collect general information about the hospital:

- Name of the hospital:
- Type of the hospital:
- Number of beds:
- In/out patients:

7. What is the present waste management system in the hospital?

- Landfill
- Use sharps pit
- Store and transport to centralized facility
- Waste minimization

8. Any training imparted?

- Yes
- No

9. Regular monitoring and record keeping

- Yes
- No

10. Quantity of sharps generated per day-

- Kg
- Tons

11. Frequency of collection of sharps-

- Everyday
- In a week

12. What are the reasons for choosing the present system?

- Cost effective
- Sustainable
- Low risk
- Hygienic

13. Do you use a sharps pit for final disposal?

- Yes
- No

14. Where do you store the waste before sending the waste for final disposal?

- Plastic bag
- Container
- Bin
- Clear bags

15. How would you store the waste before sending for final disposal?

- Plastic bag
- Container
- Bin
- Clear bags

16. Are you satisfied with the present system?

- Yes
- No

Questionnaire for nurses:

Name: \_\_\_\_\_

Are you:

- Male
- Female

How old are you:

- 10-30
- 31-50
- 51-70

1. What is the present waste management system in the hospital?

- Landfill
- Use sharps pit
- Store and transport to centralized facility
- Waste minimization

2. Any training imparted?

- Yes
- No

3. Regular monitoring and record keeping

- Yes
- No

4. What is the present sharps management system of the hospital?

- Landfill
- Use sharps pit
- Store and transport to centralized facility
- Waste minimization

5. Different categories of sharps generated-

6. Method for sharps collection from the patients bed side to the nursing station

- Plastic bag
- Container
- Bin
- Clear bags

7. Are the sharps stored in -

- Puncture proof containers
- Bags
- Bins

8. Is the container -

- Closed
- Open

9. How is the waste carried from the point of generation to the final disposal site?

- Plastic bag
- Bin
- Container
- Clear bags

10. Are the sharps bin emptied-

- Regularly
- Weekly

11. Are the sharps collected manually in -

- Open bins
- Secure containers
- Polythene bags

12. Do you think that the present system of sharps management is easy and safe?

- Yes
- No

Questionnaire for housekeeping staff:

---

Name:

Are you:

- Male
- Female

How old are you:

- 10-30
- 31-50
- 51-70

1. What is your duty in the hospital?

- Cleaner
- Ward boy

2. What kinds of waste do you collect?

- Sharps
- Infectious
- Radioactive
- Chemical

3. Was any training on waste management imparted?

- Yes
- No

4. Wastes are-

- liquid
- Solid
- Both

5. How is the waste treated at the point of generation?

- Store at bins
- Store at plastic bags
- Store at container

6. How is the waste carried from the point of generation to the final disposal site?

- Plastic bags
- Bins
- Container
- Clear bags

7. Are the sharps bin emptied –

- Regularly
- Weekly

8. Are the sharps collected manually in-

- Open bins
- Secure containers
- Polythene bags

9. What is the present system of sharps disposal in the hospital?

- Landfill
- Use sharps pit
- Store and transport to centralized facility
- Waste minimization

10. What does green colored bag contain?

- General waste
- Infected waste
- Sharp waste
- Food waste

11. What does yellow colored bag contain?

- General waste
- Infected waste
- Sharp waste
- Food waste

12. What does red colored bag contain?

- General waste
- Infected waste
- Sharp waste
- Food waste

13. What does blue colored bag contain?

- General waste
- Infected waste



- Sharp waste
  - Food waste
14. Are waste bins covered?
- Yes
  - No
15. How many color coding containers are available for biomedical waste collection?
- 2
  - 3
  - 4
  - 5
16. Bandages, gauzes and Cotton are disposed in:
- Yellow bags
  - Red bags
  - Green bag
  - Blue bag
17. Catheters, syringes and Injections are disposed in:
- Yellow bags
  - Red bags
  - Black bag
  - Blue bags
18. What materials are disposed in blue bags?
- Glass bottles
  - Sharp wastes
  - Both
  - None of the above
19. What materials are disposed in green bags?
- Discarded medicines
  - Cytotoxic wastes
  - Both
  - None of the above

Questionnaire for technology operators:

Name:

Are you:

- Male
- Female

How old are you:

- 10-30
- 31-50
- 51-70

1. Bags / bins used-

- Red
- Yellow
- Blue
- Green

2. What does green colored bag contain?

- General waste
- Infected waste
- Sharp waste
- Food waste

3. What does yellow colored bag contain?

- General waste
- Infected waste
- Sharp waste
- Food waste

4. What does red colored bag contain?

- General waste
- Infected waste
- Sharp waste
- Food waste

5. What does blue colored bag contain?

- General waste
- Infected waste
- Sharp waste
- Food waste

6. Transport method of medical waste?

7. What is the cost of sending the waste to a centralized facility?

- Low
  - Medium
  - High
8. Transport of medical waste:
- Busy hour
  - Non busy hour.
9. The approximate proportion of infectious waste among total waste generated from a health care facility is:
- 10-20%
  - 30-40%
  - 50-60%
  - 80-90%
10. Is liquid waste directly discharged in sewer system?
- Yes
  - No