

## MEDICAL WASTE MANAGEMENT SYSTEM AT UTTARA ADHUNIK MEDICAL COLLEGE HOSPITAL (UAMCH) IN DHAKA

Ayaz Rahman Nadib<sup>1</sup> and Tasnova Tabassum<sup>2</sup>

<sup>1</sup>Department of Glass and Ceramic Engineering, Rajshahi University of Engineering & Technology, Kazla, Rajshahi-6204, Bangladesh

<sup>2</sup>Department of Medical Science, Uttara Adhunik Medical College Hospital, Uttara, Dhaka-1230, Bangladesh

### ABSTRACT

Today, with the advancement of technologies and the expansion of the healthcare system, the volume of medical waste has significantly increased. Medical trash refers to the waste and garbage generated by various areas of a hospital, including doctor's offices, blood banks, wards, and OT (operation theater) rooms, among others. Based on the current situation, the rate of waste generation is alarmingly high. The management of medical waste is crucial due to its infectious and toxic nature, which causes significant risks to the environment and public health. The issue is becoming increasingly common due to the rising number of hospitals, clinics, and diagnostic laboratories in Dhaka City, Bangladesh. This study aims to assess the practices of medical waste management and to quantify the waste produced at Uttara Adhunik Medical College Hospital (UAMCH), a prominent private medical college hospital located in Dhaka. A survey was conducted to gather information regarding practices associated with waste segregation, collection procedures, types of temporary storage containers, on-site transport, primary dumping points, waste treatment, off-site transport, and final disposal options. The survey and observation are carried out across ten wards of UAMCH. According to the analysis, UAMCH generates a total of 147 kg of medical waste per day. Approximately 38 kg/day (25.85%) of this waste is classified as non-infectious, while the remaining 109 kg/day (74.15%) is considered as infectious. The average waste generation rates are 1.156 kg/bed/day for non-infectious waste and 0.384 kg/bed/day for infectious waste. The study highlights that the gynecology ward produces the highest amount of waste, generating 51.56 kg/day. In contrast, the male medicine ward generates the least, at 20.79 kg/day. The other eight wards collectively contribute about 47.83 kg of waste per day, while the doctor's office, blood banks, and operating rooms account for the remaining 26.82 kg/day. The study indicates that UAMCH does not routinely use incineration, which is the most common method for treating solid medical waste. Additionally, it does not consistently segregate all types of waste in accordance with established regulations and standards. As a result, improper handling of medical waste poses significant risks to both public health and the environment. This study emphasizes the urgent need to address medical waste management issues in order to raise awareness and improve knowledge in this area. Furthermore, this research aims to demonstrate that the inadequate management of medical waste stems from a lack of awareness, insufficient policies and legislation, and a general unwillingness to address the problem.

**Key words:** medical trash, gynecology ward, medicine ward, incineration, medical waste management, Uttara Adhunik Medical College Hospital (UAMCH)

### INTRODUCTION

As the global population grows and medical service demand increases, managing medical waste becomes a complex and demanding challenge (Windfeld & Brooks, 2015). Inadequate waste management practices pose risks to human health and the environment, making medical waste management a serious issue (Saha et al., 2023). Medical waste is critical due to its potential as an environmental hazard and a threat to human health (Ciplak, 2016). Medical waste contains pathogenic chemicals, poisonous compounds, and metallic elements. Sometimes, it may potentially include genotoxic or radioactive substances (Mbarki et al., 2013). The predominant portion of these wastes is produced during diagnosis, treatment, surgery, immunization, or research activities. Due to the modernization of medical services and the increase in patient population, hospitals produce substantial amounts of medical waste (Bhatt et al., 2013) (Ozder et al., 2013). Hospitals perform various therapeutic

procedures, such as cobalt therapy, chemotherapy, dialysis, surgery, delivery, resection of gangrenous organs, autopsy, biopsy, para-clinical tests, and injections, which generate infectious waste, sharp objects, radioactive materials, and chemical substances (Hassan et al., 2008). Medical waste poses a significant risk to physicians, nurses, technicians, custodial staff, hospital visitors, and patients due to inadequate management (Massrouje, 2001) (Becher & Lichtnecker, 2002). It may also transmit pathogens of diseases such as hepatitis B and AIDS (Coronel et al., 2002).

Inappropriate disposal of medical waste, such as open dumping and uncontrolled incineration, raises the danger of disseminating infectious diseases. The correct treatment of these wastes is vital. In numerous places worldwide, it earns significant interest. In underdeveloped nations, such as Bangladesh, medical waste management has not gained much attention. This occurs because health challenges frequently compete for few resources. Currently, hazardous and medical waste continues to be managed and disposed of alongside residential trash, posing significant health risks to municipal workers, the public, and the environment (Haque, Mohd, et al.). Regardless of the waste quantity, clinical waste can be extremely dangerous to the health of the general public as well as the environment (Hoffman & Hanley, 1994). Akter (1997) reported that 82.24 percent of respondents categorized medical trash as general waste, indicating an increasing lack of awareness and understanding regarding the definition of medical waste (Akter, 1997). The document on the "Clean Dhaka Master Plan" prepared by the Japan International Cooperation Agency (JICA) that briefly explained the management pattern of solid waste in Dhaka City (Sekaran, U. 2009). Effective management of medical waste is essential to reduce health hazards. Enhancing current waste management procedures in Bangladesh will substantially reduce the spread of infectious diseases in the long term. Medical waste necessitates specific treatment and management from its origin to final disposal. Merely discarding it in refuse bins, drainage systems, and waterways, or ultimately depositing it on the periphery of the city, presents a significant public health risk. Thus, there is a need to focus on the improvement of medical waste management to reduce the adverse impact of waste on (a) the environment, (b) public health, and (c) safety at health care facilities.

Various countries have distinct medical waste management strategies (Askarian et al., 2004; Mato & Kaseva, 1999; Patil & Pokhrel, 2005; Mato & Kaseva, 1999; Tudor et al., 2005; Miyazaki et al., 2007; Red Bags, 2023). Although medical waste disposal options are not completely risk-free, the risks can be mitigated by a careful management system (Blenkharn, 2006). Inadequate disposal of medical waste can result in harm to individuals from sharp objects, transmission of diseases by agents of infection, and environmental contamination by poisonous and hazardous substances (Lee et al., 2002; Jang et al., 2006; Abdulla et al., 2008). Consequently, the effective handling of medical waste is an important concern for ecology. The medical waste management systems in Bangladesh are severely insufficient in mitigating environmental and public health risks (World Bank, 2002; Prism Bangladesh, 2005).

At UAMCH, it has been noted that solid hospital trash is being temporarily placed in the recycling containers, and the containers are positioned in front of each ward. A garbage collector is assigned to each ward to collect rubbish and transport it to the primary disposal station within the hospital premises. There are 500 beds and additional rooms (ICU, NICU, CCU, postoperative, dialysis room, hemodialysis room, angiogram room, labor room, and operating room) from which solid waste is carried to the central dumping site. There are various types of solid waste generated by hospitals. Not all types of trash can be disintegrated due to the extensive time required for decomposition, and certain clinical waste (such as blood and needles) poses significant hazards, rendering them unsuitable for weighing. Solid hospital waste in UAMCH is divided into some basic types. These are sharps, pathological waste, pharmaceutical waste, and other waste. Sharps can be categorized into two types: syringes and needles. Pathological waste can be categorized into four types: cotton, blood bags, gloves, and bandages, and pharmaceutical waste can be divided into three types: glass bottles, drug shells, and saline. This pathological waste carries significant risks to human health (Blenkharn, 2008). In the case of UAMCH, the Dhaka North City Corporation (DNCC) waste-collecting vehicle arrives at the primary station at scheduled times each day and then transports the waste to the final disposal site. Despite its crucial importance, no measures are taken to prevent microbial putrefaction and development in temporary storage prior to dumping.

### **About Uttara Adhunik Medical College Hospital**

Uttara Adhunik Medical is the college's teaching hospital. It is a 500-bed multidisciplinary hospital in Uttara, Dhaka, providing tertiary-level health care services to patients from all over the country, including a large number of people from Uttara, Tongi, Gazipur, and Savar. The total land area of the hospital complex is 87260.035 sq. ft. (5 bighas). The main building of the hospital spans 17 stories, with the top four levels temporarily reserved for the college section. Three separate buildings house the radiology, orthopedics, ENT, dental, and emergency departments. The main building provides excellent medical, surgical, obstetrics, and gynecological services. The hospital also has 24-hour emergency services, modern diagnostic facilities, an ICU, a CCU, a NICU, and a hemolysis unit (sketch, 2017).



Figure 1 Uttara Adhunik Medical College (UAMCH)

## **AIMS & OBJECTIVES OF THE RESEARCH**

Our major objective is to quantify the solid waste produced by each hospital ward, which is subsequently transferred to the primary disposal site. By determining the number of beds in each ward, we may calculate the waste generated per bed. Through data analysis, we can also identify the day of the week with the most trash production. The inadequacy in size and quantity of garbage collection bins necessitates the utilization of the acquired data to enhance future waste management efforts.

The aims of this project are to define the state of medical waste management at UAMCH and to gather data regarding the collection, treatment, handling, transportation, and disposal of medical waste. The measurement of the output of hospital waste at UAMCH is another target of our research. Similarly, figure out the composition of clinical waste created at Uttara Adhunik Medical College Hospital and evaluate the knowledge and awareness levels of personnel engaged in medical waste management.

## **METHODOLOGY**

### **Study Area & Research design**

The investigation mainly aims to quantify the volume of medical waste across different wards at Uttara Adhunik Medical College Hospital (UAMCH), Uttara, Dhaka. This research primarily depends on data collection. The data are analyzed to address the principal issues of hospital waste management about waste generation from several sources. The project tasks are structured into data collection and data analysis to meet the targets and objectives. This research measures the waste produced in each ward. The task is carried out following a particular methodology. We have classified the hospital trash into several primary categories. The waste that is transported from the ward to the primary disposal site is measured according to its classification. Thereafter, the waste production per bed is measured via data analysis. The categories and volumes of waste generated are also quantified.

### **Classifications of Waste in UAMCH**

In UAMCH, hospital waste is generally separated into two categories. These are infectious waste & non-infectious waste.

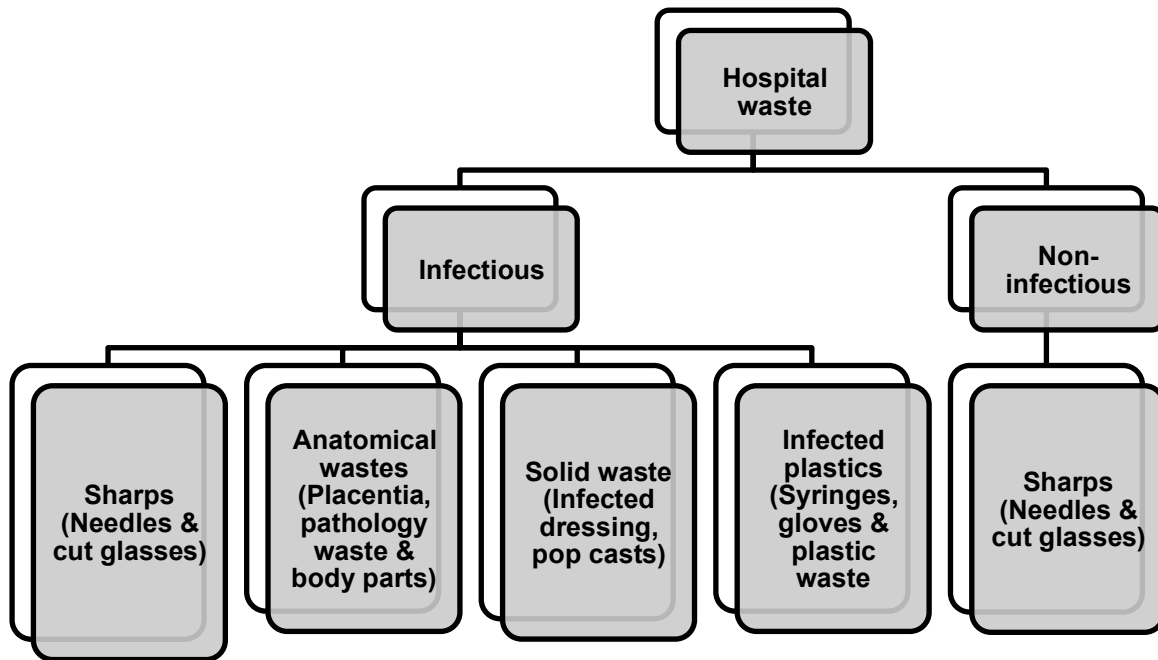


Figure 2 Classification of medical waste

During our visits to each ward, we noted that garbage was segregated before disposal, as confirmed by the waste collector during our investigation. A significant portion of this segregated waste was not recycled; however, distinct bags and plastic bins were utilized for several categories of waste, including infectious, sharp, and general waste. Still, the waste was not systematically segregated before disposal.

UAMCH generates various categories of solid hospital waste. Segregating all sorts of trash is impractical due to the time required, and certain clinical waste (such as blood and needles) poses significant hazards, making it difficult to weigh them. We categorized solid hospital trash into four primary types: sharps, pathological waste, pharmaceutical waste, and miscellaneous garbage. Sharps can be categorized into two types: syringes and needles. Pathological waste is categorized into four types: cotton, blood bags, gloves, and bandages. Pharmaceutical waste is classified into three types: glass bottles, drug shells, and saline bottles. To finalize the segregation procedure, a box or, occasionally, a poly bag was utilized to weigh the segregated garbage.

### Color coded bins

A color-coding system for individual containers is essential for efficient waste separation. At Uttara Adhunik Medical College Hospital, the color-coded containers are there, but they are not utilized appropriately. Typically, four color-coded containers are utilized. Green or black is designated for general waste, yellow for infectious waste, and red for sharp waste, as represented below (Figure 3). At UAMCH, a color code is employed based on the type of garbage.

The field survey revealed that container bins designated for recyclable waste are placed in each corner of the ward as represented below (Figure 4); however, these bins are not utilized appropriately. It is also revealed that rejected medical waste has been categorized into sharp instruments, saline and blood bags, plastic materials, tubes, and other items. Some people are responsible for collecting, segregating, and selling these wastes either for resale or reuse. They collect these either from bins or from the final disposal site. We also found this scenario during our field survey that there were no authorities from DNCC who investigated what had been done with the recyclable waste. Consequently, understanding of this issue may be essential in the formulation of new laws to safeguard individuals and the environment.



Figure 3 Color coded containers



Figure 4 Recycled waste container

### Waste treatment & disposal method

At Uttara Adhunik Medical College Hospital, waste is deposited in temporary storage bins located within the hospital premises. The primary waste collection point is situated inside the facility. Various disposal methods for hospital waste are employed, including open dumping by the Uttara North City Corporation (Figure 5). While recyclable materials are gathered by workers and cleaners, they do not segregate this waste for resale. Identified recyclable materials include syringes, plastic bags and bottles, urine bags, plastic accessories, glass bottles, glass accessories, plastic polythene, metal, rubber, and paper. Another disposal method utilized is the incineration of hazardous waste within the hospital. A medical waste incinerator, shown below (Figure 6), is a high-temperature furnace designed to combust medical waste encompassing infectious and hazardous materials. Elevated temperatures effectively eliminate bacteria, viruses, and other pathogens, ensuring the waste is rendered non-infectious.



Figure 5 Medical waste dumping site



Figure 6 Incinerator in UAMCH premises

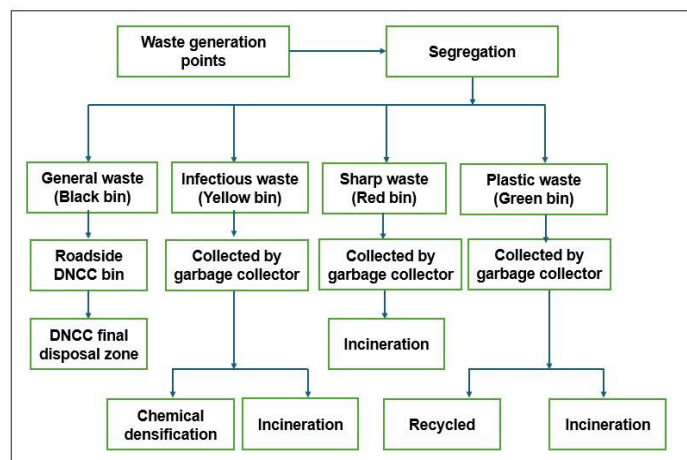


Figure 7 Existing waste management practice in UAMCH

**Use of protective wear condition**

Only 15% of medical staff use protective equipment regularly, whereas 23% do so on particular occasions, and approximately 62% of the time, no safety gear is utilized (Figure 8).

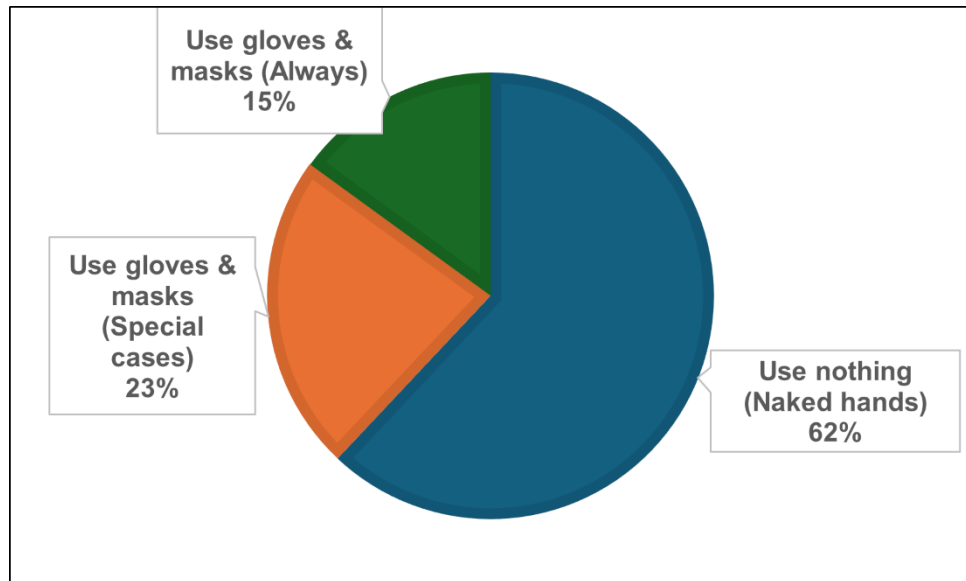


Figure 8 Use of protective wear in percentage (%)

**RESULTS & DISCUSSION**

**Results**

The study indicates that the gynecology ward generates the highest waste, producing 51.56 kg/day with a total of 110 beds. Conversely, the male medicine ward produces the least, at 20.79 kg/day with 55 beds. The remaining eight wards collectively contribute approximately 47.83 kg of waste daily, while the doctor's office, blood banks, and operating rooms account for an additional 26.82 kg/day. Furthermore, the waste per bed per day is highest in the gynecology ward at approximately 0.46 kg, whereas the gastroenterology ward has the lowest at 0.08 kg/bed/day.

The table below (Table 1) calculates and presents the daily waste per day and the daily waste per bed for ten different wards at Uttara Adhunik Medical College Hospital (UAMCH):

Table 1 Waste generation from different wards

Ward	Bed	Non-infectious	Infectious	Total waste (kg/day)	Total waste (kg/bed/day)
Pediatric	70	2.92	15.44	18.36	0.26
Gynae	110	29.08	80.64	51.56	0.46
Medicine (M)	60	2.67	18.12	20.79	0.35
Medicine (F)	60	1.90	17.33	19.23	0.32
Gastroenterology	21	0.60	1.00	1.60	0.08
Urology	40	0.89	7.56	8.45	0.21
Cardiology	47	2.88	3.99	6.87	0.15
Surgery	50	1.21	9.23	10.44	0.28
Neurology	22	1.36	4.45	5.81	0.24
Nephrology	20	1.69	2.20	3.89	0.19

Following the data collection based on the specified characteristics, it is subsequently analyzed to yield results in percentage form. The outcome is displayed beneath the pie charts (Figure 9).

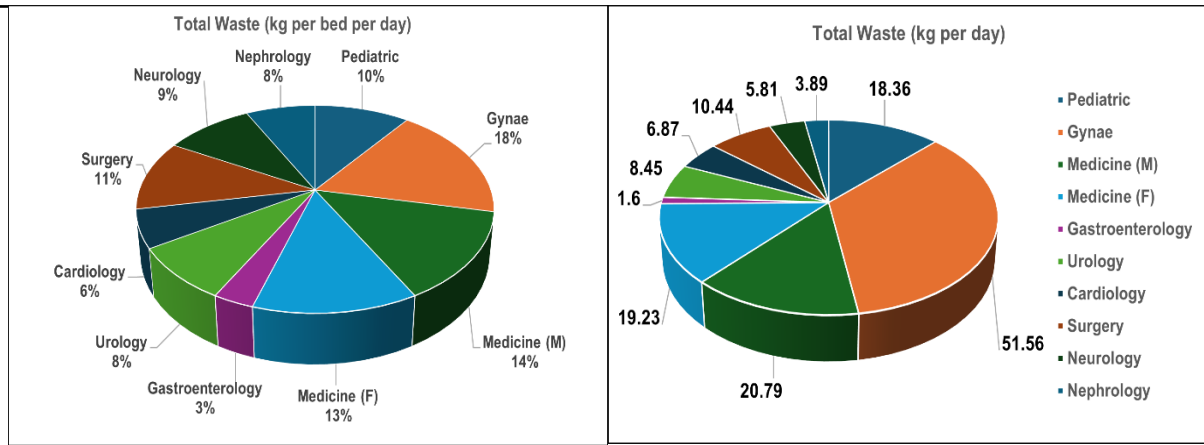


Figure 9 The amount of daily waste per day and waste per bed per day

The percentage of waste production varies depending on the type of hospital. As UAMCH is a renowned private hospital, the number of patients admitted there is very high, and it covers the northern part of Dhaka. If the number of patients increases, then the amount of waste generation also increases.

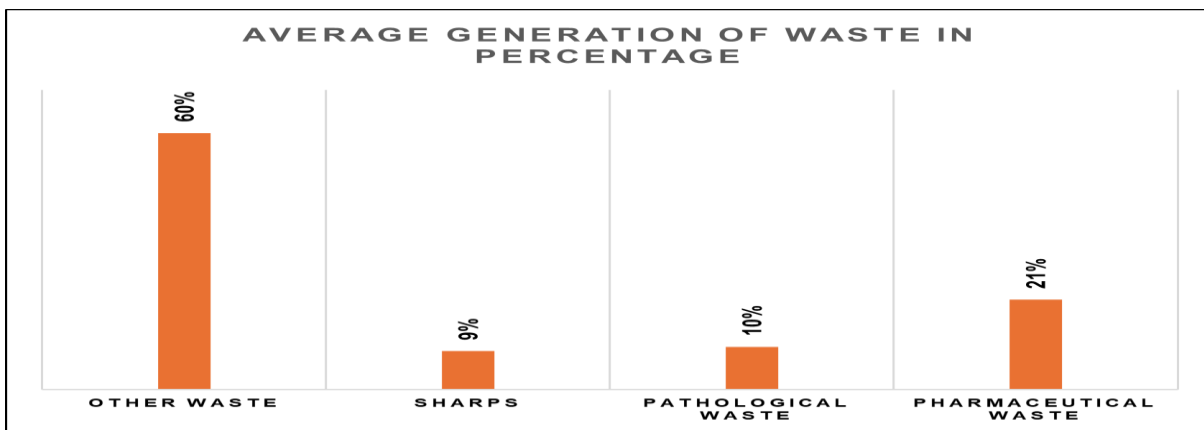


Figure 10 Generation of different types of waste from UAMCH

### Discussion

The research study reveals that the Uttara Adhunik Medical College Hospital (UAMCH) partially adheres to the standard for color coding, segregation, and system treatment. Although the hospital waste management authority endeavors to adhere to WHO standards, there is occasional deviation from the established guidelines. The personnel at Uttara Adhunik Medical College Hospital show limited awareness of disposal methods. Some waste collectors maintain safety gear, whereas the majority do not. Moreover, the number of waste management personnel is insufficient.

The hospital personnel need more training and proper knowledge about the medical waste and its management. Organizing seminars and workshops for hospital waste collectors, along with proper training on medical waste management, can enhance the waste management system in hospitals. Hospital authorities should appoint more waste management personnel so that it could be easier to maintain the waste management system. The authorized representatives from UAMCH and the solid waste management organization should collaborate to explore potential waste reduction strategies for the hospital. Dhaka North City Corporation oversees the treatment and disposal of hospital waste, employing incineration for treatment. They fail to adequately follow the guidelines set by the World Health Organization. General hospital waste are directed to an open dumping site. Consequently, Uttara Adhunik Medical College Hospital should enhance its waste management practices. Moreover, various NGOs and voluntary development organizations, such as PRISM, operate in Bangladesh and oversee the waste management of Uttara Adhunik Medical College Hospital (UAMCH). Together, the hospital authority and these organizations strive to adhere to WHO requirements and uphold standard guidelines. However, the staff at Uttara Adhunik Medical College Hospital (UAMCH) still lacks awareness about the proper methods for collecting and disposing of waste. The majority of waste

collectors are unaware of safety precautions. Most of the hospital staff are not properly trained and maintain minimum guidelines. Moreover, the number of waste management staff is inadequate.

Standard medical waste management practice is essential in all hospitals. Organizing seminars and workshops with hospital waste collectors and providing proper training on medical waste management can enhance the waste management system in hospitals. For standard segregation and color coding, the hospital authorities should follow the WHO guideline. Many organizations that are active in the northern zone of Dhaka try to control the treatment and disposal of medical waste at Uttara Adhunik Medical College Hospital (UAMCH). A public awareness campaign for proper management of medical waste would be effective in keeping the city environment safe. Awareness is essential to solving this problem, particularly with regard to the reuse of syringes and needles and other sharp contaminants in human blood or body fluids.

## CONCLUSION

The creation of medical waste has skyrocketed globally, posing a significant threat to both the general ecology and the surrounding environment. This study seeks to raise medical waste management at UAMCH as a symbol of urban development safety. Obviously, a community cannot be safe without efficient disposal of medical waste. This sector suffers from inadequate technical support from the government. Furthermore, insufficient awareness, inadequate policies and legislation, and indifference contribute to the mismanagement of medical waste at UAMCH.

The establishment of a proficient medical waste management system at Uttara Adhunik Medical College Hospital (UAMCH) in Dhaka is essential for safeguarding environmental integrity and public health. The research emphasizes the necessity of appropriate segregation, collection, and disposal of medical waste to reduce the risk of infections and environmental pollution. Through the implementation of established processes and the application of innovative waste management technology, UAMCH can markedly diminish its environmental impact and foster a safer, healthier community. Ongoing evaluation and enhancement of waste management techniques are crucial to upholding superior standards and adjusting to changing healthcare requirements.

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