

MEDICAL WASTE MANAGEMENT (MWM) AS AN ICON FOR SAFE TOWN DEVELOPMENT: A STUDY IN SATKHIRA TOWN OF BANGLADESH

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ABSTRACT

Inadequate waste management practices provide potentially severe risks to human health and the environment, making the management of medical waste a serious issue. This paper investigates the generation and composition of medical waste (MW) in the town of Satkhira, located in the southwestern region of Bangladesh. It also provides an overview of the current state of MW management, an analysis of existing problems in MW collection, separation, recycling, and disposal, and some future recommendations for improving MW systems. Data from existing MW management of different hospitals, clinics, and diagnostic centers were collected and analyzed. To validate the suggested recommendations, secondary data from municipal conservation departments and a questionnaire survey in hospitals and clinics were conducted and compared with data from other sources as well. The findings of this study expose that approximately 3.5 tons of medical waste is generated per day which is about 5.50% of total waste generation in this town and medical waste generation rate is about 1.33 kg/bed/day. The overall findings of the existing management system were comprised of disposal, collection, transportation, and treatment. From where, a significant setback was identified at government hospitals in the form of primary dumping bins compared to private hospitals & overall processing of MW in Satkhira town. As a result, a large amount of hazardous and pathogenic waste is remaining unmanaged posing an alarming vulnerability for public health of the dwellers. Finally, a comprehensible technique was proposed to find out the further improvement of clinical waste management.

INTRODUCTION

Medical waste is critical due to its potential as an environmental hazard and a threat to human health. This type of waste contains pathogenic chemicals, toxic compounds, and heavy metals, and may possibly contain genotoxic or radioactive substances (da Silva et al., 2005; Mbarki et al., 2013). The majority of these wastes are generated during diagnosis, treatment, surgery, immunization, or research (Nagaraju et al., 2013). As a result of the modernization of medical services and the rise in patient population, healthcare institutions generate vast quantities of medical waste. About 75–95% of medical wastes are non-hazardous, while the remaining 10–25% are harmful to humans or animals and the environment (Bhatt et al., 2013; Ozder et al., 2013). Although MW accounts for a relatively small proportion, around one percent of all solid wastes created, when this little amount is incorrectly managed, it becomes mixed with municipal solid waste and the entire waste stream becomes potentially dangerous (Biswas et al., 2011; Mainul Haque et al., 2021). Poor management, lack of knowledge in handling, and unscientific disposal of various healthcare wastes pose severe direct and indirect threats to the public health of healthcare workers, nurses, technicians, waste workers, hospital visitors, patients, and neighboring populations, as well as the environment (Biswas et al., 2011). Therefore, the management of MW is of the utmost significance for any regulatory agency (Jang et al., 2006). Due to the toxicity of medical waste, countries have increased their attention on proper disposal. Since then, numerous technologies, including incineration, landfill, chemical disinfection, autoclaving, microwave,

plasma, and pyrolysis, have been investigated and developed (Su et al., 2021). Compared to incineration and landfilling, the remaining waste management procedures are expensive and require a great deal of technological support, which is not readily available in underdeveloped nations such as Bangladesh. The installation of incineration facilities requires significant financial investment as well as ongoing operational and maintenance expenses; hence, incineration is not a particularly well-liked waste disposal technique (Ahmed & Moniruzzaman, 2019). In addition, open incineration can be an environmental hazard by releasing a large number of harmful byproducts when the majority of the waste is non-hazardous (Bhatt et al., 2013). Consequently, a properly designed landfill that protects the surrounding environment, including soil, groundwater, and surface water, containing leachate that is generated in landfill by controlling injection to the groundwater and assisting in the control of landfill gas migration (Datta et al., 2017; Rafizul & Datta, 2018), can be an alternative method for disposing of medical waste (Wisniewski et al., 2020). In addition, the conversion of organic waste into renewable energy in the form of biogas might be another method of waste utilization, which would not only benefit the environment but also alleviate the energy problem in a growing nation like Bangladesh (Ahmed et al., 2019; Ahmed & Moniruzzaman, 2019; M. M. Rahman et al., 2018).

The research was conducted to determine the status of the medical waste management system in Satkhira town, Bangladesh, and to make recommendations for enhancing its current condition.

Description of Study Area

As illustrated in Figure 1, Satkhira is a district in southern Bangladesh that is part of the Khulna Division. It is situated on the Arpangachhia River's bank. The capital and major city of this district is Satkhira. Satkhira District has an area of around 3,817 square kilometers (1,474 square miles), and its population is approximately 1,985,959, of which the population of Satkhira town is 2,000,000. (Bangladesh Population Census 2011, Bangladesh Bureau of Statistics). It is bounded by the Jessore district to the north, the Bay of Bengal to the south, the Khulna district to the east, and the North 24 Parganas and South 24 Parganas districts of West Bengal, India, to the west. According to the Satkhira paurashava authority, there are 72 health care facilities in the city including government and private facilities, and in this study 11 nos clinics were investigated.



Figure 1 Shows the location of the study area.

OBJECTIVES

The study's objectives are as follows:

- ❖ To assess the source of medical waste generation and waste characteristics in Satkhira town.
- ❖ To identify the problems of medical waste collection, transportation, and disposal systems in the study area.
- ❖ To identify the potential impacts that medical wastes pose to both human health and the natural environment due to improper disposal and management techniques
- ❖ To recommend a better way of medical waste management including reduction, recycling, recovery, and reuse in the Satkhira town area.

METHODOLOGY

The methodology of this study involves field observation, a questionnaire survey, and data collection from October to December 2022 from the Satkhira pourashava conservation department, various clinics, health clinics, and diagnostic facilities. On the basis of a questionnaire, primary data were collected by interviewing hospital administrators, the manager, medical staffs, nurses, cleaners, the ward master, and hospital patients, etc. Additionally, field observation was conducted to supplement the overall results. The secondary data were gathered from published sources, such as books, journals, and research reports. In the study area, a random questionnaire survey was given. There were a total of 100 respondents, and the breakdown of respondents per category is given in figure 2.

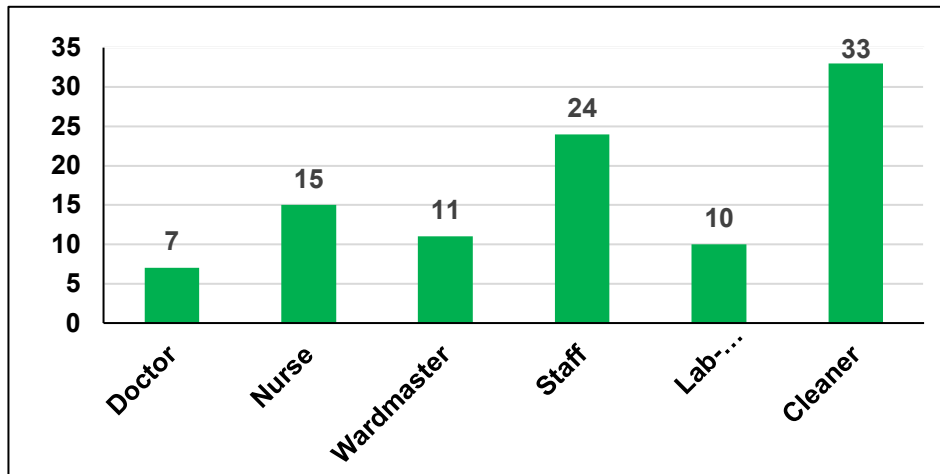


Figure 2 No of respondents on questionnaire survey

According to the origins and composition of waste generation, waste was characterized. With the aid of a comprehensive analysis, inexpensive and environmentally beneficial solutions of garbage disposal were developed. The flowchart depicted in Figure 3 provides a schematic overview of the entire project.

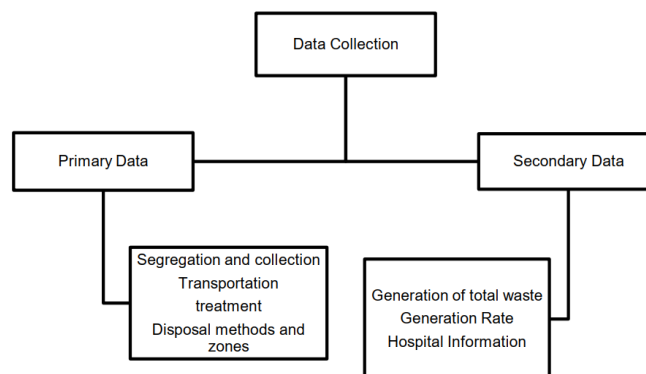


Figure 3 Flow chart of research methodology

RESULT AND DISCUSSIONS

Present Medical Waste Collection and Management System in Satkhira Waste Generation

The study reveals that approximately 3.5 tons per day of medical wastes are generated in the Satkhira sadar region, along with 1.33 kilograms per bed per day of waste, which accounts for approximately 5.50 percent of the total waste, including various types of pathological, infectious, pharmaceutical, and plastic wastes. A number of hospital kitchens and canteens located within the various medical facilities in Satkhira municipalities contribute to the significant volume of food and vegetable waste in the trash stream. From this study, it has been observed that Satkhira Sadar Hospital (SSH) generates the greatest waste (Figure 4) due to the fact that it is a government-funded hospital with access to highly qualified physicians and many treatment departments for the vast majority of diseases. Due to the widespread acceptance of single-use disposable products, the generation of medical waste in Satkhira has increased in number and variety (e.g. gloves, plastic syringes, medical packages, bedding, tubing, and containers).

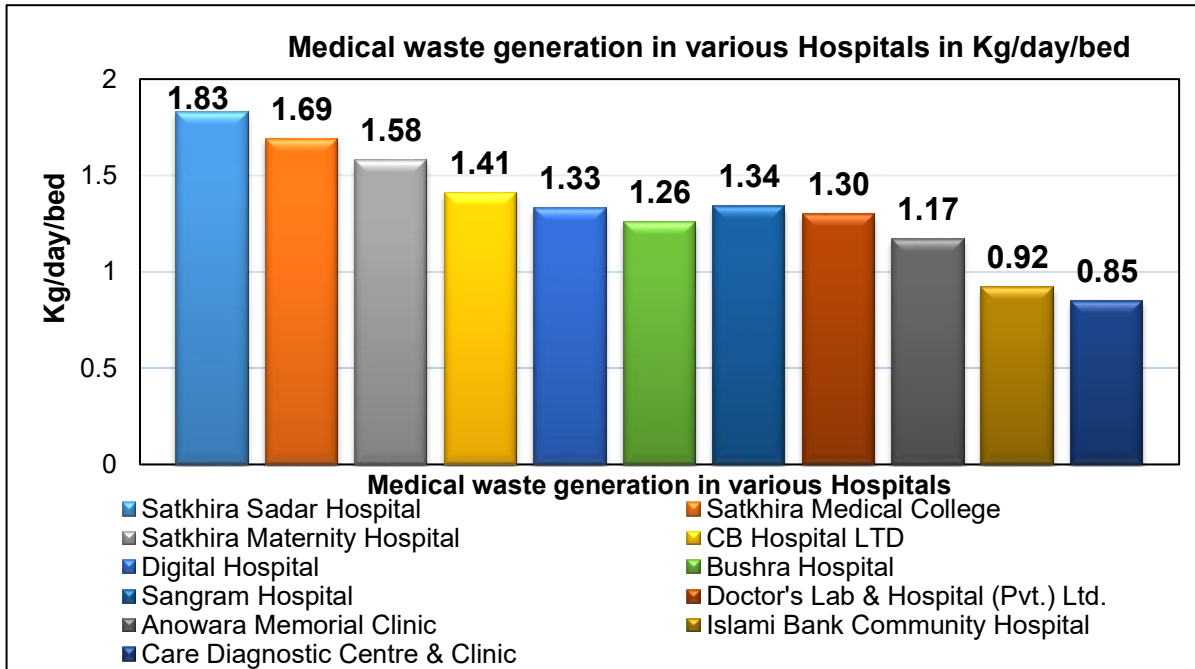


Figure 4 Medical waste generation in various hospitals in Kg/day/bed (Source: Conservancy division and field Survey, Satkhira, 2022)

Due to the potential for substantial dangers to human health and the environment, the management of medical waste has been a serious issue (Figure 5). In the past, medical waste was frequently disposed of in municipal solid waste dumps along with residential waste. In recent years, rising public concern over the inappropriate disposal of medical waste has prompted the Bangladesh Ministry of Environment to regulate the waste more systematically and strictly. Waste minimization and recycling are not yet widely encouraged, resulting in the open disposal of substantial amounts of medical waste.



Figure 5 Some pictures of medical waste in Satkhira town.

Composition of Generated Wastes

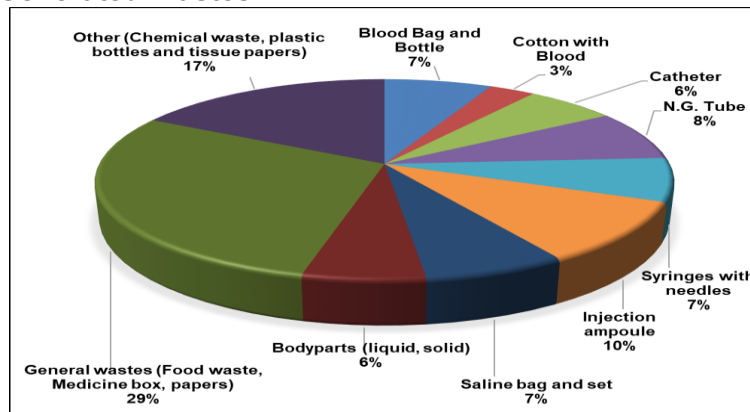


Figure 6 Classification of medical waste generation (%) (Source: Field Survey, Satkhira, 2022)

The majority of medical waste consists of general wastes (Food waste, medicine box, and papers), as shown in Figure 6. The garbage created by the examined medical centers was collected via questionnaires from the respondents. 10% of investigated medical centers and hospitals used injection ampoules, 7% blood bags and bottles, 3% blood-soaked cotton, 6% catheters, 8% N.G. tubes, 7% syringes with needles, etc (Figure 6).

General wastes (Food waste, Medicine boxes, papers, tissues, and water bottles) are placed in a green container (plastic, paper board, or metal), infected plastics such as syringes with needles are placed in a red container, pathological waste and discarded sharps are stored in a yellow container, metal glassware is stored in a blue container, and sharps are also stored in a red container (Figure 7). All containers bear the worldwide biohazard symbol that is routinely used in hospitals in developing nations. Other than placentas, recycling of separated wastes is not currently undertaken on-site.



Figure 7 Various types of containers which stored medical wastes

Use of Protective Wear condition

Only 18% of health care personnel utilize protective gear daily, while 27% do so for specific instances, and in roughly 55% of cases, no protective gear is used at all (Figure 8).

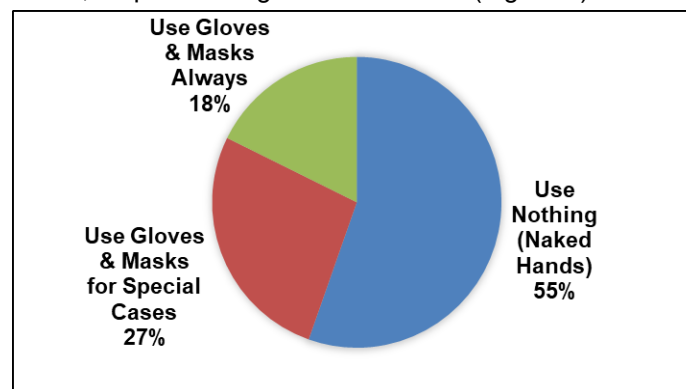


Figure 8 Use of protective wear in percentage (%) (Source: Field Survey, Satkhira, 2022)

Private Organization Involved in Clinical Waste Management

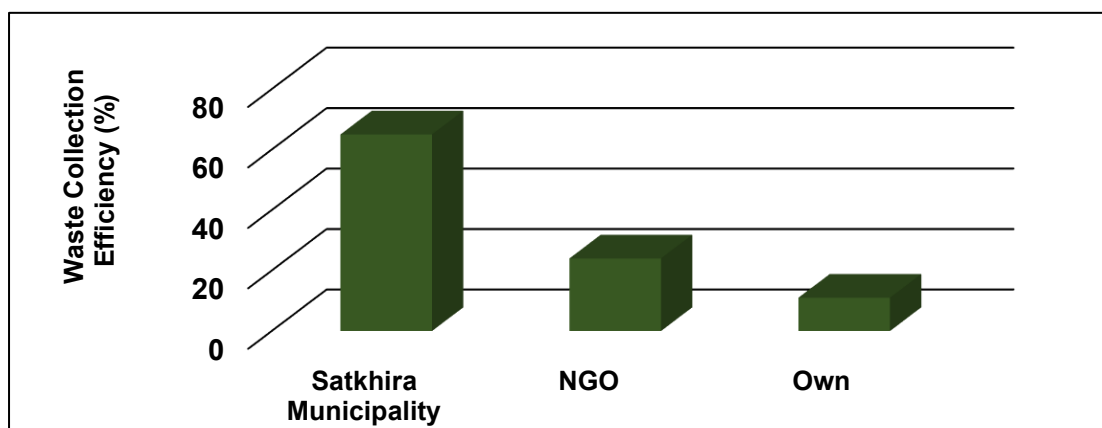


Figure 9 Waste collection by types of organization

Safe Waste Safe Country (SWSC) is a non-profit organization that contributes to the management of Satkhira pourasava clinical waste. It has recently taken steps to broaden its program to include clinical waste treatment prior to disposal. The non-profit organization provides each hospital with at least a set

of four covered drums for separating four categories of waste at the point of generation. The four drums are colored differently for identification purposes. The amount of drum sets may vary depending on the size of the facility. However, it has been observed that several hospitals have received fewer than four drums. A waste-hauling van is used to transport clinical waste from the various healthcare facilities. But majority of medical waste has been collected by Satkhira pourasava where NGO assists in collections and rising of awareness in waste management.

Collection, Transportation and Disposal

Using the same vehicle used to collect municipal waste, Satkhira pourasava gathers all types of waste, including clinical waste, twice every day from clinics. After sequential waste collection by pourasava vehicles, clinical wastes are deposited among other wastes. The vans are used exclusively for waste collection from standard waste bins. Then, minitrucks are used to move the waste from the primary bin to the secondary bin. The Satkhira municipality has just 2 dump trucks and 10 vans for the collection of municipal waste, of which two vans and one dump truck are used to collect medical waste from hospitals.

Collection and Segregation of Hospital Waste Timing of Waste Collection

62% of respondents reported that medical waste is collected in the morning, while 21% of respondents said waste collection is also performed at midday. Approximately 17% informed that in some case medical waste are collected in randomly manner (Figure 10).

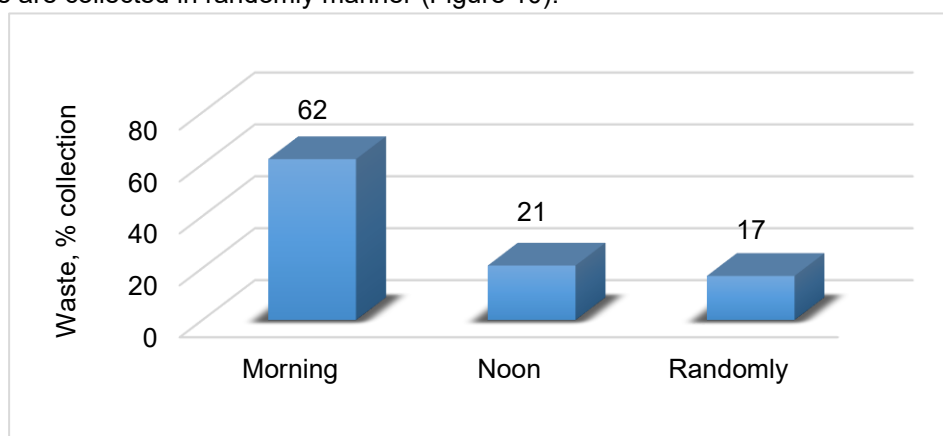


Figure 10 Percentage of the timing of waste collection from the surveyed medical centers (Source: Field Survey, Satkhira, 2022)

Final Dumping Site

Binerpota, as depicted in Figure 11, is utilized for waste disposal approximately six kilometers from the city of Satkhira. This place is used by Satkhira pourasava to dump waste, hence increasing the health risk to the nearby community. Due to the absence of a sanitary landfill, certain wastes get mixed with the pond's water. These leachates cause air pollution, noise pollution, soil contamination, and water pollution, among others.



Figure 11 Final disposal medical waste in Binerpota dumping site

Illegal Dumping Causes Different Types of Pollution

Due to a lack of sweepers or cleaners in many situations, especially in government hospitals, temporary cleaners were hired daily to complete this work. In addition, these temporary cleaners perform their duties improperly and sporadically because they have no clear obligations and receive an inadequate wage. The majority of internal waste transportation was handled by permanent or temporary/daily sweepers, cleaners, or ward boys. In the event of external (i.e. off-site) transportation, local authority collected all forms of garbage from garbage cans and transported it to a municipal disposal site via an

unprotected open track, as indicated in figure 12. As a result of inappropriate solid waste disposal, ponds, canals, and rivers are contaminated. Each day, a large quantity of solid wastes are discharged into the water, polluting it. It lowers water quality and modifies the equilibrium of dissolved oxygen (DO), pH, and biochemical oxygen requirement in water (BOD) (Islam et al., 2017a, 2017b; M. S. Rahman et al., 2020).



Figure 12 Illegal dumping of medical waste at various locations in Satkhira town.

CONCLUSIONS

This endeavor aims to promote medical waste management as a symbol of urban development safety. Clearly, a community cannot be safe without effective medical waste disposal. This study examines hospital waste management circumstances and associated concerns in the city of Satkhira, Bangladesh. This study finds that approximately 3.5 tons of medical waste are generated daily, which accounts for approximately 5.50 percent of the city's total trash production, and that the daily medical waste generation rate is approximately 1.33 kg per bed. In the majority of health care facilities, different forms of waste are not segregated adequately. A successful implementation requires the integration of social, technological, institutional, and monetary problems.

RECOMMENDATIONS

According to this study there is an urgent need for education and awareness-raising regarding medical waste issues. A proper waste management strategy is required to protect human health and the environment. Establishing a well-regulated system for the proper disposal and management of hospital and clinical wastes must commence as soon as possible in order to safeguard human right to a safe environment. The following steps may be done in this regard:

- Segregation of wastes at the time of generation.
- Storage of wastes in covered and color-coded containers.
- Disinfection of the wastes before disposal.
- Establishment of a separate unit for sharp wastes management.
- Hauling the hazardous waste materials to specific management unit at remote location and developing an infrastructure for its safe disposal and recycling.
- Constitution of an environmentally sound and economic medical waste treatment and disposal scheme.
- Ensuring worker safety through education, training and proper personal protective equipments.
- Establish sanitary landfills with proper leachate collection and extraction systems and odorous gas collection and extraction systems will minimize the groundwater contamination problems.

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