Medical waste management improvement in several private hospitals in Amanat Al-Asimah - Yamen

by Sri Sumiyati

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Adeeb Hayel Zaid[1,2], Sri Sumiyati[1], Haryono Setiyo Huboyo[1],

[1] Department of Environmental Engineering, Faculty of Engineering, University of Diponegoro, Indonesia
[2] Faculty of Engineering, Aden University, Aden, Yaman

Correspondence email: adeebhayel24@gmail.com

Abstract. Handling medical waste presents several environmental challenges in most Yemeni hospitals that need immediate attention before they get out of control. This study aims to assess current practices of medical waste management in some of the major private hospitals in Amanat AlAsimah-Yemen. This study relied on several methods of data collection, visits, observation, and interviews with health cadres, cleaners, and workers in the municipality, with the use of a checklist that contains several questions and then follow-up. The results of the study, which were conducted in the four largest private hospitals in Amanat Al-Asimah, which are the Science and Technology Hospital, Azal Hospital, European Modern Hospital, Dr. Abdul Qader Al Mutawakil Hospital showed that there were no independent and specialized administrative units within the hospitals studied how to manage, follow up on the collection, transport, and disposal of medical waste and the lack of laws and regulations on medical waste management and how to deal with them. Moreover, liquid medical waste is discharged through a sewage network that is treated only from organic matter regardless of harmful chemicals that in turn affect humans, the environment, and agriculture.

1. Introduction

Continuous progress in medical sciences and technology and expansion in the number of health institutions worldwide has been accompanied by increasing quantities of potentially hazardous medical waste. The risks include occupational exposure of health workers and waste handlers and environmental exposure to the public caused by medical waste mismanaged [1].

Medical waste is defined as the waste generated from healthcare establishments, such as hospitals, primary healthcare centers, private clinics, research facilities, and laboratories used in diagnosis, monitoring, and prevention activities (curative or palliative) drugs in the field of human and veterinary medicine including infectious hazardous materials and human body parts[2].

Although medical waste represents only a small fraction of urban municipal waste, there should be a greater consensus on its hazardous nature and how much of the waste generated is infectious or hazardous. Infectious or hazardous hospital waste represents only a small part of total medical waste; yet, because of ethical questions and potential health risks, it is a focal point of public interest. Most hazardous and toxic waste is coming from clinical and hospital waste. Only a small amount is coming from domestic or industrial sources[3].

In Yemen, as in many developing countries, solid wastes, in general, and medical and hazardous wastes, in particular, have not received sufficient attention in terms of studying the current practices and

methods applied in their collection and disposal (Ministry of Water and Environment, 2008). Where medical waste is disposed of without any sorting process, it is all collected in plastic bags and then delivered to municipal vehicles that are transferred to landfills or by trying to burn in any area or bury it. The environmental consequences and the potential sound or standard environmental management plans that need to be applied nationwide are meant to be for alleviating potential disease means and sources and consequently improving medical and health services through proper waste management [4].

Unfortunately, up to date, medical wastes and hazardous material generated from hospitals in Sana'a city and other cities in Yemen, are still handled and disposed of together, mixed with domestic wastes. Hence, such practices have commonly created or are expected to create high risks for, or great impacts on, the health of municipal workers and the surrounding environment (Ministry of Water and Environment, 2008). As such, there are many different kinds of wastes that may be produced in hospitals, such as infectious, radioactive, and chemical ones, in addition to heavy metals and regular municipal wastes. Transporting or disposing of such mixed wastes in sewers or dumping sites in the surrounding environment has ultimately been found to cause soil and groundwater pollution in such environments and consequently cause health hazards for living species[5]. Therefore, medical waste management is of great importance due to its potential environmental hazards and public health risks [6]. Nevertheless, the management of medical wastes requires reliable information, regarding their generation rates, quantities, compositions, handling, and transportation i.e. from cradle to grave [7].

This study aims to evaluate the current practices of medical waste management in some of the major private hospitals in Amanat Al-Asimah, identifying environmental and health potential effects on the surrounding environment and people, and a comprehensive national plan for the management of medical waste in the future.

2. Methodology

This study assesses the current practices of medical waste management in four private hospitals in Amana Al-Asimah, namely Science and Technology Hospital, Azal Hospital, Dr. Abd Alkader Al-Mutawakel Hospital, and Modern European Hospital(fig.1). These hospitals are ranked in Group A, which is one of the best in terms of quality services and capabilities according to the Ministry of Public Health and Housing 2022. Where 80% of these hospitals were studied, these hospitals are one of the largest and most recent and include private hospitals in Amana Al-Asimah, and include many departments such as Operations Department, Maternity Department, Kidney Department, Cardiac Catheter Department, Lump Department, Laboratory Department, X-ray Department, etc. The methodology for this study involved the following steps (Fig. 2)

1. Interviews: containing several questions with several relevant officials in the management of medical waste in hospitals such as the Director of the Infection Department, the Director of Quality, the Director of Nursing, and the Director of Services and Measures to know the regulations, laws, policies, and possibilities in the management of medical waste.
2. Observation: spending enough time in the different hospital departments to record the observation through a Checklist containing several questions including sorting, collection, transportation, and treatment of medical waste.
3. Follow up in each hospital's departments to learn how to manage medical waste. Site visits were very useful in obtaining information on common waste management practices.
4. Data analysis was performed using Statistical Package for Social Science (SPSS) version 26, and Excel software programs. Descriptive statistics such as frequencies and percentages were computed.

The results obtained were discussed to ensure that medical waste is treated in the light of written policies and established international standards in this (WHO,1999). This study is purely a case and analyses mainly descriptive. The analysis data was extracted from personal interviews and observations and its checklist and follow-up by the researcher.

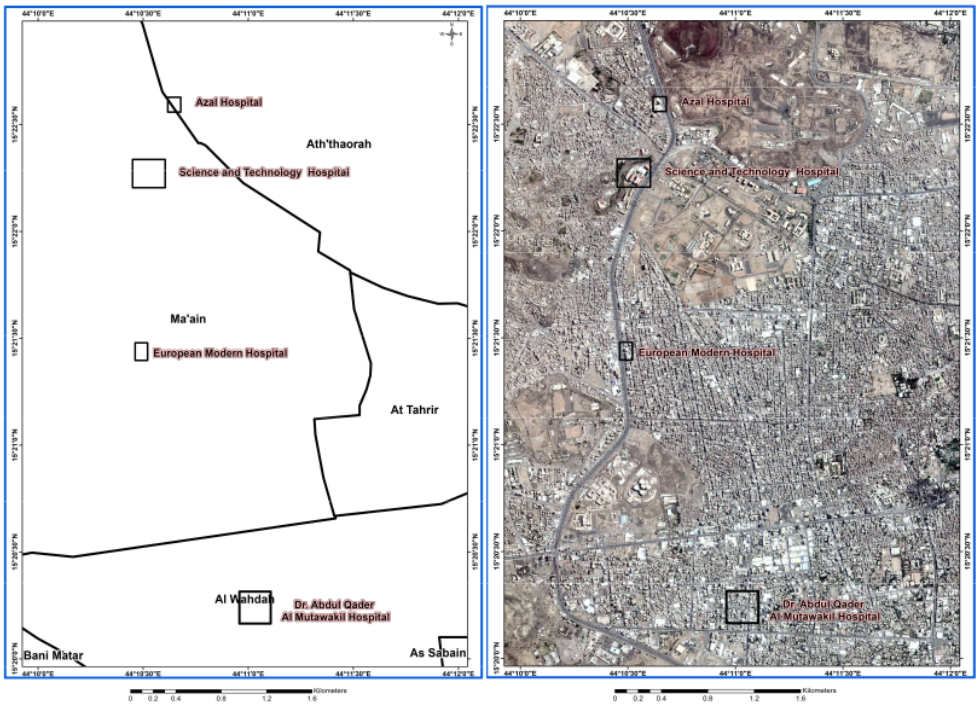

Figure 1. Map and an aerial photograph showing the location of the four hospitals under study

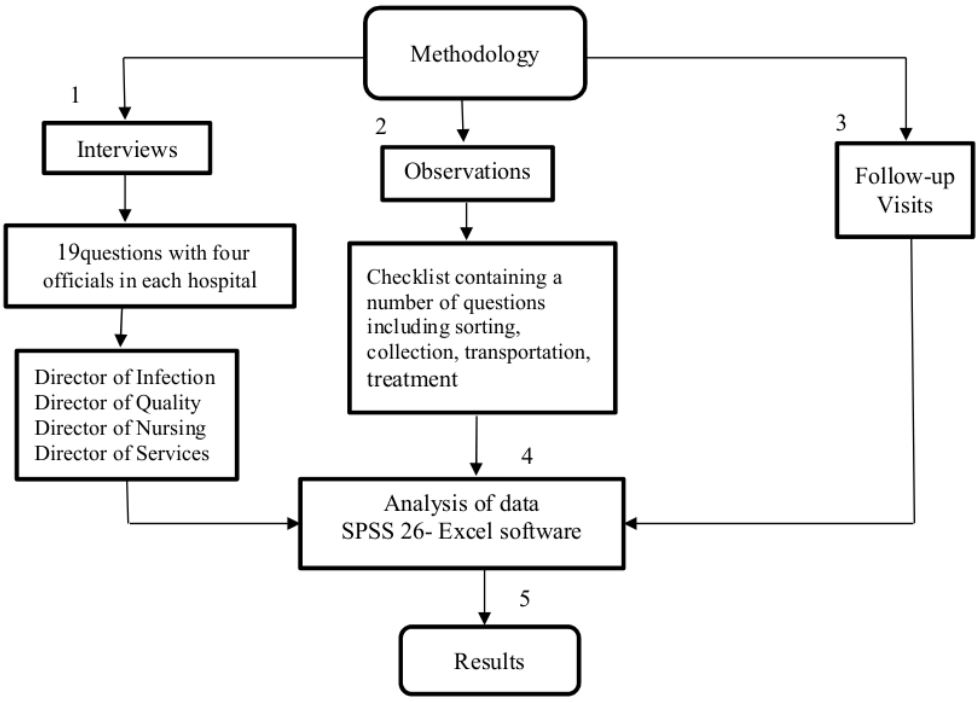

Figure 2. Methods of study.

3. Results

Waste Production: Waste is generated from the assorted activities performed within the hospitals. Wastes produced within hospitals include general and medical wastes. General waste produced at the hospitals is said to food preparation, administrative departments, and landscaping. This kind of waste is analogous to household and city waste. Within the four hospitals, different sorts of therapeutic procedures like Laparoscopic excision of benign, hematological, and malignant tumors, hemodialysis, surgery, childbirth and removal of damaged organs, etc., are meted out and end in the assembly of infectious wastes, contaminated sharps with patients' blood and secretions, radioactive wastes and chemical materials which are considered to be hazardous wastes(Prüss,1999). The number of waste generated in hospitals depends upon various factors like the number of beds, varieties of health services provided, economic, social, and cultural status of the patients, and therefore the general condition of the realm where the hospital is situated. As an example, in hospitals located in low socioeconomic areas of the cities, most of the waste consists of residues from fruits which are voluminous and abundant, whereas in those located in high socioeconomic areas of the city; most of the waste contains flowers, cans, and single-use containers for food[8]. However, during an interview with waste management staff within the hospitals, they may not tell the number of waste generated in the hospital daily. While they provided simple information that supported their observation concerning which departments generate the highest and lowest amounts of medical waste in the hospitals. Proper waste management will reduce waste at the source. For example, sorting organic and inorganic waste effectively reduces the amount of waste to more than 20% of the original waste generation [9].

Table 1. Hospitals Characteristics

Characteristics	Science and Technology Hospital	Azal Hospital	Modern European Hospital	Dr. Abd Alkader Al-Mutawakel Hospital
1. Class	general	general	general	general
2. Area	12900 m^2	3016 m^2	2438m^2	1700 m^2
3. Departments	25	25	14	22
4. Example of departments	Operations, Emergency, Laboratory, Heart, Kidney, Orthopedics, etc.	Operations, Emergency, Laboratory, Heart, Therapeutic nutrition, urology, oncology, children, etc.	Neurology, Internal Medicine, Cardiac Surgery, Ear, Nose, and Throat, Dermatology, etc.	Dental, ophthalmology, physiotherapy, central care, general surgery endoscopy, etc.
4. Beds	181	110	112	105
5. Doctors	87	75	65	34
6. Nurses	309	240	120	160
7. Administrators	110	77	70	35
8. Cleaners	154	80	45	30
9. Medical waste generation	Pathological, tissues, organs, blood, pus, and body parts and Fluids. Needles, syringes, broken glass, blades, placenta, Hazardous chemicals, Common medicines that are expired, etc.	Needles, syringes, broken glass, blades, Pathological, tissues, organs, blood, pus, body parts and Fluids, hematological and malignant tumors, hemodialysis, surgery, placenta, Common medicines that are expired, etc.	Needles, syringes, broken glass, blades, Pathological, tissues, organs, blood, pus, body parts and Fluids, placenta, Hazardous chemicals, Common medicines that are expired, etc.	Needles, syringes, broken glass, blades, Pathological, tissues, organs, blood, pus, body parts and Fluids, placenta, Hazardous chemicals, Common medicines that are expired, etc.

The results of this study, through observation and the checklist and follow-up, showed the existence of a real defect in the management of medical waste and recommended the necessity of urging decision-makers to take real measures to develop proper disposal processes (Table 2).

Table 2. Existing problems, their effects, and ways to solve them.

No	Problem	Effect	Solution
1	Medical waste is not properly separated and sorted from the source.	It causes damage to the cleaners who carry out the collection process.	Raising awareness among nurses to carry out the sorting process and provide red, yellow, and black bags.
2	The presence of open baskets in some sections.	Affect patients, nurses, and visitors.	Providing closed baskets and replacing damaged baskets.
3	No temporary collection rooms and waste collection in the bathroom corridor.	Ease of access by visitors and children, which leads to harm to them.	Providing temporary collection rooms in each section so that they are closed and that no one can open them except for the waste collection worker and with good ventilation.
4	Using public elevators to transport waste outside the hospital.	Leading to the transmission of infection to all users of these elevators.	Allocating special corridors and elevators to transport medical waste.
5	The fluids from the dialysis departments and others are discharged into the sewage network without any treatment.	Affect the environment and groundwater.	Using the chemical disinfection method to treat liquid medical waste resulting from laboratories, operations, and others.
6	Leaving medical waste in the collection room outside the hospital, mixed and exposed, for a long time.	Affects plastic collectors, animals, and people passing near them.	Creating a special room for hazardous waste and another room for non-hazardous waste are closed so that access to it is prevented, with the waste being transported daily to the treatment or disposal site.
7	Leaks occur from trucks transporting medical waste from hospitals to landfills, and these trucks are often exposed. These trucks follow the municipality.	Affect humans and the environment.	Allocating special trucks to hospitals to transport waste, which is tightly closed and impermeable to liquids.
8	All hazardous medical waste produced by the four hospitals is disposed of with normal waste in the Alzraqeen landfill.	It affects plastic collectors, animals, and people who pass by them, as well as soil, surface, and groundwater.	Establishing a central incinerator to treat medical waste away from populated areas and creating a special landfill for waste residues.

4. Conclusions

Almost all the hospital facilities studied suffer from weak sorting of medical waste because there are insufficient awareness and attention from medical staff. The collection of medical waste inside hospitals is done in incorrect ways and by means that do not conform to quality specifications and standards. Hospitals' waste collection sites do not meet environmental specifications and precautions are taken to prevent liquid leakage from bags. Medical waste remains inside the collection site for prolonged periods and there is no final treatment of medical waste in some of the hospitals studied, even liquid waste is discharged through the sewage system. There is also no special transportation of waste from within hospitals to outside hospitals and is transported by municipal vehicles. There was poor awareness about the risks of medical waste and safe treatment procedures among hospital managers, and most hospitals did not differentiate between household and medical waste. Budgets were not allocated for waste management, resulting in a shortage of waste treatment equipment and supplies and the absence of training programmers for staff, resulting in poor knowledge and practices for waste workers, and the risk of hazardous waste exposure for staff and visitors.

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