

# An analysis of clinical waste management system in a tertiary care hospital

G.S.P Ranasinghe<sup>1</sup>, W. K Wickremasinghe<sup>2</sup>, P.W.C. Panapitiya<sup>3</sup>

\* Ministry of Health and Indigenous Medical Services

\*\* Ministry of Health and Indigenous Medical Services

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## Abstract

Waste generation is un-avoidable in Hospital, 85% is general waste and remaining 15% is hazardous materials. Types of wastes generated are infectious waste, pathological waste, sharps waste, chemical waste, pharmaceutical wastes, cytotoxic wastes, radioactive wastes, non-hazardous or general waste. Life Cycle Approaches (cradle to grave) of waste management are waste avoidance, waste minimization, segregation, collection, transportation, storage, treatment and disposal. A qualitative study was done to analyze the waste management at a tertiary care hospital in Sri Lanka. High-income countries generates hazardous waste on average up to 0.5 kg of per hospital bed per day, while the average hazardous waste generation in low-income countries is 0.2 kg per bed per day, whereas in this study waste generation was 0.276 kg per bed per day. Results showed that the waste management is done in the hospital according to standard procedures. On conclusion it was recommended to use standard operation procedures, guidelines and protocols for health care institutions in waste management.

**Key words:** Health Care Institution, Waste Management

## Introduction

Waste generation is an un-avoidable event in a Hospital. According to the World Health organization health-care activities generate about 85% is general wastes out of the total amount of waste which is non-hazardous waste and it is comparable to domestic waste and remaining 15% of waste is considered as hazardous material that may be infectious, chemical or radioactive [1]. There can be many health hazards and environmental impacts due to waste produced in the health care institutions, if it is not managed properly.

## Types of Wastes

Types of wastes and by-products produced in the health care institutions covers a diverse range of materials, and they are as the follows [1]. **Infectious waste** can be describes as the materials that are contaminated with blood and other bodily fluids (e.g. from discarded diagnostic samples), waste from patients (e.g. swabs, bandages and disposable medical devices) or cultures and stocks of infectious agents from laboratory work (e.g. waste from autopsies and infected animals from laboratories). **Pathological waste** namely human tissues, body parts, organs or fluids and contaminated animal carcasses. **Sharps waste** are syringes, needles, disposable scalpels and blades, etc. **Chemical waste** are the solvents and reagents used for laboratory preparations, sterilants, disinfectants and heavy metals that contained in medical devices (e.g. mercury in broken thermometers) and batteries. **Pharmaceutical wastes** are expired, unused and contaminated drugs and vaccines. **Cytotoxic wastes** are substances with genotoxic properties (i.e. highly hazardous substances that are, mutagenic, teratogenic or carcinogenic), which are cytotoxic drugs used in cancer treatment and their metabolites. **Radioactive wastes** which are products contaminated by radio-nuclides including

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radioactive diagnostic material or radio-therapeutic materials, and **Non-hazardous or general** waste that does not pose any particular biological, chemical, radioactive or physical hazard [1].

The major sources of health-care waste are from hospitals and other health care facilities, research centres and Laboratories, autopsy centres and mortuary, animal research, testing laboratories, blood banks and collection services, and from nursing homes for the elderly.

According to the literature high-income countries on average generates hazardous waste up to 0.5 kg of per hospital bed per day, while low-income countries generate on average 0.2 kg per bed per day. However, health-care waste is not often segregates into non-hazardous or hazardous wastes in low-income countries making the real quantity of hazardous waste much higher [1].

### **Health risks**

Health-care waste which contains potentially harmful microorganisms could infect hospital patients, health workers and the general public. Drug-resistant microorganisms which spread from health facilities into the environment are the other potential hazards. Adverse health outcomes associated with health care waste and by-products includes [1], Sharps-inflicted injuries, Toxic exposure to the pharmaceutical products, particularly antibiotics and cytotoxic drugs which are released into the surrounding environment, and to substances such as dioxins or mercury, during the handling or incineration of health care wastes. Chemical burns arising in the context of sterilization, disinfection or waste treatment activities. Whereas the air pollution arise as a result of the release of particulate matter during medical waste incineration, and thermal injuries can occur in conjunction with open burning and the operation of medical waste incinerators, and radiation burns. It is estimated 16 billion injections are administered every year worldwide. It creates a risk of injury, infection and accidental reuse due to all needles and syringes are not disposed safely,.

### **Environmental Impact**

Treatment and disposal of healthcare waste may pose health risks indirectly through the release of pathogens and toxic pollutants into the environment. If those landfills are not properly constructed, the disposal of untreated health care wastes in to these landfills can lead to the contamination of drinking, surface, and ground waters. The treatment of health care waste with chemical disinfectants can result in the release of chemical substances into the environment, if those substances are not handled or disposed properly. Widely practiced method of waste disposal is the incineration of waste. But inadequate incineration or the incineration of unsuitable materials results in the release of pollutants into the air and in the generation of ash residue. Incinerated materials which contained or treated with chlorine can generate dioxins and furans, which are human carcinogens and also associated with a range of adverse health effects. Incineration of materials with high metal content or incineration of heavy metals (particularly lead, mercury and cadmium) can lead to the spread of toxic metals in the environment.

### **Waste Management Principles**

Waste hierarchy [2] is waste reduction, reuse, recycling, energy recovery, and disposal. Life Cycle Approaches (cradle to grave) [3] are waste avoidance, waste minimization, segregation, collection, transportation, storage, treatment and disposal. National color code used in Sri Lanka are Green for Bio-degradable wastes, Red for glasses, Orange for plastics, Blue for papers, and Brown for metals and Yellow color for clinical wastes and Yellow cover with red band for sharps. Type of waste and method of management [4] are as follows. Bio- Degradable Waste are manage with composting and Bio- gas generation, Plastic / Polythene Waste are manage with Recycling and Fuel generation, Glass & Metal are Recycled. Clinical wastes are incinerated, autoclaved, metamized, or chemical treatment is done.

## **Methodology**

Objective of this study is to analyze clinical waste management system in tertiary care hospital. Study setting was a National level tertiary care hospital in Sri Lanka. The selected National level tertiary care health care institution has a Bed Strength of 3200, average bed occupancy rate was 78%, average length of stay was 3.5 days and average turnover was 20.09. This was a qualitative study. Methods used were Key Informant Interviews and Observation to gather data. Key Informant Interview were done with, Medical Officer Planning of the Hospital, Hospital Secretary, Infection Control Unit Sister and Nurses, selected ward sisters from selected Medical wards, surgical wards, ICUs, Operation Theaters, Minor staff responsible for waste management at the ward level, In-charge at the waste collecting and storage section and Cleaning staff (sanitary labors). Observation was done in hospital wards and units to observe practices, waste segregation, and storage. Observations were done for waste transportation, waste storage at central level and waste disposal from the hospital.

## **Results**

Results were obtained according to the waste management cycle of waste generation, waste collection and segregation, waste transportation, waste storage and waste Disposal.

Wastes were generated from medical and surgical wards, Intensive Care Units, Operation Theaters, Laboratories, Radiology Department, Pharmacy etc. All types of wastes were generated. This study was focused mainly on the clinical waste. The clinical wastes are generated from the above mention sections. On findings surgical wards and operation theaters generate more clinical wastes compare to other units. Types of wastes generated were Swabs, Gauze, Naso-Gastric tubes, Intravenous Venous lines, contaminated saline bottles, Sharps, Needles, Cannulas, Urinary Catheters, Urinary Bags, Blood Body fluids, Blood Spills, Pathology samples, Lab Disinfected Chemicals, Radioactive chemicals, Endo-Tracheal tube, Orthopedic remnants like Blunt & Sharps, Lab waste, Culture media, Pharmaceuticals.

Waste segregation done properly and collection of waste was done according to the color codes. Green bins were used to collect Bio-degradable wastes, Yellow bin collected clinical wastes, Blue bins collect papers, Red bin collect glasses, Orange bin collected plastic Brown bin collected metal Yellow and red strips bins collected Sharps while Black bin collected other type of wastes.

Waste transportation within the hospital was done by a cart, or trolley. There is a responsible person for transportation and supervision. Transportation takes place three times a day. Culture medias were disinfected before transportation. Supervision is done by ward sister and cleaning supervisor at the wards and unit level.

There was a dedicated place for storage facilities at the Hospital premises. Generated amount of wastes are as follows. General waste was 5,100 kg per day, clinical waste was 822 kg per day, sharps were 63 kg per day and plastic waste generation was 12 kg per day. At the final storage in the hospital it is supervised by expert staff. There were color coded compartments to store wastes at wards and unit levels and also at the final storing complex in the hospital.

General waste was taken by the municipal council and clinical waste was given to a private company. The clinical wastes are incinerated by the private company. The culture media is autoclaved before it is disposed as a clinical waste. Pathological samples and body parts are disposed to a cemetery. Glasses, papers, plastics are taken by a private company for recycling.

Waste management monitoring and evaluation was done by the, Infection Control Committee that responsible for the Clinical waste management in the Hospital. There were two Microbiologists who overlook the waste management system in the hospital. These Microbiologists overlook the infection control unit in the hospital. Infectious control unit was comprised of one Sister and ten Infectious Control Nursing officers (ICNO). Each ward and unit had a liaison nursing officer for the waste management. ICNO and liaison nursing officers meetings were conducted monthly.

Some negative factors identified in the study were as follows. The awareness about segregation was poor in few wards. Also, there was poor contribution from the all the staffs (Medical Officers, Nurses, Minor staff) and cleaning service for waste management in few wards and units. It was identified that, poor contribution from the patients and the by standers for waste segregation in several units. Although these negative factor identified infection control unit and the health education unit already has taken steps to address these issues.

### **Discussion**

As in the other health care setting similar types of wastes were generated and the waste generation was similar too. According to the literature hazardous waste in high income countries produces 0.5 kg per bed per day whereas in low income countries 0.2 kg per bed per day is produced. In this study 0.276 kg per bed is produced ( $822 + 63 = 885/3200 = 0.276$ ). Sri Lanka is a middle income country, waste production in this study is 0.276 which is between high income country and low income country, but the figure is more towards the low income country. Waste segregation, transportation, storage and disposal in this study done according to the standards describes in the literature.

### **Conclusion**

The hospital in this study carries out satisfactory waste management system in the hospital. This study showed few gaps which was addressed immediately. Based on this study following recommendation will further help to improve the waste disposal system in a Health Care Institutions.

### **Recommendations**

- Health care institutions should have standard operation procedures to manage waste generated at their institutions. These standard operation procedures should be functioned at every level of the health care institutions. Guidelines and protocols on these procedures should available to the staff
- Health care staff should possess a sound knowledge on waste management and they should also possess good attitudes. Therefore they need regular updates and motivation on standard method of waste management by capacity building (training, workshop, lectures etc.).
- A monitoring and evaluation plan and a system, regular audits will help the process of waste management in health care institutions.

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## **AUTHORS**

First Author –

Dr. Gamege Samantha Prabath Ranasinghe, MBBS, MSc in Medical Administration, MD in Medical Administration, MBA, Ministry of Health and Indigenous Medical Services [gspr73@gmail.com](mailto:gspr73@gmail.com)

Second Author –

Dr. W. K Wickremasinghe, MD, MSc in Medical Administration, MD in Medical Administration, MBA, National Hospital of Sri Lanka

Third Author –

Dr. Lal Panapitiya, MBBS, MSc in Medical Administration, MD in Medical Administration, Ministry of Health and Indigenous Medical Services