

Generation of Infectious and Non-Infectious Waste in Abbottabad, Pakistan

Asim Yaqub^{*1}, Nida Mushtaq², Huma Asim³, Arshid Pervez¹, Muhammad Awais¹,
and Zahid Mehmood Khan²

¹Life Sciences Services Centre,

²Department of Environmental Sciences,

³Department of Chemistry, COMSATS Institute of Information Technology Abbottabad. Post Code 22060, Abbottabad,
NWFP – Pakistan Tel (+92-992) 383592, +923335044907, Fax: (+92-992) 383441

ABSTRACT

This study is mainly concerned with the generation of solid waste and its management in the Ayub Medical Complex (AMC) Abbottabad. The hospital serves approximately 1600 to 1800 patients daily. This study provides the estimates of the quantity of different kinds of solid wastes produced and the current solid waste management situation at the hospital. The results indicate that approximate rate of solid waste generation is 464.7 kg day⁻¹, which includes about 37.4 kg day⁻¹ i.e 8% of infectious solid waste, and 427.3 kg day⁻¹ i.e 92% of non-infectious waste. Besides this, the achievements of this study include the statistical data of solid waste on daily basis from all the departments, which was collected by the sampling at the point of generation. The mean generation rates were found to be 1.04 kg per patient per day. According to the results the highest waste generation of solid waste was observed in Gynae department that was nearly 118 kg day⁻¹ and lowest waste was observed in Psychiatry that was almost 0.2 kg day⁻¹.

Key Words: Hospital, infectious waste, generation, collection, management, Abbottabad.

INTRODUCTION

Health and environment are important issues throughout the world. The hospital waste management is one of the major environmental concerns in Pakistan, which may significantly increase the exposure of infectious pollutants (Dodhy 2006). Hospital waste in particular has increased greatly because hospitals use relatively more disposable items, such as syringes, cutlery, food trays, bed pans, etc. (Morrison 1992). Hospitals produce a tremendous amount of medical waste that is defined as any solid waste which is generated as a result of patient diagnosis, treatment, or immunization of humans or animals, in related research, and the waste capable of producing infectious disease (Al-Mutair et al. 2004, Sabiha et al. 2008). According to WHO (World Health Organization), the waste produced by hospitals carries a higher potential for infection and injury than any other kind of waste (Bos et al. 2002, Rushbrook 1995). Hospital waste is considered dangerous because it may possess pathogenic agents and can cause undesirable effects on human health and the environment (Askarian et al. 2004). In hospitals of Pakistan 15% of the hospital waste is a hazardous waste, while 85% in general non-infectious waste, which can be regarded as normal solid waste (Ikram et al. 2007). Almost 80% of total wastes generated by health-care activities are comparable to domestic waste and can be disposed through regular municipal waste methods. The remaining 20% of wastes are considered hazardous and have been classified into nine categories: infectious waste, pathological waste, sharps, pharmaceutical waste, genotoxic waste, chemical waste, waste with high contents of heavy metals, pressurized containers and radioactive waste (WHO 1999, WHO 2000).

It is because the municipal institutions of Pakistan do not have sufficient resources and capacity to collect the solid waste. It is estimated that around 250,000 tones of medical waste is annually produced from different healthcare facilities throughout the country (Askarian et al. 2004). All over the country, the hospital waste management practices have not being given due attention and the waste disposal in our hospitals is placed at a low priority which possess a risk for patients and healthcare personnel, who handle these wastes (Hashmi et al. 2000)

Main objective of the study was to identify the present status of hospital waste generation and management at the Ayub Medical Complex and quantification of infectious and non-infectious waste.

MATERIALS AND METHODS

Materials

Materials that were needed for sampling were plastic bins and bags. Gloves, facemasks and lab coat as precautionary measures. Weighing balance was used for waste measurements at different departments.

The waste generated rates per patient per day (WG) were computed using the relation:

$$WG = \frac{(W_t - W_b)}{p} = (\text{kg per patient per day}).$$

(W_b) weight of empty bin

(W_t) gross weight of bin container and waste

(p) Average number of patients admitted in the hospital at the time (t)

Methods of Data Collection

Following steps were taken during this study.

1. Personal interviews were also conducted with hospital employees working in operation theatres, X-Ray department, Laundry and Hospital Stores along with medical practitioners, nursing staff and sweepers.
2. On-site sampling of waste and measurements.

On-site waste collection and sampling

Sampling was done from at least one of the wards of each department. Early morning and late afternoon visits were made to see the performance of the waste management staff of the hospital. The samples were collected in the plastic bags and bins placed at different sites of the hospitals including Operation Theatres, x-ray departments, outside wards of each departments, disposal sites etc. Two to three wards were measured a day, usually just before 9.00 am. Since in some cases, waste was not collected according to their types, but rather was mixed together, this demanded prior sorting before measuring. Again the procedure was repeated in the evening and same sites were selected for the samples collection. The waste was measured in the evening.

RESULTS AND DISCUSSION

The survey was carried out in all the departments of the hospital. Numbers of patients on daily basis are 1600 to 1800 approximately including out door and admitted patients. Table 1 gives the details of the departments including their number of wards, beds and admitted patients. The amount of waste generated in each department is given in Table 1 as solid waste generated in Kg day⁻¹. Figure 1 shows the percentage composition of solid waste in each department of the hospital in decreasing order: Gynae (25.4%), Operation Theaters (23.01%), Surgical (10.45%), Orthopedics (10.1%), Labour rooms (7.7%), Nursery (6.46%), medical (3.87%), Gastro (3.6%), Eye (2.26%), Intensive care unit (1.5%), E.N.T (1.29%), Phlmonology and Dermatology (0.96%), C.C.U (0.86%), Cardiology and Neurosurgical (0.53%), Burn unit (0.32%), Psychiatry (0.04%).

Table 1: Mean generation rates of hospital solid waste in kg per department and per patient per day.

Departments	Wards	Beds	Admitted Patients	Mean Generation Rates	
				Kg Dept ⁻¹ day ⁻¹	Kg Patient ⁻¹ day ⁻¹
Gynae	3	100	118	118	1
O T	-	-	43	107	0.4
Surgical	3	114	97	48.5	2
Orthopedics	2	62	47	47	1
Labour Room	1	18	18	36	0.5
Nursery	1	23	30	30	1
Medical	3	114	36	18	2
Gastro	1	20	17	17	1
Eye	2	64	21	10.5	2
ICU	1	8	7	7	1
ENT	2	63	12	6	2
Phlmonology	1	20	9	4.5	2
Dermatology	1	19	9	4.5	2
C.C.U	1	8	4	4	1
Neurosurgical	1	12	5	2.5	2
Cardiology	1	12	5	2.5	2
Burn Unit	1	12	3	1.5	2
Psychiatry	1	19	2	0.2	10
TOTAL	27	712	483	464.7	1.04

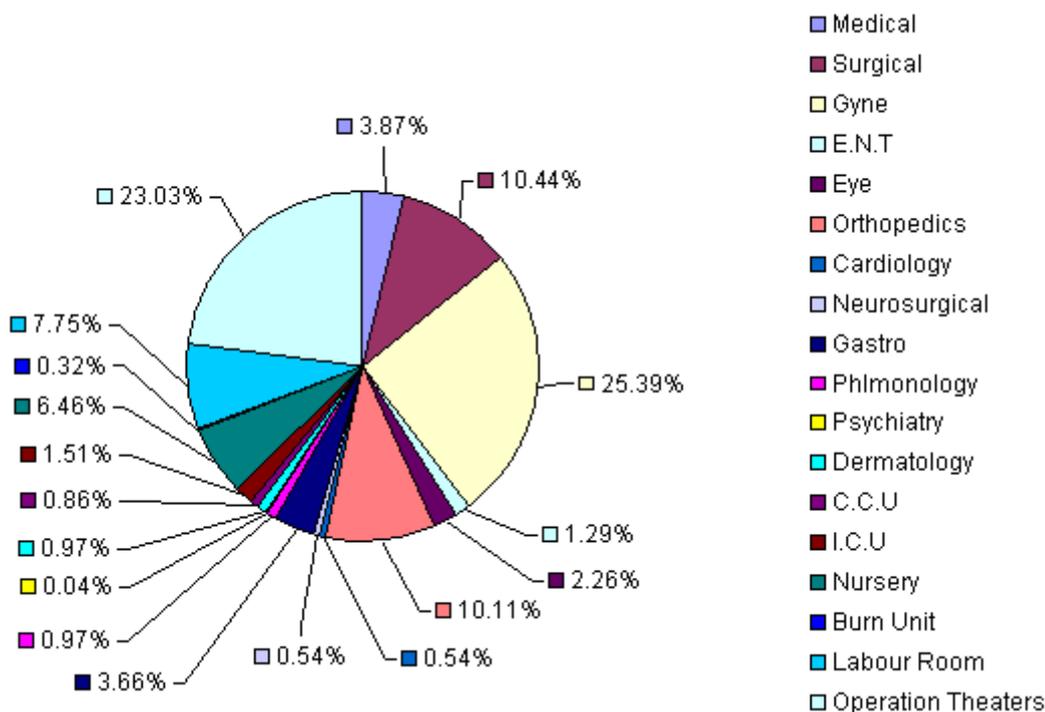


Figure 1. The percentage of solid waste generated in each department of the hospital per day.

Fig. 2.a gives the path of solid waste management in AMC and Fig 2.b gives the modern international hospitals (Nemathaga et al. 2008) the difference in the flow charts can be observed.

In this study, Ayub Medical Complex was selected for the detailed study of solid waste and its management. Ayub Medical Complex is one of the most popular hospitals in Abbottabad region. This study contains the data of infectious and non-infectious waste produced and the present situation of waste management in this hospital. The non-infectious solid waste includes general waste, which is similar to domestic waste. General waste is defined as hospital waste that does not pose any immediate danger to humans or to the environment (Nemathaga et al 2008). General waste includes packaging materials such as cardboard, office paper, leftover food, cans etc. Infectious waste is defined as waste that contains pathogens in sufficient quantity that when exposed to it can result in diseases. The infectious solid waste includes sharps (syringes, needles, blades, pipettes and tubes), blood soaked cotton, radioactive waste and cytotoxic chemicals. Most of the infectious waste are incinerated but was also found at the dumping site. The results indicate that the waste generation rate is approximately 464.7 kg/day, which includes approximately 37.4 kg/day i.e 8% of infectious solid waste and 427.3 kg/day i.e 92% non-infectious solid waste. According to the study conducted in India on the average composition of total solid waste in hospitals found infectious waste ranging from 10–36.23% with an average of 18.83% (Patil et al 2001). The mean generation rates were found to be 1.04 kg per patient per day. The amount of waste generated in each unit was affected by several major factors such as the number of patients present at the time of measurement, type of services offered, etc. In the hospital under study, there was not any training course about hospital waste management and the hazards associated with them. Beside this, the study contains so many problems related to solid waste collection and segregation due to lack of awareness in the waste handling staff. Segregation of the different types of waste is not carried out perfectly. Borg suggests that segregation reduces clinical waste volumes, perhaps reduces the disposal costs (Borg 2006). Proper collection, segregation at the source, storage and disposal of hospital waste will minimize the quantity of waste generated. These good practices will have significant economic gain and environment friendly impact for both inside hospital and outside environment.

The waste in Ayub Medical Complex is collected from generation point and is transported to dumping sites, from where it is segregated and carried to the site of incineration and is subjected to final disposal. The AMC lacks the storage area and the process of recycling (Fig 2a.) as compared to the international hospitals (Fig 2b) (Nemathaga et al. 2008). Poor management of clinical waste exacerbates the risk of infection for those exposed to it, compromises hospital hygiene and has infection control implications (Blenkham 2006).

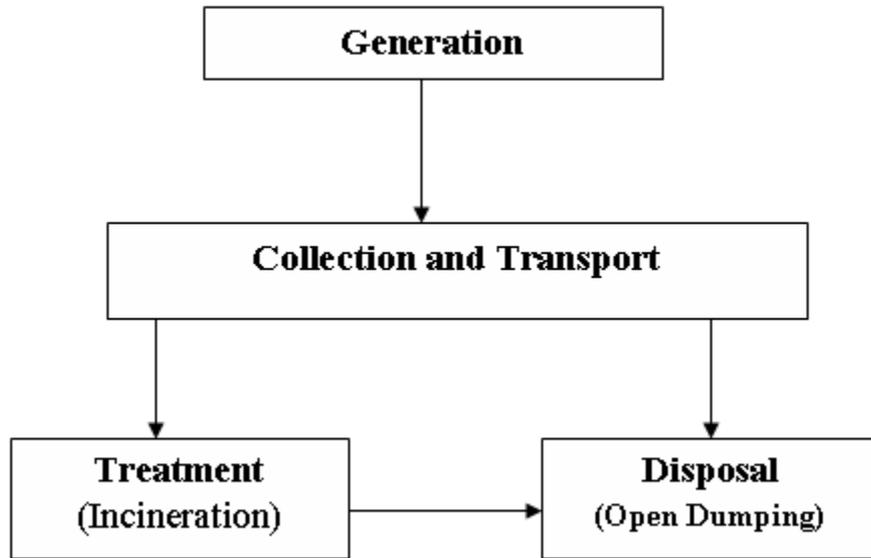


Figure 2.a. Path of Hospital Waste management in Ayub Medical Complex

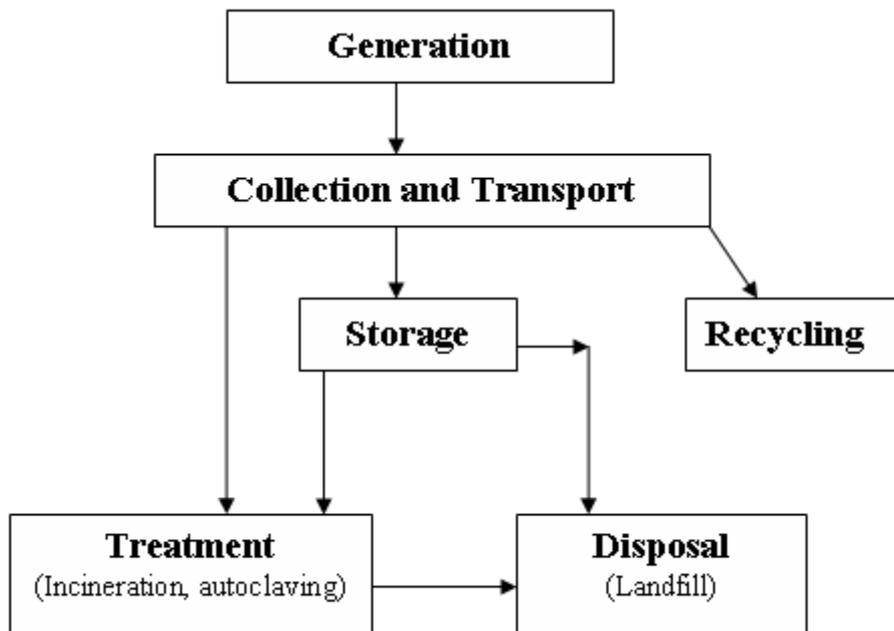


Figure. 2.b Path of Hospital Waste management in the modern hospitals

Source: (Nemathaga et al. 2008)

RECOMENDATIONS

To improve the waste management system in hospital the following practices are recommended for the collection and disposing of infectious medical waste.

1. During storage, handling, and transport, infectious medical waste (except for sharps) must be contained in disposable containers or bags that are moisture resistant and strong enough to prevent leakage or expulsion of solid or liquid waste.
2. Sharps must be disposed of in impervious, rigid, puncture-resistant containers immediately after use.

3. All bags used for the containment of infectious medical waste must be clearly identified by label or color, or both.
4. Rigid containers of discarded sharps must be labeled in the same way or placed in disposable bags used for other infectious waste.
5. It is recommended that transporters use equipment that will contain all the waste to avoid releases of infectious waste to the environment and receive training in waste handling and spill cleanup methods.

ACKNOWLEDGEMENT

Authors are thankful to the management of AMC Abbottabad for their cooperation in data collection.

REFERENCES

- Al-Mutair N, Terro. M, Al-Khaleefi A.L. (2004). Effect of recycling hospital ash on the compression properties of concrete: statistical assessment and predicating model. *Building Environment* 39: 557–566.
- Askarian M, Mahmood V, Gholamhosein K (2004). Results of a hospital waste in private hospitals in Fars Province, Iran. *Waste Manag* 24: 347–352.
- Blenkharn J.I (2006). Potential compromise of hospital hygiene by clinical waste carts, *J Hosp Infect*, 63: 423–427.
- Borg M.A (2006). Safe disposal of clinical waste: where is the science?. *J Hosp Infect* 62: 243–244.
- Bos A.V.D, Izadapanaah A (2002). Building capacity for comprehensive medical waste management in Asia. *The Urban Environment* 52: 18.
- Dodhy, S.R. (2006). Solid Waste and pollution-Silent killer. *J Pak Textile* 55: 42-44.
- Hashmi, S.K., Wahab, E., Shahab, S., Bhatti, A.M (2000). Hospital Waste Management Scenario in Pakistan. *Medical forum monthly*, 11: 1-8;.
- Ikram W, Pervez A and Raja IA (2007). Review of Hospital Waste Management in Pakistan. *Proceedings 2nd Inter Conf ESDev_2007 COMSATS Abbottabad, Pakistan*, 2: 981-985.
- Morrison J.L. (1992). The contagious hospital. *On the Horizon* 1: 11–12.
- Nemathaga, F., Maringa. S., Chimuka, L (2008). Hospital solid waste management practices in Limpopo Province, South Africa: A case study of two hospitals. *Waste Manag*, 28: 1236-1245.
- Patil, A.D., Shekdar, A.V (2001). Health-care waste management in India. *J Environ Manag*, 63: 211–220.
- Rushbrook, P (1995). Healthcare Wastes: A World Health Organization Perspective on Waste Treatment and Disposal Options. *J Water and Environ*, 13: 137 – 140.
- Sabiha-Javied, Tufail M, Sofia Khalid (2008). Heavy metal pollution from medical waste incineration at Islamabad and Rawalpindi, Pakistan. *J Microchemical* 90: 77–81.
- WHO (1999). Safe management of wastes from health-care activities. edited by A. Pruss, E. Giroult and P. Rushbrook. 1-242.
- World Health Organization. Starting health care waste management in medical institutions. *Health Care Waste practical information series* 1; 2000.