

Proposed Model for Healthcare Waste Management

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ABSTRACT

The objective of this manuscript is to propose a Healthcare Waste Management (HWM) model for the safe disposal of healthcare waste which should be comprehensive, environment friendly and in an integrated form. This descriptive analytical study was done and based upon the factors associated with the poor handling of healthcare waste at Shalamar Hospital Lahore from November, 2008 to December, 2010 in healthcare facilities (HCFs) situated in Punjab, Pakistan, a model has been proposed. Five stages for the management of the waste (a) Planning the outline, (b) Implementation of action plan, (c) Classifying job descriptions, (d) disposal method and (e) Skill Development have been evolved. This model can be applied in any healthcare facility situated in Pakistan.

KEY WORDS: Hospital Waste Management, Segregation, Collection, Disposal, Risk Factors, Incinerator, Hepatitis B and C, Tertiary level and Health Surveillance.

Pak J Med Sci July - September 2011 Vol. 27 No. 4 901-905

How to cite this article:

Habib-Ullah J, Khan MA. Proposed Model for Healthcare Waste Management. Pak J Med Sci 2011;27(4):901-905

INTRODUCTION

Hospitals in Pakistan generate tons of clinical waste everyday. Ten to twenty-five percent of the total hospital waste is considered as infectious which poses variety of health risks.¹ The management of the health care waste is a subject which has received little attention in the developing countries. Waste management is a matter of considerable public health and environmental concern. Generally waste is dumped openly without proper processing. Waste poses a threat to the hospital employees and to the population around it.

Waste generation depends on numerous factors such as process of waste management methods, type of hospital establishment, hospital specialization, proportion of reusable items employed in hospital, and proportion of patients treated on a day-care basis.²

Medical waste can be classified into human blood and blood products, cultures and stocks of infectious agents, pathological wastes, contaminated sharps, contaminated laboratory wastes, contaminated wastes from patient care, discarded biological, contaminated animal carcasses, body parts and beddings, contaminated equipment and miscellaneous infectious wastes.^{3,4}

Magnitude of Problem: Transmission of diseases generally occurs through injuries from contaminated sharps. Infections of particular concern are Hepatitis B (HBV), Hepatitis C (HCV), and the human immunodeficiency virus (HIV). For HIV and HCV, the probability that a single needle stick will result in sero-conversion is 0.3-0.5 percent and 2-5 percent, respectively.⁵ In the healthcare sector alone, the World Health Organization estimates that unsafe injections cause approximately 30,000 new HIV infections, 8 million HBV infections, and 1.2 million HCV infections worldwide every year.^{6,7} Toxic risks

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* Received for Publication: April 30, 2011

* Accepted: June 20, 2011

may arise among others from reagents (particularly laboratory reagents), drugs, and mercury thermometers.⁸

In March 2009, 240 people in the Indian state of Gujarat contracted hepatitis B following medical care delivered with previously used syringes later discovered to have been acquired from the black market trade of unregulated health care waste.⁹

According to a study an average Pakistani uses five disposable syringes per year, making a demand of about 750 million syringes. Pakistan imports over 250 million syringes and 500 million syringes are produced locally in suspicious conditions. Most of these 500 million disposable syringes are often used in rural areas.¹⁰ In Germany, about 500,000 needle stick injuries occur annually among health care workers (HCWs). These include injuries from syringes, sewing needles and other sharp objects.¹¹

SITUATION ANALYSIS

The inadequate waste management systems in the health care centres are posing a severe threat to public health as well as to the environment. This concern has been raised in many studies.^{12,13}

In a study casual attitude towards an organized, systematic approach for hospital waste management was found prevalent, as 60% of the health care facilities had no training program.¹⁴ Recent concerns raised by various authorities against hazards to the hospital professionals and community at large have necessitated a serious insight toward hospital waste and its management. A study was done in the department of community medicine, Army Medical College Rawalpindi, Pakistan regarding the awareness of health hazards for sanitary workers. It was concluded that none of the sanitary workers ever received any training and they were unaware of the risks and hazards associated with handling of hospital wastes.¹⁵ The study carried out by Sultana Habibullah and Salahuddin Afsar from Karachi showed that at health-care facilities none of the sanitary workers had good knowledge in healthcare waste disposal and 35 (71.4%) health facilities disposed the waste in public dustbins.¹

Junaid et al quantified the average waste load of various institutions by level and size of institutions. Government and private hospitals were generating an average of 0.292 kg/bed/day of the solid infectious waste. Fatima Memorial Hospital had highest weight per bed per day (0.322 kg) and private healthcare facility Ali Hospital had the lowest weight per bed per day (0.21 kg).¹⁴ This study also concluded that a general inadequacy in the awareness and

allocated staff for hospital waste management was observed in all the institutions studied. There were acute shortages in the facilities in collection, storage and transportation of the hospital waste. It was however observed that all institutions were keen to adopt a system which would be safe, sustainable and practical.¹⁵

In another study conducted in Thailand (2002), the average daily waste generated as general, medical and hazardous waste from all hospitals in Phitsanulok province was found as 1.751, 0.294 and 0.013 kg/bed respectively.¹⁶

THE STUDY

It was felt that due to the ever increasing size of patients in the secondary and tertiary care health institutions and diversification of services, it was a challenge to manage health care waste in a systematic way. It was also observed that most of the large health care institutions were unaware, or unmindful of paying attention to this important hazard due to medical waste. For this purpose a cross-sectional analytical study was carried out. In this study, a Model has been developed for the safe management of healthcare waste which is comprehensive, environment friendly and in an integrated form.

MODEL BASE

The suggested model is systematic approach of series of actions to be adopted. The situation analysis of the selected health institutions in Punjab, regarding their disposal of hospital waste has influenced us to propose the following model. The model encompasses the following stages of development;

- a) Planning of outline.
- b) Implementation of action plan.
- c) Classifying job descriptions.
- d) Disposal of waste – incinerator.
- e) Skill Development.

a. Planning the outline: The plan has to be clearly stated to include policy and objectives. The scope of management plan should include the expected waste types and the activities that would generate them. The plan should list the current activities being undertaken regarding steps like segregation, collection, storage, treatment, transportation and disposal.

The plan has to list the individual responsibilities and their training needs. Some methods of minimizing the waste generation, steps of providing the safety of the exposed should be listed. The plan has to include the steps to handle any emergency situation and ensure total quality management measures. A

system of ongoing evaluation to monitor the functioning, cost, reporting system and indicator has to be incorporated.

b. Implementation of action plan: This step would require identifying the procedures for collection, segregation, transportation and disposal of waste. The action of segregation should start from the point of generation, whereas soft infectious waste should be put in yellow bag and hard infectious waste in a sharp container. For 10-12 patient beds one trolley each with the yellow bag, white bag and for the sharp container is recommended.

Each department should have an identified collection point with the displayed instructions. The instructions should include, guidelines to place yellow bag in trolley, filling upto $\frac{3}{4}$ of the bag and not stapling the bags. Each bag should have an identity of its point of generation.

In case the yellow bags contain highly infectious waste then it should be closed and placed in a second yellow bag for extra safety. A system of daily collection or even more frequent collection may be considered with sufficient supply of empty bags to replace the filled once.

The action plan needs standard operating procedures covering all components and modes of handling the waste. These include establishing a central storage facility where displayed cautions should guide the visitors. WHO recommends that hazardous waste may not be stored for more than 24-48 hours in summer and 48-72 hours in winter.

The location of the primary storage area should ideally be close to treatment or secondary collection facility and away from food area. The primary storage sites should have the capacity to cover off-days and breakdowns. It should be inaccessible to animals, insects, birds and unrelated visitors. The facility should have cleaning, drainage, and ventilation and disinfection arrangements. The non-risk waste in white bags should be disposed through normal municipal system.

Transporting the waste from on-site to primary collection site should be through 3-4 wheeled trolleys with high sides, which should be cleaned regularly. The sealed waste bags shall be carefully loaded by hand onto the trolley to minimize the risks of the punctures or tears. Yellow-bagged risk waste and white-bagged non-risk waste shall be collected on separate trolleys which shall be painted or marked in the corresponding colours. The collection route shall be the most direct one from the final collection point to the central storage facility designated in the waste management plan. The collected waste shall

not be left even temporarily anywhere other than at the designed central storage facility.

In case of off-site transportation, the transportation of waste should be properly documented and all vehicles to carry a consignment note from the point of collection to the incinerator or land-fill or other final disposal facility.

c. Classifying job descriptions: The team of hospital waste management should consist of Medical Superintendent, Heads of Departments, Infection Control Officer, Chief Pharmacist, Radiology Officer, Senior Matron & Head of Administration, Hospital Engineer and Waste Management Officer. The job description of the waste management team should be according to the specification lay down in the HWM environmental rules 2005.¹⁷

d. Disposal of waste by incinerator: Incineration is one of the preferred disposal methods of waste in the present scenario. The incinerator used for the destruction of waste should meet the minimum technical specification criteria.

Primary Chamber

* Volume (ft ³):	120
* Temp:	800°C
* Burner Capacity BTU/Hr:	125,000
* Primary Air Fan Capacity (SCFM):	200

Secondary Chamber

* Volume (ft.3):	235
* Temp:	1100°C
* Gas Retention Time (sec. @ 1832°F):	2.1
* Burner Capacity BTU/hr:	3,000,000
* Secondary Air Fan Capacity (SCFM):	1500

Air Pollution Control System: Air pollution control system should be installed with the incinerator to further purify the toxic gases and to meet the national environmental quality standards (NEQS).

Ignition and Control System: Eclipse Therm Jet Series high-performance velocity natural gas with ultraviolet (U.V.) scanner flame detection and flame safeguard burner management control system should be inbuilt in the incinerator plant.

e. Skill Development: In order to educate the hospital staff and general public regarding hospital waste management the posters/booklets in their regional language should be developed.

SAFETY REQUIREMENTS

For Sanitation Staff:

1. Special uniform according to duty
2. Trolleys with yellow bags for the collection of infectious waste

3. Sharp boxes for hard infectious waste
4. Special boxes for the collection of organs
5. Trolleys for the collection of general waste
6. Big trolleys for the transportation of waste up to storage place
7. Miscellanies items like brush, face mask, cap, protective gloves and safety shoes

For Paramedical Staff:

1. Special uniform according to duty
2. Face mask
3. Protective gloves
4. Special shoes
5. Hand washing material
6. Needle cutter

For Doctors:

1. Long coat (overall)
2. Face mask
3. Special Shoes
4. Goggles
5. Hand washing material
6. Anything required for safety

DISCUSSION

Many models regarding the management of the waste have been established. We had a chance to study few of them. Each model has its own strengths and weaknesses. Our proposed model has also been designed according to the local environmental conditions of health institutions. This model is still in practice and providing satisfactory results. Through this model, waste management services have been provided to 222 healthcare facilities of different districts of Punjab.

One of the waste management model entitled "The Danish Waste Model by Danish Environment Protection Agency in 2004" has been studied. This model has the salient features like: waste collection should be the responsibility of local authority. The separation of waste should be at source. The organization and operation of the municipal waste should be dealt separately. They have introduced the "Waste 21" idea which focuses on quality in treatment, reducing environmental impact and increasing resource utilization. It also includes the list of undesired substances. This list is based upon the knowledge of substances having harmful effect on human health and /or the environment. In the selection, consideration has been given to problems arising in manufacture, used, and disposal of waste.¹⁸ The present model did not explain any standard operating procedures (SOPs) for segregation, collection, transportation and disposal of waste. Our proposed model describes all procedures.

World Health Organization formulated a policy paper entitled "Safe healthcare waste management" in August 2004. This paper described an organization model and strategy for developing healthcare waste management polices and plans through National Steering Committees and National Working Groups. It emphasizes on the participation of stakeholders, organization model, and process of policy making and planning. The main functions of national committee are: to assume overall responsibility for the development of healthcare waste management polices and plans, to ensure cooperation between agencies or organizations, to empower a national worker to engage with stakeholders and develop recommendations, to allocate support for the work of the National Working Group, to review, revise and approve recommendation from the National Working Group and to promulgate the national polices and plans. The other activities include developing technical guidance material for assessing the quantities and types of waste producing in different facilities, creating national action plans, developing national healthcare waste management (HCWM) guidelines and building capacity at national level to enhance the way HCW is dealt in low income countries.¹⁹ This model gives overall strategy and planning of hospital waste but planning outline given in our model is evidence based and has been under use for the last ten years.

World Health Organization also proposed a plan under title "10 Steps to Implement a Regulated Medical Waste Reduction". The main objectives of this plan are to reduce medical waste being generated in healthcare facilities, potential risks and cost involved. The steps includes: Understanding regulated medical waste definitions, Defining the problem and developing a cost/benefit analysis, creating a team to develop goals and an action plan, Planning for waste segregation, Container placement and signage, Worker training and education plans and policies, Sharps management, Problem identification and resolution plan, Waste treatment and waste hauling and tracking your progress and, reporting Successes and Reward staff.²⁰ The steps described are very useful. The capacity enhancement described in our model has significant features. Approximately thirty thousands people have been trained in this field and they are managing the waste in the better way. As awareness program, the posters in the regional language (Urdu) has been designed and displayed in all the healthcare facilities.

Royal College of Nursing-UK also established a guideline entitled "Safe management of healthcare

waste". These guidelines start from the definition and classification of waste, Waste segregation in different color coding bags, Waste assessment including waste audit types and frequency, Training and competence and ends with community nursing.²¹ This paper did not describe about the proper disposal of medical waste. At least they should recommend incinerators or other technologies. In our model we have recommended dual chamber incinerator with air pollution control system (local designed) especially for the health facilities in Punjab, Pakistan. The gases emission report is quite satisfactory. Although incineration method is discouraged in developed countries because of the environmental pollutants like dioxins, furans and PCBS but in country like Pakistan where there is no serious concept and awareness of healthcare waste management with heavy cost involved in new technologies like steam autoclaving, plasma, chemical disinfected methods etc. We strongly feel that incineration is a preferred method.

Proposed model is sustainable, cost effective and is in an integrated form. This model can be replicated in any district/city of Pakistan and even in other countries.

Indicators for the Proposed Model: Policy of healthcare waste, training, documentations, number of pricks due to syringes, medical audit of healthcare waste, budget allocation, data of diseases, color coding bags for waste, increasing of health facilities attaining the facility of incineration from Shalamar Hospital, Establishment of central storage place for waste in hospitals, special custom made trucks for waste collection, protective gloves and other materials for safety, emission data of gases are the main indicators for the proposed model.

Conflict of Interest: No conflict of interest was involved with the authors and the institutions studied.

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Authors Contribution:

Junaid Habib Ullah planned, designed and prepared the draft paper.

Amanullah Khan guided and approved the final draft.