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Questionnaire Method for Assessing Biomedical Waste Management in Shimla City–Case Studies of Public and Private Hospitals

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Abstract—*Biomedical waste is highly hazardous and infectious in nature of utmost importance due to its hazardous and infectious nature and therefore requires proper disposal techniques. Realizing its utmost significance, the Government of India (GOI) has passed the Biomedical Waste (Management and Handling) rules 1998 under the Environmental Protection Act 1986 and which is to be strictly followed while disposal of biomedical waste. In this study, the procedure of handling of biomedical waste followed by two major hospitals (public and private) has been carried out through a questionnaire study for both in Shimla city. The questionnaire utilized for this purpose has been presented. Further, the results of this questionnaire will be analyzed and utilized to observe the similarities and differences of the waste management procedures of the two hospitals in Shimla city and is currently under progress.*

1. INTRODUCTION

A hospital is an institution visited by people of any age, sex, race and religion when they are medically unfit. In addition to patients, hospitals also consist of doctors and medical staff personals [1]. Any human activity produces waste that is dangerous requiring proper disposal techniques. If these wastes are not disposed of in a safe manner they may pollute the surrounding air, water and soil.

Hospital waste (Biomedical waste) is a kind of waste that is dangerous due to its hazardous and infectious nature in comparison to the other wastes. Although, almost 75-90% of waste produced by hospitals, nursing homes etc. is non- risk in natures as they are generated from administrative and general housekeeping, the remaining 10-25% of waste is regarded as 'hazardous' and may create variety of health risks due to their infectious nature [2]. It has been observed that people dealing with biomedical wastes are often themselves subjected to infectious diseases like HIV, Hepatitis and tetanus. To prevent such adverse health effects on personals handling biomedical wastes and for general health and safety of the population The Ministry of Environment And Forest (MOEF) has notified biomedical waste (management and handling) rules in 1998 that issues guidelines to all hospitals, clinics, nursing homes and laboratories to ensure safe and environmentally sound management of waste produced by them [3].

In general, biomedical wastes are generated during diagnosis, treatment or immunization of human being or animals. It was expected that with tremendous advancement in global health care facilities adequate attention will be given to the disposal and management of biomedical wastes however the ground reality suggests that often the healthcare facility themselves have posed a huge health risk due to poor waste management by professionals and have become a huge threat to environment. This has been acknowledged globally and different countries have ensured legislations for proper biomedical waste management. The purview of these regulations caters to both the public and the private healthcare facilities [4]. Improper biomedical waste practices lead to microbial ecology change and spread of antibiotic resistance hence the most suitable method for disposal involves prevention or minimization of toxic substances from hospital to environment.

In the above context, the study has been carried out in Shimla city the capital of the state Himachal Pradesh. Shimla is located at 31°6'12" north latitude and 77°10'20" east longitude. The city is 2,206 m above the MSL covering an area of 9.2 km east-west direction. The population of the city according to the 2011 census was found to be 1, 71,817. Fig. 1 shows the details of the Shimla city.

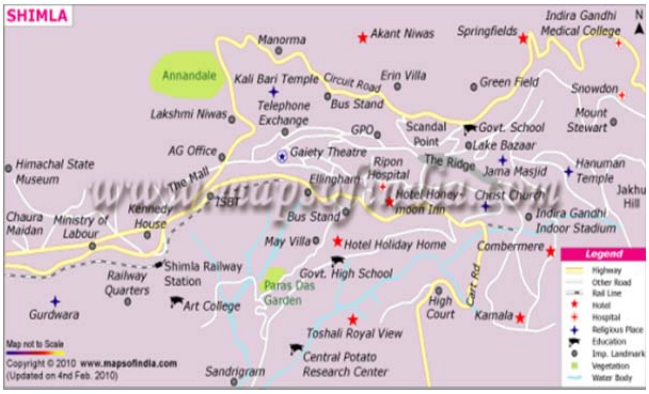

Fig. 1: A map of Shimla city (www.mapsofindia.com)

The aim of the study to be conducted is to study, evaluate and compare the waste management steps, waste handling procedures and treatment methods being undertaken by the major the Public and Private sector hospitals in Shimla City to prevent the spread of infections and other diseases due to improper disposal of hospital waste.

2. MANAGEMENT OF BIOMEDICAL WASTE

The importance of biomedical waste management first emerged in USA and its laws came into force from 1988 [5]. This led to pressure on GOI to enact its own appropriate laws in India against disposal practices of biomedical waste. Hence, The MOEF of GOI created Biomedical Waste (Management and Handling) rules which came in effect on 20 July 1998. These rules have six schedules as briefed in Table 1.

Under Schedule 1, the biomedical waste has been classified into ten categories as displayed in Table 2 with treatment and disposal options for each category respectively prescribed in Schedule 5 [6].

The schedule 2 describes the color-coding scheme and types of containers to be used for collection and storage of biomedical waste. This is shown in Table 3.

Schedule 3 and 4, describes that containers should be appropriately labeled with biohazard or cytotoxic symbols to avoid any risk and ambiguity. In case of transportation of waste to offsite locations, appropriate measures should be taken to make containers leak proof to avoid any spillage.

Schedule 6 makes it mandatory for all the hospitals, polyclinics, nursing homes and veterinary institutes, animal house and slaughterhouse to install appropriate waste management facilities in the premises.

Table 1: Schedule of Biomedical Waste (Gazette of India, 1998)

Schedule 1	Classification of Biomedical waste into different categories.
Schedule 2	Color-coding and type of containers to be used for each category of Biomedical Waste.
Schedule 3	Performa of label to be used on container/bag.
Schedule 4	Performa of label for transport of waste container or bag.
Schedule 5	Standards for treatment and disposal of waste.
Schedule 6	Deadlines for creation of waste treatment facility.

Table 2: Categories of Biomedical waste and methods of their treatment and disposal (Gazette of India, 1998).

Category No.	Type of Waste	Treatment and Disposal
1.	*Human anatomical Waste*: human tissues, organs, body parts.	Incineration[1]/ deep burial
2.	*Animal Waste*: animal tissues, organs, body parts, carcasses, fluid, blood; experimental animals used in research, waste generated by veterinary polyclinics.	Incineration[1]/deep burial
3	*Microbiology and Biotechnology waste:* waste from laboratory, cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell culture used in research , infectious agents from research and industrial laboratories, waste from production of biological, toxins, dishes, and devices used to transfer cultures.	Autoclave/microwave/incineration[1]
4	*Waste sharps:* needles, sharps, scalpel, blades, syringes, glass etc capable of causing puncture and cuts; this contains both used and unused sharps.	Disinfection(chemical treatment)[c],/autoclaving/microwaving and mutilation/shredding
5	*Discarded medicines and cytotoxic drugs:* waste comprising outdated contaminated and discarded drugs and medicines.	Incineration/destruction and drugs disposal in secured landfill
6	*Contaminated solid waste:* items contaminated with blood fluids including cotton dressing, soiled plaster casts, linens ,beddings	Incineration[a]/autoclaving/microwaving
7	*Solid waste:* Disposable items other than waste sharps such as tubings, catheters etc.	Disinfection by chemical treatment [c] autoclaving/microwaving and mutilation/shredding[b]
8	*Liquid waste:* waste generated from laboratories, washing, cleaning, housekeeping and disinfection activities	Disinfection by chemical treatment[c] and discharge into drains
9	*Incineration ash:* ash from incineration of any medical waste	Disposal in municipal landfill
10	*Chemical waste:* chemicals used in production of biological, disinfection etc.	Chemical treatment[c] and discharge into drains for liquid and secured landfill for solids

Table 3: Color-coding and type of container for biomedical waste disposal (Gazette of India, 1998).

Color Coding	Type of container and waste category
Yellow	Plastic bag Cat1, Cat. 2, Cat. 3, Cat. 6
Red	Disinfected container/plastic bag Cat. 3, Cat 6, Cat. 7.
Blue/white	Plastic bag/ puncture proof Cat. 4, Cat. 7 container
Black	Plastic bag Cat. 5, Cat. 9, Cat. 10 (solid)

Before the enactment of legislation for proper handling of biomedical waste it was responsibility of the local municipal or state government authority to handle these types of waste

properly and effectively but now it has become essential for all health care establishments to manage their waste according to the rules imposed by GOI [7].

Incineration is the most common method used for biomedical waste management and is most suitable for combustible materials but some wastes cannot be disposed by incineration like body parts and urine bags thus needing other methods for the treatment and incineration. Waste volume is reduced by 10 % of original and also the waste gets decontaminated in incineration process [8] but ultimately it is the responsibility of the waste generator to take measures to dispose waste safely so that there is no adverse effect on environment and health of the surrounding population. Under legislative actions it is mandatory for installation of an incinerator for those hospitals and healthcare systems with more than 50 beds under section 15(1) of the Environmental (Protection) Act 1996. Failure to abide by these laws is punishable by "imprisonment for term extending up to 5 years or 1,00,000 Rupees cash , or both and an additional fine may be imposed which could be extended up to 5000 Rupees per day if there is delay or continuance of the negligence after conviction for first such failure or contravention [9].

3. METHODOLOGY

The study was conducted in major public and private healthcare units of Shimla. The public hospital is a well renowned hospital in the city having a bed capacity of 800 with a high volume of patients visiting the hospital (750 patients/day) due its renowned name and its highly specialized treatment. The private hospital selected for the study is also well renowned based on American Principles working on n no profit no loss basis. The total bed strength in this hospital is about 90 but due to its location far off from the main city centre of Shimla the hospital is less visited with the number of inpatients is low.

The names of the hospitals are not disclosed due to the administrative reasons. The data from the different units was collected based on the interactive interview sessions with the person in charge, survey of the hospital units, field visits and the crucial site observations.

4. HOSPITAL SURVEY AND ANALYSIS

The hospital survey involves critically examining the quantification of waste, segregation, collection, transportation, final treatment and disposal of the waste including assessing the occupational safety of the person in charge, the degree of intensity with which the various guidelines are being followed in the institutions and the rules and regulations being imposed by the administrative staff for maintaining a healthy and safe environment around. The survey would also focus upon the potential problems faced by the workers and the staff due to disposal and the disposal sites. To assess this, a questionnaire analysis was developed and a survey was conducted in both these hospitals

5. QUESTIONNAIRE SESSION

A questionnaire session framed with the purpose of obtaining knowledge about the present waste generation and management strategy being followed in the hospitals and determining the various factors which restrict the proper management and disposal of waste being generated in various units at the hospital. The prepared questionnaire is as follows:

1. What is the procedure which is being applied for the waste handling and collection of waste in the various units in the hospitals?
2. What happens to the various categories of the waste such as sharps, anatomical waste, pathological waste and infectious waste etc?
3. Are different kinds of waste collected differently?
4. What are the various kinds of containers or bags which are used for the different categories of wastes?
5. Is there any segregation procedure at the point of generation of waste or before disposal?
6. Where is the main area of storage of waste before disposal?
7. Is the collected waste stored differently and out of the hospital campus?
8. Is the designated place of storage of waste a restricted site?
9. Are proper coats and protective gears such as masks, gloves and boots being used by the workers collecting, segregating, storing and disposing wastes?
10. Are the workers designated for handling the waste restricted to only waste handling purpose or being employed for other patient care works?
11. Do you have a waste management strategy or team monitoring and supervising waste management plans being followed?
12. Are any personnel training or instructions being given to the workers handling waste or personnel monitoring and supervising the waste management practices?
13. Are there any rules and regulations being followed in the hospital in accordance with the guidelines issued under biomedical waste (management and handling) rules issued by the government?

6. MANAGEMENT AND IMPLEMENTATION IN PUBLIC AND PRIVATE SECTOR HOSPITALS

The public sector hospital is a multistoried building with 33 departments. The biomedical waste management in the hospital premises is looked after by a team of 3 main doctors, a nurse in charge of infectious waste along with other workers

for waste collection and disposal. The main method of treatment followed at the hospital is allopathic. The annual statistics for the present year shows the total number of patients admitted were 31,872 of which 31,771 patients were discharged. The total no. of patient treatment days observed were 2, 44,503. The average length of stay for patient was reported to be 8 days. The maximum amount of infectious and non- infectious waste generated is in the cardio- thoracic vascular surgery, O.T. and I.C.U. department which is about 46.42 kg of waste/day followed by causality & O.P.D. department which ranges from about 35.35 kg/day and minor O.T. about 16.65 kg/day per day. The used syringes are disinfected with chlorine solution before treatment. The instruments used for the diagnosis are reused after sterilization. The average inpatients are 669 with average bed occupancy of 84.

The private sector hospital is a 6 storied building with 8 departments comprising of department of surgery, medicine, ayurveda, radio diagnosis and imaging, pediatrics, and adolescent medicine, gynecology and maternity, orthopedic surgery, dentistry and oral health, and physiotherapy. The biomedical waste management is managed by team of 2 main members one a head of the nurses training department and administrative head along with other workers to collect and dispose the waste from hospital wards. The hospital premises is though a small area but the hospital wards are well equipped with attached washrooms and intercom facilities in general wards and ventilators, defibrillators, piped oxygen, central suction and compressed air in the intensive care units. The hospital is looked after by 19 doctors and is open for 24 hours with assigned house physician on duty round the clock. The maximum amount of waste is generated in the female ward which is about 1.261 kg per day followed by X- ray and microbiology/ biotechnology department which is about 0.691 and 0.662 kg per day respectively. The used syringes are disinfected with chlorine solution before treatment and instruments reused after disinfection and sterilization.

7. SCOPE OF FUTURE WORK

The scope of future work involves further surveys and visits to these hospitals to determine the processes of collection, segregation, transportation and disposal of biomedical wastes. Statistical Analysis of the questionnaire data will be carried out to understand the importance of the responses. A digester design based on the data obtained for the above hospitals will also be designed.

8. CONCLUSIONS

The present study aims to analyze the procedures of biomedical waste management in Shimla city. In this context, two important hospitals (public and private) are selected and a methodology has been developed to analyze the efficiency of the biomedical waste management processes followed by these hospitals. One of the important aspects of this methodology is the framing of the appropriate questionnaires to understand the study of the system. The present paper presents the details of the questionnaire followed for its proper assessment.

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