

BIOMEDICAL SOLID WASTE MANAGEMENT PRACTICES IN MAJOR PUBLIC HOSPITALS OF SHIMLA CITYSaurabh Kumar¹, Salig Ram Mazta², Anmol K. Gupta³**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: BACKGROUND: The actual biomedical waste management situation in the democratic developing country like India is grim. Even though there are Rules stipulating the method of safe disposal of Bio-medical Waste (BMW), hospital waste generated by Government Hospitals is still largely being dumped in the open, waiting to be collected along with general waste. **OBJECTIVES:** To assess the waste handling and treatment system of hospital bio-medical solid waste **METHODOLOGY:** A Cross sectional study was conducted in the major public hospitals of Shimla city. The study comprised of cross sectional survey of the personnel handling and monitoring the biomedical waste and observational survey of the hospitals using INCLIN (International Clinical Epidemiology Network) data collection tools. **RESULTS:** The results were described under quantification of waste, segregation and collection, transport, storage, offsite transport, final treatment and disposal, occupational safety. The mean hazardous biomedical waste generated by the major public hospitals was found to be 191.5 g/bed/day (SD 93.83). In 91(86.1%) of the patient care areas of the hospitals segregation of the wastes was not observed. None of the patient care areas had designated waste route inside the hospital. All the hospitals except one public hospital had central waste storage facility. Only two of the hospitals (public hospitals) had a central storage cum treatment facility. None of the cleaning workers were using complete personal protective measures in any of the public hospitals. **CONCLUSION:** All major public hospitals of Shimla city in the study area practice poor management of biomedical wastes. The practices for segregation, transportation, storage and treatment and disposal of wastes generated at the major hospitals need change and major improvements.

KEYWORDS: public hospitals, biomedical, waste, practices.

INTRODUCTION: In pursuing their aims of reducing health problems and eliminating potential risks to people's health, health care services inevitably create waste a part of which may itself be hazardous to health.¹⁻⁵ The waste produced in the course of health care activities which usually includes sharps, human tissues or body parts and other infectious materials,⁶ also referred to as "Hospital Solid Waste" and "Bio-medical Solid Waste,"⁷⁻⁹ carries a higher potential for infection and injury than any other type of waste.

Wherever biomedical solid waste is generated, safe and reliable methods for its handling are therefore essential and hence due emphasis has been placed on segregation, safe collection, storage and treatment and final disposal at site to minimize if not eliminate the health hazard. The major identified hazard is that of infection especially to the waste handlers, cleaning workers, and ragpickers etc. who are usually less educated and rely on recyclable waste for their bread and butter. The fear of Hepatitis B and HIV infection in the community, and among health care providers has led to an increasing awareness about the risks associated with this lackadaisical practice and the need to

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evolve and implement strategies for safe and sustainable methods of disposal of waste material generated at different sites in health care delivery system. Sound management of biomedical waste is thus a crucial component of environment health protection.

According to World Health Organization (Biomedical Wastes, 2004)¹⁰ the human element is more important than the technology alone. Almost any system of treatment and disposal that is operated by well trained and well-motivated staff can provide more protection for staff, patients and the community than an expensive or sophisticated system that is managed by staff who do not understand the risks and the importance of their contributions.

There are about 1.6 million health care workers at approximately 27, 500 health care facilities in India.¹¹ Looking into the existing scenario of biomedical waste management in the country and the fact that such a comprehensive study had not been done in Himachal Pradesh; it was thought to undertake a study to: (i) assess the human factor in handling and treatment of clinical waste, i.e., to study the existing modus operandi and its compliance with the Standard Procedures of the Biomedical Waste Management Rules as per EPA¹² 1986 and (ii) quantitatively determine the amount of non-infectious and infectious waste in major public hospitals in Shimla City.

METHODOLOGY: The study was conducted in the major public hospitals of Shimla city. Shimla, the capital city of Himachal Pradesh, is located in the north-western ranges of the Himalayas at a latitude 31°06'12"N and longitude 77°09'57.6"E. There were four major public hospitals i.e. hospitals with more than 15 beds as per our inclusion criteria.

The study comprised of cross sectional survey of the personnel handling and monitoring the biomedical waste and observational survey of the hospitals:

The study was conducted through October 2009 to September 2010.

The data so collected was entered and analyzed using SPSS 14 evaluation version.

The results were expressed in percentages. The mean amount of waste generated in the various hospitals was calculated with standard deviation under 95% confidence intervals.

The results were described under quantification of waste, segregation and collection, transport, storage, offsite transport, final treatment and disposal, occupational safety and problematic issues of the subjects.

The study did not involve any experimental diagnostic tests or administration of medicines to participants. Written informed consent of all participants was obtained before gathering any information.

RESULTS: During the study 4 Hospital Superintendents/Hospital administrators, 52 nursing staff (Ward Sister/nursing in Charge), 13 lab technicians, 102 cleaning workers, respectively were interviewed regarding the biomedical waste management practices being followed in their respective hospitals. The overall in charge of biomedical waste management in the hospitals was with the Hospital Superintendents/Hospital administrators.

In addition to above personnel, technology operators of two hospitals and the regional incinerator plant (run by Municipal Corporation) and off site transport workers involved in transporting the waste from various hospitals to the regional incinerator plant located near IGMC, Shimla were also interviewed.

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Segregation and Collection: Labeling of the waste bags with the site of generation was not done in any of the hospital areas observed in the govt. hospitals; though the 80% chief lab technicians and 75.6% of ward sisters mentioned that biomedical practices were followed strictly.

On inspection it was observed that only 4.45% of the patient care areas segregation was done correctly as per CPCB guidelines. 82.4% of the patient care areas had waste bags with biohazard symbol and 71.43% of the patient care areas mixed waste was observed in the red bags. It was also observed that in only 48.4% of the patient care areas waste bags were located at the site of generation.

As per the interview of the ward sisters/nursing in charge 1 patient care yellow bags were not there and 9 patient care areas red bags were not available. In more than 90% of the patient care areas supervised by Nursing in charge/ward sisters, yellow, red and black waste bags were replaced correctly while blue waste bags were replaced correctly in 27(62.8%) of the supervised patient care areas.

Sharps Management: As per the interview of ward sisters 59.1% said that sharps were destructed individually and 88.6% of the ward sisters said that disinfectants (bleaching powder solutions) are not replaced once in each shift. On the other had 66.7% of the chief lab technicians mentioned that sharps are destructed individually and the disinfectants are replace once in each shift.

As per the observation survey 72.5% of the patient care areas had functional needle destroyer easily available and 69.2% of the patient care areas were destroying the needles after every injection.

On Site Transport: It was found in the interviews of cleaning workers that they used to close the waste bags by tying the knot and then carry to the central waste storage facility in hands.

Biomedical waste was being removed from the patient care areas for storage/treatment and final disposal in more than once a week and the remaining hospitals were removing it as and when sufficient quantity of biomedical waste accumulated.

A dedicated waste route designated to avoid the passage of wastes through patient care areas was only in one of the major public hospitals.

No trolleys were seen in any of the public sector major hospitals of Shimla city as per the observation proforma. Only in 9(9.9%) of the patient care areas, the time of removal of infectious and noninfectious waste was different.

Storage: Out of all the hospitals, one did not have any central storage area facility. Proper log book was not maintained for receipt and register of the biomedical waste at any of the hospital although a designated person was there for the storage area. It was observed that the waste bags were not labeled with the site of generation and were stored together. Functional facility to weigh the waste was there in 4(57.2%) of the hospitals with the three public hospitals having it. The state of cleanliness in the central storage facilities in all the public hospitals was poor.

Offsite Transport: Biomedical wastes of all the hospitals under study were transported by municipality. Govt. agency used open vehicles for collecting and transporting the biomedical waste from the different hospitals to the regional incinerator plant. There was no dedicated route for the transport of waste to avoid the passage through public areas. None of the vehicles had separate compartments for transporting different type of wastes.

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Treatment and Final Disposal: Only two of the hospitals (public hospitals) had a central storage cum treatment facility. Autoclave and shredder were available in both the settings. Only the plastic waste was treated with the machine i.e. autoclaved and shredded and then it was being sold to a contractor for recycling measure. One of the hospitals was operating the machine twice weekly and the other hospital was operating the machine on a daily basis for nearly 5 hours.

There were no reports of scavenging from any of the two central storage cum treatment facilities.

Regional Incinerator Plant: The technology operator revealed that mixed waste was received from the transporting agencies. The wastes were incinerated in the two incinerators provided. Only one was used at a time. The capacity of the two incinerators being 100kg/hour and 70kg/hour. Both the incinerators were double chamber pyrolytic incinerator.

Occupational Safety: There were no cases of injuries related to health care waste in last 6 months as per the interviews of the hospital superintendents. Two of the public sector hospitals had provided their waste handling staff with only masks and gloves. And one of the public sector hospitals had provided their waste handling staff with masks, gloves and boots.

Quantification: The mean hazardous biomedical waste generated by the public hospitals was calculated to be 191.5 g/bed/day (SD 93.83).

DISCUSSION:

Segregation and Collection: Segregation at source is the key to whole hospital waste management process, because at this stage wastes are segregated into different streams; incorrect classification at this stage can lead to many problems at a later stage. Difference was observed in the interview schedule results and the results of the observational survey regarding various components of segregation and collection except for labeling and signing on the waste bags. This clearly indicated the lack of attitude on the part of the nursing staff in charge and chief lab technicians in managing the segregation and collection in their respective supervised patient care areas.

Observational survey revealed that in majority of the patient care areas waste segregation was not done at the site of generation and even the guidelines were not followed in most of the patient care areas. Similar results were seen by Askarian M et al (2004),¹³ Pandit NB et al (2005),¹⁴ Gupta S et al (2006),¹⁵ Tsakona M et al(2006),¹⁶ Pandit NA et al (2007),¹⁷ Bdour et al (2007),¹⁸ Abor PA et al.¹⁹

Sharps Management: Encouraging results were seen in the sharps management in the present study as the sharps (needles) were being destroyed individually in large number of the patient care areas.

This situation was bit better in the laboratories compared to the other patient care areas as laboratories in the public sector set up used to work for 8 hours only in the day for routine sample collection.

On Site Transport: There were contrasting results obtained from the interviews of the hospital superintendents and the observational survey with the latter depicting that none of the hospitals had

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designated waste route for the transportation of biomedical waste. Even the time of removal of infectious waste from non-infectious waste was not different in majority of the patient care areas.

In the present study it was revealed that all the cleaning workers used to tie the knot in the waste bags and then carried the waste bags/containers in hands to the site of the storage. This practice exposed visitors and patients to possible contamination. Contrary to the findings of our present study, it was observed by Bdour et al (2007),¹⁸ Soliman SM et al,²⁰ Tsakona M et al (2007)¹⁶ and Abdulla F et al (2008)²¹ at least trolleys or carts were used for transporting biomedical waste to the storage facility.

Storage: The characteristics of storage locations have a direct impact on the environment and potential health risks at the hospital. Evidently, they must be well disinfected and secured so that only authorized personnel can have access to them.^{22,23}

It was found in the present study that all the hospitals except one public hospital had central waste storage facility. Storage areas were secured by lock and key. Proper log book was not maintained for receipt and register of the biomedical waste at any of the hospital although a designated person was there for the storage area. This was in concordance to the findings of El Salam MMA (2010)²⁴ and Tsakona M et al (2007)¹⁶ who found that all the central storage chambers had a limited access to only the personnel responsible of waste handling.

Functional facility to weigh the waste was there in three of the four public sector hospitals. The state of cleanliness in the central storage facilities in all the public hospitals was poor. El Salam MMA (2010)²⁴ observed a similar finding. Rouyan G et al (2010)²⁵ echoed the same sentiment as it was found that storage areas were not sufficiently cleaned after the medical wastes were transported to the disposal facilities. Bdour et al (2007)¹⁸ also observed the similar finding in Irbid city Jordan.

Off Site Transport: The Govt. agency transporting the waste used open vehicles for collecting and transporting biomedical waste. There was no dedicated route for the transport of waste to avoid the passage through public areas, thereby exposing the general public to biomedical waste. None of the vehicles had separate compartments for transporting different types of wastes. The Govt. agency did not have any log book whereas the other agency just used to mention the total amount of waste received. Similar findings were seen in the study Abdulla F et al (2008)²¹ in Northern Jordan where it was found that transportation of medical wastes was undertaken in vehicles that did not meet the regulatory requirements for safety. Yong Z et al (2009)²⁶ also observed similar problems in the off-site transport stage of biomedical waste.

Treatment and Final Disposal: Mixed waste was being treated incinerated daily and hence putting at risk the lives of not just the technology operators but also the people living in the vicinity. Similar results were seen by Tsakona M et al (2007)¹⁶ and Bendjoudi Z et al (2009)²⁷ as large amount of municipal wastes and liquids were incinerated with the infectious waste.

Occupational Safety: Poor occupational safety standards were observed in all the major public hospitals especially in cleaning workers. The reason may be their low educational status, contractual nature of the job and frequent replacements. Similar results were seen by Da Silva et al (2004)²⁸ and Tsakona M et al (2007).¹⁶ Inspire of this immunization status in particular for hepatitis B was very low amongst them and a similar finding was seen amongst the chief lab technicians and ward sisters/nursing in charge. Mbongwe et al (2007)²⁹ also observed a similar finding in Botswana where

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there were no effective occupational health programmes in place i.e. regular immunization, post exposure prophylactic treatment and medical surveillance.

Quantification: The findings of mean hazardous biomedical waste generated by the public hospitals in our study was found to be similar to the study of rural and urban areas of U.T. Chandigarh, where the rate of generation of biomedical waste varied from .06kg/bed/day to 0.25 kg/bed/day.³⁰ Jang YC et al (2006)³¹ also found similar biomedical waste generation rates in Daejeon, South Korea.

CONCLUSION: In view of the above mentioned results, it is absolutely clear that the current practices for segregation, transportation, storage and treatment and disposal of wastes generated at the major hospitals needs change and major improvements. All major public hospitals of Shimla city in the study area practice poor management of biomedical wastes.

Typically, handling of these wastes was assigned to cleaning workers who performed all activities without proper training or guidance, and with insufficient personal protective measures. However, there were significantly higher number of needle/sharp induce injuries in cleaning workers of public hospitals. Poor segregation and classification procedures of the generated wastes were observed at all of the surveyed hospitals.

The infectious biomedical waste was still being dumped and mixed with the domestic waste. Collection, internal transportation and storage facilities in the hospitals failed to meet the Bio-medical waste (Management and Handling) rules 1998. Onsite treatment facilities (autoclave and shredder) were available in only two of the hospitals which were operated by contractual staff having incomplete personal protective measures.

Vehicles used for off-site transportation of biomedical waste failed to meet the guidelines. There was a need for upgrading the personal protective measures of offsite transport workers. The most frequently used treatment for solid biomedical waste was incineration.

RECOMMENDATIONS: There is the need for proper segregation of biomedical waste. The provision of plastic bags and strong containers for infectious waste such as empty containers of antiseptics used in the hospital is necessary. Bags and containers for infectious waste should be marked with the Biohazard symbol. Imposition of segregation practices within the hospital will result in a clean waste stream which can be easily, safely and cost-effectively managed.

The hospital should institute an efficient Sharps Management System, including proper equipment and containers at all sharps generating points, a secure accounting and collection system for transporting the contaminated sharps for treatment and final disposal and the proper training of hospital staff on the handling and management of sharps. Proper training is necessary to develop awareness of health, safety and environment issues.

It is important for workers to know and understand the potential risks associated with healthcare waste. Biomedical waste should be transported in suitable dedicated wheeled leak-proof containers. They should be clearly marked and regularly cleaned. Municipal corporation and Pollution control board should ensure strict implementation of Bio-medical waste management and handling rules 1998.

REFERENCES:

1. Pruss A, Giroult E, Rushbrook P. Safe management of wastes from health care activities. World health organization 1999 Geneva.

ORIGINAL ARTICLE

2. Mato RRAM, Kaseva ME. Critical review of industrial and medical waste practices in Dar es Salaam City. *Resources, Conservation and Recycling* 1999; 25: 271–87.
3. Mohee R. Medical wastes characterization in healthcare institutions in Mauritius. *Waste Management* 2005; 25: 575–581.
4. Abdulla F, Qdais HA, Rabi A. Site investigation on medical waste management practices in northern Jordan. *Waste Management* 2008; 28: 450–458.
5. Taghipour H, Mosaferi M. Characterization of medical waste from hospital in Tabriz, Iran. *Science of the Total Environment* 2009; 407:1527–1535.
6. Manohar D, Reddy PR, Kotaih B. Characterization of solid waste of a super specialty hospital- a case study. *Ind. J. Environ. Health* 1998; 40: 319-326.
7. Baveja G, Muralidhar S, Aggarwal P. Hospital Waste Management- an overview. *Hospital Today* 2000; 5: 485-486.
8. Al-Mutair N, Terro M, Al-Khaleefi AL. Effect of recycling hospital ash on the compression properties of concrete: statistical assessment and predicating model, *Building Environment* 2004; 39: 557–566.
9. World Health Organization (WHO). Starting health care waste management in medical institutions. *Health Care Waste practical information series 1*, 2000.
10. Shah S, Mehta M, Mukherjee MD. Occupational Health Hazards encountered at health care facility and medical college in India, American Industrial Hygiene Association. Available from: URL:<http://www.aiha.rrg/abs01/01hea.html>. Accessed June 26, 2009.
11. Joseph J, Krishnan A. Hospital waste management in the union territory of Pondicherry-An exploration. Available from: URL: <http://www.pon.nic.in/citizen/science/ppcc-new/joe.pdf>. Accessed June 26, 2009.
12. Environment protection act 1986. Available from: URL: <http://www.envfor.nic.in/legis/env/env1.html>.
13. Askarian M, Vakili M, Kabir G. Results of a hospital waste survey in private hospitals in Fars province, Iran. *Waste Management* 2004; 24: 347-352.
14. Pandit NB, Mehta HK, Kartha GP, Choudhary SK. Management of biomedical waste: awareness and practices in a district of Gujarat. *Indian Journal of Public Health* 2005; 49: 245-247.
15. Gupta S, Boojh R, Mishra A, Chandra H. Rules and management of biomedical waste at Vivekananda Polyclinic: A case study. *Waste management* 2009; 29: 812-819.
16. Tsakona M, Anagnostopoulou E, Gidakos E. Hospital waste management and toxicity evaluation: A case study. *Waste management* 2007; 27: 912-920.
17. Pandit NA, Tabish SA, Qadri GJ, Mustafa A. Biomedical waste management in a large teaching hospital. *JK Practitioner* 2007; 14: 57-59.
18. Bdour A, Altrabsheh B, Hadadin N, Al-Shareif M. Assessment of medical waste management practice: A case study of northern part of Jordan. *Waste management* 2007; 27: 746-759.
19. Abor PA, Bouwer A. Medical waste management practices in a Southern African Hospital. *International Journal of Health Care Quality Assurance* 2008; 21: 356-364.
20. Soliman SM, Ahmed AI. Overview of biomedical waste management in selected Governorates in Egypt: A pilot study. *Waste management* 2007; 27: 1920-1923.
21. Abdulla F, Qdais HA, Rabi A. Site investigation on medical waste management practices in Northern Jordan. *Waste management* 2008; 28: 450-458.

ORIGINAL ARTICLE

22. Marinković N, Vitale K, Holcer NJ, Džakula A, Pavić T. Management of hazardous medical waste in Croatia. *Waste Management* 2008; 28: 1049–56.
23. Cheng YW, Sung FC, Yang Y, Lo YH, Chung YT, Li K-C. Medical waste production at hospitals and associated factors. *Waste Management* 2009; 29: 440–4.
24. El-Salam MMA. Hospital waste management in El- Beheira Governorate, Egypt. *Journal of Environmental Management* 2010; 91: 618-629.
25. Ruoyan G, Lingzhong X, Huijuan L, Chengchao Z, Jiangjiang H, Yoshihisa S et al. Investigation of health care waste management in Binzhou District, China. *Waste management* 2010; 30: 264-250.
26. Yong Z, Xiao G, Guanxing W, Tao Z, Dawei J. Medical waste management in China: A case study of Nanjing. *Waste management* 2009; 28: 1376-1382.
27. Bendjoudi Z, Taleb F, Abdelmalek F, Addou A. Healthcare waste management in Algeria and Mostaganem department. *Waste management* 2009; 29: 1383-1387.
28. DaSilva CE, Hoppe AE, Ravanello MM, Mello N. Medical wastes management in the South of Brazil. *Waste management* 2005; 25: 600-605.
29. M bongwe B, Mmereki BT, Magashula A. Healthcare waste management: Current practices in selected healthcare facilities, Botswana. *Waste management* 2008; 28: 226-233.
30. Singh K, Arora SK, Dhadwal PJS, Singla A, John S. Biomedical waste management in the Union territory of Chandigarh. *Journal of Environmental Science and Engineering* 2004; 46: 55-60.
31. Jang YC, Lee C, Yoon OS, Kim H. Medical waste management in Korea. *Journal of Environmental Management* 2006; 80: 107-115.

		(I/c Patients Care areas) (n=45) Ward Sisters	(I/c Labs) Lab technicians	Cleaning workers
Tetanus toxoid	Immunized	22(48.9%)	8(80%)	61(64.9%)
	Not immunized	23(51.1%)	2(20%)	33(35.1%)
Hepatitis B	Immunized	10(22.2%)	2(20%)	12(12.8%)
	Not immunized	35(77.8%)	8(80%)	82(87.2%)
Injuries	Yes	9(20%)	2(20%)	45(47.9%)
	No	36(80%)	8(80%)	49(52.1%)
Infectious material	Yes	0	0	14(14.9%)
	No	45(100%)	10(100%)	80(85.1%)
Reporting to seniors	Yes	4(8.9%)	1(10%)	-
	No	5(11.1%)	1(10%)	-
	NA	36(80%)	8(80%)	-

Table 1: Occupational safety aspects of Ward Sisters, Chief Lab technicians and cleaning workers

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Fig. 1: Showing Onsite Transport by a cleaning worker



Fig. 2: Showing Central waste storage facility of one of the hospitals



Fig. 3: Non-segregated waste lying outside the central storage facility



Fig. 4: Showing an Open type Off site transport vehicle of Govt Agency

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