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**Influence of Hospital Set-Up in Biomedical Waste Management: A Cross-
sectional Survey in Four Hospitals of West Delhi**

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Abstract

Objectives: To regulate the biomedical waste management and control the spread of infections through this, every country has framed rules and policies and to assess the implementation of these regulations in various hospitals, a cross-sectional survey was developed. Through this survey, the influence of hospital set-up was assessed in terms of managing the biomedical waste.

Methodology: A cross-sectional survey based on the WHO guidelines 2014 was developed and used to assess the ways of biomedical waste management among the four hospitals of West Delhi. These four hospitals were selected according to the hospital set-ups.

Results: Among the selected four hospitals, three were private [one large super specialty tertiary care hospital (A1), one medium sized multispecialty hospital (A2), and one nursing home (A3)]. The fourth hospital was a large sized multispecialty public hospital (B1). Training about the biomedical waste management rules and regulations was regular in hospital A1, hospital A2, and hospital B1, however, the trainings were totally neglected in hospital A3. Personal protective equipment are being used regularly in hospital A1, while in hospital A2 only gloves are in use. No use of personal protective equipment was observed in hospital A3. In hospital B1, only gloves and apron are used as part of personal protective equipment. Hospital A1 was observed to be regular in recording the exact weights of biomedical waste from each department (e.g., ICU, operation theatre, and wards).

Conclusions: The study results indicated that private hospitals have better practices of waste management in comparison to public hospital. Further, among the private hospitals, hospital set-up was the influential factor; the bigger the set-up better is the management.

Keywords: Biomedical waste, management, hospitals, cross-sectional survey, guidelines, rules

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Introduction

With the advancement in science and technology, medical science has reached to a very high level. However, as every medicine has some side effects, these developments in medical science are also associated with some ill effects such as generation of tons of biomedical waste. Types of biomedical waste generated from different health care facilities include infectious waste, pathological waste, radioactive waste, chemical waste, pharmaceutical waste, sharps, genotoxic waste, non-hazardous or general waste (WHO 2014).

Biomedical waste generated from various types of health care facilities, if not disposed in an appropriate manner can pose a huge risk to the environment and the humankind as a whole. Of the total waste generated from healthcare facilities, 85% is non-infectious and only 15% is infectious in nature (Mathur 2012, WHO 2014). However, if this 15% waste is mixed with the rest of the waste or with municipal waste, it can convert the non-infectious waste into infectious waste due to improper disposal (Kela 1998). Further, improper disposal of sharps such as needles can cause injuries to waste handlers and are source of transmitting viral borne diseases such as AIDS, hepatitis B, HCV, etc (Badar 2014). In addition to this, pathogens from pathological samples can also enter the body of waste handlers through the injuries from sharps (WHO 2014). Thus, segregation of waste at the time of its generation is the very important step.

It is not only the segregation of waste is the step which needs to be taken care, but also the collection, transportation, treatment, and final disposal of waste in an appropriate manner is also important and should be done as per the Biomedical Waste Management Rules, 2016 (recently updated) (Biomedical Waste Management Rules, 2016).

Biomedical waste management is not the sole responsibility of a single person on a single day. It is a team work and a continuous process which needs regular trainings and refresher courses (Basarkar 2014). Inappropriate biomedical waste management not only affects the waste handlers but it actually initiates a chain reaction where every member of the food cycle is affected including patients admitted in the hospital, visitors, hospital staff, animals searching for food in municipal waste, groundwater and every person consuming the infected water, flies and mosquitoes sitting on infected waste etc.; in short every member of the society is affected (WHO 2014).

Earlier studies have shown that biomedical waste is managed and disposed in different ways in hospitals of different set-ups (Boss 2013). To assess this difference, the present study was conducted. In this study, private and public sector hospitals were compared for their biomedical waste management practices. Further, the study assessment also focused on comparing the effect of hospital set-up among the private sector hospitals in terms of ways of biomedical waste disposal.

Methodology

This cross sectional descriptive study was conducted in four hospitals that were selected through random sampling from private and public sector hospitals in West Delhi from January 2016 to May 2016. The hospitals were randomly selected according to their set-ups. For assessment of practices of biomedical waste management, questionnaire was developed to evaluate the practices. The questionnaire consisted of questions covering the areas related to hospital set-up, knowledge of hospital administrators about biomedical waste and the associated rules and regulations (9 questions), awareness of the staff about the biomedical

waste (6 questions), practices followed for biomedical waste disposal and training status of the hospital staff (15 questions). This questionnaire was based on the WHO guidelines (WHO 2014).

Results

Among the selected four hospitals, three were private [one large super specialty tertiary care hospital (A1), one medium sized multispecialty hospital (A2), and one nursing home (A3)]. The fourth hospital was a large sized multispecialty public hospital (B1). In A1 hospital, there was a total staff of 1450 members which included 450 members responsible for housekeeping of a 400 bedded hospital. A2 hospital has a bed capacity of 116 and there are about 500 staff members including about 100 hundred housekeeping staff. A3 is a private nursing home of 40 beds with a staff number of 100 including 30 housekeeping members. B1 is a government hospital with a total staff count of 1650 handling about 500 bed load; housekeeping staff is 575.

In terms of the knowledge of hospital administrators about the Biomedical Waste Management Rules, 2016, none of the hospital administrators were aware of the new rules and regulations and they all were following the older version of rules, the Biomedical Waste (Management and Handling) Rules, 2011. A1 hospital has a team of 4 nurses under the category of infection control team responsible for monitoring the implementation of rules and training of the staff. Hospital A2 has only 1 nurse as infection control officer for the same purpose. Hospital A3 was lacking with such type of management and there was a poor awareness about medical waste risk and safe handling procedures among hospital administrator. On the other side, hospital B1 has a team of 12 members. Summary of responses regarding the knowledge of hospital administrators about the biomedical waste and its management is provided in Table 1.

A separate budget head was available in all the hospitals; however the allocated budget is never used in hospital A3. User manual is available only in Hospital A1, while in hospital A2 and B1, only few charts are available as reference to the staff members.

Table 1: Summary of knowledge of hospital administrators

Question	Answer			
	Hospital A1	Hospital A2	Hospital A3	Hospital B1
Knowledge of biomedical waste management rules and regulations,2011	Yes	Yes	Yes	Yes
Knowledge of biomedical waste management rules and regulations, 2016	No	No	No	No
Provide personal protection tools for workers	Yes	Partially	No	Partially
Monitor usage of personal protection tools	Yes	Partially	No	Partially
Train the workers dealing with medical waste	Yes (Monthly)	Yes (Quarterly)	No	Yes (Quarterly)
Medical waste budget available	Yes	Yes	Yes (Not used)	Yes
Department responsible for waste available within hospital management	Yes	Yes	No	Yes
Adequate number of workers collecting waste	Yes	Yes	No	Yes
User manual for collecting the waste available in the hospital	Yes	No	No	No

As with the case of hospital administrators, none of the hospital staff was aware of new version of rules, however they were aware of 2011 rules and regulations. Training and refresher courses were regular in hospital A1, hospital A2, and hospital B1, however, the importance of trainings and refresher courses was totally neglected in hospital A3. In Hospital A1, refresher

courses are very regular and are conducted once in a month with duration of 3 hrs. Training sessions in the hospitals comprised of modules for risk associated with biomedical waste and color coding of different type of bags for different types of waste. Summary of responses from the staff handling the biomedical waste regarding their knowledge on waste management is provided in Table 2.

Table 2: Summary of awareness of staff about biomedical waste

Question	Answer			
	Hospital A1	Hospital A2	Hospital A3	Hospital B1
Heard about the biomedical waste	Yes	Yes	Yes	Yes
Knowledge of biomedical waste management rules and regulations, 2011	Yes	Yes	Yes	Yes
Knowledge of biomedical waste management rules, 2016	No	No	No	No
Received any training on biomedical waste management	Yes	Yes	No	Yes
Knowledge of different color coding	Yes	Yes	No	Yes
Knowledge of risks associated with biomedical waste management	Yes	Yes	No	No

Personal protective equipment are being used while waste segregation, transportation and collection in hospital A1, while in hospital A2 only gloves are in use. No use of personal protective equipment was observed in hospital A3. In hospital B1, only gloves and apron are used as part of personal protective equipment and no use of other equipment was observed. Separate storage area is there in hospitals A1, A2, and B1, while this area was lacking in hospital A3. Separate storage areas are walled and well ventilated rooms in hospital A1 and hospital B1

with appropriate labeling. In hospital A2, tin-walled rooms are there to store the biomedical waste on interim basis. The segregated waste is transported to the storage area about 4 times a day in hospital A1 and B1, 3 times a day in A2.

Segregation of the biomedical waste is done at the source of generation only in hospital A1, while in hospital A2 and B1, the waste is segregated after collecting the waste which increases the chances of contaminating the non-infectious waste and making it infectious in nature. In hospital A3, no segregation is done at all.

In terms of final disposal, all of these hospitals outsourced the final disposal of the waste to a common biomedical waste treatment facility; among the four studied hospitals, the van for waste collection comes once in 24 hr in A1, A2, and B1 hospitals while the collection is infrequent in hospital A3.

Records of any injuries from the biomedical waste is only maintained in hospital A1, while there is no record book of such kind in rest of the hospitals. Practices followed for biomedical waste disposal among the surveyed hospitals are summarized in Table 3.

Records of biomedical waste generated according to the color coding are well maintained in hospital A1, A2, and B1, while the records were missing in hospital A3. Hospital A1 was observed to be more regular in recording the exact weights from each department (e.g., ICU, operation theatre, and wards), while the total waste generated from the hospital irrespective of the departments was observed to be recorded by hospital A2 and B1.

Table 3: Summary of practices followed for biomedical waste disposal

Question	Answer			
	Hospital A1	Hospital A2	Hospital A3	Hospital B1
Personal protective measures are used while handling biomedical waste	Yes	No	No	No
Are medical waste segregated	Yes	Yes	No	Yes
Who segregate medical waste?	Cleaning workers	Medical staff	-	Cleaning workers
Where segregation takes place?	At the beginning near the source	After waste is collected	-	After waste is collected
Are containers identified and distinguished?	Yes	Yes	No	Yes
Are provisional measures carried out to prohibit liquids running out from waste?	Yes	No	No	Yes
Is the help of common treatment plant is being taken?	Yes	Yes	No	Yes
Is there a closed waste storage area in the hospital?	Yes	Yes	No	Yes
Is there a specific mark showing the storage area of medical waste?	Yes	No	No	Yes
Is the storage area inside hospital protected well?	Yes	Yes	No	Yes
What is the storage period in days?	0-1	0-1	>3	0-1
Is waste burn in the hospital?	No	No	Yes	No
Is the containers used to discard needles difficult to open?	Yes	Yes	No	Yes
Are there specific marks indicating waste type?	Yes	Yes	No	Yes
Records of injuries during biomedical waste management	Yes	No	No	No

Discussion

Treatment of a patient generates lots of biomedical waste; the type of waste may vary depending upon the type of disease and treatment of the patient. However, mismanagement of the waste generated after curing one patient may make hundreds of other normal human beings sick. Thus, appropriate management of the biomedical waste is the mandatory step in maintaining the safe food chain. Hospital administrators are responsible for providing the proper resources to the hospital staff to handle the waste and the hospital staff is responsible for safe disposal of waste.

Results of the study indicated that the hospital set-up has a big impact on the biomedical waste management practices and the ways biomedical waste is handled. Overall, the study results indicated that private hospitals have better practices of waste management in comparison to public hospital. However, the results cannot be generalized due to the small sample size.

Further, among the private hospitals, hospital set-up was the influential factor; the bigger the set-up better is the management. Of the three private hospital selected for the study, all has a different set-up and management structure. Hospital A1 is the corporate hospital and has the biggest set-up, hospital A2 is a single owner hospital with a large set-up and has a team employed for managing and monitoring the hospital while hospital A3 is a nursing home with a single owner managing the hospital and has a smallest set-up.

However, the overall conclusion that can be grabbed from this study is that there is an urgent need for raising awareness and education on biomedical waste, the associated risks, and ways of proper handling and management. Appropriate management of the biomedical waste is

need of an hour to ensure the safety of humankind and the environment. In order to bring the transformation in the ways of biomedical waste handling and its management, a system of educating the staff through regular trainings and refresher courses should be introduced and implemented with compulsion in health care facilities. Further, a sense of responsibility should be inculcated in the minds of the staff members involved in handling the waste and they should be motivated to protect their own health, society's health and the environment's health. The safe management of biomedical waste is not the responsibility of a single person but everyone should hold the hands and contribute towards the safe and clean environment.

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