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Biomedical Waste Management at Health Care Facilities in Chikkaballapur District: A Situational Analysis

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Abstract

Background: It has been almost two decades since the implementation of biomedical waste management (BMWM) rules in India, but most Indian hospitals are yet to achieve the desired standards for BMWM practices. Hence, we intended to study the status of BMWM in healthcare facilities(HCFs) of Chikkaballapura district.

Methods: A cross-sectional study was conducted in Chikkaballapura district among all 67 HCFs i.e. 46 HCFs in the private sector and 21 HCFs in the government sector. A pre-tested questionnaire was used to collect information on micro level process of healthcare waste management.

Results: Segregation practices were not followed as per BMWM Rules. In private HCFs, segregation efficiency score was very poor in 23(50%) out of 46 HCFs, poor in 21(45.6%) out of 46 HCFs, and satisfactory in only 3(6.5%) out of 46 HCFs. In government HCFs, segregation efficiency score was very poor in 5(23.8%) out of 21 HCFs, poor in 12(57.1%) out of 21 HCFs, and satisfactory in only 4(19.0%) out of 21 HCFs.

Conclusion: The micro-level BMWM process at the HCF under the private and government sector was found to be very poor especially the segregation practices.

Keywords: Bio-medical waste management, health care facilities, Chikkaballapur, micro-level, segregation process, private, government

Introduction

Catering to the health needs of the increasing population of the country has lead to expansion of the health care sector to a great extent ,both public as well as private health sector. Bio medical waste management (BMWM) includes life cycle i.e. segregation, disinfection before disposal, containment, storage and final disposal of waste. Some of the blood borne infections and pollution of air, water and land is predominantly due to increased quantum of waste generated and also due to mismanagement of BMW . Realizing this, Ministry of Environment & Forests(MoEF), Government of India had notified the Bio- Medical Waste (Management & Handling) Rules

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1998 under the Environment Protection Act 1971, which has been amended and notified in 2016 keeping in view of the fact that there has been unscientific disposal BMW which is a threat to the health as well as the environment and hence its treatment and disposal should be done in a scientific manner[1].

As per WHO report, hospital waste generated is either general waste (80%) or infectious/toxic waste (20%)[2]. The general waste is treated like a municipal waste, whereas the infectious waste requires proper handling so as to avoid any spread of infections.

As per MoEF estimates, almost 4,05,702 kg waste is generated daily, of this 28% is left untreated and this acts as a health hazard by entering the system again[3]. The improper disposal of BMW not only predisposes the hospital staff and patients to risk of infections but also poses a risk to environment. A study by Patel DA et. al., found that the hepatitis outbreak in Gujarat, 2009 was due to poor management of BMW[4].

Situation Analysis is always a first step in identifying the magnitude of problem and existing practices in BMWM. Chikkaballapura is a newly carved out district from Kolar. There haven't been many studies in the district to evaluate BMWM in the HCFs of the region. The study aims at exploring the current situation and micro-level process of BMWM i.e. the amount of waste generated, to assess segregation of waste, containers used for collection, on-site transportation, temporary storage site, disinfection before disposal and final disposal among the HCFs in private sector and government sector.

Material and Methods

A cross sectional study was done to study the micro level situational analysis of BMWM at HCFs in government and private sector in Chikkaballapur district, Karnataka, during the year January - December, 2017 that were registered under the district health office and Karnataka Private medical establishment (KPME) Act 2007 . The study included the HCFs at different level both in the private sector as well as government. Ethical clearance from the institutional review board and permission from the district health office, Chikkaballapur. A written informed consent was taken from the management of all the health care facilities for the study, prior to data collection.

Sample size: Based on the INCLEN program evaluation network[5], the sample size for the study worked out to be 67 HCFs i.e. 46 health care facilities from private sector and 21 health care facilities from government sector with relative precision 15%, confidence level 95% and 10% non response rate.

Sampling method : Probability proportion to size followed by simple random sampling was applied for the selection of HCFs.

A validated questionnaire was used to collect information from the nodal officer of the HCFs regarding general description of the HCF, number of beds, process of BMWM and the quantum of waste generated by the HCF,segregation process, disinfection before disposal, management of sharps, transportation of waste, worker safety, storage of waste, liquid waste management, management of mercury and expired drugs.

The quantum of BMW generated was calculated through receipts received from the CBMWTF of the respective HCFs. The BMWM process was observed at various of sub units of the HCFs i.e. OPD, injection room, labour room, laboratory, ward and operation theatre. Segregation practices were categorized according to the tool used as mentioned. (Table 2)

Management of sharp items: This was studied by looking into how the HCFs were handling them. The current practice were put into following practices either no disinfection but contained in PPC/ Burnt using needle burner /Disfigured using hub cutter / None of the above

If any of the above existed in the HCF, it was considered that sharps were managed appropriately, if none then it was assumed that no sharp management existed in the HCF

Statistical analysis: Descriptive statistics was used to summarize the quantitative variables. Data was classified according to sector wise (Private and Government) and then based on type of HCF(Large, Medium and Small). Frequency and percentages were used for presentation and making comparison of study variables across the sectors. Data was analysed using SPSS version 18 Chicago.

Results

Quantity of waste generated

In private sector, the Quantum of infected waste generated / day was 49.4 kg whereas it was 31.5 kg / day in government HCFs. Quantum of sharp waste generated / day in private HCFs was 57.8 kg and in the government HCFs it was 28.2 kg / day **(Table 1).**

Table 1: Distribution of total quantity of waste generated/kg/day in HCFs*

Type of waste	Quantity of waste (kg)							
	Private (N=45)				Government(N=21)			
	Large	Medium	Small	Total	Large	Medium	Small	Total
Infective waste (yellow)	3	31.2	15.2	49.4	24.5	0.2	6.8	31.5
Plastic waste(Red)	2	43	16.8	61.8	218	0.2	3.4	25.4
Glass(blue)	0.5	11.3	6.5	18.3	10.5	0.1	4.0	14.6
Sharp waste(white)	2.0	39.1	16.7	57.8	19	1.0	8.2	28.2

*Note:

Private sector HCFs

a. Large – hospital, nursing home, maternity home

b. Medium - hospital, nursing home, maternity home

c. Small – physician offices, dental clinics, laboratories, physiotherapy clinics and small hospitals

Government sector HCFs

a. Large – District hospital, Taluk hospital

b. Medium – Community health centres

c. Small – Primary health centres

Table 2: Distribution of segregation efficiecny score among private and governemnt HCFs

Segregation efficiency score *	Type of health care facility (N=68)					
	Private (n=47)			Government(n=21)		
	Large (1)	Medium (18)	Small (27)	Large (6)	Medium (1)	Small (14)
Very Poor (0-25)	0	7(14.9%)	15(31.9%)	1(16.6%)	0	4(28.6%)
Poor (25-50)	0	10(21.3%)	11(40.7%)	4(66.6%)	1	7(50%)
Satisfactory (51-75)	1	1(0.05%)	1(3.7%)	1(16.6%)	0	3(21.4%)
Good (75-100)	0	0	0	0	0	0

***Note:** Segregation efficiency: segregation score obtained/maximum segregation score * 100

A. >75% - Colour coded bins/liners/exclusive bins (with lids) present on observation. Segregation of waste is done as per color code specified in BMW rules. No mix at all in any of the bins – GOOD

B. 51-75% - Segregation practice present and satisfactory-colour coded bins/liners/exclusive bins present on observation. Waste other than the specified category present in one bin [other than yellow (infected waste bin)] – SATISFACTORY

C. 25-5% - Segregation practice present but incomplete- Colour coded bins/liners/exclusive bins present on observation – POOR

D. <25% Segregation practice present but not satisfactory-Colour coded bins/liners/exclusive bins present on observation.Waste other than the specified category present in yellow, red and blue bin. More than one different category present other than prescribed category in yellow, red & blue bin..Waste other than the specified category present in yellow (infected waste) only or/+ red(plastic waste) or blue (glass items)bin – VERY POOR

E. No segregation practices -No exclusive bins for segregation.All waste dumped with no criteria or classification for segregation in only one bin. Complete mix - ABSENT

Table 3: Distribution of spill outside the waste bins in private and government HCF's

Health care facility(N=68)						
Spill outside the waste bin	Private(N=46)			Government (N=21)		
	Large(%)	Medium (%)	Small(%)	Large (%)	Medium (%)	Small(%)
Present	33.3	56.4	28.7	22.2	50	44
Absent	66.7	43.6	71.3	77.8	50	56

Table 4: Distribution of efficiency of waste storage in Private and Government HCFs

Efficiency score (%)*	Type of health care facility (N=68)					
	Private(N=46)			Government (N=21)		
	Large n(%)	Medium n(%)	Small n(%)	Large n(%)	Medium n(%)	Small n(%)
≤25	0	8 (44.4%)	26 (96.3)	2(33.3)	0	12(85.7%)
26-50	1 (100)	5 (27.8)	1(3.7)	1(16.7)	1(100)	2(14.3)
51-75	0	5 (27.8)	0(0)	3(5)	0	0

*Efficiency score expressed as obtained score/Maximum score possible * 100

≤25% - Very poor 26-50% - Poor 51-75% - Satisfactory 75% - Good

Segregation of Biomedical Waste

In the present study, among the 46 HCFs under the private sector, it was found that in the large HCF, the segregation was present and in par with the BMWM rules 2016 i.e. in the labour room, laboratory and operation theatres, whereas out of the 18 medium HCFs, segregation was appropriate in 77.7% of the OTs and out of 27 small HCFs, segregation was appropriate in 92.5% of the labor room.

Among 47 HCFs under private sector, only 1 HCF was found to have satisfactory segregation efficiency score and of the 21 HCFs under government sector, 19% of HCFs was found to have satisfactory segregation efficiency. **(Table 2)**

Spill management

In the present study, among the 46 HCFs under the private sector, it was observed that higher percentages of HCFs under private sectors had spills outside the waste bins i.e. 33.3% of the large HCF, 56.4% medium HCFs and 28.7% small HCFs had spill in the sub units when compared to the 21 HCFs under government sector i.e. 22.2% in large HCF, 50% medium HCFs and 44% in small HCFs combing the score of all sub units in the respective HCFs**. (Table 3)**

In the government sector only one PHC had a proper spill management protocol in place.

Disinfection process

In the present study, among the 46 HCFs under the private sector, it was observed that higher percentages of subunits of HCFs under private sectors and government sectors had not used disinfectant before disposal of waste i.e. between 60% to 85.8%.

Management of sharps

In the present study, among the 46 HCFs under the private sector, it was observed that higher percentages of subunits of HCFs under private sectors had managed sharps appropriately i.e. all large HCF, 82.5% in medium HCFs and 87.1% small HCFs as well as among the sub units under 21 HCFs under government sectors had managed sharps appropriately i.e. 61.2% large HCFs, all sub units under medium HCF and 74.1% of small HCFs.

Transportation of Biomedical Waste

In house, transportation of BMW is as important as segregation at the point of generation. Under the private sector, it was observed that of the 46 HCFs

under the private sector, none of the HCFs had trolley exclusively for transportation of BMW,only 18.3% sealed the waste bag, 67.3% of HCFs was found that waste was segregated properly and 23.9% of HCFs transported sharp waste in a puncture proof container. Similarly, among the HCFs under government sector, none of the HCFs were using wheeled trolleys for in- house transportation of waste, 52.4%. There was mixing up of waste(52.4%), only 28.6% of sharps were transported in puncture proof container and only 14.3% of waste handlers wore personal protective devices.

Storage process of Biomedical Waste

In private sector, among large HCF, despite a designated storage area, it was not for different types of BMW and no water supply whereas in government sector among the large HCFs, despite a designated storage area only 33.3% did not have water supply, 16.6% had no locking facility, 16.7% had separate storage are for different types of BMW and in 50% of HCFs there was mixed up of waste in storage area**.**

Out of 46 HCFs in private sector, only 5(10.8) HCFs had an efficiency score between 51-75 range and of the 21 HCFs in government sector, only 3(21.4) HCFs had efficiency of waste storage score between 51-75 (**Table 4)**

Worker's safety

In our study the large HCF in the private sector, observed deficiency in worker's safety by 60%, 80%, 60% and 80% whereas in government sector, among the large HCFs, worker's safety was found to be deficient in 40%, 43.4%, 73.3% and 43.3% at the Injection rooms, casualty, labour rooms and laboratories respectively.

In private sector, among the medium HCFs, Worker's safety was found deficient in 95.5% of Injection rooms, 78.8% of casualty, 78.8% of labour rooms and 66.6% of laboratories; in contrast, in government sector medium HCF, Worker's safety was found deficient in all Injection rooms, 80% of casualty, all of labour rooms and 80 % of laboratories.

In private sector, among the small HCFs, Worker's safety was found deficient in 46% injection rooms and 28.1% laboratories while in government sector small HCFs, worker's safety was deficient in 95.7% injection rooms and 51.4% labour rooms

Liquid waste management

It was observed that only a few Private and Government HCFs had a mechanism to disinfect liquid waste and would prepare bleach solution every day for disinfection. It was also observed that none of the HCFs had an effluent treatment plant for management of liquid waste.

Discussion

Segregation of BMW at the site of generation is the key to whole hospital waste management process. Poor segregation not only results in risk to staff and public but may also considerably increase handling and disposal cost of hospital waste. Despite amendments in the BMWM rules, there exists inadequate BMWM at different types of HCFs at the country as well as globally.

In this study, majority of HCFs showed segregation efficiency to be within the grade from very poor to poor (less than 50% segregation efficiency score) in both private and government sector. However, similar observations was found in another study done in Punjab by Devi et. al. found that 21.8% and 28.7% health facilities in government and private sectors with appropriate collection and storage [6].

It was observed that inappropriate bins were used for waste collections in small HCFs in private sector, were using materials such as discarded bottles, paint boxes and bottles and rest of the HCFs were using bins of plastic material without lids as lack of space made it challenging for the small health care facilities to accommodate so many types of bins. A study done by Jagadeesh U et. al. in Puducherry were indiscriminately using black, brown, and yellow colored bags and urban PHC used black color bags to collect all the BMW and was mixed [7].

Due to absence of proper lid cover on waste bins and attitude of the health care staff it was observed that there was spill outside the bin i.e. around 20 to 50% of the HCFs and mix up of waste in the yellow bags. This is a concern as far final treatment of yellow bags which is incineration. In the study, there was

no protocol in place at any of the HCFs for spill management and spill kit availability. In a study by D'souza et al, found that they had better knowledge that 51.9% showed that they had good knowledge about spill management and hence better BMWM [8].

In our study, HCFs lagged in disinfection process to prevent infection among the waste handlers. Similar observation was found in a study done by a Somaish PT et al, in a District Hospital, Kodagu, South India was seen wherein it was observed that no disinfection was done before disposal of waste [9]. In another study in a tertiary hospital in Muzzafar nagar by Choudary PK et al, it was observed that only sharp items were disinfected before disposal [10] . In a study by Manasi S et. al. done in Bangalore, it was observed that only sharps were disinfected, and that too only in a few HCFs with 1 % hypochlorite solution [11].

On a positive note, it was observed that the private HCFs managed sharps better than government HCFs. HCFs in both private and government sector did not have waste trolleys for in house transportation of health care waste and to add to the concern, the waste handlers did not don personal protective gear while transporting waste. Almost similar findings was found in a study done in Muzzafar by Choudary PK et al, though trolleys existed but did not have lids [10].

It was observed that the workers safety was found to be deficit (78% to 95%) in medium HCFs. Similarly in a study done in Puducherry, 86% of waste handlers had injuries while handling BMW on one or more occasions hence the recommendation to emphasize on the importance of safety while handling BMW at the HCFs.[7]

Liquid waste management among the HCFs in both private and government sectors, was found to be satisfactory though it was through simple mechanism of regular bleach solution preparation and disinfection and there was no effluent system existing in the HCFs. Similarly, in a study done in a district hospital, Kodagu, it was found that there was an absence of the effluent treatment plant /local treatment facility for infectious liquid waste.[9]

The limitation of this study was the quantum of BMW generated in HCFs was from a proxy receipt obtained from CBMWTF. Due to feasibility of time to manually weigh the BMW was challenging which would have ensured more accurate calculation of quantum of BMW generated in HCFs.

Conclusion

In the current study, overall there is scope for improvement in the micro level areas of BMWM process at the HCFs under private and government sector, as it was found to be very poor.Hence, there is a need to emphasize on continuous training of the health care staffs, monitoring of BMWM on a regular basis at all HCFs in Chikkaballapur district in order to strengthen the life cycle of BMWM process at the point of generation in all HCFs in both private and government sector as per the current BMWM 2016 rules.

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References

1. Ministry of Environment, Forest and Climate Change. The Gazette of India Notification, Published by authority: Extraordinary Part II section 3- sub section (I). New Delhi, 28th March, 2016 available at http://www.moef.nic.in/sites/default/files/BMW%20Rules,%202016_1.pdf. Accessed on 24th March 2022.
2. Pruss A, Cirouit E, Rushbrook P. Safe management of wastes from healthcare activities. Geneva: WHO; 1999. Definition and Characterization of Healthcare Waste.
3. Centre for Science and Environment. Bio Medical Waste Rules made stringent. [3] [cited 2022 Feb 22]. Available from: http://www.cseindia.org/node/3702.
4. Patel DA, Gupta PA, Kinariwala DM, Shah HS, Trivedi GR, Vegad MM. An [4] investigation of an outbreak of viral hepatitis B in Modasa town, Gujarat, India. *J Global Infect Dis*. 2012;4:55-59.
5. Bio-medical waste management: situational analysis & predictors of performances in 25 districts across 20 Indian States. INCLEN Program Evaluation Network (IPEN) study group. *Indian J Med Res*. 2014 Jan; 139(1): 141–153.

6. Devi A, Khairwal R, Kaur M, Kumar R. Evaluation of biomedical waste management practices in public and private sector of health care facilities in India. *Environ Sci Pollut Res* 2019;26:26082-89.
7. Jagadeesh U, Poyyamoli G, Roy G. Evaluation of biomedical waste management in the primary and community health centers in Puducherry,India. *Int.J.Curr.Microbiol.App.Sci*. 2013; 2(12): 592-604.
8. D'souza P, Cutinho SP, D'Silva BR, D'souza LS, D'souza DR, Jospeh JJ, et. al. a Descriptive Study on Knowledge of Registered Nurses Regarding Hospital Protocols on Biomedical Waste And Spillage Management and Needle Stick Injury in a Selected Hospital. *J Health Allied Sci NU*. 2016 Mar;06(01):045-7.
9. Somaiah PT, Shivaraj B M. A study on bio- medical waste management using kayakalp tool at district hospital in southern India. *National Journal of Community Medicine*. 2016; 7(7).
10. Choudhary PK, Singh JV, Singh N et. al. Evaluation of Biomedical Waste Management Practices in Multispeciality Tertiary Hospital. *Journal of Advanced Research in Medical Science & Technology*.2017; 4(1&2).
11. Manasi S, Umamani K S, Latha N. Biomedical Waste Management: Issues and Concerns - A Ward Level Study of Bangalore City. *The Institute for Social and Economic Change,Bangalore*. 2014.