

EFFICIENCY OF HOSPITAL WASTE MANAGEMENT IN KERALA: AN ANALYSIS BASED ON HOSPITAL OWNERSHIP

Savitha K L¹ and Dr. T J Joseph²

¹ Ph.D. Scholar, Department of Economics, Central University of Kerala, Kasaragod, Kerala, India

²Assistant Professor Department of Economics, Central University of Kerala, Kasaragod, Kerala, India

Abstract

As India's Health Services have emerged as the largest and fastest growing sector in the economy, the hospital waste generation rate in the country is also growing. Health care system has become existing since time immemorial but there have never been so much concern about waste generated by them. During the process of delivery health care institutions/ facilities generate different type of infectious and/or hazardous wastes. So this study has been undertaken to analyse the ownership-wise efficiency of hospital waste management in Kerala during the period 2010 to 2014. To prove this a survey at various hospitals in Kerala was undertaken on the basis of well structured questionnaire and shows that about major portion of hospital waste generated is uncollected. The analysis covered parameters such as average medical waste generation rate, waste treatment plant efficiency and ownership-wise which sector was more efficient in managing the waste generated within the hospitals. The study revealed that the management of hospital waste is still facing a critical problem and require huge amount and efficient technology and well storage facility other wise it will create a huge treat to the society.

INTRODUCTION

Hospitals in India have increased drastically in the last few years. Large private sector investment has boosted the hospital infrastructure in India and given the obvious cost advantages. Indian healthcare sector looks better than it was in the past (Agarwal et.al, 2015). Hospital is an institution which provides health facilities and curing the diseases of the patients. During the health care activities hospitals generates wastes these wastes carry a higher risk, infection and damage than any other type of wastes. It is essential to have reliable method for its safe handling and disposal of hospital wastes (Omojasola, 2009). Poor management of these wastes creates an infectious, toxic effects and injuries on the surrounding communities and the people associated with hospital waste management thus posing serious health problems in most developing countries of the world (WHO, 1999).

Management and disposal of hospital wastes was considered an integral part of hospital hygiene and infection control (Da Silva et al. 2005, Ogbonna, 2011). The wastes generated within a health care facility must follow an appropriate and well known area from the point of generation to the final disposal. These comprises of several steps namely generation, sorting, collection and onsite transportation, on-site storage, offsite transportation and finally on or offsite treatment and disposal. The nature and quantity of wastes generated and the institutional practices towards their management (sorting and recycling) were found to be poorly examined and documented by many health care institutions and in turn create health risks posed by improper handling of these wastes (Oke, 2008, Farzadika et.al, 2009). A study conducted by the World Health Organization in 1996, reveal that more than 50,000 people die every day from infectious diseases in the world and one of the reasons for the increase in infectious diseases is the improper wastes management (Mathur et.al, 2012).

Ownership of hospital is an important factor in determining the efficiency of hospital wastes management and the major factors that affect wastes management technique is the lack of equipments, cost enhancement, unaccountability, political risks, and lack of competitiveness (Oreyomi, 1998). To overcome the complications associated with wastes management whether solid, municipal, and industrial or hospital wastes all the sectors including public, private and cooperative sectors should contribute vigorously. Only with the cooperation of these sectors, the efficiency in handling wastes management can be enhanced.

The ownership wise study is conducted to get an understanding about the efficiency of hospital wastes management by the hospitals from different sectors of an economy. The treatment of wastes from a health care activity does not reduce their mass, but only alters their form. Earlier studies have shown that hospital wastes is managed and disposed in different ways by the hospitals of different set-ups (Boss 2013). In this study, hospitals from private, government and co-operative hospitals were selected for comparing the hospital waste treatment plant efficiency.

OBJECTIVES

The main objective of this paper is to analyse the ownership wise efficiency of hospital waste management in Kerala.

METHODOLOGY

The objective of the study is examined using secondary data. The hospital records were referred to gather secondary data regarding magnitude of hospital wastes. To analyse the efficiency of hospital waste management (treatment plant wise), the information are collected from the medical record library, medical record department, and the department of infection control regarding the total quantity of hospital waste generated and treated during the period 2010 to 2014, total number of beds and the total number of patients (both inpatient and out patient), the plant availability and capacity of hospital waste treatment plant. Based on the highest bed strength four hospitals (one government, one private, one co-operative and one medical college) are selected from each district, leading to a total sample of 16 hospitals. Thus a sample of four hospitals each under various ownership types is selected across the state.

MEASURING EFFICIENCY OF HOSPITAL WASTE MANAGEMENT

Efficiency implies avoiding or minimizing waste of valuable economic resources as a result of under-utilization of fixed assets and ineffective combination. Since the production is the combination of both inputs and output, the concept of efficiency normally refers to the utilization of inputs (Pena, and Ndiaye 2002). The ownership wise efficiency of hospital waste treatment plants which includes the availability, functioning and capacity of hospital waste treatment plants. An in-depth analysis on hospital waste treatment plant, it's functioning and capacity shows some distressing facts. The primary method of treatment and disposal of hospital waste specified in Biomedical Waste Rules 1998 are; Incineration (for treating the medical and inorganic solid waste within the hospitals), Autoclaving (for treating the medical wastes), Biogas plant (for treating the organic solid wastes within the hospitals) and STP/ETP (for treating the liquid wastes generated within the hospitals). Also a part of the waste generated within the hospitals is collected by the agencies. That is medical wastes generated within the hospitals are collected by IMAGE a common biomedical treatment facilities situated in Palakkad, Kerala and solid waste is collected by private agencies or NGOs. Incineration within the hospitals created inherent troubles to the society. Further the burning of the plastics created a new set of chemical toxins, some of which are super toxins even in extremely small quantities like dioxins and furans (Agrawal et.al 2002).

The present study followed the method used by Kagonji and Manyele in 2011 for identify the ownership wise hospital waste treatment plant efficiency. Kagonji and Manyele(2011) conducted a study on medical waste generation rate in Tanzanian district hospitals in which they identified, waste collection efficiency as an important aspect in medical waste management. They pointed out that the waste collection efficiency can help in achieving greater success through system improvements such as installing new technologies, better collection systems, equipments and collection vehicles, proper operational procedures and capacity building to health workers. In this study we adapt the same methodology to calculate the waste treatment plant efficiency used by Kagonji and Manyele 2011, where they have used it for waste collection efficiency. By defining TPE as Waste Treatment Plant Efficiency per day, and then it is denoted as

$$TPE = WT/CTP$$

Where WT is denoted as waste treated using treatment plant per day and CTP is denoted as capacity of waste treatment plant per day.

RESULTS AND DISCUSSION

The intensity of hospital waste generation per bed by selected hospitals is given in table 1.1. The table reveals that compared to a private hospitals and co-operative hospitals a government hospital generates lesser amount of waste even though bed strength is much higher than their competitors. In the case of solid waste private hospitals generates 936.52 kg of waste per bed and the co-operative hospital generated 755.06 kg per bed but the government hospital generated only 594.67 kg per bed during the period 2010-2014. Same is the situation in the case of medical and liquid waste. This indicates that the bed occupancy is more in the case of private hospitals and co-operate hospitals compared to government hospitals.

A study conducted in Dhaka reported the per capita waste generated was 1.2 kg/bed/day (Patwary et. al, 2009). A study by Komilis et.al, in 2012 in Greece revealed that the average total hazardous medical waste unit generation rates varied from 0.012 kg/bed/day, for the public psychiatric hospitals, to up to 0.72 kg/bed/day, for the public university hospitals. The intensity of waste generation rate recorded in this study is by far larger when compared to the generation rates of hospital waste per bed per day by the above mentioned studies that is an average of total solid waste generated by the selected hospitals of different ownership types and it was 2.2 kg per day while it was 2.6 kg per day in the case of medical waste and 3061.93 ltr per day in case of liquid waste.

Table 1.1 Intensity of Hospital waste generated per bed (2010-2014)

Types of waste	Private	Government	Medical College	Co operative
Solid waste(kg)	936.52	594.67	1015.29	755.06
Medical waste(kg)	1062.84	724.60	1171.61	836.99
Liquid waste (ltr)	911898.11	788933.53	2367073.78	402515.41

Source: Data complied from MRL/MRD/Infection control Department of selected hospitals during 2010 to 2014

The study also showed that the Medical Colleges generated higher amount of hospital waste per bed per year in comparison with all other type of hospitals. The probable reasons may be due to differences in the size and type of selected hospitals, in addition to differences in the financial condition and also the use of disposable instruments and packaging materials rather than the use of reusable items in healthcare facilities has increased the amount of waste generation.

Capacity of hospital waste treatment plant

The information regarding the capacity of hospital waste treatment plant, both in litre (here after ltr) per day and kilogram (kg) per day is also explained in table 1.2. While compared with other hospitals government hospitals have only one incinerator plant; their capacity is (1200 kg/day). The selected medical college hospitals (both private and government) have well functioning incinerator plant and it capacity is also similar to that of government hospital (1200 kg/ day) while the capacity of private medical college hospital is 1200 kg/day and 2400 kg per day for government medical college hospitals. Compared to all other hospitals the capacity of incinerator plant is very low in the case of co-operative hospitals that are 600/ kg/day. The capacity of autoclave plants is also more in the case of government hospitals (800 ltr per day) compared to that of private (695 ltr per day) and co-operative hospitals (442.5 ltr per day). The capacity of autoclave plant of medical college hospitals (both government (940) and private (600) hospitals is 855 ltr per day.

Table 1.2 Capacity of hospital waste treatment plant

Ownership	Total no. of hospital	Incinerator Kg/Per day	Autoclave Ltr/per day	STP/ETP lakhs/ ltr/day	Biogas plant kg/day
Private	4	1500	695	8.75	200
Government	4	1200	800	0	0
Medical College	4	3600	855	25.5	225
Co-operative	4	1800	442.5	11	512.5

Source: Data collected and compiled from Medical Record Library (here after MRL) and Infection Control Department (here after ICD) of selected hospitals from different ownership types.

The quantity of wastes treated by private hospitals through STP is 8.75 lakhs ltr per day but only two private hospitals have proper functioning STP. In the case of co-operative hospital all the hospitals hold well-functioning STP and its capacity is an average of 11 lakhs ltr per day. Interestingly the analysis showed that the government hospital does not have any STP that is they lacks in treatment facilities. The capacity of STP of medical college (both government and private) is 25.5 lakhs ltr per day but only one selected government medical college hospital have well functioning STP. Similar is in the case of biogas plant (solid waste treatment plant). As compared it with other hospitals the government hospital does not have any biogas plant for treating the solid waste generated within the hospitals. The capacity of biogas plant of private hospitals is 200 Kg per day. In the case of medical college hospitals it was 225 Kg per day and only one medical college hospital had biogas plant and it is at government medical college hospital. A notable observation from the table is that all the selected co-operative hospitals have biogas plant and its capacity is more while compared it with other hospitals.

Hospital waste treatment plant efficiency

The average quantity of hospital wastes generated and treated within the hospital through treatment plant and quantity of hospital wastes collected by the external agencies is given in table 1.3. The table revealed that the private hospitals generate around 179 Kg of solid wastes per day and treated only 166 Kg per day. Among these almost of 48 Kg of solid wastes generated within the private hospitals is collected by external agencies (private/kudumbasree/MDS) and remaining 118 kg per day was treated within the hospital using biogas plant.

Since the hospitals have the capacity of treating 200 kg of solid wastes generates within the hospital per day, and they utilize only 60 percent of plant capacity efficiently and remaining 40 percent is not properly utilized by the hospital authorities. This was mainly due to two reasons, that is either the hospital authorities have lack of finance for managing the plant or the treatment plant are not in an usable condition, that is the hospital authorities does not have any proper knowledge regarding the efficient utilization of treatment plant.

In the case of co-operative hospital they generate 91 kg of solid waste per day and treat only 60 kg per day. Among this 23 kg of waste is collected by eternal agencies and the remaining wastes is treated within the hospitals using biogas plant. The hospitals have the capacity of treating an average of 512.5 kg of solid wastes through biogas plant. Among the average quantity of solid waste generated around 4.49 percentages of waste is treated by co-operative hospitals using treatment plant and remaining wastes not treated within the hospitals this proved that the co-operative hospitals are utilizing their treatment plant less efficiently.

Table 1.3
Ownership wise average quantity of waste generated and treated per day

Ownership	Hospital Waste Generated per day			Hospital Waste treated per day		
	SWG in kg/day	MWG in kg/day	LWG in /1000ltr/day	SWT in kg/day	MWT in kg/day	LWT in /1000ltr/day
Private	179	200	67	166 (48*, 118**)	200 (106***)	48
Government	110	134	93	7 (7*, 0**)	134 (53***)	0
Medical College	712	790	1570	268 (43*, 225**)	790 (392***)	1147
Co-operative	91	105	50	60 (37*, 23**)	105 (70***)	50

Source: Data collected and compiled from MRL and ICD of selected hospitals from various ownership types, Values in parenthesis shows (Hospital waste collected by agencies private, kudumbasee/MDS, ** waste treated within the hospitals using treatment plant and *** waste collected and treated by IMAGE)*

Interestingly the study observed that the quantity of solid wastes generated within the government hospitals left untreated. That is the solid wastes treated within the hospitals using treatment plant is zero and an average of 7 kg of waste is collected and treated by the external agencies per day that is remaining 103 left untreated by the hospitals. Since the government hospitals does not have their own treatment facilities for managing these wastes generated within the hospitals, that is they does not have any biogas plant, for treating the wastes within the hospitals and the agencies are also not collecting the wastes from the hospitals. This proved that the government hospitals are illegally disposing their wastes.

Similarly the study pointed out that medical college hospitals generate an average of 712 kg of solid wastes per day and they treated only 268 kg per day. Among this an average quantity of solid wastes collected by private agencies is 43 kg per day and the average quantity of solid wastes treated within the hospital using biogas plant was 225 kg per day. The medical college hospitals have the capacity of treating 225 kg of solid wastes using biogas plant. Among the average quantity of solid waste generated the plants have the capacity of treating 32 percentages of solid waste generated within the hospitals. That is their plant utilization efficiency is 100 percentages and remaining 68 percentage of solid waste generated within the medical college hospital is either collected by the private agency or openly dumped. Thus it was clear from the table that the medical college hospitals left an average of 444 kg of solid wastes per day as untreated. Thus the study proved that almost all the selected hospitals are utilizing their waste treatment plant inefficiently.

CONCLUSION

Improper management and disposal of hospital waste continue a significant threat to the healthy working environment. The empirical findings regarding the ownership wise efficiency of hospital waste management recognized that compared to other hospitals government hospitals does not have any waste treatment plant for managing the solid and liquid waste generated within the hospitals. The study proved that the hospitals from various ownership types are utilizing their treatment plant inefficiently that is majority of the hospitals does not have proper waste disposal systems and the hospital wastes treatment plants of selected hospitals from various ownership types showed a system deficiency. The improper handling and disposal of hospital wastes constitutes a serious problem: it throw in to high morbidity and mortality rates. So an efficient hospital waste management is required for effective results in management of hospital waste.

REFERENCES

1. Agarwal,Raveesh., Chaudhary, Mona., and Singh,Jayveer (2015), Waste Management Initiatives In India For Human Well Being, *European Scientific Journal*ISSN 1857- 7431, Pp 105-127
2. Boss, U.J.C., Poyyamoli, G.,andRoy, G. (2013). Evaluation of Biomedical Waste Management in the Primary and Community Health Centres in Puducherry Region, India.*International Journal of Current Microbiology and Applied Sciences*,Vol. 2, Issue. 12, Pp. 592-604.
3. Da Silva, C., Hoppe, A., Ravello, M., and Mello, N. (2005). Medical Wastes Management in the South of Brazil. *WasteManagement*, Vol.25, Pp. 600-605.
4. Farzadika, M., Moradi, A.,andMohammadi, M.S. (2009). Hospital Waste Management Status in Iran: A Case Study in the Teaching Hospitals in Iran University of Medical Sciences.*Waste Management Research*, Vol.27, Pp. 384-389.
5. Kagonji, I.S., and Manyele,S.V., (2011). Analysis of the Measured Medical Waste Generation Rate in Tanzanian District Hospitals Using Statistical Methods. *African journal of Environmental Science and Technology*, Vol. 5, Pp. 815-833.
6. Komilis D., Fouki A. and Papadopoulos D. (2012), Hazardous medical waste generation rates of different categories of health-care facilities, *Waste Management*, Vol 32, Issue7, Pp 1434-1441.
7. Mathur, Praveen., Patan,Sangeeta., and Shobhawat.,Anand S. (2012) Need of Biomedical Waste Management System in Hospitals - An Emerging issue - *A Review Current World Environment* Vol. 7 issue1, pp 117-124
8. Ogbonna D.N (2011), Characteristics and waste management practices of medical wastes in health care institutions in Port Harcourt, Nigeria, *Journal of Soil Science and Environmental Management* 2(5): 132-141
9. Oke I.A (2008) Management of immunization solid wastes in Kano state, Nigeria, *Waste Management*, Vol28: Pp 2512-2521
10. Omojasola P.F, Adetitun D.O, Oshin O.O., and Omojasola T.P (2009), Environmental Health Hazard Assessment of Hospital Wastes in Ilorin Metropolis, *Nigerian Journal of Microbiology*, 23(1), 1882 – 1889
11. Patwary M., Ohare W., Street G., MaudoodElahi K., Hossain S., and Sarker M. (2009), Quantitative assessment of medical waste generation in the capital city of Bangladesh, *Waste Management*, Vol 29, Pp 2392-2397.
12. Pena, D. Alberto., and Ndiaye, Momar. (2002). Developing Hospital Efficiency-Cost Control Measures, *World Hospitals & Health Services*, Vol. 38, No.3.
13. World Health Organisation (1999) “Regional Workshop on Hospital Waste Management and Hospital Infection Control”, WHO Government Medical College and Hospital, Nagpur, India, Nov.18–20, (1999).