



## HOSPITAL WASTE DISPOSAL PRACTICES AT FEW HEALTH CARE CENTRES IN MYSORE CITY, KARNATAKA, INDIA – A CASE STUDY

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### ABSTRACT

Mysore is one of the famous heritage cities in India, obtained clean city status three times from the Government of India. Despite its clean city status, Mysore is still facing shortcomings in hospital waste disposal. Published reports exclusively on hospital waste disposal are wanting and need updating. The present study was conducted systematically by selecting 20 hospitals, 22 small to medium sized clinics and 33 medical shops randomly from 20 different areas in Mysore city. Total 75 respondents from various health care centres (HCCs) were met personally and collected the data on waste production, amount of bio-medical waste produced per day, isolation, organisations involved in bio-medical waste collection, mode of disposal with the help of pre-tested questionnaire. Collected data was statistically analysed by following standard methods. Around 34 different types of wastes were recorded and produced from 0.1 to >20 kilograms per day from different HCCs. Most (96.2%) of the HCCs have stored the collected hospital waste in separate dust bins which were colour coded with green (2.4%), yellow (26.8%), red (17%), blue (32%), black (15%) and white (23%). Total 40% of the HCCs have collected and isolated the hospital waste during early morning hours and 57.3% of the HCCs have isolated during late evening hours of the day. Majority (94.7%) of the HCCs have disposed bio-medical waste every day. Around 21.7% hospitals, clinics and medical shops didn't followed proper disposal practices. Majority (43.5%) of the HCCs have disposed bio-medical waste to municipality service centres. However, non-governmental agencies (NGO's) and other agencies also helped while disposing the bio-medical waste in Mysore. Only, 13.8% private agencies have collected bio-medical waste for fuel purpose. The production of bio-medical waste is inevitable in every hospital, its scientific disposal is very essential to maintain hygiene and sanitation in urban centres.

**KEYWORDS:** Source, bio-medical waste, disposal practices, health care centres, Mysore.

### INTRODUCTION

The hospital waste include 'any waste generated during the diagnosis or medical treatment or immunization of human beings or testing of biological material including categories mentioned in schedule I of bio-medical waste management and handling rules (1998) in India.<sup>[1]</sup> The hospital waste include human blood, plasma, corpuscular part, tissue or pus contaminated cotton, laboratory culture waste, contaminated stocks with pathogens, human tissues, biological fluids, diseased body organs, patient discharges, cyto-toxic waste, sharp needles, hypodermic syringe, surgical instruments, manufactured date expired pharmaceutical products, laboratory solvents, acids, hygienic fluids, dyes, low-level radioactive wastes, plastic carry bags, wrappers, disposable syringes, saline bottles, fluid bottles etc.

These wastes are termed as 'medical waste' or 'hospital solid waste' or 'bio-medical solid waste'.<sup>[2]</sup> These wastes are environmentally most sensitive products.<sup>[3]</sup> increasing day by day and creating greater impact on human health<sup>[4]</sup> and local environment in urban centres. The world health organization has opined that 85% of the hospital wastes are actually non-hazardous but, around 10% is infectious and 5% is non-infectious.<sup>[5]</sup> In USA, 15% hospital waste is regulated as infectious waste. However, in India it is ranging in between 15 and 35% depending on the amount of waste produced.<sup>[6]</sup>

Currently, hospital waste disposal become one of the major issues in most of the urban centres. Many times, hospital wastes are handled and disposed along with domestic wastes. Certain bio-medical wastes are picked up by the rag pickers and recycled back to the market

without any disinfection.<sup>[7-8]</sup> Several researchers<sup>[9-13]</sup> have reported on the hospital waste management in different parts of the world. However,<sup>[14-15]</sup> have studied the hospital waste management in India. Most of the published reports were dealt with the effects and consequences of unmanaged hospitals wastes in major cities of India and other parts of the world. All these reports suggested that bio-medical waste management is in infancy stage all over the world and need immediate measures for their safe disposal.<sup>[16,14-15]</sup> have discussed the disposal of hospital wastes at greater depth. Further,<sup>[17]</sup> have emphasized the need of safe recycling and isolation of bio-degradable and non-biodegradable materials from hospital.<sup>[3]</sup> have studied the risk of occupational exposure of health workers and waste handlers.<sup>[12-13]</sup> have studied the hazardous wastes and its potential hazard to human being and explained the risk of accidental release of hazardous materials into the environment. Therefore, hospital waste disposal and management is a multifaceted activity, necessitated the regular evaluation in urban centres.

Mysore is one of the fast growing cities in Karnataka, attracting tourists from different parts of the world every day. Local residents and people visiting to Mysore from outside places are expecting clean and disease free environment around the year. Despite its clean city status three times i.e., 2015, 2016 and 2018,<sup>[6]</sup> still Mysore is facing problem for its bio-medical waste disposal. To provide good health services to people of Mysore, government and private hospitals, super speciality hospitals, small to medium sized clinics and medical shops serving around the clock. But, the bio-medical waste produced from these centres is increasing day by day and become problem for its management. The published reports exclusively on wastes from different hospitals, clinics, pathology laboratories and diagnostic centres in Mysore is fragmentary<sup>[7]</sup> excepting the published report of.<sup>[18-19]</sup> The hospital waste is highly hazardous to human health,<sup>[12-13]</sup> management is a challenging task and becomes a major burning issue in fast growing cities like Mysore. It is one of the vital activities in every urban centre and essential for every HCC. Hence, the present study was undertaken.

## MATERIALS AND METHODS

**Study area:** Mysore is located at the foot hill of Chamundi hills between 11°40' to 12°40' N. latitude and 75°57' to 77°15' E. longitude with the elevation 770 meters mean sea level.<sup>[20]</sup> It is housed with more than one million local populations<sup>[6]</sup> and becomes third most populous city in Karnataka. The literacy rate in Mysore is higher (82.8%) than that of the State average and hosted different industrial centres which are located at Hebbal, Metagalli, Belagola, Belavadi and Hootagalli industrial areas around Mysore city. The information technology (IT) institutions have established recent past in Mysore.<sup>[20]</sup> Many tourists from different parts of the world are visiting Mysore daily. Thus, Mysore has provided shelter for diversified population with different

socio-economic conditions. To cater the need of best health services to these people, different medical practitioners are taking care of health issues through various health care centres (HCCs) viz., hospitals, clinics, medical shops by providing 24 hours services every day.

**Methodology:** During the present study, total 20 hospitals, 22 clinics and 33 medical shops were selected randomly from 20 different places in Mysore.<sup>[21]</sup> Table 1 shows the medical faculty and treatment facilities available at few HCCs in Mysore. The hospitals were visited two times in a week from January to April, 2018 and met medical practitioners personally to collect the data on source of bio-medical waste and its disposal practices by using pre-tested questionnaire. Twelve parameters such as type of treatment facilities, source and origin of bio-medical waste, collection, segregation, storage, quantity and disposal practices were considered. Hospital waste was classified into bio-medical and non-bio-medical wastes.<sup>[22]</sup> The collected data was compiled systematically and analysed, tabulated by using standard methods.<sup>[21]</sup>

## RESULTS

**Type of hospital waste produced:** The hospital waste included human anatomical waste (11%), laboratory waste (12.1%), medicine shops waste (4.4%), paper waste (15.4%), plastic waste (25.1%) and metal waste (23.3%) in few HCCs (Table 2). In addition, corporation waste (1.8%), glass waste (3.3%) and other waste (3.6%) were recorded from the HCCs. Altogether, 91.3% bio-medical waste and 8.7% non-bio-medical waste was produced from the HCCs (Table 2).

**Quantity of bio-medical waste produced:** On an average, 20.18 kilogram bio-medical waste was produced every day by the HCCs. This amounted to seven quintals of bio-medical waste from the HCCs every year (Table 3). Similarly, 20 bio-medical waste items were commonly produced by every HCCs (Table 3).

**Quantity of non-bio-medical waste produced:** Non-bio-medical waste produced every day by the HCCs is given in Table 4. Total seven types of wastes were commonly recorded from the HCCs. The quantity of these waste items produced per day and year by the HCCs is varied considerably (Table 6). Sixty per cent of the HCCs have produced 0.1 to 0.4 kilograms waste and it was followed by 10 to 19.9 kilograms waste produced by 13.4% HCCs every day. Moreover, 13.3% HCCs did produce one to 9.9 kilograms waste. Remaining 5.3% HCCs have produced more than 20 kilograms waste every day (Table 6).

**Storage of waste:** Bio-medical waste storage and isolation practices in few HCCs are depicted in Table 5. Highest (96.2) per cent of the HCCs did use dust bins for storing the waste. Six coloured dust bins namely: blue,

yellow, white, red, black and green coloured bins were used to store different waste materials and stored accordingly with green (2.4%), yellow (26.8%), red (17%), blue (32%), black (15%) and white (23%) coloured dust bins (Table 5).

**Isolation of waste:** Few HCCs have isolated 21.7% waste every day and remaining 26.1% HCCs were isolated the plastic, paper and other items from the hospital waste before disposal. Further, majority (57.3%) of the HCCs have collected the waste during end of the day for isolation and 40% waste during beginning of the day. Interestingly, 2.7% HCCs were collected and

isolated the waste both morning and evening hours in a day (Table 6).

**Disposal of waste:** Highest (43.5) per cent of hospital waste was disposed through Mysore city corporation (MCC) system and it was followed by 22.8 and 20% respectively by private companies and non-governmental organizations (NGOs) by the few HCCs (Table 6). However, only 13.7% waste was disposed by other means. Further, 94.7% HCCs disposed collected hospital waste every day. However, 2.7% of the HCCs disposed once in a week, 1.3% of the HCCs disposed once in two days and 1.4% of the HCCs disposed once in 15 days (Table 6).

**Table 1: Medical faculty and treatment facilities available at few health care centres in Mysore.**

Sl. No.	Expertise of Medical Faculty	% Occurrence	Sl. No.	Medical Facility	% availability
1.	MBBS with BDS	2.7	1.	Allopathic & English Medicine Treatment	14.3
2.	MBBS with DGO	1.3	2.	General Treatment	19.0
3.	MBBS with MD	2.7	3.	Naturopathy	2.4
4.	MBBS, BDS with MS	1.3	4.	Eye Treatment	4.8
5.	MBBS, MD with other diploma degrees	2.7	5.	Dental Treatment	4.8
6.	MBBS, MD with BDS	1.3	6.	Diabetic & Thyroid Treatment	2.4
7.	MBBS with others diploma degrees	9.3	7.	Gynaecology	2.4
8.	BSc with B. Pharma	6.7	8.	Veterinary Treatment	4.8
9.	D. Pharma	2.7	9.	T.B & Chest Treatment	2.4
10.	B. Pharma	34.7	10.	Allergy & Asthma Treatment	2.4
11.	Staff Nurse with basic educational qualification	34.7	11.	Other	40.5
Total		100.0	Total		100.0

**Table 2: Hospital waste produced at few health care centres in Mysore.**

Sl. No.	Type of waste	% age	Total (%)
1.	<b>Human Anatomical Waste</b>		11.0
	i. Tissue & Placenta	1.7	
	ii. Bedding items contaminated with blood etc.	1.4	
	iii. Infected cotton & dressing	4.1	
	iv. Solid placenta casts	3.8	
2.	<b>Laboratory Waste</b>		12.1
	i. Microbial & laboratory waste	2.1	
	ii. Blood bags	1.8	
	iii. Cotton Swabs	4.2	
	iv. Cyto-toxic drugs	4.0	
3.	<b>Waste from Medicine shops</b>		4.4
	i. Manufactured date expired Tablets		
4.	<b>Corporation Waste</b>		1.8
	i. Corporation Food waste		
5.	<b>Other Waste</b>		3.6
	i. Tender Coconut	1.8	
	ii. Fruit Peelings	1.8	
6.	<b>Paper Waste</b>		15.4
	i. Waste Paper	7.5	
	ii. Tablet boxes	4.7	
	iii. Paper covers	3.2	
7.	<b>Plastic waste</b>		25.1
	i. Plastic cups & plates	1.9	

	ii. Medicine Wrappers	2.5	
	iii. Syringe Wrappers	4.2	
	iv. Plastic catheters	1.3	
	v. Urine bags	1.3	
	vi. Tubing's	1.3	
	vii. Gloves	4.2	
	viii. Drip bottles	4.0	
	ix. Vial drains	2.4	
	x. Plastic bottles	2.0	
<b>8</b>	<b>Metal Waste</b>		
	i. Waste metal items	1.4	
	ii. Needles	3.3	
	iii. Lancets	3.3	
	iv. Ampoules	3.3	
	v. Scalpels	3.3	
	vi. Surgical blade	1.9	
	vii. Disposable Syringe	3.4	
	viii. Other used sharp metal objects	3.4	
<b>9.</b>	<b>Glass waste</b>	3.3	3.3
Total			100.0

Table 3: Quantity of hospital waste produced at health care centres in Mysore.

Sl. No.	Waste generated at HCCs	Quantity (in Kg.) per	
		Day	Year
1.	Used cotton for wound treatment during surgical operations/treatment (n=20)	5.28	1,927.2
2.	Contaminated bedding items (n=15)	1.3	474.5
3.	Expired date Tablets (n=18)	4.41	1,609.65
4.	Medicine wrappers (n=20)	0.34	124.1
5.	Unused cytotoxic drugs (n=20)	2.89	1,054.85
6.	Syringe wrappers (n=20)	0.58	211.7
7.	Used gloves during operations and other treatments (n=20)	0.68	248.2
8.	Plastic bottles (n=18)	0.03	10.95
9.	Used needles (n=20)	0.36	131.4
10.	Used surgical blade (n=14)	0.2	73.0
11.	Used disposable syringes (n=20)	0.32	116.8
12.	Other used sharp metal items (n=20)	1.41	514.65
13.	Used drip bottles (n=20)	2.11	770.15
14.	Used tubing devices (n=20)	0.27	98.55
Total		20.18	7,365.70

Note: 'n': Number of observations.

Table 4: Other waste produced at health care centers in Mysore.

Sl. No.	Type of waste	Quantity (in Kg.) per	
		Day	Year
1.	Used tender coconuts (n=14)	0.03	10.95
2.	Unused fruit peelings (n=16)	0.02	7.3
3.	Used plastic cups and plates (n=18)	0.34	124.1
5.	Used plastic covers (n=20)	0.52	189.8
6.	Used/unused waste paper (n=53)	8.18	2,985.70
7.	Card board boxes (n=33)	5.83	2,127.95
Total		14.92	5,445.80

**Table 5: Storage and isolation of waste from few health care centres in Mysore.**

Bio-medical waste											
Storage						Isolation					
Sl. No.	Type of device	% use	Sl. No.	Dust bin colour	% use	Sl. No.	Type of waste	% occurrence	Sl. No.	Time of Isolation	% amount
1.	Dustbin	96.2	1.	Blue	32.0	1.	Paper	26.1	1.	Morning	40.0
2.	Black Covers	3.8	2.	Yellow	26.8	2.	Plastic	26.1	2.	Evening	57.3
			3.	White	23.0	3.	Other Waste	26.1	3.	Both Morning & Evening	2.7
			4.	Red	17.0	4.	Without Sorting out	21.7			
			5.	Black	15.0						
			6.	Green	2.4						
Total		100.0	Total		100.0	Total		100.0	Total		100.0

**Table 6: Waste disposal practices followed by few health care centres in Mysore.**

Sl. No.	Waste disposal	%	Sl. No.	Frequency of disposal	%	Sl. No.	Quantity of waste produced (In Kg.)	%
1.	Municipality (MCC)	43.5	1.	Every day	94.7	1.	0.1 to 0.4	60.0
2.	Private Agency (NGO's)	20.0	2.	Once in 2 days	1.3	2.	0.5 to 0.9	8.0
3.	Private Companies (NGO's)	22.8	3.	Once in a week	2.7	3.	1 to 9.9	13.3
4.	Others	13.7	4.	Once in 15 days	1.4	4.	10 to 19.9	13.4
						5.	20 & above	5.3
Total		100.0	Total		100.0	Total		100.0

## DISCUSSION

Hospital waste is hazardous, could create health risks and become potentially infectious to mankind.<sup>[23-24]</sup> Hence, hospital waste produced by the HCCs should be monitored regularly on its source, origin, type, isolation, quantity and disposal at right time in right place.<sup>[5]</sup> The quantity of waste produced from different HCCs was considerably varied and it was ranged between 0.1 to > 20 kilograms every day in Mysore. Around 0.1 to 0.4 kg hospital waste was recorded from majority of the HCCs and only 5.3% of the HCCs produced >20 kg waste every day. Remaining 4.7% of the HCCs were produced one to 19.9 kilograms hospital waste every day. Total 20 types of wastes were commonly produced by every HCC that accounted 91.3%. Although the waste produced between 75-90% by the healthcare providers is considered as non-risk or general health care waste,<sup>[5]</sup> remaining 10-25% is regarded as hazardous and creates different type of health risks to human beings if not properly disposed.<sup>[3]</sup> Thus, the hospital waste becomes potentially infectious to mankind. Therefore, regular disposal and scientific management is necessitated to maintain cleanliness and disease free environment in urban centres. Further, hospital waste collection and isolation was not similar and it was attended both during morning (40%) and evening (57.3%) hours in a day. Thus, hospital waste isolation has necessitated the unification for proper disposal.<sup>[25]</sup> Further, 3.8% of the HCCs didn't use colour coded dust bins instead they used black plastic covers for waste storage. It is inappropriate, unsafe and it could contaminate the domestic waste either due to leakage or damage of

covers. Hence, it is imperative to use colour coded dust bins for safe collection and storage of the hospital waste.<sup>[5]</sup> Otherwise, unscientific way of hospital waste storage could pose problem to public health and local environment.<sup>[23-24]</sup> Moreover, considerable amount of paper, plastic, metals and food wastes were produced by the HCCs. Altogether, 91.3% bio-medical waste and 8.7% non-bio-medical waste was usually appeared at every HCC. All these wastes in/on time segregation reduces the clinical waste volume and the disposal cost.<sup>[26]</sup> Furthermore, the hospital waste disposal from all the HCCs was not regular and it was incomplete every day. Majority (94.7%) of the HCCs disburse the waste every day through Mysore city corporation (MCC) along with few private companies and non-governmental organizations (NGOs). However, 1.3, 2.7 and 1.4% of the HCCs disbursed once in two days, once in a week and once in 15 days respectively. Hence, hospital waste disposal from all the HCCs was uneven and necessitated to monitor regularly for outlay every day. The hospital waste is considered as potentially hazardous material,<sup>[23-24]</sup> creates occupational health hazards,<sup>[3]</sup> and could provide congenial breeding ground for vectors.<sup>[27]</sup> Therefore, it should be safely transported or otherwise treated with certain chemicals and later disposed properly to avoid commonly occurring infectious diseases.

Unfortunately, in India, most of the urban centres are facing difficulty to manage the municipal solid waste along with the hospital waste.<sup>[28-29,12-13,18]</sup> The status and future directions for the solid waste management in India



are enormous<sup>[30]</sup> and needs integrated solid waste management.<sup>[31]</sup> Region specific and solid waste type specific management strategies are required for Indian cities.<sup>[32]</sup> Available solid waste must be recycled environment friendly and should be taken up as one of the income generating activities.<sup>[33]</sup> From this impact of hazardous hospital waste on human health and environment could be minimized.<sup>[34]</sup> In turn it could help maintain hygiene amidst hospital premises and public places as well.<sup>[10]</sup> Therefore, it is high time to go for alternative approaches for better hospital solid waste management in urban centres.<sup>[35]</sup> Hence, proper segregation, timely storage, labelling and disposal of hospital waste are necessary<sup>[36]</sup> in urban centres and should be strengthened these activities every day. Thus, regular evaluation of hospitals for their medical and non-medical waste disposal and management is essential to have good status as per the Law of Bio-medical Waste (Management and Handling) Rules, 1998.<sup>[5]</sup> Our observations are in agreement with the observations of.<sup>[4,14-15,18-19,23-24,35-39]</sup>

## SUMMARY

Around 34 different types of wastes were recorded from the HCCs. Bio-medical waste production was in the range of 0.1 to >20 kilograms per day at different HCCs. Hospital wastes are collected and stored in separate dust bins (96.2%) which were separately stored in different colour coded dust bins. Total 40% of the HCCs have collected and isolated during early morning hours and 57.3% of the HCCs have collected and isolated the bio-medical waste during late evening hours of the day. Majority (94.7%) of the HCCs have disposed bio-medical waste every day. Around 21.7% of the hospitals, clinics and medical shops didn't followed proper disposal practices. Majority (43.5%) of the HCCs have disposed bio-medical waste to municipality service centres. However, non-governmental agencies (NGO's) and other agencies were help assisted while disposing bio-medical waste respectively 20 and 22.8% in Mysore. Only, 13.8% private agencies have collected bio-medical waste and it was used for fuel purpose.

## RECOMMENDATIONS

Hospital waste segregation must be done at its point source only and it should be properly stored in colour coded dustbins for their proper disposal. The hospital waste is typically contained with high volume of contagious and infectious agents. The storage tanks or drums or storage containers should be placard with the bio-hazard mark while on the transit. At every HCC, 'PUT THE RIGHT WASTE IN RIGHT BIN' policy must be adopted. The HCCs should have constant interaction with municipal authorities and other agencies for the disposal of bio-medical waste regularly from their hospital premise for land fill or other treatment.

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