A STUDY OF BIOMEDICAL WASTE MANAGEMENT IN NAGAMANGALA TALUK OF MANDYA DISTRICT, KARNATAKAMaheshkumar M. Shindhe¹, Harish B. R², Suresh Lankeshwar³**HOW TO CITE THIS ARTICLE:**

Maheshkumar M. Shindhe, Harish B. R, Suresh Lankeshwar. "A study of Biomedical Waste Management in Nagamangala Taluk of Mandya District, Karnataka". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 52, October 13; Page: 12109-12117, DOI: 10.14260/jemds/2014/3599

ABSTRACT: BACKGROUND: Management of biomedical waste continues to be an issue of public health concern even after the notification of the Bio-Medical Waste (Management and Handling) Rules. **OBJECTIVES:** The present study was undertaken with the objectives of assessing the type and quantity of the biomedical waste generated and the present state of biomedical waste management in selected biomedical centres/units of Nagamangala Taluk. **TYPE OF STUDY:** Cross – sectional. **MATERIAL AND METHODS:** In the selected health centres, the biomedical waste was individually weighed as per the categorization and a pretested checklist was used to collect relevant information. **STUDY PERIOD:** January 2004 to June 2005. **RESULTS:** The data was tabulated and is presented as percentages. Highest generation of biomedical waste was observed to be 343.7gms/pt/day in the medical college teaching hospital. Management and disposal of category 1 waste (human anatomical waste) was observed to be appropriate only in the medical college teaching hospital. Only 4 (8%) of the 50 centres were managing the category 4 (sharps) wastes as per the act and final disposal as per the act was being done only by the medical college teaching hospital. Appropriate colour coded bins were available only in the medical college teaching hospital. 7 (14%) of the health centres were disinfecting liquid waste (Category 8) before disposal. Manual transport of the biomedical wastes to the final site of disposal was observed in 47(94%) of the health centres. Personal protective measures were being used in 9 (18%) of the health centres. **CONCLUSION:** The management and disposal of biomedical waste was observed to be deficient in all the centres studied except for the medical college teaching hospital.

KEYWORDS: Biomedical waste, Infectious waste, Segregation of waste.

INTRODUCTION: Biomedical waste or Health care waste is a special category of waste, which needs to be handled appropriately with precautions because it carries a higher potential for infection and injury than any other type of waste. Currently it is being managed casually.¹

With a rapid increase in the number of hospitals, clinics and laboratories in the country, the generation of health care waste has been increasing considerably. In western countries it is estimated that hospitals generate 1 to 1.5kg of waste per bed per day. Also it is estimated that in clinics, total amount of waste generated is 200kg/year. It is estimated that patients in India generate between 0.5 to 1kg of waste/person/day.

In Karnataka State (SOER-2003), the generation of health care waste has been estimated to be 1.0Kg/bed/day in private and government health care establishments, 1.5kg/day in blood bank, 1.0kg/day in diagnostic laboratory, 0.2kg/day in small clinics and 0.25kg/day in veterinary clinics.

Even the healthcare industry over the last decade has shifted from a mainly reusable product supply system (eg: glass syringes, hospital laundry etc.,) to a primarily disposable product supply system (eg: disposable syringes and needles, disposable hospital linen etc.,) which has caused an increase in the health care waste generation and managing the same has become a problem.^{2,3,4}

ORIGINAL ARTICLE

According to WHO, almost 80% of health care waste is comparable to domestic waste, the remaining approximately 20% is considered hazardous, as it may be infectious, toxic and/or radioactive. Improper disposal of waste generated in health care establishments can have direct and indirect health impacts on those who work in the health care establishment, the general public and on the environment.

Such practices may contribute to the spread of diseases, as well as pollution of water, soil and air. Untreated infectious wastes dumped on the land can contaminate surface and ground water supplies and even incomplete combustion of health care waste can lead to toxic emissions, thus exposing the entire population to the risk of diseases.⁵

The so-called disposable plastic syringes if recycled indiscriminately, can become a potential source of infections [like Hepatitis 'B' virus (HBV), Hepatitis 'C' virus (HCV), and Human immunodeficiency virus (HIV)] not only to the patients but also to the workers who are recycling the syringes. As a result of the re-usage of unsterilized syringes, 8–16 million hepatitis B, 2.3 to 4.7 million hepatitis C and 80, 000 to 1, 60, 000 human immunodeficiency virus infections are estimated to occur yearly. World Health Organization has estimated that the incidence of hospital acquired infections to be about 10% in South East Asia Region.^{6,7}

Even after the implementation of bio-medical wastes rules (management and handling) in July 1998, the condition remains more or less unchanged. It can be attributed to lack of knowledge, resources and enforcement of the regulations.⁴

The indiscriminate and unregulated dumping of health care waste (especially waste sharps) exposes the rag pickers, waste handlers, and children playing in dumpsters to accidental injuries with needles and syringes potentially contaminated with human immunodeficiency virus and Hepatitis B virus.

Majority of the problems arising due to improper handling and disposal can be avoided if the health care waste management is properly managed. The activities that are commonly done in the health care waste management are segregation, storage, collection, transportation and disposal of health care waste.

It encompasses, planning, organizational, administrative, financial, legal, engineering aspects and human resource development and their management involves inter-disciplinary relationships.⁸

While health care establishments and other hospitals in developed countries conform to certain safety standards laid out by regulatory bodies on collecting, transporting and disposing of health care wastes, the same is not often true in developing countries including India where the level of awareness about the adverse impact of improper disposal of such waste is low, the regulatory tools are inadequate and the skills, resources and necessary motivation are absent.

Various studies on health care waste management in urban areas of India have been conducted to understand the problem of health care waste management whereas in the rural areas very few studies have been undertaken.

The present study was undertaken to assess the state of health care waste management in Nagamangala Taluk of Mandya District, which is predominantly a rural area.

OBJECTIVES: The study was undertaken in the selected health care centres with the following objectives:

1. To assess the type and quantity of health care waste generated.
2. To assess the present state of health care waste management.

ORIGINAL ARTICLE

STUDY AREA: The health care centres/units of Nagamangala Taluka of Mandya District of Karnataka State were taken for the study.

STUDY PERIOD: The study was conducted from January 2004 – June 2005 over a period of one and a half years.

SOURCE OF DATA: The relevant data was collected from 50 of the total 57 health care centres/units in Nagamangala taluk.

METHOD OF COLLECTION OF DATA: A pre tested checklist was used to conduct the study. The type and quantity of waste generated in each health care centres/units was assessed by the following methods:

- Prior to the start of the study, the concerned staff members for waste disposal were explained about the study and requested to store the waste for 24 hours and not to dispose the same till the interviewer met them on the next day for weighing, after which they could dispose the waste. They were requested to follow the same for 7 days.
- The waste that was stored, if not segregated was physically segregated using appropriate personal protective measures. After segregating the waste, the waste was weighed using a calibrated Braun weighing machine. The weight of waste was documented in the paper by rounding off to the nearest zero value.
- Some waste materials could not be weighed on the weighing machine as they were too light to be weighed by the machine. For these waste materials, a calibrated electronic weighing machine pre-recorded the weight of individual waste material and the same was multiplied with the number of that waste.

Next, the state of health care waste management in each health care centre/unit was observed and studied by using the pre-tested checklist. The obtained data was tabulated and the results are presented as percentages.

RESULTS AND DISCUSSION:

Sl. No	Type of Health care centres/units	Number
1	Medical college teaching hospital	1
2	Taluka hospital	1
3	Ayurvedic hospital and Unani clinic	2
4	Primary Health Centres	6
5	Primary Health Units	5
6	General practitioner's clinics	16 □
7	Dental clinics	4
8	Private laboratories	7
9	Veterinary health care centres	8
Total		57

Table 1: List of Health care centres/units covered by the study

(Of the 23 General Practitioners, 16 consented for the study)

ORIGINAL ARTICLE

Of the 57 health care centres/units, 50 were taken up for the present study, as the remaining 7 health care centres/units, all of them General Practitioners did not consent to participate in the study.

The consenting health care centres including the veterinary health care centres were divided into seven groups as shown below for ease of tabulation and analysis of the data.

Groups	Health care centres/ units	Number
Group -1	Medical college teaching hospital	1
Group - 2	Taluka hospital, Primary Health Centres and Primary Health Units	12
Group - 3	General practitioners' clinics	16
Group - 4	Dental clinics	4
Group - 5	Veterinary health care centres	8
Group - 6	Private laboratories	7
Group - 7	Ayurvedic hospital and Unani clinic	2
Total		50

Table 2: Distribution of Health care centres/units under various groups

A total of 828 staff belonging to different cadres as shown in the table was working in the health centres/units at the time of the study. Of them, 399 (48.2%) were doctors, 91 (11%) were nursing staff, 29 (3.5%) were laboratory technicians, 17 (2.1%) were pharmacists and 292 (35.2%) were the non-professional/non-technical staff.

As per the guidelines given by the biomedical waste management rules 1998, the wastes are classified into 10 categories. Out of these categories of waste, category 1 to 7 were included in the present study and the remaining category 8 (liquid waste), category 9 (incineration ash) and category 10 (chemical waste) were not quantified in the present study because it was not practically possible to quantify these categories of waste.

Groups of Health care centres/ units	Waste category (gms/pt/day)								Wt. of waste
	Cat 1	Cat 2	Cat 3	Cat 4	Cat 5	Cat 6	Cat 7	General waste	
1 n = 1	71.7 (20.8)	0	30 (8.7)	5.3 (1.6)	33.3 (9.7)	33.3 (9.7)	36.7 (10.3)	133.3 (38.8)	343.7
2 n = 12	0.9 (6.5)	0	0.04 (0.3)	4.6 (34.3)	0.08 (0.5)	1.5 (11.5)	2.2 (16.5)	4.1 (30.5)	13.6
3 n = 16	0	0	0	6.6 (56.2)	0.04 (0.4)	0.7 (6%)	0.96 (8.3)	3.4 (29.1)	11.7
4 n = 4	0.4 (6.8)	0	0	0.6 (12.4)	0	0.9 (17.6)	0.4 (7.8)	2.9 (55.4)	5.3
5 n = 8	0	0	0	2.5 (20)	0.1 (0.8)	0.4 (3.4)	2.2 (17)	7.46 (58.8)	12.7
6 n = 7	0	0	0	1.3 (28.5)	0	0.6 (12.9)	0.1 (3.4)	2.6 (55.2)	4.7
7 n = 2	0	0	0	0	0	0.4 (12.5)	0	2.9 (87.5)	3.3

Table 3: Quantity of various categories of waste produced by the various groups of health care centres/units

(Figures in parantheses are percentages)

ORIGINAL ARTICLE

The waste being generated in the Medical College hospital (Group 1) was 343.7 gms/pt/day and was high compared to other groups. This is in agreement with the study conducted by Tolerance Samuel P.M and Giri P John which had observed that the rate of generation of health care waste is high in hospital attached to the medical college.⁹

Other studies in India have observed the quantum of health care waste generated/patient/day to range from 0.5 to 3kg.^{2,10,11,12,13} The waste generated in the different groups in our study was comparatively low. This may be because the character and the quantum of waste generated vary widely from country to country and region to region as indicated by several surveys.¹⁴

It is said that an average of 1 to 8% of the health care waste would be waste sharps.¹⁴

In the present study, the quantum of waste sharps was generally higher in all the group of health care centres, except in group 1 where it is only 1.6% of the total waste generated. The higher quantum of sharp wastes in other groups may be because the generation of waste sharps depends on patient profile and the existing practices regarding injections. According to many authors, general waste is estimated to constitute about 60 to 85% of the total waste.¹⁵ But in the present study the quantum is comparatively less.

Out of 50 health care/units, the segregation of human anatomical waste was being done only by group 1 and group 2 i.e., 13 (26%) health care centres/units. Similarly, the safe transportation of this waste and appropriate final disposal options were adopted by 7 (14%) health care centres/units only. Containment of this waste in proper colour coded container/bins was observed in only 1 (2%) health care centre/unit i.e., in group 1 (medical college teaching hospital).

Disinfection was not done for this waste in any of health care centres/units. Group 3, group 5 and group 7 do not generate this waste. In group 4 and 6, appropriate mode of management of category 1 waste does not exist. Anuroopa S.M. and Ramakrishnagowda B., in their studies have also observed that the management of human anatomical waste was not being done appropriately.^{16,17}

Groups of health care centres /units	Segregation & collection	Colour coded bin	Disinfection	Disfigurement	Transportation	Final disposal
1 (n = 1)	1	1	1	1	1	1
2 (n = 12)	3	3	3	1	3	0
3 (n = 16)	1	0	0	0	0	0
4 (n = 4)	0	0	0	0	0	0
5 (n = 8)	0	0	0	0	0	0
6 (n = 7)	0	0	0	0	0	0
7 (n = 2)	NA	NA	NA	NA	NA	NA
Total (n = 50)	5 (10%)	4 (8%)	4 (8%)	2 (4%)	4 (8%)	1 (2%)

Table 4: Mode of management of category 4* waste (waste sharps) by the various groups of health care centres/units:

* Category 4 waste- Needles, syringes, scalpels, blades, glass etc., that may cause puncture and cuts.

All the steps in safe management and disposal of sharps (cat 4 waste) were being practiced only in the medical college hospital (Group 1). The neglect of segregation as a practice with respect to waste sharps may increase the risk of acquiring infection among the waste handlers at different

ORIGINAL ARTICLE

stages. In USA, the injuries from waste sharps among hospital staff are reported to be 180/1000/year. These figures are likely to be higher in India.⁴

Out of 50 health care centres/units, the segregation of soiled waste (Category 6) is being done by group 1 (medical teaching college hospital) and 3 health care centres/units of group 2 (taluka hospital and 2 primary health centres) i.e., 4 (8%) health care centres/units. Containment of this type of waste in proper colour coded bin, disinfection, disfigurement and transportation of the same was observed in 3 (6%) health care centres (i.e., by group 1 and 2 health care centres/units group 2).

The final disposal options were observed in only group 1.

Group 3, group 4, group 5, group 6 and group 7 do not practice these modes of management for this category of waste. The soiled wastes were being disposed casually.

Out of 50 health care centres/units, segregation of category 7 waste was observed in 16 (32%) health care centres/units i.e., group 1 (medical college teaching hospital), 2 health care centres/units of group 2 (in PHC and taluka hospital) and group 3 (13 health care centres/units). Containment of this type of waste in proper colour coded bin/container was observed in 3 (6%) health care centres/units i.e., group 1 and 2 health care centres/units group 2 (in PHC and taluka hospital).

Disinfection and disfigurement of this waste was not done in any of the health care centres/units. The final disposal options were not present in any of health care centres/units. It was also seen that category 7 waste was segregated because of the economic value i.e., as this waste was collected by a vendor and the same was sold to the contractor who reclaimed the hospital waste for recycling purposes.

Most of the time, disposable equipment was discarded without disfiguring and thus there remains the risk of being recycled by rag pickers in collaboration with hospital staff. Often, newspapers and television report the recycling rackets flourishing in the country. The disposables are recycled and repacked under standard company brands.¹⁸ In addition to the problem of recycling of hospital disposables, sharps injuries sustained by rag pickers also lead to spread of infectious diseases like hepatitis B virus, hepatitis C virus and human immunodeficiency virus.¹⁸

Only 7 (14%) health care centres/units out of total 50 health care centres/units

Practiced disinfection of liquid waste (Category 8) before disposal. The underground drainage system was observed in 21 (42%) health care centres/units. The management of liquid waste was inappropriate in majority health care centres/units. A study reported that 95% of study institutions practiced underground drainage disposal of liquid waste without disinfection.¹⁶ The liquid waste when let into sewers can also lead to water pollution, and may spread the disease causing agents if not properly and adequately treated.¹⁹

Appropriate colour coded bins for collection of health care waste as required was present only in the medical college hospital (Group 1). In a study, it was observed that 93% of containers were plastic and the remaining 7% of containers were cardboard boxes and another study observed that a total of about 65% and about 35% of the study institutions were having containers with lid and without lid respectively.^{16,20}

Containers with lid help in appropriate containment of waste; they would not only help from the aesthetic point of view, but would act as barrier for various vectors from accessing the contents and spreading the pathogens of infectious potential.²⁰

ORIGINAL ARTICLE

Out of 50 health care centres/units, 47(94%) health care centres/units were manually transporting the waste to the site of final disposal. Only in 3 (6%) health care centres/units the containers and trolley were being used for transportation of waste to the site of final disposal.

In a study, it was observed that transportation of waste was done manually.²¹

In another study, transportation of waste by waste collection rickshaw with containers was observed.²²

Of 50 health care centres/units, 27(54%) health care centres/units burn the waste in the open field and 21(42%) health care centres/units throw the waste indiscriminately within and around their premises. Only 1(2%) health care centre/unit uses incineration as disposal option and another 2 (4%) health centres/units use burial as disposal options. 2 (4%) health centres/units dump the waste in public bin.

In a study, it was observed that all waste was dumped in concrete bin and was subjected to open burning.²¹

Another study reported that a large number of hospitals dump the waste in public bins, sides of roads, surroundings of hospital, city corporations waste collection site and in rivers or canals.⁵

It is observed that only 2 (4%) health care centre/units had both infection control committee and waste management committee.

A study reported that only 5 (3%) study institutions had infection control committee and 4(3%) study institutions had waste management committee.

It was observed that out of 50 health care centres/units, 9 (18%). health care centres/units i.e., 1 in group 1, 4 in group 2 and 4 in group 5 used aprons as personal protective measures, masks were used by 6(12%) health care centres/units i.e., 1 in group 1, 4 in group 2 and 1 in group 4 and gloves were used by 19(38%) health care centres/units i.e., 1 in group 1, 8 in group 2, 4 in group 4 and 6 in group 5. The soap and water were provided by 41(82%) health care centres/units. Immunization (against TT and Hepatitis B) was observed in 32 (64%) health care centres.

In a study, it was observed that the staff were using apron in 2%, gloves in 20% and footwear in 69% of study institutions.¹⁶

These measures essentially protect health care workers from blood borne infections caused by human immunodeficiency virus, hepatitis B virus and hepatitis C virus.¹⁴

Although heavily relied upon, personal protective measures are often used without adequate training or a full understanding of its limitations. Since personal protective measures can give its wearer a feeling of confidence in the face of hazardous situations, the inappropriate selection or misuse of these measures can cause overexposure, illness or death.⁴

Employees are not protected and are not trained to wear boots, hand gloves, eye cover and they work barefoot amidst hospital wastes, thereby exposing themselves to injuries with sharps and needles⁴ Viral hepatitis B infections have been reported among health care personnel and waste handlers and immunization against the disease is therefore recommended. Tetanus immunization is also recommended for all personnel handling waste.¹⁴

CONCLUSION AND RECOMMENDATIONS: The study has revealed that the management of health care waste in the health care centres/units of Nagamangala taluk is not satisfactory and does not meet the guidelines of the act. It is imperative that the concerned authorities act in concert with the concerned stakeholders to improve the situation and impress upon them about the need for

ORIGINAL ARTICLE

appropriate health care waste management as per the act. To achieve quality in disposal of health care waste of the health care centres/units should have a transparent holistic approach in medical services. This should include management of their waste in an environmentally friendly manner.

REFERENCES:

1. ISHWMCon 2001. Safe management of health care waste, safe management of health care waste-Selected resources, The Indian society of Hospital Waste Management, 2001: 15.
2. Health Care Waste Management Cell. Information and learning units for safe management of Health care waste, Health care waste management cell, Dept. of Community Medicine, MSRMC, Bangalore, 2003.
3. Environmental Management and Policy Research Institute (EMPRI). Bio medical Waste Management, EMPRI Publishers, 2004.
4. Acharya D.B., and Singh Meeta. The Book of Hospital Waste Management, Minerva Press, New Delhi, 2000.
5. Akter Nasima, Hussain Zakir, Trankler Josef, and Parkpian Preeda. Hospital Waste Management and It's Probable Health Effect: A Lesson Learned from Bangladesh, Indian Journal of Environmental Health, 2002; 44 (2): 124 – 137.
6. Aggarwal K. K eds. Hospital waste- a source for AIDS, Indian Journal of Clinical Practice, 1995; 5 (8): 9.
7. ISHWMCon-2001. Safe management of Health care waste, Health care waste management cell-Original contribution, The Indian Society of Hospital Waste Management, 2001: 27 - 31.
8. Pruss A and Townend W.K. Teacher's Guide, Management of wastes from health care activities, World Health Organization, Geneva, 1998.
9. Tolerance Samuel P.M and Giri P. John. Hospital Waste Management, Indian Hospital Administration, 1999; 36 (1 & 2): 71 – 72.
10. ISHWMCon-2001. Quantification and characterization of health care waste, Health care waste management cell-Original contribution, The Indian Society of Hospital Waste Management, 2001:32-40.
11. Basu R.N. Issues involved in hospital waste management-An experience from a large teaching institution, Journal of Hospital Administration, 1995; 7-8:79-83.
12. Murali R and Kanagavel M. Hospital Waste Management, Indian Journal of Community Health, 1995; 1: 79-80.
13. Nath K. J. Environment and Health: Challenges of New millennium, Indian Journal of Public Health, 1999; 43 (3): 96-99.
14. Pruss A, Cirouit E, and Rushbrook P. Safe management of wastes from health care activities, World Health Organization, Geneva, 1999.
15. Nath S et.al. Hospital Waste Management-An Integrated Approach, Sulabh International Institute of Health Hygiene, New Delhi, 1998.
16. Anuroopa S.M. A Study on Hospital Waste Management in Davangere city, a Dissertation submitted to the Rajiv Gandhi University of Health Sciences, Bangalore, Department of Community Medicine, J.J.M. Medical College, Davangere.

ORIGINAL ARTICLE

17. Ramakrishna Gouda B. Determinants for Safe Management of Health Care Waste, a Dissertation submitted to the Rajiv Gandhi University of Health Sciences, Bangalore, Department of Community Medicine, M.S.Ramaiah Medical College, Bangalore.
18. Acharya D.B and Sharma Sarika. Disposable plastic in hospitals: A boon or a curse? Journal of ISHWM, 2004; 3 (1): 30 – 32
19. Khan F.M. Hospital Waste Management: Principles and Guidelines, 1st ed, Kanishka Publishers, Distributors; New Delhi: 2004.
20. Ramakrishna Gouda B. et.al. In house waste containment efforts in select health care institutions of Bangalore city, Journal of ISHWM, 2003; 2(1): 24 – 27.
21. Singh Zile. Bio-medical Waste Management in Teaching Hospital: An Experience, Journal of ISHWM, 2003; 2(1): 20-27.
22. Arora H.S.R. Command Hospital AF Bangalore: Hospital Waste Management, Journal of ISHWM, 2002; 1(1): 42-48.

AUTHORS:

1. Maheshkumar M. Shindhe
2. Harish B. R
3. Suresh Lankeshwar

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Community Medicine, Belgaum Institute of Medical Sciences.
2. Associate Professor, Department of Community Medicine, Mandya Institute of Medical Sciences.
3. Professor and HOD, Department of Community Medicine, Adichunchanagiri Institute of Medical Sciences.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Harish B. R,
Associate Professor,
Department of Community Medicine,
Mandya Institute of Medical Sciences,
Mandya-571401
Email: harishmims@gmail.com

Date of Submission: 26/09/2014.
Date of Peer Review: 27/09/2014.
Date of Acceptance: 08/10/2014.
Date of Publishing: 10/10/2014.