Volume – 12 Issue – 01
September 2013

# JOURNAL OF THE
# INDIAN SOCIETY OF HOSPITAL WASTE MANAGEMENT

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**Indian Society of Hospital Waste Management**

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*For Private Circulation only*

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## PRESIDENT'S MESSAGE

The UN Basel Convention has identified health care waste as the second most hazardous waste after radioactive waste. There are not very many countries which have made significant contributions in this field. India is one of them, especially in south East Asia. India was the first country to have legislation on bio-medical waste in 1998.The Indian Society of Hospital Waste Management (ISHWM) was formed soon after, in the year 2000. Air Marshal (retd) L K Verma as founder President ISHWM nurtured it for long time and made sincere efforts to bring it to a centre stage. Today, ISHWM has distinguished membership spread across the country. The ISHWM and its members have been on Board of National and International agencies, namely, Government of India, WHO, UNDP, UNIDO and others. ISHWM contributed in the planning and development of IGNOU's six month duration Certificate Programme in Health Care Waste Management (CHCWM) through distance learning.

It is heartening to note that WHO, SEARO has recently signed an Agreement for Performance of Work (APW) with ISHWM to undertake a multicentric research study "On Linkage between Hospital Associated Infections and Health Care Waste". Further, as many of you are aware that the 2nd Edition of the WHO HQ Geneva's famous Blue Book "Safe Management of Waste from Health Care Activities", January 2013 has been published. It is like a global Bible on HCWM. The President ISHWM has authored Chapter 13 in the Blue Book.http://www.healthcarewaste.org.I would recommend that you should download it and read at your convenience.

The ISHWM has a great repository of experts and talent across in HCWM the country. The last ISHWMCON 2012 at Yenepoya Medical University, Mangalore was a great success. I am grateful to KGMU, Lucknow to take a laudable initiative to host ISHWMCON 2013.I am also grateful to WHO, SEARO specially Mrs Payden to support our conferences and take initiative to invite delegates from number of SEA countries.

I am sure the delegates and students will be immensely benefited by way of rich scientific deliberations, presentations and interactions during this conference and through this coveted Journal which will be ejournal from this issue.

Wish you all Merry X-Mas and Happy New Year.

**Prof Ashok K Agarwal MD, DNB, DHSA (UK)**
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## EDITORS PAGE

**Esteemed readers and members of ISHWM!**

It brings immense pleasure to the editorial board to bring out this issue of the Journal of ISHWM (Vol 12 No1 September 2013).

Interesting experiential articles are the highlight of current issue. Situation of Health Care Waste Management in Primary Health Care setting portrayed in three articles – from Chikkaballapur District, Anekal Taluk, Udupi Taluk in Karnataka is probably representative of picture in Primary Health care system in Karnataka and rest of India. It is good to see research articles from Government Health system. Proposal to consider pasteurization of water is an attempt towards innovation by Dr Ramesh of Karnataka Pollution Control Board. Dr Arpana traces chronicles of mercury. There are articles on mercury and plastic management from MS Ramaiah Dental College and Bangalore Medical College. Dr Ramakrishna Goud takes us through grey areas of health care waste management. Dr S Kumar, President, Medical Education, Gokula Education Foundation, Bangalore makes silent contribution through inspiring quotations across the Journal.

From this issue, the Journal of ISHWM will be an e- Journal and will be hosted in website from second week of Dec 2013. The editorial board seeks support of all readers to help in designing, developing, updating an email directory of all ISHWM members and readers who subscribe to the Journal. The editorial board invites research articles, useful information on trainings, conferences, resource materials and educational materials, documentation of innovations made from across the South East Asia Region. Please help us develop the Journal, further.

Indeed it has been a tough job to bring out the journal on time. The Governing Council of ISHWM and Faculty and Post graduate students of the Dept. of Community Medicine, and friends of Health Care Waste Management Cell, MS Ramaiah Medical College have extended their support to make it possible to bring out this issue, as in the past.

We thank the readers for their continued support and participation through the forum created by ISHWM.

Merry Christmas and Happy New Year!

With warm regards

**Dr Sreekantaiah Pruthvish**

**Hon Chief Editor, Journal of Indian Society of Hospital Waste management**
**Chairperson – HCWM Cell, Professor of Community Medicine, MS Ramaiah Medical College, Bangalore 560 054, Mobile: 0091 9901042731, Email: psreekantaiah@yahoo.com**

**ORIGINAL ARTICLE**

# MANAGING BIO MEDICAL WASTE GENERATED AT HOUSEHOLDS – AN UNADDRESSED PUBLIC HEALTH PROBLEM IN INDIA.

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## ABSTRACT

***This article reflects on the current situation of management of household health care / biomedical waste in India. It reviews the efforts made in USA and Europe to address this issue and proposes 10 steps method for building a system to manage medical waste generated at a household level.***

## INTRODUCTION

Households generate Bio Medical Waste just like hospitals, nursing homes, laboratories and other health care settings like veterinary centers. This waste is generated when a sick person is managed at home post discharge from a hospital or a stand-alone domiciliary basis. In addition the waste is also generated when persons are treated for short term ailments like respiratory (acute respiratory tract infections) or gastro intestinal infections (diarrhea) as well as patient on treatment for chronic diseases like Diabetes or Hypertension. The medical waste thus generated at households due to domiciliary treatment is called Household bio medical waste. [(1)] Currently, there exists no system for managing this waste generated at households especially in India.

The paradigm of health services is changing as there is now an increased focus on early ambulation and early discharge from hospitals of patients undergoing even major surgeries, for e.g. Breast cancer, total knee replacement, coronary artery bypass graft, Laparotomies and patients on entero-stoma systems etc. [(3, 4)] This means patients have to continue to take injectable medicines like antibiotics, insulin and other support medications at home including dressing of wound, surgical or otherwise. All of these result in generation of medical waste at households. [(5, 6)]

The existing Bio Medical Waste Management Rules, 1998 addresses waste generated at health care settings only. [7] The Solid Waste Management Rules 2000 [8] also does not address the biomedical waste generated at households. Therefore, there is an urgent need to focus on this problem area.

Currently in our country, the medical waste generated at a household finds its way into municipal solid waste system thereby putting the health of municipal solid waste workers and the informal sector of rag pickers at a high risk. [1, 3, 5, 6] The scenario was also discussed among the experts working in the field of Bio Medical Waste and Solid Waste Management in City of Bangalore during the month of April 2013 during launch of *Kasa Muktha(Waste Free) Bangalore*(KMB) initiative coordinated by Health Care Waste Management Cell, MS Ramaiah Medical College in collaboration with Mrs. Kalpana Kar, convenor of KMB.

**Efforts at managing Household Health Care Waste in USA and Europe**

In the State of Hawaii, USA, the Office of Solid Waste Management has come out with a Fact Sheet cum tips for managing household healthcare waste. The focus here being on waste sharps containment. Disposing of used sharps and syringes isn't simple, especially for patients at home. The EPA promotes containment of waste sharps in puncture proof containers or use of custom made sharp containers. [5, 7, 8] Therefore, generators can't simply toss them into the trash or recycling bin, even if they're inside a plastic bottle. That would endanger municipality's waste handlers and pose potential hazards to children, pets, and others. In some states – notably California, Oregon, and Wisconsin – it is illegal to dispose of syringes and needles this way. [5, 6, 9] Few states in USA ask the household generating medical waste to contain them separately and the generators are charged an additional amount for collecting the same.

In United Kingdom, the Department of Health published a best practice guide to the management of healthcare waste. The guidelines states that healthcare waste produced in a household should never be disposed of in the domestic waste stream. If patients are treated in their homes by a community nurse or a member of the National Health System (NHS), any waste produced as a result is considered to be the healthcare professional's waste. If patients treat themselves in their own home, any waste produced as a result is considered to be their own. Only where a particular risk has been identified (based on medical

diagnosis) does such waste need to be treated as hazardous clinical waste. Local authorities have a duty to collect household waste including healthcare waste from domestic properties. Under the controlled waste regulations, the authority may charge for the collection of specific waste streams, including clinical waste.

However sanitary towels, nappies and incontinence pads (known collectively as sanpro waste) which are not considered to be hazardous when they originate from a healthy population, the municipal authorities are responsible for clearing the same. If the waste is classified as hazardous, the healthcare professional can remove that waste and transport it in approved containers (i.e. rigid, leak proof, sealed, secured etc.) and take it back to the trust base for appropriate disposal. [10]

**Ten Steps to a system for managing Biomedical Waste generated at households**

*Step 1* – Identify and list the medical waste items commonly generated in household through a survey.

*Step 2* –Assess the approximate quantum of this commonly generated medical waste items at household level.

*Step 3* – Enlist and characterize medical waste items at household level. For example syringes, tablet foils, syrup bottles etc and its character in terms of their recyclability, reusability, injury potential, infectious potential, incinerability, etc.,.

*Step 4* – Decide and finalise the number of categories of household medical waste for the purpose of segregation at point of source. The 'final to be segregated categories' of waste, could be limited in scope when compared to the norms mentioned under BMW (m&h) Rules, 1998.

*Step 5* – The specific nomenclature for the "final segregated categories" of waste is to be based on the agreed treatment and disposal options suitable for managing household medical waste. The treatment and disposal options that could be considered for managing household medical waste could preferably be four viz.: a. Landfill, b. Incineration, c. Recycling and d. Waste Sharps being contained in Puncture Proof Plastic Containers (PPC) with Concentrated Bleach Solution (PET bottles with screw cap). Few subsystems like disinfection of waste at the point of generation (for example plastic syringes contained in blue or red colour coded containers with bleach solution) done efficiently in health centers,

may not be feasible, possible or acceptable at household level.

*Step 6* – Arrive / Decide on color codes for the three "categories". Suggested colour coding system is Black for Landfill Waste; Yellow for Incinerable Waste; Blue for Recyclable Waste (if it is only plastics) and PPCs for Waste Sharps. Bio Hazard symbol to be used on containers.

*Step 7* – Decide on waste containment at the household (point of generation) and its subsequent "transport" from household to "common waste collection point". For eg. Within an apartment, a housing colony or a gated community.

*Step 8* – Consult stakeholders viz., Municipal Corporation Staff and Environmental Officers, operators of Common Bio Medical Waste Treat Facility (common treatment facility), Officers of Pollution Control Board, academia active in the field of BMW management, institutes like Environment Management and Policy Research Institute-EMPRI and Non-Governmental Organizations/Citizen groups associated with waste management issues and discuss regarding the plan of waste management both within households and outside households.

*Step 9* – Plan and undertake a pilot endeavor to finalize the systems for safe management of biomedical waste from households

*Step 10* – Undertake and plan an information dissemination activity about the system

## CONCLUSIONS

Households generate Bio Medical Waste and the quantum of BMW originating from household is likely to increase with shifting paradigm of health systems where focus is on early ambulation and early discharge. The increasing burden of chronic non communicable diseases adds to the existing problem. Currently this waste stream gets mixed with municipal solid waste there by increasing the risk of injuries to workers engaged in managing solid waste. Countries in Europe like United Kingdom and various states of USA have recognized this concern and are sensitizing citizens and communities to manage household medical wastes. In India, Household medical waste management is an unaddressed problem. The existing BMW (m & h) Rules 1998 and Draft BMW (m & h) Rules 2011 have left out household from the ambit of the rules. To bridge this gap we have proposed a 10 step for addressing this concern.

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## ACKNOWLEDGEMENTS

Mr.Srinath and Mr.Nagaraj of Maridi Eco Industries and Semb Ramky Common Bio Medical Waste Treatment Facilities respectively, Bangalore. (Jun 2013). Dr.Hemanth T and Dr.Suman G of Health Care Waste Management Cell, MS Ramaiah Medical College, MSRIT Post, Bangalore.(Dec 2012), Mrs.KalpanaKar and members of "Kasa Muktha Bangalore" initiative, Bangalore. (Apr 2013), Training team of Environment Management and Policy Research Institute (EMPRI), Department of Environment, Ecology & Forests, Government of Karnataka. (May-June 2013), Dr. Raj Kumar Amaravathy, Additional Professor of Orthopaedics, St. John's Medical College Hospital, Bangalore-34, Dr.Shashi Kumar. MD, DNB, AFIH. Primary Care Physician and Consultant- Public Health, Hesarghatta, Bangalore, Karnataka.

*"Focus on what you can control*
*The only thing you can control is your performance"*
*---Ken Chenault*
*CEO, American Express*

**ORIGINAL ARTICLE**

# EXISTING PRACTICES OF BIO-MEDICAL WASTE MANAGEMENT IN PRIMARY HEALTH CENTRES OF UDUPI TALUK, KARNATAKA

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## ABSTRACT

***Introduction:*** ***The present study was carried at the Primary Health Centres of Udupi Taluk, Karnataka to identify points of waste generation, document current practices of waste handling and determine the knowledge & awareness of Bio-medical waste among personnel.***

***Methodology:*** ***It was a cross-Sectional Study with complete enumeration method. The respondents were Medical officers, paramedical & auxiliary staff. We used Pre-tested semi-structured questionnaire.***

***Results and Discussion:*** ***7 points of generation were identified viz. Out-patient Department, Injection room, Immunization room, Dressing room, Labor room, Laboratory & Wards. Recommended color coding for waste bins was followed at all 22 PHCs. Disfiguring of used gloves and infected plastics, to prevent re-use was practiced by 47% and 83.3% PHCs respectively. Recapping of needles was practiced at only 27.3% PHCs. All PHCs had an efficient liquid waste management system at the laboratories, connected to a septic tank. 57.2% Group D staff used gloves to handle waste, 31.8% used masks, 4.5% used an apron, 4.5% did not use any personal protective gear. 20 PHCs directly added waste bags to the disposal site. Record keeping was done by the Staff nurse at 8 PHCs. 12 PHCs used an injury register. Training of all the staff was done at 45.5% PHCs & 68.2% PHCs vaccinated their staff against Tetanus and Hepatitis B.***

***Conclusion:*** ***The overall awareness and involvement was found to be high in all PHCs. Regular training/sensitization programmes are recommended be conducted to maintain a high level of involvement and participation of the staff, in accordance with existing guidelines.***

*Keywords* – Bio-medical waste management, Primary Health Centres, disposal.

## INTRODUCTION

Like other industries, healthcare facilities generate various kinds of wastes as a result of a variety of medical treatments and research. In the past 10 years, due to the increased number and size of health care facilities, medical services, and use of medical disposable products, the generation rate of health care wastes has increased rapidly. [1]Therefore institutionalizing effective waste management systems is a key prerequisite

to improving efficiency and effectiveness of healthcare.[2]

Bio-medical waste management is a concern for every health care organization.[3]These wastes pose serious occupational health risks to those who generate, handle, package, store, transport, treat, and dispose them. Proper management of Bio-medical wastes (BMW) can prevent cross infection, and spread of epidemics of infectious diseases.[4]Hence the management of BMW requires diligence from a chain of people though the technologies are available for effective management.[5] For this health team members should be aware of Bio-medical waste management, precautious in practice, careful in management of health and safety, thereby ensuring the health care settings are cleaner, safer and healthier for population they care for.[6]

Motivation and sensitization of waste generators and health care providers to make environment safe for living and to protect them from legal actions for violation of Bio-Medical Waste (Management & Handling) Rules 1998 is a must. [7]

## OBJECTIVES

The following were the objectives of the study:

1. To identify points of generation of Bio-medical waste management at the Primary Health Centres of Udupi Taluk, Karnataka.
2. To document current practices of handling Bio-medical waste at the Primary Health Centres of Udupi Taluk, Karnataka.
3. To determine the knowledge and awareness of Bio-medical waste among personnel at the Primary Health Centres of Udupi Taluk, Karnataka.

## METHODOLOGY

A Cross-sectional study with complete enumeration method was followed at all the 22 Primary Health centres of Udupi taluk, Karnataka during February to March 2012.Informed consent was obtained from the Medical Officer at every Primary Health Centre, as well as the District Health Officer. A questionnaire was used to collect data by personal interviews and observations during the visits (field survey). Details on current practices of Bio-medical waste management were provided by Medical officers, paramedical & auxiliary staff**.** Information so gathered was authenticated by direct observation, and interaction with concerned staff. Data so collected were analyzed, and observations summarized. Descriptive statistics were used and the analysis of data was done with the help of SPSS 15.0. The results are presented as a proportion.

## RESULTS AND DISCUSSION

This study identified the following points of generation in PHCs of Udupi Taluk:

1. Outpatient Department: The outpatient rooms in all the 22 PHCs carried out routine examinations.
2. Injection room: Present in all 22 PHCs visited was being used on a daily basis for routine injections.
3. Immunization room: All 22 PHCs had a separate room equipped for weekly routine immunization of children carried out every Thursday.
4. Dressing room: Present in all 22 PHCs visited, was used for wound dressing, suturing and suture removal during OPD hours.
5. Labor room: Only 19 PHCs had labor rooms. Amongst these 4 PHCs were conducting deliveries and IUD insertions. And the remaining 15 PHCs were using it for IUD insertions.
6. Laboratory: Available at all 22 PHCs visited conducting basic investigations as assigned to laboratories of Udupi district, amongst them 1 PHC was also a Designated microscopic centre under RNTCP.
7. Wards: Amongst the 22 PHCs visited, 4 PHCs did not have wards. IV lines administration were done in the wards.

All 22 PHCs made use of white containers for discarding general/ non-infectious waste like paper, plastic wrappings, card board etc. Yellow containers were used by 20 PHCs for discarding infected waste such as blood soaked cotton, dressings, bandages, gauze etc., while 6 were using it for discarding anatomical waste as well as infected waste too. Blue containers were used for discarding infected plastic such as IV lines, catheters, used gloves at all 22 PHCs visited. The red container used at only 5 PHCs. At 3 PHCs it was used to discard infected waste, at 1 PHC it was used to discard infected plastic and at 1PHC it was used to discard anatomical waste.

At 5 identified points of generation at 22 PHCs, 100% segregation was carried out at the OPD and Dressing rooms, followed by 95.5% at Injection room and laboratory and 90.9% at the immunization rooms. The remaining 2 points of generation viz. labor room were segregating at 17 (89.4%) of 19 PHCS and wards were segregating at 16 ( 88.9%) of 18 PHCs.

Availability of waste containers in OPD and dressing rooms was 100% in the 22 PHCs. The immunization room had the least percentage i.e. 90.9%, and the injection rooms and laboratories had 95.5 % in 22 PHCs. 88.9% in wards of 19 PHCs and 89.5% in labor rooms of 18 PHCs.

At the 22 PHCs, percentage of liners in waste containers at the OPD and laboratory was 100%, followed by 95.2% in the injection room, 90.9% in the

dressing room and 85% in the immunization room. For 19 PHCs with labor rooms, 82.3% had liners in the waste containers, and for 18 PHCs with wards had 81.3% liners.

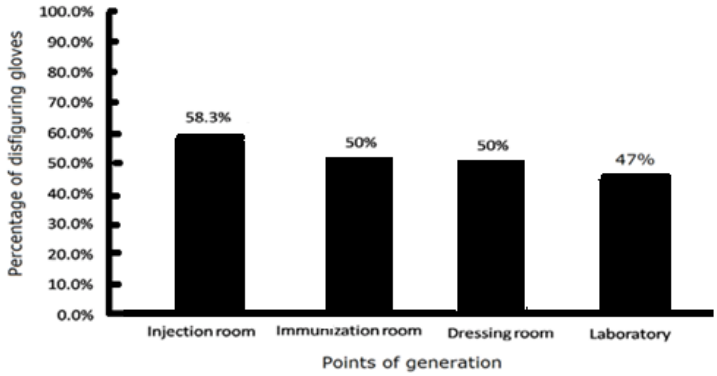
And as per the notice of BMW Rules, [6] presence of displayed written instructions for personnel was present at every point of generation i.e. 100% throughout all 22 PHCs and the instructions were in English or Kannada.

Two allotted timings were followed by all PHCs for collection of wastes from every department. These timings were either in the morning around 9 am - before opening time and afternoon around 4.30 pm - after closing time. 10 PHCs were following the morning schedule, while 12 were following the afternoon schedule.

Only 2 (9.1%) had designated storage area for keeping waste before final disposal, while the remaining 20 were directly adding the waste bags to the disposal site, as compared to the Rajasthan Health Systems Development Project which had storage areas in 80% of the facilities studied.[8]

None of the PHCs surveyed dumped their waste in municipal dustbins or made use of open dumps, sanitary landfills or outsourced the waste. 21 (95.5%) PHCs used deep burial pit as their site of final disposal. And 1 (4.5%) PHC which was functioning from the private building burnt the waste. The study also showed that 19 (90.5%) of the deep burial pits were covered, while none were fenced.

**Graph 1: Percentage of PHCs practicing disfiguring of used gloves**




Graph 1 shows the percentage of disfiguring of gloves practiced after use at the 5 identified points of generation, highest was 58.3% i.e. 7 out of 12 PHCs at the injection rooms, and 47% i.e. 8 out of 17 PHCs was the lowest at laboratories. The immunization room practiced disfiguring in 50% i.e. 4 out of 8 PHCs

and similarly the dressing room with 50% i.e. 11 out of 22 PHCs. The remaining 2 points of generation viz. labor room and wards were disfiguring 47.4% i.e. 9 out of 19 PHCs and 50% i.e. 4 out of 8 PHCs.

Similarly practice of cutting the infected plastic used in the wards like IV lines, infusion sets, tubings, catheters etc. was being done in 15 (83.3% ) PHCs.

100% of the injection rooms made use of puncture-proof plastic containers to collect sharps, 21 (95.5%) Immunization rooms made use of puncture-proof containers and the remaining 1 (4.5%) added the sharps to the waste container with a liner. At the laboratories 1 (4.5%) PHC added the sharps in to the waste containers with a liner, 1 (4.5%) in card-board box and 20 (90.9%) in puncture-proof sharps containers.

Findings by Verma *et al*., showed that of the HCFs surveyed, 81.2% did not collect sharps in puncture-proof plastic containers. They observed that sharps were collected in bags without bins, thus exposing waste handlers to sharps injuries.[9]

At 22 PHCs, 18 (85.7%) were adding 1% sodium hypochlorite solution to the sharps containers in the immunization room, 19 (90.5%) in the laboratories and 18 (95.5%) in the injection rooms. A survey conducted in Ain Shams University Hospitals, Egypt, revealed that the most common cause of needlestick injuries in Egypt occurs during recapping of needles after use.[10]In this study72.7% (16) PHCs were not recapping of needles. However, in the remaining PHCs recapping of needles was done.

All 22 PHCs (100%) had a liquid waste management system at the laboratories. These were connected to the septic tank in 100% PHCs. As compared to a study done by Banerjee *et al*., where 86.7% HCFs discarded their liquid waste in the drains.[11]

According to IMEP guidelines, floors should be washed daily with water and soap and areas such as Operation theatre and Labor room should be washed with disinfectants. [2] During the study it was seen that, all 22 PHCs followed both procedures, and a majority of 86.4% were using disinfectants throughout the PHC. Also all 22 PHCs made use of bleaching powder solution to clean spills.

In case of linen cleaning, 12(54.5%) PHCs had a separate area for washing of soiled linen and lab coats used in the laboratories while the remaining 10 (45.5%) were making use of toilet/bathroom and other open areas.

All 22 (100%) PHCs visited had a documented waste management plan. As

per BMW Rules, record keeping was followed by 100% PHCs. A study done in the Union Territory of Pondicherry, reported only 9.02% maintaining a register for waste disposal. [12]

**Table 1: Personnel in charge of record maintenance at the PHCs (N=22)**

| Personnel in charge | Number | Percent |
|---|---|---|
| Staff nurse | 8 | 36.4 |
| Lab technician | 5 | 22.7 |
| Medical officer | 3 | 13.6 |
| More than one person | 6 | 27.3 |
| Total | 22 | 100.0 |

**Table 2: Personnel in charge of preparing 1% sodium hypochlorite solution at the PHCs (N=22)**

| Personnel in charge | Number | Percent |
|---|---|---|
| Group D | 17 | 77.3 |
| Staff nurse | 3 | 13.6 |
| Headquarter ANM | 1 | 4.5 |
| Staff nurse and Group D | 1 | 4.5 |
| Total | 22 | 100.0 |

Of the 22 PHCs, a record of waste management was being maintained by Staff nurse at 8 (36.4%) PHCs. Also at 27.3% PHCs records were being maintained by more than one person.

8 (36.4%) of the PHCs were directly sending their report on waste management to the prescribed authority- Karnataka State Pollution Control Board. 2 (9.1%) were sending it to the District health office and a large number i.e. 12 (54.5%) were only maintaining waste management records.

The BMW Rules state that fresh solution of 1% sodium hypochlorite solution should be made in each shift. [13] In this study, 21 (95.5%) out of 22 PHCs were carrying it out daily, while 1 PHC was carrying it out weekly.

From Table 2, it is seen that Group D was in charge of preparing 1% hypochlorite solution in 17 (77.3%), followed by Staff nurse at 3 (13.6%) PHCs.

Group D staff was in charge of waste handling in all 22 (100%) PHCs visited.

59.2% of the waste handlers were using gloves and 31.8% were using masks. 4.5% made use of an apron. Eye shields and long boots were not used at the 22 PHCs. Also 4.5% stated that they do not use any type of personal protective equipment to handle waste, which puts them at a risk while handling waste. In the study done by Srivastav *et al*. 30% waste handlers were using gloves and 11% were

using masks while handling the Bio-medical waste. [14]A study done in Vishakapatnam by Sreegiri *et al*, showed that, personal protective equipment and accessories were not used especially by the Group D workers.[15]

Training of all staff regarding Bio-medical waste management was done at 10 (45.5%) PHCs. Findings from a study done by Joseph *et al* in Pondicherry revealed that 88% of the employees have not undergone any training on waste management.[12]

Group D staff at 20 (90.9%) PHCs were aware of the risks related to the waste. While in a study carried out at Sarojini Naidu Medical College, Agra, 37.04% waste handlers were aware of the risk involved in Bio-medical waste handling, but none had received any special training.[14]

All the staff at 14 (68.2%) PHCs were vaccinated against Tetanus and Hepatitis B. A study done in Shiraz city revealed that 92.4% workers have taken vaccine of Tetanus and Hepatitis B.[1]An important universal precaution to contain Hospital Acquired Infections (HAI) is frequent washing of hands by waste handlers after each procedure of waste handling. All the respondents i.e. 100% affirmatively said "yes" to the question.

Maintenance of Injury Register is not only a statutory obligation but also plays an important role in documentation and provision of post exposure prophylaxis (PEP) following an incident of Occupational Accident.[16] In the present study 12 (54.5%) PHCs were making use of injury registers.[17]

## CONCLUSION

The Primary Health Centres of Udupi Taluk may be considered as a good example of Bio-medical waste management. Written instructions in English or Kannada at all points of generation, Timely collection of waste, desirable Infection control methods regarding spills and daily washing were observed. The overall awareness and involvement in BMWM was found to be high in all PHCs especially by the Group 'D' staff. Record keeping was mainly by the Staff nurse. Shortage of consumables (liners, soap, mask, cap, boot, bags, and disinfectants) was observed and logistics of these need to be stream lined. At the disposal site, directly deep burial pits need to be properly secured. Disfiguring of plastic waste and not recapping needles, separate area for washing of soiled linen needs to be made universal etc. Use of

personal protective gear, vaccination etc. should be made mandatory. Assessment of Bio-medical waste management (BMWM) systems at individual institutions should be part of the agenda for monthly meetings to ensure the continued safe management of the waste generated.

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**ORIGINAL ARTICLE**

# PLASTIC BAGS –A VEHICLE FOR MICROBE TRANSMISSION.

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## ABSTRACT

***INTRODUCTION: Bacteria levels found in reused plastic bags are significant enough to cause a wide range of serious health problems and even death. As they are often reused for multiple purposes, there is a possibility of cross contamination of food products and consumer's hands. This study assessed the potential of plastic bags used in hospital environment to cause contamination when reused in the households and hence spread of micro-organisms in the community.***

***MATERIALS AND METHODA cross sectional, study done on 100 plastics bags each from wards of tertiary care hospitals attached to Medical college and from household kitchens. Sampling was done by swabbing the entire inner surface of the bags and immediately transported to the Microbiology laboratory where it was cultured aerobically using standard techniques. The results were compiled and statistically analyzed***

***RESULTS: Of the total bags sampled, 100% bags used in hospital yielded micro-organisms while only 37% of the household plastic bags were contaminated. Large numbers of potentially pathogenic bacteria were isolated from both groups of plastic bags. Staphylococcus aureus was the main organism isolated of which 30% were Methicillin Resistant Staphylococcus aureus from both groups of plastic bags.***

***CONCLUSION: Plastic bags used in hospital environment act as a vehicle for transmission of potentially pathogenic organisms to households on reuse.***

**KEY WORDS:** Plastic bags, Nosocomial infection.

## INTRODUCTION

Plastic bags are used to transport food items from house hold to hospital and vice versa. As these bags were reused, and used potentially for multipurpose, the possibility for cross contamination of food products exist.[1] Most of the cross contamination are believed to originate from hospital environment. Cross contamination occurs when pathogens are transferred from one media to another.[1] . The consumers are unaware that plastic bags could cause cross contamination. Plastic bags that are being reused can be a breeding ground for dangerous food borne

bacteria and pose a serious risk to public health [2]

These Plastic bags being non biodegradable can also cause environmental hazards. A significant increase in use of reusable plastic bags without a major public education campaign on how to reduce cross contamination can create the risk of significant adverse public health impact.[2]

Hence this study was done to assess the potential of bags used in hospital environment to cause contamination when reused in the households and hence spread of micro-organisms in the community. The objective of our study was to identify the type of pathogenic bacteria isolated from the reusable plastic bags used in hospital and house hold kitchens and to ascertain the potential role of reusable plastics in spread of hospital acquired infections.

## MATERIALS AND METHODS

A cross sectional study done on 100 plastics bags from wards of tertiary care hospitals attached to Bangalore Medical college and Research Institute and 100 from household kitchen. The plastic bags that were being used by patients who were admitted for more than 48 hours in Medical, surgical and orthopaedic wards were selected randomly. Plastics bags which are used for more than once were only included in the study. 100 plastic bags from households were selected to compare with the hospital bags

Surface sampling was done by swabbing the entire inner surface of the bags .The swab specimens were stored in a sterile test tube and transported to Microbiology lab within 1-2 hours of collection.

Swabs were inoculated onto MacConkey's agar, blood agar and trypticase soy agar, incubated at $37^{o}$C for 48-72 hours according to the standard procedure. If there was no growth then it was incubated for 72 hours. [4]

Antibiotic sensitivity test was by Kirby Bauer's disc diffusion method on Mueller Hilton agar by using Clinical and laboratory standard institute (CLSI) guidelines.[5]

## RESULTS

It was found that 100% bags used in hospital yielded micro-organisms while only 37% of the household plastic bags were contaminated. Large number of potentially pathogenic bacteria were isolated from both groups of plastic bags.

From the hospital plastic bags the commonest organisms isolated was Staphylococcus species 76%, followed by

Enterobacter species 14%, Klebsiella species 6% E.coli 4% and Pseudomonas aeruginosa 4%. From the household plastic bags, the isolates were Staphylococcus species 51%, followed by E.coli 30% and Pseudomonas aeruginosa 19%

Staphylococcus aureus was the main organism isolated of which 30% were Methicillin resistant Staphylococcus aureus (MRSA) from both groups of plastic bags.

The Antibiotic sensitivity pattern of the isolates showed that these organisms were multidrug resistant and similar sensitivities were seen in both the groups of isolates.

**DISCUSSION**

Plastic is convenient, lightweight, unbreakable and relatively inexpensive. However, there are both environmental and health risk from the widespread use of plastics. Reusable bags for transport of groceries from the store to the consumer's home have become popular in recent years. Since these bags are often reused, and used potentially for multiple purposes, there is a possibility for not only environmental risk but also contamination of food products as well as the consumer's hands.

It's estimated that most of spread of infections is from the hospital environment and reusable plastic bags are frequently used by the patients and their attendees to and from the hospital. Reusable bags if not properly washed between uses, create the potential for cross contamination of food. The result of this study indicates that large number of bacteria were isolated from plastic bags. Staphylococcus aureus is the main organism to be isolated and cause for spread of infections.The presence of these organisms in the bags demonstrate that they get contaminated in the hospital environment and are at a potential risk of cross contamination when reused.

Transport of plastic bags from hospitals to house is a route of exposure for transmission of these pathogens. The common use of plastic for other purpose than carrying groceries is also a potential concern. Transport of cloths may result in cross contamination of bacteria such as MRSA.

Unfortunately almost none of them whom we interviewed ever washed these plastic bags. Lack of Public awareness of potential risk seems almost universal. Thus, sudden or significant increase in use of reusable bags without a major public campaign on how to reduce the risk of cross contamination would create the risk of significant adverse public health impacts. Approach such as printed

instructions on reusable bags that they can be cleaned between uses or need to use separate bags for use in hospitals, public service announcements, and health advisories are recommended.

**LIMITATION:**

Potential of the organisms isolated to cause infection in healthy end users of reusable bags could not be assessed and may be taken up as a future study

**CONCLUSION:**

Plastic bags used in hospital environment act as a vehicle for transmission of potentially pathogenic organisms to households on reuse. Washing plastic bags between use and generation of public awareness around this issue will go a long way in reducing infections. Bags made of recycled paper or cloth could be used safely

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*"Being rich is about having money.*
*Being wealthy is about having money and time"*
*--Professor IRV GROUSBECK*

**ORIGINAL ARTICLE**

# ASSESSMENT OF ATMOSPHERIC MERCURY LEVELS BY INDIGENOUSLY DEVELOPED EQUIPMENT IN DENTAL HEALTH CARE SETTINGS IN BANGALORE

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## ABSTRACT

***Background: Dental health care settings use mercury with silver as a restorative material. Reports do suggest the poor mercury hygiene practices among the dental care providers contributing to atmospheric pollution by mercury vapors. Though standards are fixed as permissible levels, there is no evidence to state the safety levels of mercury.***

***Aims and Objectives: To assess the atmospheric mercury levels in preclinical labs among sample of dental colleges using a simple and inexpensive mercury analyzing device in Bangalore city.***

***Materials and Methods: Out of 16 colleges from Bangalore, three colleges were selected based on lottery method. Preclinical conservative dentistry labs were the study venues. The air sample was collected with mercury trapping apparatus and the trapped mercury was measured with atomic absorption spectrophotometer using cold-vapour technique.***

***Results: The peak mercury vapor levels in the 3 colleges were12.03, 32.52 and 18.24 µgm/mm$^3$ and were within in the current limit of 50µg/m$^3$ established by Occupational Safety and Health Administration(OSHA).***

***Conclusions: Measures to minimize the generation of mercury waste as a short goal and total elimination from dental setting as a long term goal should be considered. Until then norms for safer mercury waste management should be strictly adhered.***

## INTRODUCTION:

Mercury is an tantalizing silvery liquid known for its hazardous nature and remains among the top 20 hazardous substances listed on the agency toxic substances and disease registry[1] and has been targeted by the united states environmental protection agency [USEPA] for "virtual elimination[2]". It has been used in health care settings since 100 yrs as a part of dental filling materials, thermometers, batteries, sphygmomanometers and laboratory chemicals. Mercury in dental

setting is used extensively in both training students and treating patients. On mixing with silver alloy an amalgamation of thick mix is formed which forms a very good restorative material. In 1991, the World Health Organization confirmed that mercury contained in dental amalgam is the greatest source of mercury vapour in non-industrialized settings, exposing the concerned population to mercury levels significantly exceeding those set for food and for air.

Brief overview of mercury hazards: Mercury is highly toxic, especially when metabolized into methyl mercury. It may be fatal and harmful if inhaled and harmful if absorbed through skin. About 80% of the inhaled mercury vapour is absorbed in the blood through the lungs, and dissolved Hg vapour concentrates in circulating red blood cells[3]. Hg is carried throughout the body crossing both the blood-brain and placental barriers[3]. Hg exposure to high concentrations can cause pneumonitis, bronchitis, chest pain, dyspnoea, cough, stomatitis, gingivitis, excessive salivation and diarrhea[4]. Chronic exposure to low dose Hg vapour can impact the central nervous system causing tremors, weight loss, insomnia, nervousness, and abnormal reflexes[4]. Exposure to very high Hg vapour concentrations results in severe injury to organ systems including kidneys, liver, brain, heart, lungs and colon[4]. Health care professionals, patients and dental assistants are more likely to be affected by mercury exposure without knowing much about its hazardous effects.

It is known fact that amalgam restorations on typhodont and extracted teeth form most important curricular activity for the preclinical students. Improper mercury handling practices, the fact that is not studied much but yet appears to be a serious problem mainly because of poor awareness and unfavorable attitudes. This contributes to mercury vapor in atmosphere, which on inhalation, is rapidly absorbed into blood stream from the lungs causing array of hazards.

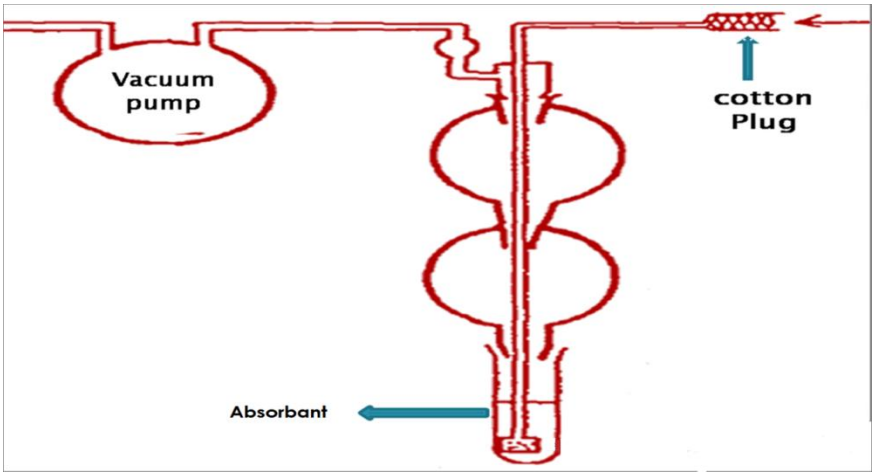
Assessment of mercury vapor in western countries is done by using various equipment those are Mercury levels (bound to PM10 and vapor) was analyzed using atomic absorption.[5]

Mercury vapor release rates analyzed with the Jerome M-411 connected to the impression tray via tygon tubing at the buccal surface.[6]

Mercury concentration was estimated in venous blood samples using a cold vapour atomic absorption method at the commencement and end of the academic

year. Daily air mercury levels were determined in clinical and teaching areas by measuring the darkening of palladium chloride discs using spectrophotometry.[7]

Hg vapor concentrations from the dental vacuum system exhaust ports were measured utilizing the Jerome 431-XTM mercury vapor analyzer, the United States Occupational Safety and Health Administration's (OSHA) method ID-140 in units of ngHg/m3 and Ohio Lumex Inc.RA-915+TM Hg vapor analyzer.[8]




GBC cold vapor atomic absorption spectrometry (AAS), using sodium borohydride as the reducing agent, was employed to determine mercury concentrations. The determination of mercury in urine and air was carried out using a flow injection system after sample treatment according to the standard procedure. [9]

Mercury in the atmosphere in the dental clinics assessed using the technique of atomic absorption spectrophotometry s[10,11]. In this study an attempt is made to assess the atmospheric mercury in sample of dental colleges of Bangalore city using simple and inexpensive mercury analyzing device.

## MATERIALS AND METHODS

The study proposal was submitted to IRB and ethical clearance was obtained. Three of the dental institutions were selected through lottery method of the 16 institutions in Bangalore. The respective Institutions Heads were approached and permission was obtained on briefing about the objectives and methods of the study.

**Study units**: Preclinical conservative dentistry labs of three dental institutions.

**Development of the study instrument:** The partners in this stage were Indian Institute of Sciences, Bangalore and MS Ramaiah Engineering College, Bangalore and MS Ramaiah Dental college,

Bangalore. The diagrammatic representation of the apparatus is shown in Figure

Brief description of the Apparatus: The absorption trap A consists of a tube containing the absorbent (25 ml) surmounted by the splash bulbs (250 ml). The deep lip at each joint prevents loss of the absorbent at the high flow rates required, while the sinter (porosity 0) ensures maximal contact between air and reagent. The diaphragm pump C draws air through the system and the flow is controlled at 25 1/ min for 40 min by a needle valve and measured with a GEC Elliot 1100 rotameter E. To prevent large particles entering the system the inlet is protected by a 15 cm plug of glass-wool. Dead space was kept to a minimum by making all connecting tubing as short and narrow as possible.

**ABSORBANT**

This solution was prepared daily by mixing 25 ml of 4% potassium permanganate solution with 25 ml of 10% sulphuric acid and diluting to 100 ml with distilled water.

**GLASSWARE**

All glassware were cleaned with a mixture of concentrated nitric and hydrochloric acids (1: l) and rinsed with water before use.On repeated estimation with known quantity of mercury, the accuracy of the apparatus was found to be 99.9%.

Sample collection was immediately after the preclinical conservative dentistry practical class. Air sample was collected at the rate of 20lt/min for 50minsusing the apparatus. Samples of air were collected from the dental labs by running the vacuum pump at 20l/min for 50 mins so that a total of 1000ml of air is passed through the absorbing solution. The trapped mercury was measured with atomic absorption spectrophotometer using a cold-vapour technique.

**RESULTS**

**Table 1: The peak mercury vapor levels in the three colleges (in μgm/mm$^3$)**

| | College 1 | College 2 | College 3 |
|---|---|---|---|
| **Atmospheric mercury Concentrations μgm/mm$^3$)** | 12.03 | 32.52 | 18.24 |

**DISCUSSION**

Exposure to metallic mercury vapour within the confines of the dental office is the major source of high blood concentrations of inorganic mercury in dentists and dental students. About 80% of inhaled mercury will rapidly cross the

pulmonary membranes and dissolve in the circulating blood. This circulating mercury is partitioned between packed cells and plasma. Increase in total mercury concentrations in plasma and blood depends on mercury hygiene and amalgam practice.

All previous studies reported on assessment of mercury levels have used expensive equipments[6-11]. In this study we have developed equipment indigenously which is cost effective. Using this equipment we could assess the atmospheric mercury in the dental health care/education setting. The equipment developed needs to be assessed for validity and sensitivity. The project could be continued further in this direction but the crux is the cost and availability of the standard equipment.

Although the levels of mercury vapour in the various rooms were within OSHA permissible levels of 50µgm/mm$^3$, one college had comparatively higher atmospheric mercury concentration.

Though mercury vapor levels were found to be within permissible levels, caution should be exercised at this point as reports also state that there is no threshold level below which mercury is hazardous. The dental community should be sensitized regarding safer mercury hygiene practices.

Measures to minimize the generation of mercury waste as a short goal and total elimination from dental setting as a long term goal should be considered. Until then norms for safer mercury waste management should be strictly adhered.

However Improvement of technical equipment and better standards of hygiene can reduce the exposure significantly. Also the way amalgam is prepared, cleaning habits, and type of floor coverings have been pointed out to be important factors.

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**ACKNOWLEDGEMENTS:**

Faculty, Indian Institute of Sciences, Mr. Nagendra, Faculty, Dept of Biotechnology. M.S.Ramaiah Institute of Technology.

*"Inspiration, not desperation"*
*--Professor Baba Shiv*
*Stanform University*

**ORIGINAL ARTICLE**

# "A SCENARIO OF HEALTHCARE WASTE MANAGEMENT IN CHIKKABALLAPURA, KARNATAKA"

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## ABSTRACT

***In Chikkaballapura, most of the doctors are ignorant of the Bio-Medical Waste (Management and Handling) Rules, 1998 and Guideline on Bio-Medical Waste Management issued by KHSDRP. Wastes from the 30 PHCs, 1 CHC, 5 THs and 1 DH in the district is being collected, transported, treated and disposed by CBMWTF. But BMWCTF is unable to collect healthcare waste on a regular basis and hence is posing a challenge to manage HCW. Generated wastes from remaining 25 PCHs are being disposed in DBPs and SPs and LDUs provided within the premises, 37.09% of the LDUs in HCFs were not working and not installed.***

**Keywords:** Samskar, Irregular Collection, Common Treatment Facility and Segregation.

## INTRODUCTION

Most of the doctors in Chikkaballapura are ignorant of Bio-Medical Waste (Management and Handling) Rules, 1998, as well as guideline on Bio-Medical Waste Management and Handling issued by Karnataka Health System Development and Reform Project (KHSDRP), Bangalore. Healthcare waste management can be maintained with a complete awareness of regulations, good Samskar (honesty, enthusiasm, dedication, self-motivation, cooperation and the participation), appropriate education, training, commitment, and understanding between each other's. Karnataka State Government have to assist the Health Care Facilities (HCFs) or institutions if they come forward, for the establishment of Deep Burial Pits (DBPs), Sharps Pit (SPs) and Common Bio-Management Waste Treatment Facility (CBMWTF), by identifying suitable land for it. It is the responsibility of the local bodies to treat and dispose the healthcare waste generated in the healthcare establishes at a safer place (Chitralekha and Sudhir, 2010).

Healthcare waste management is a concern for every HCF in the present scenario. The healthcare waste management is a process that helps to ensure proper hospital hygiene and safety of healthcare workers

and communities (Carmen *et al.,* 2008). Healthcare workers have an important roles and responsibilities to manage the environmental effects and health hazards with their practices. Their efforts may seem small, but each step builds a base of 'Sound Samskar' and 'Positive way of life' that are essential for the victory of the entire (Mcveigh, 1993 and Shalini Sharma, 2010). Healthcare is vital for all life's, health and well being. But the healthcare waste generated from medical activities can be hazardous, cytotoxic, lethal and even radioactive because of their high potential for diseases transmission. The hazardous and toxic part of healthcare wastes from healthcare establishments comprising infectious and radioactive material as well as sharps constitute a grave risk, if these are not properly treated or disposed or is allowed to get mixed with other municipal wastes (Bekir Onursal, 2004). Investigate the medical officer and staffers about the awareness of Bio-Medical Waste (Management and Handlings) Rules, 1998 and whether the HCFs being used have the color coded bins and segregation as well as the DBPs and SPs being used is as per the guidelines and Liquid Disinfection Units (LDUs) of the healthcare centers and functional are the main objectives in this first round study.

# METHODOLOGY

## STUDY AREA

Chikkaballapura is a newly created district, carved out of the existing Kolar district, with geographical area of 404501 hectaresin the southern part of Karnataka, India and 56km distance from Bangalore. It is a key transport link to North Bangalore due to origin of several national highways and is a regional transport and educational hub. The Chikkaballapura District includes the taluks of Bagepalli, Chikkaballapura, Chintamani, Gowribidnur, Gudibande and Sidlaghatta. As of 2011 India census Chikkaballapura had a population of 191,122. Males constitute 51% of the population and females 49%. Chikkaballapura has an average literacy rate of 64%, higher than the national average of 59.5%. Eleven percent (11%) of the population is under 6 years of age (Census of India, 2011).

## SAMPLE SIZE

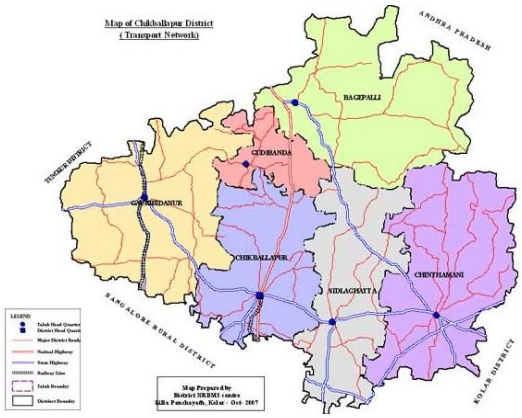
From all government healthcare centers in Chikkaballapura district62 were selected.

## STUDY DESIGN

District consultant advance tour program was sent to each of the healthcare centers to participate the on hand training, awareness and discussions about healthcare waste management.

The first round field visit was done with an updated guideline for segregation, management and disposal of infectious healthcare waste and the check list report was collected and prepared through the investigations. Concentrated on particular aspect of healthcare waste management like personal observations of the waste management and disposal practices, evaluation of knowledge, attitude and practices of medical officers as well as staffers and evaluate the bio-medical wastes weighing record (Linde, 1993; Sharma *et al.,* 1993; Al-Zahrani*et al.*, 2000; Cisse*et al.,* 2000; Dilly and Shanklin, 2000 and Kishore *et al.,* 2000).

Further, documented the physically verifications done, materials and equipments inventory and answers from doctors, laboratory technicians and other staffers that included knowledge regarding awareness about Bio-Medical Waste (Management and Handling) Rules, 1998, waste segregation, collection, labeling, disinfections, transport and disposal. The observations and suggestions of workers over accessible environment or methods of healthcare waste management in the HCFs were also recorded. Accordingly data from the first round field visit was finally interpreted, discussed and the HCFs were differentiated with grades as well as improvements needed among them were also found out (Fig. 4).




## GEO-HYDROLOGY

The highest temperature is 32$^{o}$C while the lowest is 21$^{o}$C and the average rainfall is 750.3mm and Papagni, Chitravathi and Pinakini rivers flow in Chikkabalapura district. Chikkaballapura has a high elevation located in the center of the Nandi hills region. "Panchagiri" is a common descriptor of Chikkaballapura as it is surrounded by 5 picturesque hills (Nandi Giri, Chandra Giri, Skandagiri, Brahma Giri, and HemaGiri) among which Nandi hills is the famous one.

## HEALTH AND FAMILY WELFARE

Chikkaballapura district (map) has 1 District Hospital (DH), 5 Taluk Hospitals (THs), 1 Community Health Center (CHC) and 55 Primary Health Centers (PHCs). There are 85 private healthcare facilities

(including all nursing homes, pathological laboratories and clinics registered under Karnataka Private Medical Establishment (KPME), Act 2007) also established.

## RESULT AND DISCUSSION

In this investigation, many medical officers, doctors, staff nurses, auxiliary nurse and midwifery (ANMs), health assistants, laboratory technicians, pharmacists and group-Ds were observed who do not have sufficient knowledge in this field. Most of the medical officers and doctors were observed to have poor practical knowledge of healthcare waste management and handling and their attitude towards healthcare waste management was casual. While, in the case of nurses and paramedical staffs the reverse was true, i.e., though their theoretical knowledge lagged behind that of doctors, their practical knowledge regarding healthcare waste management was better and more meticulous and careful.

The knowledge of the nurses and paramedical staff was better for the practical aspects of healthcare waste management, categories of bio-medical waste, color coding system, methods of segregation, methods of waste dispose and waste should not be stored for more than 48 hours. Awareness of the existence of Bio-Medical Waste (Management and Handling) Rules, 1998, able to identify Bio-Hazard Symbol as well as diseases spread by improper waste management.

Further, if it is possible, healthcare wastes should be disposed everyday or in every alternate days. But this BMWCTF does not collect the wastes on Saturday and Sunday after collecting Monday, Wednesday and Friday's. Every HCF (24x7) dedicate whole year for 24 hours. Saturday and Sunday are the busiest and the most healthcare waste generated days as these days are off in most offices. But due to the lack of common sense and irregularity of BMWCTF healthcare waste is unable to collect and manage properly in the HCFs. On the other hand, the collections in the weekdays are not regular so does on (weekends) Saturday and Sunday. With the calculation of three times in week, the complete stop of collection for 2/3 days is encountered after collecting 2/3 days continuously. According to LOK ADALAT, DHs, THs and CHCs should tie-up with BMWCTFs. If possible, PHCs too should be tied-up. But without seeing the capacity of this BMWCTF is tied-up more number of HCFs with following particular

agreements. And it is unable to collect in a particular timing and days as the BMWCTF is tied-up. Wastes are collected sometimes at 6.00 a.m. or at 9.00/10.00 p.m. in some HCFs. And sometimes comes back idly as an advance information is not given, thus the place remains closed. The collected wastes are not weighed properly as well as are not check whether they are segregated or not. Further, due to the lack of vehicle facility and man power, and the distance, BMWCTF is unable to collect wastes from many PHCs since the agreement had signed. The wastes are not collected so does the information of unable to come is given. This is not a matter of once or twice but for months and years even after the agreement is written.

On the other hand, infectious plastics, non-plastics and sharps healthcare wastes are stored within the campus in the open space of most HCFs. These potentially harmful wastes are also being kept bundled together in open spaces between the wards for months and years expecting the BMWCTF. But, in spite of the best efforts being made to follow the laid down norms of disposing healthcare waste strictly, problem still exist due to lack of adequate number of manpower facility, knowledge as well as negligence of doctors and other workers.

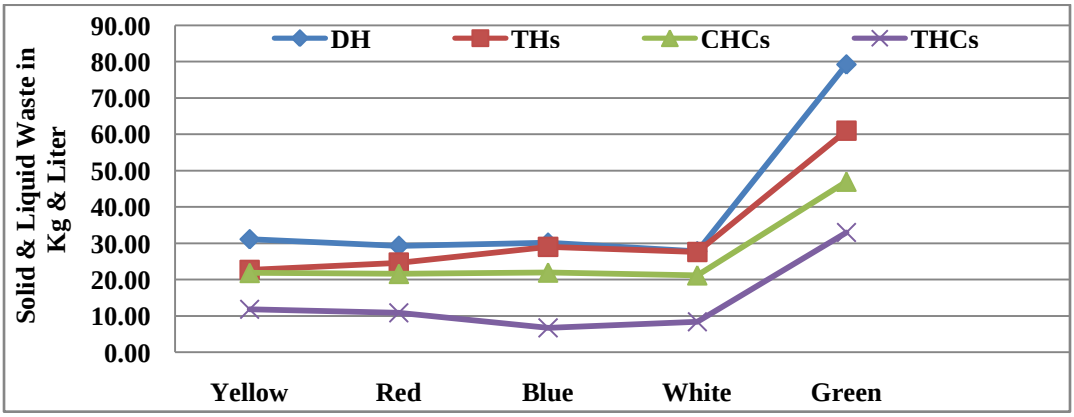



Figure 2: Generated Solid Healthcare waste from DH, THs, CHCs and PHCs in Chikkaballapura.

Medical officers and other medical staffs of entire HCFs of Chikkaballapura complain lack of information regarding waste management, confusion about segregation in rule, color coding bucket and others equipment shortage as well as finance as the major cause for not following the Bio-Medical Waste (Management and Handling) Rules, 1998. But after the first round field investigation as well as on hand training, Chikkaballapura district, having superior

indication of proper mechanism of managing and disposing of healthcare wastes in the Government HCFs, serious untroubled health hazards from these healthcare wastes are not scattered around the HCFs. Color coded bins were kept as per healthcare waste management norms in the entire HCFs and the workers were putting the waste category in their particular color bins. Per day average of 31.07, 22.70, 21.86 and 11.18Kgs of anatomical (Yellow); 29.27, 24.68, 21.59, and 10.84Kgs of infectious non-plastic (Red); 30.13, 29.03, 21.96 and 6.72Kgs of infectious plastic (Blue), 27.75, 27.61, 21.20 and 8.37Kgs of infectious sharps (White) and 79.22, 61, 47 and 33Kgs of general solid wastes are generated from DH, THs, CHC and PHCs respectively (Fig. 2). Further, per day average of 65.75, 53.93, 28.59 and 3.26Liters of infectious liquid waste are generated from DH, THs, CHC and PHCs respectively (Fig. 3). But, due to the lack of Operation Theater (OT), Laboratory facilities, Healthcare Building facility (Practice in Pvt. Building) as well as shifting to new building, 37.09% of the LDUs in HCFs were not working and not installed.

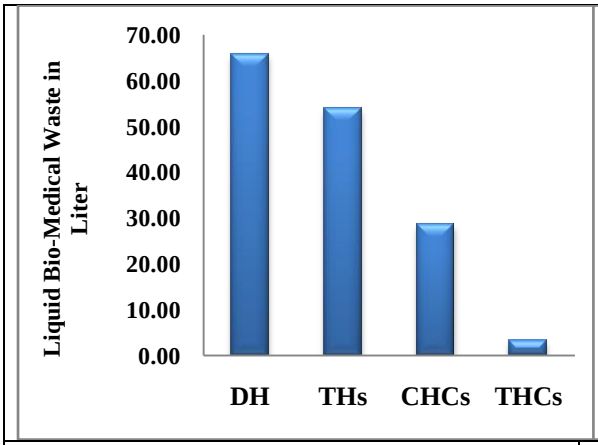



Figure 3: Generated Liquid Healthcare waste from DH, THs, CHCs and PHCs in Chikkaballapura.

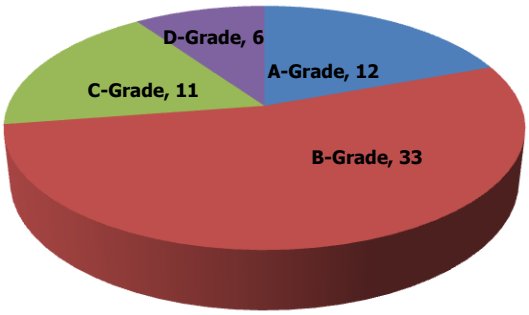



Figure 4: Grading of healthcare centers in Chikkaballapura.

At present all the infectious solid bio-medical wastes generated from Government 30 PHCs, 1 CHC, 5 THs and 1 DH in the district are being collected, transported, treated and disposed by 'M/S; MEERA ENVIROTECH PVT. LTD., in Kolar, a CBMWTF and solid and liquid healthcare wastes generated from 25 (out of 55) PCHs are being disposed in DBPs, SPs and LDUs provided within the premises.

Based on the data's collected during the present course of investigation, it was found that conditions of healthcare waste management and disposal in Bhatalahalli CHC and Burudugonte and Idagor PHCs, are better as compared to others. And these

healthcare centers personnel were trying to meet the district consultant and searching the current needs and standards.

All waste handlers, who responded to the questionnaire in each of HCFs, reported that only gloves are available as Personal Protective Clothing's (PPCs) or Personal Protective Equipments (PPEs) during handling waste and stated that they do not use any type of PPCs like apron, long boots and mask etc. In the present investigation it is observed that most of the medical officers, doctors and other healthcare staff do not worry about the hazards to health and the environment around them due to inappropriate handling and disposal of healthcare waste.

During the investigation in all healthcare established with various questionnaires, have found out that 12 healthcare centers have scored the marks ranging between 284-355, 33 centers have scored between 213-283, 11 centers have scored between 117-212 and 6 center have scored <116. According to the Marks they have scored and the respective percentage they have got i.e. 19.34, 53.22, 17.74 and 9.67%, grades have been given to them as A, B, C and D respectively (Fig. 4).

## CONCLUSION

Before the appointment of consultant in Chikkaballapura, poor healthcare waste minimization, proper segregation, store and disposal ware had happened. After the appointment and consultant first round field visit regarding healthcare waste management in the entire Chikkaballapura, more than 75.12% and 96.74% of waste ware in most of the healthcare established had been properly minimized and segregated respectively. Clarifications has been done by consultant to all the healthcare established workers regarding their confusions and misunderstandings on Bio-Medical Waste (Management and Handling) Rules, 1998 through on hand trainings, awareness, discussion in medical officer meetings and seminars. Circulation has been done of the various categories of color printed wordings, poster in both English and Kannada having bio-hazards logos according to KHSDRP manual, which can be easily seen, read and be aware to all the healthcare established workers as well as the public. Directions had been given practically face to face to the persons who were performing wrong healthcare waste management and disposal in various healthcare centers and the general public regularly and clearing their confusions trying to put a good Samskar in

their heart and forward the best of the best healthcare waste management. From the investigation consultant conclude that the knowledge and the practice of healthcare waste management were reasonable mainly among the healthcare providers.

Nurses and paramedical staffs now have more practical knowledge regarding healthcare waste management and are better and more meticulous and careful. Color coded bins were kept as per healthcare waste management norms and the workers were putting the waste category in their particular color bins, when the consultant direct them.

Information's about the risks linked to healthcare waste can be displayed by poster exhibitions in healthcare centers, at strategic points such as waste bin locations, giving instructions on waste segregation. These posters should be explicit, using diagrams and illustrations to convey the message that could be understood by all people who make regular visits to healthcare establishments, even by the illiterate people.

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## ACKNOWLEDGMENT

The authors thank the Project Administrator/ Mission Director and Deputy Director of Bio-Medical Waste Management Cell, Health System Development and Reform Project, Karnataka for providing financial assistance.

*"Surround yourself with people who will help you ask the question You never think to ask"*

*--James Will CoX(MBA01)*
*CEO – Aspire Public School*

**ORIGINAL ARTICLE**

# A STUDY ON THE STATUS OF HEALTH CARE WASTE MANAGEMENT AND INFECTION CONTROL PRACTICES IN HEALTHCARE SETTINGS OF ANEKAL TALUK, BANGALORE URBAN DISTRICT

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***INTRODUCTION: Health care waste (HCW) is a potential source of infectious diseases and may also root to environmental pollution. This hazardous impact on human and environment can be minimized by implementation and execution of standard systematic Health Care Waste Management (HCWM) procedure. The study was accomplished to observe and describe HCWM and infection control (IC) practices in health care settings (HCS).***

***MATERIALS AND METHOD: A cross sectional study was conducted in Anekal taluk, Bangalore Urban district of Karnataka state by visiting 37 HCS during August and September, 2013. Data was collected using a standard check list for HCWM and IC related practices (segregation, storage, collection, transportation and disposal). Descriptive analysis was done using Microsoft Excel and SPSS version 20.***

***RESULT: Sharp waste containment was satisfactory in 51.4% and sharp waste disinfection/treatment in 45.9% (n=17) of HCS. Infected plastic waste was being disinfected 48.6% (n=18) HCS. Appropriate final disposal of sharp waste was carried out in 89.2% (n=33), infected plastic waste in 64.9% (n=24) and soiled waste in 83.8% (n=31) HCS. Sharp waste disfigurement was done at 75.7% (n=28) HCS and infected plastic waste disfigurement in 56.8% (n=20) HCS.***

***CONCLUSION: The study on the status of HCWM and IC practices illustrates that all the guidelines are not being followed at all the HCS and there is a need to strengthen the HCWM for better enforcement of guidelines to ensure the human health and environmental protection.***

**Keywords:** Healthcare, Waste Management, Waste Disposal, Segregation, Containment, Disinfection

## INTRODUCTION

Health care sector is one of the fastest growing sectors in India especially in the urban areas with an estimated growth rate of 12% per annum[1]. With increasing number of health care settings (HCS) the health care waste generated is also increasing. An estimated 0.33 million

tonnes of hospital waste is generated annually in India; the average waste generated per bed per day ranges between 0.5kg and 2 kg [2]. WHO estimates that between 75% and 90% of hospital waste generated is non-hazardous and the remaining 10-25% is hazardous waste which has potential to affect human health[3].

Healthcare waste is a source of environmental pollution and infectious diseases, and is made up of toxic chemicals, infective materials, plastic waste, sharps and general waste for which appropriate disposal is essential. Health care waste is dependable source for infectious diseases like gastroenteric infections, respiratory infections, ocular infections, tetanus, skin infections, HIV/AIDS and hepatitis[3]. Health care waste presents a threat not only to patients and their visitors but also to health care workers[4]. Appropriate management of these wastes is important to protect human and environmental health and is a responsibility of all health care workers and facilities.[3] Guidelines have been established for segregation, containment, colour coding, transportation and final disposal of healthcare waste. Studies conducted in different parts of the country have shown poor adherence to biomedical waste management rules prescribed by the Ministry of Environment and Forests as per the Bio-Medical Waste (Management and Handling) Rules, 1998[5,6,7].

In this context the present study was conducted to observe and assess healthcare waste management (HCWM) and infection control (IC) practices in HCS located in Anekal taluk of Bangalore urban district which has seen a recent spurt in urbanisation and increase in number of healthcare centres.

## MATERIALS AND METHODS

**Study Design:** A descriptive cross sectional was conducted to assess the existing health care waste management practices in 37 HCS including Primary Health Centres (PHC), First Referral Unit (FRU), private hospitals, nursing homes, clinics, diagnostic centres.

**Study Period and Population:** The study was conducted between August and September 2013 in Anekal taluk of Bangalore urban district. Population for the study comprised of health workers (Doctors, Nurses, lab technicians, ward boys, ayah and helpers).

**Sampling:** A total of PHC-09, FRU-01, Clinics-13, Private hospital-11, Diagnostic centres-2, were selected through convenient sampling.

**Inclusion criteria:** Health care facilities with consent and permission were included. Within each centre, staff members who knew Kannada or English and willing to participate.

**Data collection and analysis:** Data was collected using a modified version of a previously tested checklist which covers the HCWM topics of segregation, containment, colour coding, disfigurement, transportation, final dispose of waste and, availability of guidelines and infrastructure for waste disposal, personal protective measures/equipment (PPE) and vaccination status of at-risk workers. Data was entered in SPSS version 20. Basic analysis was performed using Microsoft Excel and the results were stratified and compared.

## RESULTS

The final sample for analysis conducted out of total 37 HCS in the study, Table 1 shows information of the various centres surveyed. Of the surveyed centres, 43.2% had in-patient services besides OPD services (56.25% were private hospitals and 31.25% were PHC's). FRU had the most number of beds per centre, in-patient admissions, out-patient visits, followed by private hospitals. (Table 1)

**Table 1: Details about healthcare settings surveyed**

| Type of HCS | Only OPD N | % | OPD+IP n | % | Avg. Beds | Avg. admission/ month | Avg. deliveries/ month | Avg. OP visits |
|---|---|---|---|---|---|---|---|---|
| **PHC (n=9)** | 4 | 44.4 | 5 | 55.6 | 4.8 | 14 | 12.7 | 805.6 |
| **FRU (n=1)** | 0 | 0 | 1 | 100 | 100 | 80 | 140 | 22500 |
| **Clinics (n=14)** | 13 | 92.9 | 1 | 7.1 | 0.4 | 0 | 0 | 698.6 |
| **Diagnostic centres (n=2)** | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Private Hospital (n=11)** | 2 | 18.2 | 9 | 81.8 | 24.5 | 36.4 | 17.4 | 1790.9 |
| **Total (n=37)** | 21 | 56.8 | 16 | 43.2 | 11.3 | 16.4 | 12 | 1600.8 |

Avg.- Average, OPD- Outpatient Department, IPD- Inpatient Department

Sharp management practices were observed and assessed at HCS surveyed. Colour coded dustbins were present only at 66.7% of PHC's, 7.1% of clinics, 50% of diagnostic centres and 54.5% of private hospitals surveyed. While appropriate sharp waste segregation was being done only at 77.8% of PHC's and 78.6% of clinics, all diagnostic centres and private hospitals were following appropriate segregation. Containment of sharp waste was being carried out only at 66.7% of PHC's, 35.7% of clinics, 50% of diagnostic centres and 66.7% of private

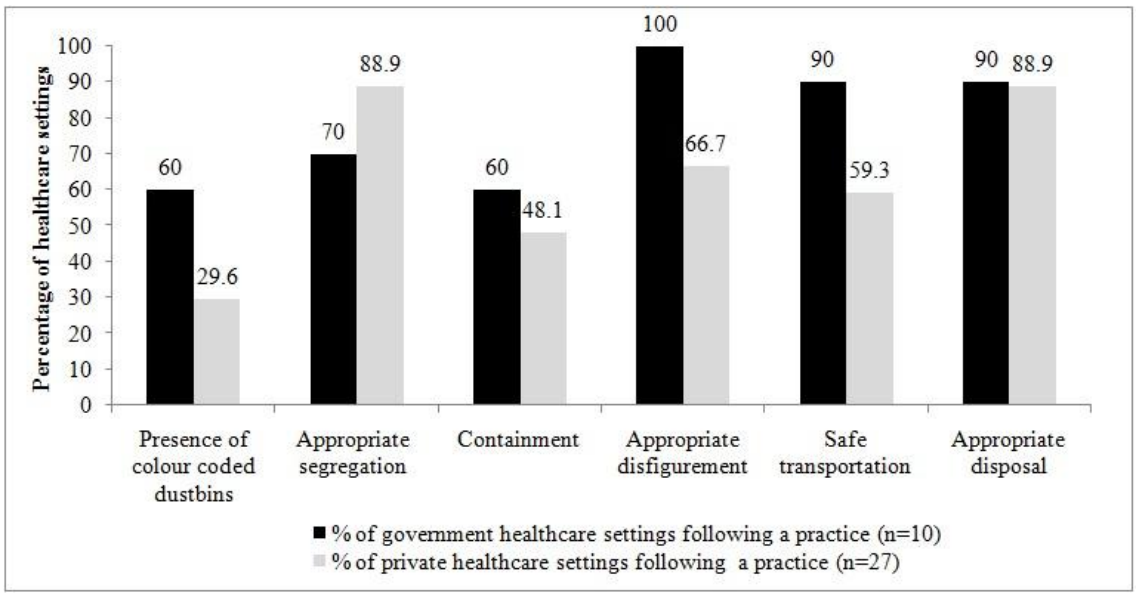
hospitals included in the study. Sharp waste disfigurement was being done at majority or all of the different types of HCS surveyed except for in clinics. Other than clinics, majority of the other HCS undertook safe transportation of sharp wastes. Appropriate sharp waste disposal was being carried out at majority of the HCS surveyed. (Table 2)

**Table 2: Sharp waste management practices being followed**

| Type of HCS | Presence of colour coded dustbins | | Appropriate segregation | | Containment | | Appropriate disfigurement | | Safe transportation | | Appropriate disposal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** |
| **PHC (n=9)** | 6 | 66.7 | 7 | 77.8 | 6 | 66.7 | 9 | 100 | 8 | 88.9 | 8 | 88.9 |
| **FRU (n=1)** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 100 | 1 | 100 | 1 | 100 |
| **Clinics (n=14)** | 1 | 7.1 | 11 | 78.6 | 5 | 35.7 | 6 | 42.9 | 6 | 42.9 | 11 | 78.6 |
| **Diagnostic centres (n=2)** | 1 | 50 | 2 | 100 | 1 | 50 | 2 | 100 | 2 | 100.0 | 2 | 100 |
| **Private Hospital (n=11)** | 6 | 54.5 | 11 | 100 | 7 | 63.6 | 10 | 90.9 | 8 | 72.7 | 11 | 100 |

N=Number of centres adhering to guidelines

**Figure 1: Sharp waste management practices in government and private settings**




Comparing government and private HCS with regards to sharp waste management shows that for all sharp waste management practices except appropriate segregation, government HCS were performing better than private HCS. (Figure 1)

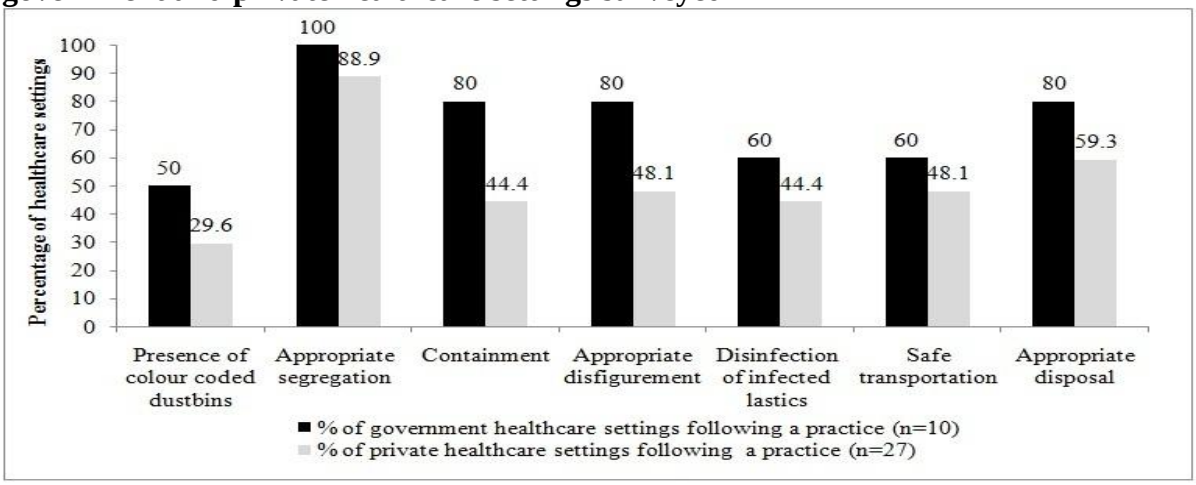
Infected plastic waste management practices were studied at HCS surveyed. Colour coded dustbins for disposal of infected plastic waste were present only at 55.6% PHC's, 14.3% of clinics, 50% of diagnostic centres, 45.5% of private hospitals and at the single FRU surveyed. Except for clinics appropriate segregation of infected plastic wasted was being carried out at all other HCS. While only at 77.8% PHC's, 35.7% clinics, 54.5% private disfigurement of infected plastic waste was being carried, at the FRU and all diagnostic centres such practice was being followed. Disinfection of infected plastic waste was being carried out at 55.6% PHC's, 35.7% clinics, 63.6% private clinics, the FRU and none of the diagnostic centres respectively. With regards to appropriate disposal of infected plastic wasted it was being done at 77.8% PHC's, 50% clinics, 63.6% private hospitals, the FRU and all the diagnostic centres. (Table 3)

**Table 3: Infected plastic waste management practices being followed at healthcare settings surveyed**

| Type of HCS | Presence of colour coded dustbins | | Appropriate segregation | | Containment | | Appropriate disfigurement | | Infected Plastics Disinfection | | Safe transportation | | Appropriate disposal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** |
| **PHC (n=9)** | 5 | 55.6 | 9 | 100 | 7 | 77.8 | 7 | 77.8 | 5 | 55.6 | 5 | 55.6 | 7 | 77.8 |
| **FRU (n=1)** | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 |
| **Clinics (n=14)** | 2 | 14.3 | 11 | 78.6 | 5 | 35.7 | 5 | 35.7 | 5 | 35.7 | 6 | 42.9 | 7 | 50 |
| **Diagnostic centres (n=2)** | 1 | 50 | 2 | 100 | 1 | 50 | 2 | 100 | 0 | 0 | 1 | 50 | 2 | 100 |
| **Private Hospital (n=11)** | 5 | 45.5 | 11 | 100 | 6 | 54.5 | 6 | 54.5 | 7 | 63.6 | 6 | 54.5 | 7 | 63.6 |

N=Number of settings adhering to guidelines

**Figure 2: Comparison of infected plastic waste management practices between government and private healthcare settings surveyed**




While comparing government and private HCS with regards to their infected plastic waste disposal it is seen that the former have better waste management practices than the latter in terms of proportion of HCS following a practice. (Figure 2)

Table 4 provides information on the facilities available and methods used for disposal of healthcare wastes at various settings. Incinerator was not available at any of the HCS surveyed. Autoclave, burial pit and sharp pit were being used present all the PHC's. In contrary to guidelines two PHC's reported that plastic waste was being burnt. Autoclave was present at 21.4% of the clinics and 45.5% of the private hospitals. The FRU, clinics, private hospitals and diagnostics centres out sourced their HCWM to a private agency for final disposal and hence had no need for burial and sharp pit.

**Table 4: Facilities available and methods used for final disposal of healthcare waste in the healthcare settings surveyed**

| Type of HCS | Burning | | Autoclave | | Burial Pit | | Waste Sharps Pit | |
|---|---|---|---|---|---|---|---|---|
| | **Yes** | **%** | **Yes** | **%** | **Yes** | **%** | **Yes** | **%** |
| PHC (n=9) | 2 | 22.2 | 9 | 100 | 9 | 100 | 9 | 100 |
| FRU (n=1) | 0 | 0 | 1 | 100 | 0 | 0 | 0 | 0 |
| Clinics (n=14) | 0 | 0 | 3 | 21.4 | 0 | 0 | 0 | 0 |
| Diagnostic centres (n=2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Private Hospital (n=11) | 0 | 0 | 5 | 45.5 | 0 | 0 | 0 | 0 |

**Table 5: Occupational safety measures for healthcare workers at healthcare settings**

| Type of HCS | Gloves usage Ward Boy | | Vaccination status of Ward Boy | | Gloves usage Ayah | | Vaccination status of Ayah | | Gloves usage Helper | | Vaccination Status of Helper | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CWWB | Satisfactory usage (%) | CWWB | Vaccinated (%) | CWA | Satisfactory usage (%) | CWA | Vaccinated (%) | CWH | Satisfactory usage (%) | CWH | Vaccinated (%) |
| **PHC (n=9)** | 5 | 100 | 5 | 100 | 4 | 75 | 4 | 75 | 1 | 100 | 1 | 100 |
| **FRU (n=1)** | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 |
| **Clinics (n=14)** | 2 | 100 | 2 | 100 | 1 | 0 | 1 | 100 | 1 | 100 | 1 | 100 |
| **Diagnostic centres (n=2)** | 1 | 100 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Private Hospital (n=11)** | 5 | 80 | 5 | 80 | 3 | 67 | 3 | 100 | 3 | 100 | 3 | 100 |

CWWB = Centres with ward boys, CWA = Centres with ayah CWH = Centres with helpers

**Table 6: Compliance with monitoring and regulatory systems for healthcare waste management at healthcare settings surveyed**

| Type of HCS | Authorisation from Pollution Control Board obtained | | System of recording of illness/ injuries/ accidents | | Monitoring of waste management system | | Training/ retraining to the staff provided | | Accident register | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Yes | % | Yes | % | Yes | % | Yes | % | Yes | % |
| **PHC (n=9)** | 8 | 88.9 | 4 | 44.4 | 5 | 55.6 | 4 | 44.4 | 2 | 22.2 |
| **FRU (n=1)** | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 | 1 | 100 |
| **Clinics (n=14)** | 13 | 92.9 | 1 | 7.1 | 1 | 7.1 | 4 | 28.6 | 0 | 0 |
| **Diagnostic centres (n=2)** | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Private Hospital (n=11)** | 10 | 90.9 | 4 | 36.4 | 3 | 27.3 | 3 | 27.3 | 1 | 9.1 |

Expect for one private hospital there was satisfactory usage of gloves by ward boy at other HCS with ward boys. With regards to vaccination status of ward boy except for private hospital rest of the HCS with ward boys had vaccinated them. Of the HCS with ayah's on roll not at all PHC's and private hospitals there was satisfactory usage of gloves and except for ayah's in PHC in all other HCS they were vaccinated. In all HCS with helpers there was satisfactory usage of gloves by them and also all of them were vaccinated. (Table 5)

District Nodal Officer for healthcare waste management has visited all the HCS

surveyed for purpose of monitoring. Majority of the HCS had obtained authorisation from Karnataka Pollution Control Board for healthcare waste generation and consequent management. There was lack of system for recording of illness/ injuries/ accidents resulting from healthcare waste handling limited to healthcare workers in majority of the HCS.

Similarly there was lack of a monitoring mechanism for healthcare waste management system in majority of the HCS. Staff training was also found to be lacking in majority of the HCS. Accident register was available only at two PHC's and the FRU. While the FRU had all the required monitoring and regulatory systems in place, the diagnostic centres were seen to be lacking in all such systems expect for obtaining authorisation from Karnataka Pollution Control Board. (Table 6)

## DISCUSSION

The present study was aimed at assessing the practice of Health Care Waste Management indicates that HCWM guidelines were not being adhered at all HCS. The situation in government HCS being better compared to private HCS as per this study. Two health centres studied were burning plastic wastes, a source of dioxins which have adverse health effects[8].

The importance of segregation is to separate infectious and non infectious waste and to avoid potential hazards which may occur as a result of mixing the waste produced. Similar to the present study, studies conducted in Lucknow, Uttar Pradesh; Pulwama, Jammu and Kashmir have shown that colour coding for containment of wastes was not being practiced at HCS which led to poor segregation practices; however a study conducted in rural India have shown that the HCS was following colour coding of wastes[6,7,9,]. Similar to our findings, a study conducted in Pune, Maharashtra showed that segregation of sharps and infected plastic waste was being adhered in majority of HCS [6,10].

Disfigurement of sharps which is important in order to prevent injuries and also to prevent transmission of communicable diseases like Hepatitis B, HIV/AIDS, is not being followed at some HCS according to the present study and also studies conducted in Pune, Kathmandu and Nepal[10,11]. Similar to the findings of the present study health care workers in Pune were provided with personal protective equipment and were in practice; however, a study conducted in Agra showed poor usage of personal protective equipment[10,12]. Thus it can be

seen that all the HCS are not adhere to HCWM guidelines. The strengths of the study is that both government and private HCS including diagnostics centres of Anekal taluk were included and tested study tool was used for data collection. However, due to time constraint, only few hospitals could be visited. Due to inability to obtain permission from some of the private HCS for this study, the sample size was reduced furthermore.

## CONCLUSION:

The study conducted in HCS located in Anekal taluk of Bangalore urban district shows that, most of the HCS are following HCWM rules prescribed by the Ministry of Environments and Forests, Government of India. There is a need to address on some of the issues like following the colour coded bins, disfigurement, disinfection and safe transportation in private HCS compare to public HCS. Enabling the knowledge and practicing skills among healthcare personnel's at HCS may lead for positive outcome. There is a need to tackle these issues with hand holding trainings, capacity building to practice and disseminate knowledge about HCWM. Continues monitoring and evaluation could help to sustain the HCWM and practice at all levels of HCS.

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## ACKNOWLEDGEMENT:

We thank the Department of Health and Family Welfare, Government of Karnataka especially Dr. Rajani District Health and Family Welfare Officer, Dr. Sunil Kumar, Taluk Health and Family Welfare Officer and his team, Healthcare Waste Management Officer for providing permission and their cooperation. We thank Dr Ramakrishna Goud (St. John's Medical College, Bangalore) for providing us with the checklist prepared by him, which we have modified for the purpose of this study. I also thank Dr. Ravi Narayan, Dr.Thelma Narayan, As Mohamed and team SOPHEA for their support and helping facilitate this process.

*"You will never reach your destination if you*
*Stop and throw stones at Every dog that barks"*
*--Winston Churchill*

**REVIEW**

# MERCURY: THE ROGUE ELEMENT

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## Part I: The Chronicles of *Mercury*

Mercury was discovered in antiquity, and was known to the ancient Chinese, Hindus, and Egyptians, but was not recognized as an element. It was first recognized as a chemical element (in the modern sense) by A. L. Lavoisier about the end of the 18th century. The name comes from the Roman god Mercury, the speedy messenger of the gods. It is also associated with the planet Mercury, which speeds around the sun. The symbol Hg comes from its Greek name, *hydrargyrum*, meaning liquid silver. It is also known as quicksilver.

The first emperor of China, QínShǐHuángDì — allegedly buried in a tomb that contained rivers of flowing mercury on a model of the land he ruled, representative of the rivers of China — was killed by drinking a mercury and powdered jade mixture formulated by Qin alchemists (causing liver failure, mercury poisoning, and brain death) who intended to give him eternal life

Each civilization had its own legends about mercury, and it was used as everything from a medicine to a talisman. Mercury's chemical symbol, Hg, comes from the Greek "hydrargyrum" meaning liquid silver. Mercury is also known as "quicksilver," a reference to its mobility. Speed and mobility were characteristics of the Roman god, Mercury, who served as a messenger to all the other gods and shared his name with the planet nearest the sun. The symbol for the planet was used by the alchemists to identify mercury before it was given its more modern chemical notation.

Alchemists thought of mercury as the First Matter from which all

metals were formed. They believed that different metals could be produced by varying the quality and quantity of sulfur contained within the mercury. The purest of these was gold, and mercury was called for in attempts at the transmutation of base (or impure) metals into gold, which was the goal of many alchemists

The line between alchemy and medicine was not always clear. In 2nd century China, the study of mercury centered on a search for an elixir of life to confer longevity or immortality. The prominent Chinese alchemist Ko Hung, who lived in the 4th century, believed that man is what he eats, and so by eating gold he could attain perfection. Yet, he reasoned, a true believer was likely to be poor, and so it was necessary to find a substitute for the precious metal. This, in his estimation, could be accomplished by making gold from cinnabar. Ko Hung's other uses for cinnabar included smearing it on the feet to enable a person to walk on water, placing it over a doorway to ward off thieves, and combining it with raspberry juice to enable elderly men to beget children.

In the era before antibiotics, sexually-transmitted diseases were deadly. Some scholars believe that syphilis was the most critical medical problem of the first half of the 16th century. A great number of printed works dealing with syphilis first appeared at the end of the 15th century when it was known by such names as "morbusgallicius," "the French disease," "the pox," and "luesvenera." In the desperate search for a cure, it was almost inevitable that various forms of mercury would be tried. Indeed, the treatment appeared to benefit some patients. While it is unclear whether mercury actually did cure syphilis (some cases of the disease resolve spontaneously), the use of mercury therapy continued into the early 20th century.

Eventually the use of solutions of mercuric nitrate was widespread in the felt industry, and mercury poisoning became endemic.

Although it has been suggested that the expression "mad as a hatter" and the character portrayed in Lewis Carroll's Alice in Wonderland may have origins other than mercurialism among hatters, few can resist making this apocryphal analogy.


In nature mercury can be found in several forms. It can be converted from one form to another by natural processes. For example, when the elemental mercury released in emissions from coal-burning power plants or waste incinerators is deposited on lakes and streams it can be converted to inorganic mercury and then to organic forms by microorganisms. Some forms of mercury are particularly potent poisons.

In 1958 a unique illness began to be recognized in the area around Minamata Bay, on the Japanese island of Kyushu. Sixty-eight people died while 397 others exhibited neurological problems. The highest rate of illness was among fishermen and their families. It turned out that chemical industries around the bay had been discharging inorganic mercury wastes into the waters, where anaerobic bacteria in the detritus on the floor of the bay converted the inorganic mercury into methyl mercury. The methyl mercury became concentrated as it was passed along natural food webs. It found its way into fish and shellfish that were consumed by people living around the bay. Scientists estimated that biomagnification in food chains may have been as high as a million-fold. Despite the recognition of the toxicity of mercury and mercury vapour in the 17th century in the Almadén mercury mines, Minamata was the first identified example of the in situ methylation and bioaccumulation of mercury in fish.

In 1971-72, a major epidemic occurred in Iraq in which 6,530 persons were hospitalized and almost 500 died. In a well-intentioned humane response to famine, several nations shipped wheat grain intended for planting to Iraq. The seeds had been treated with a methyl mercury-containing fungicide to hold down mould growth and preserve the viability of the seeds. The seeds were also dyed red to serve as a warning, and attempts were made to inform the natives of the hazards of eating the seeds directly. Unfortunately, the warnings on the bags were in Spanish, because some of the grain had originated in Mexico, and the skull and crossbones, recognized by westerners as meaning poison, meant nothing to the Iraqis. In the face of starvation many

families milled the seeds directly into flour, and made and consumed the contaminated bread. There would have been no danger in eating grain grown from the treated seeds, because the subsequent crop would contain little or no methyl mercury.

In India a study by Centre for Science and Environment (CSE) in 2012 revealed mercury poisoning in Sonbhadra district of Uttar Pradesh, indicating a Minamata-style disaster waiting to happen. Laboratory study tested soil, water, fish and human blood, nails and hair and found frighteningly high and toxic levels of mercury in most samples.


It is known fact that mercury concentrates itself in major organs such as the brain and liver. Its ability to attack the brain makes it one of the most potent neurotoxins known to this day. It destroys neurons and can easily enter body cells because of its simple composure: it is composed of hydrogen and oxygen atoms, which the body readily accepts into its cells. But even with all of this alarming information, it is still used in common materials and consumed by the world population daily.

Cliché as it is, it seems only appropriate to culminate the idea of mercury poisoning with the common expression "everything is good in moderation." Neither villain nor hero, mercury is present every day, but must be checked on for health reasons.

**Part II:MERCURY FACTS** [1, 2, 3]

1. Mercury is the only metal that is a liquid at standard temperature and pressure.
2. Although mercury is known to be highly toxic, it was considered therapeutic throughout much of history.
3. The modern element symbol for mercury is Hg, which is the symbol for another name for mercury: hydrargyrum. Hydrargyrum comes from Greek words for "water-silver" (hydr- means water, argyros means silver).
4. Mercury is the Roman name for the Greek god Hermes, the protector of travelers, thieves and merchant's. It is the only element to retain its alchemical name as its modern common name.
5. It is a very rare element in the Earth's crust. It accounts for only about only 0.08 parts per million (ppm).

6. It is a relatively poor conductor of heat. Most metals are excellent thermal conductors.
7. It can also combine with other metals to make "amalgams", or solutions of metals, and has been used in the extraction of gold.
8. Inorganic mercury compounds or mercury salts, more commonly found in nature, include mercuric sulphide (HgS), mercuric oxide (HgO) and mercuric chloride ($HgCl_2$).
9. Organic mercury is formed when mercury combines with carbon and other elements. E.g.dimethylmercury, phenylmercuricacetate and methylmercuric chloride. The form most commonly found in the environment is methyl mercury.
10. It isneurotoxin and high levels of exposure can lead to serious illness and, in extreme cases, death.

**Part III: Medical uses of mercury**(4)

Reason for it being the best liquid in traditional gauges, is that, mercury is the highest density room temperature liquid, does not wet (stick) to glass, and (for thermometry) has a decent thermal expansion coefficient. High density is important for pressure measurement because the tube does not have to be very long, and for thermometry, so you don't have to shake it back down the (thin) tube to get it back in the bulb after it's cool. Being a metal, it is also highly reflective, making it easy to see. The following lists show some of the common uses of mercury that may be found in hospitals.

Medical uses:

**1.** Thermometers
**2.** Sphygmomanometers (blood pressure monitors)
**3.** Esophageal dilators (also called bougie tubes)
**4.** Cantor tubes and Miller Abbott tubes (used to clear intestinal obstructions)
**5.** Feeding tubes
**6.** Dental amalgam
**7.** Laboratory chemicals (fixatives, stains, reagents, preservatives)
**8.** Batteries
**9.** Pharmaceutical preservatives

Non-medical uses common in medical settings:

**1.** Cleaning solutions with caustic soda or chlorine that were contaminated with mercury during the production process
**2.** Batteries
**3.** Fluorescent lamps and high-intensity discharge lamps

4. Non-electronic thermostats
5. Pressure gauges
6. Some electrical switches used for lights and appliance

**Part IV: Mercury as a Health Hazard**

Doctors, nurses and other medical staff work with mercury-based products on a routine basis and are in danger of inhaling toxic vapour when breakages or leakages occur

**Part V: Managing mercury spillage**

If small amounts of mercury are spilled in a room:

1. Evacuate the spill area. Leave all shoes, clothing and other articles that were splashed with mercury at the spill site.
2. Wash skin exposed to mercury with soap and water.
3. Isolate the spill site by closing interior doors.
4. Ventilate the spill area to the outdoors by opening outside windows for passive ventilation.
5. Assemble clean-up supplies. If a mercury spill kit is not readily available, use the following items:
   - Rubber, nitrile, or vinyl gloves.
   - Safety glasses.
   - Eye dropper or syringe without a needle.
   - X- ray film.
   - Rubber squeegee.
   - Duct tape or other heavy duty tape.
   - Plastic container with lid or heavy duty zip-lock bags.
   - Flashlight

Use an eyedropper or syringe to suck up the beads. Put the beads in a plastic container, zip-lock bag. Or use the sticky side of duct tape to grab the beads. Put the tape and beads into a zip-lock bag or other appropriate container. Once all the visible mercury beads have been picked up, re-inspect the area with aflashlight to look for more beads that may have migrated to any cracks, baseboards, etc. Continue cleaning up until all visible mercury has been removed

**Part VI: Recommendations for continued mercury elimination efforts include the following[5]:**

1. Promote health care purchasing policies that keep mercury out of facilities in the first place and that ensure the sustainability of mercury elimination efforts.
2. Formal purchasing policies that specify a mercury elimination commitment and a preference for non-mercury alternatives, both for equipment and chemicals, should be implemented facility-wide.
3. The problem of mercury contamination of wastewater must be addressed.

4. Mercury is found in avariety of chemicals, including pharmaceuticals, laboratory and radiology chemicals, and cleaning products. In each category, a full assessment should be done to identify the mercury-containing chemicals and non-mercury alternatives.
5. Mercury containing devices must be inventoried and labelled as mercury-containing until properly removed and replaced with non-mercury alternatives.
6. Proper management and disposal of mercury-containing items must be widely promoted.
7. Fluorescent light bulbs and other mercury-containing "universal wastes" remain one of the largest sources of mercury to landfills. Continued efforts to reduce this pollution must include implementing and sustaining responsible collection programs.
8. Health care facilities, must continue to provide tools for mercury education for all employees.
9. Training - both annually and for all new employees - should be performed and documented for the identification, proper handling, and segregation of items containing mercury.
10. Finally, mercury pollution must be addressed as a global issue.

**MERCURY FREE HOSPITALS IN INDIA**

| | |
|---|---|
| • Lal Bahadur Shastri Hospital, New Delhi[6] | • AcharyashriBhikshu Government Hospital, New Delhi[6] |
| • Coimbatore Government Medical College Hospital, Tamil Nadu[8] | • Parassala Taluk hospital, Kerela[7] |
| • Maharishi Balmiki Hospital, New Delhi[6] | • Himalayan Institute Hospital Trust (HIHT), Uttarakhand[6] |
| • Pt. Madan Mohan Malviya Hospital, New Delhi[6] | • Sir Ganga Ram Hospital, New Delhi[6] |
| • Dr. B.R. Sur Hospital, New Delhi[6] | • St. Stephens Hospital, New Delhi[6] |
| • Max Healthcare, New Delhi[6] | |

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*"Confidence and Hard-work is the best medicine to kill the disease called failure. It will make you a successful person."*

**VIEW POINT**

# SAFE MANAGEMENT OF HEALTH CARE WASTE: CONCEPT AND PHILOSOPHY

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## CURRENT SCENARIO

Health Care Waste (HCW) is a special category of waste that needs precautions while handling and managing. The WHO survey 2002 conducted in 22 developing countries reported, 18- 64% of Health care facilities do not comply with proper waste disposal methods. (1)

Over 1.4 million people worldwide suffer from HAI at any given time. Hospital wide prevalence of HAI varies from 5.7% to 19.1%, with a pooled prevalence of 10.1%. Surgical site infections are most frequent in developing countries, with incidence rates from 1.2 to 23.6 per 100 surgeries. The adverse impact includes increased mortality and morbidity, and compromised quality of life of the patient and family [2]. Incidence of Hospital Acquired Infections (HAI) is estimated to be about 7% in SEARO – WHO region hospitals.(3) his means that hospitals have become incubators of infection.

Health care waste is a hazardous waste that poses risk not only to its generators, operators and waste handlers but also to the general community.(4,5,6) There are reports that, syringes are often reused, mixed in with everyday garbage, or even abandoned in public areas, exposing health workers, patients, and communities to unnecessary risk and contributing to the estimated 23.5 million new HIV, hepatitis B, and hepatitis C infections transmitted every

year through needle reuse and accidental needlestick injuries. The health care system is growing stronger and better care is reaching more people, so also is the increase in the castoff medical waste. [6,7]

Sharps waste, although produced in small quantities, is highly infectious. Poorly managed, they expose healthcare workers, waste handlers and the community to infections. Contaminated needles and syringes represent a particular threat and may be scavenged from waste areas and dump sites and be reused. The WHO has estimated that, in 2000, injections with contaminated syringes caused:

- 21 million hepatitis B virus (HBV) infections (32% of all new infections);
- two million hepatitis C virus (HCV) infections (40% of all new infections);
- 260 000 HIV infections (5% of all new infections).[1, 9]

HCW is hazardous to the health of the environment and animals.

Generation of carcinogenic chemicals like Dioxin and Furans by indiscriminate burning of plastics and heavy metals in incinerators [6,7, 9] being one such example.

The healthcare workforce, 35 million people worldwide, represents 12% of the working population. The Occupational health of this significant group has long been neglected both organizationally and by Governments. Healthcare workers incur 2 million needle stick injuries (NSIs) per year that result in infections with hepatitis B and C and HIV. [9] The WHO estimates the global burden of disease from occupational exposure to be 40% of the hepatitis B and C infections and 2.5% of the HIV infections among HCWs as attributable to exposures at work. A large majority (90%) of the occupational exposures occur in the developing world.[10]

In India, where vast swaths of the urban population live in slums and a third are illiterate, experts say the reuse of syringes is rampant and deadly. The WHO estimates that 300,000 people die in India annually as a result of dirty

syringes. Across the world, that figure is 1.3 million.[11]

## QUANTUM AND CHARACTERISTICS OF HEALTH CARE WASTE

Between 75% and 90% of the waste produced by health-care providers is comparable to domestic waste and usually called "non-hazardous" or "general health-care waste". It comes mostly from the administrative, kitchen and housekeeping functions at health-care facilities and may also includes packaging waste and waste generated during maintenance of health-care institutions infrastructure. The remaining 10–25% of health-care waste is regarded as "hazardous" and may pose a variety of environmental and health risks.[12]

Since the health care institutions lack systems for waste management this 10% to 30% infectious waste gets mixed with 70% to 90% general non-infectious waste rendering the whole quantum of waste infectious. [4, 12]

There are no adequate studies directed towards quantifying health care waste. Most of the available data is based on *educated estimates and guesstimates*

Knowing the types and quantities of waste produced in a health-care facility is an important first step in safe disposal. Waste-generation data are used in estimating the required capacities for containers, storage areas, transportation and treatment technologies.

Waste-generation data can be used to establish baseline data on rates of production in different medical areas and for procurement specifications, planning, budgeting, calculating revenues from recycling, optimization of waste-management systems, and environmental impact assessments. [11]

The amount of waste generated per bed per day is said to vary from 0.33gm to a maximum of up to 1.4kg.[12] The quantum of waste generated also depends on the type of health care institution, the services/ facilities provided. [12, 13]

## WASTE TREATMENT TECHNOLOGIES AND THEIR ROLE IN HEALTH CARE WASTE MANAGEMENT.

Experience in the west and also some of the cities in India, where treatment technologies were put-up without knowing the amount of waste generated resulted in wasteful expenditure and sub-optimal use of treatment technologies such as Incinerator, autoclave, microwave, hydroclave, etc.

Waste management is not an issue of technologies but is everything about human attitude and behavior. Solutions for waste management need to be addressed at all levels of hierarchy. For technologies to be working at an optimal level it is vital that health care institutions evolve a human centered system for waste management. [11]

The choices for technologies (treatment, disposal) should be made with a clear knowledge of waste streams to be managed, their quantum of generation, and the goal to be achieved. [6,9, 12]

The qualities of the treatment technologies could be listed as follows:

- Waste Disinfection/Sterilization
- Disfigurement/Mutilation
- Volume reduction
- Cost effective
- Easy maintenance
- Safety
- Sustainable
- Sound environmentally
- Culturally acceptable
- Segregation an "Appropriate technology". [13]

The technologies should fit into a given situation or context and work in a management system to achieve the final goal as a part of the over all system and not as a replacement for the system.

## THE SYSTEMS APPROACH FOR HEALTH CARE WASTE MANAGEMENT

The systems approach for waste management would address the multi-dimensional problems involved in management of health care waste. To mention [9, 13, 14]

- Occupational safety
- Hospital hygiene and Hospital Acquired Infections
- Quality and cost
- Antibiotic resistance

- Maximizes efficiency of technologies
- Environmentally safe
- Reducing and recycling of waste. (Eg. Syringes / other plastic tunings.)
- Legal compliance
- Aesthetic aspects

Furthermore, for the systems to be in place and to work to an optimum efficiency the health care personnel need to be oriented, trained and retrained in various aspects of health care waste and occupational safety. Each and every category of health care personnel needs to be trained including the head of the institution.

There should be a periodic monitoring and evaluation of the systems, which need to be facilitatory, and problem solving in nature.

Health care settings need to have a system for documenting the quantum of waste generated and reporting/recording injuries due to handling of waste. A system of accreditation of health care institutions would be a step in the right direction in ensuring a safe environment of care.

Waste reduction, reusing and recycling should be made possible by establishing a sound and planned product purchasing and investment decision. [5] To ensure clarity, continuity and sustainability in the management practices there is a need for a comprehensive written policy, which addresses all of the above mentioned issues, concerns and requirements.

**The following aspects epitomize the meaning and concept of Sound or Safe Management of Health Care Waste:**

- Following the Golden Principles of HCW and/or Bio Medical Waste (BMW) management (Goud's principles)
  1. Reducing the number of persons coming in contact with waste during the process of its management.
  2. Reducing the number of contacts with waste during its management.
  3. Reducing the length of time of a person is with waste during its management. [13]
- Clearly defining the problem know the categories and quantum of waste generated.
- Understanding and following the steps in waste management (e.g., segregation, containment, pre-treatment etc.).

- Keep focus on waste minimization and reduction.
- Training of health care personnel; which is participatory in nature and at periodic intervals.
- Promote safe work environment through education, training and promoting practices like personal protective measures.
- Strengthening institutional infrastructure for facilitating safe waste management (e.g., collection and transport mechanisms).
- Institutional Policy(s) for waste management, occupational safety and infection control.
- Investing in equipment for reprocessing of waste for safe recycling.
- Investing in environmentally sound and cost effective treatment and disposal technologies.
- At a macro level; municipal corporations facilitating infrastructure for safe treatment, disposals and or recycling technologies, infrastructure for the same and facilitating setting up of common treatment facilities.
- Developing an infrastructure for management of municipal solid waste and integrating it with systems for health care waste management.
- Institutional responsibility to abide by the relevant laws [Air act, Water act and BMW (management and handling) Rules].
- Institutional mechanisms for regular appraisal of systems with a standardized mechanism and assessment tool(s) for example Observation Checklist for assessing waste management. [12, 14]

**STEPS INVOLVED IN SAFE MANAGEMENT OF HEALTH CARE WASTE**

- Segregation at point of generation by the person generating the waste
- Containment of waste in waste container appropriate to the volume, quantity and nature of the waste generated (for example containers for POP casts as in Orthopedic OPD/or wards, no-touch containers/foot-paddle operated containers)
- Use of appropriate colour coded containers with stenciling (labeling)

of the category of waste contained and biohazard symbol

- Use of puncture proof plastic containers for containing waste sharps along with disinfectant solution, preferably at points of generation of waste. For example at injection rooms, nursing stations (this enables segregation, containment, disinfection and disfigurement with single contact by single person generating the waste!)
- Safe in-house transportation along a laid out route plan.
- Safe temporary storage of waste within health care setting
- Safe transportation of waste from health care setting to Common Bio Medical Waste Treatment Facility in designated and prefabricated vehicles for the purpose
- Final treatment-use of double chambered standard incinerators, waste autoclaves or any other approved technology
- Disfigurement of waste plastics in mechanized shredders and recycling.
- Final disposal in designated landfills and or hazardous waste management facilities of waste like incineration ash, sharps, expired medicines etc.

The notification of Bio Medical Waste (handling and management) Rules 1998 by Government of India is a step in the right direction for making health care settings accountable in their activities. This should be followed by strict and transparent enforcement.

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*"All Birds find shelter during a rain*
*But eagle avoids rain by flying above the clouds.*
*Problems are common, but attitude makes difference"*

**ORIGINAL ARTICLE**

# WATER PASTEURIZATION AS A MEANS OF DISINFECTING BIOMEDICAL LIQUID WASTE

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## ABSTRACT

***Liquid biomedical waste is currently discharged without disinfection or usually disinfected by chlorine and chlorine compounds though out the world. Un-disinfected waste spreads communicable diseases. But some of the chlorinated organic compounds produced during disinfection with chlorine and their compounds are known carcinogens. The treatment option should not aim to safeguard only present generation. The technology options should be low cost during installing and operating. This paper attempts sustainable solution to treat liquid biomedical waste.***

## INTRODUCTION

Solid biomedical waste from health care establishments has been a challenge in many developing countries. But liquid waste is more challenging compared to solid biomedical waste as it is usually let out into environment or sewers. The pathogens will have an opportunity to multiply and survive if they manage to get food. The presence of pathogen and flow of water in which they are present can lead to spread of pathogens to ground water and surface waters from where drinking water is drawn.

Conventionally water is disinfected chemical and physical agents. Common physical agents used are heat and Ultra Violet rays. Conventional chemicals used are halogens and Ozone. Within the halogens Chlorine and its compounds are extensively as it can eliminate noxious odor, remain in water as residual chlorine for prolonged time, can oxidize certain inorganic and organic compounds, can be used with flexible dosing system, cost effective and use is well established (USEPA, 1999).

The major disadvantage of Chlorine as disinfection agent is it reacts with organic matter resulting in formation of more hazardous chemicals like trihalomethanes. Currently liquid biomedical waste is discharged without disinfection or mostly being disinfected by chlorine and chlorine compounds though out the world. While un-disinfected waste spreads communicable diseases, some of the chlorinated organic compounds produced during disinfection with chlorine and their compounds are known carcinogens. Hence this paper attempts sustainable solution to treat liquid biomedical waste.

**LIQUID BIOMEDICAL WASTE**

Microorganism contaminated wastewater generated from washing surgical/laboratory and other equipments has been threat to sustainability of water supply where awareness and law are weak. Weakness could be both due to absence of law or poor implementation. Many developing countries do not have law and discharge standards to liquid biomedical waste. Some of the countries have made disinfection with chlorine and its compounds as compulsory means of disinfection.

Sustainable approach to treat liquid biomedical waste should aim minimal use of chemical, energy and at the same time it should aim low carbon emission. Use of chlorine and its compound is not a sustainable option as it will only leave tons of carcinogens for next generation.

The quantity of liquid biomedical waste generated varies from one health care establishment to other health care establishments. The quantity in pathological laboratory varies from 10 to 100 ml/patient. The quantity in operation theatre may vary from 100 to 1000 ml/patient. The quantities are higher in hospitals where strict infection control procedures have been practiced.

**IMPACT OF LIQUID BIOMEDICAL WASTE ON SOCIETY**

Unlike industries, health care establishments are located within the urban settlement. The water often enters or leaves sewers depending on situation. If the soil in which sewers are laid is saturated with water then water will enter sewer otherwise water from sewer will trickle out. When the sewage with high pathogens trickles out the sewers it will pose threat to society.

**DISINFECTION OPTIONS AND SUSTAINABLE APPROACH**

As discussed earlier, disinfection can be done with variety of disinfecting agents that include chemicals, heat, and radiation. Sustainable option aims both current generation and future generation. The options should ensure safety of both current generation and future generation. Boiling water for few minutes definitely kill most bacteria but energy consumption can be reduced in countries where there is abundant solar radiation is received.

Use of chlorine in water treatment and waste water treatment is done only at final stage after making sure most of the organic material has been eliminated from the water by biological or physic chemical treatment methodology. The current practice of using Chlorine and its compound for disinfection of liquid waste with blood and other body fluids would definitely result in formation of Chloro-organic compounds which are known carcinogens.

The essentials of mixing and residential time cannot be overlooked while using chemical disinfectants. Improper mixing due to presence of dead zones (zones within mixing chamber which is stagnant) and shortcuts (water moving out of treatment unit in the shortest distance without undergoing treatment) can make the chemical disinfection ineffective.

A sustainable way of disinfection of liquid biomedical waste is to adopt what is adopted in dairy industry over the years – pasteurization. Water pasteurization involves heating water to 65º C for 6 minutes. There is no need to boil water and prove to be very low cost. It could be batch process or continuous process. Heating at 55°C for many hours

will reduce non-spore forming pathogens (Sobsey, 2002; Sobsey and Leland, 2001).

**Fig. 1 Solar heaters can be used as solar pasteurizers which are cost effective and do not generate secondary contaminants**

Heating water to temperatures lesser than boiling temperature can be achieved by using solar radiation. The exterior of the metal vessel filled with water to be disinfected painted black is capable of absorbing heat to pasteurization temperature. By using solar box heaters, temperatures of 65°C, up to 70°C, can be reached inactivating nearly all enteric pathogens.

Solar pasteurization can prove to be more sustainable option especially in countries with warm climate which receives abundant sunrays. The economics of adopting pasteurization depends on whether it is fabricated in-house; or local workshop; or purchased from supplier with brand attached to it.

## CONCLUSION

The water and wastewater treatment should not aim to safeguard only present generation. The technology options should be low cost during installing and operating. Even though disinfection can be achieved by using chemicals and energy, they should be used prudently. The disinfection of liquid biomedical waste should not lead to emission of green house gases and formation of secondary contaminants. In this aspect solar pasteurization is cost effective as it needs low operational cost and do not generate carcinogens.

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***Optimism***

*"They say we learn from our mistakes*
*That's why I am making as many as possible*
*I'will soon be a genius"*

**VIEW POINT**

# VERMICOMPOSTING: PROSPECTS AT A TERTIARY CARE CENTRE OF LUCKNOW

**Anshita Singh, Reema Kumari, Anupam Wakhlu, Kirti Srivastava, Mohd. Parvez Khan**

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Health-care waste comprises of all the waste generated by health-care establishments, research amenities, and laboratories. Around 75% to 90% of the waste produced by health-care providers is of non-infectious or general waste[1]. It comes mostly from the executive and housekeeping functions of healthcare settings and may also include waste generated during maintenance of healthcare premises. The remaining 10–25% of health- care waste is regarded as hazardous and may create a variety of health risks and needs treatment prior to terminal disposal. The chief part of hospital waste is general waste which can be used by converting it into useful form through an eco-friendly technique namely vermicomposting,

Vermicomposting is a non-thermophilic oxidative decomposition by mutual interaction between earthworms and micro-organisms that converts organic substrates into useful products. Composting with worms is a global practice. Vermicomposting is one of the most effective waste management techniques that not only reduces volume of waste substrates but also converts them into nutrient-rich humus like organic compounds. Composting and soil-dwelling worms are not identical but are related species, having different roles in nature.

**Food Waste:** Worms have a preference for a vegetarian diet, and will devour fruits, vegetables, leafy greens, and coffee grinds swiftly. A source of calcium is also required for reproduction. Eggshells or a calcium-rich antacid tablet may be used for this purpose.

**Earthworms:** Several species of earthworms can be used in a vermicomposting operation for animal and vegetable wastes. Nationally, Eiseniafetida, epigeic species is the most commonly used earthworm for

composting[3]. Various common types of redworms, brandling worms, manure worms, or compost worms are used because of their appetite. Any worm that is naturally attracted to fresh organic waste can be used in a vermicomposting system.

**Ideal Environmental Conditions for Earthworms:** The basic means to a flourishing vermicomposting system is to provide the earthworms with an perfect environment for growth. In addition to a food source, earthworms need oxygen, moisture, and moderate digester temperatures. The vital factors to control and maintain during the operation are pH, ammonia, and salt concentrations in the bin. Earthworms prefer moderate temperatures in the range of 40 to 90 degrees Fahrenheit, with a moisture content between 70 and 90%.

Factors Responsible for earthworm distribution[2]:

i) Physico- chemical (soil, temperature, moisture, pH, inorganic salt, aeration and texture),
ii) Available food (herbage, leaf litter, dung, consolidated organic matter),
iii) Reproductive potential and dispersive power of the species.

**Fundamentals of vermicomposting:** The basic principle of a flow-through vermicomposting operation is to add a mixture of food waste and bulking material in thin layers and allow the earthworms to process successive aerobic layers of wastes. The earthworms will generally be concentrated in the upper six inches of material, and they will move upwards as each successive waste layer is added.

Vermitechnology is a technique that has shown its potential in certain challenging areas like augmentation of food production, waste recycling, management of solid wastes etc. In a country like ours, where accumulation of organic wastes is leading to an alarming rise in pollution and simultaneously there is shortage of organic manure, this could increase the fertility and productivity of the land and produce nutritive and safe food. So there is an endless scope for this technique.

At King George's Medical University, a tertiary care centre of the state, with a 3500 bedded hospital attached, there is a well oiled system for the proper disposal

of biomedical waste[4]. This is very soon going to be augmented by a full fledged vermicomposting component, as there is ample raw material available from the associated hospital. About 80-85% of total waste generated in the university is non-infectious general waste, which is around 60,000 kg/month, out of which 40,000 kg/month is food/kitchen waste. Up till now this was untapped as to the recycling aspect. This enormous amount of kitchen waste can help in revenue generation by being utilised in the vermicomposting project. KGMU is planning to compost all this available resource with the help of earthworms.

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*"Great leaders are never too proud to learn"*
*--John Donal (MBA 86)*
*CEO – of eBay*

## RESOURCES AND INFORMATION

# HEALTH CARE WASTE MANAGEMENT - IGNOU Certificate course

### INDIRA GANDHI NATIONAL OPEN UNIVERSITY

Indira Gandhi National Open University (IGNOU), the largest open university in the democratic world, was established by an act of Indian Parliament in 1985, and started offering academic programmes in 1987 (Diploma in Management and Diploma in Distance Education with 4528 students). Today, it serves the educational aspirations of about 1.3 million students in 30 countries, including India, through eleven schools of studies and a network of 57 regional centres; five sub regional centres, 1296 study centres/tele-learning centres, 35 partner institutions overseas. The University offers 101 certificate, diploma, degree and doctoral programmes comprising 900 courses, through a strength of 300 faculty members and academic staff at the headquarters and regional centres and about 33,000 counselors drawn from conventional institutions of higher learning, professionals from various organizations and bodies, among others.

The University has been in existence for only two decades. In such a short time, the University has contributed significantly to higher education and continuing professional development in the country catering to the· education of about 12 per cent of total students enrolled in higher education (and more than 50 per cent of total students in distance education) in the country. As a world leader in distance education, it was conferred the Centre of Excellence Award in Distance Education in 1993.

### SCHOOL OF HEALTH SCIENCES

The School of Health Sciences was established in the year 1991 as one of the eleven schools of the University. Its prime objective is the development and delivery of programmes in the field of medicine, nursing, paramedics through distance education mode and the maintenance of their academic standards. The Certificate Programme in Health Care Waste Management is one of the latest programmes developed in the School for the South-East Asia Countries.

### *CERTIFICATE IN HEALTH CARE WASTE MANAGEMENT*

The concern for bio-medical waste management has been felt globally with the rise in deadly infections such as AIDS, Hepatitis and indiscriminate disposal of health care waste. The United Nations through UN Basel Convention on the control of transboundary movements of

hazardous wastes and their disposal has classified health care waste as most hazardous waste, after radioactive waste.

According to WHO, the eleven South-East Asia countries together produce some 3,50,000 tons of health care waste per year, close to 1000 tons a day. As it is not segregated at source, all of it is to be considered hazardous despite the fact that only 10-20 per cent is infectious in nature (Health Situation in the South-East Asia Region, 1998· 2000, WHO, 1999).

The main bottleneck to sound health care waste management programme is lack of training and appropriate skills, insufficient resource allocation and lack of adequate equipment. The need to educate different health care professionals/ workers, NGOs and other stake holders was thus identified as a priority. To cater the needs of these health care professionals, IGNOU and WHO, SEARO decided to develop and launch Certificate Programme in Health Care Waste Management in the South-East Asia Region Countries. This programme is a 14 credit 6-month certificate programme, through open and distance learning.

This certificate programme has been developed to create essential knowledge and skills in health care waste and equip the leaders to manage it effectively and safely and also safeguard the community against adverse health impact of health care waste.

***OBJECTIVES***

- Sensitize the learner about health care waste and its impact on our health and environment.
- Acquaint the learner about the existing legis1ation, knowledge and practices regarding infection control and heath care waste management practices in South East Asia Region Countries.
- Equip the learner with skills to manage health care waste effectively and safely.

***BENEFICIARIES***

Doctors, Nurses, Paramedics, Health Managers and other professiona1 workers with a minimum of 10 + 2 qualification.

**PROGRAMME PACKAGE**

It is a multimedia package consisting of print material in the form of booklets called blocks, audio-visual materials, teleconferencing and providing counseling by contact sessions where the learners are invited to the Programme Study Centres in India and Partner Institutions in

other countries for hands on training. The package will have eight theory blocks, a project and programme guide.

**BHM-001 Fundamentals: Environment and Health,**

Health Care Waste Management Regulations

**Block 1: Understanding Our Environment 1**

Unit 1 Introduction to Environment

Unit 2 Environmental Pollutants

Unit 3 Interrelationship of Environment and Health

Unit 4 Waste Management

**Block 2: Health Care Waste: Definitions 1**

Unit 1 Definitions, Types and Categories of Waste

Unit 2 Principles of Health Care Waste Management

Unit 3 Handling Health Care Waste

**Block 3: Need for a Sound Health Care Waste Management 1**

Unit 1 Impact of Health Care Waste on Our Environment

Unit 2 Impact of Health Care Waste on Human Health

Unit 3 Safety Methodology, worker Safety and Precautions

**Block 4: Current Status of Health Care Waste 1 Management legislation in SEAR Countries**

Unit 1 Rules and legislations

Unit 2 Regulatory Mechanisms

Unit 3 Current Status in India. Thailand. Indonesia. Sri Lanka. Bangladesh

Unit 4 Current Status in Bhutan, DPR Korea, Timor Leste, Maldives, Myanmar, Nepal

**BHM-002 Health Care Waste Management Concepts, Technologies and Training**

**Block 1 Practical Aspects of Health Care Waste Management 2**

Unit 1 Managerial and Administrative aspects

Unit 2 Integrated Infection Control Management

Unit 3 Disinfection and Transportation

Unit 4 Capacity Building. Training and Monitoring

**Block 2: Systems and Technologies in Health Care Waste Management 2**

Unit 1 Systems Options

Unit 2 Treatment and Disposal of Health Care Waste: Burn Technologies

Unit 3 Treatment and Disposal 01 Health Care Waste: Non burn technology

Unit 4 Innovative Concepts and Possibilities

**Block 3: Health Care Waste Management and Emerging Issues 1**

Unit 1 Managing Waste Water from Health Care Facilities

Unit 2 Management of Wastes from Immunizations

Unit 3 Occupation and Patient Safety

Unit 4 Success Stories

**Block 4: Training Manual for Waste Handlers 1**

**BHMP-001 Project 4**

**CREDIT SYSTEM**

In IGNOU parlance, the study hours are measured in credit system. One credit is equivalent to 30 learning hours. For example, 14 credits of Certificate in Health Care Waste Management programme means an average student will be required to give 420 hours (14 X 30) of input for this programme which includes theory reading, undertaking a project, hands on training, video viewing, counseling etc.

**IMPLEMENTATION PLAN 2006**

The programme will be implemented through a network of Programme Study Centres (PSCs) in India and Partner Institutions (PIs) located in other South-East Asia (SEA) and other countries. These Programme Study Centres and Partner Institutions will be located in health care institutions like medical colleges, hospitals, district and private hospitals, rural health centres, etc. A team of trained teachers called counselors will be identified and trained for providing academic counseling and supervising the Programme Study Centres/Partner Institutions. The administrative control will be through the Regional Centres (RCs) of IGNOU located usually at state capitals nationally, by the Partner Institutions, and Indian Consulate in other countries and the School of Health Sciences (SOHS) located at the IGNOU Headquarters, Delhi. India.

## EVALUATION

Evaluation will be through theory and project evaluation. 70 per cent weightage will be kept for theory term-end examination and 30 per cent for project evaluation. 50 per cent minimum pass mark in each component separately is required for successful completion of the programme.

Term-end examination of theory will be held twice in a year i.e. June and December. There will be no practical examination.

## ADMISSION INFORMATION

**Admission Fee:**Rs. 2000/- in India US$ 150 for other SEA countries

**Eligibility:** Doctors, Nurses, Paramedics, Health Managers and other professional workers with a minimum of 10 + 2 Qualification

Duration : Minimum 6 months Maximum 2 years

Session : January to June AND July to December

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# INDIAN SOCIETY OF HOSPITAL WASTE MANAGEMENT

(Founded – 2000, registration under the Societies Registration Act XXI of 1860, Reg No. 36939 of 2000)

The Government of India published a Gazette notification on 20 July 1998 making all personas who generate, collect received, store, transport, treat, dispose or handle medical waste in any form responsible for handling the medical; waste without and adverse effect to human health and the environment. Consequent to the publication of above Gazette Notification on Bio-Medical Waste Management. It is mandatory for all hospitals and health institutions to implement the rules.

Since Hospital Waste Management is a perpetual problem, it was felt that there should be an all India Organization/Society comprising of experts/specialists from various disciplines involved in Hospital Waste Management. This Society should provide conceptual guidance and oversee scientific research for further development.

With this important aspect in mind, the Registrar of Society at Delhi was approached for registration of the 'Indian Society of Hospital Waste Management (ISHWM)' and the Society came into existence on 10$^{th}$ April 2000 and registration under Societies registration Act XXI of 1860 with Registration Number 36939.

The aims and objectives of the Society are as follows:

(a) To promote and advance the knowledge in Environmental Protection with special reference to Hospital Waste Management/ It also envisages promotion and improvement in public health. Protection to the environment, hospital and 'individual through the practice and education in the subject's dealings with the said subject.

(b) The subject of Environmental Protection and Hospital Waste Management involves multidisciplinary approach and involves active participation by specialists of various disciplines such as pathology, Microbiology, Hospital Administration, Preventive & Social Medicine. Therefore, it will function to bring together specialists from various disciplines under a roof with a common goal a personal and environmental protection.

(c) To propagate education and inculcate awareness in hospital as well as general population.

(d) To advance research in various field, connected with Environmental Protection and Hospital Waste Management.

(e) To function as an interface with Industries involved in designation/manufacture of bio-medical waste disposal equipment/appliance for R&D development India.

To fulfill and further the above objectives the Society shall

(a) Hold periodically meetings, seminars, workshops, training courses and annual conference of the members of the Society.

(b) Conduct workshops, training courses etc. separately for the benefit of the beneficiaries such as general public, hospital waste handlers, patient & their relatives.

(c) Publish and circulate a journal on Hospital Waste Management and Environmental protection.

(d) Maintain a Library at the location of the permanent officer as a when established.

(e) Generate funds from all possible sources. The funds so generated will be utilized for advance in the knowledge of disposal of waste and environmental protection. Scholarships and Awards for outstanding contributions will be judged on merit by a special board of officers nominated from time to time.

(f) Propose to the Government the laws and regulations in respect of disposal of waste from the hospitals and environmental protection.

(g) Create and assist State-wise branches to propagate the objectives all over the country in a methodical and systematic manner.

## EMBLEM & LOGO

The Emblem of the Society has been aptly designed to convey the message of environmental protection by confining hazardous hospital waste. The concept of the Emblem is:-

Hospital waste management uses four colours namely – Green, Black, Yellow and Red (Coding colours) used for bags to collect and dispose off hospital waste.

Hands: The two figures over the top and bottom denote the hands in light brown outlined with black to denote the hands, which stand for the control and management of waste.

Syringe: The syringe has been used as a symbol to represent hospital waste due to its extensive use in clinical practice.

Biohazard: Hospital waste is a serious biohazard hence the universally accepted logo for biohazard appears in the backdrop.

Tree & the Blue background: denote the Eco friendliness, which is very important while disposing of hazardous, waste.

Summary: the Logo depicts the hospital waste (syringe), which is a biohazard to the community being efficiently managed (by hands) in an environmental friendly (tree and blue background) manner.

ISHWM: Indian Society of Hospital Waste Management.

PLEASE VISIT OUR WEBSITE: MEDWASTEIND.ORG

FOR DETAILS INCLUDING MEMBERSHIPS FORMS.

## INFORMATION

# ISHWM CONFERENCE 2012 – A BRIEF REPORT

## 12th Annual Conference of Indian Society of Hospital Waste Management Held at Yenepoya Medical College Yenepoya University Mangalore Karnatka December 1st & 2nd 2012

The 12th Annual Conference of Indian Society of Hospital Waste Management - ISHWMCON–2012 on "Healthcare Waste Management – Moving Towards Sustainable Solutions," to promote better management of Health Care Waste in different Health Care settings through convergence of resources of different stakeholders by way of information exchange, networking, building alliances, collaboration and capacity building, etc., was organized by Yenepoya Medical College in association with the Indian Society of Hospital Waste Management at Mangalore Karnatka.

The conference was inaugurated on Saturday December 1, 2012 at 9.30 am in the indoor auditorium, academic block, Yenepoya Medical College, Derlakatte, Mangalore Karnatka. More than 300 delegates from India, Nepal &Butan attended the conference. The participants included officers of MOH Government of India & Government of Karnataka & Delhi, Defense, Railways, District nodal officers of Health Care Waste Management, Academicians, Researchers, Owners of Common Health Care Waste Treatment Facilities, NGOs, Faculty and Post graduate students of Hospital & Public Health Administration.
The two-day conference began with invocation – reciting of Holy Quran followed by lighting the auspicious lamp by Yenepoya Abdulla Kunhi, Hon'ble Chancellor, Yenepoya University and other dignitaries present.

Dr P.Chandramohan, Vice chancellor, Yenepoya University was the chief guest.

Miss. Payden, from WHO, SEARO New Delhi, Dr Ramteke, Director General (M), Indian Railways, Dr C Shivaram, founder chairperson, HCWM Cell, MSR Medical College, Bangalore were the guests of honour.

Dr GhulamJeelaniQadiri, Principal & Dean YMC & Organizing Chairman, Professor A K Agarwal, President ISHWM, Mr. M K Bedi Vice President ISHWM, Dr K S Bhagotia General Secretary ISHWM and Dr SunithaSaldanha YMC Organizing Secretary were also present on the dais.

Addressing the gathering, Dr GhulamJeelaniQadiri, Principal & Dean YMC & Organizing Chairman, welcomed the guests & participants and spoke about the importance of safety in hospitals with reference to Biomedical Waste Management and highlighted the conference programme and arrangements made for the conference.

Dr. A K Agarwal highlighted that ISHWM was founded in the year 2000 with a view to attain perfection in hospital waste management system. The 12 year old association now has 330 members from all over the country.

“Major developments have been taking place in the health care sector. The waste emitted by these institutions is hazardous as it contains radioactive waste as well. The rules and regulations with regard to the waste management systems were revised in 2002 and again have been revised in 2012. The new version is yet to be received”, he said.

"The use of burn technology is declining as it is affecting the environment and more of non-burning technologies are being focused on.

IGNOU, WHO, UNDP have taken a global initiative with regard to the waste management systems in almost eight countries including India. The hospital wastes, especially mercury toxic wastes should be disposed with care as the hazardous outputs from the mercury wastes are very much toxic”, he said.

“Our nation has been playing an active role in the waste management system. The waste management system followed in the Indus Valley Civilization of the Harappa and the Mohenjodaro era is a good example for the present and the future generation”, said professor Chandramohan VC Yenepoya University.

“Hospitals have been the sources of infection and the hospital wastes are the most hazardous wastes. Proper guidance for the hospital waste disposal is to be provided so as to ensure that the radioactive wastes are also disposed safely and at regular intervals”, he said.

“Life in earth was possible due to the formation of ozone layers in the space. Due to the excess release of carbon dioxide, the ozone layer is getting affected, leading to global warming. The burn technology of wastes also affects the ozone layer as it emits high amount of carbons and toxics”, he added.

In his presidential address Mr. Abdullah Kunhi Chancellor Yenepoya University said measures have to be taken to ensure that the waste management system is done in very scientific manner on a routine basis in every hospital. By doing this and following the waste management system very affectively, better, greener and healthier environment can be ensured in the future.

Dr SunithaSaldanha Organizing secretary proposed the vote of thanks.

The deliberations during the two days conference included besides 13 oral paper and 19 poster presentations, A Key note address, Lecture discussions, Panel discussions, Audio-Visual presentations etc.

The topics discussed include 1. Minimizing Waste Generation in Health Care institutions 2.Legal issues in Health Care Waste Management 3.Capacity building and Team Approach 4. Safety Concerns related to Patients, HealthCare Workers and Handlers 5. Innovative Practices in Health Care Waste Management etc.

The best paper and poster presentations were awarded during the Valedictory Session held on December 2nd 2012 as last session of the conference. The P. Chander Mohan Vice Chancellor Yenepoya University was the Chief Guest.

**Dr.GhulamJeelani Qadiri Principal & Dean Yenepoya Medical College & Organizing Chairman ISHWMCON - 2012**



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Indian Society of Hospital Waste Management
ISHWMCON 2012
December 1st & 2nd, 2012
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# LETTER TO EDITOR

Dear Editor,

**A review of the Journal of the Indian Society of Hospital Waste Management.**

ISHWM is the official organ of the Indian Society of Hospital Waste Management, a dedicated and only specialized journal addressing this critical health systems issue at national and SE Asia regional level.

It has been widely referred by the researchers, many health administrators, post graduates and other personnel in health sciences.

Though there are well written rules and regulations on health care waste management in different settings, still we are far from satisfactory in the management of same. More research to identify the problems and issues in implementing sound biomedical waste management practices at various levels is needed.

ISHWM is in right direction in creating better knowledge and bringing to light about the studies done among the readers and I wish that it continues to do so. It will be great if efforts are put in to produce at least two issues every year and indexed.

Here are a few positive points and few areas for improvement.

***a) Positive aspects***

1. *Good variety of articles.*
2. *Overall the formatting of journal with regard to color, print is very well placed.*

***b) Few areas that can be improved.***

1. *I also kindly request the editors to publish a compilation on Include review articles.*
2. *With regard to application form in the end ..we can put those dotted lines and say tear here sign .*
3. *If possible, kindly incorporate the segregation of waste pictures at the end of the journal so that it stays in the readers mind.*

**Dr. Babitha Rajan**
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# GUIDELINES FOR AUTHORS

## JOURNAL OF THE INDIAN SOCIETY OF HOSPITAL WASTE MANAGEMENT

1. Journal of Indian Society of Hospital Waste Management publishes original articles, case reports, review articles, editorials, contemporary issues/agendas book reviews and other related scientific information towards Safe Management of Health Care Waste.

2. Articles are accepted for publications with the understanding that their contents. (All or in part) have not been published and will not be published elsewhere, except in the abstract form or with the consent of the Editor. Journal of Indian Society of Hospital Waste Management does not accept any responsibility for the statements made by the authors. The Editorial Board has the right to introduce such changes in the write-up as may be considered necessary for effectiveness of communication.

3. Following CERTIFICATES (Original Single copy) must accompany the articles.

(a) Certificate from Authors

(i) Certified that I/we have not used any information or material from official documents graded 'restricted' and above or any 'classified' information obtained in any my/our official capacity in the preparation of the article of the article title.

(ii) Certified that this manuscript contains no matter that is libelous or otherwise unlawful, or invades individual privacy or infringes on any proprietary rights.

(iii) All authors certify that they have made substantive and intellectual contributions to the article and assume public responsibility for its content.

(iv) It is also certified that none of the material; in this manuscript has been published previously or is currently under consideration for publication elsewhere.

Signatures of

| First author | Second author | Third author |
|---|---|---|
| Date_____ | Date_____ | Date_____ |

1. **MANUSCRIPT** must be typed in double space throughout, on one side of good quality white bond paper of size 22x28 cm or A4 size with margin on both sides. Words should be hyphenated at the end of a line. Three copies, soft or hard should be submitted along with 3 sets of illustration and the entire text in MS Word format on a CD. Authors must retain a copy of all the above material, as the Journal cannot be held responsible for its loss due to any reason. The material should be enclosed in a large envelope, superscripted 'Article for Publication Not to be Folded', and sent under registered cover to Editor in Chief, Journal of Indian Society of Hospital Waste

Management, Health Care Management Cell, Department of Community Medicine, M. S. Ramaiah Medical College, Bangalore - 560 054. (Karnataka).

5. **PROCESSING**: Material received for publication will be acknowledged. The article may be reviewed by referrers. When required, one copy of the typescript, suitably modified, will be sent to the principal author for revision and resubmission in duplicate. Accepted articles will be published in their turn. Reprints (at least 10) of each article will be sent free cost to the FIRST author. Articles not accepted for publications will be returned by ORDINARY post.

6. **AUTHORSHIP: Should be restricted to persons who have made sufficient contributions to (a) conception and design (b) drafting the article or revising critically (c) final approval of the article to be published. All conditions must be ideally met. The order of authorship should be joint decision of all the coauthors.**

7. **TYPESCRIPT: the typescript comprises (a) title page (b) abstract and key words (c) text (d) illustrati**ons. All these must start on separate pages and ion the above order. Pages should be numbered consecutively beginning with the title page.

(a) Title page: gives the title of the articles a short title for page heading, type of article (original article, case report etc), name(s) of the author(s), affiliations of author(s), place of work, names and address of the authors (including PIN Code and FAX). Ideally, the title should be of about 60 characters. It should have no abbreviations. Names of all the authors with highest academic degree must be typed one below the other with proper footnote marks after the name. Affiliations (with corresponding footnote marks at the beginning) and addresses of authors should be typed as footnotes only.

(b) Abstract and keywords - The abstract is a synopsis of the main article in about 200 words and gives an opportunity to the author to induce the reader to go through the article. It must give the purpose, methods, results and conclusions of the study, giving facts and not descriptions. Speculative surmises, and references to other works on the subject should be included. Avoid abbreviations. No abstract is required for case reports. Below the abstract give not more that 5 key words using terms from Medical Subject Headings list of Index Medicus.

(c) Text - The text should be divided into sections, e.g. Introductions, Materials and Methods, Results and Discussion. Each should have it individually and must not be mixed with other. Ensure that all references, tables and figures are cited in the text.

(d) Reference - The Journal follows the Vancouver style as used by Index Medicus system of references.

(e) Legend - to illustrations should be brief (rarely exceeding 40 words), but must explain the salient features of the illustrations.

(f) Illustrations - should be presented only of they depict something new or unusual. They should be serially numbered in the order of their mention in the text, irrespective of their nature viz. photograph, drawing or chart, using only the word 'figure' and not diagram,

graph etc. Type a label indicating the top ( ), the short title of the article and the figure number on a piece of paper and past in on the back of the illustrations.

Photograph L Unmounted black and white, glossy (not malt) printers of excellent and clarity and contrast should be selected. Their size ideally should be of post card. Do not write anything on the photograph, either on the back or on the front. Do not use pins, staples or even paper clips to put the photographs together. Enclose the photos in the thin cards, so that they do not get mutilated. Avoid identification, photographs, unless you have obtained the patient's permission to reproduce them (a copy of high must accompany the article). Coloured photograph are accepted only if inescapable.

Diagrams and Charts: These should be drawn on thin, white, smooth or glazed care in black ink, and not in any other colour.

8. **MISCELLENEOUS:** Use metric measurements: m, mg, kg, nl. L., No periods, no plural. 'Significant' should be reserved for use in the statistical sense Avoid name and initials of the patients and dates. Avoid unfamiliar abbreviation, medical Jargon and passive voice. Avoid duplication and repetition of material in results and discussion, in tables and in text and legends.

**Please address all your correspondences to:**
**the Journal of The Indian Society of Hospital Waste Management to be addressed to:**

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NQ.DIT (E) I 2011-12/ DEL - IE23021 - 23082011 /1081 Dated 23/08/2011

NAME &. ADDRESS: INDIAN SOCIETY OF HOSPITAL WASTE MANAGEMENT
FLAT NO 253 SEC 7 PLOT NO-11 PAPANKALAN N D

Legal Status : Society
PAN NO : AAATI5716P
GIR NO : I-864

**Sub:-ORDER UNDER SECTION 80G (5)(vi) OF THE INCOME TAX ACT, 1961**

On verification of the facts stated before me/hearing before me, I have come to the conclusion that this organization satisfies the conditions u/s 80G of the Income Tax act, 1961. The institution/Fund is granted approval subject to the following conditions:-

(i) The Donee institution shall forfeit this benefit provided under the law, if any of the conditions stated herein is not complied with/abused/whittled down or in any way violated.

(ii) This exemption is valid for the period from **A.Y.2011-12 onwards till it is rescinded** and subject to the following conditions

**Conditions:**

(i) You shall maintain your accounts regularly and also get them audited to comply with sec. 80G (5)(iv) read with section 12A(b) and 12A(c) and submit the same before the assessing officer by the due date as per section 139(1) of the Income tax Act 1961.

(ii) Every receipt issued to donor shall bear the number and date; of this order and shall state the date up to which this certificate is valid from **A.Y.2011-12 onwards till it is rescinded.**

(iii) No change in the deed of the trust/association shall be affected without the due procedure of Law and its intimation shall be given immediately to this office.

(iv) The approval to the institution/fund shall apply to the donations received only if the fund/institution, established in India for charitable purpose, fulfills the conditions as laid down in section 80G(i), (ii), (iii), (iv) & (v) of the Income Tax Act 1961.

(v) This office and the assessing officer shall also be informed about the managing trustees or Manager of your Trust/Society/Non Profit Company and the places where the activities of the Trust/Institution are undertaken/likely to be undertaken to satisfy the claimed objects.

(vi) You shall file the return of income of your fund/institution as per section 139(1)/(4A)/(4C) of the Income Tax Act, 1961.

(vii **No fee or any other consideration shall be received which comes under the proviso to section 2(15) of the Income Tax act**

Copy to:
1. The applicant as above
2. The Assessing Officer

(S. K. Dash)
Director of Income Tax (Exemption)
DELHI

Director of Income Tax
(Exemptions) Aaykar Bhawan Distt Centre
Laxmi Nagar, Delhi-110092

(Satendra Kumar)
Income Tax Officer (Exemption) (Hqrs.)
For Director of Income Tax (Exemption) DELHI

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**Volume – 12 Issue – 01**

**September 2013**


# JOURNAL OF THE

# INDIAN SOCIETY OF

# HOSPITAL WASTE MANAGEMENT