Volume – 15 Issue – 01

September 2016

JOURNAL OF THE
INDIAN SOCIETY OF
HOSPITAL WASTE MANAGEMENT

HIGHLIGHTS:

- **Impacts of sound HCWM on HAI**
- **Dental Health Care Waste Management**
- **Karnataka Government Initiatives on HCWM**
- **Tips for conducting situational analysis of HCWM**
- **Hazardous Waste in Health Care**
- **Resource Materials on HCWM**

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PRESIDENT'S PAGE

Esteemed members,

Cordial Season's Greetings.

The Indian Society of Hospital Waste Management (ISHWM) has made rapid strides in last couple of years in the area of healthcare waste management. After successfully organising ISHWMCON conferences every year for last five years, we have one now at KMC Manipal. The life membership of ISHWM is going to cross 500 mark in near future. After actively contributing and collaborating with IGNOU and WHO SEARO in the launch of the Certificate Program in Health Care Waste Management (CHCWM) in south east countries in 2006, ISHWM has not looked back. Your President while working at IGNOU contributed in deliberations at WHO Geneva and finalizing the Second Edition of the famous Blue Book-Safe management of wastes from health-care activities (2014). In fact, Chapter 13 of the Blue Book has been authored by me. I shall request you to please download it from this link http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf

Capacity building, training, awareness, consultancy and research continue to be a very weak link. The ISHWM has been very active in all these areas. With support from WHO SEARO the ISHWM recently in December 2015 completed a Multi centric research study titled "Study to understand the impacts of sound healthcare waste management on hospital associated infections". Spread over two years this study was carried out in two hospitals namely, Lady Curzon Bowring Hospital, Bangalore and ESI Hospital, New Delhi. ISHWM in collaboration with E&Y was also shortlisted in 2015 to undertake a consultancy for eight district hospital and medical colleges in Bihar. We have also contributed in finalising the Revised BMW Rules 2016. The Deccan Herald, Bangalore edition carried a full page story by your President, Dr Asima Banu and others on these rules on 4 April 2016.

There is need for bringing out user friendly training manuals in all languages across the country. I feel members of ISHWM can contribute to this in a large way. Similarly, model hospital policies, model SOPs (Standard operative protocols) can be brought out for use at large. Working towards designing and developing model health care facilities with focus on hospital/clinic sanitation is needed. Individual institutions can contribute in this direction.

There is need to work towards compilation of directory of ISHWM members with their contact details so that ISHWM Journal can reach all. I seek the cooperation of all ISHWM Members in this direction. Of course, there is need to increase membership also by drives in all states.

I am glad that the annual conference of the Indian Society of Hospital Waste Management has turned out to be International conference since 2015. This has been because of interest expressed by neighbouring countries. I feel there is lot of scope and potential to work in this direction for ISHWM. I am glad that Professor Dr Somu and his team of Hospital Administration at Manipal Academy of Higher Education, Dept of Public Health and Dept of Community Medicine have taken a lead in this year's conference and this issue of ISHWM is being released.

Let us also join hands together to improve the HCWM situation at ground level.

Wishing you all happy and prosperous New Year!

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EDITOR'S PAGE

Dear members, readers,

Cordial greetings!

Government of India has released revised Bio medical Waste Management (BMW) rules 2016 – a progressive, but a challenging step. We see improvements in the area of HCWM across the country. Also, I am glad that ISHWM and this Journal of ISHWM is contributing in its own way for the advancement in the area.

We are very happy and delighted to present articles by people who are active researchers and practitioners. Each one's input is as a senior practitioner/MD student or PhD scholar in the area. Current issue has articles focused on UNIDO sponsored endeavour on HCWM by Prof Dr AK Agarwal, article on Hazardous waste management by Dr Aparna Sharma, review article on Dental Health Care waste Management by Prof Dr Pushpanjali. Initiatives of Karnataka Government are highlighted by Dr Asha Abikar, Deputy Director of Health and Family welfare Services, Government of Karnataka in her article. Article by Dr Bijoy from MAHE focuses on challenges in a tertiary care hospital. An interesting input by Dr Ramakrishna Goud helps us with a ready reference for taking up assessment of HCWM in health care settings. He also takes our focus to revised BMW rules 2016 in his yet another note. Dr Ishfaq provides us with a compilation of recent information references for HCWM.

I wish to retiterate that this journal is for you, by you and seeks your continued contribution, patronage, criticism and support. More and more contributions are welcome. Linkages with sponsors are required. Dr Bhanu in her letter to Editor suggests us to bring out more issues per year as we are bringing out only one issue every year. Also, there is a need to bring out Directory of ISHWM members. Volunteers to serve as reviewers are welcome.

I wish to express my gratefulness to ISHWM President and Governing council for the confidence imposed on me and our team in HCWM Cell, Community Medicine for the technical part of the Journal. I am glad that the current issue is being brought out and released in MAHE, Manipal in the International Conference 2016. I am grateful to Editorial advisors, Reviewers, Editorial committee and my colleagues from Community Medicine Dept who provided assistance and support.

My special thanks to Dr Babitha Rajan , Assistant professor, Com Med and Ms Roopa whose contribution was very valuable in bringing out this issue.

We wish you and all your loved ones at home happy and prosperous 2017.

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ORIGINAL ARTICLES

STUDY OF IMPACTS OF SOUND HEALTHCARE WASTE MANAGEMENT ON HOSPITAL ASSOCIATED INFECTIONS IN A TEACHING HOSPITAL, BANGALORE

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INTRODUCTION:

A hospital in India generates around 0.5 to 2 kg of waste per bed per day with 70-80 percent of that being general waste, 15-20 percent infectious waste, 5-10 percent pathological waste, 0.5 to 1 percent being chemical and sharp wastes. Currently, waste management in India commonly means dumping at landfill sites. In most cities of India, outsourced private agencies and municipalities do the waste collection. Some restraints faced by the sector are insufficient focus on policies and procedures by Government facilities and little regard for stringent and mandatory laws at state, district and city levels. Lack of a proper waste collection and transportation system, common biomedical waste treatment facilities add to the pressures. The regional distribution is also highly skewed.

Unsafe injection practices are prevalent worldwide and may result in spread of infection. According to Rehan HS et al study was planned to observe the injection practices of healthcare professionals (HCP), including aseptic precautions and disposal of used syringes/needle. Injection practices were observed in the outpatients and inpatients departments. Questionnaire was designed, tested and administered for this purpose. 130 patients receiving injections were observed. Overall injection practices of the HCP were satisfactory. However, unsafe practices with respect to not washing hands (95.4%), not wearing/changing gloves (61.6%), recapping of needles (12.2%), wiping of needle with swab (15.4%) and breaking of ampoule with solid object (44.4%) were observed. The problem of unsafe injections can be successfully addressed by organizing continuing medical education / symposium / workshops for improving the knowledge, attitude and practices of the HCP. Periodic monitoring and such interventions may also further improve safe injection practices.

As per WHO estimates (2000), sharps injuries to health-care workers were estimated to have caused about 66 000 hepatitis B (HBV), 16 000 hepatitis C (HCV) and 5000 HIV infections among health-care workers (Prüss-Ustun et al., 2005). It is estimated that more than two million health-care workers are

exposed to percutaneous injuries with infected sharps every year. In certain facilities and countries, health-care workers may have several percutaneous sharps injuries per year, although this could be avoided by training on the safe management of sharps. The common medical and waste-management procedures that led to a sharps injury, in selected countries. Scavengers on waste disposal sites are also at significant risk from used sharps (although these risks are not well documented).

Hospitals will increasingly bear the costs for HAIs. According to Roberts R R et al attributable mortality was estimated using logistic regression. Among 1253 patients, 159 (12.7%) developed HAI. Using different methods, attributable total costs ranged between $9310 to $21,013, variable costs were $1581 to $6824, LOS was 5.9 to 9.6 days, and attributable mortality was 6.1%. The semi-log transformation regression indicated that HAI doubles hospital cost. This suggests that HAI prevention expenditures would be balanced by savings in medical costs, lives saved and available hospital days that could be used by overcrowded hospitals to enhance available services.

In view of the above it becomes prime responsibility of all stake holders such as the government, professional bodies, the WHO and others to demonstrate that scientific and proper management of biomedical waste can reduce hospital associated infections, associated morbidity and mortality, use of costly antibiotics, average length of stay (ALS), high costs and poor outcome of patient care. There is dearth of good evidence to show if there is a close relationship between healthcare associated infections and healthcare waste management.

Table 1.1 Potential infections caused by exposure to health-care wastes, causative organisms and transmission vehicles

Type of infection	**Examples of causative organisms**	**Transmission vehicles**
Gastroenteric infections	Enterobacteria, e.g. *Salmonella*, *Shigella* spp., *Vibrio cholerae*, *Clostridium difficile*, helminths	Faeces and/or vomit
Respiratory infections	*Mycobacterium tuberculosis*, measles virus, *Streptococcus pneumoniae*, severe acute respiratory syndrome (SARS)	Inhaled secretions, saliva
Ocular infection	Herpesvirus	Eye secretions
Genital infections	*Neisseria gonorrhoeae*, herpesvirus	Genital secretions

Skin infections	*Streptococcus* spp.	Pus
Anthrax	*Bacillus anthracis*	Skin secretions
Meningitis	*Neisseria meningitidis*	Cerebrospinal fluid
Acquired immunodeficiency syndrome (AIDS)	Human immunodeficiency virus (HIV)	Blood, sexual secretions, body fluids
Haemorrhagic fevers	Junin, Lassa, Ebola and Marburg viruses	All bloody products and secretions
Septicaemia	*Staphylococcus* spp.	Blood
Bacteraemia	Coagulase-negative *Staphylococcus* spp. (including methicillian-resistant *S. aureus*), *Enterobacter*, *Enterococcus*, *Klebsiella* and *Streptococcus* spp.	Nasal secretion, skin contact
Candidaemia	*Candida albicans*	Blood
Viral hepatitis A	Hepatitis A virus	Faeces
Viral hepatitis B and C	Hepatitis B and C viruses	Blood and body fluids
Avian influenza	H5N1 virus	Blood, faeces

Main Objective:

- To understand the linkage between Hospital Associated Infections and sound management of healthcare wastes.

Specific objectives:

- To carry out baseline survey of the existing situation of the hospital associated infections as well as the practices and procedures of health care waste management (HCWM) in the identified hospital.
- To assess the level of compliance to the biomedical waste management rules.
- To conduct capacity building and awareness trainings for improving the knowledge and skills of the different categories of hospital staff.
- To improve and streamline the HCWM practices including compliance with hand hygiene practices among health care workers

To analyze hospital associated infections after the intervention period of one year.

Materials and Methodology: This study was carried out in a government teaching hospital in Bangalore during September 2013 to December 2015. The WHO SEARO supported the study.

The primary and secondary data was generated and used through interviews, onsite observations, trainings & meetings, questionnaire, interventions and checklists.

The base line survey was conducted to study the existing/prevailing practices for healthcare waste management, prevalence of hospital associated infections, average length of stay, needle stick injuries and expenditure incurred per bed. The intervention in the form of capacity building/training and orientation of health care workers (doctors, nurses, paramedical and support staff), scientific waste segregation, collection, transportation and disposal was undertaken as per BMW Rules. Special focus was made on standard precautions and sharps management.

A **Gantt Chart** was drawn and the Research Project was carried out as per schedule. The old tool to assess the handling, storage and transportation of Biomedical Waste was modified and updated as per the latest amendments made in the *Bio Medical Waste Management Guidelines*.

The Bio Medical Waste Management Questionnaire - New Tool was prepared in November 2013. This questionnaire assesses knowledge in areas of segregation of waste by color coded bins, biohazard symbols, awareness of hospital associated infections, storage and transportation of Bio Medical Waste and its final treatment at the Bio Medical Waste Treatment Plant. The new tool was administered to the staff at Bowring and Lady Curzon Hospital, Bangalore. Testing of the Tool was completed by December 2013.

Baseline Analysis:

The data collected was analyzed and the results of the tool tested at this hospital are as follows:

44 % were aware of the date when the Biomedical Waste Management Rules were published in the Gazette of India.

40% knew the authority for Biomedical Waste Management Rules

50% knew the exact number of Categories of biomedical waste

80% were aware of the correct Hazard Symbol of biomedical waste

75% said Yes to labeling of the color coded plastic bag being mandatory

40% stated that hospitals are required to do Monthly reporting to State Pollution Control Board.

56% stated Hospital associated infections are those that occur after 48hrs of patient's admission in the hospital.

A workshop was conducted on healthcare waste management on 16 December 2013, for doctors, nurses and paramedical staff of the hospital. Noted and eminent researchers in the field of Bio Medical Waste Management made scientific presentations. The Investigators spoke on the Recent Advances in Segregation , Collection and Transportation of Bio Medical Waste, the importance of segregating hazardous waste, symbols of biomedical waste, infections waste, Biomedical Waste Management Handling Rules. Appropriate management of biomedical waste in terms of discarding in the appropriate containers, transportation to storage area and finally to the waste management site were also highlighted.

Situation analysis and observation visit was conducted on 25th & 26th April, 2014 to check status of infection control committee, officers responsible for stock management of healthcare waste equipment/consumables and officials responsible for preparing hospital indices and collected baseline data for formulating further training programs.

After the through inspection of Health care waste management practices in hospital on 25th April, 2014. Visits were carried out to Microbiology and Pathology laboratories, ICU, NICU, Postoperative wards and general wards of the hospital. It was observed that there was a mismatch in the colors of bins and liners (as in the photo). The team advised that this needs to be rectified to avoid confusion in segregation of waste.

A Gantt Chart of the activities in this study is given below.

Gantt Chart

S No.	**Proposed Activities**	**Months 2013 - 2014**											
A	**Activity - Project First year**	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1	Pre project Advocacy meeting of Stakeholders/briefing												
2	Situation Analysis												
3	Preparation of Tools												
4	Testing of Tools												
5	Baseline data collection												
6	Data Compilation												
7	Assessing Correlation between Health care waste management and Hospital Stay												
B	**Activity - Project Second year**	January 2015 – December 2014											
1	Formulation of Intervention Strategies as per objectives.												
2	Advocacy with stake holders												
3	Training of Medical and paramedical staff												
4	Implementation of strategies												
5	Monitoring of Healthcare Waste management												
6	Ensuring logistic support by Concerned institution												

C	Activity - Project Third year	January 2015 - December 2015											
1	Post intervention data collection												
2	Data compilation												
3	Data analysis and report writing												
4	Debriefing												
5	Report Dissemination												
6	Submission of final report												

Action points following the meeting:

1. Appointment of Nodal officers in each department to monitor waste management practices regularly.

Action : Medical superintendent

2. Establishment of Hospital Infection Control/ Waste management Committee and regular conduct of meetings.

Action : Medical superintendent

3. Provision of Incentives/certificates for best practices.

Action : Project team

4. Conduct of training programmes to nodal officers/Committee members.

Action : Project team

5. Ensure adequate supply of colour coded bins/liners.

Action : Director, BMCRI to be followed up by local coordinators.

6. Monitoring Hospital infection control rates and reporting to MS**.**

Action : Dr Asima Banu, Microbiolgy head and project coordinator

Data Analysis, Results & Discussions

Framework of Data collection: Before undertaking the study, permission was obtained from the hospital authorities for undertaking. A meeting of the Medical superintendent (MS) and senior staff members of the hospital was organized to sensitize them about sound healthcare waste management and its relationship with HAIs. During this meeting, staff members were made aware of the hospital waste management and the importance of reducing the burden of hospital associated infections.

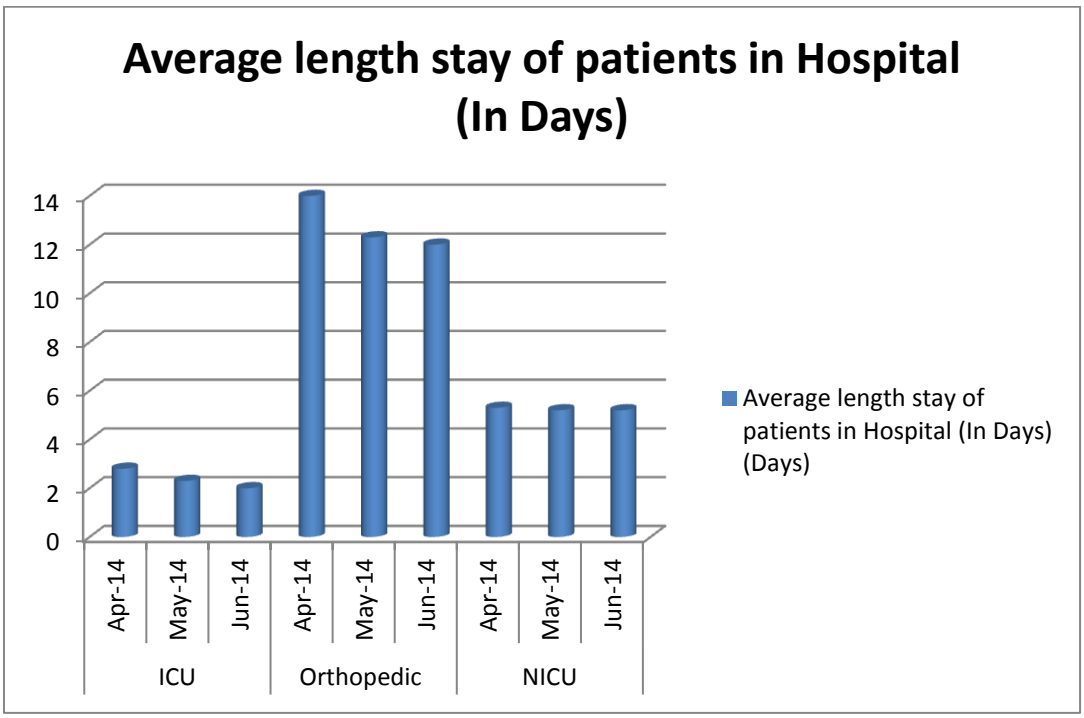
The post intervention data was collected, analyzed and collated to assess the impact of interventions. It helped in comparing the improvement in prevalence of hospital associated infections of quality of health care waste management and average length of stay.

Baseline survey was done in October 2013 with regards to average length of stay in hospital which was 4.5 days and the

commonest HAIs infections were urinary tract infections, post operative wound infections and respiratory infections. The incidence of HAI was about 10%. MRSA screening was done for nursing staff working in the intensive care units of the hospital and those who were found positive were treated as per the guidelines.

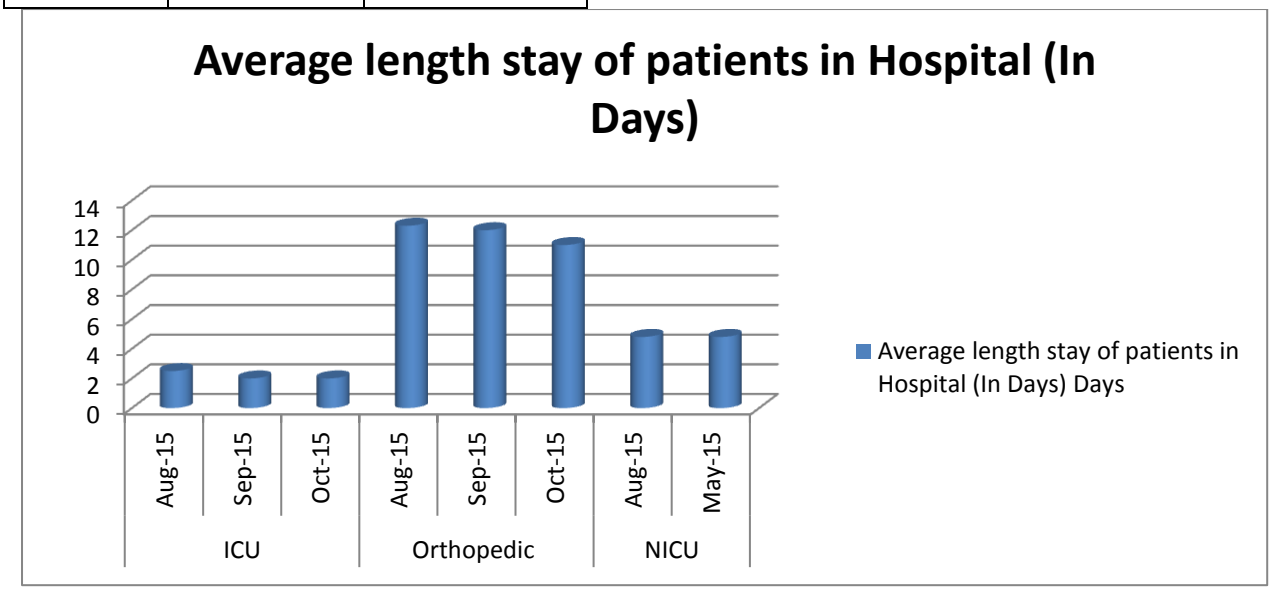
Before study. Average length stay of patients at Lady Curzon Hospital in 2014.

Wards	Month & Year	Average Days
ICU	Apr-14	2.8
	May-14	2.3
	Jun-14	2
Orthopedic	Apr-14	14
	May-14	12.3
	Jun-14	12
NICU	Apr-14	5.3
	May-14	5.2
	Jun-14	5.2



After study, Average length stay of patients at Lady Curzon Hospital in 2015

Wards	Month & Year	Average Days
ICU	Aug-15	2.5
	Sep-15	2
	Oct-15	2
Orthopedic	Aug-15	12.3
	Sep-15	12
	Oct-15	11
NICU	Aug-15	4.8
	15-May	4.8



Average length of stay of patients in hospital was more due to infections before conducting of the study. Wherever average length of the stay of patients after the study is less as described above in graphical representation.

The biomedical waste management scenario was analyzed at various wards: ICU, Orthopedic, NICU. Waste audit, training and seminars were also used as a means to investigate waste management in this hospital at periodic intervals in over 2 year of study period. Average length stay of patients due to infections in the hospital is reduced by implementation of hospital waste management guidelines and application of NABH-Safe I PROGRAME for infection control.

CONCLUSIONS

Safe and effective management of bio medical waste is not only a legal necessity but also a social responsibility. Lack of knowledge and communication among persons working in that area, lack of motivation, training, awareness and cost factor are some of the problems faced in the proper hospital waste management. Proper surveys of waste management procedures in various practices are needed. An effective communication strategy and knowledge is imperative keeping in view the low awareness level among different category of staff in the health care establishments regarding biomedical waste management. In order to have effective waste management the appointment of Nodal

Officers for all the departments in the hospital proved to very useful. There is need for Hospital infection control/Waste management committee to monitor waste management practices regularly and to develop guidelines and protocols. Biomedical waste label on waste bags and waste trolley and also posters put on the wall adjacent to the bins (waste) giving details increased awareness among staff and patients. Carry bags also have the biohazard symbol on them.

RECOMMENDATIONS

All institutions generating biomedical waste must be registered with central/state pollution control boards. All health care personnel involved in the generation, segregation or handling of biomedical waste must be trained in biomedical waste management including health and safety measures. All institutions generating biomedical waste must segregate waste in the prescribed colored containers with matching liners. Regulation about the non chlorinated liners/bags, labeling of biomedical waste containers should be implemented. Use of offsite treatment facility for disposal of biomedical waste should be encouraged. Accident reporting system for accidents related to the handling or transportation of biomedical waste should be implemented. Sharp waste should be disinfected before disposal and should be containerized in color coded containers as per rules & regulations. Another important recommendation is to integrate the waste management committee with the hospital infection control committee. Regular and periodic monitoring needs to be carried out for all such aspects.

ORIGINAL ARTICLE

IMPLICATIONS OF BIOMEDICAL WASTE MANAGEMENT RULES 2016: CASE STUDY AT A TERTIARY CARE TEACHING HOSPITAL

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Abstract:

Hospitals and healthcare institutions should ensure that the biomedical waste generated during their functioning should be disposed without any harmful impact on the community or the environment. The Bio-Medical Waste (Management and Handling) Rules, 1998 published by the Ministry of Environment and Forests, Government of India served as a regulatory frame work for management of bio-medical waste generated in the country. In March 2016, the ministry published the Bio-Medical Waste Management Rules, 2016. The healthcare facilities and common biomedical waste treatment facilities should comply with the new set of regulations that were introduced in the 2016 rules. So a study was undertaken to study the existing biomedical waste management practices in the hospital and to recommend necessary changes for compliance with the new regulations. The changes to be implemented included introduction of a barcoding system for tracking of biomedical waste, phasing out of chlorinated plastics, vaccination of healthcare workers against Tetanus, updating the hospital website with monthly and yearly records of biomedical waste management and use of cardboard boxes with blue coloured markings for glassware & metallic implants. This study will serve as a guide for hospital administrators who are in the process of upgrading the systems in existing hospitals to comply with the new regulations.

Keywords: biomedical waste management, healthcare waste, biomedical waste management rules

Introduction:

Hospitals and healthcare institutions should ensure that the biomedical waste generated during their functioning should be disposed without any harmful impact on the community or the environment. As per WHO statistics, 85% of hospital wastes are non-hazardous, about 10% are infectious waste and approximately 5% are classified as non-infectious but hazardous wastes[1]. Negligence in ensuring proper biomedical waste management significantly contributes to

environmental pollution and has serious impact on the health of the community[2]. The Bio-Medical Waste (Management and Handling) Rules, 1998[3] was published by the Ministry of Environment and Forests, Government of India on 20th July, 1998. It served as a regulatory frame work for management of bio-medical waste generated in the country. In 2011, the ministry notified the Draft Bio-Medical Waste (Management & Handling) Rules, 2011, which was updated again in 2015. These were created with the intent to improve the collection, segregation, processing, treatment, and disposal of bio-medical wastes. Focus was also placed on reducing waste generation and the impact on the environment. Finally, in March 2016, the ministry published the Bio-Medical Waste Management Rules, 2016[4]. The healthcare facilities and common biomedical waste treatment facilities should comply with the new set of regulations that were introduced in the 2016 rules. So a study was undertaken to study the existing biomedical waste management practices in the hospital and to recommend necessary changes for compliance with the new regulations.

Materials and methods:

The study was done in a 2000 bedded tertiary care teaching hospital. An observational study was conducted to understand the existing systems for biomedical waste management. The methodology also included interview of staff. Information was obtained about the generation, collection, segregation, transport, storage, and disposal of biomedical waste in the institution. This was then compared with the new Biomedical Waste Management Rules 2016 to understand the changes to be implemented.

Results:

The waste materials generated in the hospital were segregated at the point of generation. They were placed in various containers as per the segregation guidelines (Table 1) by the hospital staff. These were then collected by the environmental workers and transported to a temporary storage area.

Table 1: Segregation of biomedical waste

Container type	Waste materials
Sharps container (puncture proof)	Needles, blades, and other sharps
Yellow bag	Infectious waste meant for incineration like items soaked with blood or body fluids, dressing materials, anatomical waste etc.
Red bag	IV fluid bottles, syringes (without needles and sharps), surgical gloves, other plastic items etc.
Blue bag	All glassware
Black bag	Non-infectious waste like paper, food waste, sweepings etc. (General wastes)

The municipality waste management system is used for disposal of general wastes. Disposal of biomedical waste is outsourced to a common biomedical waste treatment

facility. Collection of waste takes place every day by a vehicle run by the treatment facility. They were taken to the waste treatment plant for final disposal. All the steps involved were found to be compliant with the regulations set forth by the Bio-Medical Waste (Management & Handling) Rules, 1998. These were compared with the new regulations and the changes to be implemented were identified (Table 2).

Table 2: Changes to be implemented in the hospital for adherence to Bio-Medical Waste Management Rules, 2016.

Changes in 2016 rules	Current practice	Action to be taken
Make a provision within the premises for a safe, ventilated and secured location for storage of segregated biomedical waste.	Storage location adheres to new guidelines.	Nil
Pre-treat the laboratory waste, microbiological waste, blood samples and blood bags as per WHO or NACO guidelines.	Chlorination and further processing in ETP.	Ensure that pre-treatment adheres to WHO or NACO guidelines.
Phasing out of chlorinated plastic bags, gloves and blood bags.	Most of the above items used in the hospital were made from non-chlorinated plastic. Powder free gloves used in the hospital are made from chlorinated plastic.	Replace chlorinated plastics with non-chlorinated alternatives.
Training to all healthcare workers at induction and at least once a year thereafter.	Training done as per recommendations.	Annual report to be submitted. Standard manual for trainers and training to be developed.
Immunise all health care workers against diseases including Hepatitis B and Tetanus.	Vaccination given against Hepatitis B.	Tetanus vaccine to be given for staff.
Establish a Barcode System for bags or containers containing	No such system in use.	Coordination with common waste management facility

bio-medical waste to be sent out of the premises.		and IT department for implementation of barcoding system.
Existing incinerators to achieve the standards for treatment and disposal of bio-medical waste as specified in Schedule II for retention time in secondary chamber.	The hospital does not have an incinerator.	Nil
Maintain and update on day to day basis the bio-medical waste management register and display the monthly record on its website.	Record maintained as per requirements. But records not uploaded to the website.	Monthly record and annual report to be updated in the website.
Cardboard boxes with blue coloured marking to be used for glassware and metallic body implants.	Blue plastic bags are used.	Cardboard boxes to be used as per the recommendation.

Discussion:

10 categories of biomedical wastes were defined in Schedule I of Bio-Medical Waste (Management & Handling) Rules, 1998 (Table 3). They were replaced with 4 colour coded categories in Schedule I of Bio-Medical Waste Management Rules, 2016 (Table 4).

Table 3: Classification of biomedical waste categories as per Bio-Medical Waste (Management & Handling) Rules, 1998.

Category	Type of Waste	Treatment & Disposal
No. 1	**Human Anatomical Waste** (human tissues, organs, body parts)	incineration[c]/deep burial[d]
No. 2	**Animal Waste** (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood, and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal houses)	incineration[c]/deep burial[d]
No. 3	**Microbiology & Biotechnology Waste** (wastes from laboratory cultures, stocks or specimens of micro-organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial	local autoclaving/micro-waving/incineration[c]

	laboratories, wastes from production of biologicals, toxins, dishes, and devices used for transfer of cultures)	
No. 4	**Waste sharps** (needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (chemical treatment)[a]/ autoclaving/ microwaving and mutilation/shredding[b]
No. 5	**Discarded Medicines and Cytotoxic drugs** (wastes comprising of outdated, contaminated and discarded medicines)	Incineration[c]/ destruction and drugs disposal in secured landfills
No. 6	**Solid Waste** (Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, lines, beddings, other material contaminated with blood)	Incineration[c]/ autoclaving/ microwaving
No. 7	**Solid Waste** (wastes generated from disposable items other than the waste sharps such as tubings, catheters, intravenous sets etc.)	Disinfection by chemical treatment[a] autoclaving/ microwaving and mutilation/shredding[b]
No. 8	**Liquid Waste** (waste generated from laboratory and washing, cleaning, house- keeping and disinfecting activities)	Disinfection by chemical treatment[a] and discharge into drains
No.9	**Incineration Ash** (ash from incineration of any bio-medical waste)	Disposal in municipal landfill
No. 10	**Chemical Waste** (chemicals used in production of biologicals, chemicals used in disinfection, as insecticides, etc.)	Chemical treatment[a] and discharge into drain for liquids and secured landfill for solids

[a] Chemicals treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent. It must be ensured that chemical treatment ensures disinfection.

[b] Mutilation/shredding must be such so as to prevent unauthorised reuse.

[c] There will be no chemical pre-treatment before incineration. Chlorinated plastics shall not be incinerated.

[d] Deep burial shall be an option available only in towns with population less than five lakhs and in rural areas.

Table 4: Classification of biomedical waste categories as per Bio-Medical Waste Management Rules, 2016.

Category	Type of Waste	Type of Bag or Container to be used
Yellow	(a) Human Anatomical Waste	Yellow coloured non-chlorinated plastic bags
	(b)Animal Anatomical Waste	
	(c) Soiled Waste	
	(d) Expired or Discarded Medicines	
	(e) Chemical Waste	Yellow coloured containers or non-chlorinated plastic bags
	(f) Chemical Liquid Waste	Separate collection system leading to effluent treatment system
	(g) Discarded linen, mattresses, beddings contaminated with blood or body fluid.	Non-chlorinated yellow plastic bags or suitable packing material
	(h) Microbiology, Biotechnology, and other clinical laboratory waste:	Autoclave safe plastic bags or containers
Red	Contaminated Waste (Recyclable)	Red coloured non- chlorinated plastic bags or containers
White (Translucent)	Waste sharps including Metals	Puncture proof, Leak proof, tamper proof containers
Blue	(a) Glassware:	Cardboard boxes with blue coloured marking
	(b) Metallic Body Implants	

Several studies[1,2] have been conducted to investigate the compliance of healthcare facilities with the biomedical waste management guidelines. All healthcare workers should be made aware of the updated regulations in the 2016 rules. In a study done by Alok Sharma et al[5] in Jaipur, the knowledge and awareness about biomedical waste hazards and management was found to be poor among the healthcare staff. They concluded that introduction of regulations should be supplemented by strategies to improve awareness among staff and ensure adherence to the laws[5].

A study by Das et al[6] has described how a hospital in Jamshedpur, Jharkhand ensured proper handling and management of waste by following a total quality management approach. Singh et al[7] documented how introduction of an information booklet on

biomedical waste management helped in raising the awareness among nursing staff in a teaching hospital.

Conclusion:

The Biomedical Waste Management Rules 2016 introduced many significant changes which are aimed at improving the generation, collection, transportation and final disposal of healthcare waste in the country. Although healthcare facilities may find it difficult in adopting/switching over to these new practices overnight, the modified rules help the hospital authorities and healthcare industry as a whole in managing waste generated through patient care activities. This also facilitates preservation of a clean and healthy environment for future generations. This case study will serve as a guide for hospital administrators in the process of upgrading the systems of biomedical waste management in the hospitals in compliance with the updated rules.

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ORIGINAL ARTICLE

HAZARDOUS WASTE IN HEALTH CARE

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Introduction

Health care has the responsibility to protect and do no harm to both human beings and the planet. It is the industries, being one of the largest contributors of waste globally—from the tons of ordinary garbage such as food wastes and containers that hospitals produce each day, to the hazardous types of waste that require special handling such as chemical, pharmaceutical, and radioactive wastes [1].

One of the biggest challenges for today's healthcare workers is defining the different categories of waste streams they manage on a daily basis and there is no clarity in the names. There's hazardous, pharmaceutical, pathological, infectious, and the list goes on. Perhaps the most confusing and dangerous wastes facilities deal with is hazardous waste. Hazardous waste is much more complicated than biohazardous waste, and more often than not, improperly recognized and categorized by healthcare professionals. So, what is hazardous waste? [2]

According to the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 "hazardous waste" is defined as any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment, whether alone or in contact with other wastes or substances,

Even "environmentally sound management of hazardous and other wastes" means taking all steps required to ensure that the hazardous and other wastes are managed in a manner which shall protect health and the environment against the adverse effects which may result from such waste. [3]

The total absence of management measures to prevent exposure to hazardous health-care waste results in the maximum health risk to the general public, patients, health-care personnel, and waste workers. Effective confinement of waste and safe handling measures provide significant health protection.

India has come a long way in the field of healthcare waste management. While waste management in general is proving to be a major area of concern in urban areas, the efforts to reduce hospital waste by the healthcare sector is highly commendable. There still remains a lacuna when it comes to

hazardous waste management including that of widely used mercury containing equipment.

Even though the bio –medical waste management guidelines suggest that hazardous waste management has to be documented, due to lack of awareness in the healthcare sector, it remains a neglected area.

Goals of management of hazardous waste include[4]:

1. Protecting groundwater and drinking water sources
2. Encouraging implementation of pollution prevention alternatives
3. Reducing the use of toxic substances and generation of dangerous wastes
4. Improving dangerous (hazardous) waste management practices
5. Increasing regulatory compliance through technical assistance

Steps for the management of hazardous and other wastes include:

a) prevention
b) minimization
c) reuse
d) recycling
e) recovery, utilisation including co-processing
f) safe disposal:

- **Step 1 – Designate the waste**

  Take a waste inventory of the hospital, in all departments that generate waste.

- **Step 2 - Counting the Dangerous Waste**

  Write the dangerous waste quantities by making a Waste Inventory section (small, medium, or large quantity generating departments).

- **Step 3- Determine the waste disposal method or identify the alternative**

- **Step 5- Proper disposal of hazardous waste**

g) Miscellaneous:

- Buy and use durable products and materials instead of "use-once, throw-away" items.
- Recycle and purchase products with recycled content.
- Demand that the vendors start take-/buy-back programs for computers and peripherals, printer and copier cartridges, etc. Recycle computer equipment and toner cartridges.
- Use energy efficient lights, and appliances.
- Keep batteries out of the trash. Use non-mercury, rechargeable batteries and implement a battery collection program.
- Place mercury spill kits in mercury use areas.
- Start a mercury elimination program. Buy mercury-free products and equipment (digital sphygmomanometers and thermometers).
- Choose less- or least-toxic products and materials. Eliminate carcinogenic chemicals, and use CFC/Freon management systems to avoid releasing CFC's.
- Do hospital-wide dangerous waste generation counts monthly.

To determine if a waste is dangerous waste, we need to know its physical and chemical nature. It is necessary to know all chemical components that make up the specific waste. Material Safety Data Sheets (MSDS) may tell something about the properties and constituents of the waste.

Some of the hazardous wastes found in healthcare settings and the various acts/rules related to them are as follows:

Hazardous wastes and substances often found in Health Care Settings	Use or Source	Available Alternatives	Examples of Acts/Rules related to hazardous waste
Mercury	• Light bulbs, lamps, and older microwaves. • Thermometers, Sphygmomanometers.	• Low-mercury or energy efficient lamps • Newer microwaves • Digital thermometers, Aneroid Sphygmomanometer	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016[3].
Batteries: Mercury, lead, acid, cadmium, nickel	• Hearing aids and pacemakers • Personal Digital Assistants and digital cameras • Communication devices	• Rechargeable batteries	Batteries (Management and Handling) Rules, 2011[5]
Toner cartridges	• Copiers • Printers	• Replace with safer cartridges • Vendor buy back policies	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016[3].
Cleaning chemicals	• Janitorial supplies	• Replace with safer chemicals	Bio-Medical Waste Management Rules, 2016 [6]
Electronic waste	• Computers • Cathode Ray Tubes (CRTs)	• Proper disposal • Vendor buy back policy	e-Waste (Management and Handling) Rules, 2016 made under the Act [7]

Waste Management and Sustainable Development Goals(SDGs) [8]:

- SDG 3: Good health and well being
- SDG 6: Clean water and sanitation
- SDG 12: Responsible consumption and production

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ORIGINAL ARTICLE

"A REVIEW ON STATUS OF DENTAL HEALTH CARE WASTE MANAGEMENT AND STRATEGIES SUGGESTED FOR IMPROVING THE SYSTEM"

RUNNING TITLE: DENTAL HEALTH CARE WASTE MANAGEMENT - REVIEW

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Abstract:

Background: Health care waste being responsible for hazards is well documented. The hazardous nature of dental health care waste is less studied. Available literature reports, dental health care waste related issues to be inadequately addressed among dental health professionals. Poor awareness and inadequate practices, lack of guidelines and system are few of the issues reported. A difference in categorization, management options underlying legal issues among countries has also been reported.

Aim and objectives: To search for information on status of dental health care waste management among dental health care facilities and to report on factors contributing / influencing the practicesand to compare the current status in Indian context to other countries. To explore the strategies suggested for improving the status of DHCWM.

Design: Integrative review

Methods: Thesteps suggested by Mendes et al(1)was adopted to conduct literature search and the descriptors were identified and used to search data bases such as PubMed, Scopus, Google scholar and web of science.

Results: This resulted in 19 articles at Global level and 9 at national level which fulfilled our criteria for inclusion. None of the studies considered all domains of DHCWM and thosereported had poor compliance to

expected standards. Information on factors contributing to best practices was not available, but the strategies for improving the system ranged from training to execution of stringent laws.

Conclusion: The literature available on focus of research was inadequate and those available lacked scientific evidence. Use of standard comprehensive validated survey tool that could be adopted at all levels of DHCFs and strategies to align with the findings is recommended.

Relevance: Concerned stake holders should pay greater attention to this area.

Key words: Dental health care waste, Dental health care personnel, mercury, lead, Plaster of Paris

Introduction:

Health care waste has been identified as one of the contributing factors to environmental pollution and for the increased prevalence of blood borne infections. This can be attributed to improper and inadequate handling of the waste. Concerns were raised by the public, communities and NGO for the callous attitude of health care professionals towards health care waste. This resulted in mediation of action at global level which also percolated to National and Regional level with legislations, plans, and guidelines for safe management of health care waste. Dental Health Care facilities also generate dental waste which is hazardous, that can be termed as Dental Health Care Waste (DHCW). The hazardous nature of some of the components of DHCW has enough evidence regarding its impact on environment, community, patients and health care personnel. India was the first country in South Asia to establish a legal framework for the management of health care waste but without specific mention for DHCW. There is scarcity of availability of guidelines, manuals, protocols, schedules relevant to dental scenario that a Dental Health Care Personnel (DHCP) can follow or Dental Health Care facilities (DHCF) can adopt. Hence this literature search is focused on critically appraising the available literature on status of DHCW at national and global levels specifically addressing awareness, compliance, regulations and suggested recommendations for improving systems.

Aim: To search for existing literature to assess the status of Dental health Care waste management among DHCP in DHCF and strategies suggested for improving systems.

Material and Methods:

Design:Integrative literature review

Development of research strategy: The following steps were followed as recommended by Mendes et al(1)

a. establishing the research question

b. search strategy (establishment of inclusion and exclusion criteria, data base and selection of studies)

c. categorization of studies

d. evaluation of the studies included in the study

e. interpretation of results

f. knowledge synthesis

Research question:

1. What is the status of dental health care waste among dental settings across countries in the literature reports?

2. What are the strategies suggested by the authors for improving system?

The following data bases were searched- Pub med (Medline), Google scholar, Scopus, Web of science.

The descriptors used were: dental health care waste management, segregation of waste, disinfection, waste sharps, dental professionals, implementation strategies, Knowledge, attitude, Practices.

Inclusion criteria: Complete articles that are reported in the literature focusing on the study of status of dental health care waste management encompassing system elements at macro and process level, published between 2000 to 2015

Exclusion criteria: Articles that did not mention the focus of the study ie strategies for improving DHCWM practices

Data extraction: This resulted in 19 articles at Global level and 9 at national level that were cross sectional and descriptive in nature.

The information was organized and tables prepared(Table 1 and Table 2). The information extracted included the sample characteristics, study tool used, method adopted for collecting data, domains included, psychometric properties of the study tool used, results and suggestions given.The WHO publication (blue book)on safe management of health care waste was followed for identifying the domains and conclusion section was assessed for suggestions and recommendations when no explicit information was available.

Table 1: Comprehensive table depicting details of studies conducted at Global level

Authors, Year Country ,	Target group/ Sample size	Study tool	Method of data collection	Focus area/domains	Results	Conclusion/ recommendation
M Daniel, 2014, Shiraz, Southern Iran(2)	Private practices, statistically arrived 110	Questionnaire and check list	Interview and direct observation	Mercury waste, amalgam, lead foil, sharps, infectious, pharmaceutical and domestic wastes	Poor compliance, 90% mixing with domestic waste, 40% poor disposal of waste sharp, 100% fixer disposal was NC, 10% recycled amalgam and lead	Lack of awareness, negligence by policy makers, need for special facilities and infrastructure for managing few wastes, enforcement of strict regulation, training, recommended quantification for future to facilitate better understanding of actual situation and enforce current regulations.
Maha Hani, 2015,Lebanon(3)	Private practice , randomly chosen 242 dentists(10% of 2400 registered)	32 items-	Interview	Organization, immunization, training, mercury waste management	90% did not have written plan, 71% poor segregation, municipal bins were disposal options, 13.428 g of mercury release per clinic (indirect estimation based on number of fillings placed multiplied by .55g mercury release established by Al- Khatib)	Poor infrastructure, training, refining guidelines, laws and regulations, mandatory curricula in higher education
Osamong, 2005, Nairobi, Kenya(4)	Dental practitioner from public and private clinics- 50	Questionnaire	Self administered	Training, guidelines,	49% guidelines, most agreed that training is essential	Need for training
Treasure, Elizabeth T. Treasure, Patrick, 1997,New	Dental practitioners- 1076 and students	Mixed method, pilot	Mailed questionnaire	Waste management and Infection	Increased quantity of disposable waste, poor	Training

Authors, Year Country ,	Target group/ Sample size	Study tool	Method of data collection	Focus area/domains	Results	Conclusion/ recommendation
Zealand(5)		tested questionnaire		control	awareness, unfavorable attitude, mixing of waste, cost implications, subjects believed HBV was not a threat.	
R Mumtaz, AAlikhan, N Noor, S Humayun, 2010, Pakistan(6)	Statistically arrived 352 dental practitioners+ 256 dentists from dental hospitals	Validated questionnaire	Questionnaire	Preference to use amalgam	Financial constraints, clinical conditions, aesthetic demands, patient choice. Amalgam was disposed into trash	Protocol for amalgam waste management
Licia, 2004, Northern Italy(7)	400 practitioners- 122 responded	Questionnaire	Mailed questionnaire	Disinfectants, infectious diseases, preventive protocol, training and immunisation	Glutaraldehyde was used predominantly for surfaces and hand piece, good awareness about infections, 89% vaccination, 73% experienced needle stick injuries, 90% compliance to PPE, 27% changed mouth mask, 94% disposed into sharp containers. 68% hand washing , poor protocol for reusable instruments	Caution to be exercised as it was self reported
RO Darwish, 2006, Palestine (8)	37, dental clinics	Questionnaire	Interview	Immunization, type of waste, disinfectants, method of disposal	Disinfectants were disposed into drains, radiology waste also into drain, amalgam as general waste, 50% treated waste sharps as general waste, Best practices were noticed were containment	Large study to arrive at sound management for health care waste

Authors, Year Country ,	Target group/ Sample size	Study tool	Method of data collection	Focus area/domains	Results	Conclusion/ recommendation
					of amalgam waste by 2 practices, puncture resistant containers for waste sharps in 4 clinics. Quantification was by estimating details of treatment done.	
Leonardo Tsuji, 2005 ,Canada(9)	Four types and sizes of intraoral dental film	Experiment-creating simulated atmosphere	Experiment-creating simulated atmosphere	Hazardous nature of lead foil	Lead content ranged between 69% to 85% and substantial release.	Foil recycling facility, use of digital radiography which would also contribute in no generation of developer and fixer
Al-Khatib, 2006,Jerusalem (10)	Randomly selected 40 dentists	Questionnaire	Interview	KAB- occupational hazards	Most respondents were aware of biological hazards: 38% specifically mentioned hepatitis B virus and 13% human immunodeficiency virus.	Perceived sources of stress included factors such as relationships with patients, physical strain and economic pressure, but also some specific to the Palestinian culture such as relationships with other dentists and Israeli occupation tax policy when dealing with the Arab dentists in East Jerusalem.
Punchanuwat,1998,Bangkok(11)	Private practitioners, rubbish collectors	Questionnaire	Interview	Disposal of dental waste	Poor practices among dentist. Rubbish collectors reported to witness dental waste in community bins	Training, policy changes in legislation and social policy

Authors, Year Country ,	Target group/ Sample size	Study tool	Method of data collection	Focus area/domains	Results	Conclusion/ recommendation
					and also experienced needle stick injuries.	
Faleh, 2010, Jordan(12)	228 dental practitioners	Questionnaire	interview	Mercury hygiene – total amalgam contact and protocol for mercury hygiene	Total amalgam contact was 3.2±3.6 hours per week. Poor ventilation, lack of training in UG, no PPE, Amalgam waste into drain,	To adopt ADA guidelines, training during UG and PG programme
AsgadAdil Mohamed 2014, Sudan(13)	200 dentists	Questionnaire	Self-administered	KAP	Good awareness, unfavorable attitude due to financial implications, poor practices	Training, annual audit, effective implementation of rules, monitoring
Hylander LD, 2006, Sweden(14)	12 dental clinics	Water sample collection	Amalgam separator based on sedimentation	Mercury emissions	Presence of mercury in the waste water from dental clinics	Improved design of discharge system, sensible use of high pressure water cleaning, and banning of Hg in dentistry as long term strategy
Chaari N, 2009, Monstair (Tunisia)(15)	Dentists and dental assistants- 52 and 52 physicians and nurses as control group	Urine sample and salivary sample	Atomic absorption spectroscopy,	Mercury impregnation,	Increased mercury levels in study group- 20.4+/-42.4microg/g of creatinine and 10.6+/-13.02microg/l. amalgam disposal was inadequate. Presence of mercury on curtains, having lunch in the work	Remedial interventions including efficient aspiration of offices containing fixed sources of mercury, adequate storage, strict compliance to mercury hygiene

Authors, Year Country ,	Target group/ Sample size	Study tool	Method of data collection	Focus area/domains	Results	Conclusion/ recommendation
					place were factors linked to increased levels	
Al-Khatib IA,2010, Nablus, Palestine(16)	97 dental clinics	Questionnaire	Interview	Handling, storage, treatment, and disposal	Poor segregation, dumping into community bins,	Collaborative approach involving dental associations, Ministries and authorities, capacity building
Nazar, 2005, Brazil(17)	105 municipal health clinics	One clinic manager, dental assistant, one general assistant	Interview	Technical and operational(waste classification, characterization, minimization, segregation, pretreatment, transportation, storage., organizational, technical assistants, health care waste management plan,	270 litres of solid waste, segregation of needles and mercury was compiled only.	Lack of scientific evidence pertaining to hazard and regulation may not ensure compliance.
Morenikeji, 2011, Ibadan, South west Nigeria(18)	130 dentists, rubbish collectors and scavengers	Questionnaire	Self administered and interview	Disposal of dental waste	69% did not have any system. Burning was the option, not aware of any regulation	Need Government to intervene, training, legislation
Adedigba MA, 2010, Nigeria(19)	Eight dental clinics-14 workers	Questionnaire	Direct observation and interview	Soil and water sample analysis for verifying contamination	Presence of inorganic elements in samples especially lead, iron, zinc, chromium, manganese, copper, cadmium, mercury. Lead and mercury were present in	Complete closure of dump site and segregation to be practiced.

Authors, Year Country ,	Target group/ Sample size	Study tool	Method of data collection	Focus area/domains	Results	Conclusion/ recommendation
					excess in water samples too	
Mushtaq A, 2008, Lahore(20)	Structured check list	Direct observation	Practices adopted for waste management	Poor segregation, no labeling, no color coded bags, Infectious waste was stored beyond 24 hours, hazardous liquid waste was led into drain, poor compliance to PPE	Waste management at Punjab Dental Hospital is not satisfactory. Interest and motivation in hospital waste management is lacking.	The administration is required to play its role.

Table 2: Comprehensive table depicting details of studies conducted at National level

Place	Author	Tools	Method	Focus areas	Findings	Recommendation
Delhi	AshimaGarg, 2011(21)	50 item questionnaire	Self administered	KAP-DHCW	Good awareness, poor practice and unfavorable attitude	Education
Pune	MusarratKhatri, 2014(22)	12 item questionnaire-206 DHCP (dentists, nurses, attenders)	Interview	KAP- DHCW	Good awareness, poor practice and unfavorable practice	Training, CDE, Short term courses,
Chattisgarh	RuchiArora(23)	27 items, 100 practicing dentists	Self administered	Management of DHCW	Poor practice	Training
National	BalendraPratap Singh, 2012(24)	Questionnaire	Self administered	KAB	60 to 70 had poor practice, waste sharps were disposed into municipal bins, boiling water was used for sterilization,	CDE, greater cooperation between all stake holders
Kothamangalam, Kerala	Sanjeev R, 2014(25)	Questionnaire-24 items, teaching faculty, students of 3 dental colleges	Self administered	KAB-DHCWM	Mean score was- Knowledge:4.35 Practice: 4.69 Attitude: 4.43	The topic should compulsorily be made a part of the dental undergraduate curriculum. Continuing dental education programs.
Chandigarh, Panchakula, Mohali	MohitBansal, 2013(26)	Pilot tested questionnaire	Self administered	Practices for DHCWM	More than 50% of the dentists complied to guidelines,	Strict enforcement of law, MOU with CTF,CDE
National	Raghuwar D Singh, 2014(27)	200 practitioners, 29 items tool	Self administered	KAB	46% cut needle before disposal, 46% led sfixer and developer into drain, mercury waste into community bins	Educate the dental practitioners regarding proper practice measures
Amritsar	Narang, 2012(28)	80 dentists and 80 auxiliary staff, pilot tested questionnaire	Questionnaire	Awareness on DHCWM	Poor awareness	Hospital authorities to develop strategies
Jaipur	Sharma, 2013(29)	Close ended questionnaire, 144 dentists, nurses, laboratory technicians, Class 4 employees	Self administered	KAB-DHCWM, needle stick injury	Poor awareness on the entire gamut of areas	Regular monitoring and training

Results:

What is the status of dental health care waste among dental settings across countries in the literature reports?

What are the strategies suggested by the authors for improving system?

All the 19 studies reported at Global level focused on obtaining data on knowledge, attitude and practices adopted for management of DHCW whereas one of the study focused on assessment of mercury levels in urine and salivary samples among dentists and dental assistants(15)(14). They reported on mercury emissions in water samples from dental clinics. The predominant unit of study was private dental facilities with 3 studies considering public dental facilities(4)(6)(17). The majority of the study sample was formed by dental practitioners, whereas Punchanuwat(11) and Morenikeji(18)considered even rubbish collectors and Chari(15)considered dental assistants. The method of data collection was predominantly interview whereas Osamong(4), Asgad(13) and Morenikeji(18)adopted self administered questionnaire, Licia(7)relied on mailed questionnaire. Two of the reports followed direct observation of the situation(2)(19)

Status of DHCW management:

The focus areas/ domains studied:

A list of areas specific to DHCW was developed based on WHO report, expert opinion and National guidelines documents which comprised of categories of waste, segregation of waste, disinfection and deformation, containment and final disposal. Our search resulted in studies focusing on segregation practices followed, methods of disposal, policy for immunisationand training, (12)(14)(15) few reports focused only on mercury waste management and associated hazards and one of the study focused on lead waste(9).Reports by Nazar(17) and Mustaq(20) have comprehensively covered all relevant areas in their studies. Adedigba(19)assessed soil and water samples to verify contamination.

Study tools/ methods used: The studies appraised have developed tools specific to their focus area of research. The process of tool development, content validation and reliability scores have not been mentioned.

Status: Poor compliancemixing of waste with domestic waste, poor disposal of waste sharp and fixer, unfavorable attitude was reported in all studies except in Italy where the system was acceptable. Some of the studies also reported about acceptable practices in terms of recycling and containment of amalgam(2)(8) use of puncture resistant containers for waste sharps, reuse of lead waste in different form(30).Adverse implications of poor disposal interms of sharp injuries experienced by rubbish collectors were reported by Punchanuwat(11). A Nigerian study reported poor system among 69% of the dentists studied and burning was

the option for final disposal. Reports from Pakistan also indicated poor dental waste management system including poor segregation practices, storing of waste beyond 24 hours and disposal of hazardous waste into drains.

Identification of the strategies/recommendations planned/initiated if any:Further studies to quantify the waste generation to better understand the situation for working on management options, special facilities for managing waste, strict enforcement of regulation, training, revising guidelines, mandatory curriculum , protocol for management, recycling options for lead, alternate radiology options resulting in reduction of fixer and developer waste, effective implementation of rules, banning of use of mercury, collaborative efforts from all stake holders were the strategies suggested in the literature reported.

National level: A total of 9 studies were reported to have been conducted in the country out of which three were conducted at national level. The reports represented wider geographic coverage. Almost all studies considered dentists as target groups whereas few considered auxiliary staff, nursing staff, laboratory technicians and students(29)(31)(25). The studies predominantly employed self administered questionnaire or interview method. None of the studies mentioned the psychometric properties of the tools used. Varied observations have been reported with good awareness, poor practices and unfavorable attitudes.

Discussion:

The studies reported were from Pakistan, Iran, Lebanon, Kenya, Palestine, Canada, Tunisia, Brazil which reported on poor compliance to DHCW management and Italy was the only study which reported to have better compliance compared to other reports. The articles related to the hazardous nature of dental health care waste very few and none of them could relate to direct health implications. Hazards of mercury, lead was studied (3)(6)(9)(15)(19) out of which evidence generated by Chari et al on mercury and leonardoetal on lead can be considered to create awareness among DHCP for safe management of these hazardous waste. The papers also lacked scientific evidence related to hazards associated with each category (17) .The reports were related to mercury waste, lead waste, plaster of paris and waste sharps.

A study report from Monstair, Tunisia (15) comparing DHCP with medical health professionals and nursing staff as cases and controls estimated the presence of mercury in urine and salivary samples and showed increased levels of mercury in salivary and urine samples as compared to the control groups. The correlating factors were presence of fabric curtains, eating lunch at work place, storage mode and poor mercury hygiene

practices. Similarly a case control study(32)reported weak link between mercury exposure and possible conditions like multiple sclerosis, autism etc. J R Mackert in their comprehensive report has supported the hazardous nature of mercury in a dental setting. “Although, there is not enough literature pertaining to mercury in dental setting as a source, the risk associated with mercury use cannot be overruled owing to enough evidence” reported in literature regarding its hazardous nature.

Referring to the guiding principles prescribed by Basel Convention; Precautionary principle and duty of care, DHCP has to give due importance to the management of hazardous waste that they generate .

Lead has been quoted as the one responsible for the fall of Roman Empire due to its neurological ill effects. But no reports directly implicating lead were available except the one by Leonardo, who experimentally proved the leachate nature of lead foils generated as waste in a DHCF when it was treated as general waste(9).

Plaster of Paris also does not have any evidence based reports to claim its hazardous nature except the release of hydrogen sulfide which is a known hazard. But the inclusion of POP in the list of waste to be incinerated in the waste management manuals of England, Australia also indicates caution to be exercised while disposal.

Waste sharp injury is yet another hazard associated with dental health care waste, similar to medical health care scenario. However, literature backing waste sharp injury and associated incidence of blood borne infections is not available. But the reports by Punchanuwat(11) stating improper disposal waste sharps causing injury to rubbish collectors is adequate to seriously consider its potential health hazards.

The next issue addressed was regarding the awareness, attitude and practices adopted by dental health care team. Most of the studies were pertaining to assessment of KAP through self reported questionnaires. A serious threat of this could be an overestimation of the actual scenario. Reports accessed represented wide geographic range at national and global levels.

Dentistry unlike any other profession is largely a team effort and the team is constituted by the dentist and supporting staff- nurse, assistants, housekeeping and secretary. Any research should include information on the entire team, but most of the studies have considered only dentists(13)(17)(19)(20)(27)(24)(23), while few have extended the study to include students, nurses, assistants, laboratory technicians and housekeeping(11)(15)(18)(22). Dental health care waste management involves system elements and process elements and hence issues at the managerial level also play an

important role. None of the studies have considered the macro issues involved in the process that contributes to the effectiveness of waste management. Morenike and Mahahani reported that none of the private practitioners included in the studies had neither policy nor plan to address the issues (18)(3).

Extrapolation of results or generalisability of results largely depends on the size of the sample and the sampling technique. Very few studies have estimated the sample size statistically and have mostly adopted convenience sampling technique which affects the external validity and also comparability of the studies.

Data collection methods and tools used contribute to internal validity and almost all studies have used self reported and interview based methods which are inherently rendered weak by the social desirability bias of the study participants. Though a study has mentioned about direct observation as a method, no supporting results were reported (20).The tool also needs to be assessed for validity and reliability, but none of the reports have clearly mentioned measures adopted for the same except for one where only reliability values were reported. This implies that there no standard tools available to comprehensively cover all areas of DHCW management.

The process of waste management involves awareness of DHCP about segregation, disinfection, color coding and its significance, regulations, common services available etc. None of the literature reviewed demonstrated compliance to standards. However the awareness range was between 10% to 50% (2)(3)(4)(16)(11)(19). Relatively good awareness was demonstrated in studies from certain countries like Northern Italy, Sudan(7)(33). Mixing of waste was common among DHCP(2)(5)(11) but one of the reports did comply with standards for mercury and sharps (17). Liquid waste in dental setting comprises of chemicals used for disinfection, fixer, developer, and standard guidelines indicate dilution and then disposal into sewage. But none of the reviewed papers reported that the participants followed this protocol (2)(8)(14).Mixing of waste or poor segregation practices were demonstrated estimating presence of inorganic elements in the water samples from dental health care setting which reported increased levels of iron, zinc, chromium, cadmium, copper, lead, mercury (19) and mercury by Hylander(14).

Reduce, recycle, reuse is the concept widely discussed to address the issue of waste. One study conducted at Shiraz by Daniel has reported that 10% of the practitioners' reused lead and amalgam waste but information on how this was done was not specified. In this regard, a study report clearly mentioned the strategy adopted to reuse the lead waste designing and developing lead shield (30).

Compliance to standards was below satisfactory level in all reports, although no studies have reported the factors responsible for this below average status. The purpose of any survey would be to assess the situation and arrive at implementation strategies that are justifiable(34).The irony is that none of the surveys did arrive at reasonable strategies that were evidence based. Though as recommendations, the reports have mentioned training to be the primary requirement to change the scenario, they have also included need for legislation, strict implementation, special facilities and mandatory curricula (35)(3)(11)(13) as strategies. One of the studies which exclusively studied the presence of mercury suggested an improved design of the discharge system(14). Chaari,(15)on the other hand suggested efficient aspiration of dental offices containing fixed sources of mercury, whereas Al-Khatib(16) suggested involvement of dental associations, ministries and authorities to bring about effective and sustainable changes.

The failure to translate knowledge into practice was evident. 46% of the DHCP cut needle before disposing , 68%(27) and 46% disposed hazardous waste into municipal waste(27). Despite the possibilities of flaws with respect to internal validity and external validity, it is evident that considerable gap exists between expected and actual situation at the DCHE. However the researchers have suggested training, CDE program,(22)(21)(27) greater cooperation between various stake holders,(36) strict enforcement of law and signing of MOU with CTF(26)as potential strategies for bringing about a difference in the situation of DHCWM.

Conclusion:

The literature review indicated poor awareness and practices among the dental health care personnel and reasons being lack of guidelines, lack of training and suggested collaborative approach between all stake holders and training as strategies for improvement.

Recommendation:

Need to conduct larger surveys utilizing validated standard tools and methods to collect comprehensive information on status of dental health care waste management and to develop strategies for improving systems in alignment with regulatory frame works.

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ORIGINAL ARTICLE

INITIATIVES OF BMW MANAGEMENT IN DEPARTMENT OF HEALTH, GOVERNMENT OF KARNATAKA

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Introduction

Wastes generated from health care facilities are varied in nature, ranging from ordinary organic waste to highly hazardous liquid and solid bio-medical waste. General waste generated in a hospital is about 75-80% the remaining 20-25% of waste generated during treatment and procedures are potentially hazardous to environment. If this hazardous waste is not managed scientifically can pose a serious risk to health of care providers, patients, and the general public. Therefore there was a need for an effective waste management system in all health care facilities. Government of India promulgated the **Bio-medical Waste (Management and Handling) Rules 1998** which detailed good practices to be followed and the roles and responsibilities for all those concerned in the generation and effective disposal of health care waste.

The System:

There are 30 Districts Hospitals, 146 Taluk Level Hospitals, 182 community Health Centres and 2355 Primary Health Centres under the Department of Health &Family welfare, Government of Karnataka.

Solid Bio Medical Waste Management

The generation of solid waste in hospitals depends on the patient load, number of beds occupied and procedures performed in the hospital. Policy was made that all District Hospitals, Taluk Hospitals, Community Health Centers and enroute PHCs would tie up with the Common treatment facility. Only the 6 bedded Primary Health Centres (PHC) would use the deep burial and sharp pit provided in the hospital premises.

BINS

SHARP PIT

DEEP BURIAL PIT

Liquid Bio Medical Waste Management

Liquid generated from laboratory washing, cleaning, housekeeping and disinfecting activity is considered as hazardous waste. It has to be disinfected before flow in to the drainage. A small disinfection unit was designed by KHSDRP. It was constructed using the NRHM funds. The CHC, Taluk hospitals and District hospitals were provided bigger liquid disinfection units which were constructed by the KHSDRP Engineering Wing. The liquid disinfection units of Health Department of Karnataka State have been implemented in many other States like Punjab, Gujarat etc.

The Health Department also hired Environmental Science Graduates as Consultants (one for each district) to handhold, supervise and monitor the BMW disposal. These Consultants were provided checklists to grade each facility on visit. The grading would help the monitors to understand the bottlenecks in disposal of BMW waste.

Primary Health Center

District Hospital/Taluk Hospital/ Community Health Center

Provision of Personal Protective Equipment

Bio medical waste rules describe segregation of waste at the point of generation. It is the Class IV workers who are responsible for the handling and transport of BMW. The Class IV workers have been using surgical gloves which are delicate and prone to tear during work thus leading to infections and endangering their health. The Department has provided all BMW handlers with personal protective equipment. (Mask, Rubber Gloves, Gowns, Goggles and Gum boots). Ensuring use of PPE by BMW handlers is a challenge for which half a day training is being conducted.

Procurement of Mercury Free Equipment (BP Apparatus and Thermometers)

Mercury is a liquid element used in many equipments of medical purpose. Mercury on spill evaporates and may be inhaled. If it comes in contact with water bodies, contamination of water may happen. Mercury has hazardous effect on human health.

The department decided to withdraw equipments with mercury and replace them with mercury free digital instruments. The equipments were supplied and are in use. Withdrawing the mercury equipments has proved a challenge as there is no authorized mercury recycler. The changeover of mind set of Doctors who previously used mercuric sphygmomanometers is happening slowly.

Supervision and Monitoring

The State Advisory Committee has been constituted vide G.O No. Akuka 220 CGA 2016, dt. 04.08.2016 under the **Chairmanship of Health Secretary** for implementation of the new rules in the state with the following representatives from the Department:

1. Principal Secretary to Government / Representative from Urban Development Department, GoK.
2. Principal Secretary to Government / Representative from Department of Animal Husbandry and Fisheries.
3. Member Secretary, State Pollution Control Board or Pollution Control Committee.
4. Urban Local Bodies or Local Bodies or Municipal Corporation.
5. President / Representative from State Indian Medical Association.
6. President of Common Bio-medical Waste Treatment Facility Association.
7. Any Non-Governmental Organization – Co-opt.

DISTRICT MONITORING COMMITTEE

District Monitoring Committees have been constituted vide G.O no. Akuka 220 CGA 2016 (Part 2) dt. 29.08.2016 under the

Chairmanship of **Deputy Commissioner** for supervision of Bio-medical waste activities in the District. The scope of supervision shall include health care facilities as defined by Pollution Control Board and Karnataka Private Medical Establishment (KPME) Act.

The District Monitoring Committee shall have the following Members are:

1. President, Arogya Sthayee Samithi, Zilla Panchayath.
2. District Surgeon / RMO of the District Hospital and Teaching Medical Colleges.
3. Environmental Officer of District Pollution Control Board.
4. Commissioner of City Corporation.
5. Chief Officers of Town Municipal Corporations.
6. Chief Engineer of Zilla Panchayath Engineer Department.
7. Additional Director / Deputy Director Veterinary Department.
8. President, Indian Medical Association – District chapter.
9. Proprietor, Common bio-medical waste treatment facility.
10. Any register NGO working in the field of bio-medical waste management as nominated by the Chairperson.
11. District Health & Family Welfare Officer – Member Secretary.

TALUK MONITORING COMMITTEE:

Taluk Monitoring Committees have been constituted vide G.O no. Akuka 220 CGA 2016 (Part 3) dt. 28.10.2016 under the Chairmanship of Tahsildhar for supervision of Bio-medical waste activities in the Taluk.

The Taluk Monitoring Committee shall have the following Members are:

1. President, Taluku Aroghya Sthayee Samithee.
2. Chief Officer of Town Municipal Corporations.
3. Executive Engineer of Zilla Panchayath Engineer Department.
4. Administrative Medical Officer of Taluk Hospital.
5. Deputy Director, Veterinary Department.
6. Representative of Alternate Medicine Association/Private Practitioners Assn.
7. Representative of Local Chapter, Indian Medical Association.
8. Taluk Health Officer – Member Secretary.

Now as BMW Rules are amended, it will be challenging to implement the new rules as the segregation and color coding system has changed. Training will have to be taken up from intellect to illiterate type of personnel. The Department is up to the challenge.

USEFUL TIPS FOR UNDERTAKING SITUATION ANALYSIS OF HEALTH CARE WASTE MANAGEMENT IN HEALTH CARE SETTINGS IN INDIA

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Step wise description of "how to use the Colour code based BMW Management Assessment Checklist"

Step 1: The reader is facilitated by a simplified note on BMW Rules 2016 to facilitate understanding the categorization of wastes and assigned colour codes for the specified categories as per the new revised BMW Rules 2016.

Step 2: A schematic diagram/illustration is also provided for reference.

Step 3: A flow chart to understand the process of waste sharps management as per BMW Rules 2016 is provided, so that the reader can assess the management of this hazardous and crucial BMW category, from the occupational health perspective.

Step 4: The assessor needs to have an initial interaction with the nodal officer/person designated for BMW management in the concerned institution, where assessment is undertaken. The assessor needs to understand the BMW management as prevalent in the institution. Further, the assessor could ask the nodal person for the strengths and also the weaknesses from the generators perspective. This initial interaction it is hoped that would facilitate a relatively objective and humane assessment of BMW management system, rather than a fault finding endeavor. This spirit is vital from the perspective of BMW management and systems improvement apart from its serving to address the behavior and motivational aspects of persons involved in the system.

Step 5: The participatory approach for assessment: It is suggested that the assessor choose a point of generation and mock assess this POG along with the nodal officer. This enables the assesse institution to understand what to expect and also note the points for rectification, modification and or correction as is appropriate. This also has the potential to gain confidence of the assesse and enhance the credibility of the assessment exercise. This strategy is vital for improving any health care system and not just the BMW management. Further, the assesse/nodal officer can be accompanied by colleagues with stake in the institution's BMW management system.

Step 6: A randomly chosen ten departments (at least) generating bio medical waste management need to be assessed. These ten departments can be: casualty dept.,

phlebotomy sections, injection room, obstetric wars/labor room, surgical and or medical ICU, OT block, pharmacy, medical general ward, surgery general ward, BMW storage point. If the institution has super specialty services than at least five points from these departments can be assessed.

Step 6: Two points of generation from each of these departments can be assessed for BMW management. However, from areas like phlebotomy sections only one point need assessed.

Step 7: The BMW containers need to have Biohazard symbol along with Categories can be stenciled/painted. The polythene liners need to be of same colour as container and they must have Biohazard symbol.

Step 8: Aspects line, tags (tagging), barcodes, and use of specific bags for containing cytotoxic drugs with symbol need to be paid attention as well.

F.

Step 9: The injury record, waste quantification record, acknowledgement receipts from common waste treatment facility waste collection vehicle needs to be inspected.

Grading of BMW Management System

A. **Excellent:** If complete segregation along with maintenance of records.
B. **Good:** If complete segregation is maintained. However, records need better maintenance.
C. **Satisfactory needing improvement:** If waste sharp segregation is complete. However, there mix if waste across other categories.
D. **Unsatisfactory:** If complete segregation of BMW not practiced and if waste sharps are found mixed in two or less than points of generation or if plastics are found partially segregated.
E. **Dangerous:** If waste sharps are found mixed or unsegregated in more than two points of generation.

Observation checklist for assessment of Bio Medical WasteManagement at Medical and Veterinary Health Care Establishments, Bengaluru-34.

Checklist for Assessment-Color Code based segregation of Bio Medical Waste in Departments (Wards, Phlebotomy sections, laboratories etc.)

Sl. no.	Colour Coding	Mention any one item found in container	Labeling	Segregation	Containment	Disinfection	Disfigure /Mutilation	Tagging	Transportation	Storage	Final Disposal @ CBWMTF
1.	**YELLOW**			C/P/US /WS	A / IA	A /I A/ NA	NA	A/IA	A / IA	A / IA	A / IA
2.	**RED**			C/P/US /WS	A / IA	A /I A/ NA	A/IA/ NA	A/IA	A / IA	A / IA	A / IA
3.	**Puncture Proof Container (PPC)**			C/P/US /WS	A / IA	A /I A/ NA	A/IA/ NA	A/IA	A / IA	A / IA	A / IA
4.	**WHITE BAG**			C/P/US /WS	A / IA	A /I A/ NA	A/IA/ NA	A/IA	A / IA	A / IA	A / IA
5.	**BLUE**			C/P/US /WS	A / IA	A /I A/ NA	A/IA/ NA	A/ IA	A / IA	A / IA	A / IA
6.	**BLACK**			C/P/US /WS	A / IA	NA	NA	A/ IA	A/IA	A / IA	A / IA
7.	**GREEN**			C/P/US /WS	A / IA	NA	NA	A/ IA	A/IA	A / IA	A / IA
8.	**Food Waste**			C/P/US /WS	A / IA	A /I A/ NA	A/IA/ NA	A/IA	A / IA	A / IA	A / IA
9.	**General Plastic Waste**			C/P/US /WS	A / IA	NA	NA	A/IA	A / IA	A / IA	A / IA
10.	**other**			C/P/US /WS	A / IA	A /I A/ NA	A/IA/ NA	A/IA	A / IA	A / IA	A / IA
11.	**other**			C/P/US /WS	A / IA	A /I A/ NA	A/IA/ NA	A/IA	A / IA	A / IA	A / IA

***Note**: CBMWTF-Common Bio Medical Waste Treatment Facility*

Key pointers for assessing:

C- Complete Segregation: is, only when biomedical waste items belonging to specified categories are found in a particular colour coded container

P-Partial Segregation: is, when along with biomedical waste items of specified

categories are found in a container of colour coding meant for other wastes

US-Unsatisfactory Segregation: is, when there is mix of biomedical waste of more than two categories with or without mixing of food waste or general municipal solid waste.

Dangerous- If waste sharps (glass or metal or both) found in any of the waste containers other than in Waste Sharp containers.

WS-Waste Sharps

A- Appropriate

IA- In Appropriate

Kindly note: Wherever there is mix of waste sharps, the same needs to be described in detail.

Guidance for assessment:

- **YELLOW CONTAINER**: Anatomical waste, Animal body parts, Placenta, tissue, Microbiology cultures, Sanitary napkins, Baby diapers, Cotton.
- **BlUE CONTAINER**: Medical plastic items, Blood bags, Urine bags, Syringes without needles, Plastic IV bottles, Plastic IV Lines, Gloves
- **PPC-White translucent** Container: Metal sharps-Injection needles, Suturing needles, Glass sharps-Broken ampoules, Broken vials, Glass slides
- **Expired drugs:** Kindly observe/enquire and note the practice
- **Glass IV bottles**: Kindly observe/enquire and note the practice.

Look for Labelling, stencilling, Bio Hazard symbols, Cytotoxic drugs-symbols if any and note the same.

USEFUL RESOURCEFUL MATERIAL AND INFORMATION

SELECT USEFUL RESOURCE MATERIAL (2012-2016) ON BIO-MEDICAL WASTE MANAGEMENT

Sl. No.	Article	Reference	Author	Web-link
1	Need of Biomedical Waste Management System in Hospitals – An Emerging issue	Current World Environment Vol. 7(1), 117-124 (2012)	Praveen Mathur, Sangeeta Patan and Anand S. Shobhawat Department of Environmental Science, MDS University Ajmer - 305 009 (India)	http://www.cwejournal.org/vol7no1/need-of-biomedical-waste-management-system-in-hospitals-an-emerging-issue-a-review/
2	Biomedical Waste Management – A Review	International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 4 Issue: 6	P. V. Deshmukh R. H. Rathod Dr.Panjabrao Deshmukh Polytechnic, Shivaji Nagar, 444603 Amravati, India	http://www.ijritcc.org/download/browse/Volume_4_Issues/June_16_Volume_4_Issue_6/1465886051_14-06-2016.pdf
3	An Overview of Medical Waste Disposal	The balance.com	Rick LeBlanc	https://www.thebalance.com/examining-the-arguments-against-waste-to-energy-2877731
4	A descriptive study on evaluation of bio-medical waste management in a tertiary care public hospital of North India	doi:10.1186/2052-336X-12-69 Journal of Environmental Health Science & Engineering 2014 12:69.	Rajiv Kumar, Anil Kumar Gupta,[#] Arun Kumar Aggarwal,[#] and Ashok Kumar Corresponding author. [#]Contributed equally	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3996946/pdf/2052-336X-12-69.pdf

Sl. No.	Article	Reference	Author	Web-link
5	Knowledge and awareness regarding biomedical waste management in dental teaching institutions in India- A systematic review.	J Clin Exp Dent. 2014 Oct; 6(4): e419–e424. Published online 2014 Oct 1. doi: 10.4317/jced.51565	Kapoor D[1], Nirola A[2], Kapoor V[3], Gambhir RS[4]. "**Author information**" 1Professor and Head. Dept. of Periodontics, Gian Sagar Dental College and Hospital, Rajpura, Punjab. 2Professor and Head. Dept. of Periodontics, Laxmi Bai Institute of Dental Sciences and Hospital, Patiala, Punjab.3Professor and Head. Dept. of Oral and Maxillofacial Surgery, Gian SagarDental College and Hospital Rajpura 4Sr. Reader.Dept.of PublicHealthDentistry	https://www.ncbi.nlm.nih.gov/pubmed/25593667
6	Situation analysis and issues in management of biomedical waste in select small health care facilities in a ward under Bruhat Bengaluru Mahanagara Palike, Bangalore, India.	Journal of Community Health April 2014, Volume 39, Issue 2, pp 310–315	Chethana T[1],Thapsey H,Gautham MS,Sreekantaiah P,SuryanarayanaSP. Author information [1]Department of Community Medicine, M S Ramaiah Medical College, Bangalore, India, chethana31@gmail.com	https://www.ncbi.nlm.nih.gov/pubmed/23982773
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LETTER TO EDITOR

Dear Editor,

As the New Year 2017 is round the corner I would like to wish all the readers of Journal of the Indian Society of Hospital Waste Management a very happy and prosperous year in advance. It is heartening to see the commitment of the editorial team and the members of the society in bringing out valuable articles on Bio Medical Waste through the journal, consistently for the past fifteen years.

As we are busy addressing the bio medical waste management, that is being generated in various health care facilities in the country and world over, there is very little or no mention has been made about the household wastes generated which possess all the characters of being termed bio medical waste. Hailing from a village in a suburban area of a small town near Bengaluru, I have been a mute spectator of indiscriminate disposal of following household biomedical wastes such as used baby diapers, sanitary napkins/ pads and soiled dressings, which may lead to various health hazards similar to those observed with the mismanagement of wastes which are termed bio medical wastes conventionally. A study published in Volume 11, Issue 1 of this Journal, by Mohan et al presents alarming results about the considerable amount of bio medical waste that is being generated at household level. The study also reveals lack of awareness regarding the hazards and management of bio medical waste in the community.

Surprisingly, even in the new BMW Rules 2016, there has been no mention about the household biomedical waste. In this context I would like to make a request to the editorial team to consider a special section to present to the readers the review of new BMW Rules 2016 in the coming issue of ISHWM Journal and invite comments from various stake holders, experts and academicians regarding the same.

The team may also consider possibility of having a theme for each issue and announce the same in advance in the previous issue so that the researchers/ authors have sufficient time to prepare for, conduct and publish the same in accordance with the theme in the subsequent issue.

As people now are more concerned with the quality of evidence that is presented/ published, also to make a lasting difference in the quality and impact of the journal in the field of bio medical waste, I wish to encourage the team to publish the journal more frequently (atleast four issues) in a year creating space for many unpublished vital findings in the field of bio medical waste which go unaccepted in many journals with broad specialties, and to try for indexing of the journal with standard sites like Pubmed.

Sincerely,

Dr Bhanu M
Village: Malagalu, **Town:** Kanakapura
District: Bengaluru, **State:** Karnataka
Email: bhanumuula@gmail.com

CERTIFICATE IN HEALTH CARE WASTE MANAGEMENT (CHCWM)

About CHCWM

This certificate programme has been developed to provide essential knowledge and skills in health care waste. It will also equip the learners to manage the biomedical (health care) waste effectively and safely and also safeguard the community against adverse health impact of the health care waste. The course material of this programme is in line with the WHO guidelines for safe management of waste from health care activities 2014 and the Biomedical waste management rules India 2016.

Objectives of the Programme

The main objectives of the programme are to:

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

" Education is a liberating force, and in our age it is also a democratizing force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances."

- Indira Gandhi

BENEFICIARIES

SCHOOL OF HEALTH SCIENCES

School of health sciences, is one of the 20 schools in IGNOU. It was established in 1991with the objective of augmenting educational avenues for medical, nursing and paramedical personnel through distance education mode. The various functions of the school are planning, developing and launching of degree, diploma and certificate level programmes for various categories of health professionals; health awareness courses for the general public and conducting research on health issues.

The School is offering a number of medical, nursing, competency based and skill enhancement programmes. Some of the important programmes are offered in the area of Maternal and Child Health, Geriatric Medicine, HIV Medicine, Dialysis Medicine for doctors and Ph.D, B.Sc, Administration, Critical Care, Maternal and Child Health and New Born and Infant nursing programmes. The School also has programmes for people working in the health sector other than nurses and doctors like PG Diploma in Hospital and Health Management, Certificate in Home Based Healthcare and Certificate in Healthcare Waste Management. All these programmes are practical based and help to sensitize and equip the learners with skills in the area specific to the respective programmes to manage various problems in the health sector.

The School is collaborating with various National and International organization like Government Departments, Ministries, Councils and reputed organizations like WHO, UNICEF, National Board of Examination, NHFW & ICMR

INDIRA GANDHI NATIONAL OPEN UNIVERSITY

Indira Gandhi National Open Universit (IGNOU), the largest open university in th world, was established by an act of India Parliament in 1985, and started offering aca demic programmes in 1987. Today, it serve the educational aspirations of about over million students through twenty one schoo of studies and a network of 67 regional cer tres, subregional centres, 3063 Learne Support Centres (LSCs). The University o fers 227 certificate, diploma, degree an doctoral programmes through a strength 700 faculty members and academic staff the headquarters and regional centres an about 52830 academic counselors draw from conventional institutions of highe learning, professionals from various organ zations and bodies, among others.

IGNOU provides seamless access to sus tainable and learner-centric quality educa tion, skill upgradation and training to all b using innovative technologies and metho ologies and ensures convergence of existin systems for large-scale human resource de velopment, required for promoting integrate national development and global unde standing.

The University has been in existence fo only two decades. In such a short time, th University has contributed significantly t higher education and continuing profes sional development in the country caterin to the education of about 13 per cent of tot students enrolled in higher education (an more than 50 per cent of total students i distance education) in the country.

As a world leader in distance educatio IGNOU was conferred the **Centre of Exce lence Award** in Distance Education in 199

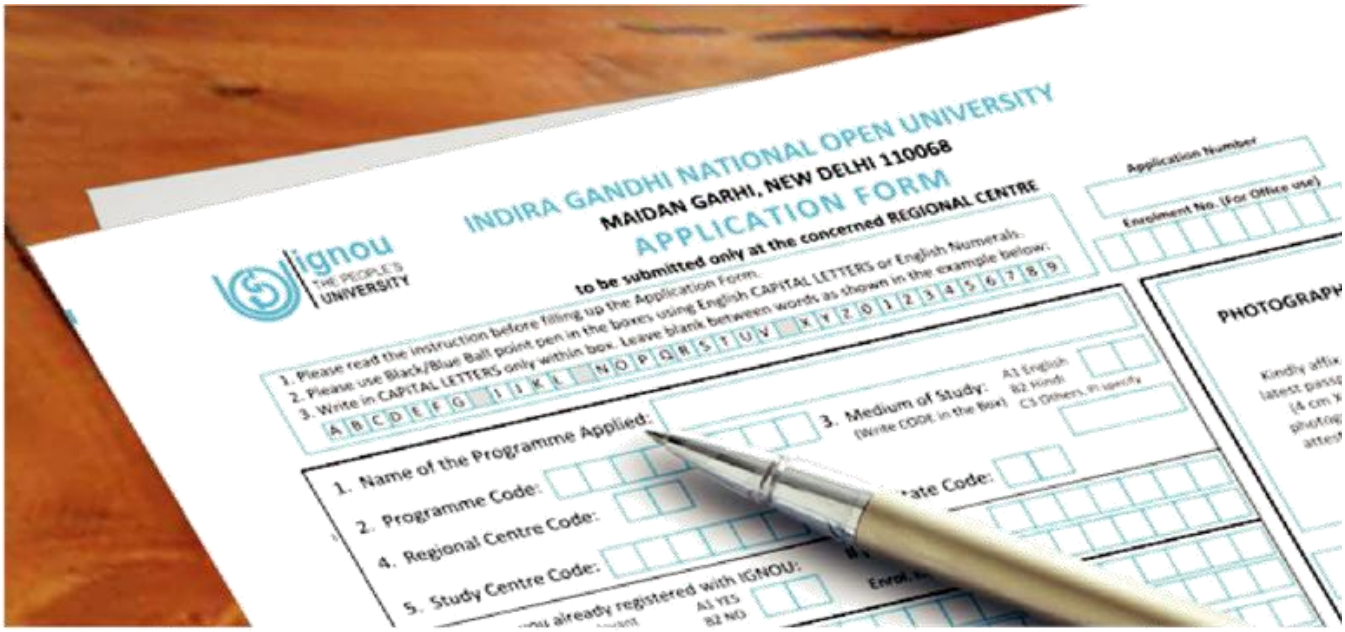
The concern for bio-medical waste management has been felt globally with the rise in deadly infections such as AIDS, Hepatitis-B and indiscriminate disposal of health care waste. The United Nations through UN Basel Convention on the control of transboundary movements of hazardous wastes and their disposal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

WHO reports (fact file November, 2015) that 58% of sampled facilities from 24 countries had adequate systems in place for the safe disposal of health care waste. High-income countries generate an average upto 0.5 kg hazardous waste per bed per day. Low-income countries on the other hand generate an average upto 0.2 kg. Health-care waste is often not separated into hazardous or non-hazardous wastes in low-income countries making the real quantity of hazardous waste much higher.

According to WHO, every year an estimated 16 billion injections are administered world wide, but not all of the needles and syringes are properly disposed off afterwards. In 2010, unsafe injections were still responsible for as many as 33 800 new HIV infections, 1.7 million hepatitis B infections and 315 000 hepatitis C infections. A person who experiences one needle stick injury from a needle used on an infected source patient has risks of 30%, 1.8%, and 0.3% respectively of becoming infected with HBV, HCV and HIV.

The main bottleneck to sound health care waste management programme is lack of training and appropriate skills, insufficient resource allocation and lack of adequate equipments. Thus the need to educate different health care professionals/workers, NGOs and other stake holders was identified as a priority. To cater the needs of these health care professionals, IGNOU and WHO, SEARO decided to develop and launch a Certificate Programme in Health Care Waste Management in the South-East Asia Region Countries. This programme is a 14 credit, six-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 learners to manage it effectively and safely and also safeguard the community against adverse health impact of health care waste. The BHWM rules 2016 have been notified in April 2016. The course material of this programme is being revised in light of there new rules.



OBJECTIVES

The main objectives of the programme are to:

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

BENEFICIARIES

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

DURATION

Minimum 6 months and Maximum 2 years

SESSION

January to June/July to December

PROGRAMME PACKAGE

The programme has a blended approach. The package consists of self instructional material in the form of booklets/blocks and audio video materials. **Web support** will be available consisting of interactive content, quiz, synchronous and asynchronous modes of communication like chat sessions, discussion forums, web resources etc. The students can opt for a project. They also have the option to undergo a face to face training in a workshop mode.

CREDIT SYSTEM

In IGNOU parlance, the study hours are measured in credit system. One credit is equivalent to 30 learning hours. For example, 16 credits of Certificate in Health Care Waste Management programme means an average student will be required to give 480 hours (16X30) of input for this programme. While undergoing the programme, students would be involving themselves in the activities like theory reading, undertaking a project, training through a workshop, video viewing, accessing the web support content, participating in chat sessions and discussion forums etc.

IMPLEMENTATION PLAN

The programme is implemented through a network of Programme Study Centres (PSCs). These Programme Study Centres are located in health care institutions like medical colleges, hospitals, district and private hospitals, rural health centres, etc. A team of trained teachers called counselors have been identified and trained for organizing and conducting workshops, assignment and project evaluation in the Programme Study Centres. The administrative control is through the Regional Centres (RCs) of IGNOU located usually at state capitals in India and the School of Health Sciences (SOHS) located at the IGNOU Headquarters, Delhi, India.

EVALUATION

Evaluation is done through the assessment of various courses. Evaluation in the form of assignments (continuous assessments) and term end examination of the various courses

DETAILED PROGRAMME DESIGN

Block 1	Understanding our Environment
Block 2	Health Care Waste Management
Block 3	Need for Environmentally Sound Biomedical Waste (HCW) Management
Block 4	Current Status of Biomedical Waste (HCW) Management Legislation in the Region (Country/Region/Continent)
Block 1	Practical Aspects of Biomedical Waste (HCW) Management
Block 2	Systems and Technologies in Biomedical Waste (HCW) Management
Block 3	Biomedical Waste (HCW) Management and Emerging Issues
Block 4	**Training Manual for Waste Handlers**
OPTIONAL COURSE	
Course 3 – Inter-relationship Between Health and Environment	
Course 4 – Worker Safety and Patient Safety	
Course 5 – Status of Biomedical Waste (HCW) Management and Legislation in the Regional Countries	
Course 6 – Managerial and Systems Approach	
Course 7 – Special Considerations of Waste Management	
Course 8 – Administrative and Legal Aspects of Waste Management	
Course 9 – Project Work	
Course 10 – Two day Workshop	

Give us a call for or an email for more information about the programme

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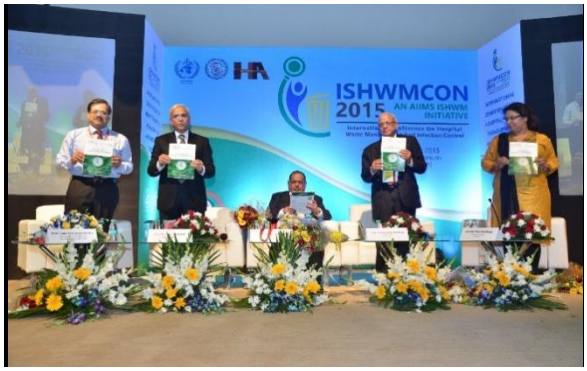
You may also visit our web support portal by scanning the QR code.

15TH NATIONAL CONFERENCE OF INDIAN SOCIETY OF HOSPITAL WASTE NOVEMBER 14TH & 15TH, 2015

ISHWMCON 2015 was organized by the Department of Hospital Administration, AIIMS, New Delhi, on 14th and 15th November 2015, at AIIMS, New Delhi, in support of the mission of the Indian Society for Waste Management to promote optimum waste management strategies in hospitals and healthcare institutions. The conference was an opportunity for coordinated learning and a platform for the sharing of knowledge on statutory requirements for biomedical waste management, occupational health issues, good practices and innovative solutions in pursuit of the Swachh Bharat mission, and the Kaya kalp initiative for hospitals. The conference was attended by ~500 delegates from all around the country and abroad, including hospital administrators, microbiologists, doctors, nurses, students, members of technical and statutory bodies.



The proceedings commenced with the key note address by the Hon'ble Justice Swatanter Kumar, Chairperson of the National Green Tribunal. Justice Kumar highlighted the various statutory requirements and expectations from the health care industry with regard to waste management and stressed upon the need for proactive interventions to ensure compliance. The scientific proceedings opened with a detailed review of the scenario of biomedical waste management in lower and middle income countries, followed by an in-depth analysis of operational issues in waste management practices and the prevention of nosocomial infections, as well as their cost implications. The conference also focused on a hitherto forgotten but probably the most vital aspect of waste management- the human element, and the behavioral aspect.

Many young students and budding professionals show-cased their achievements and scientific studies through posters and paper presentations.

Many innovations were tabled and innovative management strategies discussed. Notable among them were the nano-photo-catalyst technology, plasma pyrolysis and low heat microwaves at source, as well as environmentally friendly strategies for energy

recovery from waste. Many vendors show-cased their wares in an adjunct exhibition which were received with great enthusiasm and interest.

The proceedings ended with a panel discussion on the biomedical waste rules, 2016, which were then in the draft stage. The panel discussion was spear-headed by the think-tank behind the new rules, and the panelists included representatives of the pollution control board, hospitals, both private and public, and waste generators. It provided an open forum for the exchange of ideas, clarifications and recommendations to be incorporated in the draft rules.

The evening of the first day of scientific proceedings was charmed by a scintillating cultural program that focused on environment protection, and managed to emphasize good waste management practices through entertaining skits, mime and songs, followed by dinner.

The conference provided a lively interchange of ideas, a bare discussion of the challenges ahead, and highlighted the requirement of acculturation, awareness generation, active surveillance and waste audits, and ended with a promise of continuity and consistency in mission for ISHWMCON2016.

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Dept. of Hospital Administration,
All India Institute of Medical Sciences, New Delhi

14TH NATIONAL CONFERENCE OF INDIAN SOCIETY OF HOSPITAL WASTE MANAGEMENT ON "*TABLE TALK TO BIN'S SIDE- A PRACTICAL SOLUTION*" 6, 7 AND 8TH DECEMBER, 2013

The 14th National Conference of Indian Society of Hospital Waste Management was organized by Bio-medical Waste Management Cell, King George's Medical University (KGMU), Lucknow on 7th and 8th December, 2013 which was preceded by a workshop on 6th December 2013 at the Scientific Convention Centre, KGMU, Lucknow.

Main objective of this conference was to create a platform for exchange of ideas, concepts, current available evidence and sustainable solutions of health care waste management by national & international experts. More than 350 delegates participated in the conference.

There was a large team of delegates from Bir Hospital, Kathmandu, Nepal led by Mr. Mahesh Nakarmi, Director, Health Care Waste Management Program, Health Care Foundation- Nepal & a team from Indonesia and WHO also participated in the conference.

Large number of groups from healthcare and allied fields actively participated in the workshop.

The workshop began with the talk of Prof. A. K. Agarwal, President, ISHWM on Healthcare Waste Management.11th & 12th standard students of different schools participated in the poster competition based on the theme "Healthcare Waste & Health Hazards". Selected posters by the students were displayed in the workshop.

Miss. Payden, Regional Consultant from WHO, SEARO New Delhi, was the chief guest

Dr. J. K. Das, Director, NIHFW, New Delhi, Dr Kajal, Special Secretary, Health & Additional Director, NRHM, Dr. S. Kumar, President, Gokula Education Foundation, Bangalore were the guests of honour.

Dr. D. K. Gupta, Hon'ble Vice Chancellor, KGMU, Dr S. N. Sankhwar, Chief Medical Superintendent, KGMU & Organizing Chairperson, Prof. A K Agarwal, President ISHWM, and Dr Kirti Srivastava, Member Secretary, BMWM Committee, KGMU & Organizing Secretary were also present on the dais.

The Inaugural function began with the Vandana of Godess Saraswati followed by lighting the auspicious lamp by Miss. Payden and other dignitaries present.

Dr. Kirti Srivastava, Organizing Secretary, welcomed the guests and participants.

Souvenir and News Bulletin was released by the chief guest, guests of honour and other dignitaries present.

Dr Anupam Wakhlu, Co-organizing secretary proposed the vote of thanks.

The various talks in the conference emphasized the following key areas:

1. Healthcare Waste management in Developing Countries.
2. Bio-Medical Waste Management in Mega Cities.
3. Status of Healthcare Waste Management in Uttar Pradesh.
4. Bio-Safety in Bio-medical Waste Management.
5. Affordable and sustainable Bio-medical waste management strategies in KGMU: cost containment with optimal care.
6. Waste Tracking System for Waste Management in Healthcare Facilities.
7. The Need for ETP in Healthcare Establishments.
8. Vermicomposting & Biogas Plant.
9. Bio medical waste management in rural health facilities.
10. Some role model hospital's case study.
11. Special Waste Stream Management and Emerging Challenges.
12. Establishing and Designing a Central BMWM Treatment Unit within a Hospital.
13. Study to determine circumstances of NSI in AIIMS hospital staff.
14. HIV/AIDS status in India: Journey so far and the Road Ahead.
15. Post Exposure Prophylaxis.
16. Menace of Radioactive Waste to Human Being.
17. Mercury phase out in Healthcare facilities.

The deliberations during the two days conference included besides 12 free oral papers, 17 oral papers and 25 poster presentations, A Key note address, Lecture discussions, Panel discussions, Audio-Visual presentations, Skits etc.

Prof. Dr. A. K. Agarwal and Prof. Dr. S. Pruthvish were awarded FISHWM (Fellowship of Indian Society of Hospital Waste Management) during valedictory.

This whole exercise proved to be quite an educative experience for all the participants who according to their feedback were highly satisfied with the scientific content of the proceedings.

Kirti Srivastava
Professor, Department of Radiation Oncology &
Member Secretary, University Environment Cell, KGMU,UP,Lucknow

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 10th 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.

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.
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(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.

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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).

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(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.

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