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JOURNAL OF THE
INDIAN SOCIETY OF HOSPITAL WASTE MANAGEMENT

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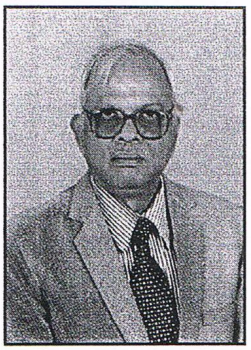
PRESIDENT'S PAGE



Friends,

The Indian Society of Hospital Waste Management (ISHWM) has been rendering an essential and very useful service to the society. This is the only society in India totally focused towards healthcare waste management issues. It is important that all of us realise that better hospital waste management has cascading positive effects – on patients, on healthcare workers, and on the society. Better management of waste in the hospitals would mean quicker turnover without complications, such as Hospital Acquired Infections (HAI) etc, and safety to patients, their relatives, and public at large. Thus aspiring for best practices in healthcare waste management is a 'win-win' situation, advantageous to the healthcare workers, patients in the hospitals and other healthcare facilities, and for the whole society.

Of late, great concerns have been raised with regard to patient safety. WHO in fact is greatly concerned on this issue. Right to life is fundamental, and finds a mention in the constitution of most of the countries. With this we must also ponder over the question of what we mean by 'life'. Is it life as we live or is it life with total health? Aspiring for total health is fundamental right of every individual. But it may not be within the capability of each of us to achieve total health on our own since there are many external factors which influences health. So it may not always be possible to achieve total health by an individual. This is where the role of the informed society comes in. We as repository of scientific knowledge have a role to play, and it must be practiced and demonstrated for the sake of the society. Healthier individuals will form a healthier society, and add to the core mental capacity and acumen. From muscle power the mankind has graduated to the era of power of intellect (brain power), and damaging effects of environmental pollution on the health of an individual, specifically in the development of mental faculty in a child is well known and well documented. In fact, now we are talking about Quality Adjusted Life Years (QALYs) and not only about Disability Adjusted Life Years (DALYs). It may be alright to assume that a person who is sick may not be able to go to work resulting in loss of man-hours, and it may be easy to compute such loss. But it is now even more important to calculate quality of work. A person who is harbouring a non-manifest disorder (due to biological or chemical pollutants) cannot perform same quality and quantum of work as a person who enjoys total health. Strategies for achieving Millennium Development Goals (MDG) and for sustainable development cannot succeed unless proper waste management is assured. In fact, application and practice of non-burn technologies for healthcare waste is very much in focus now days.

Waste in any form adds to environmental pollution, and healthcare waste contains microbes and chemicals adverse to human health. Healthcare waste management has two aspects –

a) management of waste, and

b) developing waste management system in a hospital or healthcare facility for control of

infections, including hospital acquired infections. As is well known that incidence of HAI, the world over has been increasing, and it is also well documented that mortality rate amongst the HAI patients may be as high as 12 to 25 per thousand! What is the importance or role of healthcare waste management in this cannot be said for certain (since it may require more research), but going just by plain logic it could be substantial. Therefore if one feels satisfied after having outsourced the waste management to a Common Biomedical Waste Treatment Facility (CBWTF) operator, the sense of satisfaction is misplaced.

Moreover, it leads to a false sense of security in the mind of the 'occupier'; and therefore no further steps are taken for 'in house' development of waste management system in a hospital/ healthcare facility directed towards infection control and patient as well as workers safety. This attitude needs change. Along with this monitoring and implementation, including monitoring of precautionary measures will have to be strengthened.

The society has an onerous responsibility and it is for us – the scientists in the field to discharge it, and discharge it diligently and properly.

Jai Hind!

Lalji K Verma

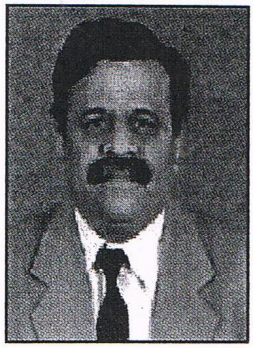
HEALTH-CARE WASTE MANAGEMENT

To reduce the burden of disease, health-care waste needs sound management, including alternatives to incineration

In the last few years there has been growing controversy over the incineration of health-care waste. Under some circumstances, including when wastes are incinerated at low temperatures or when plastics that contain polyvinyl chloride (PVC) are incinerated, dioxins and furans and other toxic air pollutants may be produced as emissions and/or in bottom or fly ash (ash that is carried by air and exhaust gases up the incinerator stack). Exposure to dioxins, furans and co-planar PCBs may lead to adverse health effects.

Source: WHO website www.who.int

EDITOR'S NOTE



Esteemed ISHWM members and all readers,

Cordial Greetings!

To drive safely ahead, a good driver should periodically look at the rear-view mirror; let us look at HCWM practices: both past and present.

BMW management is important from the point of patient and workers safety, apart from environmental protection and infection control. It is more than a decade since the rules were promulgated. The situational analysis of health care waste management practices before the promulgation of Biomedical waste Management Rules - 1998 and now, reveal few improvements: these include segregation of waste, disinfection before disposal, waste sharps containment, maintenance of records of waste quantity, needle-stick injury, etc. establishment of centralised biomedical waste management facilities, and most importantly acceptance of concept of these facilities by both government and private sector institutions in many states. This improvement in practices and acceptance is not universal and is visible only in pockets particularly in the urban areas. There is hardly any strategy developed for healthcare waste management in the rural areas. However, a positive trend (at least in thinking) is discernable across the country. Due to the fear of spread of HIV, Avian flu, and now H1N1, awareness and concern amongst the healthcare providers for better waste management practices is distinctly visible in most of the healthcare facilities and not just hospitals.

In this context, there are a number of achievements and initiatives to inspire us.

1. There is now a full-fledged Department of Health care waste management in Safdarjang Hospital, New Delhi.

2. Health care waste management and Infection Control has been recognized by National Disaster Management Authority (NDMA) as an important area for intervention during immediate phase of a disaster.

3. During a visit to Civil Hospital Gandhinagar recently – I was able to see good practices of segregation, disinfection before disposal, containment of sharps, maintenance of waste management quantity and its recording in a register, SOPs for management of Mercury, Management of liquid spills, a mechanism for recording, surveillance and post exposure prophylaxis for prevention of HIV/AIDS. Patient safety issues were given primacy by Rogi Kalyana Samitis. Similar good practices were found in Civil hospital at Porbander. I was given to understand that Civil Hospital, Gandhinagar is a NABH accredited institution in Phase II and Government of Gujarat is planning to introduce NABH accreditation throughout the State soon. If NABH accreditation can make a difference to HCWM and Infection Control as part of total quality healthcare management, why not make NABH accreditation mandatory to all major health care institutions. It is a question of commitment, resource mobilization and concerted action.

4. Crossing over the border of our country, I witnessed Castle Street Hospital and Ampara District Hospital in Srilanka making concerted efforts towards better waste management practices.

All this mean that change is possible even within the constraints of low resource settings.

Now, to the other side of the coin, let us re-view at what could, or rather should have happened after the promulgation of BWM Rules

1998. Despite being a decade now,

- We do not see an universal improvement in waste management practices across the country
- The required attention to management of liquid waste is lacking.
- A system of surveillance of needle stick injuries has not been set up.
- Links to hazardous waste management facilities, recycling industries and related is not delineated.
- Worker safety and welfare measures for Health care staff remains a neglected area.

Research

Very little research has gone into finding eco friendly methods of treatment and final disposal of facilities for health care waste and finding methods for final disposal of metal, broken glass and plastic. There is a need to involve educational institutions, universities, research institutions in this area. Coordination, networking and collaborative research is the need of the hour.

DILEMMA

India has the advantage of having relevant legislation in place. The question in front of us is its effective implementation. All stake holders need to address following questions: Should we follow the rules by force? Should we follow because we are responsible to our environment, our people? Are there lacunae with law? Is it an issue of implementation or attitude of health care staff and institutions? Is a comprehensive review warranted?

Training and capacity building

Indira Gandhi National Open University (IGNOU) has started six month certificate course on HCWM in distance learning mode. This opportunity is less utilized. There is a need to utilize the existing opportunities, develop new centers and identify more institutions to train all categories of health staff (doctors, nurses, laboratory technicians, waste handlers, support staff, security) and others in the health care sector. I suggest all of us introspect one more issue: How are we training of medical students, dental students, nursing students adequately in the area of HCWM and Infection control?

Patient safety issues

It is increasingly recognized that a significant number of patients in health care settings face the challenge of medical errors, often not noticed by patients and overlooked by the profession: it is estimated that nearly one million deaths and ten times this number suffer excess injuries each year. We wish to focus the next issue on patient safety, HCWM and Infection control. Readers are requested to contribute research articles and related scientific resources for the same before February 2010.

The issue of healthcare waste management has surfaced time and again in different conferences and forums, and keeps to occupy centre stage in patient safety and infection control. WHO has made important recommendations in this regard, and WHO-SEARO had participated and jointly drafted the Delhi Declaration during ISHWM Con 2006, and also voiced their concern during 2007 in different meetings of the countries of South East Asia Region which reminds us much needed action.

A brief report of resourceful workshop in Trivandrum organized by Trivandrum Medical Association (TMA), and interesting articles from Centre for Environment Education, Government of Delhi, apart from other equally relevant articles are included in the journal.

With passage of time and with newer technologies in place there is a need for review of the rules. Review of BMW Management (and handling) rules 1998 is under review by a parliamentary committee on subordinate legislation, and President, ISHWM has submitted some recommendations for consideration.

There are several challenges and many areas for each and every stake holder in developing an eco-friendly attitude including ensuring an appropriate response from the health profession with respect to HCWM and Infection control. Needless to say, ISHWM and its journal is no exception to this. We need more research articles, profile articles on HCWM and Infection control. One can contribute articles, scientific research papers, case studies, incidents etc, and on the lighter plane anecdotes, and case reviews. ISHWM

is your Journal. All are requested to contribute to the journal to strengthen it. We request the readers to contribute often and regularly too and thus strengthen the journal. Help us realize bringing out two issues every year from now onwards. You will find all previous issues of Journal on ISHWM website.

Mr. Alexander Von Hildebrand, Regional Environmental Advisor, WHO SEAR, has moved to WHO PAHO, Ecuador, since September 2009. He has been a cherished friend of ISHWM and a valuable member of editorial advisory board of the Journal of ISHWM. We appreciate him for his committed support. We have requested him to continue on the Editorial advisory board and help spread the message to Americas. He has been elected as the Honorary Fellow of ISHWM and will be honored at appropriate occasion during 2010.

Indian Society of Hospital Waste Management (ISHWM) will continue to work towards achieving best and clean practices in healthcare waste management. In the long run, this means a cleaner society comprising of healthier individuals – mentally and physically, where life will thrive in an environment devoid of pollutants. Join us to achieve this onerous task!

Dr. S. Pruthvish

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WHAT ARE DIOXINS, FURANS AND CO-PLANAR PCBS?

Dioxins, furans and co-planar PCBs are toxic substances produced as by-products of various industrial processes, including the combustion of wastes containing polyvinyl chloride (e.g., some plastics, some blood bags and fluid bags). This happens particularly when wastes are incinerated at temperatures lower than 800 degrees Celsius or when the wastes are not completely incinerated. Dioxins, furans, co-planar PCBs and other toxic air pollutants may then be produced as emissions and/or in bottom or fly ash. In some circumstances dioxins and furans can be produced under natural conditions (e.g. volcanic activity and forest fires).

Polychlorinated dibenzo-para-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) are called dioxins, furans and co-planar PCBs, respectively. Amongst the different dioxins and furans, not all have the same toxicity; some are even harmless. Dioxins, furans and co-planar PCBs are persistent substances that do not readily break down in the environment and that bio-accumulate in the food chain. Most human exposure to dioxins, furans and co-planar PCBs is through the intake of food.

Source: WHO website www.who.int

LETTER TO EDITOR

Sir,

It is indeed a great pleasure to note the growth of ISHWM journal over the past few years: sincere congratulation to the entire team for this commendable job. Though biomedical waste management and handling rules have been there from 1998, the implementation has been tardy. Major hospitals and few smaller ones have adhered to the guidelines to some extent; however, the same has not been the case in smaller nursing homes, private clinics and primary health centers. Even today majority of the doctors feel that waste management is the responsibility of Group D staff. A major attitudinal change needs to be brought in if things have to change.

I feel the journal should publish more articles on best practices in Government hospitals especially Primary health care centers; this would encourage them to practice better and sound health care waste management practices. In addition, the journal could consider bringing out useful resources which could include SOP's and frequently asked questions in a phase wise manner for benefit of all health care institutions. An electronic solution exchange group can be formed for regular interaction on the lines of the one existing for disaster management. Issues on Liquid waste management, Mercury and spill management need more attention and elaboration from experts.

Wishing the journal reaches greater heights with far more wider circulation in the years to come and also gets indexed.

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ARTICLE

Bio-dental waste management – a survey of Dental health care settings in pondicherry

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ABSTRACT

Dental hospitals and clinics generate a number of infectious and hazardous wastes that can be detrimental to the public and health care workers. A pre-tested anonymous questionnaire was given to the dentists in Pondicherry, Karaikal, Yanam and Mahe. Overall response rate was 91%. 60% of the dentists were not aware of legislation related to waste management. 38% followed segregation. 79% of them did not follow any color coding. Bio-hazard symbol was used by only 17% of the dentists. Safe management of health care waste was agreed to be an important issue by the majority. 86% of the respondents expressed interest in attending a program on waste management. There is profound need to increase awareness about rules, regulations and procedures regarding waste management.

INTRODUCTION

Over the years waste has become an issue of major global concern. According to WHO the waste produced by health care facilities i.e., the bio-medical waste carries a higher potential for injury and infection than any other kind of waste[1]. The traditional solution has been to dump the waste on low lying areas near outskirts of the city. The negative health and environmental effects of such waste may include transmission of disease by micro organisms as well as the far reaching consequences of mercury.

Competing with all other environmental problems faced by developing countries, the problem of medical waste is often overlooked[2]. However, sound medical waster management is key to protecting public health and requires dedicated planning, training and tracking through waste collection, storage, treatment & disposal process.

The introduction of Bio-medical waste Management and Handling rules in 1998 has not been enough for the dentists to comply with proper guidelines. Though they are aware that waste management is a serious issue, they are not motivated enough to follow better waster management practices[3]. A survey was undertaken with the following aims and objectives :

1) To study the awareness of waste management policy and practices among dentists in Health care setting.
2) To determine the awareness of dentists regarding waste management policy and practices.
3) Attitude assessment towards waste management.
4) To assess the attitude towards waste management

MATERIALS AND METHODS

A pre-tested anonymous questionnaire was distributed among the dentists in Pondicherry, Karaikal, Yanam and Mahe and were retrieved at a later date[4]. The respondents were asked to indicate their views on waste management policy,

involved. The respondents seem to have a general awareness of environmental pollution, but majority had no specific knowledge about the issues involved and ways to tackle them. Safe management of health care waste has come to be recognized as being more of a problem of attitude rather than just providing technology or facilities[5]. A notable factor in the attitude assessment was an overwhelming percentage agreeing that it is an issue that needs to be tackled and effective management is based on teamwork. It is time that curriculum for dental education gives due importance to this issue. So also the academic institutions and NGO's could play a pivotal role in disseminating information regarding this vital issue.

CONCLUSIONS

There is need,

1) To increase awareness about rules, regulations and procedures regarding waste management.
2) It is a fact that no appropriate strategy exists for proper management and disposal of bio-dental waste.
3) By dealing with dental office waste problem in a proactive way dentists could be environmentally responsible and provide dental care without harm.

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HEALTH CONCERNS AND INTAKE LIMITS

Long-term, low-level exposure of humans to dioxins and furans may lead to the impairment of the immune system, the impairment of the development of the nervous system, the endocrine system and the reproductive functions. Short-term, high-level exposure may result in skin lesions and altered liver function. Exposure of animals to dioxins has resulted in several types of cancer.

The International Agency for Research on Cancer (IARC) classifies dioxins as a "known human carcinogen". However, most of the evidence documenting the toxicity of dioxins and furans is based on studies of populations that have been exposed to high concentrations of dioxins either occupationally or through industrial accidents. There is insufficient evidence to prove that chronic low-level exposures to dioxins and furans causes cancer in humans.

WHO has established a Provisional Tolerable Monthly Intake (PTMI) for dioxins, furans, and polychlorinated biphenyls (PCBs) of 70 picograms (10^{-12} g) per kilogram of body weight. The PTMI is an estimate of the amount of chemical per month that can be ingested over a lifetime without appreciable health risk. Almost all exposure to dioxins and furans is through the food chain and the PTMI represents the cumulative exposure to dioxins and furans from all sources including food and water.

It has not yet been possible to estimate the worldwide burden of mortality and morbidity from exposure to dioxins and furans: the exposure and risk assessment has many uncertainties; data gaps are very large.

Additionally, the types of health effects that may result (e.g. cancer, impaired immune function) would only show up after long exposure periods and would be difficult to measure.

Source: WHO website www.who.int

Knowledge of Statutory Acts Governing Health Care Waste among Health Care Personnel Of Bangalore City

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ABSTRACT

Objective: To assess the legal literacy status of health care personnel as applicable to health care waste management.

Methods: A descriptive study of laboratory waste management in 23 select health care establishments of Bangalore was undertaken between January to April 2006.

Methods and Material: The research instrument was a pretested questionnaire. Occupiers, doctors and direct waste handlers were interviewed about every aspect of waste management like segregation, pretreatment, storage and its disposal. The waste management was personally witnessed in all the study establishments. Their knowledge about the various acts governing the waste management was assessed during the process of interview.

Statistical analysis: Number of health care personnel who were knowledgeable about various acts related to waste management was recorded.

Results: 15% doctors and 6% personnel other than doctors were knowledgeable about Environment (Protection) Act, 1986, Biomedical waste (Management & Handling) Rules, 1998, Air Act, 1981, Water Act, 1974.

Conclusion: Legal awareness is very low among health care personnel.

Keywords: Environment, health care waste, statutory acts

INTRODUCTION

Bhopal gas tragedy of 1984 resulted in increased public awareness of the effects of chemicals released into the environment. The Environment (Protection) Act was passed in 1986 and a host of rules regarding waste management followed including the Biomedical Waste (Management and Handling) Rules, 1998[1].

The health care waste contains heavy metals (mercury, zinc, cadmium etc), chemical solvents, preservatives and plastics. Plastics (Polyvinyl chloride) which are widely used in hospitals when combusted produce dioxins, hydrogen chloride, phosgene and other pollutants which pose serious human health risks. They gain entry into our body through food[2,3,4]. The hospitals who are the generators of health care waste are ethically and legally responsible for its safe disposal also.

Bangalore is the fifth largest metropolis in India spreading around an area of 446 Sq. km with a population is 5.7 millions (2001 census). Many government and private health care establishments, both bedded and non bedded are catering to the health needs of the population. There are about 590 hospitals having in-patient facility (44 Government, 546 private) with 25,000 beds [5]. There are 52 hospitals with more than 100 bed strength contributing 19,000 beds out of which 13 hospitals with more than 500 bed strength contribute 10,300 beds. 8,800 beds are contributed by 23 government hospitals and 10,200 beds by 29 private hospitals. In addition, there are 115 diagnostic laboratories[5], all private, urban oriented and 90% of them are small, undertaking only simple hematology and biochemical investigations. About 2000 tons of solid waste/day is generated, of which health care waste constitutes 13,500 kg[6].

MATERIAL AND METHODS

A descriptive study of laboratory waste management was conducted in 23 select health care establishments of Bangalore from January 2006 to April 2006. The study addressed a range of topics regarding the knowledge, attitude and practices of health care personnel towards health care waste management. The occupiers (in this study, those who are in charge of waste management), doctors and direct waste handlers were included in the study. Accordingly three separate elaborate questionnaires were designed. A pilot study of 2 well-established teaching hospitals was undertaken to pretest the questionnaire.

A stratified simple random sampling representing 18 hospitals (7 government, 11 private) and 5 large laboratories (non bedded) (private) were included in the study. Hospitals having minimum bed strength of 100, undertaking biochemistry, microbiology and pathology investigations in a central laboratory were included in the study. Since the study was regarding laboratory waste management, private diagnostic laboratories undertaking biochemistry, microbiology and pathology investigations were also included.

Hospitals included all categories like teaching hospitals (09) (03 government, 06 private), autonomous (government) hospitals (04), corporate hospitals (04), mission hospital (01). The total bed strength of these hospitals was 8,300 which represented 33% of the over all existing beds of 25,000 and 44% of 19,000 beds among hospitals having more than 100 bed strength. All hospitals had a bed occupancy rate of more than 80% and cater to a large number of urban populace.

Seven out of 23 government hospitals (contributing 3,100 beds) and 11 out of 29 private hospitals (contributing 5,200 beds) were selected for the study. Considering the number of beds, nine out of thirteen hospitals having more than 500 beds (6,100 beds out of 10,300 beds) and another nine out of 39 hospitals having less than 500 but more than 100 beds (2,200 beds out of 8,900 beds) were selected.

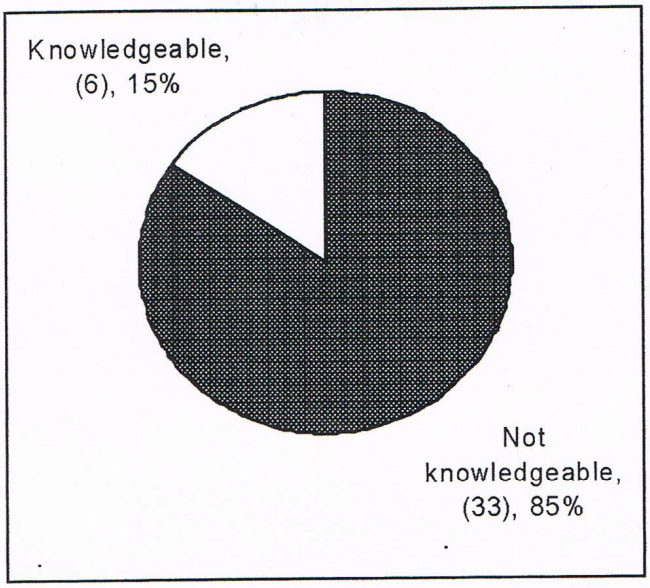
The number of investigations undertaken per day ranged from 50 to 7000. Three out of seven study government hospitals and six out of 16 study private hospitals and diagnostic laboratories undertook more than 1000 investigations per day (Table 1).

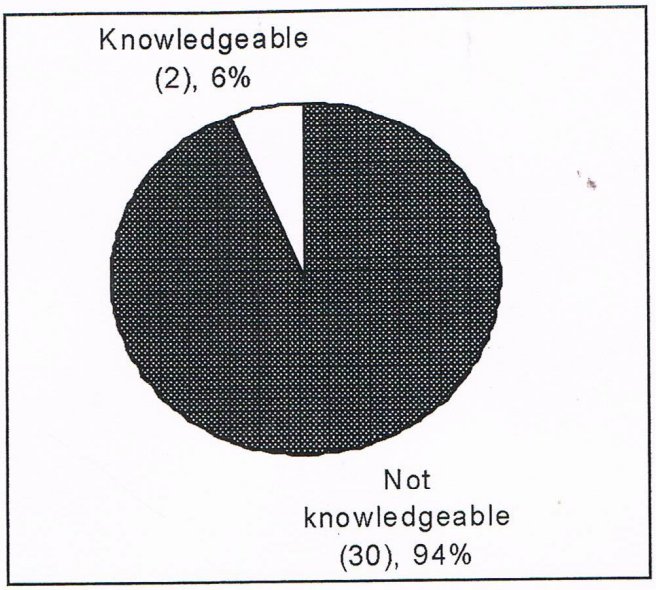
A total of 39 doctors and 32 personnel other than doctors, who were in charge of waste management in various capacities, were interviewed and the practices adopted by them were physically observed.

The occupiers were interviewed regarding the legal aspects of waste handling like various acts and rules governing waste management, standards for emission and effluent discharge and regarding environmental aspects of waste management like methods of disposal of waste,

Table 1
Profile of Study Health Care Establishments (HCEs) in Bangalore,2006

Health Care Establishments	No. of beds	No. of investigations/day
HCE 1	0	2500
HCE 2	0	750
HCE 3	0	500
HCE 4	0	1000
HCE 5	0	800
HCE 6	800	3500
HCE 7	686	1000
HCE 8	500	1250
HCE 9	473	300
HCE 10	850	1000
HCE 11	565	1500
HCE 12	580	2000
HCE 13	100	50
HCE 14	420	1500
HCE 15	150	400
HCE 16	530	1500
HCE 17	200	1000
HCE 18	200	2000
HCE 19	600	7000
HCE 20	160	600
HCE 21	1020	700
HCE 22	250	1000
HCE 23	250	900





precautions taken during disposal, etc. Various documentary practices adopted were personally scrutinized and the occupational safety practices were enquired and observed.

The doctors were interviewed regarding every aspect of waste management. Segregation practices, collection and in house transportation of waste were witnessed and storage areas were personally visited in all the study establishments. Pretreatment of waste was keenly looked into. Documentary practices adopted were scrutinized and the occupational safety practices observed. Attitude and knowledge towards waste management, legal and environmental aspects of waste handling were assessed throughout the process of discussion. The various legal aspects enquired in particular were the Acts governing the health care wastes and some important rules/ specifications under the Acts which are applicable to health care waste.

The direct waste handlers were specifically enquired regarding their awareness of bio-hazard symbol, segregation and other waste management practices. The occupational safety practices adopted by them were enquired and observed.

RESULTS

Analysis was carried out using descriptive statistics and legal awareness was evaluated by the number of health care personnel who were knowledgeable about the important specifications of the rules pertaining to biomedical waste management as per the various Acts.

Of the total number of 39 doctors and 32 other personnel interviewed, 15% (06/39) of the doctors and (02/32) 6% other than doctors were thoroughly knowledgeable of the rules under Environment (Protection) Act, Biomedical waste (Management & Handling) Rules, Air (Prevention and Control of Pollution) Act and Water (Prevention and Control of Pollution) Act.

DISCUSSION

Once the legislation is passed and becomes a statutory obligation, enforcement of the legislation and monitoring the compliance of the health care establishments is a challenging task.

The Environment (Protection) Act of 1986 provides detailed procedures for carrying on periodic inspections, investigations, sampling, testing and analyzing effluents and in determining levels of pollution. Elaborate references for setting standards to pollution levels, licensing and for setting up of treatment plants are present. Specific rules pertaining to the management of biomedical waste, hazardous waste, plastic, lead etc. are notified under this act. Radioactive waste is to be managed according to Indian Atomic Energy Act, 2002.

Bio-medical waste (Management and handling) Rules of 1998, defines bio-medical waste and provides guidelines for obtaining authorization from the prescribed authorities and to manage health care waste from the process of segregation ,collection, transportation, storage, pretreatment to its safe disposal.

Air (Prevention & Control of Pollution) Act or Air Act of 1981, prescribes the standard for emission for sulphur dioxide, nitrogen dioxide, carbon monoxide, suspended particulate matter, lead and repairable particulate matter to maintain the National Ambient Air Quality Monitoring in addition to conferring various powers to the prescribing authority.

Water (Prevention & Control of Pollution) Act or Water Act of 1974, prescribes the standard for ph, temperature, biological oxygen demand, chemical oxygen demand, levels of heavy metal in the effluents in addition to biological assay of survival of fish in addition to conferring various powers to the prescribing authority.

In the present study, mere 15% of doctors and 6% personnel other than doctors are knowledgeable about the legal aspects of waste management. Awareness at all levels of health care personnel is a basic pre requisite for efficient management of health care waste. Lack of awareness can be the primary reason for failure of proper enforcement of the rules.

The health care personnel who were knowledgeable knew all the details of the various specifications under the Rules. 85% doctors were not heard of any acts or rules but were vaguely aware of some guidelines issued from Karnataka State Pollution Control Board without knowing that it is the prescribing authority. 92% health care personnel other than doctors were simply following the instructions of their superiors and were not inquisitive to the least to know about the rules.

Developed countries in USA have specific legislations to deal with the health care wastes and are managing it in a better way than some developing countries in Asia[7].

In New York State, Medical Waste Tracking Act (MWTA) was enacted in 1988. This legislation, required the Environment Protection Agency (EPA) to mandate medical waste tracking systems; required management standards for the segregation, packaging, labeling, transporting and storage of medical waste, established record-keeping requirements, and allowed for penalties to be imposed for the mismanagement of medical waste.

In California State, the Medical Waste Management Act (MWMA) is effective since 1991. All medical waste must be treated prior to disposal. Storage of waste shall not exceed 7 days at temperatures above 0 C. and up to 90 days at temperatures at or below 0 C. Transportation of medical waste is done by a registered medical waste hauler. Generators who treat their own waste must register with the Environmental Management Department (EMD) and are subject to inspection.

In Canada, the provincial governments exercise primary control over the disposal of hazardous biomedical and pathological waste and the federal government regulates the inter-provincial transportation and handling of infectious medical wastes through its Transportation of Dangerous Goods Act, 1985 (TDGA). The express purpose of TDGA is to promote public safety.

In Pakistan, the Pakistan Environmental Protection Ordinance (PEPO), 1983 provides the legislation to control environmental pollution, but does not specifically mention health care wastes, whereas PEPO, 1997, which supersedes PEPO, 1983, defines hospital waste and deals with the handling of hazardous substances[8].

In Vietnam, the Ministry of Health, has issued guidelines for managing health care wastes and 1996 circulars have drawn attention to the poor practice in storing, transporting and disposing of health care wastes and made recommendations for improvement[9,10].

In Philippines, hospital waste is primarily regulated by 1990 Act and a comprehensive ordinance issued by the Metropolitan Manila Authority in 1991[11,12].

There are no rules and regulations for healthcare waste management in Bangladesh. This is one of the most neglected managerial processes. Neither the government nor the hospital authorities pay attention. No one is conscious of harmful effect of hazardous waste on the environment[13].

In Bhutan, Environmental Assessment Act was passed by Parliament in July 2000 but there is no specific legislation on the health care waste management. A series of guidelines prepared with Technical assistance by DANIDA provide directions for the management of solid waste, hazardous waste including health care waste[14].

CONCLUSION

Our environment is fragile and finite. Legislations, only when enforced become a complementary tool to protect the environment. The legal awareness among doctors and other health care workers is pitiably low. The awareness of the general population may be bare minimum. Hence any amount of legislation put forth will be a futile one. What is needed to be done urgently, is to make reach to the common man, the environmental awareness by active participation of the administration, media, NGOs and civic society, so that every man protects the environment surrounding him. Human resource management is the most important determinant as it involves changes in attitude, behavior and human relationships. In this regard legislation can only become a supplementary tool. One of the key factors needed for enforcement is commitment at political, bureaucratic and managerial levels.

Environmental problems are becoming serious in India as the population is increasing. Unless some regulatory measures are taken up immediately, the irreversible damage to the environment is bound to happen.

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Category wise Quantification of Waste generated in a Tertiary Care Multi speciality hospital in New Delhi: A Retrospective analysis

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ABSTRACT

The objective of the BMW Rules 1998 is to protect people who handle waste from injuries, prevent the spread of infections to healthcare service providers, and waste handlers, prevent the spread of infection to the community, & protect the environment.

Improper management of medical waste is a serious life threatening risk for all health care personnel, patients, rag pickers, municipal & recycling industry workers as well as the community at large

In Safdarjung Hospital waste is segregated at the site of generation in all patient care areas/ clinical areas. Generally there is no mixing of waste. There is dedicated staff at the waste site who directly Monitor the final treatment. Recycling of plastics, glass and other containers, cans, cardboard etc. is undertaken.

If efficient and proper segregation (and pretreatment wherever required of plastic or other reusable/recyclable waste is) is done at the place of generation it gives an advantage of safety of waste handlers, environment conservation, observable reduction in treatment cost as well as revenue generation. Alternatives to plastic usage or its safe disposal are not in site in near future, hence wherever possible the practice of 3Rs i.e., 'reduction', 'reuse' wherever possible and 'recycle' should be encouraged.

INTRODUCTION

The safe management of healthcare waste has been in focus over the last 20 years all over the world. Today there is a lot of awareness regarding the need to manage waste safely. Stress is laid mainly on the handling, segregation[1] and disposal of the healthcare waste.

Growing urbanization and advances in medical technologies, access to state of the art healthcare services has led to several changes in the healthcare industry in India. Waste management technologies, management of plastics have become international issues but limited options available today. It is one of the most significant challenges faced by the Healthcare service providers and to effectively deal with this challenge, it is crucial, first, to 'understand the waste'.

This retrospective, quantitative and qualitative analysis of the waste generated in Safdarjung hospital gives an insight into various components thrown away as waste in healthcare facilities, without realizing their potential hazards to community and environments or potential utility to mankind.

AN OVERVIEW OF SAFDARJANG HOSPITAL

It is one of the largest multi specialty hospitals in Delhi having 1531 sanctioned beds, , In the year 2008, there were 1,29,271 admissions, bed occupancy of 118.5%, average daily OPD attendance was approx. 7500 per day 26,102 deliveries (avg. 72 per day) took place. The hospital is performing 170-180 operations per day; patient-attending casualty is about 700 per day and 10-15 postmortem per day.

Total land area of Hospital is 40 acres and area for onsite waste treatment is 1000 Sq. Meters approx. The waste is treated onsite and disposed of. The treatment technologies used are:

- Incineration: The incinerator is fitted with APCD, having chimney height of 30 meters, capacity 150-175 kg/hr.
- Shredder Machine.
- Microwave

OBJECTIVES

- To analyze the percentage of different components of biomedical and general waste, generated in all clinical areas of the hospital.
- Quantity each category of bio-medical waste (as specified by the Biomedical Waste Management and Handling Rules, 2000) generated in the hospital.
- Quantify all the recyclable items of biomedical waste.
- Quantify the different types of plastic items of Biomedical waste generated in the Hospital and the annual revenue earned by recycling.

METHODOLOGY

As per hospital policy, the waste is segregated at the site of generation in all patient care areas/ clinical areas. There is no mixing of waste. Biodegradable plastic bags of 3 colors yellow, blue and black are used, to line the same colored bins.

Segregation is done as follows:

YELLOW BAGS

Soiled bandages, soiled cotton, gauze dressing, generated by mopping, infective spills, other soiled waste blood bags.

For body parts, blood and body fluid contaminated items double packing is done.

BLUE BAGS

Individual blue bags i.e., one for each of following Disposable plastic items are used:

- Syringes which are crushed immediately after use and pretreated
- IV fluid bottles
- Gloves (after pretreatment)
- IV canulas ,catheters, tubings etc.
- Separate Puncture proof Containers are used i.e., one for each of following:
  - Metallic sharps in a container with hypochlorite solution and
  - Glass vials, broken glass

Waste quantification analysis has been done for a period of twelve months i.e., from January 08' to December 08'. Hospital waste is transported category wise, on dedicated, color coded, covered and leak proof wheel barrows from the site of generation to the waste treatment site.

DAILY QUANTIFICATION OF WASTE

Weighment of waste was made where these bags are counted before disposal. Also, verification of labels is made checking with counterfoil of receipts from each area.

After this the trolley containing all yellow/ blue/black bags is weighed on the ground fitted weighing machines. All the wheel barrows have been pre-weighed. The weight of the trolley, which is already known, is then subtracted from the figure obtained, to get the weight. of the respective 'waste' and the relative quantities of waste generated in kg/day, in each of the hospital area is obtained.

YELLOW BAGS

The yellow bags containing the infectious waste are counted and the number is confirmed with the receipt from each area, and then weighed . All Yellow bags are directly sent for incineration. Ash from the incinerator is collected in black bags and kept along with the general waste after weighing

BLUE BAGS

Each of the blue bags containing the individual disposable plastic items (syringes, gloves, IV canulas and bottles) are duly verified in number from the receipt at the site. The infected plastics and gloves are then put in the microwave for treatment following which they are shredded. The shredded material so obtained from the shredder is placed and stored in blue bags till further disposal.

THE RECYCLING OF WASTE

All disinfected and shredded plastic, gloves, glass, cardboard etc. are, pretreated at the point of use and then micro waved at the waste site. This is followed by shredding at the wastesite. The shredded plastic is stored in blue bags and every fortnight handed over to Govt. authorized vendors days at Govt. approved rate for further recycling.

SHARPS: All sharps which are stored and transported in puncture-proof containers are also weighed upon receiving at waste site. The metallic sharps are not being recycled at present. Deep pits for sharps have been made in a safe area as per guidelines of BMW. All the metallic sharps are put in the pits. Currently fourth pit is in use.

The glass sharps, cardboards, cans and other such materials are also handed over to Govt. approved vendors for further recycling.

LIMITATIONS OF STUDY

- It is a retrospective analysis from the available data, which is routinely being recorded in the hospital. However improvements are being made constantly.
- As per routine practice yellow and blue bags are weighed everyday where as black bags are weighed once a week or even less frequently. The black trolley (Gen. waste) is generally overloaded and the waste bags hang out many times hence the quantum of general waste may be under-reported.
- The Departments of Obstetrics (72 deliveries/ day) and Dept. of Burns & Plastic (101 beds) generate a large amount of category 1 and 6 waste.
- Plastic being light in weight compared to metal and glass is heaviest; a comparison of weights may not be true representative of quantity.
- Plastic drinking water bottles and other item are put in black bags.
- Some mixing of waste does occur in spite of all efforts.

Observations and results (Tables 1-5 and Figures 1-4):

1. Total waste generated in the hospital in the year 2008 was 6,75,756 kgs . Out of this Biomedical waste was 1,76,774 kgs The biomedical waste generated per day per[3] patient was 0.268 kgs.
2. The total infectious incinerable[2] waste of (BMW Categories 1,3 & 6), was 1,19,212 Kg and the same as per calculation per day per patient was 0.0035 kgs
3. The plastic waste items generated were individually measured /weighed (Category 7 of BMW). The total plastic waste generated was 35,348 kgs . The generation of plastic per

Table 1
Total Waste Collection during the Year – 2008

(JAN. TO DEC.)

Sl. No	Month (Kgs)	BMW (Kgs)	Gen.Waste (Kgs)	Total (Kgs)
1	Jan	15324	42032	57,356
2	Feb	14299	39128	53427
3	March	14598	43136	57,734
4	April	13381	41950	55,331
5	May	13927	51665	65592
6	June	13823	40700	54523
7	July	14161	37907	52068
8	Aug	14895	42328	57223
9	Sept	15636	41509	57,145
10	Oct	15518	42771	58289
11	Nov	15091	41983	57074
12	Dec	176774	43500	675756

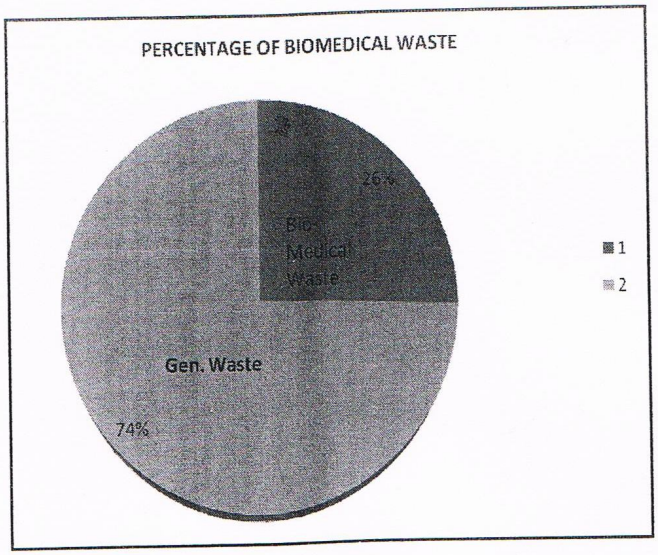

Fig 1: Percentage of Biomedical waste

Table 2
Total BM Waste Collection during the Year – 2008

(JAN. TO DEC.)

Sl. No	Month	Cat. 1,3,6	Needles Cat.4	Glass Cat.4	Plastic Waste	Total Bio medical
1	Jan	10473	73	1896	2882	15324
2	Feb	9288	83	2199	2729	14299
3	March	9912	90	1972	2624	14598
4	April	9309	107	1252	2713	13381
5	May	9289	101	1615	2922	13927
6	June	9451	94	1489	2789	13823
7	July	9854	91	1333	2883	14161
8	Aug	10090	96	1806	2903	14895
9	Sept	10381	92	1950	3213	15636
10	Oct	10553	115	1764	3086	15518
11	Nov	9938	110	1783	3260	15091
12	Dec	10674	100	2003	3344	16121
Total (Annual)		119212	1152	21062	35348	176774

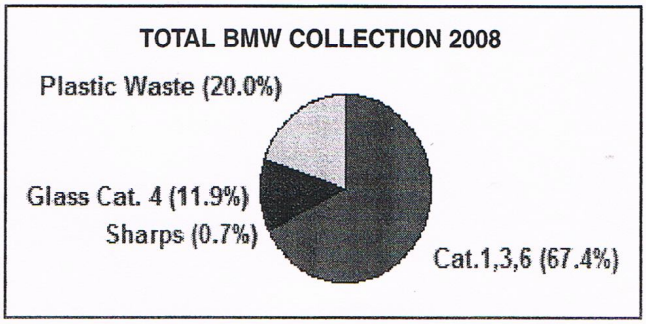

Fig 2: Total BMW Collection 2008

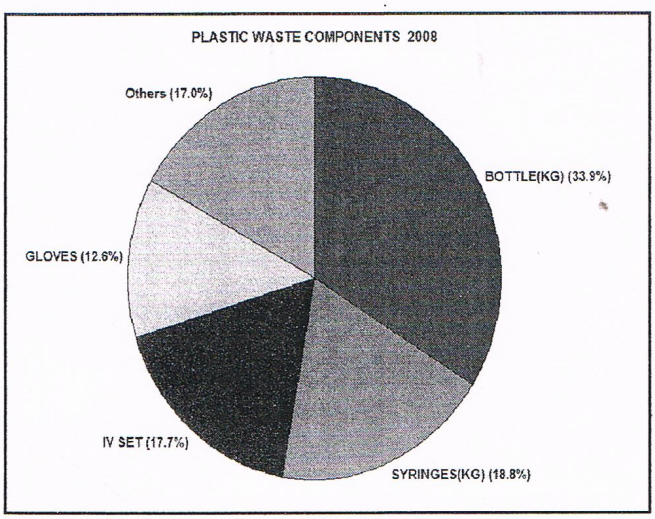

Fig 3: Plastic Waste Components 2008

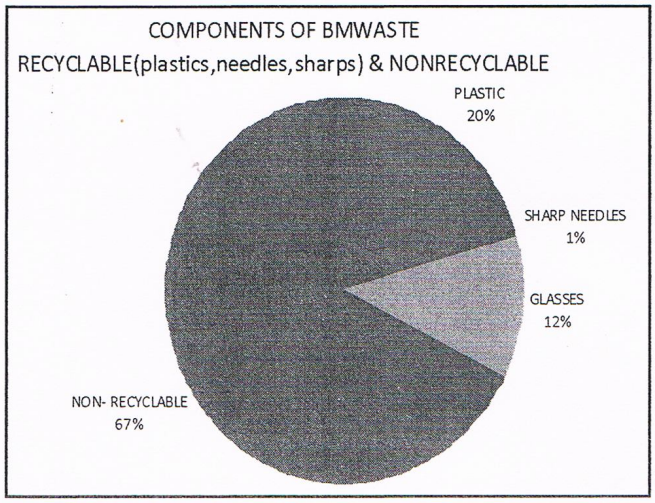

Fig 4: Components of BMWaste

Table 3
Plastic Waste Components And Revenue Earned : YEAR 2008

Sl. No	Month	Bottle (Kg)	Syringes (Kg)	IV	Gloves	Others Set	Total in Rs.	Revenue
1	JAN	986	534	521	307	534	2882	49114/-
2	FEB	840	502	461	383	543	2729	50155/-
3	MAR	1160	491	484	384	105	2624	56548/-
4	APR	669	409	403	210	1022	2713	34377/-
5	MAY	873	551	527	347	624	2922	43834/-
6	JUN	912	687	446	318	426	2789	74692/-
7	JULY	1181	441	442	237	580	2881	58098/-
8	AUG	1052	625	611	331	284	2903	50595/-
9	SEP	712	599	385	255	1262	3213	45901/-
10	OCT	1058	566	610	522	330	3086	50768/-
11	NOV	1250	582	685	563	180	3260	57155/-
12	DEC	1290	645	675	598	136	3344	59665/-
	Total (Annual)	11983	6632	6250	4455	6026	35346	630902/-

day was 96.84 kgs. The breakup of different plastic items was as follows:

- I/v bottles, 11983 kgs, Syringes, 6632 kgs
- Catheters, IV canulas, tubings 6250 kgs
- Others i.e, cans,cardboard, plastic covers, other containers etc. was 6026 kgs.

(One kilogram of IV bottles contain approximately 45-50 bottles. 1 Kg of mixed syringes contains 250-275 syringes)

4. Sharps
   - Metallic 1152 kgs
   - Glass 21062 kgs

Table 4
Recyclable Waste : 2008

Sl. No	Month	Total Plastic in kgs	Sharp Needles in kgs	Glasses in kgs	Total clable in kgs	Total Bio-medi-cal	% Recy-clable in kgs out of BMW
1	JAN	2882	73	1896	4851	15324	31.0
2	FEB	2729	83	2199	5011	14299	35.0
3	MAR	2624	90	1972	4686	14598	32.0
4	APR	2713	107	1252	4072	13381	30.0
5	MAY	2922	101	1615	4638	13927	33.0
6	JUN	2789	94	1489	4372	13823	31.6
7	JULY	2881	91	1333	4305	14161	30.4
8	AUG	2903	96	1806	4805	14895	32.3
9	SEP	3213	92	1950	5255	15636	33.6
10	OCT	3086	115	1764	4965	15518	32.0
11	NOV	3260	110	1783	5153	15091	34.1
12	DEC	3344	100	2003	5447	16121	33.8
	Total	35346	1152	21062	57560	176774	32.5

Table 5
Some Averages of Waste Generated in Safdarjung Hospital : 2008

Sl. No.	Name	Total in kgs	%age	Per Day in kgs	Per patient per day in kgs
1	Total waste	675756	—	1851.4	1.025
2	Gen Waste	498982	74% of total	1367.07	0.757
3	Biomedical Waste	176774	26%of total	484.3	0.268
4	Plastics	35348	20% of BMW	96.84	0.0537
5	Glass	21062	11.91% of BMW	57.7	0.032
6	Needles	1152	0.655% of BMW	3.15	0.0016
7	Others	6026	3.4% of BMW	16.5	0.009
8	Recyclable Waste	57560	32.56%of BMW	157.71	0.087

The total revenue generated out of disposal of recycling during the year 2008 was Rs, 630902/- with monthly average Rs 57,560/.

CONCLUSION

The total bio-medical waste generated per day in the hospital is less than the western countries and is comparable to other reports from India. The Bio-medical waste constitutes 26% of the total waste generated in the hospital. The incinerable waste generated is about 67.4% of the total BMW.

The quantity of waste sharps measured shows that glass waste constitutes 11.5% of the total quantity of Bio-medical waste where as metallic waste is 0.7%.

The plastic recyclable waste, generated per day is 157.71 kgs i.e., 32.6% of the total biomedical waste.

As is obvious nearly one third of the biomedical waste can be recycled. But for this it is crucial that hospital waste management systems focus on waste segregation at the point of generation. Enforcing segregation practices within the hospitals to separate various types of waste results in a clean recyclable solid waste stream which can be easily, safely and cost-effectively managed through recycling .Literature shows excellent examples of segregation exist in various countries.

If efficient and proper segregation and pretreatment (wherever required of plastic or other reusable/recyclable waste is) is done at the place of generation it gives an advantage of safety of waste handlers, environment conservation, observable reduc-tion[4] in treatment cost as well as revenue generation. The revenue generation should only be seen as a byproduct a decision taking should not be influenced by it.

The percentage of plastic waste generated is increasing steadily.

Alternatives to plastic usage are not in site in near future, Therefore it is mandatory that recycling should be promoted and encouraged by a strong institutional mechanism.

R[5] and D should be continued to explore uses of recycled plastic as well as metal sharps.

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HEALTH-CARE WASTE AND THE CREATION OF DIOXINS AND FURANS

WHO has established tolerable intake limits for dioxins and furans, but not for emissions. The latter must be set within the national context.

A number of countries have defined emission limits that range from 0.1 ng TEQ/m^3 (Toxicity Equivalence) in Europe to 0.1 ng to 5 ng TEQ/m^3 in Japan, according to incinerator capacity.

Even in high temperature incinerators (>800 °C), temperatures are not uniform and dioxins and furans can form in cooler pockets or during start-up or shut-down periods. Optimization of the incineration process can reduce the formation of these substances by, for example, ensuring that incineration takes place only at temperatures above 800°C, and that flue gas temperatures in the range of 250°C to 450°C are avoided.

In the last 10 years, stricter emission standards for dioxins and furans in many countries have significantly reduced the release of these substances into the environment. In several European countries where tight emissions restrictions were adopted in the late 1980s, dioxin and furan concentrations in many types of food (including mother's milk) have decreased sharply.

Source: WHO website www.who.int

A Need to Incorporate Sound Waste Management Practices for Improving Environmental performance, Public health safety and Delivery of quality-healthcare by Clinical Laboratories in India – A case study

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ABSTRACT

India has high incidence and frequent outbreaks of diseases like tuberculosis, malaria, cholera, encephalitis, typhoid, measles, hepatitis and dengue. Various clinical and disease surveillance laboratories in India, carry out testing for infectious and contagious diseases, such as malaria, typhoid, cholera and hepatitis, tuberculosis, polio and HIV/AIDS. These laboratories therefore generate waste, which include infected human tissues, blood samples, microbes, discarded chemicals, sharps, etc. Although the amounts of waste generated from such laboratories is small, its varied and hazardous composition requires comprehensive management of the waste lifecycle, from source to disposal, to prevent adverse impacts on the environment and public health.

The present communication summarizes results of the study, which analyzed the composition of medical waste in 65 private clinical laboratories of a town in southern India – Kannur, Kerala. The aim of the study was to characterize the medical waste, recognize the environmental health effect of the existing practices, determine the awareness level of lab workers on management of such waste, identify the weaknesses and provide suggestions for improvement.

Metal sharps constituted the maximum proportion followed by infected plastic waste. 28% of which were syringes, about 49% of the laboratories handled potentially infected blood samples and 32% urine samples. Almost 95% of the labs disposed blood and body fluids into municipal sewers without any disinfection. The study recommends both upstream and downstream activities for achieving comprehensive and environmentally sound waste management practices in the clinical laboratories.

Keywords: Clinical Laboratory waste, Environmental Health, laboratory containment, Waste Audit

INTRODUCTION

The word 'laboratory' (or lab) is generally used to describe a facility that conducts experimental or routine testing. Most people associate labs with activities involving chemicals. Although there are some large lab organizations, such as research and development functions in corporations and government, most labs are small businesses or small entities within larger organizations. These local labs may test a wide range of environmental, physical material, medical, biological, or food samples. In most of the smaller laboratories, environmental management is a "shared" responsibility as opposed to that of a single individual. Finally, because there is no single association representing all labs, it is difficult to reach them effectively. Common small lab types include:

- Clinical labs associated with medical or dental practices.
- Forensic testing labs.
- Environmental testing labs.
- Quality Assurance labs for chemical or other manufacturing plants.
- Teaching and academic research labs (grade school, high school, and college).

Laboratory waste also contributes much to the total biomedical waste generated in a region. Mushrooming of labs in various parts of the country without any facilities for the treatment of

the biomedical waste generated, lead to serious environmental hazards. There is no prescribed authority to govern these private labs, hence disposal of waste is seen to be unsatisfactory in most of these labs. Similarly, there is no inventory of the private labs or quality and quantity of waste generated by them, hence a strong need was felt to conduct a survey on prevalent scenario of private labs.

Biomedical waste programs have been largely discussed in India with reference to overall hospital waste management but pathology and microbiology laboratories also generate a significant proportion of biomedical waste and have not received much attention. High prevalence of various infectious diseases in the population pose a great risk of occupational hazards to the forensic/ pathologist/ autopsy surgeon and other staff involved with agents such as HIV, Hepatitis B, C, viruses, *Mycobacterium tuberculosis,* etc. Other hazards include toxic chemicals like formalin, phosphine gas and organophosphates, etc.[1]

In the surveillance conducted by CDC, at least 54 health care workers in the USA had HIV infection developed after occupational exposure[2]. Among the occupational hazards in lab workers, HIV is of low infectivity as compared with other blood borne viruses such as hepatitis B and C. Deep injury, visible blood on the device causing the injury, injury with a needle used in a vessel, and injury with hollow bore needle (compared to a solid needle) all increase the likelihood of a larger inoculums of blood entering the recipient. Other factors such as penetration of a needle through a latex glove (which may have wiping effect) also alter the risk of transmission[3].

Among the physicians, pathologists have been recognized as a high risk group for occupationally acquired hepatitis B virus (HBV) because of their exposure to blood. According to the study, hepatitis B was found to be positive in 8.8% in the technicians who were in direct contact with blood during profession[4].

AIM AND OBJECTIVE

This study conducted between January 2005 Feb, 2006 aimed at assessing the prevalent scenario of waste management in laboratories of Kannur district of Kerala and the impact of it on the environment and the hospitals.

The objective of the study was to make an inventory of the quantity and quality of waste generated at various clinical laboratories of Kannur and assessed the improvement of practices by continuous education & training programme.

MATERIALS & METHODS

The study was carried out in 65 private clinical laboratories of Kannur.

METHODOLOGY

A detailed tool in the form of questionnaire was developed to assess the scenario of waste management and occupational hazards prevailing in the private laboratories in the district. The aspects considered while surveying was to get an overall idea on the type of lab, amount of waste generated per day and the prevalent situation of waste management and occupational hazards encountered. Through this survey we evaluated the following details from each lab

- Type of lab and services offered
- Number of each samples received per day
- Awareness on Biomedical Waste Management (& Handling) rules, 1998
- Quantity and quality of different categories of waste generated
- Status of Segregation practices
- Items segregated, type of container used and the frequency of removal of waste
- Treatment and disposal of each category of waste
- Availability of waste treatment or disposal equipments
- Affiliation to common treatment facility or willingness to join such a facility
- Injuries or infections acquired by staff
- Cleaning routine followed for spillages
- Immunization status of staff
- Usage pattern of protective gear and equipment by the laboratory personnel
- Training need and requirement on various aspects of waste management and occupational safety

Supreme Court of India on solid waste management in Class 1 cities.

Planners and administrators of health institutions will find this book practical since it gives details on the action and activity plan on management of HCW from the point of generation to the point of disposal. Further, resource materials used for the development of this book have been included, in addition to each method of waste treatment in meticulous detail. Rules for BMW, 1998, of the Ministry of Environment and Forests, Government of India, have also been included. Finally a checklist for evaluation of the HCWM in hospitals is a useful inclusion.

The book has been translated to Kannada and Tamil and will be available in Hindi by early 2010. All in all, the simple language of this book and its publication at a time when many institutions are acknowledging the need for guidelines on HCWM will make it widely acceptable.

2. "Short Customized Guidelines for Safe and Sound Management of Health Care Waste" (Fact Sheets)

These fact sheets are an adjunct to the "Information and Learning Units" (ILU) mentioned above. It has been published in the form of a folder which holds individual fact sheets. Each sheet is devoted to one important aspect of HCW. It is a more concise version of the ILU and highlights the more practical facts of HCWM. It can be used as a ready reckoner in clinics, hospital wards and out patient departments and in situations where quick information is required. This has been released as a draft in April 2009 and inputs from users are solicited.

For any enquiries, suggestions or to procure copies of any of the above two resource materials, *please contact :*

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GLOBAL PATIENT SAFETY CHALLENGE ANTIMICROBIAL RESISTANCE

The World Alliance for Patient Safety has established a coalition of internal WHO programmes (including the WHO programme on food-related antimicrobial resistance as lead of the "Animal Husbandry" working group) and external partners to address antimicrobial resistance, under the direction of Dr David Heymann, as the topic for its third Global Patient Safety Challenge. This programme is due to be launched in 2010.

More information on this programme is available at:

http://www.who.int/patientsafety/amr/en/

Source: WHO website www.who.int

NEWS

Establishment of Health care waste management Cell of Bangalore Medical College and Research Institute (BMCRI) Fort, Bangalore, India.

Health care waste management cell of BMCRI was inaugurated by Hon'ble member of Lokad Adalat Mr. A. N. Yellappa Reddy, Former Secretary, (Environment, Ecology and Forests), Government of Karnataka. The goal of the cell is to make the attached hospitals of BMCRI demonstration models of health care waste management institutions. A nodal officer has been identified from each of the 32 departments who will be trained to monitor the management of waste generated in their respective departments and also to carry out periodic training programmes to other staff. A Continuing Medical Education (CME) programme was held on 21.11.09 to sensitize the nodal officers and nursing staff with regards to the above. A series of such programmes are planned hospital wise.

A core committee headed by Dr. T. Subhash, Director consisting of Superintendents, Professors, Nodal officers and nursing superintendents will ensure smooth and effective functioning of the Health care waste management cell.

Shortly, BMCRI will have its own strengthened Liquid waste management plant which will be the first in any government hospital in Karnataka.

The Cell would take Guidance from experts, members of Health care waste management Cell, M S Ramaiah Medical College and pollution control board officials from time to time.

GUIDELINES FOR AUTHORS

JOURNAL OF THE INDIAN SOCIETY OF HOSPITAL WASTE MANAGEMENT

1. Journal of Indian Society of Hospital Waste Management publishes orginal 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 writeup as may be considered necessary for effectiveness of communication.
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   (i) Certified that I we have not used any information or material from official documents graded 'restricted' and above or any 'classified' information obtained in any my our official capacity in the preparation of the article of the article title

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   (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.

   First author Second author Third author
   Date Date Date

4. MANUSCRIPT must be typed in double space throughout, on one side of good quality white bond paper of size 22x28 cm or A4 size with margin on both sides. Words should be hyphenated at the end of a line. Three copies, sets or hard should be submitted along with 3 sets of illustration and the entire text in MS Word format on a 1.44 MB floppy. 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, superscribed 'Article for publication Not to be Folded', and sent under registered cover to Executive Editor, Journal of Indian Society of Hospital Waste Management, Health Care Management Cell, Department of Community Medicine, M. S. Ramaiah Medical College, Bangalore - 560 054. (Karnataka).
5. PROCESSING: Material received for publication will be acknowledged. The article may be reviewed by referrers. When required, one copy of the typescript, suitably modified, will be sent to the principal author for revision and resubmission in duplicate. Accepted articles will be published in their turn. Reprints (at least 10) of each article will be sent free cost to the FIRST author. Articles not accepted for publications will be returned by ORDINARY post.
6. AUTHORSHIP: Should be restricted to persons who have made sufficient contributions to (a) conception and design (b) drafting the article or revising critically (c) final approval of the article to be published. All conditions must be ideally met. The order of authorship should be joint decision of all the coauthors.
7. TYPESCRIPT: the typescript comprises (a) title page (b) abstract and key words (c) text (d) illustrations. All these must start on separate pages and ion the above order.

Pages should be numbered consecutively beginning with the title page.

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

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

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

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

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

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INDIAN SOCIETY OF HOSPITAL WASTE MANAGEMENT

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

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

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

With this important aspect in mind, the Registrar of Society at Delhi was approached for registration of the 'Indian Society of Hospital Waste Management (ISHWM)' and the Society came into existence on 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 subjects 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 an 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

Table 2
Treatment and Disposal of Various Categories of Waste in Laboratories of Kannur

Metal Sharps		Glass Sharps		Infected Plastics		Liquid Waste	
Prevalent Treatment Practices							
	% Implementation		% Implementation		% Implementation		% Implementation
Mutilation with ND	61.53	Broken/ Shredded	1.53	Mutilated	1.53	Disinfected & Discharge into Drain	75.38
Chem Disinf & mutilation	1.53	Chemical Disinfection	32.3	Chemical Disinfection	23.07	Discharge into Drain	20
Chem Disinf	3.07	Washing with Water	9.23	Washing with Water	4.61	Open Burning	1.53
No Treatment	33.84	No Treatment	56.92	No Treatment	70.76	Given to IMAGE	3.67
Prevalent Disposal Practices							
Given to IMAGE	16.92	Municipal Bin	18.46	Open Dumping in Pit	9.23		
Open Dumping in pit	7.69	Open Burning	23.07	Open Burning	55.38		
Open Burning	35.38	Burial	7.69	Municipal Bin	7.69		
Burial	4.61	Given to IMAGE	15.38	Burial	6.15		
Sold to recycler	1.53	Sold to recycler	4.61	Given to IMAGE	20		
No disposal	33.84	No Disposal	3.07	No Disposal	1.53		

generated are more (an average of 17/day) followed by lancet, scalpel and blade. In glass sharps broken test tubes and cover slips are generated more (average of 11/day) followed by slides, ampoules and vials. In spite of high generation of sharps and information regarding occupational hazards due to sharps, only 36.92% of the labs segregated sharps.

Syringes were the major category generated in infected plastics category (17/day) followed by micro tip, sample container, plastic test cards and gloves.

In labs liquid samples left after the diagnosis formed major category of waste which was drained into common drainage without any treatment by most of them. Blood sample was the major category of liquid waste in labs (an average of 15 samples/ day) followed by urine (10 samples/day), sputum (3 samples/day), stool (2 samples/day) and body fluid (1 sample/day).

About 61.53% of the labs claimed to mutilate the metal sharps with needle destroyer, which was followed by 4.64% of the labs practicing deep burial of metal sharps, similarly; only 1.53% of the labs were shredding glass sharps before disposal. Majority (55.4%) of labs were practicing open burning of infected plastics, which is against the Rules. Only 20% of the labs were found to send infected plastics to the common treatment facility. The study revealed that 50% of the labs were directly discharging the potentially hazardous liquid waste to drainage without any pre-treatment. It was satisfactory to find that about 73.84% of the labs possessed needle destroyer for mutilating needle tips. Apart from it most of the labs studied did not have any other waste treatment technology for treatment of waste within their premises.

Most of the studied labs do not have any proper or effective waste disposal mechanism and were dumping or burning the waste in open.

Increased risk of hepatitis B virus infection has been found among health care workers especially those having frequent contact with blood and/ or exposure to needles or sharp instruments[6]. The first case of occupationally transmitted HIV infection was reported in medical literature in 1984[7]. In the present study, only 18.5% of the laboratory personnel admitted having occasional needle stick injuries. About 8% of the staff among them revealed getting an average of 2 such injuries per day. Others were not ready to reveal the status of occurrence of such injuries.

Immunization status of the staff was found to be satisfactory but no regular medical check up was arranged for the staff by the management.

Studies in British clinical laboratories between 1970 and 1989 established that the highest rate of laboratory acquired infections was in autopsy lab workers [8]. It has been reported that resident doctors working in pathology sustained a percutaneous injury with blood exposure in 1 in 11 autopsies whereas the experienced pathologists it was 1 in 55 autopsies[9]. Scalpel blades made majority of these cuts. However, many other objects such as broken glass, needle fragments, bone pieces, and fragmented projectiles can injure the autopsy and laboratory personnel[10]. In spite of knowledge on potential infections that can be spread through laboratories, it was found that no importance for occupational safety is given in any of these labs. Only about 29.23% of the staff uses mask and a mere 33.84% reported using apron, while performing testing and analysis in the labs.

Among the labs surveyed, 44.61% showed their willingness to join such a facility. This is mainly because of lack of time, resources and funding to implement onsite waste management facility.

CATEGORIES OF WASTE GENERATED IN THE STUDIED LABORATORIES

Human anatomical waste is usually generated in operation theatres but a number of specimens are sent to the pathology department for diagnosis. Similarly, in laboratories performing autopsies, a large amount of category 1 waste was generated. Category 2 (animal waste), category 5 (discarded medicines and cytotoxic drugs) and category 9 (incineration ash) was not found in pathology laboratory. Microbiology waste generated in the form of specimen, cultures, tubes and plates used in identification and drug sensitivity test and stock cultures have highest infectious potential, which should be autoclaved. Among waste sharps (category 4) the quantity of metal sharps in clinical labs was found to be more than glass sharps and category 6 (soiled waste) is a small quantity in form of cotton balls used while blood collection practices. Category 7 is the solid waste mainly from disposable items other than sharps for example tubing, tubes, gloves, syringes, plastics test cards, microtips, containers used for blood and other pathological samples, blood collection sets in blood bank and blood bags, plastic culture plates, Elisa wells, plastic sticks etc. Category 8 includes liquid waste generated while washing of laboratory waste and processing of samples on the analysers, these include blood samples, sputum, urine, vomit, serum, semen etc. Category 10 is the chemical waste generated while testing and analysis.

The various items, which are generally reused in the laboratories are ESR tubes, gloves, microtips, sample containers, plastic test tubes, slides, glass test tubes, coverslips, plastic sticks, and glass bottles.

SUGGESTED PRACTICES FOR WASTE MANAGEMENT IN A CLINICAL LABORATORY

All the culture plates, drug sensitivity plates, culture material with bacterial growth in liquid or solid media in tubes, bottles and plates and specimens from patients needs to be collected in red liners/stainless steel trays/boxes which can be directly loaded in to an autoclave. The autoclave holding time is 30 min at 121 degrees Celsius and 15 PSI..

The blood samples in labs are either collected by syringe and needle and adding blood samples to in house anticoagulant /plain containers or in vacutainers. In case of liquid sample collected in syringes and needle, the conventional needles needs to be cleaned and expelled with water followed by a pre-treatment with a minimum of 10% of bleaching solution and then can be mutilated over the electric needle destroyer[11]. However, vacutainer needles cannot be mutilated conveniently and need to be capped carefully by keeping the cap on the table surface and pushing the needle in it without touching the cap and then fitting the cap. All the burnt needles and vacutainer needles can be collected in blue puncture proof containers/ jerry cans. The needles from the filled jerry cans can be disposed off in sharp burial pit.

Liquid waste generated from laboratory washing, cleaning and disinfecting activities has to be disinfected by chemical treatment before discharging in drain. However, it is at times not practical to disinfect huge volumes of liquid waste.

Blood samples received for analysis can be carefully decanted in metal containers and can be autoclaved in waste autoclave[12]. The small amount of residual blood in the containers should be disinfected by 10% bleach solution or appropriate hypochlorite solution. However, hospital liquid waste is likely to contain pathogens and multidrug resistant bacterial pathogens. Considering this the labs, where central municipal effluent treatment plants are not available, should have their own effluent treatment facility. The treated water can be used for sanitary cleaning and green belt irrigation[13].

There is also a huge amount of chemical waste generated in labs owing to testing and processing during analysis and also the chemicals used in disinfection. Chemical treatment with hypochlorite has been suggested for chemical waste treatment in BMW Rules, 1998 but it is inappropriate since treatment with agent like hypochlorite cannot neutralize the chemical waste. Small amounts of a wide range of chemical residues produced in laboratory operations may be safely disposed of to the sewerage system. However, this method of disposal is not desirable for the following chemicals:

- persistent chemicals such as heavy metals and various organic compounds
- water-immiscible organic liquids such as petroleum hydrocarbons and chlorinated compounds
- compounds which produce toxic vapours, such as cyanide, ammonia, formaldehyde and glutaraldehyde
- strongly acidic or alkaline wastes
- highly reactive chemicals or flammable wastes

Laboratory liquid waste approved for discharge to the sewer should pass through a neutralization / dilution pit prior to sewer discharge. Large quantities of concentrated acids or alkalis (greater than 2.5 litre) should be neutralised prior to disposal to sink/ drain. Small amounts (less than 1 litre of concentrated solution) of wastes containing organic liquids miscible with water may be discharged to sink/drain. Where these liquids have toxic or flammable vapours (such as formaldehyde) the wastes must be diluted with large amounts of water. Wastes containing the heavy metals arsenic, cadmium, mercury and silver in amounts above one gram, or copper, chromium, lead, nickel and zinc above 10 grams should be pre-treated to remove these metals prior to discharge of the waste to sink/ drain.[14]

Similarly the blood / body fluid soaked cotton/ gauze could be discarded in yellow liners which could be sent to common facility or autoclaved in wax coated paper bags and then the material can be composted or appropriately deep buried as per the Rules. The autopsy samples and other small tissues excised for testing etc should be washed with water to remove formalin and then sent in yellow liners to central common facility for incineration. In case the town's population is less than five lakhs, the same can also be buried in appropriately designed deep burial pits.

The infected plastic items require autoclaving or chemical disinfection with 10% bleaching solution or appropriate concentration of hypochlorite solution. The gloves used in the laboratory should also be disinfected with 10% bleaching solution before mutilating and disposal.

Six Sigma is a global management strategy introduced to the industrial world in the 1980s. This methodology has been widely implemented in companies such as Motorola, General Electric, Allied Signal and many others, with tremendous success in terms of customer satisfaction and global profitability. To achieve similar benefits in the healthcare field, Six Sigma is currently being deployed in several laboratories around the world. The clinical laboratories in India should also work towards adopting similar kind of concept to improve their quality assurance and environmental performances[15].

It is imperative that above cited recommended practices are implemented in surveyed or similar laboratories and their efficacy to mitigate the problems encountered are studied separately and results published after the implementation. The scope of this paper is only to report that despite the Rules, this is the status in most private labs and based on Rules, literature and experience, the recommended practices are suggested.

CONCLUSION

There have been cases of detection of wild polio virus in sewage sludge of Egypt and the disposal of laboratory infected sample or stock culture directly into sewers could have been one

of the causes. The municipal sewers installed in most of the cities in India are not equipped with the handling of high loads of potential pathogens contained in the biomedical waste. The National Action Plan (under The Global Commission for Certification of Polio Eradication) for laboratory containment of wild polioviruses in order to eliminate the risk of reintroducing wild polioviruses from the laboratory to the community, is the road map that needs to be drawn for safe management of Laboratory waste in India.

Even experienced laboratory workers have a tendency to become lax or complacent in the laboratory when they are "just cleaning up". Unfortunately, "just cleaning up" involves hazardous chemicals and infective body fluids, and if these are improperly disposed or segregated, the results can be tragic. Proper management of laboratory waste need not be an all consuming task, but it takes discipline, vigilance and common sense to implement it.

Disposable syringes, bottles, tubing, blood and uro bags, catheters, surgical gloves, etc are some of the examples of plastic usage in health care. Plastic has been associated with decline in sperm count, genital abnormalities and a rise in the incidence of breast cancer. Burning of plastics releases carcinogens like dioxin and furan. Once hailed as a 'wonder material', plastic is now a serious environmental and health concern, essentially due to its non-biodegradable nature. The options for plastic waste disposal are environmentally compatible long term land filling or recycling. All disposable plastic should be subjected to disinfection / sterilisation and shredding before disposing off to vendor. Designing eco friendly, biodegradable plastics are the need of the hour. Minimizing the generation of plastic waste in laboratories is also very important. Emphasis on recycling of sterilized / disinfected laboratory waste should also be considered.

Through this study, it has been quite evident that a satisfactory waste management system in most of clinical labs of Kannur is severely lacking. Enumerating the public health hazards by these laboratories may not be easy considering that there is no existing legal or other requirement for their registration in India. This mismanagement of potentially infected waste and stock cultures by labs is a particular problem in developing countries where contaminated medical wastes find their way into municipal garbage where people are known to scavenge and recycle. This poses obvious health risks, both in terms of direct exposure and environmental contamination. The gap in the knowledge of the environmental impacts of health care products and services underscores the need for increased understanding among health professionals of the integral links between human health and environmental health. Adequate waste management in laboratories will not only improve overall environmental performance but also facilitate in providing a safe workplace for the laboratory personnel. Continued surveillance and monitoring of the waste management practices by the labs is needed to determine the effectiveness of these recommendations on protecting and improving the people's health. The study recommends focusing both upstream and downstream activities while devising comprehensive environmentally sound waste management practices in the clinical laboratories. The study does not contend that the quality of health care should be sacrificed for the environment, but it does suggest incorporating environmental performance as part of the natural evolution of quality in health care.

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THE AMOUNT OF HEALTH-CARE WASTE PRODUCED CAN BE SUBSTANTIAL

The safe disposal of health-care waste generated at smaller rural clinics or larger facilities is feasible where adequate, well-operated infrastructure exists. However, the volume of waste generated within large facilities and during immunization campaigns may be difficult to dispose of safely when resources are limited. In 2001, during a measles mass immunization campaign in West Africa (covering all or part of six countries), 17 million children were vaccinated, resulting in the generation of nearly 300 metric tonnes of injection waste. Without adequate waste disposal options at both local and regional levels, this volume of waste would have been difficult to eliminate safely.

Incorrect disposal of health-care waste creates other health risks

The unsafe disposal of health-care waste (for example, contaminated syringes and needles) poses public health risks. Contaminated needles and syringes represent a particular threat as the failure to dispose of them safely may lead to dangerous recycling and repackaging which lead to unsafe reuse. Contaminated injection equipment may be scavenged from waste areas and dumpsites and either be reused or sold to be used again. WHO estimated that, in 2000, contaminated injections with contaminated syringes caused:

* 21 million hepatitis B virus (HBV) infections (32% of all new infections);
* two million hepatitis C virus (HCV) infections (40% of all new infections); and
* at least 260 000 HIV infections (5% of all new infections).

In 2002, the results of a WHO assessment conducted in 22 developing countries showed that the proportion of health-care facilities that do not use proper waste disposal methods ranges from 18% to 64%.

In addition to the public health risks, if not managed, direct reuse of contaminated injection equipment results in occupational hazards to health workers, waste handlers and scavengers. Where waste is dumped into areas without restricted access, children may come into contact with contaminated waste and play with used needles and syringes. Epidemiological studies indicate that a person who experiences one needle stick injury from a needle used on an infected source patient has risks of 30%, 1.8% & 0.3% respectively of becoming infected with HBV, HCV & HIV.

Source: WHO website www.who.int

Biomedical Waste Management- Delhi Experience

Dr. Baghotia. K. S.
Hon Secretary - ISHWM

There are 2233 health care institutions with indoor facilities in public and private sector in Delhi. The average quantum of waste generated in Delhi Government Hospitals is 260 grams per bed per day whereas it is 200 grams per bed per day in hospitals other than Delhi Government. Needle stick injuries are commonest hazard of biomedical waste. There are 18 Incinerators, 18 Autoclaves and 3 Microwaves for biomedical waste management in Delhi with a total capacity of 2675 Kg/hour. The average cost involved in management of biomedical waste is Rs.5361/- per bed per annum. The institutions using on site treatment facility are spending three times more than the facilities using centralized biomedical waste treatment facilities for biomedical waste management.

Every thing is made for a defined purpose. 'Anything which is not intended for further use is termed as waste'. There are large number of health care institutions in Delhi managed by various agencies. Major stakeholders are Government of India, Delhi Government, Municipal Corporation of Delhi and New Delhi Municipal Council, Employees State Insurance Scheme and private registered nursing homes. In Delhi, there are 72 hospitals under govt. sector, 610 registered nursing homes and 945 dispensaries. In addition to this there are about 1550 unregistered establishments with different names like Nursing Homes, Medical Centers, Dental Hospitals and MTP Centers etc. More than 41000 hospital beds are available in the public and private sector in Delhi.

LEGAL PROVISIONS

Ministry of Environment & Forest, Govt. of India issued a notification for Biomedical Waste (Management & Handling) Rules 1998 in exercise of powers conferred by section 6, 8 & 25 of the Environment (Protection) Act, 1986. Under these rules, the Delhi Pollution Control Committee has been designated as prescribed authority to implement these rules in the National Capital Territory of Delhi. The Lt. Governor of Delhi has constituted an advisory committee which has 10 members with Parliamentary Secretary (Health &FW), Govt. of Delhi as Chairman and Director Health Services as member secretary / convener (7). It is the primary responsibility of the

Table 1: Agency wise Healthcare Institutions in Delhi

Sl. No.	Organization	Hospitals	Beds	Dispy	Allop	Homeo	Ayur	Unani	SHS	MHS	MCWC	Tota
1	Delhi Govt	31	7704	391	193	51	12	0	63	72	0	391
2	MCD	15	3625	274	37	14	99	15	0	0	109	274
3	NDMC	2	200	45	11	12	10				12	45
4	ESIC	4	1000	34	34							34
5	Central Govt.	10	3840	99	84	11	3	1				99
6	Autonomous	6	2994	0								0
7	Defence	3	1850	1	1							1
8	DVB	0		24	24							24
9	DJB	0		15	14		1					15
10	DTC	0		27	27							27
11	SBI	0		9	9							9
12	RBI	0		8	8							8
13	Railways	2	466	12	12							12
14	Thermal Plants	0		3	3							3
15	Indian Airlines	0		3	3							3
16	Regd. NH	610	15079	0								
17	Un Regd. NH	1550	5000	0								
	Total	2233	41758	945	460	88	125	16	63	72	121	945

government to implement the recommendations and directions of the Supreme Court and these rules in public interest, so that biomedical waste does not cause any harm to human health, animal and environment.

FEE STRUCTURE IN DELHI FOR AUTHORIZATION

All health care institutions attending more than 1000 patients per month are liable to obtain authorization from prescribed authority i.e. Delhi Pollution Control Committee. The Delhi Government has approved following fee structure for obtaining authorization from Delhi Pollution Control Committee.

Violators/defaulters are liable to be fined up to Rs.100,000/- (Rupees One Lac only) or imprisoned for five years or both. So far DPCC has taken action against 12 health care institutions.

Sl. No.	Type of Health Care Institutions/facility	Fee in Rupees
1	Clinics, pathological labs and blood banks	Rs.1000/- per annum
2	Veterinary institutions, dispensaries & animal houses	Rs.1000/- per annum
3	Hospitals, nursing homes and health care establishment	Rs.1000/- per annum up to 4 beds & additional Rs.100 per bed per annum from fifth bed onwards
4	Operator of the facility of bio-medical waste (excluding participation)	Rs.10000/- per annum
5	Transporter of bio-medical waste	Rs.7500/- per annum

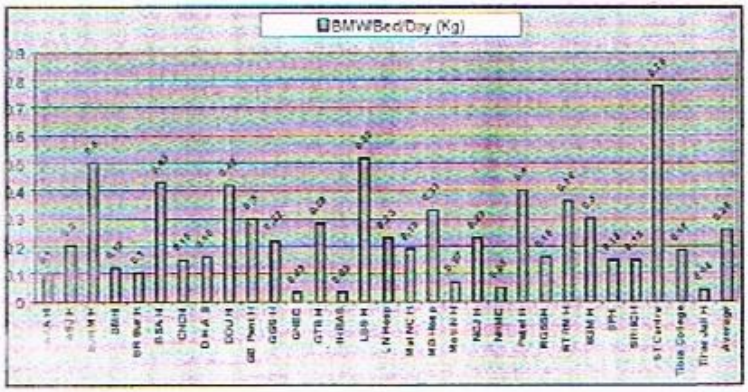

Fig. 1: Hospitals

QUANTUM OF WASTE

The quantity of waste produced in India is estimated to be 1–2 Kg per bed per day whereas in United States, it is as high as 5kg per bed per day (5). Medical waste is subset of municipal waste, and regulated medical waste comprises less than 1% of municipal waste produced in United States (10). The hospital waste generated in a tertiary care hospital of Delhi is 1.45 kg per bed per day (2).

BIOMEDICAL WASTE GENERATED IN GNCT HOSPITALS PER BED PER DAY

Delhi is generating approximately 7000 metric tons of municipal waste out of which 70 tons are expected to be biomedical waste. Biomedical waste generated in 30 Delhi govt. hospitals varies from 780 grams/bed/day (Shushruta Trauma Centre) to 30 gram /bed/day (Guru Nanak Eye Centre) with an average of 260 gram /bed /day. Similarly biomedical waste generated in 30 hospitals other than Delhi Govt. vary from 580 grams/bed/day (Infectious Disease Hospital) to 30 gram /bed/day (Venu Eye Institute and Research Centre) with an average of 200 gram /bed /day (4).

COST INVOLVED

The cost per bed per year involved in management of biomedical is Rs.5361. The institutions having on site treatment facility are spending three times more than the institutions utilizing services of Centralized facility. The average expenditure for institutions having onsite treatment facility is Rs.7228 whereas the institutions using centralized facility are spending only Rs.2100 per bed per annum (4).

COST RS/BED PER DAY ON BIOMEDICAL WASTE MANAGEMENT

Keeping in view the difficulties faced by private hospitals, nursing homes and clinics that cannot make their own arrangements due to high cost involved in treatment facilities, there is a need for centralized system for treatment. In order to facilitate the proper treatment of the biomedical waste generated from smaller nursing homes /clinics / blood banks/diagnostic

laboratories etc., the Government is taking initiatives to establish centralized waste treatment facilities. The Delhi Government has purchased land from Delhi Development Authority (DDA) for establishment of centralized biomedical waste treatment facilities at Okhla and Gazipur in Delhi. The Okhla plant has become operational on 11th November 2006. The Gazipur plant will be ready in 2009. At present there are two entrepreneurs in the market namely 'Synergy Waste Management Pvt Ltd. at Okhla, Delhi.' and 'Metro Bio-care Technological Services, 55, Railway Road, Samaipur Industrial Area, Delhi-42'.

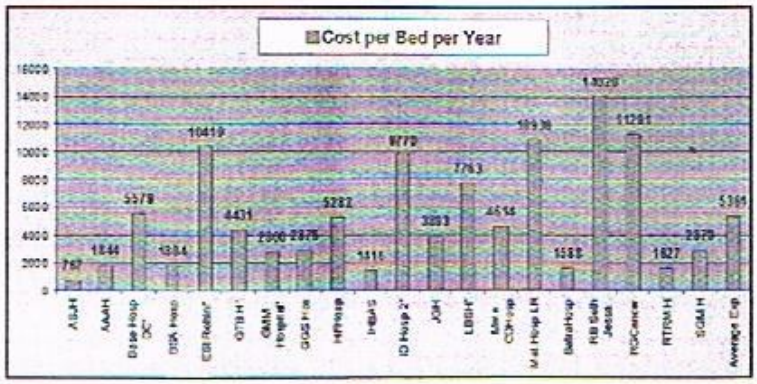

Fig. 2 : Hospitals

HAZARDS OF HEALTH CARE WASTE

In additions to the legal provisions to manage waste in safe and eco-friendly manner, there are compelling reasons to prevent the hazards of health care waste. Percutaneous needle stick injuries are very common in (27%) health care staff including 100% dentists, 81% surgeons, 32% non surgical physicians and 31% of nursing staff (1). The commonest hazards are as follows:

1. Infection: Organisms can enter in the body through a puncture, abrasion, or cut in the skin; through mucous membranes; by inhalation and ingestion.
   a. Commonest infections are gastro enteric through faeces and/or vomit (Salmonella, Shigella spp., Vibrio cholera, Helminthes; Hepatitis A),
   b. Respiratory infections through inhaled secretions; saliva (Mycobacterium tuberculosis; measles virus; streptococcus pneumonae),
   c. Ocular infections through eye secretions (Herpes virus),
   d. Genital infections (Neisseria gonnorrhoeae; herpes virus),
   e. Skin infection through pus (Streptococcus spp.),
   f. Meningitis through cerebrospinal fluid (Neisseria meningitides),
   g. AIDS through blood and sexual secretions (HIV),
   h. Haemorrhagic fevers through body fluids (Junin, Lassa, Ebola and Marburg viruses),
   i. Septicaemia and bacteraemia through blood (staphylococcus aureus, Enterococcus, enterobacter, klebsiella and streptococcus) and
   j. Viral Hepatitis B & C through blood and body fluids (hepatitis B & C viruses).
2. **Genotoxicity and Cytotoxicity**: Many cytotoxic drugs are extremely irritant and have harmful local effects after direct contact with skin and eyes (alkylating agents; intercalating agents; vinca alkaloids and derivatives and epipodophyllotoxins). Many neoplastic drugs are carcinogenic and mutagenic; secondary neoplasia is known to be associated with chemotherapy.
3. Chemical toxicity: toxic, genotoxic, corrosive, flammable, reactive, explosive and shock-sensitive. They may cause intoxication by acute or chronic exposure, injuries including burns, poisoning.
4. **Radioactivity hazards**: The radioactive waste exposure may cause headache, dizziness, vomiting, genotoxicity and tissue damage.
5. **Physical injuries**: May result from sharps, chemicals and explosive agents.
6. **Public sensitivity**: The general public is very sensitive about visual impact of the anatomical waste, recognizable body parts including foetuses if handled improperly (12)

SOUND WASTE MANAGEMENT PRACTICES

SEGREGATED COLLECTION

Segregation need to be done at source in colour coded containers (red, yellow, blue / white translucent & black). There should be puncture proof containers for sharps. The bags once 3/4th filled should be tied. The label should be put for name of ward, date of packaging, destination (treatment site) bio hazard / cytotoxic symbol. There should be weighing & recording in separate register with separate weighing machine. The daily recording should be supervised

STORAGE

As per biomedical waste (management & handling) rules 1998, there should be no storage beyond 48 hours, and if unavoidable, information should be sent to prescribed authority and adequate measures taken so that there are no hazards to human health & environment. Storage site should be washable, rodent, animal, rag picker proof and at height of at least one foot from ground, clean smooth stone walls and flooring with proper lock & gate with guard on duty.

TRANSPORTATION

Inside hospitals, we can use wheel barrow/ trolley. It should be covered, washable with rounded corners. It should be separate for general & bio-medical waste, preferably colour coded, spillage proof. There should be separate cleaning facility for daily disinfection. For transportation outside the hospital there should be special vehicle authorized by DPCC/ SPCB/ prescribed authority. Vehicle should have separate compartments for driver & waste. It should be pollution free, small or medium size with easy maneuverability, aesthetically good and preferably air conditioned. The diagnostic specimens must be packed in a triple packaging consisting of primary receptacle, a secondary packaging and an outer packaging. The completed package must be capable of passing the drop testing 178.603 of the drop height of at least 1.2 meters or 3.9 feet (9).

temperature in primary chamber 800 ± 500 C and secondary chamber 1050 ± 500 C. Waste treated

Category	Waste type	Treatment /disposal
Cat. I	Human anatomical waste	Incineration @ deep burial*
Cat. 2	Animal waste	Incineration @ deep burial*
Cat. 3	Microbiology & biotechnology waste:	Local autoclaving/ micro waving/incineration @
Cat.4	Waste sharps	Disinfection by chemical treatment @@@ / autoclaving / microwaving and mutilation/ shredding # #
Cat. 5	Discarded medicines and cytotoxic drugs:	Incineration @/destruction & drugs disposal in secured landfills
Cat. 6	Soiled waste :	Incineration @ autoclaving/ micro waving
Cat. 7	Solid waste (disposables):	Disinfection by chemical treatment @@ /autoclaving/ microwaving and mutilation/ shredding # #
Cat 8	Liquid waste	Disinfection by chemical treatment @@ and discharge into drains
Cat. 9	Incinerator ash	Disposal in municipal landfill
Cat.10	Chemical waste	Chemical treatment @@ & discharge into drains for liquids and secured landfill for solids

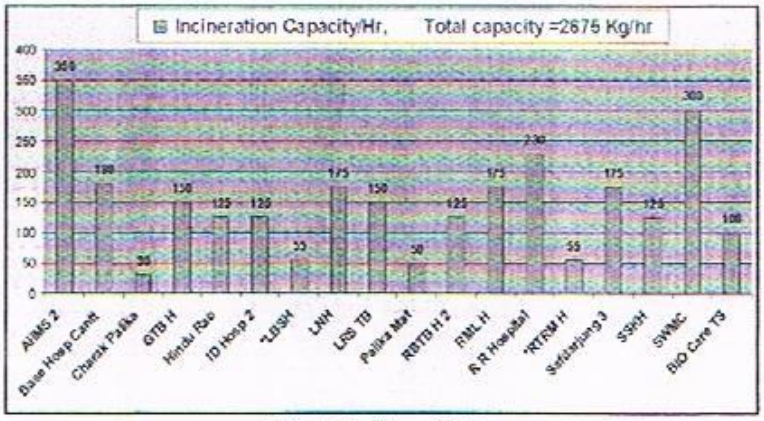

Fig. 3 : Hospitals

TREATMENT & DISPOSAL

There are ten categories mentioned under the rules. The biomedical waste management and handling rules 1998 (11) have suggested the following treatment and disposal:

INCINERATOR

The quality of incinerator depends on the capacity, make and its type. Today only double chambered incinerators are allowed with

with chlorinated disinfectants/ chlorinated plastics should not be incinerated. The fuel used is low sulphur Diesel/ LDO. The Stack Height should be more than 30 meters. The incinerator should be fitted with scrubber / pollution control device. Ashes need to be disposed of properly in the secured land fill. Aesthetics of Treatment Facilities should always be highest.

INCINERATORS CAPACITY IN DELHI:

The Government hospitals and major private hospitals have their own arrangement for treatment of biomedical waste. At present there are 18 incinerators, 18 autoclaves and 3 microwaves in operation in Delhi. Delhi has total incinerator capacity of 2675 kg per hour (figure3) Delhi has total incinerator capacity of 2675 kg per hour (figure3) which is more than sufficient if proper segregation is done at source of generation of biomedical waste(4).

AUTOCLAVE

There are two kinds of autoclave available in the market: gravity flow and vacuum flow. This works on the wet heat sterilization mechanism. Gravity flow Autoclave works on following parameters:

a) Temp. >121degree C; Pressure 15 psi; Residual Time >60 minutes. (OR)

b) Temp. >135 degree C; Pressure 31 psi; Residual Time >45 minutes (OR)

c) Temp. >149 degree C; Pressure 52 psi; Residual Time >30 minutes

Vacuum Autoclave works on following parameters:

a) Temp. >121 degree C; Pressure 15 psi; Residual Time >45 minutes (OR)

b) Temp. >135 degree C; Pressure 31 psi; Residual Time >30 minutes (6).

Sterilization monitoring and validation test are done to verify the efficacy of the autoclave. Wet heat sterilization is considered to be cost effective and pollution free treatment technology for infectious waste.

MICROWAVE

It cannot to be used for cytotoxic, hazardous or radioactive wastes, contaminated animal carcasses, body parts & large metal items. Use of metal detectors and scintillators is required for microwaves. Efficacy test / routine test are similar to autoclave. Performance Guarantee by supplier before operation is essential as it may go out of order more frequently.

MUTILATION

The waste should be disposed of after proper mutilation to make it unrecognizable. The shredder should be covered, spillage & sound proof and ergonomically designed. There should be no illegal recycling / reuse of waste. For sharps and needles in side the wards there should be needle destroyer. We need to ensure its availability, working conditions, usage, electric supply, proper connections, ergonomics, adequate quantity purchased, issued and service points and continuous maintenance & repair. The shredders in Delhi government hospitals lack conveyer belts.

ERGONOMICS OR HUMAN ENGINEERING

It refers to the design of machines, machine systems, work methods, and environments to take into account the safety, comfort, and productiveness of human users and operators. It is mutual adjustment of man and machine, seeking to ensure that the tools and machines man uses and the work he performs are in accordance with his physical characteristics. The equipment need to be ergonomically designed and aesthetically used.

EFFLUENT TREATMENT PLANT (ETP)

Effluent Treatment Plant is required to maintain the Standards of Liquid waste. The quantum of liquid waste generated in Europe is 1000liters per patient per day (3-5 times more than standard citizen) *(8)* whereas quantum of liquid waste generated in Delhi is 1470 liters per bed per day *(3)*. The effluent generated from the hospital should confirm to the following limits (11):

Parameters	Permissible Limits
PH	6.5-.9.0
Suspended Solids	100 mg/1
Oil and Grease	10 mg/1
BOD	30 mg/1
COD	250 mg/1
Bio-assay test	90% survival of fish after 96 hours in 100% effluent

CENTRALISED BIOMEDICAL WASTE TREATMENT FACILITIES (CBWTF)

Total number of CBWTF operating in the country is about 143. The average no. of health care facilities per CBWTF are 508 and average No. of beds catered by CBWTF are 6606. There are three largest operators of CBWTF in the country:

Maharashtra: M/s. E.A. Infrastructure Operation Pvt. Ltd., Mumbai,

Punjab: M/s. SembRamky Environmental Management Pvt. Ltd. Ludhiana,

Delhi: Synergy Waste Management Pvt. Ltd, Delhi

The directorate of health services has recently proposed to amend the Delhi Nursing Homes Registration Rules to incorporate such clauses by which it becomes mandatory for nursing homes to implement the Biomedical Waste (Management & Handling) Rules 1998.

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ISHWM - INTERNATIONAL CONFERENCE ON HEALTH CARE WASTE MANAGEMENT - 2010

With the objective of promoting and strengthening information exchange between countries, the decennial conference of Indian Society of Hospital Waste Management (ISHWM) is being designed as an International conference on Health Care Waste Management at New Delhi in October 2010. The event will have distinguished participants from across the South East Asia Region and other parts of the world and will focus on all facets of health care waste management – legislations, system development, training and capacity building, worker safety, patient safety, hospital acquired infection, alternative technological options and best practices. Coupled with Continuing Medical Education workshops as pre-conference events, exhibitions on alternative technologies it will be a resourceful event.

Suggestions, collaborations, sponsorships, participation in the exhibition, participation in the conference, CME, exhibition is most welcome. Please visit website **medwasteind.org** for details.

Healthcare Establishment Waste Management and Education Programme_(HEWMEP) and its role in fulfilling the mandate of Common Healthcare waste Appropriate Management Plant (CHAMP)

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INTRODUCTION

Many of the communicable diseases are spread through the environment, through particulate matter or aerosols in the air, through water and food. They are also transmitted through untreated waste – biomedical and others, which often act as carriers or vehicles for microorganisms and cause injury to the people handling these wastes thus creating a portal of entry for pathogens (Becker, 1989). The environment is also the reservoir for many unwanted chemicals which are genotoxins and these contribute to the decline of immunity amongst humans, animals and even damage the ecosystem's ability to control or stabilize pathogenic microorganisms (Bencko et al, 1993).

Typically, in low-income countries, the greatest burden of disease results from communicable diseases like respiratory illness, measles, malnutrition and complications of pregnancy and childbirth. The worst scenario is a partial transition wherein a large part of the society makes a transition and begins requiring costly hospital treatment for chronic illness. On the other hand, the very significant balance remains mired in an earlier (communicable) disease profile. India is currently in this phase of the Double burden of Disease (Hauri et al, 2000).

GROWTH OF HEALTHCARE INDUSTRY

Poor health status and demand for services has led to a phenomenal growth of private healthcare establishments in the country. Delhi has nearly 9000 establishments of which more than 50% are in the private sector. Ninety nine per cent of the healthcare establishments in Delhi are the smaller ones including nursing homes, dispensaries and clinics of private practitioners, laboratories etc., Although larger hospitals especially those providing secondary and tertiary care generate large amounts of infectious wastes, the scattered smaller establishments contribute to half of the infected biomedical wastes produced in Delhi and since many of them do not segregate their wastes or disinfect them before giving to common facility operators / service providers who often discard at least part of this waste into municipal bins, the entire municipal waste becomes infectious, thus increasing the total quantity of infectious waste which can contribute to the increased morbidity in the city (Verma, Mani et al, 2008) .

To address this demonic problem, an integrated waste management plan involving the coordinated working of several departments in a health-care establishment such as housekeeping, engineering, laundry, kitchen, security, yard supervisor besides nursing, medical, surgical, laboratory and administrative departments, needs to be put in place. Many health-care settings may have had incinerators for incinerating pathological waste and body parts earlier. These can no longer be used since most cities in India have banned their use except in common facilities located several kilometers away from the city. Other type of waste treatment facilities such as autoclaving followed by shredding which may not be there in many of the health-care establishments would need to be set up either in house or at the common facility. Model common facilities would have to be set up in each state and systems for collecting and storing separated waste would have to be set up for collection and transport to common facilities (HT, Rae, 2007).

HEALTHCARE ESTABLISHMENT WASTE MANAGEMENT AND EDUCATION PROGRAMME (HEWMEP)

The most important component of all is the education and training aspect of the integrated waste management plan which involves not only training of several medical, para-medical & non-medical employees of the establishments for source reduction, segregation, disinfection, transport, treatment and disposal, but also creation of awareness among public, public servants, professionals and the government for taking serious note of the consequences of improper management of hospital waste (Mani et al, 2000).

HEALTH-CARE ESTABLISHMENT WASTE MANAGEMENT AND EDUCATION PROGRAMME (HEWMEP) evolved by WaRM group, CEE addresses precisely this (Mani et al, 2000):

STEP 1 : WASTE REDUCTION

STEP 2 : SEGREGATION AT SOURCE

STEP 3 : SEPARATION OF GLASS SHARPS FROM METAL SHARPS

STEP 4 : DISINFECTION BY DIPPING IN 5-10% BLEACH OR SODIUM HYPOCHLORITE FOR 6-8 HOURS

STEP 5 : TRANSPORT AND ROUTING OF HOSPITAL WASTES FROM DIFFERENT ZONES AND WARDS TO THE PLACE OF TREATMENT

STEP 6 : AUTOCLAVING / MICROWAVING/ DRY HEAT TREATMENT OF WASTE & SHREDDING (for plastics, and metal sharps)

STEP 7 : INCINERATION/DEEP BURIAL (for pathological and anatomical waste)

STEP 8 : RADIOACTIVE WASTE

Must be stored in lead containers according to BARC regulations for ten half life period for radioactive decay of the wastes

STEP 9 : CYTOTOXIC WASTE Deep burial/ landfilling in hazardous waste site

STEP 10: GENERAL WASTE Composting of kitchen waste - Recycling for Office and packaging waste

Confidential paper to be shredded and then sent for recycling

STEP 11 : HAZARDOUS CHEMICAL PLASTICS

Should not be shredded. Separate collection for these should be organized for making into structurals such as girders for buildings, culverts, lamp posts and telephone poles etc. or for burying in hazardous waste lanfills

STEP 12: Training and education at all levels within the healthcare establishment/s & outside for achieving the above steps

Biomedical Waste (Management and Handling) Rules, 1998 often referred to as BMWM 1998 was promulgated in July 1998 and categorizes the various types of waste generated in healthcare establishments along with the methods that can be used to treat and dispose the waste. The subsequent amendments also suggest how larger and smaller hospitals can manage their waste and make use of common facilities for treating it (BMWM Rules, 2000). These rules and their implementation have brought about a degree of awareness and concern among those managing healthcare establishments. As an NGO and a part of the concerned public, CEE tried to assess whether the wastes actually being managed in the healthcare establishments led to reduction in infection levels and whether the knowledge, attitudes and practices of the healthcare staff had any relation with the changed infection status in a healthcare setting Mani et al 2001).

This was studied by evaluating the infection status using environmental monitoring methods (Tsai et al, 1998, Urbanowicz, 1998, Zimmers et al, 1999) in several healthcare establishments of different sizes in Delhi, Pune, Kannur, Gulbarga & Bhubaneswar and is being continuously checked in other places too. The knowledge, awareness/ attitudes and practices (KAP) of doctors, nurses and housekeeping staff of these establishments who are primarily concerned with waste generation and management were assessed using carefully designed KAP questionnaires. This was followed by a cross sectional study of biomedical wastes generated in all healthcare establishments, research institutions in Delhi and many other states throughout the country and the profile status of all these institutions towards

handling and management of wastes generated by them was assessed using interview schedules and observation tables. The infection status of all these healthcare establishments were also checked using standard environmental monitoring methods like settle plates, Anderson 2 stage and 3 stage samplers, microbial testing of location swabs, instruments, material prior to and after HEWMEP which were consolidated into an Environmental impact index score and correlated with the KAP as well as profile scores in all the locations. A practical and ongoing training schedule for the staff was evolved, conducted with several educational aids in different languages which had been developed for training and reinforcement of the healthcare workers showed that education and training do help to change infection status in and around HCEs leading to a better environment for healthcare workers, patients, their attendants (Mani et al, 2002).

The KAP and profile tests repeated and scored after training, showed that the adoption of best practices at the HCEs due to education and training, directly impacted the infection status at the HCEs. Therefore we can now state that if a certain type of training programme to increase/ improve the awareness and best practices in the HCEs along with development of infrastructure e.g. development of common facilities and safe transport of waste to them is implemented at any place, spread of infection from bio-medical waste in the city can be curtailed. The greatest unseen benefit of this would go to the institutions and the government health departments since they would greatly improve the overall health status which would reduce the economical burden of medical care on the city's citizens (Mani et al, 2002).

Formation of professional associations like National, State, District Hospital Waste Management Associations, Infection Control Committees, special groups among the Municipal Solid Waste Associations, Municipalities, Corporations, other relevant bodies for carrying out advocacy through various national & international conferences on various issues of Hospital Waste Management & developing plans through them for awareness among public, establishing model waste management in hospitals, common facilities, monitoring & evaluation, helps greatly in taking the movement forward & achieving tangible results like increasing compliance to the Rules and improving the disease burden status of a city or a particular location (HCWM, 2004).

Since Hospital Waste Management involves not only the medical fraternity but also several other professional groups, NGOs and most of all the general community, without whose conscious effort, not only hospitals & clinics but even homes, (where a lot of treatment occurs these days), cannot stop the spread of infection from the monstrous hospital waste. Their awareness & education through the media and other means like door-to-door motivation is all important. College students, youth, women's groups & service clubs play a vital role in spreading awareness about this all important topic and can do so along with the AIDS awareness programmes. School children too need to be conscientisized towards this immense problem from a young age to adopt practices, which along with acquiring personal hygiene and good habits helps them develop responsible behaviour for their well being and those of the others (Ibid).

To demonstrate this important aspect of implementation of BMWM, wherein training combined with good facilities are used to achieve tangible and sustainable results, CEE, with the support of the Indo-Norwegian Environment Programme (INEP) in Gulbarga, Karnataka, established a Common Healthcare waste Appropriate Management Plant (CHAMP) at Gulbarga to collect and treat the waste segregated by the HCEs in the city and nearby taluks and districts which helps to greatly reduce waste burden in the districts (Liberti et al, 1996 & Klangsin, 1998).

METHODOLOGY

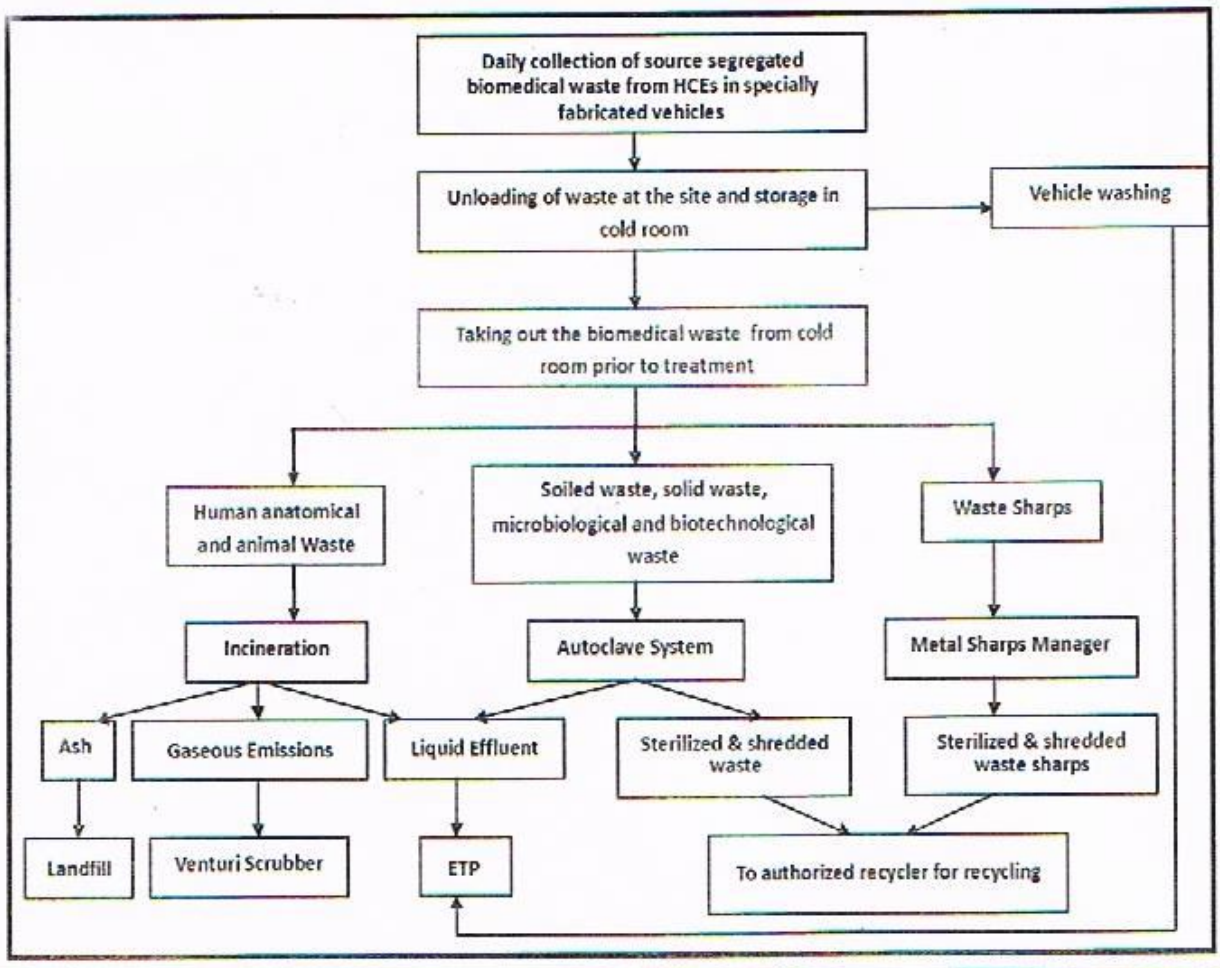
HEWMEP Gulbarga

Education for proper waste management and transportation of Bio-medical waste from the HCEs to CHAMP began in 1999, when CEE first conducted a baseline survey on the existing situation in the healthcare establishments, teaching, research institutions, laboratories and blood banks in Gulbarga city and found the awareness levels to be appallingly low. Consequently, compliance to the Rules was equally low and the adverse impact on the environment was very high. Therefore, HEWMEP Gulbarga was started where systematic and methodical

training of all personnel in the above institutions was started and is continued till date. The training of HCE personnel has been done at different levels. This includes doctors, nurses, administrators, paramedical personnel, housekeeping staff, engineering, kitchen and laundry personnel, *ayahs* (women who work as helpers in cleaning), ward boys, security staff, gardeners, rag pickers, sorters and all those involved in BMWM.

Different types of educational material were prepared and published for the training, which was approved by the Central Pollution Control Board (CPCB) & MoEF, Govt of India and WHO India. The materials were developed in Hindi, English and Kannada. The material developed for the HEWMEP includes –

- Integrated Healthcare waste Management Plan (*in the form of Master Poster*)
- 10- poster set-, which is meant for use in HCEs to promote better practices for the BMWM.
- Sticker set as per the colour codes prescribed; these are to be placed on different colour coded bins and bags. The sticker set has illustrative as well as textual information about the kinds of the waste that need to go into a particular colour coded bag/bin pertaining to a particular category as described in the BMWM Rules.
- **Booklet on HWM** – This booklet helps to understand the need for source segregation and waste management practices. It is a compact and user friendly booklet with illustrations and charts and acts as ready reference for all healthcare workers and paramedical staff.
- **Frequently Asked Questions Booklet** – This is a pamphlet on frequently asked questions related to segregation and management of biomedical waste, occupational health hazards, need for compliance to the rules and consequences of non-compliance.



- "No Sharps, No Cry!" pamphlet – This is a pamphlet on how sharps injuries can be responsible for transmitting blood borne diseases in hospitals and other institutions. This pamphlet also speaks of the dangers of contracting Hepatitis B, C and E from contaminated sharps since the same routes also transmit these viruses as well as HIV.
- Audio and video spots on HWM

Periodical training programmes at the HCEs, CHAMP and in the general community followed by KAP and Profile surveys of Healthcare workers were conducted to gather information on status of BMWM at the HCEs and at CHAMP.

Advocacy on importance of acquiring necessary equipment like bins, bags, disinfectants, mutilating/cutting equipment, personal protection gear at the HCEs, CHAMP, maintaining a proper system of storage of the collected waste in separate colour codes at the HCEs in designated and well-designed storage rooms, facilitating transporting the waste in a safe manner in designated well-designed vehicles to the CTF CHAMP, ensuring proper treatment and final disposal of the waste collected from the HCEs in different equipment meant for waste in different colour codes, were all carried out to support the training of healthcare workers at the HCEs and the CHAMP CTF.

Besides KAP and Profile scores, type and number of HCEs using the CHAMP CTF, status and quantity of waste treated at CHAMP were also used to measure the efficiency of the system and the effectiveness of the HEWMEP at Gulbarga.

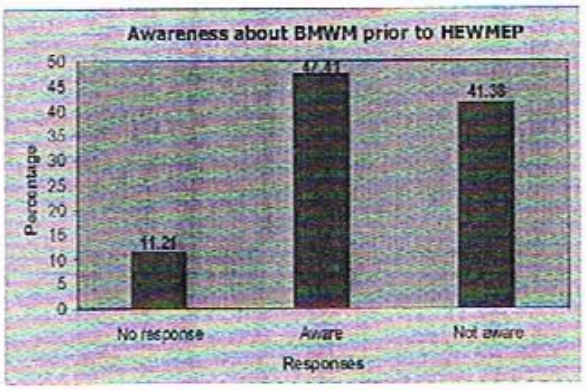
The CHAMP facility of Gulbarga became operational in May 2005. Even in the lead-up to the inauguration, positive response was seen. The comparative analysis of the situation in terms of biomedical waste management prior to the project implementation and the recent post project implementation scenario brought out several interesting facts, some of them are summarized below:

Table 1

Sl. No	Parameter	Pre project implementation scenario	Post project implementation scenario
1	Awareness of BMWM Concepts	47.41 % of HCEs stated that they were aware	77.59% of HCEs stated that they were aware
2	Following BMWM Rules	33.62 % of HCEs stated that they were following the Rules.	86.21% of HCEs responded stated that they were following the Rules.
3	Segregation of waste	24.14% of HCEs stated that they were segregating waste	81.03% of HCEs responded stated that they were segregating waste
4	Biomedical waste treatment	No proper system in place. Waste was thrown in municipal bins with or without treatment.	100% of the bedded HCEs and 78.45% of all the categories of HCEs in Gulbarga city are handing their waste to the CHAMP CBWTF
5	Biomedical waste generation	—	71.95% of HCEs responded confirmed that there has been reduction in the quantity of Bio-medical waste generated because of segregation of waste, the training for which was imparted by CEE.
6	Level of segregation	—	About 6.03% of HCEs surveyed segregated only one type of biomedical waste from the total waste produced.About 57.76% of HCEs surveyed segregated biomedical waste into two to four typesAbout 13.79% of HCEs surveyed segregated biomedical waste into more than four types waste.
7	Treatment & Disposal of bio-medical generated	No proper system for Bio-medical waste treatment and disposal. About 91.13% of HCEs confirmed disposal in municipal stream and about 8.51% confirmed selling untreated waste to recyclers.	About 78.45% of HCEs who responded confirmed using CHAMP.
8	Improvement in working standards of HCE workers		About 73.27% of HCEs also confirmed that their working conditions had improved through CEE's training programmes since the stakeholders are now aware of the hazards involved in improper BMWM.

DISCUSSION

The essence of HEWMEP is sound education/ training to influence practice at all levels of the BMWM chain, putting in place a system / protocol that enables good practices by all involved in the chain, and a disinfection / sterilization and recovery-based system at the facility, moving away from the currently prevalent mixed waste incineration-based facilities (Fig 1) that are the norm in India and which are known to cause health and environment problems the world over (GAIA, 2000). The development of training and practice methodologies has involved research, experimentation, innovation and perfecting. While education and training especially HEWMEP has been shown improvement in waste management (Table 1, Fig. 2, 3, 4, 5), increase in number of HCEs participating and the quantity of waste being treated (Fig 6), a well-operated CTF facility like CHAMP which treats the segregated waste (Fig 7 &8) further improves the status of waste management in the HCEs and in the city thus leading to improvement in overall waste management and infection control status in the city and compliance to BMWM Rules 1998



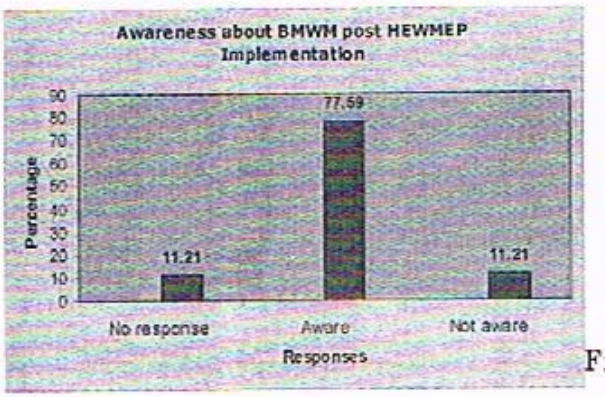
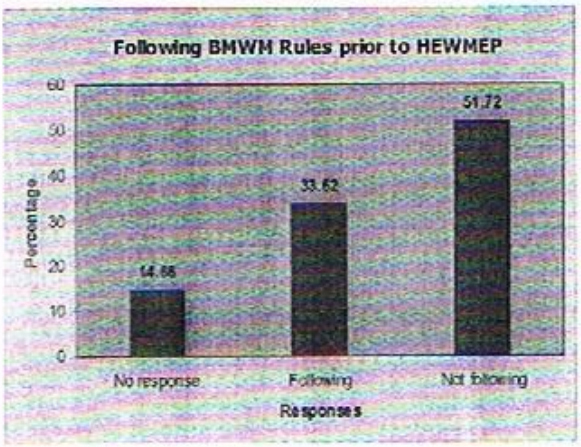


Fig.2



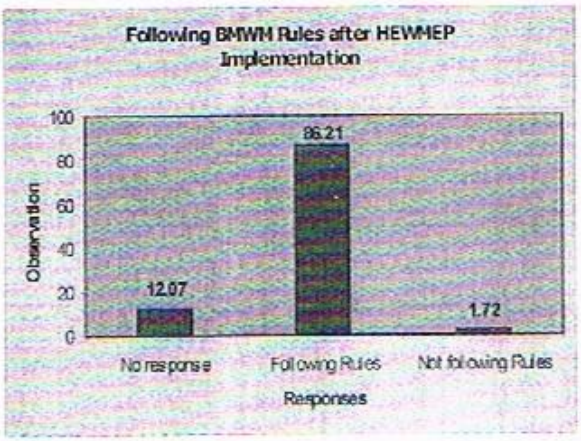
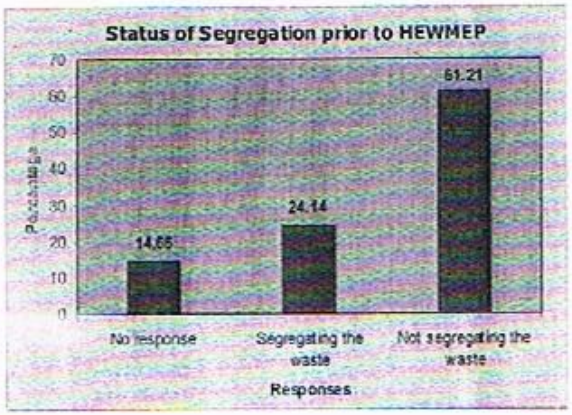


Fig.3



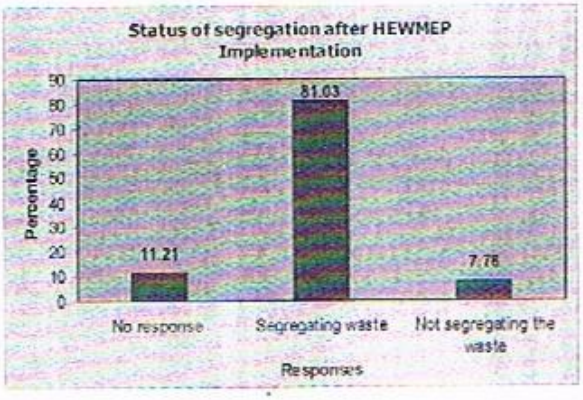
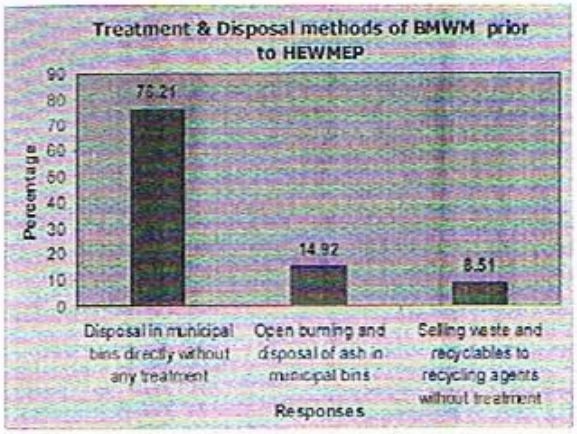


Fig.4



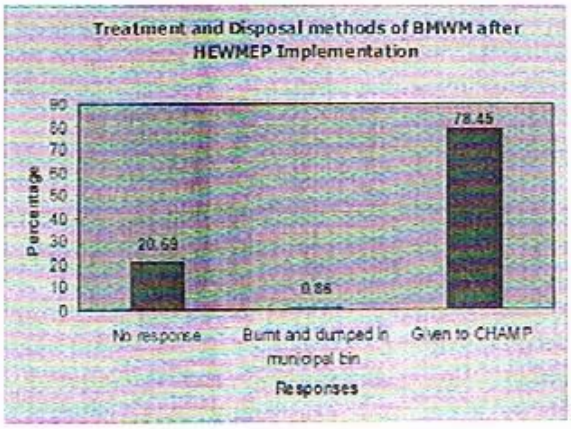
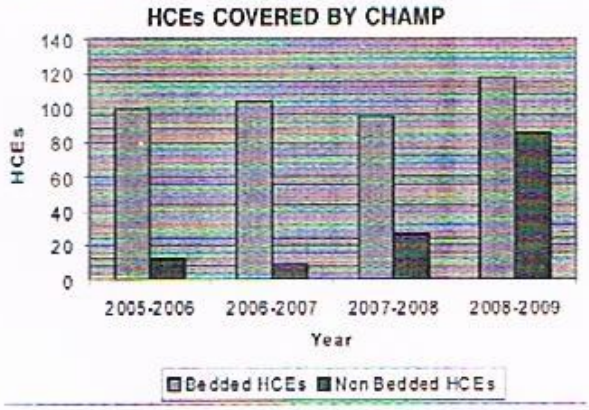


Fig.5



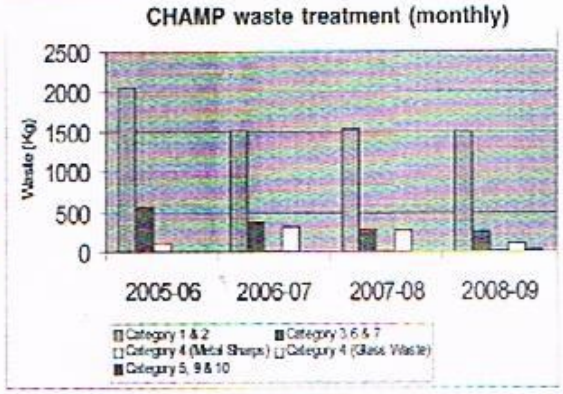


Fig.6

Fig. 7 : Ash produced after incineration of the biomedical waste (L) stored in black liners prior to disposal in landfill (R)

Fig 8 : Sterilized and shredded plastic waste (L) and Metal sharps waste (R) to be handed over to authorized recycler.

(Halbwachs, 1994). Projects like CHAMP as examples of self-sustainable and ecofriendly waste management units are essential for furthering the state of the art technology in India especially in the field of biomedical waste management (WHO, 1999).

However, CHAMP's potential as a benchmark in technology and for enhancing training at the HCEs and in the city needs to be established. There are knowledge gains relevant for regulation (including engineering regulation by CPCB), enforcement, setting of standards, practice etc that are yet to be realized. Training of Healthcare workers using pedagogic material consisting of print, audio-visual and website material for wider dissemination has to be continuous for achieving consistency and sustainability (Fay et al, 1990).

CONCLUSION

HEWMEP, using a variety of educational material and training methodologies enhances compliance when combined with good facilities at the HCEs and in the city. A well-designed and properly functioning CTF like CHAMP helps to strengthen education and training of healthcare workers as a result of which compliance to Rules and proper waste management are achieved.

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Health Care Waste Management in Srilanka: few issues of capacity building, training

Collaborative effort of HCWM Cell, MS Ramaiah Medical College, India, Eforum, Srilanka, WASTE – Netherlands, CWG

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ABSTRACT

Health care waste management and Infection control are neglected areas. They become doubly important in disaster situations and more so in tsunami and floods. An attempt was made by Health Care waste Management (HCWM Cell) of the Department of community medicine of MS Ramaiah Medical College, Bangalore, India with the support of Eforum, Srilanka, WASTE – Netherlands and CWG to support mitigate the effects of tsunami in the area of health care waste management.

The effort started in October 2006 with situational analysis and followed up with training and capacity building of three hospitals, interaction with different stake holders in NGO, Private and Government sector institutions and a leading Medical University. A cell has been focusing on HCWM issues in the community medicine faculty of Colombo University – a very important outcome of the collaborative effort.

Training of nurses and support staff provided in three Hospitals: A, B and C during Dec 2006 and April 2007 have motivated the staff and management to strengthen HCWM work. The three hospitals are located in coastal areas of Srilanka which were affected by tsunami in a very large way.

Effort was directed towards training and capacity building of nurses and support staff that will strengthen HCWM systems in the three hospitals. Also, effort was directed towards impacting on the external environment for large scale impact at country level.

Improvements noticed in the areas of:

- Improved segregation practices, use of colour code, spill management, use of personal protective equipment, transportation, waste within health care settings, maintenance of waste management register and injury register.
- Focused attempts towards sensitization of staff of Hospital C has continued and sustained the interest and follow-up effects of training.
- Introducing the concept, ideas to consider establishment of common treatment facilities as an option for final disposal of HCW.

It is anticipated that HCWM Cell established in Colombo University will work towards sustainability of the endeavour with the support of different stake holders. Entire effort involved addressing the issue in a low resource setting in a developing country. Lessons learnt will be very useful internationally for strengthening HCWM systems in developing countries.

Health care waste management and Infection control are neglected areas. They become doubly important in disaster situations and more so in tsunami and floods. An attempt was made by Health Care waste Management (HCWM Cell) of the Department of community medicine of M. S. Ramaiah Medical College, Bangalore, India with the support of Eforum, Srilanka, WASTE – Netherlands and CWG to support mitigate the effects of tsunami in the area of health care waste management.

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Methodologies and approaches followed, what worked, what did not work and lessons learnt.

1. Methodologies attempted:

Lectures with power point (presentation) followed by discussion

Tracings conducted by HCWM Cell have few 20 minute lectures cum discussion sessions. Every effort was made to make it interesting. Toics for these were Situation analysis of HCWM in the respective country/ hospital/health centre, Biomedical waste management in the country, WHO Policies on HCWM, Mercury and worker safety , Universal precautions for prevention of HIV/AIDS, Liquid spill management.

Informal interactions and discussions, negotiating interactions

Informal discussions throughout the training sessions use to help build rapport, create open ambience for inquiry, chose technological options in low resource settings and helped create belief and confidence that HCWM can be done by local resources and technology with focus on attitudinal change.

Field visit to select locations in hospital, observation, Interaction with nurse, waste handlers, management. SWOT analysis (use of long questionnaire and short questionnaire for waste survey)

Steps used in this included: discussion of prepared checklist/ survey form and providing clarifications (1 hour), 4 to 5 participants going for 4 to 6 locations in a group (laboratory, Operation theatre, laundry, general ward, special ward, casualty, etc; make observations, interact with staff in charge of locations (2 hours), come back together, pool the observations, prepare report (1 hour), present in the plenary (2 hours) t, discuss. This will be followed by discussion in the groups to develop an action plan and a schedule activity (2 hours). Last session of training will be presentation of these before hospital management for endorsement and total acceptance (1 hour).

In our experience, this is the best part where participants use to spend full two days from the morning of Day II of training. On many occasions we put up series of posters focused on options for management of HCWM, make participants before going in for Action plan development.

Group discussion; use of posters on HCWM for group discussion

Group discussion will be the main modus operandi and in this process we overcame language barriers too.

Field visit to select locations Eg. Model practice/best practice situations, centralized treatment facilities

One of the highlights used to be making field visits to both poor practice and best practice locations and central waste management facilities. We plan these for 3 day and especially 10 day training endeavors. The were very much liked by the participants. Usual sites will be Large Government Hospital, Large Private Hospital, Primary Health Centre, District Hospital, Dental clinic, Family practitioners clinic, Blood bank, Laboratory, etc.

Use of playing cards for discussing segregation of waste

This was one methodology introduced by HCWMCell. Bins will be labeled as Red, Blue, white, yellow, black, etc according to color codes stipulated by the legislations of the country and type of waste like : paper:, :plastic:, sharp, bandage will be written on the 52 playing cards/ cards made of card board.

Trainer will keep the bins, cards ready and take out cards and request the trainees to suggest where to put (which color bin). After few minutes, trainees take over the entire exercise. The exercise has lot of utility for understanding color code for segregation and keeps trainees active.

Action plan development, presentation, discussion

All our three day training endeavors will conclude with development an action plan and a schedule activity (2 hours). Last session of training will be presentation of these before hospital management for endorsement and total acceptance (1 hour).

Follow-up of action plan in some situations

This was the tough part. We did through follow-up visits, email, and activity by nodal person in each institution and we were successful in many occasions. Changes and acceptance were overwhelming in some, too.

Contribution to distance learning programmes on HCWM

Indira Gandhi National Open University (IGNOU) offers courses in Distance education on HCWM. Our centre is also a Programme study centre of IGNOU. Six month certificate course a week of contact direct learning, doing a project in the location where the participant is working, oral and theory examinations. This has been accepted in the neighboring countries too.

1.1 What worked most?

Field visits, SWOT analysis

Informal interactions and discussions

Action plan development

1.2 What did not work much?

Only lecture followed by discussions worked least

2. Lessons learnt from Srilanka:

Attitude is the critical issue when it comes to HCWM, an important element of solid waste management. Among the the three hospitals: Hospital A and Hospital B, there already existed a fair system of HCWM and training and capacity building inputs helped strengthen the HCWM system.

In the hospital C, training was provided once followed by follow-up visits twice at an interval of four months and change was negligible. Here, rather than training efforts, attitude of management mattered. After one year of third visit when the management structure changed, practices with respect to HCWM also changed.

We did not know Sinhalese, local language. English was the mode of training. What we did was, we spent more time on Informal interactions and discussions, Field visit to select locations in hospital, observation, Interaction with nurse, waste handlers, management , SWOT analysis, Group discussion, Action plan development, presentation, discussion. Follow-up of action plan in some situations. These worked well.

When we made follow-up visits to Hospitals A and B – each time we found some improvement and these included:

- Attempts by Trained staff to train other staff
- Introduction of Needle stick Injury register, Waste management register.
- Better practice of liquid spill management
- Better practices of segregation of waste

- Efforts towards adopting centralized treatment facilities
- Increased motivation of staff towards better HCWM
- Able to motivate University of Colombo to establish a HCWM Cell for sustaining efforts made towards capacity building in HCWM in Srilanka

In our battle towards reducing burden of disease from ill managed HCW, we need to envisage awareness creation, capacity building, action for change and improved settings.

- Awareness creation within and outside the health sector, we are having increasingly so, we are becoming quite smart in describing the problems and the causes thereof.
- Training sessions are being carried out, here also with GO and NGO partners, as one of the first measures to tackle the roots causes, one being poor education
- Helping out with regulatory tools, national plans of action, etc.. Is also doing quite well. Behavioral change is of course very slow and we are not seeing much of that yet.
- Proper HCW systems in place and functioning are even rarer, to date. Also because we do not monitor implementation of agreed action.

Current challenges are therefore:

1. Awareness creation: the general public is not being addressed much. Need for campaigns, linkages with Patient safety concept. Pressure form the public can do miracles.
2. Training: capacity building is not been done for waste handlers who are and continue to be most at risk. We need to develop better training materials and supports that allow them to get involved. Also we need to work much more with nurses and nurses associations as they also are at the front of the risk.
3. Regulation is one thing, reality a complete other one. There is need to translate regulation texts in such manners that the general public relate to them. Comics, for instance is one promising way, but also school based material, audio visuals, etc... more imagination is needed to effectively make a difference.
4. Success stories need to be depicted more accurately to explicitly find out WHAT made things change: people, infrastructure, resources, one time opportunities...etc, to assess potential for duplication.
5. Monitoring of our various efforts such as training workshops, dissemination of materials, assessments, etc is not done. We have to become much more serious about follow up, learning form past experiences and capitalizing them into new initiatives , if not our work will be short lived and die off.

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7. Personal communication with: Mr.Alexander Hildebrand, Regional Advisor - Environmental Health, WHO – SEARO.

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Indian Society of Hospital Waste Management

Indira Gandhi National Open Univ., New Delhi

MS Ramaiah Medical College and Group of Hospitals

HCWM Cell, MSRMC, Bangalore

ANNEXURE

Summary of involvement of HCWM Cell in training and capacity building exercises in Health care waste management facilitated by HCWM Cell in developing countries:

HCWM Cell, Dept. of Community Medicine, MS Ramaiah Medical College had opportunities to work in the area of Health care waste management since 1995 December. Our main activities comprised research, training and capacity building, advocacy and system development. Here, we wish to focus on training and capacity building in the area of health care waste management. We involved ourselves in conduct of training for various categories of personnel in the area of HCWM. In brief, we can put this as follows:

Type of training and number conducted so far	No. of people trained per session	Methodologies adopted
1. One day training for nurses and doctors (50) India	15 to 25 per session	**Participatory training** : Presentation of situational analysis, conduct of waste survey and SWOT analysis in a field visit, analysis , discussion, tips for development of action plan.
2. Three day training for doctors, nurses, technicians, maintenance staff (Blood bank, Laboratory, CSSD, ICU, Labour ward, etc) (23 trainings have been held in India, 21 trainings held in Indonesia in disaster situation including one TOT & 3 in Srilanka Total : 50)	25 per session	**Participatory training** : Presentation of situational analysis, **select presentations on "spill management", 'universal precautions", "segregation of waste", "Biomedical waste legislation"** conduct of waste survey & SWOT analysis in a field visit, analysis , discussion, **development of action plan ; demonstration of segregation, demonstration of spill management, open house discussion**
3. 10 day International training on HCWM for developing countries (Maldives – 3 batches , Myanmar (2 batches 3 week WHO Fellowship training, Srilanka one batch)	12 to 15 per training : 6 batches	**Participatory training : Review of legislations and available technologies for HCWM** (a) Presentation of situational analysis, select **presentations on "spill management", "universal precautions", "segregation of waste", "Biomedical waste legislation"** conduct of waste survey and SWOT analysis in a field visit, analysis , discussion , (b) Field visits to: Two major hospitals – Government and Private Field visit to Primary Health centre, District Hospital Field visit to LaboratoryField visit to Dental clinicField visit to common treatment facility Field visit to effluent treatment plant (c) development of action plan: demonstration of segregation, demonstration of spill management, open house discussion
4. Training cum orientation for UG medical students and Interns	3 hours : about 100 students	Focus is on presentation of policy and procedures of HCWM, demonstration of segregation and question and answer session
5. One day training for sanitary inspectors	About 100 per batch 10 batches so far	Presentation of situational analysis, conduct of waste survey and SWOT analysis in a field visit, analysis, discussion, tips for development of action plan.

Training materials developed:

Materials developed on HCWM	Utility
1. Information and learning units on HCWM (Available in English, Kannada, Tamil, Hindi), translation to Sinhalese planned)	Training manual for doctors, nurses, hospital staff
2. Thirteen steps for better hcwm systems in Primary Health centres (draft)	Primary Health Centre staff
3. Long and short survey questionnaires for HCWM	Conduct of survey, SWOT analysis during field visits
4. Journal of Indian Society of Hospital waste management	Six issues available : for information dissemination on HCWM
5. Contributed to material development on HCWM developed by Indira Gandhi National Open University	Fostering distance learning in HCWM
6. Short customized guidelines on HCWM : 15 issues/equipment (under preparation)	Health personnel who are seeking information on different facets of HCWM.
7. Orientation on HCWM for policy makers / management of bigger health care institutions	Usually conducted as part of inauguration programme in a training endeavour with a report of recommendations, negotiations with them.

(Information shared at CWG workshop at Ouagadougou, Burkina Faso – December 2008)

HEALTH CARE WASTE MANAGEMENT THE WAY FORWARD

The management of health-care waste requires increased attention and diligence to avoid the substantial disease burden associated with poor practice, including exposure to infectious agents and toxic substances. Incinerators provide an interim solution especially for developing countries where options for waste disposal such as autoclave, shredder or microwave are limited.

Whatever the technology used, best practice must be promoted to ensure optimal operation of the system. To reduce exposure to toxic pollutants associated with the combustion process such as dioxins, furans, co-planar PCBs, nitrogen and sulphur oxides as well as particulate matter and to minimize occupational and public health risks, "best practices" for incineration must be promoted & must include the following elements:

1. Effective waste reduction and waste segregation, ensuring that only appropriate wastes are incinerated;
2. Siting incinerators away from populated areas or areas where food is grown, thus minimizing exposures and thereby risks;
3. A properly engineered design, ensuring that combustion conditions are appropriate, e.g., sufficient residence time and temperatures to minimize products of incomplete combustion;
4. Construction following detailed dimensional plans, thus avoiding flaws that can lead to incomplete destruction of waste, higher emissions, and premature failure of the incinerator;
5. Proper operation, critical to achieving the desired combustion conditions and emissions. In summary, operation must: utilize appropriate start-up and cool-down procedures; achieve (and maintain) a minimum temperature before waste is burned; use appropriate loading/charging rates (both fuel and waste) to maintain appropriate temperatures; ensure proper disposal of ash; and ensure use of protective equipment to safeguard workers;
6. Periodic maintenance to replace or repair defective components, including inspection, spare parts inventory, record keeping, and so forth;
7. Enhanced training and management, possibly promoted by certification and inspection programmes for operators, the availability of an operating and maintenance manual, management oversight, and maintenance programmes.

Management and operational problems with incinerators, including inadequate training of operators, waste segregation problems, and poor maintenance, are recognized as critical issues that should be addressed in assessment and waste management plans.

Source: WHO website www.who.int

A Study on Current Status of Hospital Waste Management Practices at Bangalore Medical College and Research Institute

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"Bio-medical waste" means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals and including categories mentioned in schedule I of Bio-Medical Waste Management and Handling) Rules, 1998 of India like human anatomical waste, micro biology and biotechnology wastes, waste sharps, discarded medicine and cytotoxic drugs, soiled waste, solid waste, liquid waste, incineration ash, chemical waste. Between 75-90% of the waste produced by the health-care providers is non-risk or "general" health-care waste. The remaining 10-25% is regarded as hazardous and may create a variety of health risks.[1]

The indiscriminate and unregulated dumping of hospital waste exposes the most underprivileged and informal sector like rag pickers and municipal corporation waste handlers to injury and infection.[2] Hospital waste also has direct impact on spreading of infectious diseases like tetanus, hepatitis and AIDS. Chitra et.al. have reported the prevalence of hepatitis infection in Bangalore Mahanagara Palike (BMP) waste handlers at 5%.

OBJECTIVE

To study the current practices of hospital waste management at attached hospitals of Bangalore Medical College and Research Institute, Bangalore.

STUDY DESIGN

Cross sectional study

MATERIALS

A pre tested observation check list.

METHODS

Five attached Hospitals were visited in coordination with superintendent / RMO and an observation checklist was used to observe the process of waste management in these locations.

A brief statistics about the hospitals is given below:

Table 1
Basic statistics of hospitals attached to BMCRI

Name of Hospital	Bed strength	Old OPD cases per day (Average)	New OPD cases per day (Average)	Admission per day (Average)
Victoria Hospital	961	400	800	55
Bowring & L.C. Hospital	686	500	700	60 to 70
Vani Vilas Hospital	536	8	282	53
Minto Hospital	300	30-35	230-250	23-25
S.D.S.	470	30-40	50-60	22-25
Total	2956	976	2055	219

Table 2
Policies and committees regarding Waste Management available in these hospitals

Parameter	Availability
Infection Control Committee	YES
Waste Management Committee	YES
Waste Management Policy	No written policy
Disinfection Policy	No written policy
Waste Sharps Management Policy	No written policy
Occupational Safety Policy	No written policy

Bangalore Medical college and research institute (BMCRI) is a tertiary care teaching institution with 5 attached hospitals. The above table presents the basic statistics of the hospital. As BMCRI is a Government institution most of the patients attending or receiving care at these hospitals are from the lower socio economic group.

All the five attached hospitals have Infection control and waste management committees. The superintendent, professor and head of microbiology, matron and few other key staff are members of these committees. None of the hospitals have a written policy on waste management, disinfection, sharps management and occupational safety. The bio medical waste generated is segregated transported to a storage site and than handed over to common treatment facility operator authorized by pollution control board. The frequency of collection by the CTF operator is on a daily basis.

A pretested questionnaire was used to asses the Knowledge, Attitude and practice of health care personnel from all the 5 attached hospitals. A group of 5 doctors, 5 nursing staff, and 2 waste handlers were selected using simple random sampling in each of the hospitals and interviewed. The above figures show cumulative results of the questions asked and have been rounded of to the nearest percentage. Though all health care personnel were having adequate knowledge regarding segregation, disinfection, color coding, containment and transportation, attitude and practice was lacking. Among the groups doctors were having more knowledge but less attitude and practice compared to other groups. Nurses and technicians were more positive towards following sound practices. Waste handlers though aware of segregation and transportation issues did not practice the guidelines to the fullest extent. Transportation was being done either manually or on a wheel chair, stretcher or barrow depending upon the nearest and easily available mode.

Table 3
Knowledge, attitude and practice with regards to biomedical waste management

Activity	Knowledge	Attitude	Practice
Segregation	75%	50%	50%
Disinfection	75%	60%	45%
Colour coding	75%	50%	50%
Containment	100%	72%	60%
Transportation	75%	50%	50%

Table 4
Usage of protective devices and vaccination status of Health care personnel

Manpower	Protective devices	Vaccination
Nurses	50%	75%
Technicians	50%	75%
Waste Handlers	50%	50%

It was seen that the usage of protective devices was only 50% among all the health care personnel. More number of nursing staff and technicians had been vaccinated when compared to waste handlers. The vaccinations received were Hepatitis B and tetanus toxoid. The institute is in process of formulating a waste management and occupational safety policy.

DISCUSSION

While carrying out a survey of the hospitals it was found that segregation needs improvement. The color coded bins with inner lining were available at all points of waste but were not being used properly. In majority of areas needle destroyer and syringe cutters were not functional. The disposal of laboratory waste is not done as per guidelines. Transportation facility to storage site needed to be improved. Storage sites need to be improved in some hospitals.

It was observed that most of the doctors though aware to a great extent regarding waste disposal did not follow protocols of waste management. House surgeons need to be oriented regarding waste disposal before starting internship. Blame for not managing waste properly was shifted down the hierarchy. It was thought waste management is the responsibility of Group D staff. Nursing staff have sufficient theoretical knowledge, but practice is limited.

SWOT ANALYSIS

Strengths

- Partially functioning system in place (including Final disposal options-CTF)
- Waste management committee has been constituted & is in place

- Necessary infrastructure for functional system is in Place
- Awareness at grass root level is more than satisfactory
- Few trained staff available in the institution
- A positive attitude only among few key functionaries
- An immunization policy about Hepatitis-B in place in few hospitals
- Post exposure prophylaxis in place

Weaknesses

Segregation is incomplete

Practice pertaining to safe and sound management of health care waste low for all health care staff

Monitoring of injuries inadequate

Effluent treatment plant not available at present

Practice of universal precautions

No protocol for mercury management

Opportunities

Need for superintendent in Health Care Waste Management Committee

Designated HOD's as members

Need for Hospital infection Control committee

Training course for faculty, nursing staff and technicians on HCWM from IGNOU/WHO

Injury register & Waste management register

Awareness creation for managing MERCURY

Need For Needle cutters/Burners

To establish Effluent treatment plant

Further enhancement of systems is feasible and possible

THREATS

- Cost of Final disposal is increasing as only two common facility operators are there in Bangalore and they hike charges every year
- Attitude problems
- Need for proactive Senior faculty so that they can lead by example
- Staff/Interns turnover

SUGGESTIONS

1. Waste management committee (WMC) shall be responsible for initiating, operating, regulating and monitoring waste management policy of this hospital
2. Standard Operating Procedures (SOP) to be developed for Waste management chain to be evolved
3. Infection control committee to be established and designated members of ICC will be on WMC, designated members of WMC will be on ICC
4. All steps will be taken by the occupier of the institution to ensure that Bio medical waste is managed in such a way so as not to have any impact on Human health and Environment
5. All functionaries of the institution shall be motivated and encouraged to comply with the provision of UNIVERSAL PRECAUTIONS
6. Incentives/Recognition for Best practices
7. Ongoing training and retraining for all, Deputation to HCWM course from IGNOU/WHO
8. Workers safety, Immunization Policy and annual Health Check up
9. Post Exposure Prophylaxis
10. Management of MERCURY
11. All New Staff, Postgraduates, Interns, Nursing students and paramedical students to be oriented about the policy and protocols in this area before they start working in this hospital.

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LESSONS FROM DEVELOPING COUNTRIES

Successful Story of Waste Management in a Tertiary Care Hospital : A Case Study from Sri Lanka

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ABSTRACT

Castle Street Hospital for Women, a 400 bedded pioneer women's hospital in Sri Lanka is the centre for National Quality Assurance Programme in the country. In year 2000, the hospital introduced the concept 'Quality Health Care through Productivity'- Japanese Management Concepts which also included waste management. The objective of this study was to describe the waste management system in the hospital. The important outcome of the system was Pleasant Environment, Improved Quality of Work Life (QWL), Income Generation, Improved Patient Care , decrease in infection rate, reduction in annual utilization of antibiotics, reduction in bed occupancy rate and average length of stay and this in turn resulted in high turnover of the beds. This case study emphasised that any quality programme in hospitals is not comprehensive without a proper waste management system and this is a model which many other hospitals may adopt.

INTRODUCTION

Healthcare waste (HCW) includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials. Poor management of HCW exposes healthcare workers, waste handlers and the community to infections, toxic effects and injuries. It has also been identified as one of the important aspects in infection control. [1].

Evolution of medical and health care services has led to increase in quantum and spectrum of health care. Hospital waste needs to be given serious attention and properly defined as an individual waste stream. [2]. However, it has been observed that Health care establishments in Srilanka have not paid adequate attention towards the sound management of healthcare waste.

Between 75% - 90% of the waste generated in healthcare facilities are 'non-risk' or 'general waste'. These wastes come from administrative and housekeeping functions of the care facility. The remaining 10-25% of health care waste is considered as Hazardous because of their infectious nature, and may create a variety of health hazards [3].

The key to minimization and effective management of infectious waste is segregation of waste at the point of generation. Appropriate handling, treatment and disposal of segregated waste reduce costs and help to protect public health.

In Sri Lanka, the Ministry of Healthcare and Nutrition issued a circular (General Circular No: 01 – 12 / 2006) on national colour code to be followed by all health care centres for the segregation of hospital waste (Annexure 1). It emphasized that all health care facilities should attempt to minimize the generation of infectious waste by segregating the waste according to the above Colour Code. Promoting recycling of paper, glass and plastic waste to occur after the wastes are decontaminated [3].

OBJECTIVE

- To conduct a case study of the waste

management system in a Tertiary Hospital in Srilanka post quality programme.

STUDY DESIGN

Case study

BACKGROUND HOSPITAL INFORMATION

Castle Street Hospital for Women is a 400 bedded pioneer women's hospital in Sri Lanka which serves as an academic training institute in Obstetrics and Gynaecology for undergraduate and postgraduate medical students and other allied health staff of University of Colombo at all levels.

There are five Obstetrics and Gynaecology units and there is a Neonatology Unit with intensive care facilities having 50 neonatal cots. Approximately, 18,500 deliveries occur in this hospital. The hospital is managed by a staff of 930 employees and is the focal centre for National Quality Assurance Programme in the country.

In year 2000, the hospital introduced the concept 'Quality Health Care through Productivity' – Japanese Management Concepts to accomplishment its objectives and improve patient care. These improvements paved the pathway for the hospital to win the various awards like Taiki Akimotto '5S' Award – 2001, National Productivity Awards – 2001, Sri Lanka National Quality Award – 2002 M and Productivity Gold Award – 2003.

SITUATION ANALYSIS BEFORE YEAR 2000

Before the year 2000, waste management process was not well established in the hospital. Segregation, decontamination, containment and disposal practices were grossly inadequate and this was coupled with unfavourable knowledge & attitude of the staff. There was indiscriminate dumping of the placenta which had led to animal menace.

IMPORTANT OUTCOMES

a. **Pleasant Environment:** has enhanced the aesthetic environs of the hospital and greatly reduced the noxious odours emanating from dumped health care waste. The fly, dogs and cats menace has reduced considerably.

b. **Improved Quality of Work Life (QWL):** The Quality of Work Life of the staff too improved by the change done by the management.

c. **Income Generation:** An average of 26 Kg of plastics was generated daily in the hospital because of better segregation practices and was sold for recyclers at Rs 39.0/ KG. This has led a considerable income being generated to the hospital.

d. **Improved Patient Care:** by improving the aesthetic conditions of hospitals, reduction of hospital infection rates. The following graphs indicate how infection rate was reduced in the recent past.

The reduction in the infection rate has reduced the annual utilization of antibiotics, reduction in bed occupancy rate and average length of stay. This in turn resulted in high turnover of the beds.

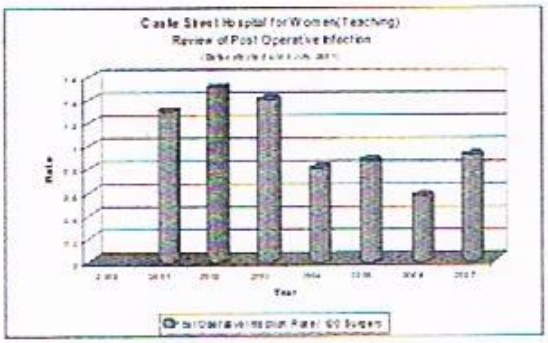

Fig. 1: Post Operative Infection Rate

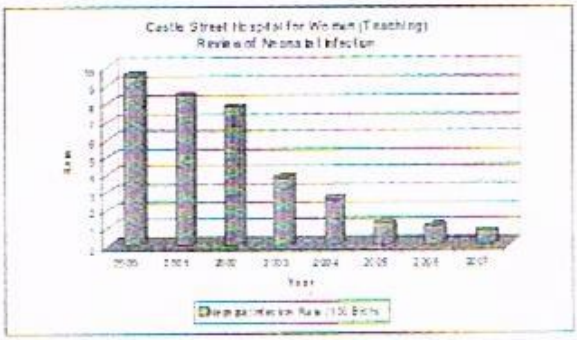

Fig. 2: Neonatal Infection Rate

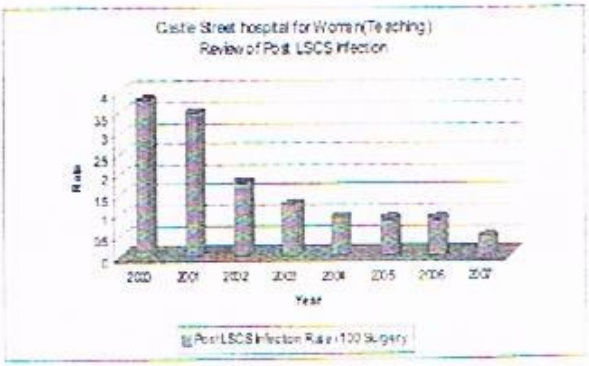

Fig. 3: Post LSCS Infection Rate

In the labour room a labelled yellow bin personalised to each patient was placed under each labour bed to receive the gauze swabs and towels used during the delivery. The yellow plastic bag in the yellow bin was kept for three hours in the labour room and was available for examination to the OBG specialists to look for the degree of blood loss in case of any complications to the mother post delivery. This system thus enhanced the quality of care

Figure 4 shows the arrangement of yellow bins in a labour room.

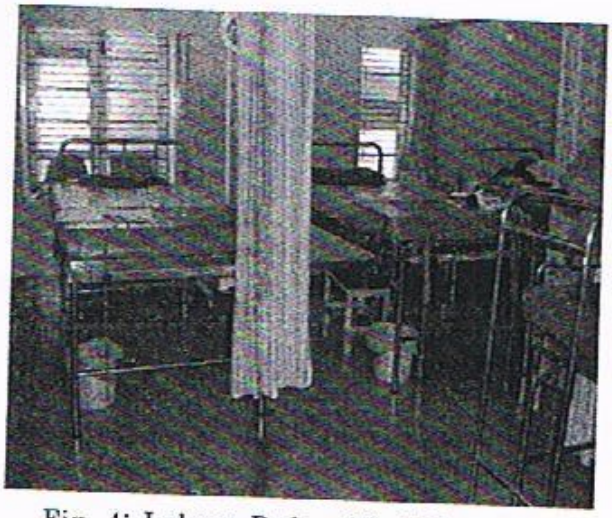

Fig. 4: Labour Beds with Yellow Bins

2. Present Challenges

The present challenge faced is the final disposal of waste. The following figure shows the recommended way of final disposal of waste.

CURRENT DISPOSAL PRACTICES

1. Infected waste, general waste and discarded food are sent to the municipality. Permission for an onsite Incinerator was denied by the environmental authorities citing that the residence nearby the hospital may suffer due to the pollution created from the incineration process.
2. Sharps are burnt under the supervision of a Nursing Officer in charge of Infection control unit and dumped.
3. Plastics, papers and metals are sold. Bottles such as Ampicillin, Hydrocortizone, Zinacef etc., vials are reused to collect blood for investigation purpose.

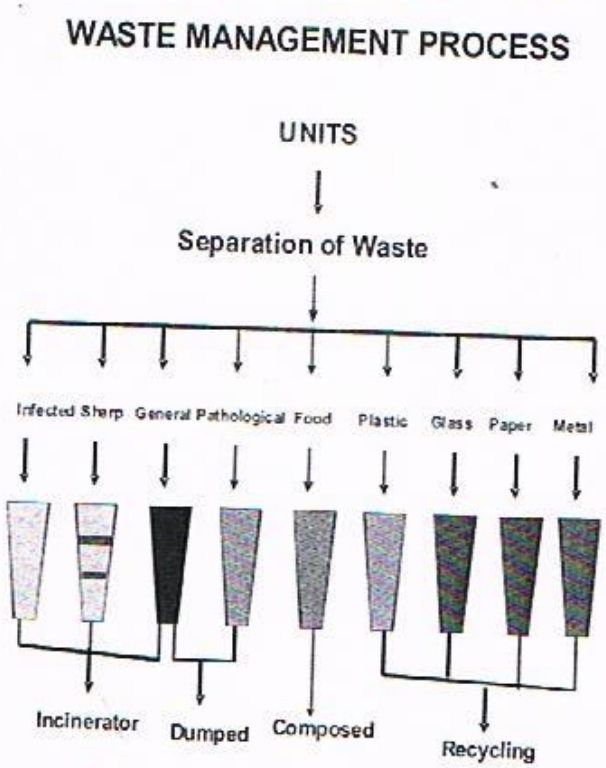

Fig. 5: Waste Management Process

4. Broken glasses has been collected and stored since 2000 and negotiations are being held with glassware companies for recycling. The management is also divided regarding whether to dump the glassware or wait until glassware companies buy from the hospital. If so, how long the hospital has to wait?
5. The pathological wastes are given to the caretaker to be disposed at the cemetery.

Under the World Bank project, the hospital is scheduled to get an autoclave within few months which will be used for autoclaving infected yellow waste and infected sharps.

It is obvious from the challenges faced by the hospital that multiple stakeholders are involved in Health care waste management and there is a need for intersectoral coordination between these stakeholders for effective and sustainable health care waste management system in the hospital.

CONCLUSION

This case study revealed that with minimal resource allocation coupled with educational and attitudinal change training, the hospital was able to achieve observable improvement in the system

within a limited period of time. Proper waste management also contributed to the improvement of 'Quality Healthcare through Productivity' emphasising that any quality programme in hospitals is not comprehensive without a proper waste management system. Castle Street Hospital for Women started their quality improvement programmes with proper waste management and has set an example which other hospitals may adopt to enhance their quality.

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ANNEXURE 1 :

I. Infectious waste – colour to be used for bins and bags – Yellow

Infectious waste could be defined as waste that is suspected to contain pathogens such as bacteria, viruses, parasites or fungi in sufficient concentration or quantities to cause disease is susceptible hosts.

II. Sharp waste – Colour to be used for bins – Yellow with a red stripe

Sharp waste that is contaminated with body fluids are also considered as highly infectious waste.

III. General waste – colour to be used for bins and bags – Black

General waste can be defined as wastes that are non-infectious. These could be considered as general or municipal waste.

IV. Biodegradable waste – Colour to be used for bins and bags – Green

Biodegradable waste is the types of waste that decompose naturally.

V. Glass waste – Colour to used for bins and bags – Red

Glass waste includes glass bottles and pieces which could be recycled

VI. Paper waste – Colour to be used for bins and bags – Blue

Paper waste could be recycled if collected separately

VII. Plastic waste – Colour to be used for bins and bags – Orange

Plastic waste could be recycled if collected separately.

ANNEXURE 2 :

Colour Code for Waste Disposal

LESSONS FROM DEVELOPING COUNTRIES

The Regional Workshop: Building Capacity for Implementing Sound Health Care Waste Management in SEAR Countries, Bangalore, India, 17-19 December 2007 – WHO SEARO

Senior Government Officers from the countries of South East Asia Region such as Bangladesh, Nepal, Myanmar, Srilanka, India, Maldives, Thailand and also representative from Mongolia and WHO staff from SEARO and the Western Pacific Region met from 17-19 December 2007 at M S Ramaiah Medical College, Bangalore and deliberated at length about the status and issues of HCWM including needed legislative system, training support, logistic support for the countries of the region and arrived at following conclusion and recommendations for the countries of the region:

RECOMMENDATIONS

1. Those countries which do not have a proper health care waste management system should establish HCWM Cell in either health department/appropriate organization. The Cell should undertake health care waste survey to set up a baseline in the countries.
2. Each country should have comprehensive policies and guidelines on HCWM in place by June 2008, those who already have these policies and guidelines should review and further strengthen it.
3. The guidelines should promote non burnt treatment technologies and encourage centralized treatment facilities (CTF). In order to check the proliferation of poor quality of treatment equipment the respective countries should come out with minimal specification and operating standards for these equipments.
4. The countries which do not have HCWM legislation in place should have draft legislation by December 2008. The existing WHO policies on HCWM, legislation of India and Thailand may be used as references for developing the draft.
5. The capacity building of the health care functionaries and other stake holders should be undertaken in a comprehensive manner. WHO SEARO may carry out the train the trainers (TOT) programme in India and Thailand for all the SEARO countries. These trainers should in turn carry out the training of the concerned health staff in the respective countries.
6. The IGNOU certificate programme in HCWM in distance learning should be used for establishing programme study centers in all the member countries as has been done in Bangladesh. The respective WHO country office together with the ministry of health/ DGHS should support the enrolment in this programme
7. The capacity building efforts should encompass the attitudinal and behavioral changes of the policy makers, senior medical staff and others.
8. The mass Information Education and Motivation (IEM) campaign through mass media should be undertaken by all the member country to sensitize and increase the awareness of the masses on HCWM.
9. Each country should strive for elimination of toxic substances usage such as mercury in order to minimize hazardous waste component present in HCW stream. In case toxic substances are in use in health care practices, appropriate protocols to be developed for their proper management in the HCWM guidelines.

10. The member countries should promote innovations and research in HCWM to evolve alternative environment friendly technologies for treatment and disposal. This should also address the liquid waste management issues in all care settings. Best available technologies and best environmental practices and research findings to be shared among the member countries.
11. The immunization waste/ AD syringes is a vexed issue and should draw the urgent attention of the member countries for its safe disposal.
12. All this will require additional budgetary support. The health department / private and corporate health institutions of the respective countries should allocate additional resources preferably under a separate budgetary head to meet the cost of consumables / non consumables / payment to the CTF and related expenses. Initial support from WHO / World Bank and other donors may be available. Simultaneously the respective governments should be able to meet the recurring and other expenses in a sustainable manner.
13. The member countries should develop standard operating procedures (SOPs), surveillance systems and documentation for hazardous procedures including needle stick injuries, patient safety, occupational safety (prophylaxis against Hepatitis B) and post exposure prophylaxis (PEP).

HOW TO ADDRESS UNSAFE INCINERATION

To better understand the problem of health-care waste management, WHO guidance recommends that countries conduct assessments prior to any decision as to which health-care waste-management methods be chosen. Tools are available to assist with the assessment & decision-making process so that appropriate policies lead to the choice of adapted technologies. In support of sound health-care waste management, WHO proposes to work in collaboration with countries through the following strategy:

In the short-term

- Until countries have access to proven, environmentally safe options for the management of health-care waste, incineration may still be seen as an appropriate response. Incineration should comply with the following recommendations:
- good practices in incinerator design, construction, operation (e.g., pre-heating and not overloading the incinerator, incinerating only at temperatures above 800°C), maintenance and lowest emissions;
- The use of waste segregation and waste minimization practices to restrict incineration to appropriate infectious wastes;
- availability of good practices tools, including dimensional construction plans, clear operational guidelines, etc.;
- correction of current deficiencies in operator training and management support, which lead to poor operation of incinerators;
- materials containing chlorine such as polyvinyl chloride products (e.g., some blood bags, IV bags, IV tubes, etc.) or heavy metals such as mercury (e.g., broken thermometers) should never be incinerated.
- Research and production by manufacturers of all syringe components made of the same plastic to facilitate recycling;
- Selection of PVC-free medical devices;
- Identification and development of safe recycling options wherever possible (for plastic, glass, etc.);
- Research and promotion of new waste management technologies or alternatives to incineration;
- Promotion of the principles of environmentally sound management of health-care waste as set out in the Basel Convention.

In the mid-term

- Further efforts to eliminate unnecessary injections to reduce the amount of hazardous health-care waste that needs to be treated;
- Research into the health effects of chronic exposure to low levels of dioxin, furan and co-planar PCBs;
- Risk assessment to compare the health risks associated with first incineration and secondly exposure to health-care waste.

In the long-term

- Support of countries in the development of national guidance manuals for the sound management of health-care waste;
- Effective, scaled-up promotion of non-incineration technologies for the final disposal of health-care wastes to prevent the disease burden from (a) unsafe health-care waste management and (b) exposure to dioxins and furans;
- Allocation of human and financial resources to safely manage health-care waste in countries
- Support of countries in the development and implementation of a national plan, policies and legislation on health-care waste.

WHO aims to promote effective non-burn technologies for the final disposal of medical wastes to avoid both the disease burden from unsafe health-care waste management and potential risks from dioxins, furans and co-planar PCBs. WHO will:

- Prevent the health risks associated with exposure to health-care waste for both health workers and the public by promoting environmentally sound management policies for health-care waste;
- Support global efforts to reduce the amount of noxious emissions released into the atmosphere to reduce disease and defer the onset of global climate change;
- Support the Stockholm convention on Persistent Organic Pollutants (POPs);
- Support the Basel Convention (1989) on hazardous wastes and other wastes;
- Reduce the exposure to toxic pollutants associated with the combustion process through the promotion of appropriate practices for high temperature incineration.

Source: WHO website www.who.int

AGENDA

Two days National Seminar on Hospital Waste Management
Organised by : Trivandrum Medical Association
at Mascot Hotel, Thiruvananthapuram on 26-27 October, 2009

Lalji K Verma
President, ISHWM

A 2 days seminar was organized by TMA, Kerala at Mascot hotel on the 26th and 27th October, 2009.

The seminar was well attended, and well covered by the print media. Participants included experts from hospitals, waste management service providers, Pollution Control Board chairpersons/ representatives from the state of Keral, Tamil Nadu, and Karnataka. The seminar was inaugurated by Mr Manoj Joshi, IAS – Health Secretrary, Govt of Kerala. Theme presentation as key note address was delivered by the President, ISHWM, New Delhi - Air Mshl Lalji K Verma, AVSM (Retd).

Presentations and discussions were of high scientific value, and the discussions were more towards practical problems and difficulties rather on basics of healthcare waste management. On recapitulating the complete event few things emerged clearly:

- Practice of healthcare waste management was somewhat better in the state of Kerala compared to most of the northern states of India.
- Hospitals were cleaner in this regard, and were alive and concerned to the risks posed by healthcare wastes.
- Training and awareness programmes required to be regular for all groups of healthcare providers to update the knowledge in this fast changing field.
- Safety and precautionary measures at hospitals and healthcare facilities requires to be strengthened, specifically amongst the waste handlers.
- Larger and separate budgetary provisions and allocations were required for healthcare waste management. It may be appreciated that Min of Env & Forest, and not the Min of Health are the nodal ministry, hence separate budgetary provision may be required.
- Licensing/certification and its periodical renewal etc for hospitals and other healthcare facilities should be introduced by relevant legislations, if not existing, and suitable guidelines issued by the health department and the pollution control board in tandem.
- Bar coding may be made essential for each healthcare facility from where the waste is being transported for disposal. This will ensure tracking, which may also be a medico legal requirement.
- All healthcare facilities regardless of the fact whether they have outsourced waste management, should develop at their premises:
- Disinfection, mutilation procedures of the waste.
- Practice waste reduction, and recycling wherever opportunities exist. And it does exist in respect of many ingredients of healthcare waste,
- Protection procedures for all persons engaged in healthcare waste management,
- Regular training and awareness programmes for all groups in a hospital/healthcare facility,
- Standing procedures (SOP) be developed for waste management at each hospital/ healthcare facility,
- SOP may also be developed for dealing with mercury spill etc,
- Gradually all hospitals and healthcare facilities should do away with mercury equipped instruments.

The conference was held in a cordial atmosphere, and initiative of the Trivandrum Management Association was appreciated by one and all.

NEW ARRIVAL

HOSPITAL ACQUIRED INFECTIONS

Power Strategies for Clinical Practice

Hospital-acquired infections (HAI) pose a significant health problem to patients, practitioners, organizations and countries. When we address this problem, there is often a feeling of despair and powerlessness, similar to the feeling one gets when looking at a dirty, polluted river. Our response generally is, "Why does'nt someone take care of the problem?". The other response is a feeling of detachment in those who think the problem is distant and is not going to affect them. The implications are similar- it affects everyone and everyone is responsible for correcting the problem. All of us involved directly or indirectly, in clinical practice need to be activists in combating HAI!!

We can no longer say that we are not responsible!!

Increasing awareness amongst patients, demand for quality health care by the public, fear of litigation and stringent requirements for accreditation have all made it imperative for those involved in clinical practice, at various levels in the health care set-up, to adopt a proactive approach to the management of HAI.

Understanding Powerful Strategies and New Perspectives

The idea of this book was conceived to equip practitioners with powerful strategies and perspectives complementary to their clinical practice. Once the basic processes are understood, one can fine-tune them to their institutions and personalized needs, taking their clinical practice to a higher level.

Helping decision-making

This book also attempts to inspire, influence and empower those involved in clinical practice to make informed decisions, regarding manpower, materials and processes related to HAI control.

Terminologies – "Lets Talk the same language"

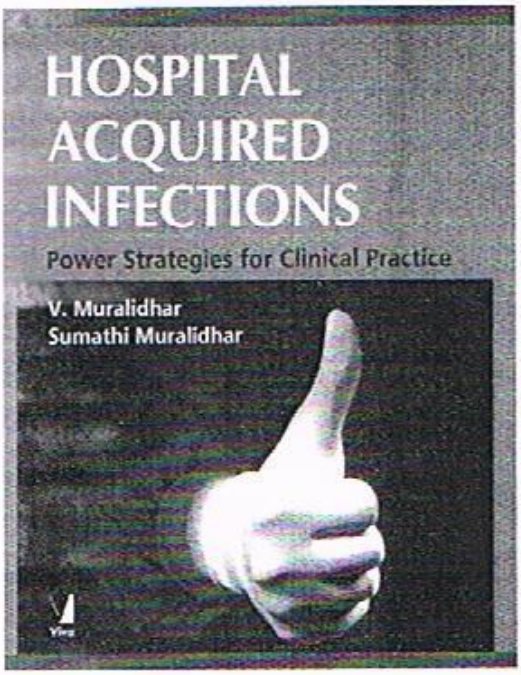
We are all used to looking at different areas concerning Hospital Acquired Infections (HAI) as separate, watertight compartments like the blind men trying to describe an elephant in their own ways . The effectiveness of combating HAI, a clinical risk, is dependent on many complex entities in a system - clinical, managerial, epidemiological, microbiological etc. One not only needs inputs from all these areas, but also a co-coordinated approach – We need to talk the same language ,think of the problem in its entirety ,work together to solve the problem and try to look at the larger picture giving due emphasis to various aspects in equal measure.

The silver lining!

The book offers hope to every practitioner by empowering him/her with evidence based strategies to handle HAI with confidence. This optimism is aptly reflected in the design of the cover page - Thumbs Up!

About the Authors

Dr. Muralidhar is a Senior Consultant (anaesthesiology and intensive care) at the Indraprastha Apollo Hospitals, New Delhi. He was formerly Associate Professor (Anaesthesiology and Intensive care) at the All India Institute of Medical Sciences, New Delhi. He is also an elected member of the National Academy of Medical Sciences and has authored numerous publications



Dr. Sumathi Muralidhar is a Microbiologist at the Regional STD Teaching, Training & Research Centre, Safdarjang Hospital, New Delhi. This Centre is one of five of its kind in the country, recognized by the National AIDS Control Organization (NACO) and caters exclusively to the care of patients with STDs and HIV/AIDS. She is also a part of the teaching faculty of the Department of Microbiology at the attached Vardhaman Mahavir Medical College, Safdarjang Hospital, New Delhi. In addition, she is an academic counsellor for the Certificate course on Healthcare Waste Management, sponsored by IGNOU and WHO (SEARO).

PATIENT SAFETY

Patient safety is a fundamental principle of health care. Every point in the process of care-giving contains a certain degree of inherent unsafety.Adverse events may result from problems in practice, products, procedures or systems. Patient safety improvements demand a complex system-wide effort, involving a wide range of actions in performance improvement, environmental safety and risk management, including infection control, safe use of medicines, equipment safety, safe clinical practice and safe environment of care.

Source: WHO website www.who.int

RESOURCES & INFORMATION

IGNOU CERTIFICATE COURSE

Indira Gandhi National Open University

Indira Gandhi National Open University (IGNOU), the largest open university in the democratic world, was established by an act of Indian Parliament in 1985, and started offering academic programmes in 1987 (Diploma in Management and Diploma in Distance Education with 4528 students). Today, it serves the educational aspirations of about 2.1 million students in 30 countries, including India, through twenty one schools of studies and a network of 57 regional centres; five sub regional centres, 1296 study centres/tele-learning centres, 35 partner institutions overseas. The University offers 125 certificate, diploma, degree and doctoral programmes comprising 900 courses, through a strength of 300 faculty members and academic staff at the headquarters and regional centres and about 33,000 counselors drawn from conventional institutions of higher learning, professionals from various organizations and bodies, among others.

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

SCHOOL OF HEALTH SCIENCES

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

CERTIFICATE IN HEALTH CARE WASTE MANAGEMENT

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

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

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

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

OBJECTIVES

- Sensitize the learner about health care waste and its impact on our health and environment

- Acquaint the learner about the existing legislation, knowledge and practices regarding infection control and heath care waste management practices in South · East Asia Region Countries.
- Equip the learner with skills to manage health care waste effectively and safely.

BENEFICIARIES

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

PROGRAMME PACKAGE

It is a multimedia package consisting of print material in the form of booklets called blocks, audio-visual materials, teleconferencing and providing counseling by contact sessions where the learners are invited to the Programme Study Centres in India and Partner Institutions in other countries for hands on training. The package will have eight theory blocks, a project and programme guide.

DETAILED PROGRAMME DESIGN

BHM-001 Fundamentals: Environment and Health, (4 Credits)

Block 1: Understanding Our Environment 1

- Unit 1 Introduction to Environment
- Unit 2 Environmental Pollutants
- Unit 3 Interrelationship of Environment and Health
- Unit 4 Waste Management

Block 2: Health Care Waste: Definitions 1

- Unit 1 Definitions, Types and Categories of Waste
- Unit 2 Principles of Health Care Waste Management
- Unit 3 Handling Health Care Waste

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

- Unit 1 Impact of Health Care Waste on Our Environment
- Unit 2 Impact of Health Care Waste on Human Health
- Unit 3 Safety Methodology, worker Safety and Precautions

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

- Unit 1 Rules and legislations
- Unit 2 Regulatory Mechanisms
- Unit 3 Current Status in India. Thailand. Indonesia. Sri Lanka. Bangladesh
- Unit 4 Current Status in Bhutan, DPR Korea, Timor Leste, Maldives, Myanmar, Nepal, Mongolia.

BHM-002 Health Cart Waste Management Concepts, Technologies and Training (8 Credits)

Block 1 Practical Aspects of Health Care Waste Management 2

- Unit 1 Managerial and Administrative aspects
- Unit 2 Integrated Infection Control Management
- Unit 3 Disinfection and Transportation
- Unit 4 Capacity Building. Training and Monitoring

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

- Unit 1 Systems Options
- Unit 2 Treatment and Disposal of Health Care Waste: Burn Technologies
- Unit 3 Treatment and Disposal 01 Health Care Waste: Non burn technology
- Unit 4 Innovative Concepts and Possibilities

Block 3: Health Care Waste Management and Emerging Issues 1

- Unit 1 Managing Waste Water from Health Care Facilities

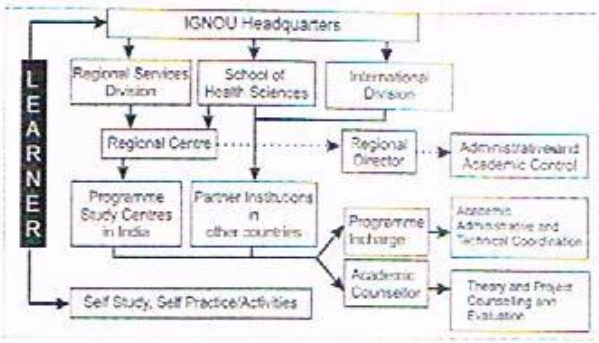
Unit 2 Management of Wastes from Immunizations

Unit 3 Occupation and Patient Safety

Unit 4 Success Stories

Block 4: Training Manual for Waste Handlers 1

BHMP-001 Project 4 (4 Credits)



CREDIT SYSTEM

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

IMPLEMENTATION PLAN

The programme is implemented through a network of Programme Study Centres (PSCs) in India and Partner Institutions (PIs) located in other South-East Asia (SEA) and other countries. These Programme Study Centres and Partner Institutions 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 are providing academic counseling and supervising the Programme Study Centres/Partner Institutions. The administrative control is through the Regional Centres (RCs) of IGNOU located usually at state capitals nationally, by the Partner Institutions, and Indian Consulate in other countries and the School of Health Sciences (SOHS) located at the IGNOU Headquarters, Delhi, India.

EVALUATION

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

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

RESOURCES & INFORMATION

Resource Material on Health Care Waste Management

Dr. Shalini Nooyi
Associate Professor, Dept. of Community Medicine
M. S. Ramaiah Medical College

1. "Safe Management of Health Care Waste-Information and Learning Units"

There may be many books on health care waste management but very few on how to manage health care waste safely.

Following the Bio-medical Waste (Management and Handling) rules in 1998, put up by the Ministry of Environment and Forests, India's awareness and knowledge of health care waste and its management have increased. One such exemplary endeavour in the midst of indifference and ridicule was the conception and development of the Health Care Waste Management (HCWM) Cell of the Department of Community Medicine in MS Ramaiah Medical College, Bangalore

A product of the incessant efforts of the HCWM Cell is this book. It is a comprehensive source of information on safe management of health care waste and reflects the exceptional effort that has gone into its development. It helps fill the void on paucity of guidelines for safe management of health care waste and will be of immense use to administrators of hospitals, nursing homes, independent clinic practice as well as physicians, nurses and trainers of health care personnel and health care waste handlers.

In the first few pages the book gives us a glimpse into the present appalling status of health care waste and its management in India. Tips on how waste should be managed in a city and suggestions for civic bodies have been detailed. Another useful feature is its section on how to use this book and how the facilitator can train new learners.

Following this, the book describes how health care waste can be managed in detail. Each chapter discusses one aspect, starting with basic information on what health care waste is and its classification. The rest of the chapters are on management of infected waste, non-infectious waste, prevention of infection in health care settings and management of linen to name a few. Another useful chapter is on how the civic bodies can garner community cooperation and support for waste management. Guidelines for storage, collection, transportation and disposal of general waste in cities and towns have also been described in addition to the recommendations of the

- Availability of educational materials and signage on waste management and occupational safety

The laboratories were surveyed on the basis of responses against the questions of the developed tool as well as through direct monitoring of the scenario by the project staff.

RESULT AND DISCUSSION

The study provided an exhaustive picture of the waste management practices followed in the private labs of Kannur.

All pathology, microbiology laboratories and blood banks are governed by the regulations of Biomedical Waste (BMW) Management Rules, 1998[5]. However, authorization for handling and management is required for the laboratories with a patient attendance of more than 1000 per month. Majority (93.84%) of the studied labs claimed to be aware of BMWM & Handling rules, 1998 but 86.15% of them are not following the rules and are practicing improper segregation and disposal method. The chemical disinfection practiced by most them are ineffective and 89.23% of them are found to be reusing kits. Apart from this mixing

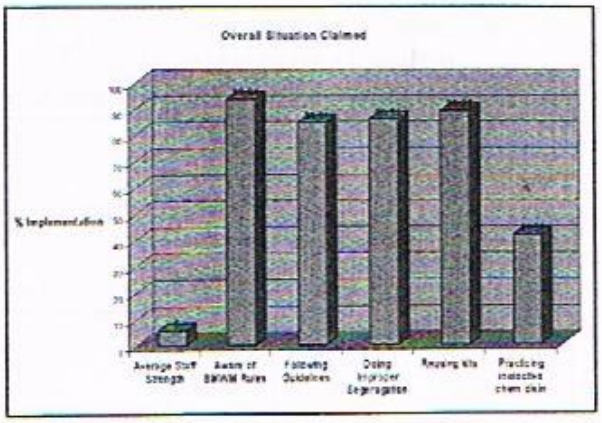


Fig.1 Prevalent Situation of Waste Management in Laboratories of Kannur

of waste is seen in most of these labs which claimed to be practicing proper segregation.

In the labs studied, the generation of infected waste of category 1 and 2 (according to schedule I of BMWM Rules) is very less compared to other categories of waste. The major categories of biomedical waste generated from labs include infected plastics, sharps and liquid samples. Sharps are the major category of waste, which should be handled properly to avoid injuries and spreading of diseases. Among metal sharps, needles

Table 1
Various categories of waste generated in Laboratories in numbers per day (Avg, (%))

Glass sharps		Metal sharps		Infected Plastics		Liquid Samples Received		Reusable Items	
Broken Glass	2 (5.7)	Needles	17 (81.0)	Gloves	2 (3.3)	Blood samples	15 (48.4)	ESR Tubes	57 (87.7)
Reagent Bottles	2 (5.7)	Lancet	2 (9.5)	Syringes	17 (28.3)	Urine samples	10 (32.3)	Gloves	6 (9.2)
Slides	8 (22.9)	Scalpel	1 (4.8)	PI test cards	6 (10.0)	Body fluid samples	1 (3.2)	Microtip	20 (30.8)
Test Tubes	11 (31.4)	Blade	1 (4.8)	microtip	12 (20.0)	sputum samples	3 (3.7)	Sample container	13 (20.0)
Cover Slips	11 (31.4)			Elisa well	1 (1.7)	stool samples	2 (6.5)	Plastic test tubes	6 (9.2)
Amp Vials	1 (2.9)			Plastic culture plates	1 (1.7)			Slides	5 (7.7)
				Plastic test tubes	3 (5.0)			Test tubes (glass)	6 (9.2)
				Sample containers	10 (16.6)			Cover slips	1 (1.5)
				Plastic sticks	8 (13.3)			Plastic Sticks	1 (1.5)
								Glass Bottles	1 (1.5)