

Research Article

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An Economic analysis of Hazardous waste management and Health care services in Dindigul district

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Abstract

Health care play an important role for human resource development in modern days. For that Health care unit is an important part for any health system. Anyhow hazardous waste management in India had received very little attention from the policy makers and academicians than that of the attention is paid to start medical unit. So the study needs to assess the knowledge and practice of effective management system of hazardous waste management among the healthcare providers in Dindigul district. The study used descriptive and analytical research methods. Appropriate statistical methods are used to analyse the objectives and test their hypothesis through SPSS package in order to study the relationship between the environment and the efficiency of medical waste management. Though health care waste management is a community problem no one take care of that. The consequences lead to increasing rate of waste generation, its unscrupulous segregation and improper disposal call for halting and reversal of upwards trends of overall mismanagement. Hazardous waste management rules-2005 is framed by the government, but the hazardous waste management practices are not being given due importance in Dindigul. Merely having a squad of sweepers, who keep the hospital clean, but scavenge recyclable and reusable hospital items like syringes are dumped aside the road.

Keywords

Biomedical waste,
Healthcare unit,
Healthcare clinics,
Waste disposal,
Waste management.

Introduction

Health care occupies a vital place in the social services sector and is essential for achieving sustainable human development. Hospitals are a very important part of any health system. The largest share of national health expenditures

ranging between 60 to 80 percent, is for hospitals, regardless of the health status and income level of a country. Within the public hospital sector, the large and teaching hospitals are granted a higher proportion of the available financial and other health sector essentials in terms of human, physical and technological resources.

Status of healthcare waste management in Tamilnadu

Tamil Nadu has performed well in health sector when compared with other states in India. Tamil Nadu is the leading state in implementing various government health programmes as per the observations made by UNICEF and WHO. But it is widely observed that today the public healthcare system does not deliver services adequately to those who need them. A number of studies on healthcare wastes management reported that health and environmental risk posed by healthcare waste can be reduced by having careful planning, proper guideline and full participation of Health Care Wastes. Collection of waste using recommended color coding container and storage of waste in isolated areas were not satisfactory. In Tamil Nadu now a day healthcare facilities are becoming greater than ever to address the health needs of the society and to achieve the Millennium Development Goal (MDG).

Significance of the study

Hazardous Waste Management in India had received very little attention from the policy makers and academicians than that of the attention is paid to the environmental problems, such as air pollution and waste water treatment. Nevertheless, the improper handling and disposal of Hazardous Waste constitutes a serious problem.

These kind of problem assumed that immediate action had become an absolute necessity. So this study has focused its attention on the improvement of medical waste management with healthcare services. Moreover, there was the need for awareness among the healthcare workers as well as sanitary workers. The information collected through this research study could be used to improve the quality of medical waste management.

So, this study is assessing health care waste type, generation rate, and management system in health

centers and to described healthcare waste management practices among healthcare workers in Dindigul district. More over the present study will also focus intensively to find out the knowledge and practice of bio-medical waste management among the health care providers in Dindigul district.

Statement of the problem

Many times even health care worker do not receive proper medical care, which makes it more difficult to detect hazardous waste management problems and to provide adequate healthcare to victims. Generally, health care waste is generated from medical sources such as waste include hospitals, health clinics, nursing homes, medical research laboratories, offices of physicians, dentists and veterinarians, home health care and funeral homes. In Dindigul Medical waste constitute 19.95 % of hazardous waste in Dindigul. Biomedical waste in the form of excised body organs, blood and body fluids contaminated cotton, bandage, and plaster casts forms (15%). Sharps as used needles, syringes and scalpel constitute (1%). Chemical and pharmaceutical waste present (3%) while genotoxic, radioactive and heavy metals wastes present (1%). Garbage and rubbish of the hospitals which are similar in nature to household trash and formed of food remnants, packaging materials, bottles and plastic containers constitute (80%) of hazardous waste in Egypt. Although they pose no risk of injury or infection, unfortunately, they are usually mixed with the hazardous waste and increase the volume of hazardous waste to entail all the hospital waste. Many physicians especially at the beginning of their career are not aware of the proper management of the medical wastes. Therefore, they may not only harm themselves but also share in dissemination of these hazardous wastes. Therefore, the research studies are needed to examine the health care facilities and hazardous waste management in Dindigul district.

Objectives

In order to solve the problem of the study the following specified objectives are to be analysed for the study purpose:

- To assess the knowledge and practice of effective management system of bio-medical waste management among the health care providers in Dindigul district.
- To assess healthcare waste type, generation rate, and management system in health centers in Dindigul District.
- To assess healthcare waste management practices among healthcare workers in healthcare facilities in Dindigul district.

The main objectives is to focused on the need for medical waste management for reducing different effects, protecting both patients and staff working in entities generating such type of waste and protecting health of environment. Following safe manner in all stages of waste management leads to push the level of efficiency and effectiveness which contribute in achieving the objectives.

Review of literature

The HW can be dangerous to people or the environment. In contrast, non-hazardous waste does not directly harm people or the environment, like cardboard, glass, plastic, rocks, metals, and food scraps. The United Nations Environmental Programme (UNEP) has indexed waste in the category of hazardous material if they acquire one or more of the characteristics that may lead to the consequences (Saeidi-Mobarakeh et al. 2020), such as:

- (i) Fires during routine management
- (ii) Corrosive upon exposure to air, or in some particular environment
- (iii) Chemical reactions that lead to toxic gas emissions into the atmosphere
- (iv) Long-term environmental, geological, and ecological disaster effect

The EPA has established a Toxics Release Inventory (TRI) database in which more than 600

potentially hazardous chemicals are listed (DeVito et al. 2015). On the other hand, hazardous waste is garbage that can be dangerous to people or the environment, like things that can burn easily, poisonous materials, things that react with other substances, or things that can corrode.

The identification and classification of HW are essential to ensure their effective management. The identification process also varies from country to country. In the USA, the Resource Conservation and Recovery Act (RCRA) Subtitle C is commonly used to identify HW (USEPA 1976). In India, the hazardous and other waste rules— 2016 (HWM rules-2016, 2019) is the identification standard, whereas China uses GB 5085.7 identification standard for HW. The various steps for the preliminary identification of the HW are described, as per the hazardous and the other waste rule—2016, India, RCRA Subtitle C, USA, and GB 5085.7 identification standard, China. The classification of HW is not unique and varies from country to country. For example, in China, HW is classified as household hazardous waste (HHW), industrial hazardous waste (IHW), and medical waste (MW) (Duan et al. 2008). Most developing countries classify HW as industrial hazardous waste (IHW) and medical waste.

Waste is part of the agenda of the European Environment and Health Process and included among the topics of the Sixth Ministerial Conference on Environment and Health. Disposal and management of hazardous waste are worldwide challenges. We performed a systematic review to evaluate the evidence of the health impact of hazardous waste exposure, applying transparent and a priori defined methods. The following five steps, based on pre-defined systematic criteria, were applied. 1. Specify the research question, in terms of “Population-Exposure-Comparators-Outcomes” (PECO). Population: people living near hazardous waste sites; Exposure: exposure to hazardous waste; Comparators: all comparators; Outcomes: all diseases/health disorders. 2. Carry out the literature search, in Medline and EMBASE. 3. Select studies for inclusion: original

epidemiological studies, published between 1999 and 2015, on populations residentially exposed to hazardous waste. 4. Assess the quality of selected studies, taking into account study design, exposure and outcome assessment, confounding control. 5. Rate the confidence in the body of evidence for each outcome taking into account the reliability of each study, the strength of the association and concordance of results.

Fifty-seven papers of epidemiological investigations on the health status of populations living near hazardous waste sites were selected for the evidence evaluation. The association between 95 health outcomes (diseases and disorders) and residential exposure to hazardous waste sites was evaluated. Health effects of residential hazardous waste exposure, previously partially unrecognized, were highlighted. Sufficient evidence was found of association between exposure to oil industry waste that releases high concentrations of hydrogen sulphide and acute symptoms. The evidence of causal relationship with hazardous waste was defined as limited for: liver, bladder, breast and testis cancers, non-Hodgkin lymphoma, asthma, congenital anomalies overall and anomalies of the neural tube, urogenital, connective and musculoskeletal systems, low birth weight and pre-term birth; evidence was defined as inadequate for the other health outcomes. The results, although not conclusive, provide indications that more effective public health policies on hazardous waste management are urgently needed. International, national and local authorities should oppose and eliminate poor, outdated and illegal practices of waste disposal, including illegal transboundary trade, and increase support regulation and its enforcement.

Methodology

Model of the study

Presumptive model has been built includes two variables represent management and organisation of medical waste on environment and on the other

hand, it was presented in accordance with the horizontal design of by way imposing the existence of mutual relations of influence between them and the model reflects the correlation between the efficiency and effectiveness of different functions of medical waste management and organisation with environment and the direct impact on each other, noting that this model is the main base of study hypothesis.

Methodology of the study

The study has followed the descriptive and analytical research methods. As to descriptive research method, it has depended on measures description that has been taken by hospitals in general to get safe management of medical waste. As a result, a desk survey is done to get studies and theoretical research in order to identify principles of theoretical framework, understanding the most important former studies which are the vital source in the study along with its knowledge levels.

As for field research and analysis, a comprehensive field survey is done, all data and requirements which were collected and reached through by answering the questionnaire developed by the researcher is analysed and appropriate statistical methods for addressing all of these data and the requirements are used.

Used statistical methods

- Descriptive statistics (frequencies and percentages) to show and analyse the characteristics of the study sample.
- Means and Standard deviations are having been used to answer the questionnaire.
- Appropriate statistical analytical methods have been used to analyse the study data and test their hypothesis (SPSS).
- Chi square test has been used to study the relationship between the environment and the efficiency of medical waste management.

Tools and Analysis

Introduction

The study is based on segregation of healthcare waste. Descriptive statistics are used to analyse the segregation in all the hospitals in Dindigul. In this study the following hypothesis are to be tested to analyse these objectives.

- To assess healthcare waste management practices among healthcare workers in healthcare facilities in Dindigul district.

Major hypothesis

There is no statistically significance relationship between the environment and the efficiency and effectiveness of medical waste management at level 0.05. Following sub-hypotheses is emerged from such hypothesis:

H01: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste sorting at level 0.05.

H02: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste classification at level 0.05.

H03: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste collection at level 0.05.

H04: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste storage at level 0.05.

H05: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste handling at level 0.05.

H06: There is no statistically significance relationship between the environment and the

efficiency and effectiveness of waste disinfection at level 0.05.

H07: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste processing at level 0.05.

H08: There is no statistically significance relationship between the environment and the efficiency and effectiveness of the final disposal of waste, at the level 0.05.

Analysis and Interpretation of Results

The above said variables are measured with the following hypothesis.

Hypotheses Testing

Hypothesis – 1

There is no relationship between the environment and the effective and efficient utilisation of medical waste management H0.

One sample T test has been used for sorting waste. We find through computer results by table (1) the value highlighted that calculated value (T calculated = 20.820) is greater than the tabulated value (0.001), since the decision rule is to accept the null hypothesis (H0) if T calculated is less than T tabulated and null hypothesis H0 be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (H0) and accept the alternative one (Ha) which means that from the computer result the study found out that there is a relationship between the environment and the effective and efficient utilisation of different types of medical waste management.

Table – 1

	Environment and the efficiency and effectiveness of waste sorting					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X1	20.820	149	.000	2.520	2.28	2.76

First Sub-Hypothesis

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste Ho.

One sample T test has been used. We find through computer results by table (2) that the value of (T calculated =18.713) is greater than the tabulated

value. Since the decision rule is to accept the null hypothesis (HO) it T calculated is less than T calculated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Table – 2

	Classification of medical waste					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X2	20.796	149	.000	2.547	2.30	2.79

Second Sub-Hypothesis

HO: there is no relationship between the environment and the efficiency effectiveness of sorting medical waste HO.

One sample T test has been used. We find through computer results by table (22) that the value of (T

calculated= 20.806) is greater than the tabulated value. Since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null greater than T tabulated. Therefore, we reject the null which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Table – 3

	Collection of medical waste					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X3	20.806	149	.000	2.533	2.29	2.77

Third sub-Hypothesis

Ho: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste Ho.

One sample T test has been used. We find through computer results by table (3) that the value of (T calculated = 21.590) is greater than the tabulated

value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than t Tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject than null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Table – 4

	Storage of medical waste					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X4	21.590	149	.000	2.607	2.37	2.85

Fourth Sub-Hypothesis

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste Ho.

One sample T test has been used. We find through computer results by table (4) that the value of (T calculated = 21.707) is greater than the tabulated

value., since that decision rule is to accept the null hypothesis (HO) if t calculated is less that T tabulated and null hypotheses HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Table -5

	Circulation of medical waste					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X5	21.707	149	.000	2.673	2.43	2.92

Fifth Sub-Hypothesis

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste.

One sample t test has been used. We find through computer result by table (5) that the value of (T calculated =3.873) is greater than the tabulated

value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null Hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept then alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Sixth Sub- Hypothesis

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste.

One sample T test has been used. We find through computer results by table (6) that the value of (T calculated =20.345) is greater than the tabulated

value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be reject if the T calculated value is greater than T tabulated . Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Table – 6

	Disinfection of medical waste					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X6	20.345	149	.000	2.340	2.11	2.57

Seventh Sub- hypothesis

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste.

One sample T test has been used. We find through computer results by table (7) that the value of (T calculated = 20.645) Is greater than the tabulated

value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than Y tabulated and null hypothesis be rejected if the T calculated value is greater than T tabulated. Therefore we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Table – 7

	Processing of medical waste					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X7	20.645	149	.000	2.507	2.27	2.75

The reason for that is because the high cost of processing in general and also the study questionnaire is not applied in most hospitals as the process of medical waste needs materials, expensive equipment and well qualified technical workers.

Eighth Sub-Hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste.

One sample T test has been used. We fine through computer results by table,(8) that the value of (T calculated = 20.477) is greater than the tabulated value. Since the decision rule is to accept the null hypothesis (HO) If T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste disposal.

Table - 8

	Final disposal of medical waste					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X8	20.477	149	.000	2.447	2.21	2.68

Conclusion:

The recent for that is because that high cost of processing of waste management in Dindigul district. The questionnaire is prepared on the basis of theoretical background of the chapter-4 and the influencing factors (variables) of hazardous waste establishment in general. But the study questionnaire is not applied in most of the hospitals in the study area. Because the process of medical waste management needs more material, high expensive equipment and highly qualified workers. So the study found out that from the above said analysis. The management and disposal of waste are very adequate and unhygienic. Most of the wastes collected from them are openly dumped on sites and there by endangering the environment.

Suggestion & Conclusion

Introduction

In developing countries, medical waste has not received much attention and it is disposed of together with domestic waste. Medical waste can be infectious. It acts as an agent in the transmission of infections. This is because it contains micro-organisms which can be communicated by invasion followed by multiplication in body tissues. These so transmitted pathogens can cause disease or diverse health impacts to humans.

Improper healthcare waste management puts the patients, healthcare workers, waste handlers and community at risk both in terms of risks from inadequate storage, transportation and disposal of infectious waste and from the environmental risks arising from burning hazardous wastes in open pits or badly maintained incineration equipment.

One of the problems in Dindigul faces today is the improper handling and disposal of solid wastes. During the evaluation of injection safety and Health Care Waste Management (HCWM) in Uganda, it was found that 92% of waste handlers have poor waste disposal methods, 3.4% have acceptable waste disposal methods and 4.6% have good waste disposal methods. Hazardous waste management is one of the biggest challenges facing in addressing the growing quantity of waste generated.

Globally, it is estimated that accidents caused by sharps accounts for 66,000 cases of infection with the hepatitis B virus, 16,000 cases of infection with hepatitis C virus and 200 to 5,000 cases of HIV infection amongst the personnel of healthcare facilities. In france in1992, eight cases of HIV infection were recognized as occupational infections; two of these cases, involving transmission through wounds occurred in waste handlers. Due to infections which can arise from improper HCW management, it was pertinent to undertake this study.

The part of the medical waste are classified into Infectious waste, Anatomical waste, Sharp waste, Chemical waste and Pharmaceutical waste. The medical waste management is a procedures taken by the concerning authority in sorting, collecting, storing and processing of medical waste generated in hospital. But if it is not mentioned properly, it may lead to environment problems such as air pollution and waste water treatment. So these kind of problem assumed that the policy maker as well as academicians are to be more attention to the study. So the present study had focused its attention which are related to biomedical waste management with healthcares service in Dindugul. The present study focus intensively to

assess the knowledge and practice of management system of bio-medical waste management among the healthcare providers in Dindigul, to assess healthcare waste type, generation rate, and management system in healthcare centres in Dindigul and to assess healthcare waste management practices among healthcare workers in healthcare facilities in Dindigul.

Dindigul has number of medical and healthcare centres. As mentioned in the first chapter the problems which are involved in handling, transportation and disposal of healthcare waste is a predominant problem in Dindigul.

The safe management of hazardous waste has received much attention over recent years in Dindigul. Emphasis is placed mainly on the proper handling, segregation and disposal of the hospital wastes. Wastes minimization and recycling are still not well promoted. The main issues considered were the adverse environmental and health impacts that arise from poor handling and disposal practices, the responsible institutions and initiatives taken and the policy framework.

In order to analyse the various problems which are existing in Dindigul, the study followed the descriptive and analysis. The segregated collection of various types of healthcare waste has been conducted in all the hospitals in order to selected objectives. The hospital have temporary storage areas.

The study highlighted that at many places, authorities are failing to install appropriate systems due to a variety of reasons, such as non-availability of appropriate technologies, inadequate financial resources and absence of professional training on waste management.

The proper hazardous waste management system can help the control diseases can reduce community exposure to resistant bacteria, and could reduce HIV/AIDS and Hepatitis transmission from dirty needles and other improperly cleaned or disposed medical items. Regarding the environmental issues, a correct and sustainable management system of hazardous

waste will avoid the negative long term health effects, from the environmental release of toxic substances such as dioxin, mercury and others. From both volume and toxicity perspectives, the use of plastics in society is a focus of waste management concerns. In the past, medical waste was often mixed with household waste and disposed of in municipal solid waste landfills. In recent years, increased public concerns over the improper disposal of hazardous waste have led to a movement to regulate the waste more systematically and stringently by the Indian Government.

Proper collection and segregation of biomedical waste are important. There is not enough information on medical waste management technologies and its impact on public health and environment. Practice of proper medical waste disposal and management is also inadequate. However, there is need for raising awareness about medical waste and its related issues. Comprehensive analysis of current waste management practices in both government and private hospitals. Arrangement of proper training programs of hospital staff and health professionals. Monitoring and evaluation of hazardous waste management interventions. The need for health care waste management planning to facilitate the implementation of necessary measures to improve the present health care waste management situation.

The role for pharmacists in this area is significant. As one pharmacist stated, "if we sell it, we are responsible for collecting and disposing it as well". Elements of the role for pharmacists include. Establishing a disposal process, possibly in conjunction with associations, manufacturers and hospital administration. Establishing a program for the return and disposal of unused drugs which includes: Encouraging patients to return their drugs to the pharmacy, of waste and rationale/causes/sources for waste and Using this information to support the need for waste reduction programs and attract or maintain sponsorship.

The study highlighted that the status of collection, temporary storage, and transportation were better than segregation and disposal process the status of disposal process. Additionally, among the mentioned process the status of disposal is the most problematic. So, appropriate technologies should be used and the comprehensive program should be initiated to prevent adverse impacts of inappropriate disposal on the environment. As it was found that having environmental health experts besides holding training course in a matter of appropriate healthcare waste management influence healthcare waste management, these should be accepted in all hospitals. Considering the findings of this study, there are hospitals not obeying the ratified regulations. More comprehensive program should be conducted and practiced in hospitals to implement the mentioned regulations completely.

Sensitization, motivation campaigns and technical courses among professionals, technicians and sanitary workers should be carried out; So that they identify themselves with their responsibilities suggested strategy to develop training courses should be "Training of trainees". Course content and planning procedures are included. In relation to wastewater management, an adequate wastewater treatment system is required at all facilities. Discharging of hospital wastewater to municipal sewers without pretreatment is not recommended. Minimal requirements for small facilities would be installation of proper septic tanks and soak-away systems.

It is fundamental to ensure a good design, construction, functioning and monitoring of septic tank and soak-away system, otherwise odor nuisance, flooding and pollution problems could be generated. A proper and on-time maintenance to the system, including a periodic monitoring are also obligatory activities. At the end it is recommended to implement the suggested measures on hazardous waste management, drinking water supply and facilities; which are going to improve human health and environment.

The study revealed that majority of the health care providers did not have any in service training. It is

to be noted that all healthcare providers should have adequate knowledge to treat the medical waste in a proper way to protect self, the community and particularly the environment. But knowledge retention has its limit in the study area. So in order to improve the healthcare worker periodical in service training is the solution to practice medical waste management in a better way.

This study investigated the current waste management practices in Dindigul Hospital. The study proved that the problem waste management exists and possible solutions have been suggested to alleviate the problems. Based on the findings of this study, the following recommendations have been proposed which once implemented will improve the current situation of medical waste management in the hospital. Some of the proposals can be easily implemented at the institutional level in a short term with very limited costs involved while others at the national level and requires significant funding and time.

- The management structure proposed by World Health Organization needs to be adopted and implemented.
- Strict segregation of wastes and labeling of waste bins should be encouraged.
- A well trained permanent employee incinerator operator should be deployed for effective and efficient incineration.
- Proper use of color codes needs to be observed. The linings need to match the color of the containers to avoid confusion when waste is finally delivered at the incinerator.
- Design and construction of a new incinerator whose design should be based on the established data from the hospital should be considered urgently.
- Improvement of storage area at the incinerator site by concerning the floor for easy cleaning and partitioned for safe and proper storage of different types of waste.
- Proper waste management policies and guidelines that conform to the internationally recommended standards and practices should be developed by the central government to guide health care waste handlers.

- Appropriate short term trainings for staff to improve their skills in medical waste management practices and safety measures in waste handling.

Storage of waste pending final disposal:

The following points need to be considered:

1. Do not store waste beyond a period of 48 hours.
2. Bins can be of metal or plastic.
3. If bins are re-usable, ensure their cleaning and disinfection.
4. Containers should not be too large as they may be difficult to lift and there can be spillage.
5. Each receptacle should be properly marked to show the ward or section where it is kept.
6. Bins preferably should be inner lined with polythene bags and provided with lids.
7. Move bins at least once a day from all areas, twice or more from OTs, ICUs.
8. Bags for wastes needing incineration should not be made of chlorinated plastic.
9. Categories 8 and 10 (liquid waste) need not be put in containers.
10. Category 3 if disinfected locally need not be put into containers.
11. Polythene bags carrying waste should be sealed/tied at the top. Whenever waste is being transported within or outside the hospital.
12. Disposal items should be shredded or mutilated to prevent reuse. Subsequently, they should be disinfected/disposal off as per guidelines.
13. Bins or polythene bags placed in the containers to be changed with each shift or when they are $\frac{3}{4}$ full. At this point, they should be treated with suitable chemical disinfectant to the final site as stipulated.

Maintenance of Records:

All hospitals should maintain records regarding quantity and category of all biomedical waste, which are subject to inspection and verification by the Government prescribed authority at any time.

Annual Report:

Every hospital is required to submit an annual report as per prescribed proforma by 31 January every year regarding the quantity and category of waste handled during the preceding year to the prescribed authority who in turn will forward a consolidated report to Central Pollution Control Board of the state by 31 March every year.

Accident Reporting:

When any accident occurs while handling or transportation of waste, the authorized person shall report the accident in prescribed form to the authority forthwith.

Training of Personnel:

The objectives of a waste management scheme should be to change a mindset through training. Standard training modules/manuals for doctors, nursing staff, lab technicians, ward attendants, safaiwalas, patients and their attendants should be developed to create awareness and ensure efficient handling and management of biomedical waste.

Evaluation:

Ongoing evaluation of the biomedical waste management programme in the hospital is very important to identify bottlenecks and to take remedial action. It is suggested that Hospital Infection Control Committee (HICCOM) should specifically look into this aspect.

Very few data are available on the health impacts of exposure to healthcare waste, particularly in the case of developing countries. Better assessment of both risks and effects of exposure would permit improvements in the management of health-care waste management and in the planning of adequate protective measures. Unfortunately, the classical application of epidemiology to the problem is difficult because of methodological complications and uncertainties regarding evaluation of both

exposure and health outcome. The great diversity of hazardous wastes that can be involved and of circumstances of exposures is a particularly problematic feature of all such evaluations. It prevents not only the development of a unified analytical approach to the assessment of exposure and health outcome but also the generalization of any statistical inferences drawn about a specific waste-exposed population. Nevertheless, suspected cases of adverse health effects of health-care waste should be adequately documented, with precise descriptions of exposure, exposed individuals or populations, and outcome.

Within health-care establishments, the surveillance of infection and record-keeping are important tools that can provide indications of inadequate hygiene practices or of contamination of the immediate environment (including that caused by health-care waste). Surveillance allows an outbreak of infection to be recognized and investigated and provides a basis for introducing control measures, for assessing the efficacy of those measures and of the routine preventive measures taken by the establishment, and for reducing the level of avoidable infection. It will also ensure that the control measures have maximum effect and are as cost-effective as possible.

Conclusion

Health care waste management is a community problem. The consequences thereof are many and varied. Increasing rate of waste generation, its unscrupulous segregation and improper disposal call for halting and reversal of upward trends of overall mismanagement. Hazardous waste management rules-2005 are force, but the hazardous waste management practices have not been / are not being given due importance in Dindigul. Merely having a squad of sweepers, who keep the hospital clean, but scavenge recyclable and reusable hazardous items like syringes and dumped the waste just across the wall is certainly not an answer.

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