# A STUDY ON COST DETAILS OF BIO MEDICAL WASTE MANAGEMENT IN COIMBATORE DISTRICT

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**Abstract**

*This paper is a sincere effort to assess the biomedical waste management practices and its impact with special reference Coimbatore hospitals. The study was confined to the major district of Coimbatore where hospitals are located. The views of enforcement authorities on the biomedical waste management practices and its extent were also elicited. A neighbourhood survey was conducted to assess the views of people who reside near these hospitals in order to find out the difficulties they face due to the biomedical waste generated in these hospitals. Survey method was adopted for the study. Major statistical techniques such as coefficient of correlation and Factor Analysis were done in order to analyse data. The study found that majority of the hospitals studied depends on IMA Goes Eco-friendly (IMAGE) facility, a waste treatment facility provided by Indian Medical Association (IMA) for biomedical waste disposal and treatment. But the number of professionally trained staff for biomedical waste management is very few in all the hospitals. Use of gloves is observed by all the hospitals studied. But it was found that majority of the hospitals were ignorant about importance of using face masks in preventing the hazards posed by biomedical waste*

**Keywords:** Biomedical waste, Coimbatore hospitals, Correlation.

## INTRODUCTION

Appropriate biomedical waste (BMW) disposal is very important, from public health point of view, and implementing it is really a challenging task. The World Health Organization (WHO) reports that health-care wastes are the ones generated by health-care activities including a broad range of materials, from used needles and syringes to soiled dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices, and radioactive materials. As per Government of India gazette, "bio-medical waste" is defined as any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps.

BMWs are generated from hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories, blood banks, AYUSH hospitals, clinical establishments, research or educational institutions, health camps, medical or surgical camps, vaccination camps, blood donation camps, first aid rooms of schools, forensic laboratories, and research laboratories. Although of the total amount of waste generated by health-care activities, about 85% in general, is nonhazardous waste, the remaining 15% is considered hazardous material that may be infectious, toxic, or radioactive and it is important for a proper BMW disposal. Health-care waste contains potentially harmful microorganisms, which can infect hospital patients, health workers, and the general public. In this article, we review the rules of BMW disposal laid down by the Government of India from time to time and the published literature evidence related to the practice of BMW disposal across the states of India, and also where we feel the gap needs to be filled.

## REVIEW OF LITERATURE

**Panduranga, Murthy, Leelaja and Hossmani (2014)** studied the biomedical waste disposal and management in some major hospitals in Mysore city. The study was conducted in six major hospitals including Apollo Hospital by analysing the procurement lists for six months. They found that in the 3 of the hospitals, no proper disposal methods were employed when compared to the remaining hospitals.

**Vyas, Urvij, and Hemal (2015)** recommend plasma pyrolysis, an innovative technology to treat hospital waste, in place of incinerators. They are of the opinion that

pathogenic, sharp and infectious wastes can be disposed with this technique where the leftover will be negligible with no additional cost of treatment. This kind of treatment is also causing no environmental degradation like incinerators.

**Bhaskar, Nidugala and Avadhani (2016)** assessed the knowledge and practices of healthcare providers in handling biomedical waste Mangalore city. The study was conducted in the year January 2011. The sample consisted of 58 doctors, 62 nurses, 43 laboratory technicians and 53 non-teaching staff. They found that the awareness level on collection, segregation and disposal of biomedical waste of most of the sampled respondents is moderate. Among them, nurses have the highest percentage of awareness (61.3%) followed by doctors (46.6%). While 37.7% of non-teaching staff has good awareness, laboratory technicians were found to be having the lowest level of awareness (27.9%). Most of the doctors were of the opinion that even though the cost of biomedical waste disposal is very expensive, it cannot be comprised as improper handling may spread infectious diseases. The study found that about 18% of doctors dump the medical waste in the municipal garbage or using it as landfill. Sharing of expenses of infrastructure development for medical waste handling by government, public bodies and voluntary organizations is mooted by the authors. According to the authors inclusion of biomedical waste management as a subject in the curricula of healthcare education is urgent.

**Mohan, Prasad and Sai's (2017)** designed to analyze the effectiveness of training programme conducted on bio medical waste management. A sample of 38 staff nurses has been randomly selected from a 1000 bedded tertiary care teaching hospital and training was provided to them on various factors related to bio medical waste management. The various factors under training include definition, categories of bio medical waste, classification, process of waste management etc. The assessment tool basically followed is the Kirk Patrick's model of training evaluation consisting of reaction evaluation and learning evaluation through a structured questionnaire with before and after training programme. The marks obtained by the respondents before training and after training have been analyzed. The Wilcoxon matched pairs test has been applied to analyze the data. The analysis reveals that there is a significant improvement in the skill levels of the

sample respondents after undergoing the training programme. The effectiveness of the training programme was also measured and rated by collecting the opinion of respondents. Questionnaire analysis showed that a large number of respondents gained knowledge on various aspects of bio medical waste management.

## STATEMENT OF PROBLEM

Improperly contained contaminated sharps pose greatest infectious risk associated with hospital waste. There is also theoretical health risk to medical waste handlers from pathogens that may be aerosolized during the compacting, grinding or shredding process that is associated with certain medical waste management or treatment practices. Physical (injury) and health hazards are also associated with the high operating temperatures of incinerators and steam sterilizers and with toxic gases vented into the atmosphere after waste treatment. Public impacts are confined to esthetic degradation of the environment from careless disposal and the environmental impact of improperly operated incinerators or other medical waste treatment equipment. There may be increased risk of nosocomial infections in patients due to poor waste management. Improper waste management can lead to change in microbial ecology and spread of antibiotic resistance.

## OBJECTIVES OF THE STUDY

1) To find out the biomedical waste cost incurred in selected hospitals.
2) To analyze the initiatives of hospitals for environmental protection and problems faced by the sample in Coimbatore.

## HYPOTHESES OF THE STUDY

1) There is no significant association between environmental protection and problems faced by the hospital.
2) Biomedical waste management strategies and environment protection strategies does not have significant impact on cost of biomedical waste management.

## METHODOLOGY

The present study is a descriptive research. The primary data was collected from the nurses of the selected hospitals in Coimbatore city. For the purpose of collection of data, interview schedules were prepared separately to cover nurses. The interview schedules are

prepared in such a way that they are simple and understandable so as to enable the respondents to express their opinions freely and frankly. Adequate care has been taken to collect unbiased data from the respondents. Hence the researcher collect data from 250 nurses i.e., 50 nurses from each private hospital in Coimbatore district. Thus **disproportionate random sampling** was used in this study.

## RESULTS AND DISCUSSION

### RELIABILITY TEST

**Table 1**

**Indicating the reliability of the data**

| S.no | Name of construct | Number of items | Cronbach alpha |
|---|---|---|---|
| 1) | Cost of biomedical waste | 7 | 0.76 |
| 2) | Waste management system | 6 | 0.79 |
| 3) | Management of hazardous substances | 7 | 0.81 |
| 4) | Energy conservation | 7 | 0.82 |
| 5) | Green environment | 5 | 0.78 |
| 6) | Recyclability | 3 | 0.74 |
| 7) | Green building initiative | 7 | 0.73 |

**Source:** Primary data

The above table shows the reliability of the data collection by the researcher. According to the standard norm the cronbach alpha should be more than 0.7. It is identified that the entire **cronbach alpha** for value of the Constructs are at the satisfactory level. Hence the constructs are found to be reliable.

### CORRELATION AND REGRESSSION

**Table 2**

**Coefficient of correlation between various biomedical waste management strategies, environment protection strategies and cost associated with it**

| S.No. | Strategies | R-Value | Sig. |
|---|---|---|---|
| ***Biomedical waste management strategies*** | | | |
| **1** | Segregation of waste | **0.61** | **0.001*** |

| | | | |
|---|---|---|---|
| **2** | Recycling strategy | **0.58** | **0.001*** |
| **3** | Medical waste audit | **0.55** | **0.001*** |
| **4** | Establishment of green team for biomedical waste management | **0.49** | **0.001*** |
| ***Environment protection strategies*** | | | |
| **5** | Waste management system | **0.71** | **0.001*** |
| **6** | Management of hazardous substances | **0.69** | **0.001*** |
| **7** | Energy conservation | **0.64** | **0.001*** |
| **8** | Green environment | **0.63** | **0.001*** |
| **9** | Recyclability | **0.68** | **0.001*** |
| **10** | Green building initiative | **0.54** | **0.001*** |

**Source**: Primary data

The above table shows **the level of waste management strategies in hospital as a part of environment protection strategies**. The table depicts that the results of coefficient of correlation that check the relationship between biomedical waste management strategies, environment protection strategies and cost associated with it. The study shows that all the variables have a positive relationship between the biomedical and cost. It was identified that among the biomedical waste management strategy segregation of waste has highest positive correlation. Whereas establish of green team for biomedical waste management system has lowest positive correlation. Among the environment strategy waste management system as the highest positive correlation where as green building has lowest positive Correlation. Hence the null hypothesis is rejected and the researcher concludes that, there is a significant positive correlation between all biomedical waste management strategies environment protection strategies and the cost associated with it. These results are significant that 5% level of significance.

**Table 3**

**Impact of various biomedical waste management strategies and environment protection strategies on the cost of biomedical waste management**

| Model | Variables | UC | | SC | T | Sig |
|---|---|---|---|---|---|---|
| | | **B** | **SE** | **Beta** | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Impact of various biomedical waste management strategies and environment protection strategies on the cost of biomedical waste management** | **(Constant)** | 15.37 | | | | 0.001* |
| | Segregation of waste | 0.45 | 0.02 | 0.44 | 22.5 | **0.001*** |
| | Recycling strategy | 0.56 | 0.06 | 0.57 | 9.33 | **0.001*** |
| | Medical waste audit | 0.67 | 0.04 | 0.65 | 16.75 | **0.001*** |
| | Establishment of green team for biomedical waste management | 0.59 | 0.03 | 0.57 | 19.66 | **0.001*** |
| | Waste management system | 0.66 | 0.01 | 0.65 | 66 | **0.001*** |
| | Management of hazardous substances | 0.7 | 0.04 | 0.69 | 17.5 | **0.001*** |
| | Energy conservation | 0.64 | 0.03 | 0.66 | 21.33 | **0.001*** |
| | Green environment | 0.79 | 0.04 | 0.80 | 19.75 | **0.001*** |
| | Recyclability | 0.77 | 0.03 | 0.75 | 25.66 | **0.001*** |
| | Green building initiative | 0.68 | 0.02 | 0.69 | 34 | **0.001*** |

***Model summary***

| **R** | R-Square | Adjusted R-Square | Std. error | Durbin Watson | F | Sig. |
|---|---|---|---|---|---|---|
| 0.67 | 0.45 | 0.43 | 0.14 | 1.84 | 124.54 | **0.001*** |

***Dependent Variable: Cost of biomedical waste management***

**Source**: Primary data

The above table shows that result of multiple regression analysis. That checks the impact of various biomedical waste management strategies and environment protection strategies on the cost of biomedical waste management. The $R^2$ value shows that 67% changes in the dependent variable will be explained by changes in independent variable. The $R^2$ value shows that any changes in the existing model will leads to 45% changes in the dependent variable. The adjusted $R^2$ value shows that, the $R^2$ value shows the absence of multicollinearity issues in the model. The Durbin Watson Statistics proves the absence of auto correlation issues in the model. A significant "F" statistics in the ANOVA shows the efficiency of $R^2$ value.

The standardize coefficient of beta shows the relative importance of each variable in the regression model. The study shows that green environment and recyclability has highest impact on cost followed by management of hazardous substance and green building initiatives. Variables Such as segregation of Waste and recycling strategy have the lowest impact on the cost and the entire beta coefficients are significant. Since all the T values are significant and P values

are less than 0.05. Hence the null hypothesis rejected and all biomedical waste management strategies and environment Protection strategies have significant impact on cost of biomedical waste management. The results are significance that 5% level of significant.

## CHI-SQUARE ANALYSIS

**Table 4**

**Association between initiatives of hospitals for environment protection and various problems faced by hospitals**

| Environment protection strategies | Chi-square test | | |
|---|---|---|---|
| | Pearson chi-square | D.O.F. | Asymp.sig. |
| Waste management system | 64.56 | 2 | **0.001*** |
| Management of hazardous substances | 110.25 | 2 | **0.001*** |
| Energy conservation | 98.36 | 2 | **0.001*** |
| Green environment | 74.15 | 2 | **0.001*** |
| Recyclability | 69.14 | 2 | **0.001*** |
| Green building initiative | 58.14 | 2 | **0.001*** |

**Source**: Primary data

The above table checks association between initiatives of hospital for environmental protection and various problem faced by hospitals. The result shows that there is significant association between all the initiative of hospitals for environment protection and various problems facing by hospitals. Since all the P values are less than 0.05. Hence the null hypothesis rejected and there is a significant association between environment protection and various problems faced by the hospitals. The results are significance that 5% level of significant.

**Table 5**

**Checking the association between amounts invested in biomedical waste management and initiatives of hospitals for environment protection**

| Environment protection strategies | Chi-square test |
|---|---|

| | **Pearson chi-square** | **D.O.F** | **Asymp.sig.** |
|---|---|---|---|
| Waste management system | 25.67 | 3 | **0.001*** |
| Management of hazardous substances | 48.54 | 3 | **0.001*** |
| Energy conservation | 64.15 | 3 | **0.001*** |
| Green environment | 77.29 | 3 | **0.001*** |
| Recyclability | 84.15 | 3 | **0.001*** |
| Green building initiative | 69.34 | 3 | **0.001*** |

**Source:** Primary data

The above table checks **association amounts invested in biomedical waste management and initiatives of hospitals for environment protection**. The result shows that there is significant association between amounts invested in biomedical waste management and initiatives of hospitals for environment protection. Since all the P values are less than 0.05. Hence the null hypothesis rejected and there is a significant association between amounts invested in biomedical waste management and initiatives of hospitals for environment protection. The results are significance that 5% level of significant.

**Table 6**

**Checking the association between tenure of investment in biomedical waste management and initiatives of hospitals for environment protection**

| **Environment protection strategies** | **Chi-square test** | | |
|---|---|---|---|
| | **Pearson chi-square** | **D.O.F** | **Asymp.sig.** |
| Waste management system | 1.26 | 3 | 0.06 |
| Management of hazardous substances | 0.74 | 3 | 0.18 |
| Energy conservation | 1.39 | 3 | 0.09 |
| Green environment | 1.45 | 3 | 0.07 |
| Recyclability | 0.87 | 3 | 0.24 |
| Green building initiative | 0.79 | 3 | 0.11 |

**Source:** Primary data

The above table checks **association between tenure of investment in biomedical waste management and initiatives of hospitals for environment protection**. The result shows that there is no significant association between all the initiative of hospitals for environment protection and various problems facing by hospitals. Since all the P values are greater than 0.05. Hence the null hypothesis accepted and there is no significant association between environment protection and various problems faced by the hospitals. The results are significance that 5% level of significant.

**Table 7**

**Checking the association between hospital involving biomedical waste management and initiatives of hospitals for environment protection**

| **Environment protection strategies** | **Chi-square test** | | |
|---|---|---|---|
| | **Pearson chi-square** | **D.O.F** | **Asymp.sig.** |
| Waste management system | 11.56 | 2 | **0.001*** |
| Management of hazardous substances | 48.45 | 2 | **0.001*** |
| Energy conservation | 64.21 | 2 | **0.001*** |
| Green environment | 78.25 | 2 | **0.001*** |
| Recyclability | 94.15 | 2 | **0.001*** |
| Green building initiative | 67.29 | 2 | **0.001*** |

**Source**: Primary data

The above table checks **association between hospital involving biomedical waste management and initiatives of hospitals for environment protection**. The result shows that there is significant association between all the initiative of hospitals for environment protection and various problems facing by hospitals. Since all the P values are 0.05. Hence the null hypothesis rejected and there is a significant association between environment protection and various problems faced by the hospitals. The results are significance that 5% level of significant.

**Table 8**

**Checking the association between amounts invested in biomedical waste management and initiatives of hospitals for environment protection**

| Environment protection strategies | Chi-square test | | |
|---|---|---|---|
| | **Pearson chi-square** | **D.O.F** | **Asymp.sig.** |
| Waste management system | 48.65 | 3 | **0.001*** |
| Management of hazardous substances | 36.54 | 3 | **0.001*** |
| Energy conservation | 12.58 | 3 | **0.001*** |
| Green environment | 69.35 | 3 | **0.001*** |
| Recyclability | 78.12 | 3 | **0.001*** |
| Green building initiative | 84.56 | 3 | **0.001*** |

**Source:** Primary data

The above table checks **association between amounts invested in biomedical waste management and initiatives of hospitals for environment protection**. The result shows that there is significant association between all the initiative of hospitals for environment protection and various problems facing by hospitals. Since all the P values are 0.05. Hence the null hypothesis rejected and there is a significant association between environment protection and various problems faced by the hospitals. The results are significance that 5% level of significant.

**Table 9**

**Checking the association between supports received in biomedical waste management and initiatives of hospitals for environment protection**

| Environment protection strategies | Chi-square test | | |
|---|---|---|---|
| | **Pearson chi-square** | **D.O.F** | **Asymp.sig.** |
| Waste management system | 104.54 | 3 | **0.001*** |
| Management of hazardous substances | 98.47 | 3 | **0.001*** |

| | | | |
|---|---|---|---|
| Energy conservation | 85.26 | 3 | **0.001*** |
| Green environment | 78.45 | 3 | **0.001*** |
| Recyclability | 66.14 | 3 | **0.001*** |
| Green building initiative | 90.25 | 3 | **0.001*** |

**Source**: Primary data

The above table checks **association between supports received in biomedical waste management and initiatives of hospitals for environment protection**. The result shows that there is significant association between all the initiative of hospitals for environment protection and various problems facing by hospitals. Since all the P values are 0.05. Hence the null hypothesis rejected and there is a significant association between environment protection and various problems faced by the hospitals. The results are significance that 5% level of significant.

**Table 10**

**Checking the association between effectiveness of biomedical waste management and initiatives of hospitals for environment protection**

| **Environment protection strategies** | **Chi-square test** | | |
|---|---|---|---|
| | **Pearson chi-square** | **D.O.F** | **Asymp.sig.** |
| Waste management system | 94.56 | 3 | **0.001*** |
| Management of hazardous substances | 83.65 | 3 | **0.001*** |
| Energy conservation | 74.25 | 3 | **0.001*** |
| Green environment | 79.84 | 3 | **0.001*** |
| Recyclability | 93.45 | 3 | **0.001*** |
| Green building initiative | 61.23 | 3 | **0.001*** |

**Source:** Primary data

The above table checks **association between effectiveness of biomedical waste management and initiatives of hospitals for environment protection**. The result shows that there is significant association between all the initiative of hospitals for environment protection and various problems facing by hospitals. Since all the P values are 0.05. Hence the null

hypothesis rejected and there is a significant association between environment protection and various problems faced by the hospitals. The results are significance that 5% level of significant.

## CONCLUSION

In conclusion, BMW is grossly deficient at both macro and micro levels in different parts of India. Urgent interventions for improving systems capacity and greater resource commitment are required, specifically focussing on primary care health facilities both in public and private sectors. Accountable and responsive governance is likely to institute appropriate processes and establish acceptable BMW system. The human element is far more important than the technology. Almost any system of treatment and disposal of BMW that is operated by well-trained and well-motivated staff can provide more protection for staff, patients, and the community than an expensive and sophisticated system that is managed by staff who do not understand the risks and the importance of their contributions. The present study was done to evaluate the compliance of biomedical waste management among different patient care areas in a tertiary care hospital in Coimbatore based on a checklist. It was found that more importance needs to be rested for 'mutilation of recyclable waste' especially in wards. Hospital administrators may need to devise and implement a plan for providing adequate and appropriate training to Health Care Workers (HCW) so as to tackle the deficiencies detected in the study. In order to protect our environment and public health must sensitize to this important issue. Although the knowledge of biomedical waste management is adequate among the doctors and other health care workers, there was a deficit in practical implementation. Also, data about the knowledge and compliance was not adequate in the locality under study. Hence, this study was done to analyse the compliance of biomedical waste management in hospitals so as to create awareness about safe practices from the point of generation to final disposal. Recommendations and follow-up were made for the improvement of biomedical waste management practices of the hospital.

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