A Study on the Effectiveness of the Biomedical Waste Management System in Selected Hospitals in Trichy Region

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Abstract— Biomedical Waste Management has emerged as an issue of major concern. Hospitals play a vital role in offering the basic and advanced technology for the people but at the same time the amount of waste generated have to be considered. The waste generated have an impact over the public and the environment if not treated or managed properly. This study is to know the level of awareness and knowledge among the medical personnel, study the existing Biomedical Waste Management System in the selected hospitals and to find out the effectiveness of Biomedical Waste Management in the selected hospitals in Trichy region. A pilot study was conducted prior to the main study. It was conducted through survey method using the questionnaire and through site visitation. The collected data was analysed using the Correlation and ANOVA. It was found that the demographic variables have an influence over the Management of biomedical waste. The level of awareness and knowledge among the medical personnel is good but when it comes to application, it is less. Recommendations were given to improve the Management of Biomedical Waste for the benefit of everyone thereby creating a healthier environment. Therefore it is necessary to manage the biomedical waste in a proper manner to safeguard the health and hygiene of the public and also to control the environmental pollution.

Key words: Biomedical Waste Management, Hospitals, Effectiveness, Environment

I. INTRODUCTION

Biomedical waste has to be properly managed in order to avoid the risks associated with it. Hospitals which provide treatment for the disease is also prone to be a place of disease spreading if the biomedical waste are not properly managed. Biomedical waste has to be properly segregated at the point of source itself. It is important to separate infectious waste from the non-infectious waste. The waste are being segregated in different colour bags in the hospitals. After the waste segregation, the waste has to be treated properly by any of the following methods such as Double chambered incineration, Autoclaving, Hydroclaving, Microwaving, Plasma torch, Chemical treatment, etc. After the treatment, the biomedical waste should be stored in the hospitals in the storage area. The waste should not be stored beyond 48 hours. Finally the waste has to be transported to the final site for the final disposal of the waste. All these have to be properly managed to avoid the risks associated such as spread of disease and infections, injuries due to sharp items for the medical practitioners.

II. REVIEW OF LITERATURE

Pornwipa Klangsin & Anna K.Harding, 2011 Investigated the Medical waste treatment and disposal methods used by the hospitals in Oregon, Washington and Idaho. The results reported focussed on the infectious waste segregation, waste treatment and disposal practices and the operating status of the incinerators in these three states.

Medical Waste Committee, 2012 Examined the Medical waste disposal. They discussed about the various techniques used for managing the biomedical waste. They found that incineration has been the most effective method for destroying the waste.

Dasimah Omar et al, 2012 Carried out the study to find the variations and similarities in the practice of clinical waste management practices within three district hospitals located in Johor. Microsoft Excel and relevant statistical tools like ANOVA was used to analyse the data collected. The results showed that similar activities take place within hospitals and variations in hospitals was due to the internal and external factors which affects the clinical waste management.

C.Bokhoree et al, 2013 Addressed the risks associated with medical waste management in Mauritius. One private and one public was taken for analysis. Observations were made in hospitals and results demonstrated that the waste management is different in hospitals. Recommendations were given to improve the practices in the medical institutions of Mauritius.

Harender Singh et al, 2014 Focussed on the Management of biomedical waste that awareness and knowledge should be given to the medical personnel. For the better results, the level of training and education regarding the biomedical waste have to be given much importance.

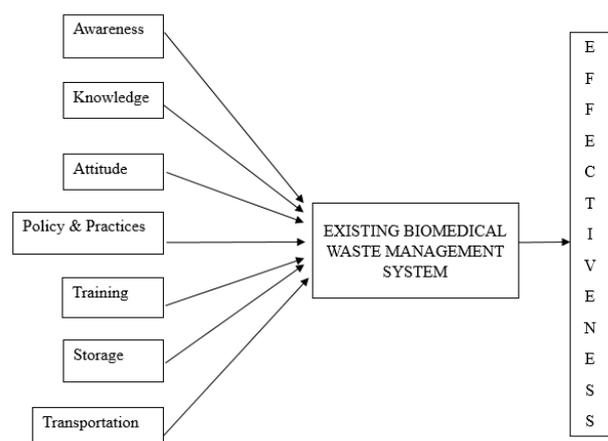## III. BIOMEDICAL WASTE MANAGEMENT FRAMEWORK

Fig. 1

The Biomedical waste management framework is framed by considering the various factors such as awareness, knowledge, attitude, policy and practices, training, storage and transportation of biomedical waste management. These factors will have an influence over the existing biomedical

waste management system in the hospitals which in turn lead to the effectiveness of the biomedical waste management.

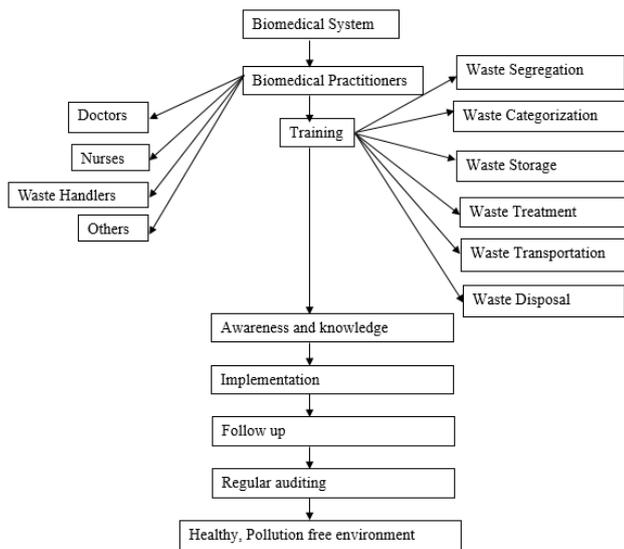## IV. MODEL DEVELOPED FOR THE PROPER MANAGEMENT OF BIOMEDICAL WASTE

Fig. 2

The Biomedical system revolves around the biomedical practitioners which include the Doctors, Nurses, Waste Handlers, Others (House Keeping). Proper training about the waste segregation, categorization, storage, treatment, transportation and disposal has to be given to the biomedical practitioners. Once the training is given to the respondents, they will be awareness of the importance of biomedical waste management and hence knowledge will be imposed to them through the training. This is considered to be most important since the training lacked in many hospitals as per the review of literatures. This process has to be properly implemented and followed up. Regular auditing is also needed for proper management of biomedical waste. All these will lead to a healthy, pollution free environment.

V. OBJECTIVES OF THE STUDY

− To find out the level of awareness, knowledge among the medical practitioners in the selected hospitals
− To know the demographic profile of the medical practitioners
− To study the existing biomedical waste management system in the selected hospitals
− To determine the effectiveness of the biomedical waste management system in the selected hospitals

VI. SCOPE OF THE STUDY

This study will be beneficial in knowing the level of awareness and knowledge among the medical practitioners and thereby helps in improving the biomedical waste management system where there is improper management.

VII. RESEARCH METHODOLOGY

A. Research Design

Descriptive study

B. Data collection source

This study was done with the primary and secondary set of data. The primary data was collected through the structured questionnaire from the respondents of both the private and government hospitals in the Trichy region. The secondary data was collected from the funded projects, articles, journals, books, thesis, etc.

C. Methods of Data collection

The data was collected through Questionnaire and site visitation (field visit). The questionnaires were given to the doctors, nurses, waste handlers and others who are involved in the management of biomedical waste.

D. Questionnaire design

The scaling technique used is Likert-type scale to obtain the data from the respondents. The structured questionnaire with open and close ended questions are used for the study.

E. Area of the study

The hospitals with 15-150 beds were selected for the study in the Trichy region.

F. Sampling design

The sample was collected by using the non-probability technique (convenient sampling method). The sample size of 32 was taken for conducting the pilot study from the selected hospitals (three). The sample size of 123 was collected from seven hospitals for the main study.

G. Pilot study

The pilot study was conducted prior to the main study. The structured questionnaire was given to the respondents at three hospitals. The data was collected through Questionnaire and site visitation. The questionnaires were given to the doctors, nurses, waste handlers and others who are involved in the management of biomedical waste. A sample of 32 was taken to test the validity and reliability of the questionnaire.

H. Factor analysis

Factor analysis was used to identify the dimensions and reduce the number of variables. It is used to check the validity of the questionnaire.

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5
Stored beyond 24 hrs	.897	.073	.026	.165	.041
Need transport	.838	-.099	.327	-.087	.174
Team work	.805	-.167	-.182	.290	.328
Improper-major consequences	.794	-.004	.388	-.194	.020
Adequate training	.714	.549	.132	-.259	-.138
Not an issue	-.681	-.029	-.222	-.199	-.018
Need for BMW	.668	-.085	.567	-.019	.260
Increase financial burden	.058	-.905	.218	-.092	-.050
Signage	.030	.900	.192	.008	-.014
Storage area	-.029	.887	.343	.058	.169
Report PCB	.553	.609	.280	-.068	.143
Job description	.324	-.595	.247	.446	-.319
Labelling	.037	.086	.887	.236	.172
Adequate transport	.336	.215	.806	.044	-.187
Easy transport	.342	.094	.739	-.253	-.315
Monitored	.047	-.213	.183	.904	-.091
Department meeting	.159	.260	-.265	.763	.289
Programs conducted	.171	.529	.154	.684	-.088
Duration of training	.482	.102	.031	-.611	-.199
Treated	.254	.134	-.047	.037	.846
Training needed	.321	.369	-.105	.019	.657
Extra burden	-.502	-.251	.189	.120	.590

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 9 iterations.

Table 1: Validity check

Reliability Statistics

Cronbach's Alpha	N of Items
.742	34

Table 2: Reliability check

Reliability check was done to check the reliability of the questionnaire. Cronbach's Alpha value is 0.742 which means the questionnaire is highly reliable.

After the validity and reliability check, few questions were removed from the questionnaire and few needed questions were added after conducting the pilot study through data collection from the field visit and issue of questionnaire.

VIII. LIMITATIONS OF THE STUDY

It was not possible to collect data from more hospitals since there was restriction in giving permission to collect the data. The data obtained might not be accurate since the respondents tried to safeguard the image of the hospital.

IX. STATISTICAL TOOLS USED

For the purpose of analysis and interpretation, the data collected from the questionnaires were taken into consideration and analysed using the following.
− Correlation
− ANOVA

X. DATA ANALYSIS AND INTERPRETATION

A. Correlation

1) Hypothesis 1
− H_0: There is no significant relationship between the management practice of using protective gears and awareness that improper management lead to major consequences.
− H_1: There is significant relationship between the management practice of using protective gears and awareness that improper management lead to major consequences.

Correlations

		Use of protective gears	Improper lead to major consequences
Use of protective gears	Pearson Correlation	1	.303**
	Sig. (2-tailed)		.001
	N	123	123
Improper lead to major consequences	Pearson Correlation	.303**	1
	Sig. (2-tailed)	.001	
	N	123	123

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3: Correlation for Hypothesis 1

Interpretation

From the table 10.1.1, it is inferred that Pearson's r value is positive which means there is positive correlation between the management practice of using protective gears and awareness that improper management lead to major consequences. Sig (2-Tailed) value is less than the critical value 0.05 which means there is statistically significant correlations between the two variables. Therefore there is positive relationship between the management practice of using protective gears and awareness that improper management lead to major consequences.

Inference

Therefore there is positive relationship between the management practice of using protective gears and awareness that improper management lead to major consequences.

2) Hypothesis 2
− H_0: There is no significant relationship between the knowledge that waste should not be stored beyond 48 hours and management practice of monitoring by higher authority.
− H_1: There is significant relationship between the knowledge that waste should not be stored beyond 48 hours and management practice of monitoring by higher authority.

Correlations

		Not to be stored beyond 48 hours	Monitored by higher authority
Not to be stored beyond 48 hours	Pearson Correlation	1	.217*
	Sig. (2-tailed)		.016
	N	123	123
Monitored by higher authority	Pearson Correlation	.217*	1
	Sig. (2-tailed)	.016	
	N	123	123

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4: Correlation for Hypothesis 2

Interpretation

From the table 10.1.2, it is inferred that Pearson's r value is positive which means there is positive correlation between the knowledge that waste should not be stored beyond 48 hours and management practice of monitoring by higher authority. Sig (2-Tailed) value is less than the critical value 0.05 which means there is statistically significant correlations between the two variables. Therefore there is positive relationship between the knowledge that waste should not be stored beyond 48 hours and management practice of monitoring by higher authority.

Inference

Therefore there is positive relationship between the knowledge that waste should not be stored beyond 48 hours and management practice of monitoring by higher authority.

B. ANOVA

1) Hypothesis 1
− H_0: There is no significant difference between the experience of the respondent and the training needed for them.
− H_1: There is significant difference between the experience of the respondent and the training needed for them.

ANOVA

Training

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1089.000	3	363.000	.271	.846
Within Groups	21449.200	16	1340.575		
Total	22538.200	19			

Table 5: ANOVA for Hypothesis 1

Interpretation

From the table 10.2.1, it is inferred that Sig. value .846 is greater than the critical value 0.05. Hence Ho is accepted and H_1 is rejected. Therefore there is no significant difference between the experience of the respondent and the training needed for them.

Inference

Therefore there is no significant difference between the experience of the respondent and the training needed for them.

2)   Hypothesis 2
−   H$_0$: There is no significant difference between the designation of the respondent and their attitude towards Biomedical waste management as an extra burden on their work.
−   H$_1$: There is significant difference between the designation of the respondent and their attitude towards Biomedical waste management as an extra burden on their work.

ANOVA

Burden

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4245.800	3	1415.267	13.156	.000
Within Groups	1721.200	16	107.575		
Total	5967.000	19			

Table 6: ANOVA for Hypothesis 2

Interpretation

From the table 10.2.2, it is inferred that Sig. value .000 is lesser than the critical value 0.05. Hence Ho is rejected and H$_1$ is accepted. Therefore there is significant difference between the designation of the respondent and their attitude towards Biomedical waste management as an extra burden on their work.

Inference

Therefore there is significant difference between the designation of the respondent and their attitude towards Biomedical waste management as an extra burden on their work.

XI.   FINDINGS, RECOMMENDATIONS AND CONCLUSION

A. Findings of the Study

1) Correlation
−   There is positive relationship between the management practice of using protective gears and awareness that improper management lead to major consequences.
−   There is positive relationship between the knowledge that waste should not be stored beyond 48 hours and management practice of monitoring by higher authority.

2) ANOVA
−   There is no significant difference between the experience of the respondent and the training needed for them.
−   There is significant difference between the designation of the respondent and their attitude towards Biomedical waste management as an extra burden on their work.

B. Recommendations
−   Biomedical waste should not be mixed with the other garbage waste.
−   Biomedical waste Management Board can be established in each District.
−   Training for the newly joined staff has to be provided.
−   Practical training should be given to all the staff in the hospitals.
−   Hospitals should provide the necessary protective gears for all the staff in the hospitals.

−   Protective gears should be worn by the house keeping staff and waste handlers.
−   There should be sufficient manpower available in the hospitals in order to take care of the work in the hospitals.
−   Public should be aware of the consequences of the Biomedical waste. Awareness should be given in their own language for better understanding
−   Diagrams can be used in the bins to avoid the mistake of mixing up of waste.
−   Containers should be closed properly.
−   Patients and visitors should be aware and avoid mixing up of the general waste with the hospital waste like syringes, catheter tubes, etc.
−   Respondents suggested to change the syringe disposal method.
−   There should be proper supervision in order to avoid the issues in Biomedical Waste Management.
−   There should be proper signage in the place of waste storage in the hospitals.

XII.   CONCLUSION

The level of awareness and knowledge is good but when it comes to application, it is less. The existing system of Biomedical waste management system in the hospitals are not uniform (syringe disposal system). It is important to protect our environment and health of the community by addressing this important issue. Therefore it is important to have a proper management of Biomedical waste in order to have a safe and healthier environment. This study paves way for future research.

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