

# Assessment of Effectiveness of Educational Intervention on Practice among Bio-Medical Waste Handler

Dr. Asha. K. Pratinidhi<sup>1</sup>, Tukaram B. Zagade<sup>2</sup>, Dr. Satish V. Kakade<sup>3</sup>

<sup>1</sup>Director of Research, Krishna Institute of Medical Sciences University, Karad-415539 (Maharashtra), India

<sup>2</sup>Krishna Institute of Nursing Sciences, Krishna Institute of Medical Sciences University, Karad-415539 (Mahārāshtra), India

<sup>3</sup>Associate Professor, Department of Preventive and social medicine Krishna Institute of Medical Sciences University, Karad-415539 (Maharashtra), India

**Abstract:** ***Background:** The seriousness of improper bio-medical waste management was brought to the light during summer 1998. Data available from Indian studies, mostly hospitals, indicate that roughly about 1-5kg/ bed/day of waste is generated.<sup>1</sup> The Knowledge of medical, paramedical staff about the biomedical waste management is important to improve the biomedical waste management practices.<sup>2</sup> **Aim:** To improve environmental sanitation, reduce the risk of infectious and toxic waste to the biomedical waste handlers and the community. **Objectives:** To assess the status of practice among bio-medical waste handlers regarding disposal of biomedical waste in Krishna Hospital, Karad. To assess the status of practice among bio-medical waste handlers regarding disposal of biomedical waste after the educational Intervention. To determine the association of practice among bio-medical waste handlers with selected sociodemographic variables. **Material & Methods:** A before and after interventional study was carried out on the same group of participants' i.e. biomedical waste handlers at Krishna Hospital, Karad in the state of Maharashtra from October 2008 to September 2013. **Results:** Area wise effectiveness of educational intervention has shown an improvement in proportion of workers improvement related to practice correctly. The percentage improvement ranged from 6.4 to 78.1%. Least improvement was observed in the area of categorization of human anatomical waste and action to be taken after the needle stick injuries. In all except two areas there has been improvement in proportion of biomedical waste handlers practicing them correctly.*

**Keywords:** Biomedical waste management, Educational Intervention

## 1. Introduction

The establishment of large hospitals where hundreds to thousands of patients are treated, it has created a serious problem of bio-medical waste management. The seriousness of improper bio-medical waste management was brought to the light during summer 1998. In India studies have been carried out at local/regional levels in various hospitals. Data available from these studies, mostly hospitals, indicate that roughly about 1-5kg/ bed/day of waste is generated<sup>1</sup>.

Among all health care personnel, ward boys, sweepers, operation theatre and laboratory attendants have come into contact with biomedical waste during the process of segregation, collection, transport, storage and final disposal. The knowledge of medical, paramedical staff about the biomedical waste management is important to improve the biomedical waste management practices<sup>2</sup>.

## 2. Importance of This Study

The bio-medical waste requiring special attention includes those that are potentially infectious, sharps, e.g. needle, scalpels, objects capable of puncturing the skin, also plastic, pharmaceutical and chemically hazardous substances used in laboratories etc<sup>3</sup>.

A need clearly exists for education of at risk health care workers on the nature of the risk exposed by the medical waste and methods for their proper handling. Biomedical

waste treatment facilities are mostly licensed by the local government that have specified rules and laws regarding the possessing and disposal of waste. The laws ensure that general public is protected from any form of contamination<sup>1</sup>.

Worldwide, approximately 2 million workers experience a needle stick injuries each year. A needle stick injury could transmit hepatitis-B, Hepatitis-C or the Human Immunodeficiency Virus HIV. The risk of infection after exposure to the infected blood varies with the type of pathogen. The risk of transmission after exposure to HIV – infected blood is about 0.3% whereas it is estimated to be up to 100 times greater for Hepatitis –B virus (30%) and could be as high as 10% for Hepatitis C virus. A similar risk is associated with pre-existing cuts or wounds on the hands of waste handlers not using gloves while handling the waste<sup>4</sup>.

Recently a study conducted by the central pollution control board has been evaluated for the disposal procedure and found that almost 56% biomedical waste is disposed of with the municipal waste<sup>4</sup>.

The investigator has experienced in his professional experience that, most of the bio-medical waste handlers are unaware of the categories of biomedical waste, color coding of the containers, segregation, transportation, treatment and disposal etc. Considering above mentioned factors, it was thought that there is a need to update their knowledge and practices of disposal of hospital waste through educational intervention. The training would equip the biomedical waste handlers with latest information and knowledge about

disposal of hospital waste improving their work efficiency and enabling them to adopt safe practices of bio-medical waste disposal. A study was therefore undertaken at Krishna Hospital, Karad to find out effectiveness of the educational intervention on knowledge and practices of biomedical waste handlers.

### 3. Conceptual Framework

The conceptual framework provides a systematic approach to nursing research. The conceptual framework selected for the study was based on the general system theory by Ludwig Bertalanffy (1969) as explained by Putt<sup>5</sup>. The system is composed of a set of interactive elements and yet each system is distinct from the environment in which it exists. In all systems, the activities can be resolved in to an aggregation of a feedback circuit such as an input, throughput and an output. The feedback circuit helps in the maintenance of an intact system.

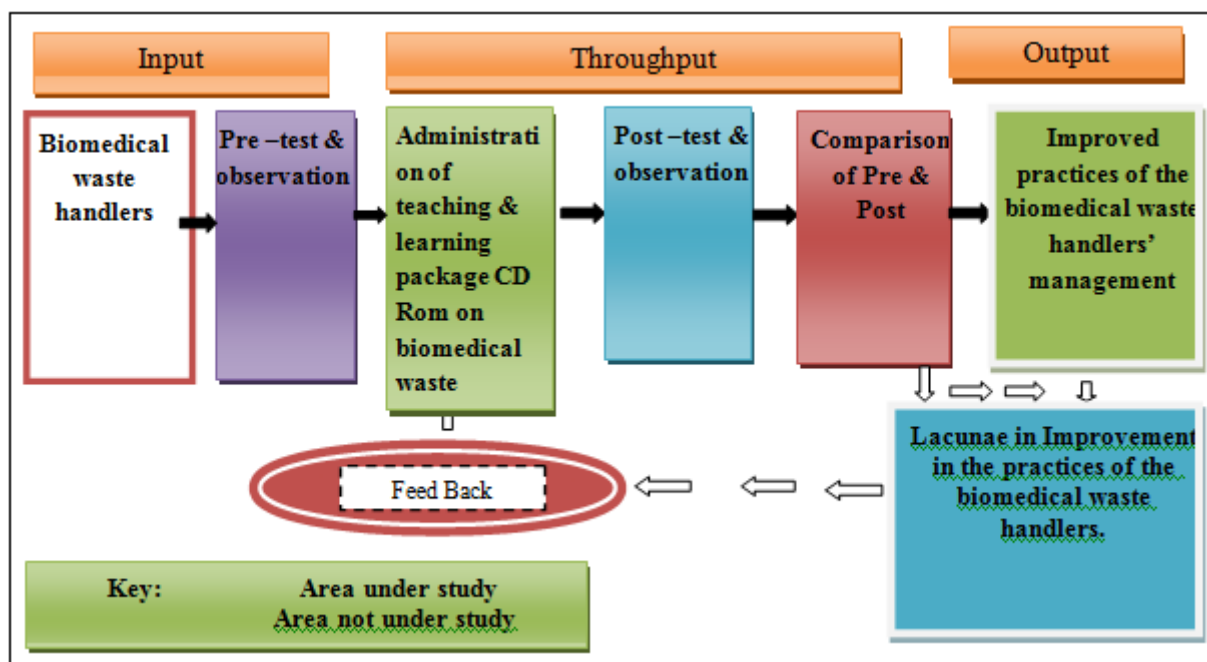


Figure 1: Conceptual Frame Work Based on the General System Model

### 4. Methodology

A before and after interventional study was carried out on the same group of participants' i.e. biomedical waste handlers.

#### 4.1 Sample and sampling technique

The 187 biomedical waste handlers from Krishna Hospital attached to K.I.M.S. Karad were included in the study which fulfilled the sampling criteria. A written informed consent was taken from all the willing workers. Enrollment of all biomedical waste handlers in the study was undertaken.

#### 4.2 Subjects

The participants of the present study comprised of 187 all biomedical waste handlers, who were working during October 2008 to July 2010 in Krishna Hospital attached to K.I.M.S. Karad.

#### 4.3 Variables

- **Independent variables-** Independent variable was Educational Intervention that is planned teaching and

audio-visual C D ROM presentation regarding biomedical waste management.

- **Dependent variables-** The dependent variables of this study were knowledge and practice, age, sex, educational status, work place and experience of biomedical waste handlers.

#### 4.4 Data Collection

A pre-tested structured questionnaire and observational check list was prepared and used for data collection. A Planned teaching and Audio-visual C D ROM presentation for the biomedical waste management was prepared based on guidelines from Govt. of India which are supported by Dept. for International Development (DFID) India<sup>7</sup> and Training Module on Biomedical waste Management (2009) by Regional Center for urban and Environmental Studies(RCUSE), All India Institute Of Local Self Government, Mumbai For Maharashtra Pollution Control Board<sup>8</sup>.

#### 4.5 Tool and Technique Structured Questionnaire

**Section A-** Dealt with the demographic data of the study population like, age, sex, educational status, experience, working place and previous in-service education regarding

biomedical waste management of biomedical waste handlers.

**Section B** – Consisted of a 33 observational items as per check list to observe the practices of biomedical waste handlers regarding biomedical waste management. One mark was given for each correct practice and 0 mark was given for each wrong practice. The range of possible score varied from a minimum of 0 to maximum 33. The practice score was arbitrarily graded as follows:

Poor : 0-11

Good : 12-22

Excellent: 23-33

**Inclusion criteria:**

1. Biomedical waste handlers who could understand Marathi language.
2. Biomedical waste handlers who were working in the Krishna hospital and K.I.M.S. Karad on the basis of both daily wages and permanent employee.
3. Biomedical waste handlers who were willing to participate in the study.

**4.6 Ethical clearance**

The study was approved by the Institutional Ethical committee of the Krishna Institute of Medical Sciences Deemed University, Karad Maharashtra, before the commencement of the study.

A written permission was obtained from the Dean of Krishna Institute of Medical Sciences, Karad. The pre-training interventional data were collected from 1<sup>st</sup> July 2009 to 30<sup>th</sup> April 2010. Each biomedical waste handler was interviewed to assess the knowledge. All wards were observed. The biomedical waste handlers were observed during their peak working time while they were handling biomedical waste between 5.00am to 7.00am, 1.00pm to 3.00pm and 9.00pm to 11.00pm.as per schedule.

To observe cuts and aberrations on the hands of biomedical waste handlers the workers were made to wash their hands thoroughly with soap and water. After drying the hands with clean towel observations with naked eye and observations under the 10 X lens were made. Application of India blue ink manufactured by Camlin Limited Talaja, India was undertaken after sterilization of the ink by autoclaving and cooling. Observations were made by naked eyes as well as by 10X magnifying lens after washing the hands with plain tap water. The blue ink was retained by the cuts and aberrated skin surface where as it was washed away to a large extent from the undamaged skin surfaces.

**5. Results**

In all 187 biomedical waste handlers were enrolled. Out of them 146(78.9%) were males and 41(21.1%) were females.

**Table 1:** Distribution of Biomedical Waste Handler According Age and Sex

Age in completed years	Sex				Total	
	Male		Female			
	No.	%	No.	%	No.	%
18 to 24 years	15 (100)	10.3	0 (00)	0	15 (100)	8.0
25 to 34 years	26(81.2)	17.8	6(18.8)	14.6	32(100)	17.1
35 to 44 years	55(79.7)	37.6	14(20.3)	34.1	69 (100)	36.8
>45 years	50(70.4)	34.2	21(29.6)	51.2	71(100)	37.9
Total	146(78.1%)	100	41(21.1%)	100	187(100.0)	100

Foot note\*Row wise percentages are given in parenthesis.  $\chi^2=6.93$ ,  $p=0.074$

Age of male and female biomedical waste handlers ranged from minimum 18years to maximum 59years and minimum 25years to maximum 59years respectively. Participants were working in different wards from different clinical disciplines. The proportion of female biomedical waste handlers increased with increasing age. There were 21(51.2%) female biomedical waste handlers above the age of 45 as compared to 6(14.6%) between 25 to 34years.

**Table 2:** Educational Status of Biomedical Waste Handlers

Educational status	Sex				Total	
	Male		Female			
	No.	%	No.	%	No.	%
Illiterates	6(50)	4.1	6(50)	14.6	12(100)	6.4
1 to 7 <sup>th</sup> Std	35(57.3)	23.9	26(42.7)	63.4	61(100)	32.6
8 <sup>th</sup> to 10 <sup>th</sup> Std	85(91.3)	58.2	8(8.7)	19.5	93(100)	49.7
11 <sup>th</sup> to 12 <sup>th</sup> Std	20(95.7)	13.6	1(4.8)	2.4	21(100)	11.2
Total	146(78.1%)	100	41(21.9%)	100	187(100)	100

\*Row wise percentages are given in parenthesis  $\chi^2 = 34.049$ ,  $p<0.001$

Majority 175 (93.6%) of the waste handlers were educated and had education from 1<sup>st</sup> to 12<sup>th</sup> standard. Only 21 (11.2%) could reach up to 11<sup>th</sup> to 12<sup>th</sup> standard and 12(6.4%) of waste handlers were illiterate. It was observed that male biomedical waste handlers were more educated than the female waste handlers. ( $\chi^2 = 34.049$ ,  $p<0.001$ ). Majority 132(70.5%) of the waste handlers were experienced and had experience of more than 10 years.

There was no significant difference in the experience of male and female waste handlers. The average experience in years of male biomedical waste handlers was 15.2 years with SD of 8.22 years as compared to females of 16.4 years with a SD of 8.07years.

**Table 3:** Comparison of Practice Score of Biomedical Waste Handlers Before and After the Educational Intervention (EI)

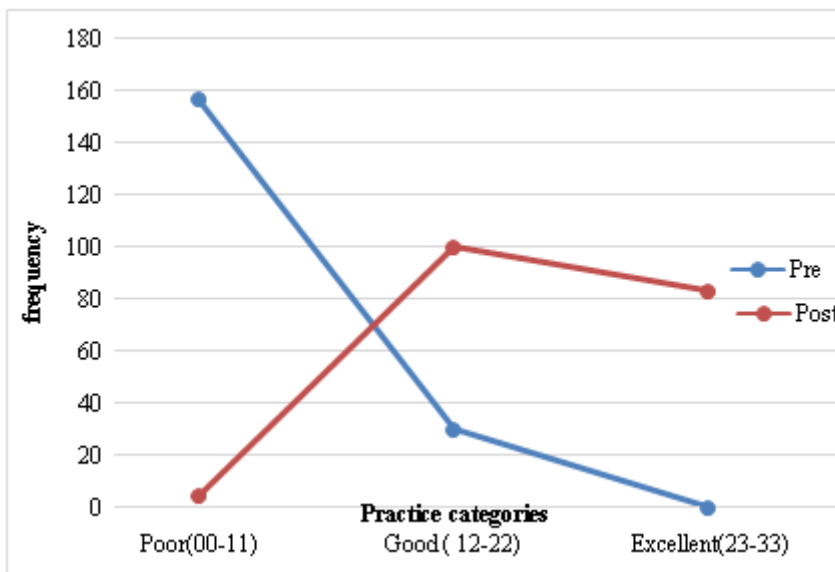
Time of Assessment	Biomedical Waste Handlers Scores			
	practice			diff
	N	Mean	SD	
Before E.I.	187	7.8	3.8	0.6
After E.I.	187	21.6	3.8	0.2
t value	39.1			
P value	<0.001			

Assessment of pre training and post training Practice was undertaken for all biomedical waste handlers. The mean pre training practice score was 7.8 with a S.D 3.8, which improved to 21.6 with a S.D. of 3.8 ( $t= 39.1, p<0.001$ ).

**Table 4:** Distribution of Subjects According to Practices Scores Before and After Educational Intervention

Practices Scores	Pre-Training		Post-Training	
	Frequency	%	Frequency	%
Poor(00-11)	157	83.9	04	2.1
Good ( 12-22)	30	16.0	100	53.4
Excellent(23-33)	00	00	83	44.3
Total	187	99.9	187	99.8

The biomedical waste handlers were grouped in three categories according to their practice scores in to poor, good and excellent scores obtained in pre-training- observation and post training-observation. (Table 4) Initially there were 157(83.9%) in the poor category, who all improved after educational intervention as seen in the post training observation results showing only 4(2.1%) persons in poor category. There was not a single worker in the excellent category of score before intervention which increased to 83(44.3%) in excellent category of practices.



**Diagram 1:** Frequency Distribution of Subjects According to Practice before and After Educational Intervention

Out of all biomedical waste handlers, 103 (55.0%) were wardboys and wardayas followed by 60 (32.0%) sweepers and remaining 24(12.8%) were attendants. There was no woman in attendant category.

male and female was also not statistically significant ( $t=0.23, p=0.82$ ). The age group wise effect of education intervention on knowledge and practices of male and female biomedical waste handlers is given in table 7 and 8.

**Table 5:** Comparison of Practice Score of Male and Female Waste Handlers Before and After the Educational Intervention (EI)

Practice	Gender						Difference between M&F	t value	p value
	Male(M)			Female(F)					
	N	Mean	SD	N	Mean	SD			
Before EI	146	8	3.8	41	7.3	3.8	0.7	0.75	0.34
After EI	146	21.7	3.5	41	21.5	4.8	0.2	0.23	0.82
t value	37.8			14.7					
P value	p<0.001			p<0.001					

In table 5, the effect of educational intervention on practices regarding biomedical waste handling and management was studied in both the sexes. The educational intervention was effective in both the sexes and improved the practice scores significantly. The mean practice score was 8 in males and 7.3 in females which increased to 21.7 and 21.5 respectively after training. The Pre-training practice score of male and female was statistically not significant ( $t=0.95, p=0.34$ ) and after educational intervention the mean practice score of

It was also observed that the educational intervention was effective in all the experience groups in both the sexes ( $p<0.001$ ).

The mean practice scores before educational intervention ranged from 7.5 to 8.4 in males and 6.1 to 7.7 in females which improved after educational intervention ranging from 21.1 to 22.0 in males and 20.6 to 22.2 in females.

It was observed that the experience level of the workers was not related to the knowledge and practice scores before or after educational intervention. The improvement in the mean practice scores ranged from 7.5 to 8.4 in males and 6.1 to 7.7 in females of initial scores to 21.1 to 22.0 in males and 20.6 to 22.6 in females of after scores. All the differences were insignificant before and after training in scores in all knowledge groups. The experience status wise gender differences in practice scores were not significant in any of experience status group before and after educational training assessments. However a highly significant improvement was observed in both sexes in knowledge as well as practice scores after educational intervention at all levels of an experience.

For all 25 questions there was an improvement in a proportion of workers answering them correctly. The percentage improvement ranged from 6.4 to 78.1%. Least improvement was observed in the area of categorization of human anatomical waste (Q.8.) and action to be taken after the needle stick injuries (Q.14).

For all except two areas there were improvements in proportion of biomedical waste handlers practicing them correctly. The two areas which did not show any change after training were immunization with hepatitis B and tetanus for protection, and addition of disinfection before sending the soiled linen for washing. The percentage improvement ranged from 1% to 86.6%. Those are on which has <20% improvement were 2.3, 2.4, 5.2, 5.11, 5.12 & 5.15.

## 6. Discussion

The investigator has assessed the observed practices of biomedical waste handlers pre and post training on the same group of biomedical waste handlers. The sample has been selected using purposive sampling technique. There is a male preponderance (78.9%) among 187 workers participating in the study. A majority (37.9%) of biomedical waste handlers have been in the age group of 46 to 59 years. There have been no female biomedical waste handlers below the age of 25 years. The proportion of female biomedical waste handlers has increased with increasing age. The biomedical waste handlers have been grouped in three categories according to their practice scores as poor, good and excellent scores. There has been highly significant improvement in grades in both the knowledge and practice after training.

WHO regional office for Europe has convened a meeting of personnel for the hospital waste management at Bergen, Norway in 1983. This has been probably the first time that this issue has been discussed after recognizing AID as emerging disease in 1980s.<sup>1</sup>

By 1998 the seriousness of unsafe biomedical waste management was apparent. The rules and regulations were imposed by the international, national and provincial bodies for ensuring safe disposal of biomedical waste. Many studies were undertaken thereafter to find out risks of transmission of various diseases, lacunae in the biomedical waste, knowledge level among hospital staff from doctors to biomedical waste handlers.<sup>1</sup>

Sagoe-Moses C, et al<sup>2</sup>(2001) have conducted a study on risks to the health care workers in the developing countries which has revealed that protecting health care workers in developing countries is a challenge as even the basics of medical care are difficult to provide and where the protection of health care workers does not appear in any health care priorities. Clearly, health care workers in developing countries are at serious risk of infection from blood born pathogens particularly HBV, HCV and HIV because of the high prevalence of such pathogens in many poorer regions of the world. Although the prevalence of blood borne pathogens in many developing countries is high, documentation of infections caused by occupational exposure is poor. It is unlikely that surveillance and

reporting of occupational exposure to infected blood will be undertaken in places where post exposure prophylaxis, treatment, and workers' compensation are lacking. The risk to the health care workers in developing countries is due to a lack of gloves, masks, and goggles to protect them from contaminated blood and body fluids.

Dement JM et al(2002)<sup>9</sup> has been carried out a study in North Carolina USA to find out risk for the HCWs when exposed to Blood and Body fluid (BBF). The study has reported 2730 blood and body fluid exposures among a population of 24,425 HCWs resulting in an overall annual rate 5.5 events and a rate of 3.9 for percutaneous exposures.

WHO (2005) has published a report in India, which has demonstrated that 25% of HIV and 40% of Hepatitis B and C infections occur among health care workers as a result of occupational exposure. In India (2005) approximately 3 million health workers experience percutaneous exposure to blood borne viruses each year<sup>4</sup>.

A study has been conducted by Kermod M, et al<sup>10</sup>(2005) regarding hospital waste management among the health workers in a hospital. A study has revealed that needle stick injury occurs during procedures while drawing of blood (22.6%), recapping (11%), needle disposal (10.5%), garbage disposal (12.5%) and the categories of staff exposed to needle stick injuries are staff nurses (34.6%), interns (15.7%), residents (11.7%), practical nurses (8.5%), technical staff (6%). In the present study around 30% of biomedical waste handlers have had aberrations on their hands, without being aware of them or knowing them or the danger associated with it. There have been three workers exposed to the needle stick injury while working. They have been ignorant about the risk associated with it, and have had no post exposure prophylaxis.

There are many studies undertaken on assessment knowledge, attitude and practice of HCWs which have uniformly indicated that the knowledge, attitude and practices to be very good among consultants and medical doctors and being very poor among the laboratory workers and biomedical waste handlers<sup>(3,11, 14, 16, 18, 22)</sup>.. Most of the nurses in between the doctors and the waste handlers. A study carried out in AIIMS has observed excellent knowledge and practice among nursing staff<sup>11</sup>.

In the present study we have also observed highly significant improvement among knowledge and practice scores after educational intervention. The effect of socio demographic variables before and after educational intervention among various types of workers<sup>(15, 22)</sup> has studies also been which has not shown any correlation between age, sex, education, experience and pre and post educational intervention scores in all the studies except two studies done by SaharHamdy EI<sup>21</sup> and Nagaraju B<sup>22</sup>. In one study carried out on nurses by SaharHamady EI-Syed et al (2012)<sup>21</sup> in Egypt researchers have been observed significant associations between education levels and practice score. As a study carried out Nagarajappa<sup>23</sup> in Karnataka has observed significant association between total years of experience and the practice score. In our study we have not observed any

correlation between sociodemographic variables and pre & post educational intervention scores.

In the present study educational intervention has consisted of the planned didactic teaching program use as well as audio-visual CD ROM prepared on recommended procedures for biomedical waste handling and its management as compared to the only didactic training given by N. Manthar Mohideen<sup>3</sup>, Mostafa GM<sup>14</sup>, Birder VS<sup>15</sup>, Singh R<sup>16</sup> and Nagarajappa D<sup>23</sup>. It is expected that when dos and don'ts are audio-visually shown it have been higher impact than the didactic educational intervention. It has been observed that training with audio visual educational intervention has better impact than just telling the facts in a didactic manner.

## 7. Strong and Weak Areas

There has been a significant improvement in practice score. The weak areas before educational intervention have been duration of storage of waste. strong areas among practices has been collecting waste in covered bins, infectious waste, non sharp to be disposed in red bin/ plastic bag, identification of infectious waste, Identification of non infectious waste and their color coding, not mixing infectious and non infectious waste.

The weak areas in practice have been many out of which washing of hands before and after handling waste or any other procedures, Use of personal protective devices. , Adding of disinfectants to soiled linen before sending it for washing. Cleaning of liquid waste was done by adding bleaching powder and leaving it for 30 minutes. Disposal of sputum cup in to burial pit after disinfection and disposal of liquid waste into sewage line after disinfection etc.

A study has been conducted by Prabhudeva SS<sup>24</sup> (2004) on the management of biomedical waste. In the study he has observed that although hospital has become serious concern throughout the world, in India only ten states have given adequate thought to the management of collection and disposal of hospital waste.

Similar study has been conducted by Hegde V, Kulkarni RD, Ajantha GS<sup>25</sup> (2007) on disposal of bio-medical waste. This study has shown that proper handling, treatment and disposal of biomedical wastes are elements of health care infection control program. Correct procedure will help protect health care workers, patients and the local community. Appropriately designed and applied waste management can be effective and efficient. Safe and effective management of waste is not only a legal necessity but also a social responsibility. Lack of concern, motivation, awareness and cost factor are some of the problems faced in the proper biomedical waste management. Bio-medical waste practice clearly needs education about the hazards associated with improper waste disposal<sup>7</sup>. Our study has been based on the Infection Management and Environment Plan Guidelines for Government of India which is supported by Dept., for International Development, NRHM Ministry of Health and Family Welfare Govt., India<sup>7</sup>. With educational intervention there is a significant difference in knowledge and practice among them which is encouraging.

It can be concluded that based on pre and post educational intervention assessment of knowledge and observation of practices the structured teaching programme and audio visual C D ROM on biomedical waste management educational learning package on knowledge and practices in Krishna Hospital, Karad was very excellent. Repeated educational intervention (training) would enhance improvement in knowledge and practices with due emphasis on identified respective weak areas.

## 8. Acknowledgement

The authors would like to thank all the respondents for sharing their time to respond to the study and a word of gratitude to all management of Krishna Institute of Medical Sciences University, Karad, Maharashtra.

## References

- [1] Mukesh Yadav. Hospital Waste - A major problem. *Practitioner JK* 2001; 8(4):276-202.
- [2] Sagoe-Moses C, Pearson RD, Perry J, Jagger J. Risks to health care workers in developing countries. *N Engl J Med* 2001; 345(7):538-41.
- [3] N. Mathar Mohideen. Hospital Waste Management A Burning Problem. *Nightingale Nursing Times* 2007; 3(3):21-23
- [4] World Health Organization. Safe Management of Biomedical Sharps in India. New Delhi. WHO Health Care Waste Policy: 2005
- [5] Julia BG. Nursing Theories. The base for professional nursing practice. 3<sup>rd</sup> Ed. Morwaalk, Connecticut Appleton and Lange a Publishing Division of Prentice Hall. 1990: 381.
- [6] Lwanga SK, Lemeshow S. Sample size determination in health studies: A practical manual. *World Health Organization* 1991:1-3.
- [7] Govt. of India. Ministry of Health & Family Welfare, National Rural Health Mission. Infection Management and Environment Plan: Guidelines for Healthcare Workers for Waste Management and Infection Control in Community Health Centres. 2005-2012.
- [8] Training Module on Biomedical waste Management (2009) by Regional Center for urban and Environmental Studies (RCUSE), All India Institute of Local Self Government, Mumbai for Maharashtra Pollution Control Board
- [9] Dement JM, Epling C. Truls S, Pompeii LA & Hunt DL. Blood and body fluid exposure risks among health care workers: Results from the Duke Health and safety surveillance system. *Am J Ind Med* 2004; 46:637-648.
- [10] Kermod M, Jolley D, Langkham B, Thomas MS, Crofts N. Occupational exposure to blood and risk of bloodborne virus infection among health care workers in rural north Indian health care settings. *Am J Infect Control* 2005; 33(1):34-41.
- [11] Sharma RK, Nagarajan S, Saini S. Waste: Attitude and Actions. *Asian Hospitals and Health Care Management* 2004; 10(2): 10-3.
- [12] MC Yadavannavar, Aditya S Berad, and PB Jagirdar. Biomedical Waste Management: A Study of Knowledge, Attitude, and Practices in a Tertiary Health

Care Institution in Bijapur. *Indian J Community Med* 2010; 35(1): 170-171.

- [13] Ramokate T & Basu D. Knowledge and practices of doctors and nurses about management of health care waste at Johannesburg Hospital in the Gauteng Province, University of the Witwatersrand, Johannesburg South Africa 2008: 1-25.
- [14] Mostafa GM, Shazly MM, Sherief WI. Development of a waste management protocol based on assessment of knowledge and practice of healthcare personnel in surgical departments. *Waste Manag* 2009; 29(1):430-9.
- [15] Biradar VS. Biomedical waste management and role of class-IV Staff. *Nightingale Nursing Times* 2010; 5(10): 58-62.
- [16] Singh R, Kishore J, Mathur RG, Mandal K, Puri S. The role of an information booklet on bio-medical waste management for nurses. *Nurs J India* 2002; 93(12):271-272.
- [17] Ashima Garg Sood, Abhinav Sood. Dental perspective on biomedical waste and mercury management: A knowledge, attitude and practice survey. *Indian Journal of Dental Research* 2011; 22(3): 371-375.
- [18] Suvarna Madhukumar, Ramesh G. Study about awareness and practices about health care waste management among hospital staff in a Medical College Hospital, Bangalore. *IJBMS* 2013; 4(3).
- [19] Mathur V, Dwivedi S, Hassan MA, Misra RP Knowledge attitude and Practices about Biomedical Waste Management among Healthcare personnel: A cross-sectional study. *Indian J Community Med* 2011; 36(2): PG143-145.
- [20] Sahar Hamdy El-Sayed, Abeer Mohamed Zaaria and Nervana Abdel-Rehman Gheith Intervention Program for Nurses about Health Care Waste Management. *Res J Medicine & MedSci* 2012; 7(1): 25-37.
- [21] Nagarajappa D. Biomedical waste management practices at primary health centers. *Nightingale Nursing Times* 2013; 8(12):31-32 & 64-65.
- [22] Prabhudeva SS. Biomedical Waste Management. *Nightingale Nursing Times* 2004; 10: 17-19.
- [23] Hegde V, Kulkarni R D, Ajantha G S. Biomedical waste management. *J Oral Maxillofac Pathol* 2007; 11:5-9
- [24] Tukaram Zagade<sup>1</sup>, Milka Madhale<sup>2</sup> “ An observational Study of the neurological assessment on the clients with altered sensorium with a view to prepare a learning package and to evaluate the efficacy of the staff nurses in terms of gain in practice in KLES Hospital &MRC Belgaum, Karnataka.2006
- [25] Tukaram Zagade<sup>1</sup>& Asha Pratinidhi<sup>2</sup> “Effectiveness of Educational Intervention on Knowledge and Practice among Biomedical Waste Handlers” International Journal of science and Research Volume 3 Issue 5, May 2014: 285 to295.
- [26] Tukaram Zagade<sup>1</sup>& Amol Patil<sup>2</sup>” Effectiveness of Self Instructional Module on Knowledge Regarding Prevention of Micro vascular and Macrovascular Complications among Patients with Diabetes Mellitus” International Journal of science and Research Volume 3 Issue 5, May 2014: 902 to 908.
- [27] Nilesh Pendase<sup>1</sup> Tukaram Zagade<sup>2</sup> “Knowledge and Attitude Regarding Health Hazards of Mobile Phone Users among the Junior College Students”

International Journal of science and Research Volume 3 Issue 5, May 2014 (IJSR):554 to 561.

- [28] Amosh Talsandekar<sup>1</sup> Tukaram Zagade<sup>2</sup> “Effectiveness of Learning Package on Knowledge about Cardio-Respiratory Assessment Among under Graduate student Nurses” International Journal of science and Research Volume 3 Issue 5, May 2014: 548 to 553.

*Author for correspondence:* Prof. Tukaram B. Zagade, Dept. of Medical-Surgical Nursing, Krishna Institute of Nursing Sciences, Krishna Institute of Medical Sciences University, Karad, Maharashtra, India.

### Author Profile



**Dr. Asha K. Pratinidhi**, M.D., D.Ph., D.Ch. is Director of Research & Professor, Department of Community Medicine Krishna Institute of Medical Sciences, Krishna Institute of Medical Sciences Deemed University, Karad-415539(Maharashtra) India.



**Mr. Tukaram B. Zagade**, M.Sc.(N) PGDMS is working as Professor, Department of Medical-Surgical Nursing Krishna Institute of Nursing Sciences, Krishna Institute of Medical Sciences Deemed University, Karad-415539(Maharashtra) India.



**Dr. Satish V. Kakade** M.Sc. PhD. is working as Assoc Professor (Statistition) Department of Community Medicine Krishna Institute of Medical Sciences, Krishna Institute of Medical Sciences Deemed University, Karad-415539(Maharashtra) India.