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Assessment of Effectiveness of Educational Intervention on Knowledge among Bio-Medical Waste Handlers

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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 [1]. The Knowledge of medical, paramedical staff about the biomedical waste management is important to improve the biomedical waste management practices [2]. 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 knowledge among bio-medical waste handlers regarding disposal of biomedical waste in Krishna Hospital, Karad. (1) To assess the status of knowledge among bio-medical waste handlers regarding disposal of biomedical waste after the educational Intervention. (2) To determine the association of knowledge among bio-medical waste handlers with selected socio demographic 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 answering questions related to knowledge correctly. The percentage improvement has ranged from 6.4% to 78.1%.***

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[1].

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[2].

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[3].
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 facilitates 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[1].

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[4].

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[4]. 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 Bertanlanffy (1969) as explained by Putt[5]. 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.

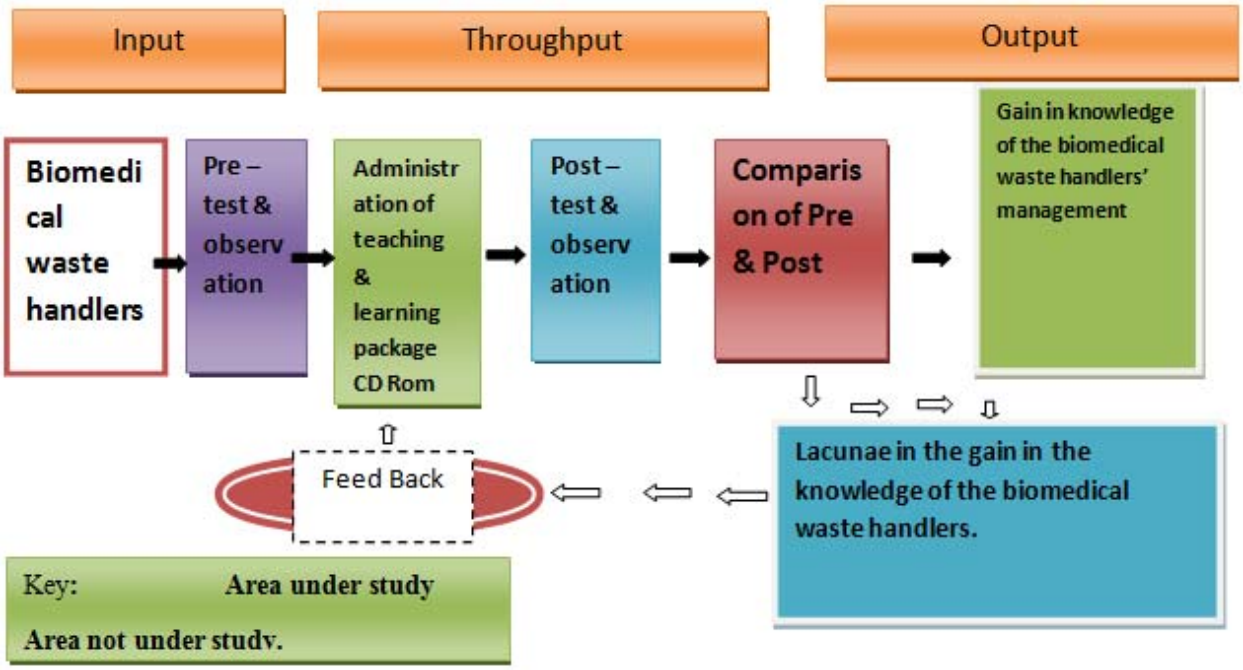

Figure 1: Conceptual Frame Work Based on the General System Model

4. Methodology

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

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.

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.

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.

Data collection:
A pre-tested structured questionnaire 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[7] 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[8].

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 25 multiple choice questions to assess the knowledge of biomedical waste handlers regarding biomedical waste management. A maximum score of 25 and minimum sore 0 was given. One mark was given for each correct response and 0 mark was given for each wrong response. No negative marking was done.

The knowledge score was arbitrarily graded as follows:
Poor: 0 to10
Good: 11 to 18
Excellent: 19 to 25

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.

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 1st July 2009 to 30th April 2010. Each biomedical waste handler was interviewed to assess the knowledge. 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 Taloja, 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 aberated 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 to34 years	26(81.2)	17.8	6(18.8)	14.6	32(100)	17.1
35to 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.χ^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 7thStd	35(57.3)	23.9	26(42.7)	63.4	61(100)	32.6
8th to 10thStd	85(91.3)	58.2	8(8.7)	19.5	93(100)	49.7
11th to 12ThStd	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

Majority175 (93.6%) of the waste handlers were educated and had education from 1st to 12th standard. Only21 (11.2%) could reach up to 11th to 12th 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. (χ^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 Knowledge Score of Biomedical Waste Handlers before and After the Educational Intervention (EI)

Time of Assessment	Biomedical Waste Handlers Scores			
	Knowledge			diff
	N	Mean	SD	
Before E.I.	187	9.3	3.9	2.0
After E.I.	187	20.0	2.4	0.3
t value	34.4			
P value	<0.001			

Assessment of pre training and post training knowledge was undertaken for all biomedical waste handlers.

The mean pre training score was 9.3.with a S.D. Of 3.9, which improved to 20.0 with SD of 2.4. (t=34.4, p<0.001)

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

Knowledge score	Pre-test		Post -test	
	Frequency	%	Frequency	%
Poor(00-10)	110	58.8	00	00
Good (11-18)	76	40.6	39	20.8
Excellent(19-25)	01	0.5	148	79.1
Total	187	99.9	187	99.9

The biomedical waste handlers were grouped in three categories according to their knowledge scores in to poor, good and excellent scores obtained in pre and post training assessment. (Table 4) Initially there were 110(58.8%).workers in the poor category who all improved after educational intervention as seen in the post test results showing no persons in poor category. There was only one worker in the excellent score category before intervention which increased to 148(79.1%) in excellent category of knowledge after training.

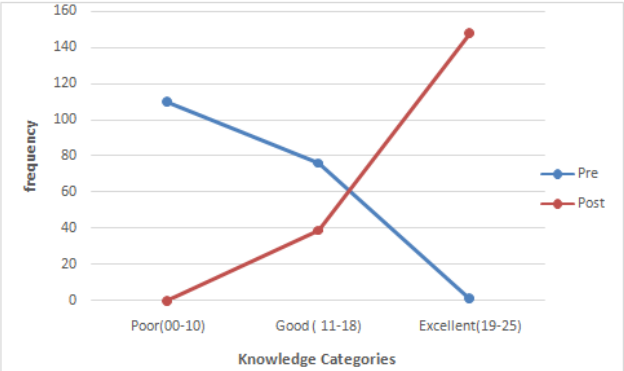

Diagram 1: Frequency Distribution of Subjects According to Knowledge Categories before and After Educational Intervention

Table 4: Comparison of Knowledge Score of Male and Female Waste Handlers Before and After the Educational Intervention (EI)

Knowledge scores	Gender						Difference between M&F	t value	p value
	Male(M)			Female(F)					
	N	Mean	SD	N	Mean	SD			
Before EI	146	9.7	3.6	41	7.7	4.5	2.0	2.63	0.00
After EI	146	20.0	2.3	41	19.8	2.8	0.2	0.66	0.5
t value	30.7			16.6					
P value	p<0.001			p<0.001					

In table 6, the effect of educational intervention on knowledge regarding biomedical waste was studied in both the sexes. The educational intervention was effective in both the sexes and improved the knowledge scores significantly. The mean knowledge score was 9.7 in males and 7.7 in females which increased to 20 and 19.8 respectively after training. The difference in before scores of two sexes was statistically significant and after scores not significant.

All the differences were insignificant before and after training in scores in all knowledge groups. However a highly significant improvement was observed in both sexes in knowledge 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).

6. Discussion

The investigator has assessed the knowledge of biomedical waste handler's 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 prepondevence (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 knowledge and 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.[1]

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.[1]

Sagoe-Moses C, et al [2](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)[9] 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[4] .

A study has been conducted by Kermode M, et al[10](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[3,11, 14, 16, 18, 22].. 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[11].

The present study has taken in to consideration knowledge among biomedical waste handlers only and the knowledge scores have been very low among these workers before training. Educational intervention has been given to the health care workers by many researchers they have found a significant improvement in the knowledge after training [3, 5, 11, 14, 16, 18, 20, 22].

In the present study we have also observed highly significant improvement among knowledge scores after educational intervention. The effect of socieodemographic variables before and after educational intervention among various types of workers [15, 22] 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 [21] and Nagaraju B[22].

In one study carried out on nurses by SaharHamady EI–Syed et al (2012)[21] in Egypt researchers have been observed significant associations between education levels and practice score. As a study carried out NagarajappaD[23] 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[3],Mostafa GM[14], Birder VS[15], Singh R[16]andNagarajappa D[23]. 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.

Strong and Weak Areas of Knowledge

The pre and post training score of knowledge have indicated that there have been 7 out of 25 questions which have been answered correctly by more than 50% of biomedical waste handlers. These questions related to the responsibility of collecting all waste from the wards, what is mean by biomedical waste management treatment facility, What is biomedical waste management, sodium hypochlorite solutions should be changed., Importance of hand washing, how disinfection of plastic waste should be done, why biomedical waste handlers should segregate all waste from wards., meaning of biomedical waste treatment, importance of biomedical waste management protocol and process of biomedical waste management before educational intervention.

Weakest area of knowledge before educational intervention has been how to do disinfection in the wards? , which waste is included in solid biomedical waste management?, what is highest risk from biomedical waste?, what all things are included in non-hazardsnon infectious waste?, Laundry waste is considered as which type of waste?, meaning of biomedical waste, human anatomical waste is included in which category of waste?, ideal container for collection of general waste., if there is a needle stick injury what is to be done?, general non hazardous waste includes what?, knowing symbol of label of biomedical waste, yellow plastic bag is used for which waste? and handling of biomedical waste.

A study has been conducted by Prabhudeva SS[24] (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, AjanthaGS[25](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[7].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[7]. 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.

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