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.

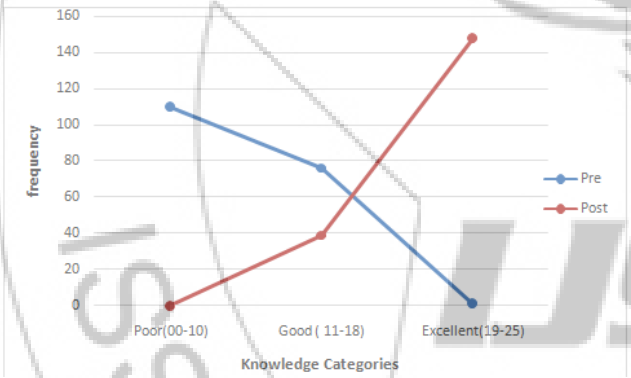

Diagram 1: Frequency Distribution of Subjects According to Knowledge Categories before and After Educational Intervention

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

Knowledge scores	Gender								
	Male(M)			Female(F)			Difference between M&F	t value	p value
	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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