A Study on the Knowledge and Practices of Hospital Waste Management at INSCOL Hospital.

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ABSTRACT

Introduction: Biomedical waste also known as infectious waste or medical waste, is defined as any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining there to or in the production or testing of biological and including categories mentioned in schedule I.
Aim: To assess the knowledge regarding biomedical waste.
Methodology: This study is conducted at INSCOL Healthcare Limited Sector 34 A Chandigarh. A cross sectional survey research design was adopted by using questionnaire as research tool in the study. Questions related to demographic variables including age, gender, designation, working in medical profession since, department/unit, source of information regarding biomedical waste management.
Result: Knowledge according to age in our study, is statistically significant ($\chi^2_{(4,0.05)}$ = 71.605, 0.000). The gender wise knowledge of respondents shows that males significantly surpass the fairer gender with ($\chi^2_{(2,0.05)}$ = 9.873, 0.007) in our study. Out of 40 males 22 had excellent knowledge but among 30 female only 6 showed excellent knowledge score.
Conclusion: It can be concluded that age, experience and department had significant effect on the knowledge regarding bio-medical waste management among the healthcare personnel. Department provide them practical exposure thus help in improving the knowledge of the respondents. Age was emerged as an influencing factor even in the multivariate regression analysis.

Keywords*: Biomedical waste, Knowledge, Medical, Para-medical, Age, Gender etc.*

I. INTRODUCTION

Biomedical Waste Rules
The Government of India as contemplated under Section 6, 8 and 25 of the Environment (Protection) Act, 1986, has made the Biomedical Wastes (Management & Handling) Rules, 1998. The rules are applicable to every institution generating biomedical waste which includes hospitals, nursing homes, clinic, dispensary, veterinary institutions, animal houses, pathological lab, blood bank, the rules are applicable to even handlers.

The large volumes of health care waste if not managed properly can lead to a global hazard. This could not only lead to the spread of highly contagious diseases but the hazardous chemical waste produced by the use of items can cause considerable damage to the ecosystem and the environment[1].

One of India's major achievements has been to change the attitude of the operators of the health care facilities to incorporate good BMW management practices in their daily operations and to purchase on site waste management services from the private sectors[2].

Thus health care waste, if not managed properly will be a cause in ushering of "disasters in making" by causing air, water, soil pollutions and helping in emergence of antibiotic resistant strains of microbial ingress of pollutants in the food chain and thus becoming a part of human consumption. The scenario is no different in any metropolitan city of India. To ensure implementation of the waste management system in accordance with the (*Biomedical Waste Management and Handling rules, 1998),* the Ministry of Environment and Forests, Government of India circulated manuals and memorandum amongst the concerned staff. However, the improper practice of segregation at the site of origin has been observed which causes mixing of infectious and non-infectious waste[3].

As such, there is an urgent need to demonstrate and promote best practices and techniques for health care waste management in countries that have not yet fully operationalized, and to facilitate operationalization by developing

appropriate and affordable infectious waste treatment technologies that avoid formation and release of persistent organic pollutants (POPs) where none are yet available. There is also growing concern about the spread of HIV, Hepatitis and other infectious disease that can be caused by needle-stick injuries and other forms of contagion that can result from the improper management of biomedical wastes by hospitals and other health care institutions. As health systems are strengthened and health care coverage expanded in developing countries through efforts to meet the Millennium Development Goals, the releases of persistent organic pollutants (POPs) and other persistent toxic substances (PTS) to the environment can increases substantially. This is often an unintended consequence of choices in materials and processes that seek to improve health outcomes. India already has biomedical waste management regulations including a ban on the incineration of biomedical waste with the exception of human and animal waste at the Union level, but their implementation and enforcement throughout the country has been inconsistent[2].

The Bio-Medical Rules have recommended different colour codes for waste containers in which different types of wastes needs to be stored. Clinical and general wastes should be segregated at source and placed in colour coded plastic bags and containers of definite specifications prior to collection and disposal[3].

Effects of biomedical waste on health

Sharps: The reuse of syringes: Worldwide, an estimated 10 to 20 million infections of Hepatitis B and C and Human Immunodeficiency Virus (HIV) occur annually from the reuse of discarded syringe needles without prior sterilization[2].

Accidental Contacts: This happens through contaminated air, water or food, by accidental contact with soiled dressings or by injury from sharps. People are caught unawares because someone carelessly threw hazardous waste into the municipal bins and someone who had to treat the wastes and render them non- infectious and safe, did not do so[2].

Infections and diseases: Serious diseases may develop in health- care personnel, waste handlers, patients and the general public. In any healthcare establishment, nurses and house-keeping personnel are the main groups at risk of injuries, annual injury rates are 1020 per 1000 workers[2].

Highest rates of occupational injury among all workers who may be exposed to health-care waste are reported by cleaning personnel and waste handlers, the annual rate in USA is 180 per 1000.There are reported cases of staphylococcal bacteraemia and endocarditis among housekeeping staff after a needle injury. Risk of infection of hepatitis B after needle stick injury-chances of susceptible health care workers (HCWs) is 6-30% after single needle stick exposure. In USA, in June, 1994, 39 cases of HIV infection were recognized by the centers for disease control and prevention as occupational infection[5].

The Government of India (notification, 1998) specifies that Hospital Waste Management is part of hospital hygiene and maintenance activities. This involves management of range activities which are mainly engineering functions, such as collection, transportation, operation or treatment of processing system, and disposal of wastes[7].

A total of 347 injuries occurred, mainly due to improper disposal of needles recapping and carelessness during use. The percentage of injuries attributed to improper disposal fell from 69.2% in 1995 to 38.5% in 1996 after the education programme.

A further decrease was noted after the additional introduction of small sharps containers. In 1995, 73% of injuries involved housekeeping staff, this fell to 12% in 1998.It is recommended that all healthcare institutions should have a system of documenting needle-stick injuries and take measures to decrease their incidence. According to WHO, HBV can survive in dry condition for a week or more. Worldwide more than 8 million Hepatitis B, more than 2.3 million Hepatitis C and more than 8000 cases of HIV infections are estimated to occur yearly from the reuse of syringe and needles without sterilization. Thus there is need for proper health care waste management to ensure the safety of health care workers and the community at large[6].

Biomedical waste management has recently emerged as an issue of the major concern not only to the hospitals, nursing home authorities but also the environment. The bio-medical waste generated from the health care units depend on number of factors such as waste management methods, type of health care units, occupancy of healthcare

units, specialization of health care units, ratio of reusable items in use, availability of infrastructure and resources etc[7].

The proper management of biomedical waste has become a worldwide humanitarian topic today. Although hazards of poor management of biomedical waste have aroused the concern world over, especially in light of its far-reaching effects on human, health and environment[7].

Now it is a well established fact that there are many adverse and harmful effects to the environment including human beings which caused by the "Hospital Waste" generated during the patient care. Hospital waste is a potential health hazard to the health care workers, public and flora and fauna of the area. The problems of waste disposal in the hospitals and other health care instructions have become issue of increasing concern[7].

In June, 1996 in Iran the cumulative recognized cases of occupational HIV infection had risen to 51. All cases were nurses, medical doctors, or laboratory assistants. HCWs who are immunized are not at risk. Post exposure prophylaxis (PEP) with HB Ig and HB vaccine is 90% effective. However, Preexposure prophylaxis with HB vaccine is essential. There are no vaccines against HIV. Post exposure prophylaxis with a two drug combination has to be administered within 6-12 hours for 80% effectiveness[8].

Aim: To assess the knowledge regarding biomedical waste

II. METHODOLOGY

Study area: This study is conducted at INSCOL Healthcare Limited Sector 34 A Chandigarh. INSCOL is a 50 bedded premier tertiary care Hospital equipped with modern facilities. It serves the need of the patients by providing superior comprehensive & affordable health care services.

Study design: A cross sectional survey research design was adopted by the investigator to assess the knowledge related to the management modalities of biomedical waste.

Study tool: Questionnaire was used as a research tool in the study. Questions related to demographic variables including age, gender, designation, working in medical profession since, department/unit, source of information regarding biomedical waste management. This was composed of 19 knowledge items regarding biomedical waste management rule and modalities.

Data analysis: The data collected was analyzed by using Microsoft excel. Percentage, tables, pie charts, graphs and chi square test were used for the interpretation of data.

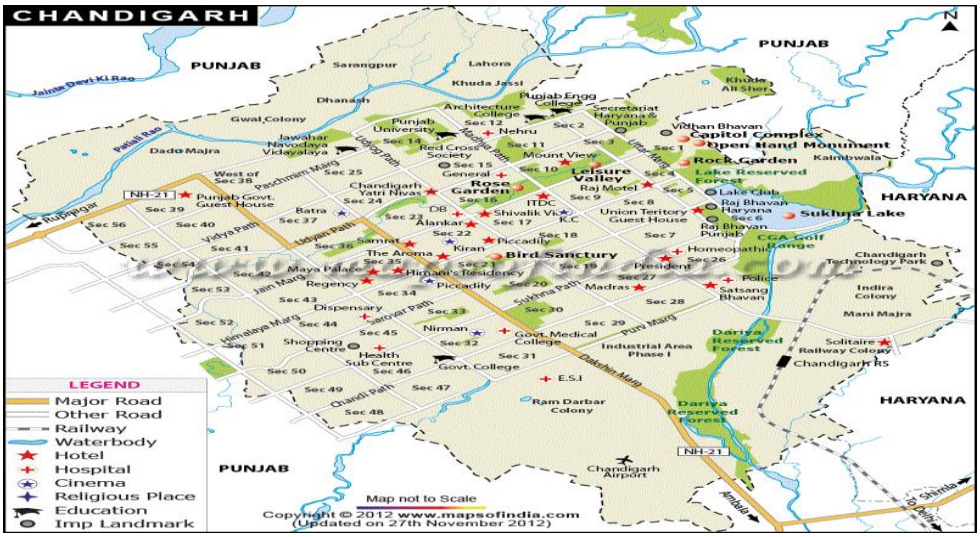
Ethical consideration: The subjects were informed about the purpose of the study. Only those willing for the study have been included. They were assured that all personal information would be kept confidential and used only for the research and study purpose.

Data was analyzed using percentage, calculating the score in terms of mean and standard deviation. Chi-square was used to associate the findings of knowledge, attitude and practices with selected socio-demographic variables. The level of significance chosen was $p<0.05$. The data was presented in the form of tables, pie and column diagrams.

Objectives of the study were:

- To assess the knowledge of the subjects related to biomedical waste management modalities.
- To associate the selected demographic data with knowledge of subjects.
- To find the factors influencing knowledge scores of health personnel regarding bio-medical waste management.

STUDY AREA MAP



Organization of data:
The data collected was entered in a master sheet and analyzed and interpreted using descriptive and inferential statistics. The data was organized and presented under the following sections:
Section I: Distribution of respondents enrolled in the study according to their socio-demographic profile.
Section II: To assess the knowledge of the subjects related to biomedical waste management modalities.
Section III: To associate the selected demographic data with knowledge subjects.
Section IV: To find the factors influencing knowledge scores of health personnel regarding bio-medical waste management.

III. RESULTS

The study subject ranged 23-40 with average age 29.6 years. The male and female ratio was 40:30. The wide range of working experience from 1.0-17.0 had average of 4.2 years. The mean knowledge score was 13.8(out of 19 maximum).

Table 1: Descriptive statistics of study population

S. No.	Variable	Descriptive statistics (n-70)
1.	**Age(in years)**	
	Min. – Max.	23 - 40
	Mean ± SD	29.6 ± 4.5
2.	**Gender**	
	Male : Female	40 : 30
3.	**Experience (in years)**	
	Min. – Max.	1.0 – 17.0
	Mean ± SD	4.2 ± 3.7
4.	**Knowledge score**	
	Min. – Max.	7.0 –19.0
	Mean ± SD	13.8 ± 4.0

Table 2: Age and gender distribution of enrolled study population

Age (in years)	Male (n-40)		Female (n-30)		Total	
	N	**%**	**N**	**%**	**N**	**%**
21-25	4	10.0	10	33.3	14	20.0
26-30	16	40.0	12	40.0	28	40.0
31-35	13	32.5	7	23.3	20	28.6
36-40	7	17.5	1	3.3	8	11.4

The age and gender distribution had been depicted in the above table. Only 14 health personnel were in the age group 21-25 years, from which 4 were males and 10 females. Most of the respondents were in the age group of 26-30 years in both males and females i.e. 16(40%) males and 12(40%) females, comprising the total of 28(40%). In the higher age group 36-40 years 7(17.5%) were males and 1(3.3%) female.

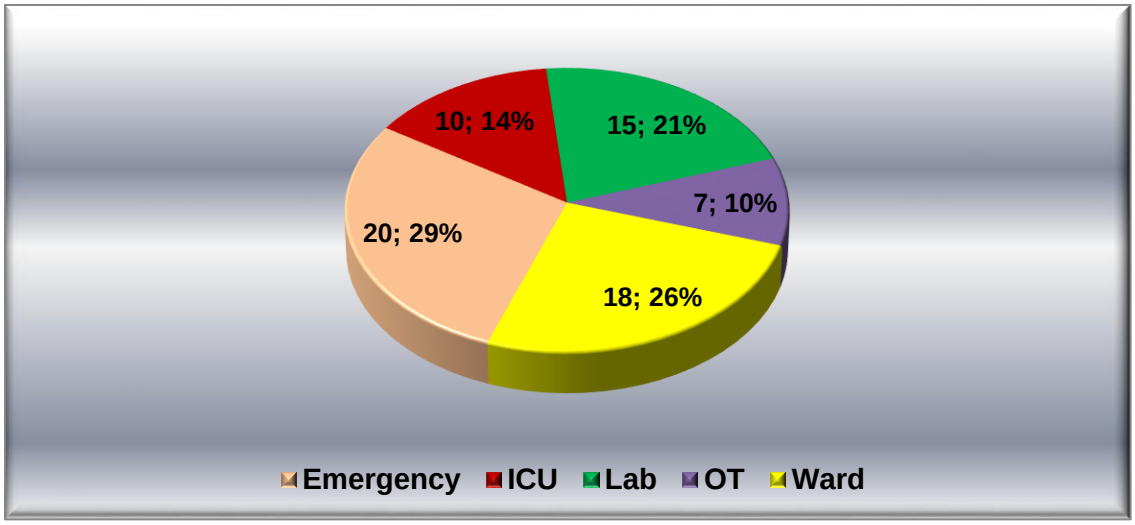


Figure 2: Department wise distribution

Majority of the respondents were from the emergency accounting for 20; 29% as clearly seen in the figure 2 followed by ward 18; 26%. Least respondents 7(10%) were from the OT department.

Table 3: Experience of study subjects enrolled in the study (N=70)

Experience (in years)	Frequency	Percentage
≤1	24	34.3
2-4	20	28.6
≥5	26	37.1

Table 3 shows that more than 50% of the respondents 44(62.9%) out of 70 had experience less than 5 years. Out of these 44, 24(34.3%) had experience less than and equal to 1 year. Respondents having experience of ≥5 years were 26(37.1%).

Table 4: Distribution of source of information

Source of information	Frequency	Percentage
Mass media	18	25.7
Friends	4	5.7
Seminar/workshop	30	42.9
Health personnel	36	51.4
All the above	27	38.6

Table 4 reveals that multiple sources of information were reported by the respondents for assessing knowledge about BMW management. Among them health personnel 36(51.4%) and seminar/workshop 30(42.9%) contributed a lot in this regard.

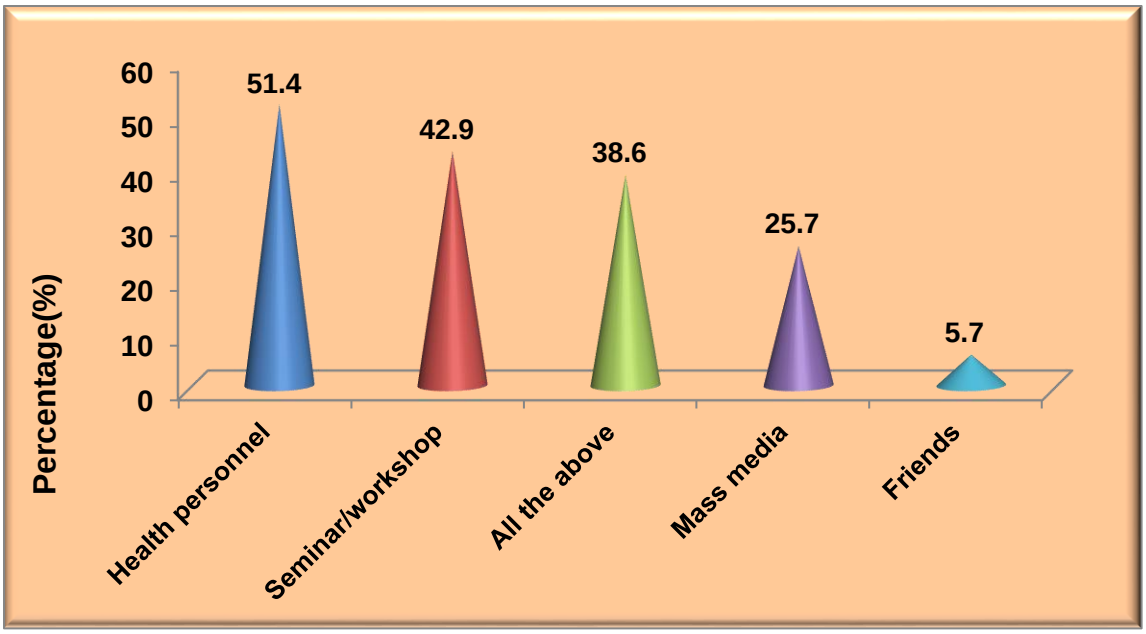


Figure 3: Source of information

Figure 3 shows the contribution of each source of information in percentage. Maximum respondents 51.4% got information through health personnel, followed by seminar/workshop. Out of 70 respondents, 38.6% consider all the sources as their source of information regarding BMW management. Mass media was reported by 25.7% and only 5.7% told friends as their source of information.

Table 5: Distribution of subjects knowledge of various items of Biomedical waste

S. No.	Item	N=70 (%)
1.	Have you heard about Biomedical waste rule/act 1998?	34(48.6)
2.	Do you know about Bio hazard symbol?	43(61.4)
3.	Chemical treatment should be done with at least 1% hypochlorite solution?	45(64.3)
4.	Do you know BMW categories?	46(65.7)
5.	Mutilations/shredding are done to prevent reuse?	64(91.4)
6.	Which schedule prescribes the standards for treatment and disposal of BMW?	28(40.0)
7.	Do BMW containers and bags should be labeled according to schedule 3?	63(90.0)
8.	Chemical treatment is done before incineration?	24(34.3)
9.	Disposal by deep burial is only permitted in rural area where common facility of BMW management is not available?	44(62.9)
10.	Are there any guidelines provided for colour coding at work area?	67(95.7)
11.	Sharps should be disposed in:	70(100.0)
12	Human anatomical waste should be disposed in:	67(95.7)
13.	Category outdated or expired medicines fall in which category?	35(50.0)
14.	Needles should be re-capped/bent after use.	36(51.4)
15.	Post exposure prophylaxis really necessary.	59(84.3)
16.	Needle-stick injury should be reported.	60(85.7)
17.	Needle should be discarded immediately after use.	59(84.3)
18.	Gloves provide protection against needle-stick injury.	60(85.7)
19.	Is vaccination against HBV necessary?	60(85.7)

Table 5 shows the knowledge of respondents regarding various aspects of bio-medical waste management. Only 34(48.6%) had heard about biomedical waste rule/act 1998. Bio hazard symbol was known to 43(61.4%) only. Good knowledge was observed regarding disposal of sharps 70(100.0%), followed by provision of guidelines for colour coding at work area 67(95.7%) and disposal of human anatomical waste 67(95.7%), then by labeling of BMW containers and bags according to schedule 63(90.0%). Only half of the respondents 36(51.4%) know that to re-

cap/bent needle after use is necessary. Necessity of post exposure prophylaxis was known to 59(84.3%). Need of reporting needle-stick injury was known to most of the staff i.e 60(85.7%). In all 59(84.3%) have the knowledge that needle should be discarded immediately after use. Among 70, 60(85.7%) know the protection provided by Gloves against needle-stick injury. The importance of vaccination against HBV was known to 60(85.7%).

Table 6: Knowledge level of study population regarding Biomedical waste

Knowledge level	Knowledge score	Frequency	Percentage
Poor	**0 – 4**	0	0.0
Fair	**5 – 9**	13	18.6
Good	**10 – 14**	29	41.4
Excellent	**15 – 19**	28	40.0

Here table 6 reveals that none of the respondents had poor knowledge regarding bio medical waste management. Fair knowledge was demonstrated by 13(18.6%). The number of respondents having the good knowledge scores was 29(41.4%) and excellent knowledge score was 28(40.0%).

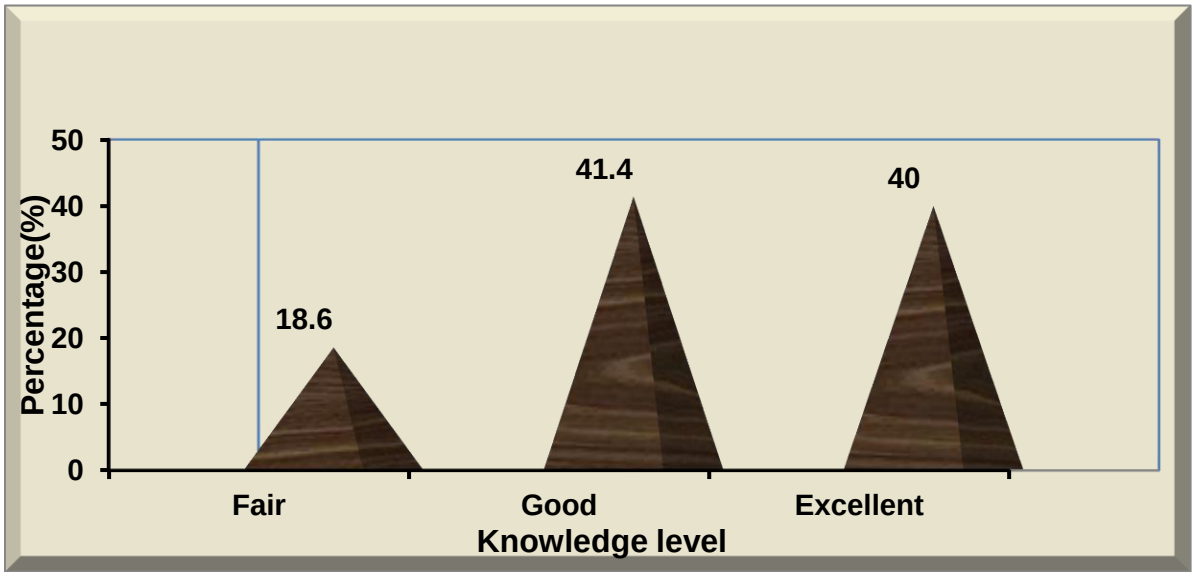


Figure 4: Distribution of knowledge among respondents

The above figure shows that the percentage of health personnel having fair knowledge was only 18.6%. About 82% of the respondents had good and excellent knowledge, among them 41.4 had good knowledge and a good number 40% had excellent knowledge.

Table 8: Distribution of knowledge level according to their age

Age (in years)	N	Fair (n-13)	Good (n-29)	Excellent (n-28)	χ^2, p-value
21-25	14	9(69.2)	5(17.2)	0(0.0)	71.6, 0.000***
26-30	28	4(30.8)	22(75.9)	2(7.1)	
31-35	20	0(0.0)	2(6.9)	18(64.3)	
36-40	8	0(0.0)	0(0.0)	8(28.6)	

*** P-value < 0.001

In Table 8, it is depicted that the younger respondents in 21-25 age group showed fair 9(69.2%) or good 5(17.2%) knowledge. Among respondent 26-30 year of age group only 4(30.8%) had fair knowledge, 22(75.9%) had good and 2(7.1%) had excellent knowledge. On the other hand out of 28 respondents, above 30 years of age, 26 have attained excellent knowledge score. Thus hypothesis H_1 is accepted with significant ($\chi^2_{(6, 0.05)} = 71.605, 0.000$).

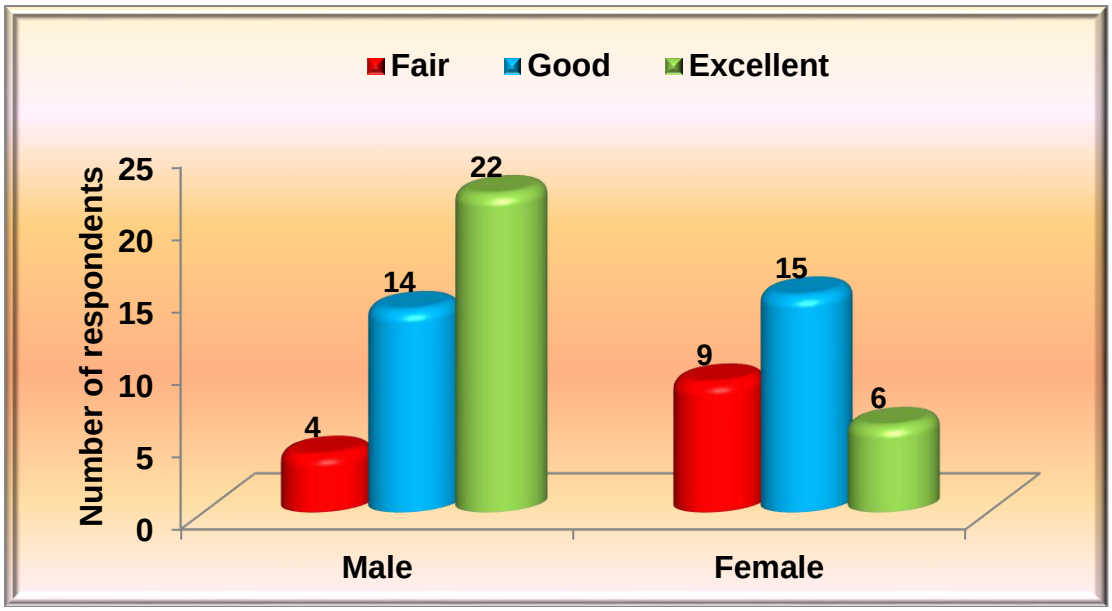


Figure 5: Distribution of knowledge level according to their gender

The above Figure 5 depicts the knowledge of respondents regarding bio-medical waste management according to their gender. The males excelled females with 22 males having excellent knowledge compared to 6 females.

Table 10: Distribution of knowledge level according to their department

Department	N	Fair (n-13)	Good (n-29)	Excellent (n-28)	χ^2, p-value
OT	7	2(15.4)	4(13.8)	1(3.6)	
Emergency	20	0(0.0)	15(51.7)	5(17.9)	
ICU	10	2(15.4)	2(6.9)	6(21.4)	21.7, 0.006**
Lab	15	6(46.2)	3(10.3)	6(21.4)	
Ward	18	3(23.1)	5(17.2)	10(35.7)	

** P-value < 0.01

The above tables shows that maximum fair knowledge level was witnessed among the lab technicians(46.2%) whereas the emergency staff was well aware of the bio-medical waste management as all 20 respondents had either shown good 15(51.7%) or excellent 5(17.9%). Good knowledge was almost equally seen among all the others departments except emergency i.e OT 4(13.8%), ICU 2(6.9%), Lab 3(10.3%) and 5(17.2%). The distribution of knowledge according to their department reveals that maximum respondents working in ward 10(35.7%) had excellent knowledge followed by ICU and lab 6(21.4%) each respectively. The significant ($\chi^2_{(8,\ 0.05)}$ = 21.656, 0.006) proves the hypothesis H_1 that department of the respondents is associated with their knowledge.

Figure 6: Distribution of knowledge level according to their experience

Figure 7 shows that 24 respondents with least experience of less than and equal to 1 year have fair and good knowledge level only, none of them had excellent knowledge. The 12 respondents with 2-4 years of experience have the good knowledge and 7 achieved the excellent score. The respondents having more than and equal to 5 years of experience excelled above all and 21 out of 26 had excellent scores.

The highly significant ($\chi^2_{(8,\ 0.05)}$ = 39.215, 0.000) in table 11 proves that experience of respondents contributes towards their better knowledge. The higher the experience, the better the knowledge of the health personnel is expected.

Table 12: Distribution of knowledge level according to source of information

Source of information	N	Fair (n-13)	Good (n-29)	Excellent (n-28)	χ^2, p-value
Mass media	18	1(7.7)	8(27.6)	9(32.1)	2.869, 0.238
Friends	4	0(0.0)	3(10.3)	1(3.6)	2.181, 0.336
Seminar/Workshop	30	3(23.1)	12(41.4)	15(53.6)	3.415, 0.181
Health personnel	36	7(53.8)	16(55.2)	13(46.4)	0.473, 0.789
All the above	27	6(46.2)	8(27.6)	13(46.4)	2.522, 0.283

In Table 12 the knowledge level of respondents was assessed according to different sources of information. Although excellent knowledge was obtained from seminar/workshop 15(53.6%) followed by another source health personnel 13(46.4%). Even 13(46.4%) respondents who had scored excellent knowledge gave equal importance to all the mentioned sources of information. But no significant chi-square value was obtained in any of the source. Thus proves that source of information do not affect the level of knowledge.

The multivariate analysis was applied to know the factors influencing knowledge score of health personnel regarding bio-medical waste management. First of all descriptive statistics in the table below had been depicted. Mean knowledge score among health care personnel was 13.8. Average age of the respondents was 29.6. Mean years of experience were 2.0.

Variables (N=70)	Mean	Std. Deviation
Knowledge score	13.77	3.972

Designation	2.21	.866
Age	29.64	4.469
Gender	1.43	.498
Experience(in years)	2.03	.851
Dept	3.24	1.377
Mass media	.26	.440
Friends	.06	.234
Seminar	.43	.498
Health personnel	.51	.503

Table no.14 : Correlations

		Knowledge_new	Designation	Age	Gender	Exp_new	Dept	Mass_media	Friends	Seminar	Health personnel
Pearson Correlation	Knowledge score	1.000	-.104	.827	-.345	.607	.087	.175	.030	.226	-.071
	Designation	-.104	1.000	-.077	.556	.090	.174	-.413	.010	-.350	-.190
	Age	.827	-.077	1.000	-.321	.685	.179	.158	.020	.245	-.033
	Gender	-.345	.556	-.321	1.000	-.166	.100	-.245	.036	-.283	-.025
	Experience	.607	.090	.685	-.166	1.000	.130	-.097	-.081	-.063	-.272
	Dept	.087	.174	.179	.100	.130	1.000	-.033	-.044	.078	.173
	Mass media	.175	-.413	.158	-.245	-.097	-.033	1.000	.137	.415	.506
	Friends	.030	.010	.020	.036	-.081	-.044	.137	1.000	.036	.116
	Seminar	.226	-.350	.245	-.283	-.063	.078	.415	.036	1.000	.495
	Health personnel	-.071	-.190	-.033	-.025	-.272	.173	.506	.116	.495	1.000
Sig. (1-tailed)	Knowledge score	.	.197	.000	.002	.000	.237	.074	.403	.030	.280
	Designation	.197	.	.262	.000	.230	.074	.000	.467	.001	.058
	Age	.000	.262	.	.003	.000	.069	.096	.435	.020	.393
	Gender	.002	.000	.003	.	.085	.206	.020	.385	.009	.419
	Experience	.000	.230	.000	.085	.	.142	.211	.252	.301	.011
	Dept	.237	.074	.069	.206	.142	.	.394	.360	.259	.077
	Mass_media	.074	.000	.096	.020	.211	.394	.	.129	.000	.000

	Friends	.403	.467	.435	.385	.252	.360	.129	.	.385	.169
	Seminar	.030	.001	.020	.009	.301	.259	.000	.385	.	.000
	Health personnel	.280	.058	.393	.419	.011	.077	.000	.169	.000	.

According to table no 14. age was emerged as an influencing factor in the multivariate regression analysis.

IV. DISCUSSION

Medical care is vital for our life and health, but the waste generated from medical activities represents a real problem of living nature and human world. Every day, relatively large amount of potentially infectious and hazardous waste are generated in the health care hospitals and facilities around the world. Indiscriminate disposal of BMW or hospital waste and exposure to such waste possess serious threat to environment and to human health that requires specific treatment and management prior to its final disposal. Hospital waste is a potential health hazard to the health care workers, public and flora and fauna of the area. The problems of the waste disposal in the hospitals and other health-care institutions have become issues of increasing concern.

The present study was undertaken to assess the awareness, practices and attitude of the employees regarding biomedical waste management. The hospital chosen for the study Was a premier tertiary level institute. This study was designed to assess the knowledge, attitude and practices amongst the medical and paramedical staff of INSCOL Healthcare Ltd. Chandigarh. It was inferred that a total of 70 medical and paramedical staff was enrolled in the study consisting 20(29%) doctors, 15(21%) lab technicians and 35(50.0%) nurses. The age distribution was in the range of 23 to 40 years with mean age 29.6 years. The gender ratio of males and females was 40:30. Most of the males 29(72.5%) were in the age group of 26-35 years, whereas 22(73.3%) females lies in the age category of 21-30 years. Majority of the respondents 20(29%) enrolled were from the emergency department, followed by 18(26%) from the ward. Respondents from lab were 15(21%). The share of ICU respondents was 10(14%) and 7(10%) were from OT. There was large gap between the experiences of the respondents. The experience of the staff was ranging from 1 year to 17 years resulting in 4.2 years of mean experience. Out of 70, 24(34.3%) respondents were having experience of less 1 year and 4(5.7%) respondents had experience of more than 10 years. While talking about the most common source of information among respondents, 36(51.4%) reported health personnel. Seminar/workshops provided knowledge to 30(42.9%), mass media 18(25.7%) and 4(5.7%) got information regarding biomedical waste from their friends. Out of 70, 27(38.6%) said that all the above sources provided knowledge related to BMW.

In the present study to assess the knowledge of the subjects related to biomedical waste management modalities 19 questions were designed. The minimum knowledge score achieved by respondents was 7.0 and maximum score was 19.0. Mean knowledge of respondents was 13.8. In all only 13(18.6%) respondents had fair knowledge, 29(41.4%) had good knowledge and 28(40.0%) emerged with having excellent knowledge regarding BMW.

In our study 34(48.6%) respondents heard about the biomedical waste rule/act 1998 and 43(61.4%) know about the Bio hazard symbol. The provision of guidelines for colour coding at work area was agreed by 67(95.7%). Only 46(65.7%) of the respondents had knowledge about the categories of biomedical waste management. The attitude of the medical and paramedical staff enrolled in the study was assessed while practicing the biomedical waste management. In this study 36(51.4%) respondents were having the knowledge that needle should be re-capped/bent after use. Out of 70 respondents 59(84.3%) feel the necessity of post exposure prophylaxis. According to 60(85.7%) needle-stick injury should be reported. Needle discarding is must for 59(84.3%) and 60(85.7%) agree that gloves provide protection against needle-stick injury. A good number of respondents 60(85.7%) had believed in vaccination against HBV. Sanjeev R et. al (2014) in a study related to knowledge, attitude, and practices about biomedical waste management among dental healthcare personnel in dental colleges in Kothamangalam had mean knowledge 4.35±1.6(max. score 9). But our study has mean knowledge score 13.8 ± 4.0 (max. score 19). Nagaraju B et. al (2013) in his study to assess the knowledge and practice on bio-medical waste management among the health care providers working in PHCs of Bagepalli Taluk, Karnataka found that 10% had poor knowledge, 65% average and only 24% had good knowledge. The mean knowledge score was 15.3 ± 3.5 (Max. score 21) in this study. Waseem Q.et al (2007) conducted a study on awareness of bio medical waste management among the staffs of the Government SMHS hospital, Srinagar. The results of the study showed that out of 150 respondents 83% had good knowledge related to bio medical waste management. Rajesh K Chudasama et.al. (2013) in a study done to study the

knowledge attitude and practices among health care personnel at a tertiary care hospital in Rajkot showed 145(51.4%) of the health personnel are aware of biomedical waste rule and 287(87.6%) are familiar with the Bio hazard symbol. Among 282 respondents 229(81.2%) agreed that at the work area guideline were provided for colour coding. The knowledge regarding all the categories was known to only 114(40.4%). In another study done by Masumi Basu et. al (2012) in West Bengal 94.4% heard about the BMW rule 1998, and 67.9% knew about the Bio Hazard symbol.

The study done in Ludhiana by Savan Sara Mathew et. al (2011) shows out of 100 respondents 79% know about the Biomedical waste rule/act. The respondents had knowledge of Bio hazard symbol were 84%. The awareness about the categories of waste was among 97% .

The study conducted by Vanesh Mathur et. al (2011) in a hospital at Allahabad showed, 207(73.1%) out of 283, respondents having knowledge about the Biomedical waste Rule.

Knowledge according to age in our study, is statistically significant ($\chi^2_{(4,0.05)}$ = 71.605, 0.000). Thus it is concluded that age plays a significant role in increasing the knowledge of the medical and paramedical staff. Fair knowledge was witnessed among respondents in the age groups of <30 years and 8(28.6%) respondents which had excellent knowledge were in the age group of 36-40 years.

On the contrary Nagaraju B et. al (2013) study rejected the association of age with the knowledge of the medical and paramedical staff. The increasing age was not showing better knowledge score in that study, out of 29 who scored best 9(31.0%) health care personnel were in 21-30 years and only 5(17.2%) were > 50 years. Average score was witnessed almost equally among all the age groups. Also 3(25.0%) out of 12 with poor knowledge were the eldest ones among the respondents.

The gender wise knowledge of respondents shows that males significantly surpass the fairer gender with ($\chi^2_{(2,0.05)}$ = 9.873, 0.007) in our study. Out of 40 males 22 had excellent knowledge but among 30 female only 6 showed excelent knowledge score.

In Nagaraju B et. al (2013) study females showed better knowledge as compared to males. In total 29 respondents had good knowledge, 18(62.1%) out of them were females and 11(37.9%) were males. The distribution of knowledge was non-significant. Knowledge according to experience: The present study shows that experience helps in sharpen the knowledge skills. The calculated ($\chi^2_{(8,0.05)}$ = 39.215, 0.000) confirms the importance of experience as practical is involved. Most of the respondents with excellent knowledge were having experience of 5 years or more i.e 21 out of 28. The study by Nagaraju B et. al (2013) denied our association of knowledge among healthcare personnel with the their experience. Although 10(34.5%) respondents with <5 years had good knowledge, 25(31.6%) were possessing average knowledge and 4(33.3%) had poor awareness. Same trend was followed in other age groups. Even respondents having >15 years were in the same boat 9(31.0%) with good, 21(26.6%) with average and 5(41.7%) with poor knowledge. Knowledge according to designation: Although the calculated ($\chi^2_{(4,0.05)}$ = 10.806, 0.029) is significant in our study but the percentage of good and excellent knowledge in all the three designations was almost same. Surprisingly Nurses showed better knowledge even above the doctors. The percentage of nurses(50.0%) with excellent knowledge was nearly double the doctors(28.6%). Bansal M et. al (2013) in a study in Gwalior, concluded that medical staff have good knowledge 21(58.6%) over paramedical 15(31.9%) and Non medical 2(4.9%). Non medical staff were least educated with 70.7% having poor knowledge.

V. CONCLUSION

It can be concluded that age, experience and department had significant effect on the knowledge regarding bio-medical waste management among the healthcare personnel. The increasing age showed improved knowledge among respondents. The more the experience the better the knowledge level was displayed by respondents. Lab technicians had worst knowledge (46.2%) about bio-medical waste management. Department provide them practical exposure thus help in improving the knowledge of the respondents. Age was emerged as an influencing factor even in the multivariate regression analysis.

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