

Assessment of Knowledge and Practices Regarding Disposal of Biomedical Waste by Health Care Providers

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Abstract: According to WHO, Biomedical waste is defined as “any solid or liquid waste generated during the diagnosis, testing, treatment, research and production of biological product for humans and animals” The different location of waste generation in hospital are operation theatres, wards, labor room, laboratory and nursing homes. The knowledge and practices for handling of biomedical waste is generally restricted to waste handlers (sweepers), that causes main obstruction in biomedical waste management. So, to assess the level of knowledge and practices regarding disposal of biomedical waste by health care providers involved in health care unit, researchers decided to conduct this study. The research study was conducted with an objective to assess the level of knowledge and practices regarding disposal of biomedical waste by healthcare providers. A descriptive research design was used to assess the level of knowledge and practices regarding disposal of biomedical waste in 40 health care providers selected by convenience sampling technique at Regional Hospital in District Hamirpur, Himachal Pradesh. Data was collected by using observation method and self (interview) method. Result revealed that the calculated chi-square (χ^2) values were less than the table value at the 0.05 level of significance. There was non-significant association in level of knowledge and practices with their selected demographic variables and also revealed that there was a significant correlation between the level of knowledge and practices of health care providers regarding disposal of biomedical waste. The study concluded that there was significant correlation (0.506) with Table Value (0.312) and P value (0.001) between the knowledge and practices of health care providers.

Keywords: Biomedical waste, biomedical waste disposal, Health care providers, Knowledge and practice

1. Introduction

Waste is any substance which is discarded after its primary use, it is worthless, defective and of no use.¹ According to the Basal Convention on the Control Movements of Hazardous Waste and Their Disposal of 1989, “Wastes are any substances or objects, material and products which are disposed and eliminated as no longer useful or required”.² The biomedical waste produced in the course of health care activities is mainly in hospitals, clinics, laboratories or similar establishments. Biomedical waste may be solid or liquid which is different from normal trash or general waste.³

The latest guidelines for bio-medical waste Rule on 28th march 2016 notified by the Ministry of Environment and Forest. The rule had recommended color coding in four categories-Red Bag-syringes (without needles), soiled gloves, catheters, IV tubes etc should be all disposed of in a red colored bag, which will later be incinerated. Yellow Bag – all dressings, bandages and cotton swabs with body fluids, blood bags, human anatomical waste, and body parts are to be discarded in yellow bags. Cardboard box with blue marking-Glass vials, ampules, and other glass ware is to be discarded in a cardboard box with a blue marking/sticker. White Puncture Proof Container (PPC)-Needles, sharps, blades are disposed off in a white translucent puncture proof container and black bag for other waste.⁵

The problem of bio-medical waste disposal in the hospitals and other healthcare establishments has become an issue of

increasing concern, prompting hospital administration to seek new ways of scientific, safe and cost effective management of the waste, and keeping their personnel informed about the advances in this area.⁶ The need of proper hospital waste management system is of importance and is an essential component of quality assurance in hospitals as well as the knowledge of the workers in effective waste disposal also prime importance.

A major issue related to current biomedical waste management in many hospitals is that the implementation of biomedical waste regulation is unsatisfactory as some hospitals are disposing of waste in a haphazard, improper and indiscriminate manner. Lack of segregation practices resulting in mixing of hospital wastes with general waste and making the whole waste stream hazardous. Inappropriate segregation ultimately results in an incorrect method of waste disposal.⁷

The Government of India under the provision of Environment Act, 1986 notified the Biomedical waste Rules, 1998. The rules regulate the disposal of biomedical waste. In 2016, new guidelines for handling biomedical waste were released by the Ministry of Environment, Forest and Climate Change. Categorization and authorization for proper control has been made mandatory. They have also made provision for pre-treatment of blood samples, lab waste etc. It is required that the hospital put effective disposal mechanisms in place either directly or through common biomedical disposal and treatment facilities.⁸

Biomedical waste when not disposed properly can pose serious risks to society and the environment through air emissions, contamination of water and physical contact. Improper handling involves unsafe procedures followed during handling of waste i. e. without wearing protective equipment, poor storage, transporting manually for longer distances, uncovered or unpacked containers instead of puncture proof bags, etc. All of which effect hospital workers in different ways.

Inadequate waste management can cause environment pollution, unpleasant odors, growth and multiplication of insects, rodents and worms which can lead to transmission of disease like typhoid, cholera etc. Infectious agents can cause serious health risk on individual like anthrax, meningitis, AIDS, hemorrhagic fever, Hepatitis A, B, C and Influenza etc.⁷ Biomedical waste emerged as issue of concern over the world. It causes real problem for man, community and environment.⁸

According to WHO (2011) the inappropriate health care waste management globally caused 21 million hepatitis B (HBV infection), 2 million hepatitis C virus (HCV) infection and 26000 HIV cases in year 2000. Epidemiological study indicate that the person who experience needle stick injuries becoming a hub of spreading disease rather than working toward eradicating them. Hence there is a need for resource material and education to nurses, doctors and other personnel.⁹ Hence the researcher decided to assess the level of knowledge and practices regarding disposal of biomedical waste by health care providers working at Regional Hospital in District Hamirpur, Himachal Pradesh. This in turn may help nurses and all health personnels to enhance their knowledge and discard the material appropriately without harming them and others.

2. Material and Methods

A non experimental research approach was used to assess the level of knowledge and practices regarding disposal of biomedical waste by health care providers working at Regional Hospital in District Hamirpur, Himachal Pradesh. A descriptive research design was used to assess the level of knowledge and practices regarding disposal of biomedical waste.

A sample of 40 health care providers was selected by convenience sampling technique based on inclusion and exclusion criteria. The sample was conducted on the all the health care providers including physicians, surgeons, nursing staff, lab technicians, waste handlers (sweepers) and fourth class workers, working in the Regional Hospital The Hospital is 300 bedded tertiary care hospital situated at Hamirpur. Hamirpur is a district of Himachal Pradesh. The criteria for selecting the setting were availability of subjects, feasibility of conducting the study, economy of time and easy access and familiarity of researcher to the setting for conducting the study. The tool consists of three parts, part A, part B and part C.

Part A: Socio-demographic variables of health care providers.

Part B: Structured knowledge questionnaire to assess the level of knowledge health care providers regarding disposal of biomedical waste.

Part C: Structured checklist to assess the level of practices of health care providers regarding disposal of biomedical waste

Part A: socio-demographic variables of health care providers:

This part contains the following item for obtaining personal and professional. It includes age, gender, habitat, education, religion, family income, socio-economic status, present designation, attended any class regarding biomedical waste disposal and work experience

Part B: Structured knowledge questionnaire to assess the level of knowledge health care providers regarding disposal of biomedical waste:

This part include structured knowledge questionnaire to assess level of knowledge regarding disposal biomedical waste. A tool was developed by an extensive review of research and non research literature, taking opinion of the experts and the investigator's professional experience into consideration. It consist multiple choice questions.

Table 1: Criterion to measure the level of knowledge among health care providers regarding disposal of bio-medical waste:

S. No.	Level of knowledge	Knowledge score	% age range
1)	Excellent	15 – 20	75%-100%
2)	Good	10 – 15	50%-75%
3)	Average	05 – 10	25%-50%
4)	Below Average	0 – 05	0%-25%

Table 2: Criterion to measure the level of practices among health care providers regarding disposal of bio-medical waste

S. No.	Level of practices	Practice score	% age range
1)	Satisfactory Practices	15 – 30	50%-100%
2)	Unsatisfactory Practices	0 – 15	0%-50%

The tool was validated from experts from the field of nursing and as per guidance and suggestions from the experts, the suggested amendments were made in the tools. A written permission was obtained from the Medical Superintendent and Matron of the Regional Hospital Hamirpur prior to data collection. All the health care providers of Regional hospital were selected by convenience sampling technique who met inclusion and exclusion criteria. The purpose of study was explained. Informed consent was taken from the health care providers for the participation in study. Socio-demographic profile of health care providers was filled by interviewing the health care providers. Level of knowledge was assessed by distributing the knowledge questionnaire. Practices level is assessed by the observing the practice of health care providers during the disposal of biomedical waste.

Analysis of data was done in accordance with the objective of the study. Both descriptive and inferential statistics were used for analysis. Calculation were carried out manually with the calculator and with the help of the Microsoft excel and SPSS (Statistical Packages for Social Sciences).

3. Results

3.1 Sample demographics

Table-3 depicts that according to age, majority 12 (30%) health care providers belonged to age group 31-35 years, followed by 10 (25%) health care providers belonged to age group 36-40 years, 6 (15%) health care providers belonged to age group 41-45 years and age group 26-30 years, 4 (10%) health care providers belonged to age group 46-50 years and 2 (5%) health care providers belonged to age group 21-25 years.

According to gender, 25 (63%) health care providers were female and 15 (38%) health care providers were male.

According to habitat, 21 (53%) health care providers had urban habitat and 19 (48%) health care providers had rural habitat.

According to qualification, majority 10 (25%) health care providers were secondary educated or graduated, followed by 7 (17.5%) were post graduated, 5 (12.5%) were primary educated and 2 (5%) health care providers had passed middle education and matriculation.

According to religion 40 (100%) health care providers are Hindu.

According to Socio-economic status of health care providers, majority 20 (50%) health care providers belonged to upper middle class (II), 16 (40%) belonged to upper class (I), 2 (5%) belonged to lower middle class or upper lower class.

According to occupation of the health care providers, 28 (70%) have government occupation and 12 (30%) have a private occupation.

According to present designation of health care providers, 12 (30%) health care providers were staff nurses, 8 (12%) were lab technician and sweepers, 6 (15%) were ward boys, 5 (13%) were doctors and 1 (2.5%) was ANM.

According to in-service education regarding biomedical waste disposal, 26 (65%) health care providers had attended the in service education and 14 (35%) had not attended the in service education.

According to work experience (in years), 28 (70%) had a experience of 1 – 10 years, 7 (18%) had a experience of 11 years, 4 (10%) had a experience of 21 – 30 years and 1 (2%) had experience of 31 – 40 years.

Table-5 depicts that findings showed the level of knowledge regarding the biomedical waste disposal i. e.55% of health care providers that falls in good knowledge category regarding disposal of biomedical waste, followed by 20% that falls in Average category, and minority was 25% health care providers falls in excellent category.

Table no.6 shows the descriptive statistics of knowledge score i. e. mean was 12.08, standard deviation was 3.09,

Median was 12, Mean Percentage was 60.4% and range was 13.

Table no.7 depicts the findings related to level of practices i. e.40 (100%) health care providers were found following satisfactory practices and none of them were found following unsatisfactory practices.

Table no 8 shows the descriptive statistics of practices score i. e. mean was 27.35, standard deviation was 2.39, Median was 28, Mean Percentage was 91.2% and range was 9.

Table No.9: Shows that an association between level of knowledge and demographic variables of health care providers which were calculated by chi square with software application.

The association between age and knowledge score of health care providers shows ($X^2= 21.421, 0.124; p>0.05$) non significance. Hence there is no association between age and knowledge score.

The association between gender and knowledge score of health care providers shows ($X^2= 3.022, 0.388; p>0.05$) non significance. Hence there is no association between gender and knowledge score.

The association between habitat and knowledge score of health care providers shows ($X^2= 3.958, 0.266; p>0.05$) non significance. Hence there is no association between habitat and knowledge score.

The association between qualification and knowledge score of health care providers shows ($X^2= 21.878, 0.237; p>0.05$) non significance. Hence there is no association between qualification and knowledge score.

Table No.10: depicts an association between habitat and knowledge score because chi test is not applicable

The association between monthly income and knowledge score of health care providers shows ($X^2= 21.421, 0.124; p>0.05$) non significance. Hence there is no association between monthly income and knowledge score.

The association between socio economic status and knowledge score of health care providers shows ($X^2= 2.899, 0.968; p>0.05$) non significance. Hence there is no association between socio economic status and knowledge score.

The association between occupation and knowledge score of health care providers shows ($X^2=4.401, 0.221; p>0.05$) non significance. Hence there is no association between occupation and knowledge score.

The association between designation and knowledge score of health care providers shows ($X^2=17.242, 0.305; p>0.05$) non significance. Hence there is no association between designation and knowledge score.

The association between in-service education and knowledge score of health care providers shows ($X^2=3.736,$

0.291; p>0.05) non significance. Hence there is no association between in-service education and knowledge score.

The association between work experience and knowledge score of health care providers shows ($X^2=5.731$, 0.766; p>0.05) non significance. Hence there is no association between work experience and knowledge score.

Table 3: Frequency and percentage distribution of health care providers as per socio-demographic variables, N = 40

Socio-demographic Variables	Total Number (N=40)	Percentage %
Age: (in years)		
21 – 25	2	5%
26 – 30	6	15%
31–35	12	30%
36 – 40	10	25%
41 – 45	6	15%
46 – 50	4	10%
Gender:		
Male	15	38%
Female	25	62%
Habitat:		
Rural	19	47.50%
Urban	21	52.50%
Qualification:		
Primary Education	5	12.50%
Middle Education	2	5%
Matriculation	2	5%
Secondary Education	10	25%
Graduation	10	25%
Post Graduation	7	17.50%
Any others	4	10%
Religion:		
Hindu	40	100%
Muslim	0	0%
Christian	0	0%
Jain	0	0%
Sikh	0	0%
Any other	0	0%

Table 4: Frequency and percentage distribution of health care providers as per socio-demographic variables, N = 40

Socio-demographic Variables	Total Number (N=40)	Percentage %
Monthly income:		
<5000	5	12.50%
6000-10000	10	25%
11000-15000	1	2.50%
16000-20000	10	25%
21000 – 25000	2	5%
>25000	12	30%
Socio-economic status:		
Upper Class (I)	16	40%
Upper Middle Class (II)	20	50%
Lower Middle Class (III)	2	5%

Table 6: Descriptive Statistics table

Descriptive Statistics	Mean	SD	Median	Maximum	Minimum	Range	Mean %
Knowledge Score	12.08	3.09	12.00	19	6	13	60.4%

Maximum = 20 Minimum = 0

Table no.6 shows the descriptive statistics of knowledge score i. e. mean was 12.08, standard deviation was 3.09,

Upper Lower Class (IV)	2	5%
Lower Class (V)	0	0%
Occupation:		
Private	12	30%
Government	28	70%
Any other	0	0
Present Designation:		
ANM	1	2.50%
Staff Nurse	12	30%
Matron	0	0%
Doctor	5	12.50%
Lab Technician	8	20%
Ward Boy	6	15%
Sweeper	8	20%
Attending in-service Education:		
YES	26	65%
NO	14	35%
Work Experience:		
1 – 10 years	28	70%
11 – 20 years	7	18%
21 – 30 years	4	10%
31 – 40 years	1	2%

Table 5: Table Showing Level of Knowledge Scores

Criteria Measure of Knowledge Score		
Category Score	Frequency	Percentage
Excellent (15-20)	10	25%
Good (10-15)	22	55%
Average (5-10)	8	20%
Below average (0-5)	0	0%

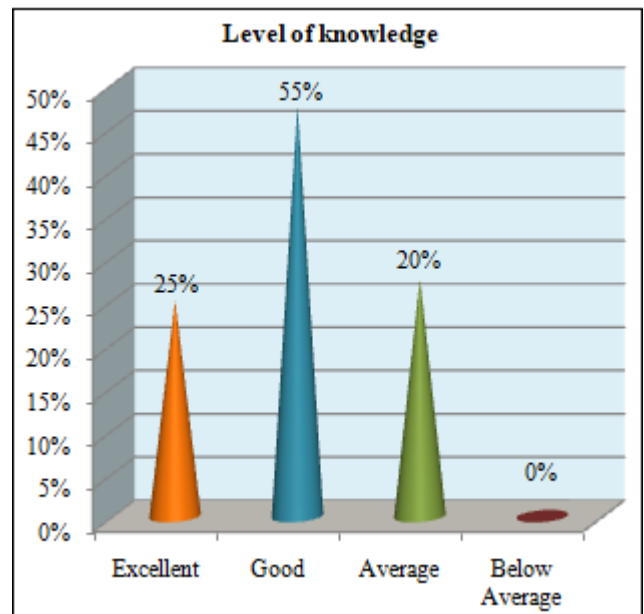


Figure 3: Percentage distribution of level of knowledge regarding disposal of biomedical waste among health care providers

Median was 12, Mean Percentage was 60.4% and range was 13.

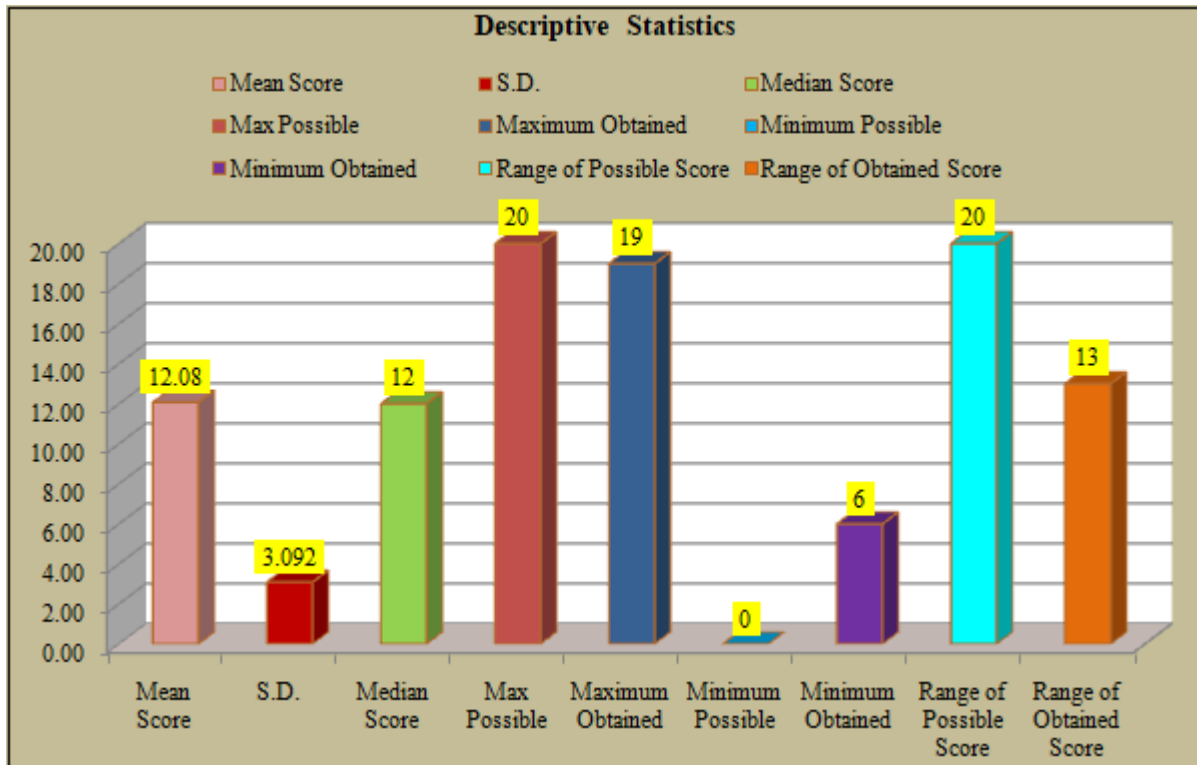


Figure 4: Diagram showing descriptive statistics

Table 7: Table Showing Level of Practice Scores

Criteria Measure Of Practice Score		
Category Score	Frequency	Percentage
Satisfactory (15-30)	40	100%
Unsatisfactory (0-15)	0	0%

Maximum Score=30 Minimum Score=0

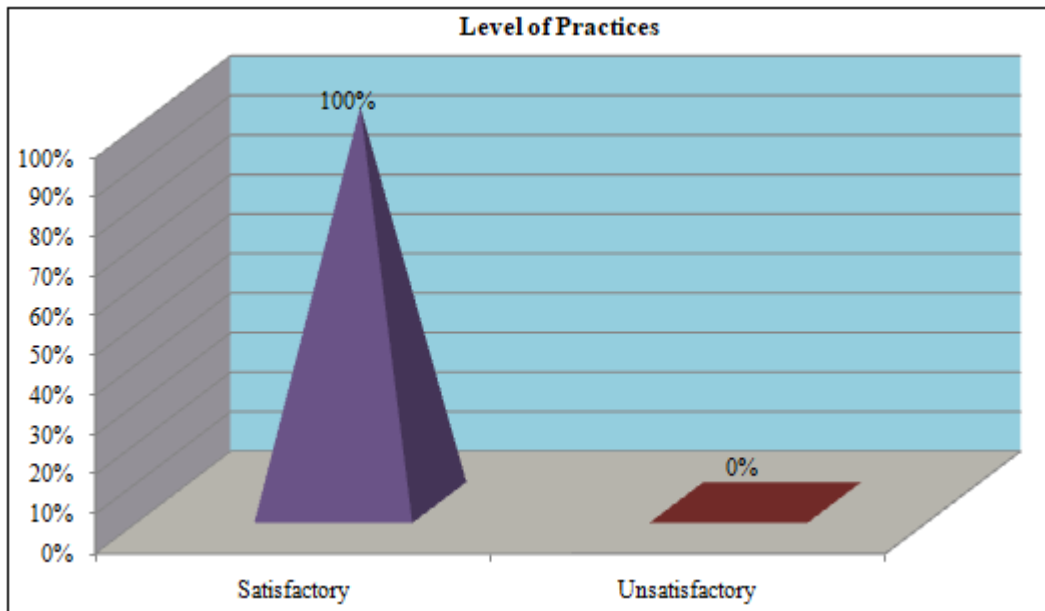


Figure 5: Percentage distribution of level of knowledge regarding disposal of biomedical waste among health care providers

Table 8: Descriptive Statistics table

Descriptive Statistics	Mean	SD	Median	Maximum	Minimum	Range	Mean %
PRACTICE Score	27.35	2.39	28.00	30	21	9	91.2

Maximum= 30 Minimum= 0

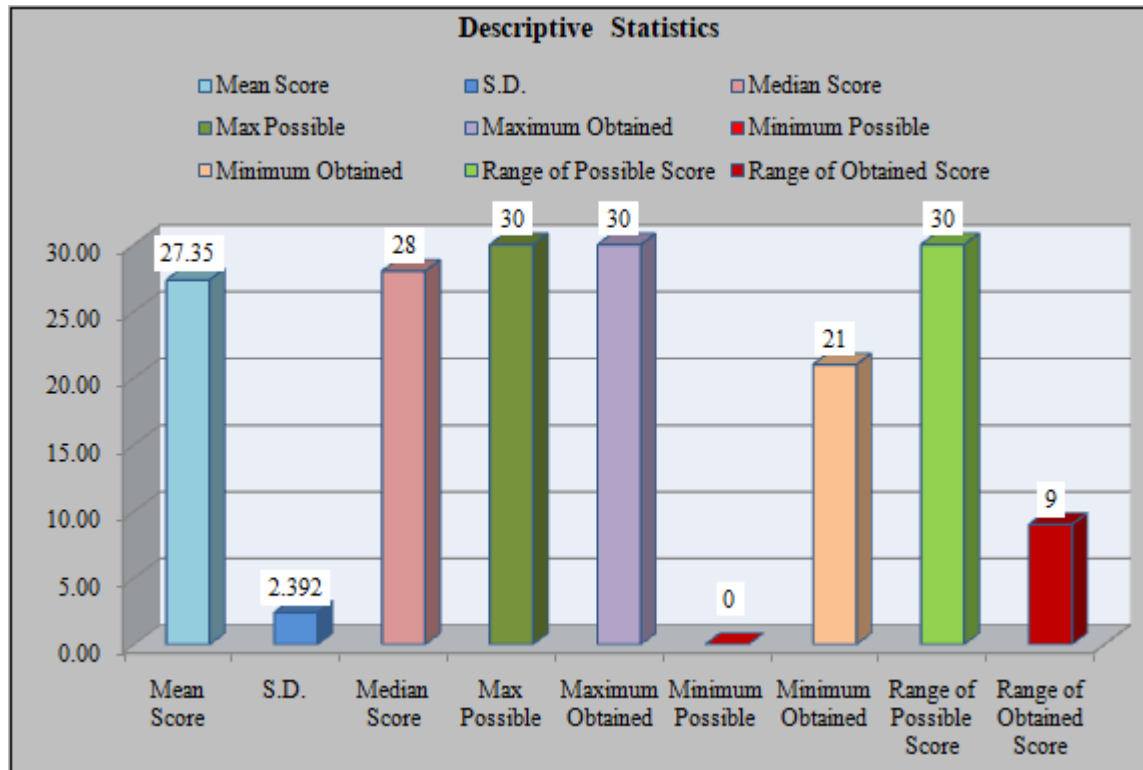


Figure 6: Diagram showing descriptive statistics

Table 9: Table Showing Association of knowledge Scores and Demographic Variables

Demographic Variables	Levels (N=40)				Association with KNOWLEDGE Score				
	Excellent	Good	Average	Below average	Chi Test	P Value	df	Table Value	Result
Age									
21 – 25	0	0	2	0	21.421	0.124	15	24.996	NS
26 – 30	5	0	1	0					
31-35	9	1	1	1					
36 – 40	4	3	2	1					
41 – 45	2	0	3	1					
45 – 50	1	0	3	0					
Gender									
Male	7	2	6	0	3.022	0.388	3	7.815	NS
Female	14	2	6	3					
Habitat									
Rural	10	3	6	0	3.958	0.266	3	7.815	NS
Urban	11	1	6	3					
Qualification:									
Primary Education	3	0	2	0	21.878	0.237	18	28.869	NS
Middle Education	0	0	2	0					
Matriculation	1	0	1	0					
Secondary Education	5	2	2	1					
Graduation	7	1	2	0					
Post Graduation	3	1	3	0					
Any Other	2	0	0	2					

Table 10: Table Showing Association of knowledge Scores and Demographic Variables

Variable	Excellent	Good	Average	Below average	Chi Test	P Value	df	Table Value	Result
Religion									
Hindu	21	4	12	3	NA				
Muslim	0	0	0	0					
Christian	0	0	0	0					
Jain	0	0	0	0					
Sikh	0	0	0	0					
Any other	0	0	0	0					
Monthly Income									
< 5000	2	0	2	1	12.056	0.675	15	24.996	NS
6000 – 10000	7	0	3	0					
11000 – 15000	1	0	0	0					

16000 – 20000	3	3	3	1					
21000 – 25000	2	0	0	0					
> 25000	6	1	4	1					
Socio economic status									
Upper class (I)	10	2	3	1	2.899	0.968	9	16.919	NS
Upper middle class (II)	9	2	7	2					
Lower middle class (III)	1	0	1	0					
Upper Lower class (IV)	1	0	1	0					
Lower class (V)	0	0	0	0					
Occupation									
Private	9	2	2	0	4.401	0.221	3	7.815	NS
Government	12	2	10	3					
Any other	0	0	0	0					
Designation									
ANM	0	0	1	0	17.242	0.305	15	24.996	NS
Staff Nurse	8	1	1	2					
Matron	0	0	0	0					
Doctor	2	1	2	0					
Lab Technician	4	2	2	0					
Ward boy	5	0	1	0					
Sweeper	2	0	5	1					
In-service education									
YES	7	0	5	2	3.736	0.291	3	7.815	NS
NO	14	4	7	1					
Work Experience									
1 – 10 years	15	3	8	2	5.731	0.766	9	16.919	NS
11 – 20 years	4	0	3	0					
21 – 30 years	1	1	1	1					
31 – 40 years	1	0	0	0					

*Significant p<0 NS= Non Significant

Table 11: Descriptive score according to demographic variables

Practice Score				
Frequency Distribution	Mean%	Mean	SD	N
Age				
21 – 25	95.0	28.50	0.71	2
26 – 30	90.6	27.17	2.93	6
31 – 35	95.0	28.50	0.67	12
36 – 40	91.0	27.30	2.71	10
41 – 45	83.9	25.17	2.64	6
46 – 50	90.0	27.00	2.94	4
Gender				
Male	93.1	27.93	2.37	15
Female	90.0	27.00	2.38	25
Habitat				
Rural	94.0	28.21	1.55	19
Urban	88.6	26.57	2.77	21
Qualification				
Primary Education	89.3	26.80	2.39	5
Middle Education	96.7	29.00	1.41	2
Matriculation	91.7	27.50	0.71	2
Secondary Education	95.7	28.70	0.95	10
Graduation	92.0	27.60	2.50	10
Post Graduation	89.0	26.71	2.29	7
Any Other	80.8	24.25	3.40	4
Religion				
Hindu	91.2	27.35	2.39	40
Muslim	0.0			0
Christian	0.0			0
Jain	0.0			0
Sikh	0.0			0
Any other	0.0			0
Monthly Income				
< 5000	93.3	28.00	1.41	5
6000 – 10000	93.3	28.00	1.94	10
11000 – 15000	93.3	28.00		1

16000 – 20000	87.0	26.10	3.21	10
21000 – 25000	96.7	29.00	0.00	2
> 25000	90.8	27.25	2.34	12
Socio economic status				
Upper class (I)	88.3	26.50	2.80	16
Upper middle class (II)	92.3	27.70	2.00	20
Lower middle class (III)	100.0	30.00	0.00	2
Upper Lower class (IV)	93.3	28.00	0.00	2
Lower class (V)	0.0			0

Practice Score				
Frequency Distribution	Mean%	Mean	SD	N
Occupation				
Private	94.4	28.31	1.03	13
Government	89.6	26.89	2.72	27
Any other	0.0			0
Designation				
ANM	93.3	28.00		1
Staff Nurse	88.9	26.67	2.87	12
Matron	0.0			0
Doctor	87.3	26.20	2.59	5
Lab Technician	93.8	28.13	2.53	8
Ward boy	96.1	28.83	1.17	6
Sweeper	90.4	27.13	1.81	8
In-service education				
YES	92.1	27.64	1.86	14
NO	90.6	27.19	2.65	26
Work Experience				
1 – 10 years	91.4	27.43	2.43	28
11 – 20 years	91.0	27.29	2.56	7
21 – 30 years	90.0	27.00	2.83	4
31 – 40 years	90.0	27.00		1

Table 12: Correlation between both Tools

Pearson's Correlation	Pair1	
	Knowledge Score	Practice Score
Mean	12.08	27.35
SD	3.092	2.392
N	40	
Correlation	0.506	
Table Value	0.312	
P Value	0.001	
Result	Significant	

4. Discussion

The discussion of the findings of the study interpreted from the statistical analysis. The findings are discussed in relation to the objectives, need for the study and related literature of the study. It is presented in the line with objectives of the study problem stated is *"A descriptive study to assess the level of knowledge and practices regarding disposal of biomedical waste by health care providers working at Regional Hospital in District Hamirpur, Himachal Pradesh."*

Objectives of the study:

- To assess the knowledge regarding disposal of biomedical waste by health care providers.
- To assess the practices regarding disposal of biomedical waste by health care providers.
- To associate the findings of knowledge and practices regarding disposal of biomedical waste by health care providers with their selected socio-demographic variables.

The findings are discussed based on the objectives of the study:

In the first part of the analysis of the present study, results revealed that the socio-demographically the majority of subjects 30% were in age group of 31 – 35 years, majority 63% were female gender, majority 53% subjects were had urban habitat, majority 25% were secondary educated and graduated, majority 100% were of hindu religion, majority 30% had monthly income of about >25000, majority 50% health care providers belonged to upper middle class (II), majority 70 % health care providers had government occupation, majority 30 % had a designation of staff nurse, majority 65% had attended in-service education and majority 70% had work experience of 1 – 10 years.

Objective-I: To assess the knowledge regarding disposal of biomedical waste by health care providers

Based on the objective of the study, it was found that, Knowledge level i. e. 25% health care providers had excellent level of knowledge, 55% of health care providers that had good knowledge followed by 20% that had average knowledge regarding disposal of biomedical waste, and none of them falls in the poor knowledge category.

Objective – II: To assess the practices regarding disposal of biomedical waste by health care providers.

Based on the objective of the study, it was found that majority 100% health care providers were found following satisfactory practices and none of them were found following unsatisfactory practices.

Objective-III: To associate the findings of knowledge and practices regarding disposal of biomedical waste by health care providers with their selected socio-demographic variables.

In the study findings chi square (χ^2) value showed that there was statistically non-significant association between knowledge score and practices score with socio demographic variables i. e. age, gender, habitat, qualification, religion, monthly income, socio-economic status, occupation, designation, in-service education and work experience.

The above objectives and findings are supported by the another study conducted a descriptive study to assess the knowledge and practices on disposal of biomedical waste among the health care providers working in PHCs of Bagepali Taluk. Result concluded that 24% had a good knowledge, 65% had an average knowledge and 12% had a poor knowledge whereas 35% were following satisfactory practices, 53% were found following partially satisfactory and 12% were found following unsatisfactory practices. Hence the findings revealed that there is increase in the level of knowledge and practices regarding the disposal of biomedical waste the health care providers.

5. Conclusion

The study concluded that there was significant correlation between the knowledge and practices of health care providers.

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