Original Article

A Study On Knowledge And Practice Of Covid-19 Biomedical Waste Management Among The Health Care Workers Of Health Facilities Of Rural Ghaziabad.

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DOI: 10.47750/pnr.2022.13.S08.513

Abstract

Introduction: Improper waste management has a negative impact on the health of medical professionals, sanitary staff, general public and the environment in general.

Objectives: To assess the Knowledge and Practice regarding COVID-19 biomedical waste management (BMWM) among healthcare workers (HCW) of government health facilities of rural Ghaziabad.

Methodology: A cross-sectional study was conducted to assess the knowledge and practices regarding Bio-Medical waste, in rural blocks of the district Ghaziabad at C.H.C, P.H.C and Sub-centres. Health care worker (HCW) like Doctor, Nursing Staff, Laboratory technician and Sanitary staff working in the Health care facilities were selected for the Study. A total number of 122 HCW were selected, which included 27 Doctors, 75 Nurse, 06 Lab technician and 14 sanitary staff, using Proportional allocation scheme respectively.

Result: The Knowledge regarding Biomedical waste management of COVID-19 was 62.2% and practice was 50.8% among the HCW. Multinomial regression between socio-demographic features of HCW and their practice regarding COVID-19 Biomedical waste revealed that the practice was three times better 3.859 (1.378-10.811) in graduate and four times 4.062 (1.030-16.024) in post graduate than diploma holders. Doctors had three time better 3.595 (1.304-9.908) practice of COVID-19 biomedical waste management than nurses. Similarly, the CHC's COVID 19 biomedical waste management practices were more than four time 4.440 (1.482-13.974) better than sub centers.

Conclusion: Level of knowledge and practice scores were unsatisfactory. Healthcare facilities should provide periodic training and adequate supplies for the waste handlers.

Key words- Biomedical waste, COVID-19, Health Care workers.

INTRODUCTION

In the past few years many countries have experienced a tremendous expansion in health care system across the world.[1] Health-care waste (HCW) is a serious problem, which frequently causes water, air and soil pollution along with dreaded nosocomial diseases.[2] India generates 600 metric ton of BMW every year.33 Small-scale incinerators have been used as a temporary solution in less developed and developing countries due to the lack of appropriate waste disposal options.[3] Every year approximately 1.7 million hepatitis B, 315,000 hepatitis C viral infections and 33,800 HIV infections occur in low-income countries due to poor waste management.[4] The recent COVID-19 pandemic has significantly accelerated global BMW generation. Despite the fact that the WHO has specific guidelines for waste management in both pandemic and normal health situations, it is very challenging to follow the rules in this current emergency. More so far, the developing countries like India.[5] Wastes from COVID-19 wards should be collected separately, and transferred directly to treatment facilities to avoid cross-contamination. [6] If these wastes are not handled adequately, the dangerous effects of medical waste on the general public and the environment will be multiple. Hospital waste management has a wide range of health consequences for patients, healthcare professionals (doctors, nurses, sanitary staff, etc.), and the general public.[7] Therefore, the purpose of this study was to assess the Knowledge and Practice of COVID-19 Biomedical Waste Management among the Health Care Workers of Health Facilities of rural Ghaziabad.

MATERIALS AND METHOD

This is a health care facilities based cross-sectional study. This observational cross-sectional study was conducted from 27th July 2022 to 23rd Sept. 2022. Ggovernment health facilities in district Ghaziabad i.e. Community health center (C.H.C), Primary health center (P.H.C) and Sub-center was the sampling frame. Doctors, Nursing Staff, Laboratory technician and Sanitary staff working in the Health care facilities was taken as a study Unit of the study. For sample size calculation, total number of health care worker working in selected health facilities in the district was taken out from the Chief medical officer (CMO) office, which came out to be 232.The sample was calculated by using the estimated proportion of knowledge (79%) on BMW among healthcare workers, reported by Pavan P. Amin et al, in the year 2018.[8] Using the proportion with the estimated population of health care worker i.e., 232 (which is the finite population) we have calculated the sample size using formula

$$n = \frac{m}{1 + \frac{m-1}{n}} \qquad \text{where } m = \frac{z^2_{1-\alpha/2}pq}{d^2}$$

n= sample size, m= Adjustment factor with respect to FPC (finite population correction), $z^2 1\text{-}\alpha/2$= Critical value of z for 95% confidence interval, p= Estimated proportion, q= 1-p, d= Desired absolute precision. The required sample size came out to be 122. Proportional allocation scheme was used to select the required number of health care workers from each facility. Stratified sampling technique was used with proportional allocation scheme. The total sample size was first stratified on the basis of educational qualification of the respondents and then on the basis of health care facilities where the respondents were posted. There are four blocks in district Ghaziabad, in each block there is one CHC, under each CHC there are four PHC. The total number of sub-centres in these four blocks are 145. Data was collected randomly from 4 CHC, 12 PHC and 50 Sub-centres. A predesigned Semi-structured questionnaire was used a study tool to collect data. Consents & Approvals: Informed written consents have taken from Health Care worker and Ethical approval have been taken from the intuitional ethical committee. The data was collected and entered in MS excel 2016. Analysis was done with the appropriate statistical method using SPSS software version 20.0 If p value <0.05, considered as statistically significant and if p-value>0.05, then it is statistically insignificant.

RESULTS

1) Demographic characteristics

In this study we have collected data from 122 health care workers working in different health facilities in the district. Out of total health care workers, 26 (21.3%) were from CHC, 46 (37.7%) were from PHC and 50 (41%) were from sub-centre. Majority of the study participants 96 (78.6) were female. Maximum number of the study participants 61 (50.0%) were in the age group of 31-40 years. Most of the health care workers were 71 (58.2%) diploma holders followed by 25 (20.5%) being graduate and 13 (10.7%) were post graduate. The complete socio-demographic characteristics are depicted in **table 1** below.

Table: 1. showing socio-demographic characteristics of the Health Care Workers.

Socio-demographic characteristics	Health Care workers (n=122)	Percentage (%)
Health Facilities		
C.H.C (n=4)	26	21.3
P.H.C (n=12)	46	37.7
Sub Center (n=50)	50	41.0
Gender of Health Care workers		
Male	26	21.3
Female	96	78.6
Age of the Health Care workers		
21-30	17	13.9
31-40	61	50.0
41-50	37	30.3
51 and above	07	5.70
Education of the Health Care workers		
Post Graduate	13	10.7
Graduate	25	20.5
Diploma	71	58.2
12th Pass	03	2.50
10th pass	10	5.40

We observed that, Of the total 27 (22.1%) doctors 18 (69.2%) were from CHC and 9 (19.6%) were from PHC. The 75 nurses selected were 50 (100%) from sub centre, 21 (45.7%) from PHC and 4 (15.4%) from CHC. One lab technician (3.8%) was from CHC and the remaining 5 (10.9%) from PHC. Regarding the 14 (11.5%) sanitary staff 11 (23.9) were from PHC and 3(11.5%) from CHC. The complete distribution of study participants according to occupation are depicted in **table 2** below.

Table 2: Distribution of study participants according to occupation.

Health Facilities	Doctor (%)	Lab Technician (%)	Nurse (%)	Sanitary Staff (%)	Total (100%)
CHC (Community Health Centre)	18 (69.2)	1 (3.8)	4 (15.4)	3 (11.5)	26
PHC (Primary Health Centre)	9 (19.6)	5 (10.9)	21 (45.7)	11 (23.9)	46
Sub-Centre	0 (0)	0 (0)	50 (100)	0 (0)	50
Total	27 (22.1)	6 (4.9)	75 (61.5)	14 (11.5)	122

2) Knowledge regarding COVID-19 Biomedical Waste Management

The appropriate Knowledge of COVID-19 Biomedical Waste Management was found in 62.2% of the health care workers. We found that 13 (48.1%) doctors, 3 (50%) lab technicians, 22 (29.3%) nurses and 4 (28.6%) sanitary staff workers, knew that goggle, face shield and gloves used in COVID 19 are to be disposed in red bins. We observed that 11 (40.7%) doctors, 2 (33.3%) lab technician, 39 (52%) nurses and6 (42.9%) sanitary staff workers, were correctly disposing the used COVID 19 protective equipment like mask in yellow bin. Unfortunately, 31 (25.4%), 20 (16.4%) were wrongly disposing them in red and black bins respectively. A little less than three fourth 71 (58.2%) of the total health care worker including 16 (59.3%) doctors, 5 (83.3%) lab technician, 44(58.7%) nurses and 6 (42.9%) sanitary workers correctly knew about the use of double layered bags for collection of COVID-19 waste. In the current study 77 (63.1%) and 26 (21.3%) of the health care worker knew to dispose off COVID-19 waste in 12 hours and 24 hours respectively, the latter being prescribed method. We observed that 40 (32.8%) of the health workers said correctly that the plastic overall used were disposed off in red bins. On the other hand, 45 (36.9%) and 18 (14.8%) answered wrongly yellow and black bin respectively and 19 (15.6%) were unaware about the correct options. More than half 71 (58.2%) of the health care workers correctly knew that the inner and the outer surface of biomedical waste container from COVID-19 must be disinfected daily with 1 % Sodium Hypochlorite. COVID 19 BMW is the name of the application developed by the state pollution control board was known by only 29 (23.8%) of the health care workers and most of them 56 (46.7%) were unware about it. Deep burial as the preferred method for disposing COVID 19 waste from remote quarantine center was known by 64 (52.5%) while 6 (4.9%) and 4 (3.3%) thought it to be microwaving and recycling respectively. The complete knowledge regarding precautionary measures in Biomedical Waste Management are depicted in **table 3** below.

Table 3: Showing knowledge regarding COVID-19 Biomedical Waste Management

Knowledge regarding COVID-19 Biomedical Waste Management						
Parameters	**Doctor (%)**	**Lab Technician (%)**	**Nurse (%)**	**Sanitary Staff (%)**	**Total**	**Percentage**
Personal protective equipment used in COVID19 like goggles, face shield and gloves are disposed in?						
Red bin	13 (48.1)	3 (50.0)	22 (29.3)	4 (28.6)	42	34.4
Yellow bin	9 (33.3)	2 (33.3)	37 (49.3)	6 (42.9)	54	44.3
Black Bin	2 (7.4)	1 (16.7)	11 (14.7)	0 (0)	14	11.5
Don't know	3 (11.1)	0 (0)	5 (6.7)	4 (28.6)	12	9.8
Personal protective equipment used in COVID19 like Used mask (N95) are disposed in?						
Yellow bin	11 (40.7)	2 (33.3)	39 (52.0)	6 (42.9)	58	47.5
Red bin	9 (33.3)	3 (50.0)	14 (11.5)	5 (35.7)	31	25.4
Black Bin	3 (11.1)	1 (16.7)	16 (21.3)	0 (0)	20	16.4
Don't know	4 (14.8)	0 (0)	6 (8.0)	3 (21.4)	13	10.7
How many layered bags are used for collection of waste from COVID-19 to ensure zero-leaks?						
Single	1 (3.7)	0 (0)	9 (12.0)	2 (14.3)	12 (9.8)	9.8
Double	16 (59.3)	5 (83.3)	44 (58.7)	6 (42.9)	71 (58.2)	58.2
Triple	6 (22.2)	1 (16.7)	8 (10.7)	1 (7.1)	16 (13.1)	13.1
Don't know	4 (14.8)	0 (0)	14 (18.7)	5 (35.7)	23 (18.9)	18.9
Biomedical waste generated from COVID-19 related activities should be strictly disposed of within?						
12 hour (%)	16 (59.3)	3 (50.0)	48 (64.0)	10 (71.4)	77	63.1
24 hour (%)	10 (37.0)	1 (16.7)	14 (18.7)	1 (7.1)	26	21.3
48 hour (%)	0 (0)	1 (16.7)	2 (2.7)	1 (7.1)	4	3.3
Don't know (%)	1 (3.7)	1 (16.7)	11 (14.7)	2 (14.3)	15	12.3
Health care worker working in a COVID ward should dispose off the plastic overall in?						
Red bin (%)	12 (44.4)	1 (16.7)	24 (32.0)	3 (21.4)	40	32.8
Yellow bin (%)	9 (33.3)	3 (50.0)	29 (38.7)	4 (28.6)	45	36.9
Black Bin (%)	2 (7.4)	2 (33.3)	11 (14.7)	3 (21.4)	18	14.8
Don't know (%)	4 (14.8)	0 (0)	11 (14.7)	4 (28.6)	19	15.6
Inner & outer surface of Bio-Medical Waste containers from COVID 19 must be disinfected daily with?						
0.5% Formaldehyde (%)	5 (18.5)	1 (16.7)	9 (12.0)	1 (7.1)	16	13.1
1 % Sodium Hypochlorite (%)	21 (77.8)	5 (83.3)	41 (54.7)	4 (28.6)	71	58.2

2% Methyl Bromide (%)	0 (0)	0 (0)	0 (0)	0 (0)	0	0
Don't know (%)	1 (3.7)	0 (0)	25 (33.3)	9 (64.3)	73	28.7
What is the name of the App developed by the State pollution control board for the record of BMW generated from COVID-19						
AROGYA SETU (%)	3 (11.1)	1 (16.7)	9 (12.0)	0 (0)	13	10.7
COVID19BMW (%)	11 (40.7)	2 (33.3)	16 (21.3)	0 (0)	29	23.8
COVIN BMW (%)	3 (11.1)	0 (0)	20 (26.7)	0 (0)	23	18.9
Don't know (%)	10 (37.0)	3 (50.6)	30 (40.0)	14 (100)	57	46.7
What is the method for handling Bio medical waste, generated from COVID19 by remote quarantine centers in rural area?						
Deep burial (%)	17 (63.0)	2 (33.3)	44 (58.7)	1 (7.1)	64	52.5
Microwaving	3 (11.1)	0 (0)	3 (4.0)	0 (0)	6	4.9
Recycling	0 (0)	1 (16.7)	3 (4.0)	0 (0)	4	3.3
Don't know	7 (25.9)	3 (50.0)	25 (33.3)	13 (92.9)	48	39.3

3) Practice regarding COVID-19 Biomedical Waste Management

Overall appropriate practice regarding COVID-19 Biomedical Waste Management was found in be 50.8% of the health care workers. We observed that most of the study participants 87 (71.3%) were wearing PPE and 35 (28.7%) were not, while handling biomedical waste. Puncture proof containers for sharps waste were used by 72.1%. In this study majority 88 (72.1%) of the health care workers were having a system of reporting injuries and accident due to biomedical waste. We observed that 86 (70.4%) health care workers were reporting any hazardous event due to COVID-19 biomedical waste management within 24 hours. In the present study all of the lab technician 6 (100%), 25 (92.6%) doctors, 60 (80%) nurses and 8 (57.1%) sanitary staff workers, were immunized against Hepatitis B. After needle stick injury or percutaneous injury, it was observed that 101 (82.8%) were taking but 21 (17.2%) were not taking the post exposure prophylaxis. We observed that, among the doctors 27 (100%), 27 (100%), 21 (81.5%) and 24 (88.9%) respectively wear gloves, mask, goggle and PPE while handling COVID-19 biomedical waste. In case of sanitary staff workers, the result was 14(100%), 9 (64.3%), 6 (42.9%) and 7 (50%), while in case of nurses it was 71 (94.7%), 61 (81.3%), 53 (70.7%) and 57 (76%) for gloves, mask, goggles and PPE respectively. The complete practice regarding COVID-19 Biomedical Waste Management are depicted in **table 4** below.

Table 4: Showing Practice regarding precautionary measures in Biomedical Waste Management

Practice regarding precautionary measures in Biomedical Waste Management						
Parameters	Doctor (%)	Nurse (%)	Lab Technician (%)	Sanitary Staff (%)	Total	Percentage
Do you wear PPE (Personal Protective Equipment) while handling COVID-19 Bio Medical Waste management?						
Yes	21 (77.8)	53 (70.7)	5 (83.3)	8 (57.1)	87	71.3
No	6 (22.2)	22 (29.3)	1 (16.7)	6 (42.9)	35	28.7
Do you use puncture-proof plastic/cardboard container to collect waste sharp?						
Yes	25 (92.6)	50 (66.7)	6 (100)	7 (50)	88	72.1
No	2 (7.4)	25 (33.3)	0 (0)	7 (50)	34	27.9
Do you have a system of reporting injuries and accidents due to COVID-19 Bio-medical waste?						
Yes	23 (85.2)	50 (66.7)	5 (83.3)	10 (71.4)	88	72..1
No	4 (14.8)	25 (33.3)	1 (16.7)	4 (28.6)	34	27.9
How much time was taken to report any hazardous event occurred due to COVID-19 bio medical waste in your setup?						
12 hour	13 (48.1)	42 (56.0)	5 (83.3)	8 (57.1)	68	55.7
24 hour	7 (25.9)	9 (12.0)	0(0)	2 (14.3)	18	14.8
48 hour	1 (3.7)	9 (12.0)	0(0)	2 (14.3)	7	5.7
No such event occurred	6 (22.2)	21 (28.0)	1 (16.7)	1 (7.1)	29	23.8
Have you been immunized against Hepatitis B?						
Yes	25 (92.6)	60 (80.0)	6 (100)	8 (57.1)	99	81.1
No	2 (7.4)	15 (20.0)	0 (0)	6 (42.9)	23	18.9
Do you follow PEP after needle stick injury or percutaneous injury?						
Yes	26 (96.3)	62 (82.7)	0 (0)	7 (50)	101	82.8
No	1 (3.7)	13 (17.3)	6 (100)	7 (50)	21	17.2
What precautions do you take while handling Biomedical Waste?						

Gloves (Yes)	27 (100)	06 (100)	71 (94.7)	14 (100)	118	96.7
Mask (Yes)	27(100)	6 (100)	61 (81.3)	9 (64.3)	103	84.4
Goggle (Yes)	21 (81.5)	05 (83.3)	53 (70.7)	06 (42.9)	86	70.5
PPE (Personal protective equipment) Kit (Yes)	24 (88.9)	05 (83.3)	57 (76.0)	7 (50)	93	76.2

In the present study we observed that a significant association was found between education level and occupation with Knowledge of COVID 19 of biomedical waste management. The odds of this knowledge being good in 10th pass healthcare workers were lower 0.144 (0.029-0.732) the diploma holders. Secondly, the sanitary staff workers had less chances 0.153 (0.039-0.598) of possessing good knowledge compared to nurses. The complete relationship of Knowledge of COVID-19 BMWM with socio-demographic variable are depicted in **table 5** below.

Table 5 Relationship of Knowledge of COVID-19 BMWM with socio-demographic variable

Variable	Category	**Knowledge with COVID19 of BMWM**		Total (100%)	p value	OR (CI)
		Good (%)	Bad (%)			
Gender	Male	14 (53.8)	12 (46.2)	26	0.23	
	Female	64 (66.7)	32 (33.3)	96	Reference	
Education	10th Pass	2 (20)	8 (80)	10	0.019*	0.144 (0.029-0.732)
	12th Pass	0 (0)	3 (100)	3	0.999	
	Diploma	45 (63.4)	26 (36.6)	71	Reference	
	Graduate	20 (80)	5 (20)	25	0.133	
	Post Graduate	11 (84.60	2 (15.4)	13	0.152	
Occupation	Doctor	22 (81.5)	5 (18.5)	27	0.1	
	Lab Technician	5 (83.6)	1 (16.7)	6	0.357	
	Nurse	48 (64)	27 (36)	75	Reference	
	Sanitary Staff	3 (21.4)	11 (78.6)	14	0.007*	0.153 (0.039-0.598)
Health Facilities	C.H.C (Community health center)	20 (76.9)	6 (23.1)	26	0.145	
	P.H.C (Primary Health Center)	28 (60.9)	18 (39.1)	46	0.931	
	Sub- Center	30 (60)	20 (40)	50	Reference	

A significant association was found between education level, occupation and health facilities and practices of COVID-19 waste management. The practices were three times better 3.859 (1.378-10.811) in graduate and four times 4.062 (1.030-16.024) in post graduate than diploma holders.

Doctors had three time better 3.595 (1.304-9.908) practice of COVID-19 biomedical waste management than nurses. Similarly, the CHC's COVID 19 biomedical waste management practices were more than four time 4.440 (1.482-13.974) better than sub centers. The complete relationship of Practice regarding Precautionary measure of BMWM with socio-demographic variable are depicted in **table 6** below.

Table 6: Relationship of Practice of COVID-19 BMWM with socio-demographic variable

Variable	Category	**Practice with COVID19 of BMWM**		Total (100%)	p value	OR (CI)
		Good (%)	Bad (%)			
Gender	Male	17 (65.4)	9 (34.6)	26	0.167	
	Female	48(50)	48(50)	96	Reference	
Education	10th Pass	3 (30)	7 (70)	10	0.374	
	12th Pass	1 (33.3)	2 (66.7)	3	0.691	
	Diploma	32 (45.1)	39 (54.9)	71	Reference	
	Graduate	19 (76)	6 (24)	25	0.010*	3.859 (1.378-10.811)
	Post Graduate	10 (76.9)	3 (23.1)	13	0.045*	4.062 (1.030-16.024)
Occupation	Doctor	21 (77.8)	6 (22.2)	27	0.013*	3.595 (1.304-9.908)
	Lab Technician	3 (50)	3 (50)	6	0.975	
	Nurse	37 (49.3)	38 (50.7)	75	Reference	
	Sanitary Staff	4 (28.6)	10 (71.4)	14	0.161	
Health Facilities	C.H.C (Community health center)	21 (80.8)	5 (19.2)	26	0.008*	4.440 (1.482-13.974)
	P.H.C (Primary Health Center)	20 (43.5)	26 (56.5)	46	0.657	
	Sub- Center	24 (48)	26 (52)	50	Reference	

DISCUSSION

Central Pollution Control Board (CPCB) of India brought out specific guidelines for the handling, treatment, and disposal of waste generated during treatment, diagnosis, and quarantine of COVID-19 patients on March 18, 2020. These guidelines were revised on July 17, 2020.[9]

Majority of the study participants in the present study were female 96 (78.6). Similar finding was seen in a cross-sectional study conducted by Saha A et.al in Tripura, where majority of the study participants (65.4%) was female[10]

In current study, maximum number of the study participants 61 (50.0%) were in the age group of 31-40, followed by 41-50 years (30.3 %). There were 17 (13.9%) subjects` of the age 21-30 years respectively. Similar result was found in a study conducted by a Kamakar N et al in Agartala, where maximum number (74.2%) of health care worker were from 20-30-year age group.[11]

In this study most (58.2%) of the health care workers were diploma holders followed by 25 (20.5%) graduates and 13 (10.7%) were post graduates. Also 10 (8.2%) had studied till 10^{th} and 3 (2.5%) up to 12^{th} respectively. Similar result was found in a cross sectional study in Haryana conducted by Singh S at el in 2020, where maximum number of health care workers were diploma holders (47.6%).[12]

In the present study 13 (48.1%) doctors, 3 (50%) lab technicians, 22 (29.3%) nurses and 4 (28.6%) sanitary staff workers, knew that goggle, face shield and gloves used in COVID 19 are to be disposed in red bins. In Comprehensive Review of the National and International guidelines done by Capoor MR et al. in the year 2021, the author enlightens us that the face shields, goggle, and gloves used for COVID 19 patients should be collected in red bags[13]

In current study, 11 (40.7%) doctors, 2 (33.3%) lab technicians, 39 (52%) nurses and 6 (42.9%) sanitary staff workers, were correctly disposing the COVID-19 infected N-95 mask in yellow bin. Used (N-95) masks of COVID-19 patients, blood- or body fluid–contaminated swabs should be treated as BMW. They should be collected in non-chlorinated yellow bags, according to comprehensive review conducted by Capoor MR et al.[13]

In the present study, 71 (58.2%) of the total health care workers were aware of the use of double layered bags for collection of COVID-19 waste.The Indian guidelines prefer the use of double-layered bags for collection and transport of COVID-19 infected waste to prevent spillage or leaking[13]

In the present study more than half 71 (58.2%) of the health care workers correctly knew that the inner and the outer surface of biomedical waste container from COVID-19 must be disinfected daily with 1 % Sodium Hypochlorite. Same is recommended by the Indian guidelines, as seen by the author Capoor MR et al in comprehensive review[13] Level of awareness was less among nurses (9.3%) and sanitary staff workers (35.7%).

Deep burial was the preferred method for disposing COVID 19 waste from remote quarantine centre for 52.5% of the study subjects. Similar findings were corroborated by Saha A et.al in Tripura, where they reported that deep burial was the preferred mode of disposal in hospitals situated in remote areas by 53.33% health care workers.[10]

The practices of wearing PPE were considerably better (71.3%) in this study than a study conducted by Basavaraj TJ et al in Bangalore in the year 2021, where sanitary Staff were not wearing PPE while the nurses and doctors were wearing PPE most of the time[14]

In the present study puncture proof containers for sharp waste were used by 88 (72.1%) of the HCW. Likewise, Amin PP et al in, found that around 3/4th (75.3%) of the participants dispose off the sharps in white puncture proof container.[8] In the present study most of the doctors (85.2%) were practicing a system of reporting injuries and accidents due to COVID-19 BMW. Basavaraj TJ et al., also observed that majority of the doctors and nurses were in a habit of reporting injuries and accidents.[14]. In the study conducted by Amin PP et al, the doctors had a system for reporting the incidence of any hazardous event.[8] In this study, a system of reporting needle stick injuries within 24 hours was being practiced by 86 (70.4%) health care workers. Amin PP et al., observed that majority of health care workers (91.7%) believed that needle-stick injuries should be reported immediately[8]

In the present study 99 (81.1%) of the HCW were immunized against Hepatitis B, which is comparatively higher than the findings of Saha A et.al., where only 66.17% were immunized against hepatitis B.[10] In Current study, 101 (82.8%) of the health care workers were following Post Exposure Prophylaxis. Mehta TK et al., found that 42.46% doctors and only 15.9% nurses were following post exposure prophylaxis (PEP).[15] Basavaraj TJ et al., observed that practice of the following PEP after needle stick injury was lowest among sanitary staff. While in our study, doctors and nurses were following PEP the most.[14] In the present study 96.7% of the HCW were using gloves and 88.9% of our health care workers were wearing PPE. Bit similar finding was seen in Deress T et al., where 44 (80.0%) of the study participants were using heavy-duty gloves while 48 (87.3%) were using protective apron.[16]

In the present study practice practices of COVID-19 BMW were three times better 3.859 (1.378-10.811) in graduate and four times 4.062 (1.030-16.024) in post graduate than diploma holders. Doctors had three time better 3.595 (1.304-9.908) practice of COVID-19 biomedical waste management than nurses. Similarly, the CHC's COVID 19 biomedical waste management practices were more than four time 4.440 (1.482-13.974) better than sub centers. Capoor MR et al in comprehensive, had stated that practice will significantly higher among health-care workers having higher technical qualifications.[13]

To conclude Level of knowledge and practice scores among the among the health care workers were unsatisfactory. Technical qualification of the health-care workers was identified as the important determinant of their waste management practice. This emphasizes that healthcare facilities should provide periodic training for the waste handlers.

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