Research Article

Knowledge, attitude and practices of paramedical workers and support staff in a private tertiary care hospital regarding biomedical waste management

Ashwini S, Bhavana R Hiremath

Department of Community Medicine, SDM College of Medical Sciences & Hospital, Hubli, Karnataka, India

Correspondence to: Ashwini S, E-mail: ashwini2184@gmail.com

Received: October 27, 2016; **Accepted:** June 01, 2017

ABSTRACT

Background: Appropriate knowledge regarding biomedical waste management and an attitude to practice what is known is required to achieve effective biomedical waste management. **Objective:** To assess the knowledge, attitude and practice of the paramedical workers and the support staff regarding biomedical waste management. **Materials and Methods:** After the calculation of an appropriate sample size, 155 nursing staff, 39 technicians, and 47 ward support staff working at a private tertiary care hospital in North Karnataka were selected using stratified random sampling. They were interviewed using a pre-tested, semi-structured questionnaire after taking oral informed consent. **Results:** Knowledge regarding correct segregation of biomedical waste was 89.7% among nursing staff, 83.0% among ward support staff, and 25.6% among technicians; whereas, it was correctly practiced by 87.1%, 57.4%, and 23.1% of nursing, ward support staffs, and technicians, respectively. Association of working status and months of service with both knowledge as well as the practice of segregation of biomedical waste was statistically significant. **Conclusion:** Better knowledge regarding the segregation of biomedical waste led to the better practice of the same. Hands on training to all the paramedical staffs at the time of entry to the job and also a periodical refresher course are a must.

KEY WORDS: Medical Waste; Allied Health Personnel; Nursing Staff; Waste Management; Tertiary Care Centers

INTRODUCTION

According to biomedical waste (management and handling) rules, 1998, biomedical waste means "any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals."[1] All human activities produce waste, some of which may be hazardous like those generated in any health care setup.

Access this article online	
Website: http://www.ijmsph.com	**Quick** Response code
DOI: 10.5455/ijmsph.2017.1060901062017	

India has more than 15,000 hospitals and nursing homes. An estimated 0.1-4.5 kg of waste is generated per bed each day.[2-4] Around 3 million tonnes medical waste is generated per year. It is growing at a rate of 8% annually.[1] In Karnataka, around 80,000 kg of biomedical waste is produced each day, and about 1 kg of biomedical waste is produced per bed.[5] It is estimated that 10-25% of health care waste is hazardous, and if it is not properly segregated the entire 100% will be converted into a hazardous waste.[6]

Earlier no effective system of biomedical waste disposal existed. Hospital waste was dumped in local municipal bins or even worse in the open. Health care establishments were not giving due attention to waste management. Biomedical waste (management and handling) rule was notified in the year 1998. It contains two schedules with the type of biomedical waste, color coding, type of container and disposal method. A deadline was set for the June 2000 to streamline

the process of segregation, collection, treatment and disposal of biomedical waste. Many health care institutions have streamlined it effectively.

However, effective management of biomedical waste requires conscious, coordinated and cooperative efforts of every single individual working in a hospital which can happen only if they have appropriate knowledge regarding biomedical waste management and an attitude to practice what is known. Hence, this study was conducted to assess the knowledge, attitude and practice of the paramedical workers and the support staff regarding biomedical waste management.

MATERIALS AND METHODS

Nurses, technicians and ward support staff working at a private tertiary care hospital in North Karnataka were interviewed using a pre-tested, semi-structured questionnaire after taking oral informed consent.

Prevalence of appropriate practice of biomedical waste segregation was 86.9% among paramedical workers in a study conducted in Gujarat.[7] Absolute error of 5.00% was considered. Using the formula $N = Z^2 pq/d^2$ with a confidence interval of 95%, a sample size of 241 was derived.

Stratified random sampling technique was used. They were stratified into the nursing staff, technicians, and ward support staff. There were 325 nursing staff, 107 technicians, and 190 ward support staff in total. Nursing staff constituted 52.25%, technicians constituted 17.20%, and ward support staff constituted 30.55% of the total. By applying these percentages to the sample size calculated, we sampled 155 nursing staff, 39 technicians, and 47 ward support staff. We selected these participants randomly from wards, intensive care units, operation theatres, blood bank and laboratories. Score ranging from 0 to 4 was given for the knowledge of segregation based on the answers given for the questions regarding wastes to be disposed in yellow, red, blue, and black colored bins. Similarly, a score of 0-4 was given for the practice of segregation based on the answers given for the questions regarding disposal of different categories of biomedical wastes usually generated in particular wards, intensive care units, operation theatres, and laboratories into various colored bins.

SPSS version 18.0 was used to apply statistical tests. Percentages were used to represent frequencies; Chi-square test was used to test the associations. Spearman's rank correlation test was used to test the correlation between the knowledge and the practice of segregation scores.

RESULTS

A majority of 162 (67.2%) study participants were females and 86 (35.7%) were in the age group of 26-30 years. Median age of the study participants was 28 years with a range of 20-53 years.

As many as 112 (46.5%) had 13-60 months of experience. A large number of 171 (71.0%) participants had never received any training regarding biomedical waste management (Table 1).

As many as 145 (70.0%) nursing staff, 37 (17.9%) technicians, and 25 (12.1%) ward support staff correctly knew the meaning of biomedical waste. Only 7 (2.9%) of the study participants had heard of biomedical waste (management and handling) rules, 1998 out of which six were nursing staff and one was a laboratory technician. Waste categories were unknown to 82 (34.0%) of the study participants. A majority of 96 (39.8%) of the study participants thought there were only four categories of waste. Only one nursing staff knew all the 10 waste categories.

According to a majority of 51 (21.2%) study participants it is important to manage biomedical waste appropriately to prevent the spread of infections in oneself and patients. Among the study participants 15 (6.2%) knew inappropriate management of biomedical waste can spread human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV)infections. A large number of 171 (70.0%) study participants thought only hospital staff are at risk of acquiring infections spread by inappropriate management of biomedical waste (Table 2).

Among the nursing staff, 105 (77.8%) knew the correct symbol of biomedical waste as against 20 (14.8%) technicians, and 10 (7.4%) ward support staff (Graph 1).

Biomedical waste should be stored for not more than 6 h in wards, operation theatres and laboratories. This knowledge was correct among 157 (65.2%) study participants. The four colors used in the biomedical waste management were correctly enumerated by 179 (74.3%) of the study participants among whom nursing staff were a majority of 142 (79.3%) (Graph 2).

Table 1: Distribution of study participants based on months of experience and training regarding biomedical waste management (*N*=241)

Characteristics of study participants	*N* (%)
Months of experience	
<12	32 (13.3)
13-60	112 (46.5)
61-120	64 (26.6)
>121	33 (13.7)
Range – 1-252 months, Mean – 65.07±51.411 months	
Training regarding biomedical waste management	
Not received	171 (71.0)
Received	70 (29.0)

Table 2: Distribution of study participants according to the knowledge regarding importance of appropriate biomedical waste management, infections transmitted and individuals at risk of acquiring infection through biomedical waste (*N*=241)

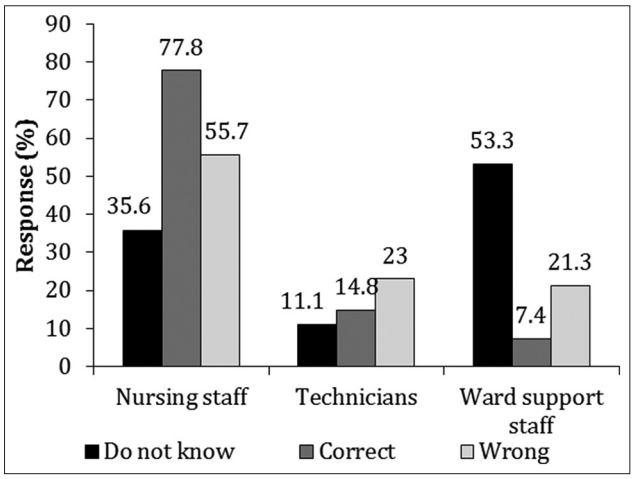
Biomedical waste management	*N* (%)
Importance of appropriate biomedical waste management	
Do not know	19 (7.8)
Prevent infections in self	74 (30.7)
Prevent infections in self and patients	51 (21.2)
Easy disposal	35 (14.5)
Prevent infections and injuries in self	17 (7.1)
Others	45 (18.7)
Infections transmitted through biomedical waste	
Do not know	36 (14.9)
HIV	19 (7.9)
HIV and HBV	63 (26.1)
HIV, HBV, and respiratory infections	31 (12.9)
HIV, HBV, and HCV	15 (6.2)
Respiratory infections	15 (6.2)
Various infections	62 (25.8)
Individuals at risk of acquiring infection through biomedical waste	
Do not know	7 (2.9)
Hospital staff	171 (71.0)
Patients and public	1 (0.4)
Hospital staff, patients, and public	62 (25.7)

HIV: Human immunodeficiency virus, HBV: Hepatitis B virus, HCV: Hepatitis C virus

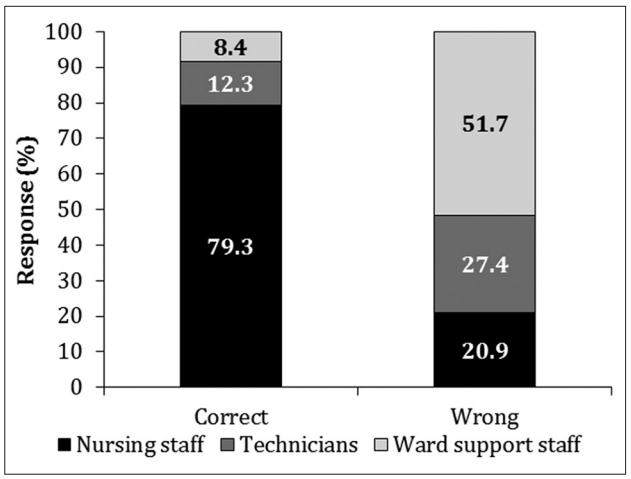
As many as 20 (8.3%) participants had the wrong practice of re-plugging the used needle, that too using both their hands. As many as 60 (87.0%) nursing staff, 8 (11.6%) laboratory technicians, and 1 (1.4%) ward support staff had the correct knowledge of what is to be done when they suffer a needle stick injury. While handling the biomedical waste, 38 (15.8%) study participants had been injured at least once in their service. Out of these injured participants, 15 (39.5%) had taken appropriate treatment which included washing liberally under running water, checking the patient's serostatus, testing self for HIV, HBV and HCV, informing physician or casualty medical officer and taking appropriate treatment as advised by the physician.

Association of working status and months of service with both knowledge as well as the practice of segregation of biomedical waste was statistically significant ($P < 0.05$). Whereas, the training received regarding biomedical waste did not have any statistical significance with the knowledge and practice of segregation of biomedical waste (Table 3).

Mean knowledge of segregation score was 3.5 with a standard deviation of 0.96 and mean practice of segregation score was 3.06 with a standard deviation of 0.99. Spearman's rank correlation coefficient for correlation between the knowledge and the practice of segregation scores was 0.356 which was statistically significant ($P < 0.01$). Hence, the practice of



Graph 1: Distribution of study participants according to the knowledge regarding correct symbol used to represent biomedical waste (*N*=241)



Graph 2: Distribution of study participants according to the knowledge regarding the four color bins used in biomedical waste management (*N*=241)

biomedical waste segregation is better among those whose knowledge regarding the same is better.

Attitude of the workers toward various aspects of biomedical waste was fairly satisfactory. As many as 238 (98.8%) study participants felt safe management of biomedical waste is an absolute necessity and also 178 (73.9%) felt it was not a financial burden on the hospital. A majority of 235 (97.5%) agreed that biomedical waste management is a team work and 191 (79.3%) disagreed that it is an extra burden on them. Requirement of a periodic training program regarding biomedical waste management was expressed by 210 (87.1%) study participants and 141 (58.5%) were willing to attend such a program voluntarily.

DISCUSSION

Knowledge regarding correct segregation of biomedical waste was 89.7% among nursing staff, 83.0% among ward

Table 3: Association of working status, training received and months of service with knowledge and practice of biomedical waste segregation

Parameters	Correct (%)	Wrong (%)	Total	Significance
Knowledge regarding biomedical waste segregation				
Working status				
Nursing staff	139 (89.7)	16 (10.3)	155	χ^2=75.322
Technicians	10 (25.6)	29 (74.4)	39	df=2
Ward support staff	39 (83.0)	8 (17.0)	47	*P*<0.001*
Training received				χ^2=1.085
Yes	53 (75.7)	17 (24.3)	70	df=1
No	118 (69.0)	53 (31.0)	171	*P*=0.298
Months of service				
<12	25 (78.1)	7 (21.9)	32	χ^2=9.138
13-60	86 (76.8)	26 (23.2)	112	df=3
61-120	43 (67.2)	21 (32.8)	64	*P*=0.028*
>121	17 (51.5)	16 (48.5)	33	
Practice of biomedical waste segregation				
Working status				
Nursing staff	135 (87.1)	20 (12.9)	155	χ^2=67.136
Technicians	9 (23.1)	30 (76.9)	39	df=2
Ward support staff	27 (57.4)	20 (42.6)	47	*P*<0.001*
Training received				χ^2=0.43
Yes	54 (77.1)	16 (22.9)	70	df=1
No	134 (78.4)	37 (21.6)	171	*P*=0.836
Months of service				
<12	24 (75.0)	8 (25.0)	32	χ^2=7.51
13-60	95 (84.8)	17 (15.2)	112	df=3
61-120	48 (75.0)	16 (25.0)	64	*P*<0.05*
>121	21 (63.6)	12 (36.4)	33	

**P*<0.05: Significant difference

support staff, and 25.6% among technicians; whereas, it was correctly practiced by 87.1%, 57.4%, and 23.1% of nursing, ward support staffs, and technicians, respectively. Association of working status and months of service with both knowledge as well as the practice of segregation of biomedical waste was statistically significant. Better knowledge regarding the segregation of biomedical waste led to the better practice of the same.

In this study, a majority of 71.0% of the study participants had not received any training regarding biomedical waste management. In a study conducted in a tertiary care center in Rajkot, it was observed that 55.3% of the study participants had not received training regarding the same.[7] None of the health care workers had received any special training regarding biomedical waste management as per a study conducted in 14 medical centers in Agra by Sharma.[8]

As many as 70.0% of nursing staff, 17.9% of laboratory technicians, and 12.1% of ward support staff knew the meaning of biomedical waste in this study; whereas, 51.4% of the study participants knew the same in a study conducted in a tertiary care center in Rajkot.[7] However, in this study, only 2.9% of the health care workers had heard of biomedical waste (management and handling) Rules, 1998. Similarly, the awareness regarding existence of legislation related to biomedical waste management and handling was 3.33% among the personnel of a tertiary care hospital in Dakshina Kannada.[9] A study conducted in Agra showed that such awareness was as high as 17.07%.[8]

A study was conducted in a tertiary care center in Rajkot in which it was seen that 97.2% were aware of the importance of appropriate biomedical waste management which was almost similar to 92.2% of the study participants being aware regarding the same in this study.[7]

Symbol used for biomedical waste was correctly identified by 77.8%, 14.8%, and 7.4% of nursing staff, laboratory technicians, and ward support staff, respectively. A different observation was made in a study conducted among the personnel of a tertiary care hospital in Dakshina Kannada that 30.0%, 63.33%, and 23.33% of nursing staff, laboratory technicians, and ward support staff correctly identified the symbol, respectively.

The four colors used for the biomedical waste storage bins were correctly enumerated by 79.3% of the study participants in this study which is almost similar to 84.4% of the health care personnel in a study undertaken in a tertiary care center in Rajkot.[7]

As many as 87.0% of the nursing staff, 11.6% of the laboratory technicians, and 1.4% of the ward support staff had the correct knowledge of what is to be done when they suffer a needle stick injury. While handling the biomedical waste, 15.8% of the study participants had been injured at least once in their service. Out of these injured participants, 39.5% had taken appropriate treatment. This observation was different from studies conducted in various places in which 2-67% of the study participants were injured while handling the biomedical waste at least once but not a single person had been treated appropriately.[9,10]

The practice of correct segregation was highest among the nursing staff at 87.1% followed by the ward support staff at 57.4% and finally laboratory technicians at 23.1% in this study. Observation made by the researchers in a tertiary care center of Dakshina Kannada varied from this finding wherein 43.33% of the nursing staff, 30.0% of the laboratory technicians, and 13.33% of the ward staff had the correct practice of biomedical waste segregation.[9]

Attitude of the study participants was favorable with 98.8% of the participants feeling safe management is needed and 73.9% opining that it is not a financial burden on the hospital administrators. Biomedical waste management is a team work was opined by 97.5% of the participants. Attitude was not so favorable in a study undertaken in Jaipur wherein 29.0%, 50.0%, and 65.0% were of the opinion that safe management is needed, biomedical waste management is not a financial burden on hospital administrators, and it is a team work. Requirement of a training regarding biomedical waste management was expressed by 87.1% of the participants which was similar to the finding in a study conducted among health care personnel in a tertiary care center in Rajkot.[7]

Strength of this study is that all cadres of paramedical staff who are involved in biomedical waste management were involved in the study and an appropriate representative sample was chosen. Limitation of this study is that all the practices were self-reported, so there is a chance of bias. Hence, study involving participant observation must be carried out. Nevertheless, based on the findings of this study it is required to provide hands on training to all the paramedical staff in small batches of 15-20 personnel at once with more attention being given to technicians and ward staff. Training at the time of entry to the job and also a periodical refresher course is a must.

CONCLUSION

Better knowledge regarding the segregation of biomedical waste led to the better practice of the same. Hands on training to all the paramedical staffs at the time of entry to the job and also a periodical refresher course are a must.

ACKNOWLEDGMENT

We acknowledge Medical Superintendent, Principal and other administrators of the tertiary care hospital, for permitting us to carry out the study. We are thankful to the nursing staff, the ward support staff, and the technicians for their cooperation.

REFERENCES

1. CPR Environmental Education Centre. Bio-Medical Waste Management. Chennai: CPR Environmental Education Centre; 2013.
2. Khajuria A, Kumar A. Assessment of healthcare waste generated by Government hospital in Agra city, India. Our Nat. 2007;5:25-30.
3. Patil AD, Shekdar AV. Health-care waste management in India. J Environ Manage. 2001;63(2):211-20.
4. Bio-Medical Waste Audit Report. Uttaranchal Health Systems Development Project; 2010. Available from: http://www.india.gov.in/allimpfrms/alldocs/9746.pdf. [Last cited on 2012 Apr 28].
5. State of the Environment Report 2003. Ministry of Environment and Forest, Government of India; 2003. p. 146-51.
6. WHO. Safe Management of Waste from Health Care Activities. Geneva: WHO; 1999. Available from: http://www.who.int/water_sanitation_health/medicalwaste/wastemanag/en/index.html. [Last cited on 2012 May 19].
7. Chudasama RK, Matib R, Sheth A, Misra SK, Kadri AM, Patel UV. Biomedical waste management: A study of knowledge, attitude and practice among health care personnel at tertiary care hospital in Rajkot. J Res Med Dent Sci. 2013;1(1):17-22.
8. Sharma S. Awareness about bio-medical waste management among health care personnel of some important medical centers in Agra. Int J Environ Sci Dev. 2010;1(3):251-5.
9. Ismail IM, Kulkarni AG, Kamble SV, Borker SA, Rekha R, Amruth M. Knowledge, attitude and practice about bio-medical waste management among personnel of a tertiary health care institute in Dakshina Kannada, Karnataka. Al Ameen J Med Sci. 2013;6(4):376-80.
10. Sharma A, Sharma V, Sharma S, Singh P. Awareness of biomedical waste management among health care personnel in Jaipur, India. Oral Health Dent Mamage. 2013;12(1):32-40.

How to cite this article: Ashwini S, Hiremath BR. Knowledge, attitude and practices of paramedical workers and support staff in a private tertiary care hospital regarding biomedical waste management. Int J Med Sci Public Health 2017;6(8):1272-1276.

Source of Support: Nil, **Conflict of Interest:** None declared.