

# Assessment of Knowledge, Attitude and Practice about Biomedical Waste Management among Healthcare Workers in a Tertiary Care Centre, Southern India

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## 1. Introduction

Biomedical waste (BMW) is any waste produced during the diagnosis, treatment, or immunization of human or animal research activities pertaining thereto or in the production or testing of biological or in health camps. It follows the cradle to grave approach which is characterization, quantification, segregation, storage, transport, and treatment.<sup>1</sup>

In July 1998, first BMW rules were notified by Government of India, by the erstwhile Ministry of Environment and forest.<sup>2</sup> In India, BMW problem was further compounded by the presence of scavengers who sort out open, unprotected health - care waste with no gloves, masks, or shoes for recycling, and second, reuse of syringe without appropriate sterilization.<sup>3</sup>

In 2015, the Central Pollution Control Board, India, has estimated that 169, 913 health - care facilities (HCFs) of India have generated approximately 495.30 tons/day biomedical waste, which roughly translates into 0.5–2 kg/bed/day.<sup>4</sup> Though first regulation for efficient management of biomedical waste in India came in 1998, medical sciences transform faster than the methods of waste management methods. The most comprehensive and effective guidelines of waste management were introduced by the Government of India as Biomedical waste Management (BMWM) rules, 2016, and BMWM (amendment) rules, 2018.<sup>5,6</sup>

Staff Nurses, Sanitary workers and lab technicians are directly related with the handling or managing of the biomedical waste. They are the most important people who could speak about their knowledge, perception and practices on biomedical waste. If there are any knowledge gaps in these fore mentioned cadres can help us to determine the strategy how to guide or inform about the waste disposition.<sup>7</sup>

The present study was conducted to evaluate the effectiveness of training Program on awareness among Nursing Staff, Lab - Technicians and Sanitary Workers regarding Bio - medical Waste Management in a Tertiary Care Hospital in Southern India. This study also performed to evaluate KAP on BMWM among healthcare workers.

## 2. Materials & Methods

This is a single centre, prospective cross - sectional study including 423 health care workers (HCW) such as Nursing Staffs, paramedical staffs and Sanitary Workers who are in the act of dealing the biomedical waste in Arunai Medical College & Hospital, Tiruvannamalai. This study was done after ethical Committee clearance was obtained. After a detailed training among all the staffs in the hospital by Hospital Infection Control Committee, audit was conducted for a period of 1 year for compliance. Pre and post - training assessment was done among the attendees using a questionnaire. Audit was conducted at various sites such as OPD, Laboratory, wards, procedure rooms, OT, ICUs, etc., at various levels such as collection, segregation and disposal areas by Infection Control Officer and Infection control nurses. Audit was conducted randomly without prior intimation. Statistical analysis were reported as percentage and compared using the  $\chi^2$  test. A value of  $P < 0.05$  was considered statistically significant.

## 3. Results

In Knowledge, attitude and Practice (KAP) of BMWM, no significant difference was observed among males and females, whereas with experience and age, KAP scores increases as the age advances. Above 60 years, there was a decline in the score may be due to more illiterate in this age group (Table 1). Among the healthcare workers, doctors and nurses had similar KAP scores but it was less among the other paramedical staffs (Fig 1).

**Table 1:** Socio - demographic variables for KAP in BMWM among HCW

Variables	Response category	Knowledge (%)	Attitude (%)	Practice (%)
Sex	Male	58	54	59
	Female	62	57	60
Age in years	<25	45	56	65

	25 - 45	52	61	67
	45 - 60	70	63	43
	>60	29	33	24
Level of Education	Masters & above	77	61	64
	Bachelors	61	59	69
	School	23	22	51
	Illiterate	19	46	55
Work Experience	<1 years	22	49	60
	1 - 5 years	46	51	63
	>5 years	69	61	70
Qualification	Doctors	76	66	81
	Nursing staff	71	65	71
	Paramedical staffs	54	46	39
	Sanitary workers	32	19	22

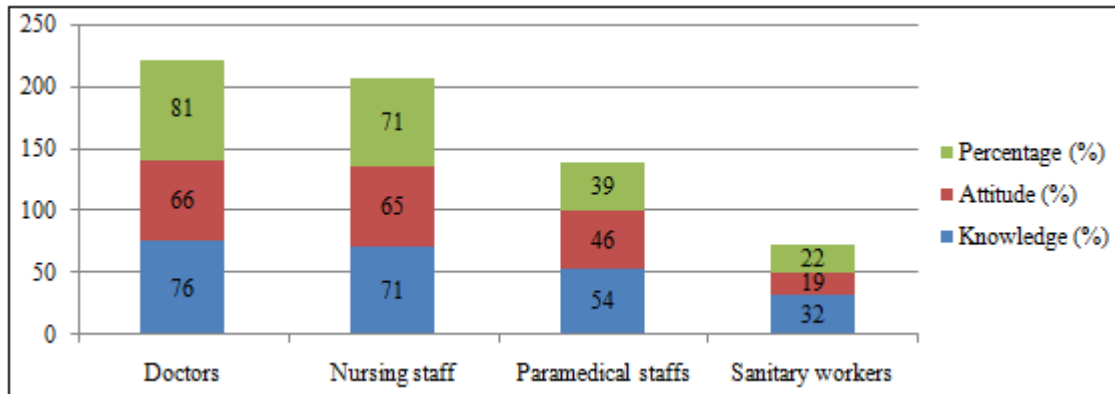


Figure 1: KAP scores of BMWM among health care workers

Knowledge, attitude and practice (KAP) score of BMWM in health care workers were good in 60.5 %, 50.5 % and 59.3% respectively. Attitude and practice were directly in relation

to knowledge of BMWM (Table 2, 3, 4). Knowledge on disposal methods was poor in all HCWs.

Table 2: Knowledge on BMWM guidelines among HCWs

Variables	Response Category	Response (n=423)	Percentage
About health hazards associated with BMWM?	Yes	299	70.7
	No	124	29.3
Awareness on PPE purpose	Yes	356	84.2
	No	67	15.8
Are all BMWs are infectious?	Yes	189	44.7
	No	234	55.3
Awareness about different colour coding of BMWM	Yes	314	74.2
	No	109	25.8
Aware about what type of BMW stored in Yellow bin?	Yes	317	74.9
	No	109	25.8
Aware about what type of BMW stored in Red bin?	Yes	304	71.9
	No	119	28.1
Aware about what type of BMW stored in Blue bin?	Yes	361	85.3
	No	62	14.6
Aware about what type of BMW stored in White container?	Yes	382	90.3
	No	41	9.7
Are you aware about our outsourcing facility for BMW disposal?	Yes	254	60
	No	169	40
Aware about BMW's disposal methods?	Yes	241	57
	No	182	43
Summary of Knowledge	Good	256	60.5
	Poor	167	39.5

Table 3: Attitude towards BMWM among HCW

Variables	Disagree	Neutral	Agree
Improper BMWM can predispose to infection	83	49	291
HIV may be transmitted through BMW	21	22	380
HBV may be transmitted through BMW	38	68	317
HCV may be transmitted through BMW	86	36	301

BMW segregation to be done at the point of generation	29	53	341
Barcoding and labelling adds value to the BMWM	206	96	121
BMWM adds extra burden to work	51	137	186
BMW to be disinfected before disposal	28	112	283
Wearing PPE reduce the chance of infection	46	58	319
Summary of BMWM attitude	Good	214 (50.5%)	
	Poor	209 (49.5%)	

**Table 4:** Practice of HCWs in BMWM in the hospital

Variables	Response Category	Response	Percentage
Incidents with sharp injuries	Yes	46	10.9
	No	377	89.1
Spill management	Yes	91	21.5
	No	332	78.5
Frequency of glove utilization	Always	126	29.8
	Sometimes	213	50.3
PPE during collection of BMWM	Yes	186	44
	No	237	56
Colour coding followed	Yes	312	73.8
	No	111	26.2
Where infection waste such as urinary catheter, syringe hub, IV set to be discarded?	Green Bin	27	6.4
	Red bin	299	70.7
	Yellow Bin	97	22.9
Where sharps to be discarded?	White Container	356	84.2
	Yellow bin	41	9.7
	Red bin	26	6.1
Do you recap your needles	Yes	126	29.8
	No	297	70.2
Do you disinfect the surfaces after usage?	Yes	304	71.9
	No	119	28.1
Where do you discard paper, food waste wraps, etc. ?	Green Bin	319	75.4
	Blue bin	104	24.6
Summary of BMWM practice	Good	251 (59.3%)	
	Poor	172 (40.7%)	

Immediately after training, compliance was good for up to 20 days at all the health care sites. Maximum adherence of 92% was observed in Operation theatres and Pediatric ICU. Next 87% adherence was found in SICU, followed by 73% in MICU. Among the wards, around 77% adherence was maintained and, whereas in OPDs it was around 69% and 58% in general areas. Laboratory maintained around 91% adherence, may be because of less public influence (Table 5).

But reduction in the percentage of an average 3 - 20% was observed in all areas after 3 months of training. This may be due to reduction in knowledge or lack of interest. After 6 months most of the places recorded less than 50 % of adherence except OT (73%) and ICU (69%) adherence to BMWM (Fig 2).

**Table 5:** Pattern of adherence towards BMWM over the course of 6 months in hospital

Area	1 Month	3 Months	6 Months
Operation Theatre	92 %	89 %	73 %
MICU	73 %	72 %	62 %
SICU	87 %	92 %	69 %
PICU	92 %	88 %	71 %
NICU	91 %	81 %	78 %
OPD	69 %	59 %	48 %
Wards	73 %	65 %	49 %
Labour Room	79 %	74 %	70 %
Laboratory	91 %	76 %	51 %
Others	58 %	51 %	46 %

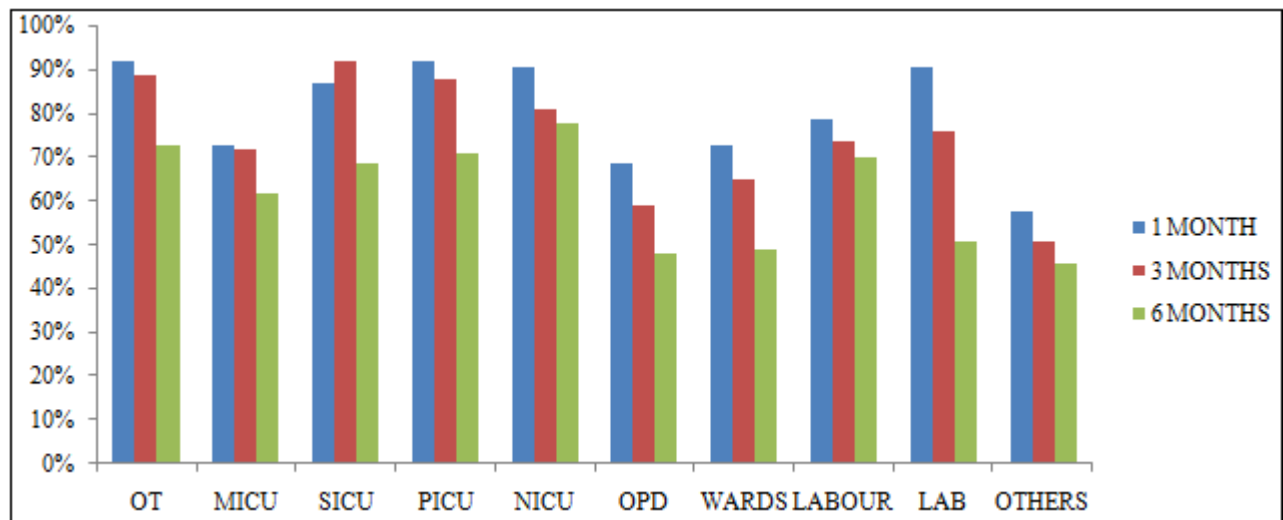


Figure 2: Trend in BMW over the course of 6 months in different places in hospital

#### 4. Discussion

In this study, with experience and education, the knowledge about biomedical waste management was better, though above 60 years there was a sharp decline in the knowledge, may be house - keeping were majority in that age group who are mostly illiterate correlating with Mituku G et al<sup>8</sup>. However the knowledge in disposal methods were not up to the mark in any category as observed in other studies.<sup>8,9</sup>

Health care workers who had a good attitude toward BMW were more likely to practice good biomedical waste management than those who had a poor attitude toward BMW.<sup>8</sup> Though knowledge is important to cater, it is very important to change their attitude towards BMW to provide better practices.

In a Descriptive study performed in Pakistan tertiary care health facilities, on the knowledge, attitude; and practices of healthcare staff regarding infectious waste handling revealed socio - demographic information such as age, gender, level of education; and experience, when compared with the practices, was found to be statistically significant ( $p < 0.05$ ).<sup>10, 11</sup> In our study, statistical significance was observed in with age, education and experience. Knowledge and practice gap still exists in our study, which needs better training and auditing, whereas Dalui et al and Karmakar et al demonstrated statistically significant relation of Knowledge and attitude of health personnel with practice of BMW management.<sup>12, 13</sup>

In our study, during follow - up, though knowledge was retained there was a sharp drop in practices of 20 % and 50 % after 3 and 6 months of training respectively. Only critical areas where constant reinforcement is advocated, BMW practices were maintained or improved even after 6 months of training. Intervention with another training session after 6 months, improved the statistics significantly. When the best adherent wards or staffs were acknowledged or awarded, the percentages improved around 30%. The importance of training regarding biomedical waste management needs emphasis; lack of proper and complete knowledge about biomedical waste management impacts practices of appropriate waste disposal.<sup>14</sup>

Pandey et al demonstrated the practice of BMW Management was lacking in 30 - 35% HCP which may lead to mixing of the 15% infectious waste with the remaining non - infectious. Therefore, training courses and awareness programs about BMW management will be carried out every month targeting smaller groups.<sup>15</sup>

Singh et al studied the structured training on all aspects of BMW management led to statistically significant improvement in the knowledge among health - care professionals,<sup>16</sup> similar to our study.

Limitations of the study are it represents only a tertiary health care center in southern India, with health care workers on all strata. Better results could have obtained if the progress was studied in each group of health care workers separately, which is planned in future follow - up.

#### 5. Conclusion

Our study concluded the need for regular training sessions in the health care set - up quarterly for better adherence to biomedical waste management practices. Knowledge may be important for immediate results but for sustaining reinforcement is required. Induction training should be given all new joiners in a health care set - up regarding BMW and the in - house protocols. BMW topic can be included in under - graduate curriculum of all health care professionals for better understanding.

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#### Conflicts of interest

There were no conflicts of interest in this study.

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