

**KNOWLEDGE, ATTITUDES AND PRACTICES OF
HEALTH-CARE PERSONNEL TOWARDS
BIOMEDICAL WASTE DISPOSAL MANAGEMENT
AT ARBOR BIOTECH LTD, MUMBAI**

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ABSTRACT

This study evaluated the knowledge, attitudes and practices of health-care providers towards biomedical waste management at Arbor Biotech Ltd, Mumbai. In this cross-sectional study 12 physicians, 16 laboratory technicians and 09 housekeepers were interviewed using a pre-designed study questionnaire. Housekeepers were significantly more knowledgeable than physicians or laboratory technicians regarding policies and systems for waste disposal, however less so about precise details regarding its disposal. Housekeepers also had the highest overall scores for attitudes to waste disposal among the 3 groups. Significantly more laboratory technicians had satisfactory practice scores (84.0%) than did physicians (67.3%) (Housekeepers were not assessed). Training and duration of work experience were not significantly associated with knowledge, attitude and practice scores, except for laboratory technicians with longer work experience, who were more likely to have satisfactory knowledge about waste disposal than less experienced laboratory technicians.

Keywords: Attitude, Biomedical waste disposal, Knowledge, Laboratory technicians, Practices

I. INTRODUCTION

In the recent times, Biomedical Waste Management has emerged as a major cause of concern to hospitals, primary health-care centres, nursing home authorities and the environment [1]. Recent technological breakthroughs in medical facilities and the incorporation of superior sophisticated instruments have amplified the quantum of biomedical waste generation per patient in health-care units worldwide [2]. As per the records of World Health Organization (WHO), high-income countries generate on average up to 0.5 kg of hazardous waste per hospital bed per day. In the low-income countries, even though the figure is only 0.2 kg per hospital bed per day, healthcare waste is seldom separated into hazardous or non-hazardous waste thereby severely amounting to the actual quantity of hazardous waste [3]. In the health-care facilities of some developing countries, the most serious challenge is posed by clinical solid waste. In such countries, inappropriate disposal of biomedical waste and poor waste handling practices is an ever-increasing health hazard [4].

Like other developing nations, India is also struggling to improve its biomedical waste management practices [5,6]. Health-care workers in India are often unaware of several governmental legislations due to the lack of information of documented guidelines, written policies and protocols [7]. The most recurrent methods of final waste disposal are autoclaving or incineration [8]. Most medical establishments in Mumbai use incineration while the majority of teaching and university based medical centres use autoclaving [9]. The objective of our study therefore was to assess the Knowledge, Attitudes and Practices (KAP) of health-care providers towards biomedical waste management at Arbor Biotech Ltd, Mumbai.

II. METHODS

2.1 Design of our Study

A cross-sectional study was conducted among 37 health-care personnel. Calculation of the sample size was done using the Statcalc module of the Epi-Info program, version 6, with expected frequency of satisfactory KAP score 30% +/- 5% at alpha error = 0.05 and power of the test = 80%. This yielded a sample size of 31 people. In order to find the association between job title and satisfactory KAP scores, the sample was adjusted and increased to 37 subjects. The study included both males and females. Approval from the organization administration was obtained to conduct the study. An oral consent was obtained from participants after explaining the study objectives and assuring data confidentiality. To maintain confidentiality the study questionnaire was anonymous and data were kept confidential in a file that could be accessed only by the authors.

2.2 Data collection

The study questionnaire comprised of matters related to the occupational background of participants (department, job title, lifetime duration of work experience and working hours per day). The questions related to KAP included 12 items. For the matters of knowledge, 4 items e.g. on colour coding for waste disposal bags and identification of biohazard symbol were included in the study questionnaire. The matters of attitude were assessed using 4 questions, e.g. about whether they considered proper waste disposal plans a prime priority, whether waste disposal was a team work and whether wearing Personal Protective Equipment (PPE) decreases infections contraction or not. Practices were evaluated by a participant observation checklist concerning wearing personal protective equipment, correct disposal of sharps and other waste, correct handling of blood-contaminated fomites, hand-washing after injection. Housekeepers were excluded in the assessment of practice items since it included items that were not related to their profession. The Study questionnaire was set in the English language. The reliability of the study questionnaire was assessed by applying reliability test using Cronbach alpha (0.73). Distribution of the study questionnaire was done by interview method since almost of the housekeeping staff was illiterate or had difficulty in reading and writing. Interviews were conducted by one of the authors. Emphasis was placed on using simple language for housekeepers. The data were collected over a period of 4 weeks. After interviewing the participant, he/she were observed on the same day by one of the authors in order to score the practice items in the observation checklist. The observation checklist was attached to the end of the questionnaire to facilitate the incorporation of all data for the same person in one sheet.

2.3 Statistical analysis

Data entry and Data analysis was conducted using SPSS (version 15). A summary of data was performed where mean and standard deviations (SD) were calculated for quantitative data while percentages and frequencies were calculated for qualitative data. The KAP scores were estimated as follows: satisfactory knowledge was score ≥ 4 (range 0–6); satisfactory attitude was score ≥ 4 (range 0–6); satisfactory practice was score ≥ 3 items practised correctly (range 0–5). The KAP scores were bifurcated into categories named satisfactory and unsatisfactory to compare our findings with those of other studies. The chi-squared test was applied to estimate the relationship between the study variables and KAP scores for the job groups. P-values were considered significant at ≤ 0.05 .

III. RESULTS

The mean ages of participants were as follows: physicians 28.5 (SD 1.8) years, laboratory technicians 33.8 (SD 7.9) years and housekeepers 42.7 (SD 6.5) years. All laboratory technicians were males, while 33.3% of physicians and 71.4% of housekeepers were females. Whereas, 66.7% of physicians and 28.6% of housekeepers were males (TABLE 1).

TABLE 1 Attributes of the study participants

Variable	Physicians		Laboratory Technicians		Housekeeping staff	
	n=12		n=16		n=9	
Age (years)						
Mean (SD)	28.5 (1.8)		33.8(7.9)		42.7(6.5)	
Range	24-33		29-38		34-48	
Sex (no. %)						
Male	8		66.7		16	
Female	4		33.3		0	
Length of work experience (years) (%)						
<2	3	33.3	14	87.5	3	33.3
≥ 2	9	66.7	2	12.5	6	66.7

3.1 Knowledge Score

For physicians, the percentage with correct knowledge about the use of red disposal bags (58.3%) and sharps boxes (50.0%) and correct identification of the biohazard symbol (41.7%) was significantly higher than among the other 2 study groups ($P < 0.001$). There was no significant difference among the 3 study groups regarding knowledge about the correct content of the black disposal bags ($P > 0.05$). By comparing the total satisfactory knowledge scores, it was found that the percentage of physicians with satisfactory knowledge scores (52.7%) was significantly higher than among laboratory technicians (45.3%) and housekeepers (36.07%) ($P < 0.001$) (TABLE2).

Table 2 Observed Knowledge of healthcare workers in different jobs about aspects of biomedical waste disposal

Knowledge item	Physicians		Laboratory Technicians		Housekeeping staff		χ^2 -value	P-value
	n=12		n=16		n=09			
	No.	%	No.	%	No.	%		
Identification of biohazard symbol	5	41.7	5	31.2	2	22.2	24.3	<0.001
What to put in sharps box	6	50	7	43.7	2	22.2	21.4	<0.001
What to put in red disposal bags	7	58.3	6	37.5	4	44.4	15.7	<0.001
What to put in black disposal bags	7	58.3	11	68.8	5	55.5	6.5	<0.05
Satisfactory knowledge score (\geq 60% items correct)	6	52.07	7	45.3	3	36.07	16.8	<0.001

3.2 Attitude items

Moreover, the percentage of physicians agreeing that using personal protective equipment decreases the risk of contracting infection (55.5%) was significantly higher than among laboratory technicians (43.0%) and housekeepers (22.5%) ($P < 0.001$). In contrast, the proportion of housekeeping staff agreeing that waste disposal is a team responsibility was 73.0% versus 29.8% among laboratory technicians and 28.2% among physicians and the difference was statistically significant ($P < 0.001$). The percentage of housekeepers agreeing that safe waste disposal should be a priority of the institution (59.6%) was also significantly higher than among laboratory technicians (35.8%) and physicians (40.9%) ($P < 0.001$). Moreover, significantly more housekeepers (30.3%) than laboratory technicians (27.8%) and physicians (16.4%) agreed that safe waste disposal might be a financial burden on the administrative department ($P < 0.05$). Satisfactory attitude scores were the highest among housekeeping staff (39.7%) compared with 34.1% among laboratory technicians and 36.8% among physicians, but this was not statistically significant (TABLE 3).

Table 3 Observed Attitude of healthcare workers in different jobs about aspects of biomedical waste disposal

Attitude item	Physicians		Laboratory Technicians		Housekeeping staff		χ^2 -value	P-value
	n=12		n=16		n=09			
	No.	%	No.	%	No.	%		
Wearing PPE decreases the risk of contracting infection	7	58.3	7	43.7	2	22.2	23.24	<0.001
Waste disposal is a team work	4	33.3	5	31.2	7	77.7	52.64	<0.001
Safe waste disposal should be a priority	5	41.7	6	37.5	5	55.5	14.6	<0.001
Efforts in safe waste disposal are a financial burden on the administration	2	16.7	4	25	3	33.3	7.32	<0.05
Satisfactory attitude score (\geq 60% items correct)	5	36.8	5	34.1	4	39.7	7.85	0.009

3.3 Practice items

On observation of health-care workers, significantly more laboratory technicians than physicians correctly disposed of blood-contaminated fomites (82.4% versus 67.1%) ($P < 0.001$). Moreover, the percentage of laboratory technicians showing satisfactory overall practice scores (82.4%) was significantly higher than that of physicians (67.1%) ($P = 0.001$) (TABLE 4).

Table 4 Observed Practices of healthcare workers in different jobs about aspects of biomedical waste disposal

Practice item	Physicians		Laboratory Technicians		χ^2 -value	P-value
	n=12		n=16			
	No.	%	No.	%		
Washing hands after injections	7	58.3	11	68.8	3.52	0.1
Correct handling of sharps	10	83.3	15	93.75	4.76	0.05
Correct handling of blood-contaminated fomites	8	66.7	13	81.25	18.7	<0.001
Wearing personal protective equipment	7	58.3	10	62.5	5.42	<0.06
Satisfactory practice score (\geq 60% items correct)	7	67.1	12	82.4	10.13	0.001

3.4 Relationship with training and work experience

On studying the variables that could affect KAP scores, it was found that duration of work experience and having ever received training on waste management were not significantly related to satisfactory scores in any of the studied domains among physicians and housekeepers, and training was not related to KAP scores of laboratory technicians ($P > 0.05$). The only significant variable was lifetime work experience among laboratory technicians; more of those who had worked ≥ 2 years had satisfactory knowledge scores (55.5%) than those who had worked < 2 years (42.9%) ($P < 0.05$) (TABLE 5)

Table 5 Relationship of Professional work experience and training of healthcare workers with Knowledge, attitudes and practice scores on biomedical waste management.

	Knowledge				Attitudes				Practices			
	Satisfactory		Not Satisfactory		Satisfactory		Not Satisfactory		Satisfactory		Not Satisfactory	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Physicians												
Whether received training												
Yes	5	83.3	1	16.7	4	80	1	20	5	83.3	1	16.7
No	4	66.7	2	33.3	3	42.9	4	57.1	4	66.7	2	33.3
	$\chi^2 = 0.98, P > 0.05$				$\chi^2 = 1.72, P > 0.05$				$\chi^2 = 1.31, P > 0.05$			
Professional years of working												
<2	5	83.3	1	16.7	5	83.3	1	16.7	5	71.4	2	28.6
≥ 2	3	50	3	50	2	33.3	4	66.7	3	60	2	40
	$\chi^2 = 0.30, P > 0.05$				$\chi^2 = 3.49, P > 0.05$				$\chi^2 = 2.65, P > 0.05$			
Laboratory Technicians												
Whether received training												
Yes	5	62.5	3	27.5	6	60	4	40	8	72.2	3	27.8
No	6	75	2	25	3	42.9	4	57.1	4	80	1	20
	$\chi^2 = 0.58, P > 0.05$				$\chi^2 = 1.09, P > 0.05$				$\chi^2 = 0.55, P > 0.05$			
Professional years of working												

<2	3	42.9	4	57.1	3	50	3	50	5	83.3	1	16.7
≥2	5	55.5	4	45.5	5	50	5	50	8	80	2	20
	$\chi^2 = 6.73, P > 0.05$				$\chi^2 = 0.10, P > 0.05$				$\chi^2 = 1.51, P > 0.05$			
Housekeeping staff												
Whether received training												
Yes	1	25	3	75	2	66.7	1	33.3	n/a	-	n/a	-
No	2	40	3	60	2	33.3	4	66.7	n/a	-	n/a	-
	$\chi^2 = 0.03, P > 0.05$				$\chi^2 = 0.44, P > 0.05$							
Professional years of working												
<2	1	33.3	2	66.7	2	66.7	1	33.3	n/a	-	n/a	-
≥2	3	50	3	50	4	66.7	2	33.3	n/a	-	n/a	-
	$\chi^2 = 0.02, P > 0.05$				$\chi^2 = 0.15, P > 0.05$							

IV. DISCUSSION

Fundamental strength of our study was that it helps to identify the gaps between the current KAP among the health-care workers involved in biomedical waste management and the future desired level that should be attained. In this study it was found that knowledge about the existence of department plans for biomedical waste disposal was significantly better among housekeeping staff than laboratory technicians or physicians. The housekeeping staff that participated in our study was less knowledgeable about specific details of disposal. This is in contrast to an Indian study carried out by Mathew, which found that knowledge of the existence of biomedical waste management rules was better among doctors than laboratory technicians or paramedical staff, but that knowledge of the practical aspects of biomedical waste management was better among laboratory technicians and paramedical staff [10]. In another study, it was suggested that the knowledge regarding colour coding and waste segregation at source was better among laboratory technicians and laboratory staff than among doctors [11]. Our study is also in contrast to work done by Mochungong, where most of the respondents involved in collecting, segregating, transporting and disposing clinical waste had never heard of any policy on safe clinical waste management [12]. Our findings showed that, overall, the percentage of physicians with satisfactory knowledge scores regarding waste disposal (68.3%) was significantly higher than that of laboratory technicians (60.9%) and housekeepers (40.4%). The high overall knowledge of doctors in our study was mainly because more in-depth and detailed information

is usually the concern of individuals with higher education and professional levels. Mathur et al (2011) reported that the knowledge about biomedical waste management rules among the technically qualified personnel such as doctors, laboratory technicians and laboratory staff was high but was low among the sanitary staff [13].

Interpreting the attitude of healthcare workers towards waste disposal at our institution, it was noted that, overall, more housekeeping staff had satisfactory attitude scores (61.9%) than did laboratory technicians (49.0%) and physicians (56.4%), although the differences were not significant. Physicians were more likely than other workers to agree that wearing personal protective equipment reduces the risk of contracting infection, and were more likely to express a willingness to cooperate in the biomedical waste management team. Study carried out by Shafee M (2010) is in disagreement to our observation where laboratory technicians had better attitudes towards separation of waste, proper disposal, implementation of rules and cooperation in programmes than did technicians and housekeeping staff [14]. Whereas, for certain items—that safe waste disposal should be a priority, that waste disposal is teamwork, and that disposal is a financial burden on the administration—the proportion of housekeeping staff showing approval of these items was significantly higher than that of physicians and laboratory technicians. In study carried out by Pandit N B (2005), it was found that 98% of the laboratory technicians and 79% of the housekeeping staff had positive attitudes versus only 59% of the technical staff [15].

Our study also report that the practice scores of laboratory technicians were significantly higher than those of physicians (84.8% versus 67.3% had overall satisfactory practice). This certainly indicates doctors' lack of awareness of the problem in general and their role in waste management in particular. A particular reason may be due to their lack of training, since fewer physicians in our study reported receiving training on proper waste management than did laboratory technicians (38.2% versus 67.5%). Another explanation for such flawed practices among doctors might be patient overload. Lack of interest in engaging to training programmes might also contribute to unsatisfactory practices

The relationship between duration of work experience and KAP scores among different job categories in our study was found to be not significant, besides for the relationship between work duration and knowledge of biomedical waste management among laboratory technicians; the percentage of laboratory technicians with satisfactory knowledge scores was higher among those who had worked ≥ 2 years than those who worked < 2 years. Our study also investigated the association between training received on biomedical waste management and KAP scores, and surprisingly it was found to be non-significant across all the study groups. Though this observation does not undermine the significance of training courses and orientation programmes on awareness about biomedical waste management, but it does induce a critical question regarding the clarity of knowledge and practical skills offered in such programmes. Lakbala et al. recommended that majority of training courses and orientation programmes highlight on several theoretical lectures and not on comprehensive hands-on training. Furthermore, training programmes should take into account the academic background and educational level of housekeepers, since in developing countries like India a significant proportion of participants are illiterate [16]. There were some limitations of our study. The sample size was small thereby generating low statistical power. Further larger studies are required to confirm these results. Also, the sampling method was a convenience sample.

V. CONCLUSION

Our findings conclude that there exists a disparity between the current knowledge of biomedical waste management among health-care workers and that demanded by institutional waste management implementation policies. We suggest that there ought to be suitable and rigorous training programmes related to awareness and practices of biomedical waste disposal for all health-care staff, with constant monitoring at frequent intervals. Further research is essential to bridge the existing gaps in the knowledge about biomedical waste management. The findings of our study will assist in addressing this issue more appropriately, for better training programmes and monitoring of biomedical waste management systems.

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