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Knowledge, Attitudes, and Practices About Biomedical Waste Management among Healthcare Workers in Erbil Teaching Hospitals.

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Abstract

Background and objectives: Biomedical waste must be handled and disposed of properly to prevent several detrimental impacts on the populations it serves. The study assesses healthcare workers' knowledge, attitudes, and practices on biomedical waste management in Erbil's teaching hospitals.

Methods: A hospital-based cross-sectional study was conducted between October 1st, 2022, and September 30th, 2023. This research was conducted at the teaching hospitals in Erbil. Healthcare workers, including physicians, pharmacists, nurses, laboratory technicians, and sanitary staff, were included in this study. Knowledge, attitude, and practice about biomedical waste management were investigated.

Results: A total of 530 participants were included in the study. 55.7% were female, 24.3% were physicians, and 45.7% were nurses. 45.8% of participants had medium knowledge of biomedical waste management, while 33% had poor knowledge. 60.9% had a positive attitude about biomedical waste management. About 41% of the study participants had bad practices in biomedical waste management, 40.6% had medium, and 18% had good practices. There was a significant statistical association between knowledge and attitude levels among healthcare workers, their degree of practice, and gender. P value = 0.000, 0.000, and 0.000, respectively. >15 years of experience were better practiced (p-value = 0.05).

Conclusion: The results of our study showed significant associations between knowledge and attitude toward their practice, gender, and health workers' attendance at biomedical waste management training courses.

Keywords: Attitude, Biomedical waste management, Healthcare workers, Knowledge, Practice

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Introduction

The term "biomedical waste" (BMW) refers to the trash generated by hospitals, research facilities, and laboratories during patient or animal diagnosis, treatment, and immunization. Hazardous wastes, which might include human or animal tissue, blood or other body fluids, excretions, medications, swabs, bandages, syringes, needles, or other sharp objects, are thought to pose a serious hazard to both human health and the environment.[1-3] To avoid negative effects on public health and the environment, proper biomedical waste management (BMWM) is required. Managing trash from the time of generation to the point of disposal involves separating, collecting, transporting, and treating it. Improper management and exposure to infectious waste produced by positive patients can easily infect healthcare staff, such as doctors, nurses, and waste pickers.[4-6] A new concern for human health and the environment has emerged as a result of BMW's huge production during the pandemic and is usually handled by healthcare personnel of all groupings in hospitals. Therefore, in this pandemic, healthcare personnel's understanding of biomedical waste (BMW) management is essential, and extreme caution and personal protection should be exercised by all healthcare personnel handling biological waste.[7, 8] The term "BMWM" describes eliminating all infectious and hazardous waste produced in medical environments. Waste treatment aims to decontaminate the waste produced to eradicate any harmful organisms. This aids in the prevention of several serious health problems that infected trash may cause. It is a technique for averting any environmental risks. Standard precautions (SPs) and extra (transmission-based) precautions are two categories of infection prevention methods. The SPs policy protects healthcare workers, patients, and the general public, which lowers the risk of hospital-acquired illnesses.[9] The employees must know the hazards of BMW in the work environment and make its disposition effective and scientific. The various healthcare providers need to possess the necessary BMWM knowledge, attitudes, and practices (KAP).[10] Healthcare professionals are the primary group in charge of managing medical waste from generation to disposal. The objectives of this study were to investigate the KAP regarding BMWM among health care workers (HCWs), including physicians, pharmacists, nurses, laboratory technicians, and sanitary staff working in Erbil teaching hospitals, and find out their associations with certain demographic characteristics of the studied participants.

Subjects and methods

A cross-sectional study was conducted between October 1st, 2022, and September 30th, 2023.HCWs included in this study completed a well-designed, self-administered questionnaire containing questions on KAP regarding BMWM. Data from illiterate sanitary workers who could not read or write was collected through direct face-to-face interviews. Before distributing the questionnaire, all participants were given a brief explanation of the study's objectives in the local language. This research was conducted in the Rizgary, Rapareen, Maternity, and Erbil teaching hospitals in Erbil. The Erbil General Directorate of Health's statistical division provided a total population of 2707. The sample size was then calculated using Epi Info version 7 with an acceptable major error of 5%, a confidence level of 95%, and an expected frequency of 50. The proportional systemic random sampling approach was used to obtain 530 samples to overcome non-respondents, despite the projected sample size of 336. Exclusion standards were absent. Another person was randomly selected in place of those who declined to participate in the study. Table (1) showed the distribution of population and selected samples. Part I of the questionnaire focuses on the sociodemographic traits of the

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study participants. Part II-Table (4) includes 12 BMWM-Knowledge-Questions; Each question requires the participant to mark the appropriate response. Yes or no. The minimum, maximum, and median of the correct answer was detected at 0 to 12, the respondent's correct answer with < 7 regards us as poor, 7 to 9 intermediates and 10 to 12 were considered good knowledge, shown in Table (3). Part III Table (5) consists of 15 attitude questions; Each question requires the participant to mark the appropriate response: 1 for disagree, 2 for neutral, and 3 for agree. Then, utilizing our disagree-and-neutral combo and awarding a 0-score, the minimum, maximum, and median of the correct answer were detected from 0 to 15. Then those who responded less than the median was considered to have a negative attitude, and those above the median a positive attitude, as demonstrated in Table (3). Part IV consists of 11 practice questions; Table (6) Each question requires the participant to mark the appropriate response. Yes or No, then the minimum, maximum, and median of the correct answer were detected. 0 to 11 medians were 7, Those who responded < 7 considered us a bad practice, 7 to 9 medium practice, and > 9 correct answers regarded us as a good practice Table (3). A group of three specialists in the field of community health medicine have validated the questionnaire to look at the content of the survey for appropriateness, relevance, and clarity. The scientific ethical committee of the Kurdistan Board of Medical Specialties (KBMS) has approved, and the general directorate of health in Erbil has granted permission for the participation of medical personnel throughout the study. For data input and analysis, SPSS version 26 statistical software for social science was used. The calculation of frequencies and percentages of variables was done using descriptive statistics. The chi-square association test was performed to determine whether category variables are associated. A statistically significant value is one with a p-value less than 0.05.

Table (1): Distribution of population and selected samples

Occupations	Hospitals				
	Rizgary	Rapareen	Maternity	Erbil	% of samples
Physician	225	99	149	187	
	43	20	29	37	24.4
Pharmacist	61	27	41	52	
	12	6	8	10	6.7
Lab workers	118	52	79	99	
	23	9	16	20	12.9
Nurse	421	188	281	350	
	84	37	54	67	45.7
Sanitary workers	94	42	63	79	
	18	8	13	16	10.3
Total populations	919	408	613	767	
Total samples	180	80	120	150	100

Results

In terms of hospitals, Rapareen Teaching Hospital had the lowest study sample percentage 15.1%, and Rizgary Teaching Hospital had the highest 34%. A total of 530 people made up the sample: 235, 44.3% men, and 295, 55.7% women. The majority 63.6% of the samples had college or higher education levels, while 2.6% of them were illiterate. Table (2).

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Table (2): Sample distribution according to sociodemographic factors

Sociodemographic data		No. (%)
Hospital	Rizgary	180 (34)
	Rapareen	80 (15.1)
	Maternity	120 (22.6)
	Erbil	150 (28.3)
Gender	Male	235 (44.3)
	Female	295 (55.7)
Age groups	< 25	106 (20)
	25 to 35	190 (35.8)
	36 to 45	135 (25.5)
	>45	99 (18.7)
Occupations	Physician	129 (24.3)
	Pharmacist	36 (6.8)
	Laboratory workers	68 (12.8)
	Nurses	242 (45.7)
	Sanitary workers	55 (10.4)
Educational level	Illiterate	14 (2.6)
	Read & write	18 (3.6)
	Primary school	23 (4.3)
	Secondary school	58 (10.9)
	College & institute	337 (63.6)
	Postgraduate	80 (15.1)
Qualifications	Nothing	70 (13.2)
	Diploma	170 (33.6)
	Bachelors	215 (40.6)
	Masters	35 (6.6)
	Bord or PhD	32 (6)
Attending the BMWM training course	Yes	134 (25.3)
	No	396 (74.7)
Hepatitis vaccine	Yes	381 (71.9)
	No	149 (28.1)
COVID-19 vaccine	Yes	339 (75.3)
	No	191 (24.7)

We found that 21.2% of participants had good knowledge, 45.8% had average knowledge, and 33% had inadequate or poor knowledge. Positive attitudes made up 60.9% of the total, followed by negative attitudes at 39.1%. 18.5% of respondents practiced well, 40.6% practiced moderately, and 40.9% practiced insufficiently or poorly. Table (3).

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Table (3): Distribution of the sample according to knowledge, attitude, and practice levels

KAP	Levels of KAP	No. (%)
Knowledge	Poor	175 (33)
	Intermediate	243 (45.8)
	Good	112 (21.2)
Attitude	Negative	207 (39.1)
	Positive	323 (60.9)
Practice	Bad	217 (40.9)
	Medium	215 (40.6)
	Good	98 (18)

Table (4) shows that the majority of health professionals recognized the correct response to the question of whether wearing personal protective equipment lowers the risk of infection by 90.2%. 89.8% of people were aware that the illness was spread via biomedical waste, and 84.2% were concerned about a needlestick or sharp injury.

Table (4): Sample distribution by knowledge regarding biomedical waste management

Knowledge	Response	No. (%)
Do you know about the Bio Hazard Symbol?	Yes	334 (63)
	No	196 (37)
Have you received any information on BMWM?	Yes	266 (50.2)
	No	264 (49.8)
Do you know about the BMW color-coding system?	Yes	212 (40)
	No	318 (60)
Do you know about BMW separation?	Yes	300 (56.6)
	No	230 (43.4)
Do you know about BMW storage and collection?	Yes	242 (45.7)
	No	288 (54.3)
Do you know about BMW disposal management?	Yes	213 (40.2)
	No	317 (59.8)
Are BMW recyclable?	Yes	180 (34)
	No	350 (66)
Any health hazard associated with BMW?	Yes	430 (81.1)
	No	100 (18.9)
Is needle-stick/sharp injury a concern?	Yes	446 (84.2)
	No	84 (15.8)
Is BMW transmitting any disease?	Yes	476 (89.8)
	No	54 (10.2)
Is BMW transmitting any disease?	Yes	478 (90.2)
	No	52 (9.8)
Does the disinfection of medical wastes decrease infection transmission?	Yes	445 (84)
	No	85 (16)

In terms of attitude, 86.6% agreed that handling medical waste properly is a crucial issue, and 86.4% agreed that BMWM requires teamwork. 82.8% believe that hospitals should create a continuing education program on BMWM. 71.3% agreed to take additional training in the subject. Table (5).

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Table (5): Sample distribution based on attitudes on the treatment of biomedical waste

Attitude	Response	No. (%)
Proper medical waste handling is a necessary issue.	Disagree	33 (6.2)
	Neutral	38 (7.2)
	Agree	459 (86.6)
Safe medical waste management needs teamwork.	Disagree	22 (4.2)
	Neutral	50 (9.7)
	Agree	458 (86.4)
The use of color codes for the segregation of waste is a must.	Disagree	26 (4.9)
	Neutral	63 (11.7)
	Agree	441 (83.2)
Medical waste segregation can facilitate safe handling.	Disagree	23 (4.3)
	Neutral	104 (9.6)
	Agree	403 (76)
Medical wastes are segregated at the site of generation.	Disagree	55 (10.4)
	Neutral	154 (29.1)
	Agree	321 (60.6)
Segregation of waste at source increases the risk of injury to waste handlers.	Disagree	66 (12.5)
	Neutral	164 (30.9)
	Agree	300 (56.6)
Labeling the container before filling it with waste is of clinical significance.	Disagree	23 (4.3)
	Neutral	108 (20.4)
	Agree	399 (75.3)
Infectious waste should be sterilized before shredding and disposal.	Disagree	59 (11.1)
	Neutral	122 (23)
	Agree	349 (65.8)
Reporting of needle stick injury is a must.	Disagree	38 (7.2)
	Neutral	126 (23.8)
	Agree	366 (69.1)
Post-exposure prophylaxis should be initiated as soon as possible.	Disagree	24 (4.5)
	Neutral	84 (15.8)
	Agree	422 (79.6)
It is important to know about BMW generation, hazards, and legislation.	Disagree	32 (6)
	Neutral	95 (17.9)
	Agree	403 (76)
Require any further training on BMWM.	Disagree	41 (7.7)
	Neutral	111 (20.9)
	Agree	378 (71.3)
your knowledge regarding BMWM is adequate.	Disagree	123 (23.2)
	Neutral	126 (23.8)
	Agree	281 (53)
The hospital should organize a continuing education program About BMWM.	Disagree	22 (4.2)
	Neutral	69 (13)
	Agree	439 (82.8)
I would like to attend voluntary programs that enhance knowledge About BMWM.	Disagree	41 (7.7)
	Neutral	92 (17.4)
	Agree	397 (74.9)

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The practices of healthcare professionals are shown in Table (6). To separate waste sharps at work sites, 81% of respondents utilize puncture-proof plastic containers, 77% wear personal protective equipment while handling, 73.8% segregate, and 64.7% follow color coding.

Table (6): Distribution of samples by practice concerning biomedical waste management

Practice	Response	No. (%)
Do you wear personal protective equipment while handling BMW?	Yes	408 (77)
	No	122 (23)
Do you follow color coding for the segregation of waste?	Yes	343 (64.7)
	No	187 (35.3)
After a needlestick injury, do you adhere to post-exposure prophylaxis?	Yes	362 (68.3)
	No	168 (31.7)
Do you put non-infectious wastes in black containers?	Yes	263 (49.6)
	No	267 (50.4)
Do you Practice the correct method for collecting used disposable plastic items?	Yes	270 (50.9)
	No	260 (49.1)
Are you Practicing the correct method for collecting soiled dressings Plaster, casts, and linen?	Yes	295 (55.7)
	No	235 (44.3)
Do you Practice the correct method for collecting sharps and Needles?	Yes	403 (76)
	No	127 (24)
Do you Practice the correct method for collecting human anatomical waste?	Yes	319 (60.2)
	No	211 (39.8)
Do you Disinfect biomedical waste before disposal at the workplace?	Yes	275 (51.9)
	No	255 (48.1)
Do you Segregate biomedical waste at the workplace?	Yes	391 (73.8)
	No	139 (26.2)
Do you use puncture-proof plastic containers to collect waste sharps?	Yes	433 (81.7)
	No	97 (18.3)

The current study discovered statistically significant differences between health professionals' knowledge and attitudes and their level of practice, with p values of (<0.001, <0.001). Table (7).

Table (7): Associations between levels of knowledge, attitude, and their degree of practice

LKA		Degree of practice			
		Bad	Medium	Good	p value*
		No. (%) **	No. (%) **	No. (col%) **	
Knowledge	Poor	99 (56.6)	55 (31.4)	21 (12)	< 0.001
	Intermediate	98 (40.3)	117 (48.1)	28 (11.5)	
	Good	20 (17.9)	43 (38.4)	49 (43.8)	
Attitude	Negative	108 (52.2)	84 (40.6)	15 (7.2)	< 0.001
	Positive	109 (33.7)	131 (40.6)	83 (25.7)	

***** Chi-square test, ** Row number and percentage, LKA: levels of Knowledge and Attitude

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The results of the current study showed that the experience and practice level of health professionals differed statistically significantly with p value of 0.05. This conclusion is illustrated in Table (8).

Table (8): Association between the number of years of HCWs experience to the degree of practice

Years of experience	Degree of practice				
	Bad	Medium	Good	total	p value
	No. (%)	No. (%)	No. (%)	No. (%)	0.05
< 5	75 (47.5)	65 (41.1)	18 (11.4)	158 (100)	
5 to 10	40 (35.4)	52 (46)	21 (18.6)	113 (100)	
11 to 15	50 (49)	35 (34.3)	17 (16.7)	102 (100)	
>15	52 (33.1)	63 (40.1)	42 (26.8)	157 (100)	

Table (9) displays the association between KAP and gender. There is a statistically significant association between males and females regarding their knowledge and practice of BMWM, with p-values of < 0.001 and <0.001, respectively. However, attitude does not have a p value of 0.78. Also, a statistically significant correlation was observed between the knowledge and practice levels of health professionals and their attendance at the BMWM training course (ATC), with p values of <0.001 and <0.001, respectively.

Table (9): Association between KAP of HCWs to gender, and to their ATC of BMWM

KAP	LKAP	Gender				ATC			
		Male	Female	Total		Yes	No	Total	
		No. (%)	No. (%)	No. (%)	p value	No. (%)	No. (%)	No. (%)	p value
Knowledge	Poor	84 (48)	91 (52)	175 (100)	.007	156 (89.1)	19 (10.9)	175 (100)	< 0.001
	Inter mediate	116 (47.7)	127 (52.3)	243 (100)		188 (77.4)	55 (22.6)	243 (100)	
	Good	35 (31.3)	77 (68.8)	112 (100)		52 (46.4)	60 (53.6)	112 (100)	
Attitude	Negativ e	85 (41.1)	122 (58.9)	207 (100)	.22	156 (75.4)	51 (24.6)	207 (100)	0.78
	Positiv e	150 (46.4)	173 (53.6)	323 (100)		240 (74.3)	83 (25.7)	323 (100)	
Practice	Bad	106 (48.8)	111 (51.2)	217 (100)	.09	178 (82)	39 (18)	217 (100)	< 0.001
	Mediu m	94 (43.7)	121 (56.3)	215 (100)		162 (75.3)	53 (24.7)	215 (100)	
	Good	35 (35.7)	63 (64.3)	98 (100)		56 (57.1)	42 (22.9)	98 (100)	

* Chi-square test. LKAP: levels of KAP, ATC: Attending to BMWM training courses

Discussions

Hospitals and other healthcare institutions produce a lot of hazardous and possibly infectious waste every day. Biological waste created in hospitals is mishandled and haphazardly disposed of, which has several detrimental health consequences on the environment, the general public, and the employees of healthcare institutions. The

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environment and public health are seriously threatened by this; Thus, disposal requires extra caution. It is the responsibility of healthcare facilities to protect the environment and public health. As a result, healthcare personnel must have proper management training. Research revealed that the sociodemographic characteristics of the participants were comparable to those of studies carried out in Lahore, Gurugram, and Bengaluru respectively. The study's findings indicate that 40.6% of the participants were certified bachelors, 55.9% were female, and around 36 % were between the ages of 25 and 35.[11-14] According to this survey, around 75 % of them have received the COVID-19 vaccination and have been vaccinated against hepatitis. These results imply that 25 % of healthcare workers may be at risk, since they are unaware of the vaccination and should get vaccinated immediately, which is in line with previous research.[11,14-16] The study's findings showed that, on average, 45.8% of participants had medium knowledge. HCWs must be aware of color coding since biomedical waste handlers sort trash at the site of generation into containers marked with certain colors. Each HCW must know, where the garbage is kept, which color it indicates, and which Ward and Operation Room it should be collected from. Less than half of the study's participants had adequate color-coding knowledge, Similarly, Shaheen's study found that just 40 % of the nurses had adequate knowledge of color-coding.[14] The outcomes of another study conducted in Lucknow showed a significant relationship between waste segregation and the BWM training of HCWs. Training is therefore an effective tactic to spread knowledge about the color-coding of biological waste. As a result, training is a useful strategy that can raise awareness about the color coding of biomedical waste.[12,17,18,22] 40 6 % of participants practiced moderately, and approximately two-thirds of participants had a good opinion regarding BMWM. Numerous studies conducted throughout the globe further support this.[11,15,19] Other studies conducted in the same setting also revealed a notable improvement in nurses' practices and understanding of biomedical waste control. The percentage of nurses with good expertise rose from 17 % to 58 %.[22] Consistent with previous research, the current study discovered a statistically significant difference (P-value < 0.001, < 0.001) between health professionals' knowledge and attitude levels and their level of practice.[12,20,21]. The results of the current study are consistent with previous research in that they indicate statistically significant differences between the experience and degree of practice of health professionals (P-value 0.05).[11,22] Additionally, the study validated the notion that women had superior BMWM knowledge and practice than men (p-values = 0.007 and 0.09, respectively).[22] Study Limitations. In terms of methodology, the study concentrates on an Erbil four-teaching hospital. The results from this study and their generalizability to healthcare professionals' knowledge, attitudes, and actions about biomedical waste management in Erbil are limited since we lack information on other hospitals in the city.

Conclusion

The results of this study show that participant practice is generally poor, despite HCWs' positive attitudes and thorough knowledge of BMWM. For this reason, effective obligatory training programs that teach HCWs how to handle and regularly organize BMW are essential. We will be able to improve patient care and bridge the existing gap between knowledge and practice by doing this.

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