

Study of knowledge, Attitude, and Practices of Health Care Workers towards Biomedical Waste Management in Government Hospitals in Benghazi, Libya

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Abstract— The study Aimed to assess the knowledge, attitude and practice of healthcare providers towards medical waste management. **Methodology:** Descriptive cross-sectional study included 773 participants were convenience sample, the study was conducted in five government hospitals including (Benghazi Medical Center, Al-Jalaa Hospital for Accidents and Surgery, Children Hospital Benghazi, Psychiatric Hospital Benghazi, and Benghazi Teaching Eye Hospital) from January to May 2024. The study targeted health workers who were presented during the period of data collection, including nurses, physicians, pharmacist, laboratory technician, hygienist or sanitary staff and others from all selected hospitals, the data were collected by using self-administrated questionnaire. Chi-square test used to determine any significant association. **Result:** The study showed that score of knowledge, attitude and practice were (62.97%), (63.07%), and (82.91%), respectively. There are significant relationships between the overall adequate knowledge, positive attitudes, and practices of participant's knowledge. the present study found that (64.6%) of the sample members had not received training courses, this may refer the lack of training courses for new employees, or the lack of periodic training courses to deal with medical waste. **Conclusion:** The high knowledge of healthcare workers was associated with their positive attitude and good practice in respect of MWM and was consistent with their KAP rating scores categorized as high knowledge, positive attitude, and good practice. The duration of working experience of healthcare workers was the most significant factor influencing good practices related to medical waste management.

Keywords: Knowledge, Attitude, practice, Medical Waste Management, Health Care Workers.

I. INTRODUCTION

Growing medical advancements and the building of new hospitals to provide better healthcare have led to an increase in the amount of waste generated by healthcare facilities. Both categories of waste from medical procedures in hospitals, labs, and testing facilities are referred to as "Health Care Waste" or "Bio-Medical Waste" (1).

Medical waste is defined by the World Health Organization (WHO) as waste produced by health care activities. This includes bodily parts, chemicals, medications, radioactive materials, spent needles and syringes, soiled dressings, diagnostic tests, blood, and First of all (2).

A subset of the waste generated by healthcare facilities, such as hospitals, doctor's offices, dental offices, blood banks, veterinary clinics, and research and development facilities, is known as medical waste. Healthcare waste that may have been tainted by bodily fluids, blood, or other potentially infectious materials is commonly referred to as medical waste, or regulated medical waste (3).

According to the World Health Organization (WHO), high-income countries generate an average of 0.5 kg of hazardous waste per hospital bed per day. Low-income nations only produce 0.2 kg, though. However, health care waste is often not separated into hazardous and non-hazardous waste in low-income countries, which leads to a significantly higher actual amount of hazardous waste (4).

Ordinary, non-hazardous waste makes up about 85% of the total waste generated by healthcare operations. The remaining 15% is thought to contain potentially toxic, infectious, or radioactive material (5).

Potentially dangerous microorganisms that can infect patients, hospital employees, and members of the public can be found in medical waste. Exposure can occur through a variety of routes, such as cuts, pricks, contact with the skin or mucous membranes, inhalation, and ingestion (6).

Biomedical waste can be categorized into various groups according to the risk of infection and/or injury during handling and disposal. Among the wastes that need particular handling and disposal protocols are sharps (needles or scalpel blades), pathological (anatomical body parts, microbiology cultures, and blood samples), and infectious (items contaminated with bodily fluids and discharges, like 2 dressings, catheters, and IV lines). Radioactive wastes, devices containing mercury, and polyvinyl chloride (PVC) plastics are additional pollutants generated in healthcare settings (7).

II. THE STUDY PROBLEM

The inefficiency of biomedical waste management has been attributed to a number of factors by the World Health Organization (WHO). These factors include a lack of systems for managing and disposing of waste, inadequate training in waste management, a lack of funding and human resources, a

lack of awareness of the health risks associated with medical waste, and the topic's low priority (8).

In addition to the fact that biomedical waste management (BWM) is not properly implemented in many developing countries, there are also few clear guidelines, operating standards, and well-defined laws (9).

There is an inevitable need for healthcare professionals to have adequate knowledge and a proper attitude towards BWM and its management. Therefore, the present study carried out to evaluate the knowledge, attitudes, and practices of healthcare workers (HCWs) in public healthcare facilities in Benghazi city regarding the management of biomedical waste.

III. THE AIM OF THE STUDY

This study aims to assess healthcare worker's knowledge, attitude, and practices regarding biomedical waste management in public hospitals, focusing on waste management in public settings.

IV. OBJECTIVE

1. To measure the level of knowledge, attitudes, and practice among health care workers in studied hospitals
2. To explore the relationship between knowledge, attitudes, and practice level with socio-demographic factors of the participants.
3. To determine the association between knowledge level with practice level, and knowledge level with attitude level.

V. MATERIAL AND METHOD

A. Study design:

The study adopted a cross-sectional study design was conducted among HCWs from period of January to May 2024 in the governmental hospitals

B. Study area and setting:

The study carried out to assess the knowledge, practice and attitude on BWM management among various healthcare employees from five government hospitals in Benghazi city (Benghazi Medical Center, Al-Jalaa Hospital for Accidents and Surgery, Children Hospital Benghazi, Psychiatric Hospital Benghazi, and Benghazi Ophthalmology Teaching Hospital for Ophthalmology).

C. Sample Size and Sampling Method:

study design with convenience sampling as sampling technique. The study targeted health workers who were presented during the period of data collection and involve 773 populations, including nurses, physicians, pharmacist, laboratory technician, Hygienist or sanitary staff and others from all selected hospitals.

VI. PROCEDURE:

A. Questionnaire:

Data were collected using a self-administered questionnaire designed to match study needs among the study population.

These questionnaires were developed after reviewing and evaluating similar published article (10).

The questionnaire was divided into four sections: demographic details, knowledge, attitude, and practices regarding HCWs. The first part contained socio-demographic characteristic of participants (age, gender, education level, job category, working experience). The second part of questionnaire consisted of knowledge of health care workers which includes 9 items, for example: color coding for waste disposal bags, existence plan or strategy for biomedical waste in hospital. The attitude of health care workers was assessed by using 6 questions such as: Do you think the hospital has good policies for disposing of medical waste? Do you think that wearing personal protective equipment (PPE) reduces the risk of infection, Is waste management a team works? The practices part was assessed by 8 questions e.g. hand washing before and after procedure, do you put sharp waste in steel boxes?

B. Knowledge scale:

The knowledge section featured nine questions, each with three options: yes, no, and I don't know, in which there was two incorrect with one correct option.

The correct answer gets one mark. Analysis was finished once all marks were added. The overall score for knowledge varied from Scores of 5 or higher were defined as "high knowledge" and scores of 0-4 as "low or poor knowledge."

A comparable approach for gathering knowledge scores was utilized in a study by Pravinraj, *et al.* (11).

C. Attitude scale:

The attitudes section had six questions, and the participants' responses were documented. Each question is marked as agreed, neutral, or disagreed. Participants who agreed with three or more questions were defined as having a "good attitude," whereas those who disagreed with less than three questions were classified as having a "poor attitude".

D. Practice scale:

Regarding the practice section; the study including eight practice-related items with answers of always, sometimes, and never. Scores below or equal four suggest poor practices, while scores over four indicate good procedures.

E. Data Analysis:

All relevant data was collected and subsequently entered and analyzed by using Statistical Package for Social Sciences (SPSS) version 25. Chi-square analysis was used to test the association between the KAP of HCWs on BWM and their demographic characteristics, and the p value was equal to 0.05 or less.

VII. RESULT

Socio –demographic characteristic of participants:

Table 1 depicts the sociodemographic characteristics of the respondents. Of the 773 participants, the majority (75.7%) respondents were females, and (42%) were aged between from 32 to 38 years, highest education qualification as bachelor's degree (66.1%), and had 6 to 10 years of work experience in the healthcare settings (37%). Laboratory technicians made up (38%) of the HCWs in the sample under study. While a higher

percentage of responders (64.6%) had no training, and (75.8%) had adequate knowledge about medical waste disposal bins.

TABLE I. SOCIO –DEMOGRAPHIC CHARACTERISTIC OF PARTICIPANTS

Variable	Frequency (N)	Percentage (%)
<i>Age</i>		
18-24	29	3.8%
25-31	271	35.1%
32-38	325	42.0%
>39	148	19.1%
<i>Gender</i>		
Male	180	23.3%
Female	593	75.7%
<i>Occupation</i>		
Physician	113	14.6%
Nurse	250	32.3%
Laboratory technician	294	38.0%
Hygienist	62	8.0%
Pharmacist	26	3.4%
Other	28	3.6%
<i>Educational level</i>		
Primary	55	7.1%
Secondary	207	26.8%
University or more	511	66.1%
<i>Years of experience from</i>		
1 to 5	228	29.5%
6 to 10	286	37.0%
>10	259	33.5%
<i>Training courses</i>		
Yes	272	35.2%
No	499	64.6%
<i>Are there special bins for disposing of medical waste</i>		
Yes	586	75.8%
No	179	23.2%

Participants' knowledge of BWB:

As shown in table (2); when asked if they were aware of the risks involved with managing medical waste, nearly all of the participants (81.5%) responded "yes". In addition, over 72.4% of participants said they knew that medical waste could be segregated as soon as it was created. Furthermore, only (63.4%) of participants claimed to be aware of the policies and regulations governing the disposal of medical waste. Regarding their understanding of a bag or box's maximum filling limit, only (62.9%) their knowledge was good. When asked if liquid waste may be dumped in sewage without being treated (66.8%) of the respondents choose "yes.". 80.3% correctly recognized the color coding waste segregation. 76.5% of the respondents were aware of the yellow bin for infectious waste. in addition to knowing that expired.

TABLE II. PARTICIPANTS' KNOWLEDGE OF BIOMEDICAL WASTE MANAGEMENT

Knowledge questions	Yes	No	I don t know
Are you aware of the risks of dealing with medical waste?	630(81.5%)	48(6.2%)	95(12.3%)
Is medical waste separated immediately after its production?	560(72.4%)	64(8.3%)	149(19.3%)
Do you have knowledge of the legislation and policies used to dispose of medical waste?	490(63.4%)	151(19.5%)	132(17.1%)
What is the appropriate time to dispose of medical waste to avoid the risks resulting from it?	695(89.9%)	53(6.9%)	25(3.2%)
Do you know the color coding of medical waste disposal bags and bins?	621(80.3%)	73(9.4%)	79(10.2%)
Does the maximum filling of the bag and box reach three quarters of the content?	486(62.9%)	77(10.0%)	210(27.2%)
Are liquid wastes disposed of in sewage with treatment?	516(66.8%)	95(12.3%)	162(21.0%)
Are expired medications considered medical waste?	620(80.2%)	45(5.8%)	107(13.8%)
Are infectious wastes placed in yellow bags?	591(76.5%)	75(9.7%)	106(13.7%)

Participants' attitude of BWB:

The attitude of health care workers towards BWB management was reported in Table (3): the majority of participants (92.2%) agreed that it is essential to separate medical waste in order to stop or prevent the spread of illness. 91.7% believed that personal protective equipment (PPE) should be worn while handling biomedical waste. Only less than half of the participants (43.3%) believed that handling biomedical waste. their work involved separate medical waste. When asked if they thought that disposing of waste was a common task rather than the hospital's responsibility, the study indicated that (55.4%) were in agreement. Moreover, over half of them (53.8%) thought the hospital had appropriate procedures in place for getting disposal of medical waste. In addition to, (62.2%) of the participants expressed agreement with the international standards of attitudes towards biomedical waste management.

TABLE III. PARTICIPANTS' ATTITUDES OF BIOMEDICAL WASTE MANAGEMENT

Attitudes questions	Agree	Neutral	Disagree
Do you think that the correct separation of medical waste is important to prevent transmission of infection?	713(92.2%)	43(5.6%)	16(2.1%)
Do you think that wearing personal protective equipment (PPE) reduces the risk of infection?	709(91.7%)	59(7.6%)	3(0.4%)
Is it your duty to separate medical waste?	335(43.3%)	229(29.6%)	208(26.9%)
Is the disposal of medical waste a team work and not the responsibility of the hospital administration?	428(55.4%)	173(22.4%)	171(22.1%)
Do you think the hospital has good policies for disposing of medical waste?	416(53.8%)	251(32.5%)	105(13.6%)
Do you think that medical waste disposal policies are consistent with international standards for the disposal of medical waste?	481(62.2%)	212(27.4%)	79(10.2%)

Participants' practice of MWM:

As indicated in table (4); 72.6 % of the study's participants separated the waste.

Furthermore, (94.3%) of the study group reported that they always wear gloves when handling medical waste. The vast majority (95.9%) wash their hands after dealing with medical waste. While, (64.8%) of respondents are always in favor of placing sharp waste in steel boxes. However, two thirds of the study group (61.6%) indicated that the transportation method of disposal waste carried out accordance with standards. Less than half of participants (47.1%) were practicing the segregation of infectious and non-infectious waste. While less than half of them (42.7%) hypothesized that the visitors facing risk of medical waste.

TABLE IV. PARTICIPANTS' PRACTICE OF BIOMEDICAL WASTE MANAGEMENT

Practices questions	Always	Sometimes	Never
Is medical waste separated?	561(72.6%)	155(20.1%)	56(7.2%)
Do you wear gloves when handling medical waste?	729(94.3%)	40(5.2%)	3(0.4%)
Do you wash your hands after handling medical waste?	741(95.9%)	26(3.4%)	5(0.6%)
Do you put sharp waste in steel boxes?	501(64.8%)	231(29.9%)	40(5.2%)
Is the method by which waste is transported from its source to disposal sites in accordance with standards?	476(61.6%)	232(30.0%)	64(8.3%)
Are infectious, non-infectious and sharp waste stored separately?	364(47.1%)	147(19%)	262(33.9%)
Are the numbers of workers disposing of	288(37.3%)	253(32.7%)	232(30.0%)

medical waste sufficient?			
Are hospital visitors at risk from medical waste?	282(36.5%)	330(42.7%)	161(20.8%)



FIGURE (1) LEVEL OF KNOWLEDGE, ATTITUDE AND PRACTICE AMONG HEALTH CARE WORKERS

Figure (1): displays the KAP score classification. Of the 773 responders, 63.9%, 63.7%, and 83.6% of the HCWs had good knowledge, attitude, and practice level, respectively.

Cross-tabulation between knowledge level and socio demographic factors:

According to table (5); the cross-tabulation between knowledge score categories and sociodemographic characteristics revealed a significant association ($p = 0.000$) between occupation and work experience.

TABLE V. CROSS-TABULATION BETWEEN KNOWLEDGE LEVEL AND SOCIO DEMOGRAPHIC FACTORS:

	High knowledge	Low knowledge	p-value
Age			
18-24	55.2%	44.8%	0.582
25-31	61.3%	38.7%	
32-38	65.8%	34.2%	
39 or more	66.2%	33.8%	
Gender			
male	60.0%	40.0%	0.087
female	65.1%	34.9%	
Occupation			
Physician	54.0%	46.0%	0.00
nurse	72.4%	27.6%	
laboratory	65.0%	35.0%	
technician	66.1%	33.9%	
hygienist	19.3%	80.8%	
pharmacist other	53.6%	46.4%	
Educational level			
Primary	72.7%	27.3%	0.110
Secondary	68.1%	31.9%	
University or more	61.3%	38.7%	
Years of experience			
1 to 5	54.4%	45.6%	0.00
6 to 10	73.4%	26.6%	
More than 10	61.8%	38.2%	

Cross tabulation between attitude level and socio-demographic factors:

Table (3) displays the cross-tabulation of attitude score categories with sociodemographic attributes. A significant association between occupation type and the 773 samples examined was discovered ($p = 0.045$). No significant association was found between the attitude score categories and any other sociodemographic factors, such as age, gender, education, or work experience.

TABLE VI. CROSS TABULATION BETWEEN ATTITUDE LEVEL AND SOCIO DEMOGRAPHIC FACTORS:

	Poor attitude	Good attitude	P-value
Age			
18-24	35.7%	64.3%	0.206
25-31	40.0%	60.0%	
32-38	36.2%	63.8%	
39 or more	29.5%	70.5%	
Gender			
male	41.8%	58.2%	0.079
Female	34.6%	65.4%	
Occupation			
Physician	46.9%	53.1%	0.045
nurse	31.6%	68.4%	
Laboratory	37.5%	62.5%	
technician	32.8%	67.2%	
Hygienist	44.0%	56.0%	
pharmacist other	22.2%	77.8%	
Educational level			
Primary	21.8%	78.2%	0.068
Secondary	37.9%	62.1%	
University or more	37.2%	62.8%	
Years of experience			
1 to 5	38.6%	61.4%	0.335
6 to 10	38.2%	61.8%	
More than 10	32.0%	68.0%	

Cross tabulation between practice level and socio-demographic factors:

Cross-tabulation between practice score categories and sociodemographic characteristics found a significant association with occupation type ($p = 0.047$)

The study revealed that there is significant relationship between knowledge level and attitude level of the study participants on biomedical waste management with a p value (0.001).

The study shown that there is significant relationship between knowledge level with regard to practice level in population sample ($p = 0.001$).

TABLE VII. CROSS TABULATION BETWEEN PRACTICE LEVEL AND SOCIO-DEMOGRAPHIC FACTORS:

	Poor practice	Good practice	P-value
Age			
18-24	25%	75%	0.204
25-31	19%	81%	
32-38	14.9%	85.1%	
39 or more	13%	87%	
Gender			
male	16.9%	83.1%	0.796
female	16.1%	83.9%	
Occupation			
Physician	16.1%	83.9%	0.047
nurse	19.6%	80.4%	
laboratory	12.7%	87.3%	
technician	16.4%	83.6%	
hygienist	34.8%	65.2%	
pharmacist other	10.7%	89.3%	
Educational level			
Primary	9.1%	90.9%	0.155
Secondary	19.5%	80.5%	
University or more	15.8%	84.2%	
Years of experience			
1 to 5	18.9%	81.1%	0.290
6 to 10	16.6%	83.4%	
More than 10	13.7%	86.8%	

VIII. DISCUSSION:

Health care waste poses a significant risk to public health and the environment due to its high infection and injury potential. So inadequate handling can lead to serious consequences, making it crucial to have a safe and reliable method for waste disposal (12).

As we mentioned earlier in the research problem, the factors that contribute to the ineffectiveness of biomedical waste management which include insufficient knowledge of the health risks associated with medical waste, insufficient training in waste management, and the absence of waste management and disposal systems. Accordingly, we will discuss here the findings of the study and compare them with previous studies conducted in the same field. In this study, 64% of the study participants had high level of knowledge towards the appropriate disposal of biomedical waste based on their answers to the questions. This might be explained by higher education level of the respondents, which agree with studies in Northwest Ethiopia in which 56.8% of the study participants had adequate knowledge score, and in Saudi Arabia that show

(47.1%) of the participants had high knowledge of medical waste management generated at their work settings (13,14).

However, our study doesn't agree with study conducted at public hospitals of Al-Najaf province in Iraq that found that only 25.1% of healthcare workers had good knowledge of BWM (15).

Moreover, our study found there is a significant association between knowledge score and work experience ($p=0.000$) and occupation ($p=0.000$). Moreover, the study indicated that nurses demonstrated a higher level of knowledge than the other designations. The low level of knowledge of other professional healthcare workers is surprising considering that pharmacists and physicians have regular contact with hazardous healthcare material and should be knowledgeable about waste management. This may refer to about two thirds of respondents (64.6%) did not receive training courses in the study were from pharmacists and physicians. However, the regular training of medical staff should be strengthened to ensure proper disposal of biomedical waste. This finding is similar to the study conducted at Al Ain Shams university hospitals, Egypt; which found that the association between duration of work experience and KAP scores among different job categories in the current study was not significant, except for the relationship between work duration and knowledge of waste management among nurses (16). Also another study carried out in Egypt (2017); is in line with the result of the present study which concluded that over 75% of nurses had acceptable waste management knowledge (17). Our study also agrees with the results of a study in 2016 from India by Sarotra, P., *et al.*, which indicated that knowledge about biomedical waste management among nurses was high (18).

Self-awareness among health care workers is one of the most significant skills in dealing with medical waste that impacts the quality of the process. The current study revealed that nearly two-thirds of the participants (63%) had a high attitude regarding safe waste disposal. This finding was in line with another study carried out in KwaZulu-Natal province in South Africa, which revealed that more than half of all respondents (54%) had good attitude, however the findings were lower than that reported in India that showed (91.2%) had a favourable attitude, and in Pakistan that found that (83%) of the total participants from all categories of workers had a good attitude regarding BWM (11,19,20). The differences in results between the present research could be attributed to differences in data collection methods, survey settings, and cultural variables. Also the current study found that the occupation is the only factor that has a significant association with attitude scores ($p=0.045$). Furthermore, nurses' attitude of health care waste management was better than the other health care professionals. This might be explained by that the other health care professionals were more likely to disagree that the waste disposal is a teamwork. Although most participants (92.2%) were in agree with correct separation of biomedical waste to prevent infection, but less than half of them (43.3%) were aware that it was their responsibility to separate medical waste.

Regarding BWM practices, it was found that the (72.6%) of the studied sample undergoes the separating medical waste, and this is a good step in waste management, and (94.3%) of

them have a correct practice such as they wear gloves when dealing with medical waste, also (95.9%) of respondents wash their hands after handling medical waste, these finding are similar with study done in Iraq, Basra (2022) they have good of practices of the separating medical waste (70.4%), also had good practices of such that they wear gloves while dealing with medical waste (80.6%), and majority of them (85.7%) had good practices regarding wash their hands. These practices despite their simplicity, but are an important factor in preventing infection in hospitals and protecting health workers and patients (26). The current study showed that more than half of respondents (64.8%) had good practice towards place sharp waste in solid bins. This result is similar to a study conducted in Thailand (2020); which found that (95.6%) had good practices about that they place sharp waste in solid bins (9). Our study revealed that about two thirds of sample (61.6%) had correct practices regarding transportation waste from its source to its disposal place it is carried out in accordance with the standards. This result is agreed with another study conducted in Ethiopia (2022) which found that (85.6%) of the participants had good waste transportation practices (25). In generally the level of correct practices score in current study was high (82.9%) and this can be explained by the long experience of the workers in job. This is consistent with a study conducted in India in the year 2016 which find 80.2% doctors and 88.7% nurses were having correct practices regarding BWM (21).

IX. CONCLUSION:

The current study investigated the KAP in respect of BWM of personnel in big government hospitals in Benghazi city, with the aim of contributing information useful in planning for improvements in the BWM system. The high knowledge of healthcare workers was associated with their positive attitude and good practice in respect of BWM and was consistent with their KAP rating scores categorized as high knowledge, positive attitude, and good practice. The duration of working experience of healthcare workers was the most significant factor influencing good practices related to BWM This study suggests that a regular training program for the HCWs on BWM management is necessary. Finally, it is vital that policy and regulatory guidelines in respect of medical waste management should be strictly enforced by government in order to improve BWM practices, especially in the collection and transportation of medical waste.

X. RECOMMENDATIONS:

1. Health education programs regarding BWM should be planned, to increase the knowledge level of healthcare workers and to enhance the practices among them with special highlighting the new staff with supervision and monitoring.
2. The government should develop strategies and systems and regulation to incrementally improve waste segregation, destruction and disposal practices with the ultimate aim of meeting national and international standards.
3. Enforcement of laws needed to nudge hospitals into compliance.

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