

Knowledge, Attitude, and Practice of Medical Waste- Management regarding Health Care Providers in Zawia Medical Center: 2023-2024

Mufida Khetresh¹ , Reemah Almadah², Shahrazad Gazeti², Hana Alazraq²,
Izar Baeishu³, Dala Dura³

¹Department of Family and Community Medicine, Faculty of Medicine, University of Zawia, Libya.

²Department of Pharmacology, Faculty of Medicine, University of Zawia, Libya.

³Faculty of Medicine, University of Zawia, Libya.

*Corresponding author email: Mufida Khetresh | E-mail address: m.khetresh@zu.edu.ly

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Abstract

Biomedical waste (BMW) is defined as any type of waste that is generated during diagnosis, treatment, immunization, or research in humans and/or animals. The World Health Organization (WHO) reports that only 15% of the total amount of waste generated during healthcare activity is categorized as hazardous waste, this category includes broken medical equipment, radiation waste, blood and tissues, human anatomical parts, radiation waste, chemo-toxic drugs. Around 85% of the waste are non-hazardous, similar to household waste. Aim of determining the current status of awareness and practices regarding BMWM among the healthcare workers (HCWs) in the hospital, identifying the areas of deficit, and forwarding the results to the BMWM Committee (BMWMC) of the hospital to take the requisite corrective action. In this cross-sectional study, participants were interviewed using a predesigned questionnaire that included items about the occupational background of participants and questions related to KAP regarding BMW Management (BMWM) and areas of deficit amongst the participants in Zawia Medical Center. The majority (86%) respondents were female, and the majority of the sample (59%) comprises healthcare providers with less than 5 years of experience. Most of them had not received any waste management related training/education (77%). We recommended there is an urgent need to raise awareness about BMWM among the hospital staff.

Keywords: Knowledge, Medical Waste Management, medical staff, Zawia, Libya.

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INTRODUCTION

According to Singh et al ¹, biomedical waste (BMW) is any kind of waste produced during human and/or animal research, diagnosis, treatment, or vaccination. Only 15% of the total waste generated during healthcare operations is categorized as hazardous waste, which includes a variety of waste types such as human anatomical parts, blood and tissues, radiation waste, chemo-toxic drugs, and broken medical equipment. The remaining 85% of waste is non-hazardous, such as household waste, according to the World Health Organization ².

In addition to hospitals, primary care centers, and nursing home authorities, the handling of biomedical waste has grown to be a major environmental concern. Due to improvements in medical facilities and the introduction of more advanced equipment, the amount of waste generated per patient in healthcare facilities has increased globally ³. Even though MW management procedures vary from hospital to hospital, MW management implementation is still difficult. WHO has created a number of biological waste management standards for MW management

in order to guarantee the secure handling of waste from medical establishments ³.

The World Health Organization (WHO) reports that countries with high incomes generate up to 0.5 kg of hazardous waste per hospital bed every day on average. The actual quantity of waste potential is higher since medical waste is frequently not segregated into hazardous and non-hazardous materials, even though the figure for low-income countries is just 0.2 kg per hospital bed per day ^{4,5}.

The most significant environmental laws and decrees passed in Libya during the early 1980s were the Law of Environment No. 7 (1982), the Law of Atmosphere and Air Protection (1992), and the Law of Transport of Hazardous Materials (2005). These laws address pollution prevention and municipal waste management, but they don't contain any explicit instructions on how to handle medical waste. In actuality, Libya lacks explicit laws governing the appropriate handling of medical waste. The draft was prepared after reviewing several international laws in addition to the recommendations made by the World Health Organization to regulate waste from healthcare establishments ⁶. In their study, "Hospital waste management in Libya: A case study," Sawalem et al. aimed to accurately describe hospital waste management in order to provide a solid foundation for a suitable waste management plan. One of the study's particular goals was to evaluate current procedures. It found that none of the hospitals surveyed had any rules regarding how to dispose of hospital waste. In the last few years, the Environmental General Authority in Libya has worked together with the ministry of health to create regulations and instructions for medical waste management ⁷. These are still in development because there is minimal information available regarding generation (quantities and compositions), handling and disposal of hospital waste. An appraisal of the current situation regarding hospital waste management in Libya is essential. With this concern a study was conducted in a Zawia medical hospital in AL-Zawia, Libya. with the aim to determine the current status of awareness and practices regarding BMWM among the healthcare workers (HCWs) in the hospital, to identify the areas of deficit and to forward the results to

BMWM Committee (BMWMC) of the hospital to take requisite corrective action. The objective of this study is to assess the knowledge, attitudes and practices (KAP) of health-care providers towards waste management at Zawia medical hospital and implementation of the existing worldwide (WHO) guidelines.

MATERIALS AND METHODS

A cross-sectional indirect interview type of study was conducted in Al-Zawia medical hospital. Is one of the governmental general hospitals in Wester Libya, over a period of one and half month, through self-distributed pre-tested semi-structured pre-validated questionnaires distributed among four categories of HCWs: Doctors, nurses and technicians staff of the hospital.

Sampling

The convenience sampling method was used to collect data from all departments of hospital and Approval from hospital administration were obtained to conduct the study. An oral consent was obtained from participants after explaining the study objectives and assuring data confidentiality. Participants were distributed on the following departments/ unit (laboratory, radiology, pharmacy, emergency, surgery, derma clinic, obstetrics / gynecology, pediatric and medicine).

Data collection

A pre-designed questionnaire included items about the background of participants (department, job title, and lifetime duration of work experience). The research instruments were used in this study according to WHO standards ¹ Demographic questionnaire, (ii) Awareness questions, and (iii) the Observational checklist. The questionnaire was developed in Arabic using simple local language and was tested in a pilot study with 20 persons of different job titles and validated by the researchers prior to using. A preliminary test was applied on representative sample (around 17% of the target sample) (n= 20) to address any ambiguity in the questions and to determine whether the data would provide reliable information (change some terms for more clarification) and all pilot study respondents acknowledged that the data collection form was simple, clear, and easy to

understand. The questions related to KAP were developed by the authors after reviewing similar published articles. For knowledge, e.g. on the presence of a medical waste unit or regulation on medical waste management at the hospital, Attitudes were assessed about whether they colour coding for waste disposal bags and identification of biohazard symbol. Actual practices were assessed by a participant observation concerning wearing personal protection, correct disposal of sharps and other waste, hand-washing after injection. A sample of 120 after obtaining verbal informed consent to participate in the study, returned and valid questionnaires 100(83.33%) and 20 unreturned questionnaire 20 (16.6%).

Ethical consideration

The study was approved from Zawia medical center administration and faculty of medicine Zawia University to conduct the study. An oral consent was obtained from participants after explaining the study objectives and assuring data confidentiality.

Statistical analysis

SPSS, will be used for data entry and analysis. A summary of data was done where frequencies and percentages were calculated for qualitative data while for quantitative data, mean and standard deviations (SD) were calculated.

RESULTS

Demographic characteristics of participants

A total 120 questionnaires were distributed, out of which 100 (83.33%) were received back. Depicts the sociodemographic characteristics of the respondents, the majority (86%) respondents were female, highest education qualification as bachelor's degree (72%), and the majority of the sample (59%) comprises healthcare providers with less than 5 years of experience, while 20% have 5-10 years of experience, and (21%) have more than 10 years of experience. The age range of most health care providers was between 30 and 39 years (45%). Most of them had not received any waste management related training/education (77%), while only (23%) have received such training. It is revealed to note that (66%) of health care providers have not been vaccinated against Hepatitis B virus

which is provided as mandatory vaccination for all healthcare providers and support staff, while 34% have received the vaccination.

Table 1: Frequency and percentage of demographic characteristics (N = 100).

Demographic characteristics	N	%
Gender		
Male	14	14
Female	86	86
Age group		
Less than 30	35	35
30-39	45	45
More than 40	20	20
Level of education		
Primary	6	6
Secondary	6	6
Bachelor	72	72
Higher	14	14
Years of experience		
Less than 5	59	59
5-10	20	20
More than 10	21	21
Place of work		
Emergency Room	7	7
ENT	5	5
Radiology	2	2
Derma clinic	2	2
Pharmacy	4	4
Pediatrics	32	32
Obstetrics/Gynecology	7	7
Surgical	15	15
Laboratory	14	14
Medical	12	12
Training or work shop		
Yes	23	23
No	77	77
Vaccination		
Yes	34	34
No	66	66

Awareness of respondents

Table 2 describes awareness about biomedical waste management among health care providers in Zawia Medical Center. The results in table indicate varying levels of awareness among the respondents regarding different aspects of medical waste management. While a majority of respondents are aware that hepatitis B, C, and HIV can be transmitted through medical waste (88%), the awareness levels for other aspects such as the biohazard

symbol (62%), puncture-proof containers for sharps (67%), and methods for medical waste treatment (42%) are lower. Additionally, only (34%) of the respondents are aware of regulations on medical waste management. However, only (49%) are aware that the maximum time for medical waste to be kept in hospital premises is 48 hours. These findings suggest that there are gaps in knowledge and awareness among healthcare providers regarding crucial aspects of medical waste management.

Table 2: Awareness about medical waste management among health care providers (N = 100).

	Items	Answer	Count	%
1	Have you ever heard about medical waste Unit	Aware	47	47
		Not	53	53
2	Are you aware of regulation on medical waste management	Aware	34	34
		Not	66	66
3	Do you know about the biohazard symbol	Aware	62	62
		Not	38	38
4	What is puncture-proof container for sharps	Aware	67	67
		Not	33	33
5	What is the correct bag for disposal of cytotoxic drugs	Aware	45	45
		Not	55	55
6	What is the correct bag for intravenous sets, catheters, and tubes?	Aware	51	51
		Not	49	49
7	Hepatitis B, C and HIV can be transmitted through medical waste	Aware	88	88
		Not	12	12
8	Do you know about methods for medical waste treatment	Aware	42	42
		Not	58	58
9	The maximum time for medical waste to be kept in hospital premises in 48 hours	Aware	49	49
		Not	51	51

Practice on medical waste management

Table 3 describes the practice on medical waste management for four categories; a) condition of waste receptacles, b) Segregation of waste, c) Transportation of medical waste, d) Appropriate use of PPE. A significant majority of wards do not have green (78%), red (79%), yellow (63%), or blue (78%) colored waste bins available. Additionally, a large proportion of waste bins are not covered (49%) or do not have foot-operated covers (48%).

Furthermore, the biohazard symbol is not imprinted over waste bags in the majority of cases (72%), and posters to guide users are not displayed near waste bins (87%). A large majority of respondents reported that the green, yellow, red, and blue bags do not contain only the specified types of waste. For example, only (8%) of respondents indicated that the green bag contains only general waste, while (71%) reported that it does not. Similar patterns were observed for the yellow, red, and

blue bags. A significant proportion of respondents reported that appropriate on-site transport of medical waste is not consistently used (37%), and transportation of medical waste is not consistently done during non-busy hours (35%). Additionally, infectious and general waste are not consistently transported separately (40%). These findings suggest that there are potential issues in the transportation practices of medical waste, which could impact the safety and proper management of such waste. The results in table (3) indicate that there are areas of both strength and concern regarding the appropriate use of PPE and handling practices among healthcare providers. A majority of respondents reported

wearing PPE (62%) and correctly handling blood-contaminated fomites (68%), sharps (73%), and general waste (64%). Additionally, a high percentage of respondents reported washing their hands after injections (83%). However, there are still areas of concern, as a notable proportion of respondents reported not wearing PPE (33%), not correctly handling blood-contaminated fomites (24%), sharps (21%), and general waste (26%), and not washing their hands after injections (15%). These findings suggest that while there are strong practices in some areas, there are still gaps in the consistent and appropriate use of PPE and handling practices among healthcare providers.

Table 3: Practice of medical waste management.

Parameters		Answer	Count	%
Condition of waste containers				
1	Is green colored waste bin available in ward	Yes	11	11
		No	78	78
		NA	11	11
2	Is yellow colored waste bin available in ward	Yes	27	27
		No	63	63
		NA	10	10
3	Is red colored waste bin available in ward	Yes	10	10
		No	79	79
		NA	11	11
4	Is blue colored waste bin available in ward	Yes	12	12
		No	78	78
		NA	10	10
5	Are waste bins covered	Yes	48	48
		No	49	49
		NA	3	3
6	If covered, is cover foot-operated	Yes	49	49
		No	48	48
		NA	3	3
7	Is the biohazard symbol imprinted over waste bags	Yes	20	20
		No	72	72
		NA	8	8
8	Are posters to guide users displayed near waste bins	Yes	8	8
		No	87	87
		NA	5	5
Segregation of waste				

9	Does green bag contain only general waste?	Yes	8	8
		No	71	71
		NA	21	21
10	Does yellow bag contain only sharp waste?	Yes	11	11
		No	69	69
		NA	20	20
11	Does red bag contain only soiled infected waste?	Yes	8	8
		No	69	69
		NA	23	23
12	Does blue bag contain only food waste?	Yes	11	11
		No	67	67
		NA	22	22
Transportation of medical waste				
13	Appropriate on-site transport of medical waste used	Yes	45	45
		No	37	37
		NA	18	18
14	Is transportation of medical waste done during non-busy hours	Yes	44	44
		No	35	35
		NA	21	21
15	separately Are infectious and general waste transported	Yes	42	42
		No	40	40
		NA	18	18
Appropriate use of PPE				
16	Wearing personal protective equipment	Yes	62	62
		No	33	33
		NA	5	5
17	Correct handling of blood-contaminated fomites	Yes	68	68
		No	24	24
		NA	8	8
18	Correct handling of sharps	Yes	73	73
		No	21	21
		NA	6	6
19	Correct handling of general waste	Yes	64	64
		No	26	26
		NA	10	10
20	Washing hands after injections	Yes	83	83
		No	15	15
		NA	2	2

Relationship of duration of work experience and knowledge, attitudes and practice of medical waste management among health care providers

In terms of knowledge, there is a statistically significant difference between the different experience levels, as indicated by the F-value of 4.475 and a P-value of 0.014. This suggests that the level of knowledge regarding medical waste management varies significantly based on years of experience, with those having 5-10 years and over 10 years of experience demonstrating higher levels of knowledge

compared to those with less than 5 years of experience. However, when it comes to attitudes, the comparison shows no statistically significant differences between the different experience levels, with a P-value of 0.768. This indicates that attitudes toward medical waste management are consistent across the various experience levels. Regarding specific practices such as the condition of waste containers, segregation, transportation of medical waste, and the appropriate use of personal protective equipment (PPE), the comparison reveals no statistically significant differences between the different experience levels.

Table 4: Comparison between years of experience in terms of knowledge, attitude and practice of medical waste management.

Parameters	years of experience	N	Mean	Std	F value	P-value
1) Knowledge	< 5	59	4.34	1.979	4.475	0.014
	5-10	20	5.40	2.257		
	> 10	21	5.76	2.211		
2) Attitudes	< 5	59	24.02	5.880	0.265	0.768
	5-10	20	24.95	4.989		
	> 10	21	23.62	7.513		
a) Condition of waste containers	< 5	59	12.03	3.513	0.391	0.678
	5-10	20	12.70	3.197		
	> 10	21	12.71	4.755		
b) Segregation	< 5	59	5.58	2.07	0.034	0.967
	5-10	20	5.65	2.08		
	> 10	21	5.71	2.47		
c) Transportation of medical waste	< 5	59	6.41	2.20	3.221	0.044
	5-10	20	6.60	1.64		
	> 10	21	5.19	1.97		
d) Appropriate use of PPE	< 5	59	12.02	3.72	0.593	0.555
	5-10	20	13.00	3.32		
	> 10	21	12.48	3.39		

Relationship of Place of work and knowledge, attitudes and practice of medical waste management among health care

The table (5) show the results of the comparison between different places of work in terms of knowledge, attitude, and practice of medical waste management reveal some interesting insights. In terms of knowledge, the mean scores vary across different

departments, with Obstetrics/Gynecology having the highest mean score (6.71) and Pharmacy having the lowest (3.00). The F-value of 1.846 and the associated p-value of 0.071 indicate that there may be some significant differences in knowledge levels between the departments, although it does not reach the conventional threshold for statistical significance ($p < 0.05$). Similarly, for attitude, there are variations in the mean scores across

departments, with Obstetrics/Gynecology again having the highest mean score (27.71) and ENT having the lowest (17.00). The F-value of 1.600 and the associated p-value of 0.127 suggest that there may be some differences in attitudes between the departments, but again, it does not reach statistical significance. For the condition of waste containers, segregation, transportation of medical waste, and the appropriate use of personal protective equipment (PPE), the F-

values and p-values also indicate that there are no statistically significant differences between the departments in these aspects. Overall, while there are some variations in knowledge and attitude scores across different departments, the differences are not statistically significant based on the p-values. This suggests that, in general, the knowledge, attitudes, and practices of medical waste management are relatively consistent across the various departments surveyed.

The table 5: Comparison between Place of work in terms of knowledge, attitude and practice of medical waste management.

Parameters	Place of work	N	Mean	Std	F value	P-value
Knowledge	Emergency Room	7	5.00	1.83	1.846	0.071
	ENT	5	5.40	1.14		
	Radiology	2	5.00	0.00		
	Derma clinic	2	4.50	2.12		
	Pharmacy	4	3.00	2.94		
	Pediatrics	32	4.38	1.81		
	Obstetrics/Gynecology	7	6.71	1.89		
	Surgical	15	5.93	2.60		
	Laboratory	14	4.14	2.38		
	Medical	12	4.83	1.95		
Attitude	Emergency Room	7	25.00	5.26	1.600	0.127
	ENT	5	17.00	2.83		
	Radiology	2	24.00	9.90		
	Derma clinic	2	23.00	11.31		
	Pharmacy	4	18.75	2.63		
	Pediatrics	32	23.91	5.25		
	Obstetrics/Gynecology	7	27.71	5.38		
	Surgical	15	24.93	7.08		
	Laboratory	14	25.21	6.61		
	Medical	12	24.75	5.91		
Condition of waste containers	Emergency Room	7	13.00	2.24	1.524	0.151
	ENT	5	9.60	3.58		
	Radiology	2	12.00	5.66		
	Derma clinic	2	12.00	5.66		
	Pharmacy	4	9.00	2.00		
	Pediatrics	32	12.00	3.06		
	Obstetrics/Gynecology	7	15.57	3.36		
	Surgical	15	13.40	5.01		
	Laboratory	14	12.14	4.06		
	Medical	12	12.67	3.11		
Segregation	Emergency Room	7	6.86	2.34	1.009	0.439
	ENT	5	4.00	.00		

	Radiology	2	6.00	2.83		
	Derma clinic	2	6.00	2.83		
	Pharmacy	4	5.00	2.00		
	Pediatrics	32	5.84	2.10		
	Obstetrics/Gynecology	7	5.00	2.65		
	Surgical	15	5.20	1.66		
	Laboratory	14	6.29	2.55		
	Medical	12	5.17	2.12		
Transportation of medical waste	Emergency Room	7	5.14	1.77	1.137	0.346
	ENT	5	5.00	2.83		
	Radiology	2	6.00	1.41		
	Derma clinic	2	5.00	2.83		
	Pharmacy	4	4.75	1.71		
	Pediatrics	32	6.06	1.97		
	Obstetrics/Gynecology	7	7.14	1.46		
	Surgical	15	6.33	2.02		
	Laboratory	14	6.79	2.46		
	Medical	12	6.92	2.19		
Appropriate use of PPE	Emergency Room	7	10.57	4.69	1.077	0.388
	ENT	5	10.40	4.56		
	Radiology	2	9.50	4.95		
	Derma clinic	2	13.00	0.00		
	Pharmacy	4	12.00	3.83		
	Pediatrics	32	12.25	3.44		
	Obstetrics/Gynecology	7	14.43	1.51		
	Surgical	15	12.40	3.58		
	Laboratory	14	11.86	4.19		
	Medical	12	13.92	2.39		

DISCUSSION

The evaluation of KAP in relation to health-care waste management was a major strength of this study since it provided us with a rare chance to educate people on a subject that is underrepresented in our nation, as we have only found few studies in the literature addressing the similar objective as Laila Karawad et al.⁸ on develop a comprehensive vision of healthcare waste management system in Misrata city hospitals and to determine the components, classification of medical solid waste in Misrata city hospitals and other study was conducted to assess the awareness of healthcare providers and other supporting staff in Al-Graifa Rural Hospital Obari/ South Libya for medical waste management⁹. It also helps to identify the gaps between the current KAP among the health-care workers involved in waste management

and the future desired state that should be reached. Our study show that a majority of respondents are aware that hepatitis B, C, and HIV can be transmitted through medical waste (88%) as occupational health infection, this agrees with findings reported in similar studies conducted in Belgaum city in India and Ile-Ife in Nigeria^{10,11}. Although only (34%) of the respondents are aware of regulations on medical waste management, the failure to adhere to these guidelines may be due to absence of strict rules and regulation by hospital infection control team which was a similar result from the researches showed in Egypt and Indian^{12,13}. Healthcare personnel must be knowledgeable about waste segregation in order to correctly separate all waste types and stop the spread of pathogens. This prerequisite helps to assist the community, healthcare professionals, patients, and visitors

while lowering expenses and wasteful expenditures. In absent knowledge improper waste management occur. The comprehension of the classification framework for hazardous waste (HW) and the associated color-coding systems constitutes a critically significant component in the management of hazardous waste. The current study revealed that most of participants had not received any waste management related training/education (77%), while only (23%) have received such training although, higher when compared to a study conducted in 2011 in a tertiary facility in Nigeria which revealed that the proportion of respondents who had received specific training in the management of HCW was 11.5% and in Nepal only 6.0%¹⁴. on contrast, the figure is lower than studies was done in Sri-Lanka ((91.1%)¹⁵, so that, a large majority of respondents reported that the green, yellow, red, and blue bags do not contain only the specified types of waste. For example, only (8%) of respondents indicated that the green bag contains only general waste, while (71%) reported that it does not. Similar patterns were observed for the yellow, red, and blue bags this agree with the findings of several studies^{10,14}. Therefore, organizing routine awareness programmers' to enhance the knowledge and training of HCP on HW is essential. A significant majority of wards do not have green (78%), red (79%), yellow (63%), or blue (78%) colored waste bins available. Additionally, a large proportion of waste bins are not covered (49%) or do not have foot-operated covers (48%). Furthermore, the biohazard symbol is not imprinted over waste bags in the majority of cases (72%), and posters to guide users are not displayed near waste bins (87%). This revealed that no color-coded plastic bag was available in the wards and laboratory departments. This implies that wastes were not segregated either before temporal storage or final disposal, which is a very poor HCWM practice among all health workers. Similarly, a study done in Kaduna State, Nigeria, on hospital waste management¹⁶. The waste generated is required to be transported by following the WHO guideline. Such wastes are collected and transported using a trolley, wheeled barrow, trucks, etc. Data from this study revealed that the waste is transported appropriate on-site transport of medical waste

is not consistently used (37%), and transportation of medical waste is not consistently done during non-busy hours (35%). Additionally, infectious and general waste are not consistently transported separately (40%) and supporting staff loads it into the trucks by hand which could be dangerous. Although WHO instructs that different trolleys should be used in transporting the different categories of wastes³. use of adequate PPE is essential to avoid unnecessary health effects. Our Findings reveals that 62% of respondents reported wearing PPE as gloves. However, several previous studies conducted in Northwest Ethiopia¹⁷ and South Africa¹⁸ have reported very lower rates of PPE usage. Which is not consistent with the recommended standard of WHO which requires the use of heavy-duty gloves, boots, and apron. However, there are still areas of concern in our study, as a notable proportion of respondents reported not wearing PPE (33%), these results were almost the same as reported on 2021 by (Letho Z and colleges)¹⁹, only 35.4% complied with the use of appropriate PPE with 32.3% not complying and 32.3% not applicable. As important as protective equipment is to anybody who handles medical wastes not correctly handling blood-contaminated fomites (24%), sharps (21%), and general waste (26%), and not washing their hands after injections (15%). This study's main strength was the evaluation of waste management knowledge and practice, which, provided an ideal opportunity to educate hospital staff on an area that is ignored. Finding the gaps between the healthcare practitioners' existent waste management knowledge and practices and their desired future state is also helpful.

CONCLUSION

Healthcare workers continue to face several hazards in their workplaces. Although national regulations exist on medical waste management, adherence to the practice is often limited due to inadequate sensitization amongst the health care workers and support staff. The findings highlight the need for targeted interventions to improve awareness and practices related to medical waste management (BMW) among healthcare providers by a regular training program through

symposiums, role-play, interactive lectures, and other feasible training methods. Addressing the identified gaps and challenges can contribute to a safer and more effective management of medical waste, ultimately enhancing the overall quality of healthcare services.

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REFERENCES

1. Singh Z, Bhalwar R, Jayaram J, Tilak V. An introduction to essentials of bio- medical waste management. *MJAFI* .2001; 57(2):144-47. DOI 10.1016/S0377-1237(01)80136-2.
2. World Health Organization (WHO). 2021. Health workforce: categorized of biomedical waste hazardous. <https://www.who.int/data/gho/data/themes/topics/health-workforce>.
3. World Health Organization. 2022. Integrated health services / Injection safety. <https://www.who.int/teams/integrated-health-services/infection-prevention-control/injection-safety>.
4. Radha K, Kalaivani K, Lavanya R. A case study of biomedical waste management in hospitals. *Global Journal of Health Science* 2009;1(25):82-88.
5. World Health Organization (WHO).2013. Waste from health-care activities. Fact sheet No. 253. <http://www.who.int/mediacentre/factsheets/fs253/en/>
6. Altabet, A. Libyan draft Regulations for the Management of Medical Waste.2016. [النادي الليبي للمخلفات الطبية](http://medicalwaste.org.ly) <http://medicalwaste.org.ly>.
7. Sawalem M, Selic E., Herbell J. Hospital waste management in Libya: A case study. *Waste Manag.* 2009; 29(4): 1370–75. doi: 10.1016/j.wasman.2008.08.028. 8.Karawad L, Elwahaishi S, Elhamrouh A, Altabet A. Assessment of Medical Solid Waste Management in Misrata Health Care Centers and Hospitals. *Scientific Journal of Faculty of Education*.2019;1(12):28-54.
9. Zaedmone O, Salim E. Assessment of the awareness and practices of medical waste management among healthcare and supporting providers in Al- Graifa Rural Hospital, Obari, Libya *AJAPAS*. 2025;4(4):278-95. DOI: [10.65418/ajapas.v4i4.1616](https://doi.org/10.65418/ajapas.v4i4.1616).
10. Enwere O, Diwe K. Knowledge perception and practice of injection safety and healthcare waste management among teaching hospital staff in south east Nigeria: an intervention study. *Pan Afr. Med.*2014; 17 (1):218-35 DOI: [10.11604/pamj.2014.17.218.3084](https://doi.org/10.11604/pamj.2014.17.218.3084).
11. Viragi P, Ankola A, Hebbal M.Occupational hazards in dentistry–Knowledge attitudes and practices of dental practitioners in Belgaum city. *Journal of Pierre Fauchard Academy*2013; 27 (3) : 90–94.
12. Bhagawati G, Nandwani S, Singhal S. Awareness and practices regarding bio-medical waste management among health care workers in a tertiary care hospital in Delhi. *J Med Microbiol* 2015;33(9):580-92.
13. Hakim S, Mohsen A. Bak I . Knowledge, attitudes and practices of health-care personnel towards waste disposal management at Ain Shams University Hospital, Cairo.*EMHJ*.2014 ;20(5):347-54.
14. Sapkota B, Gupta GK, Mainali D. Impact of intervention on healthcare waste management practices in a tertiary care governmental hospital of Nepal. *BMC Public Health*. 2014; 14 (1):1–8. doi: 10.1186/1471-2458-14-1005.
15. U dayanga L, Sahana L, Perera A, Ranasinghe K , Ranatunga T. Knowledge, perceptions and practices on healthcare waste management and associated occupational health hazards among healthcare professionals in the Colombo District, Sri Lanka: a cross-sectional study. *Front. Public Health*.2023; 11(12):156-68. doi: [10.3389/fpubh.2023.1215648](https://doi.org/10.3389/fpubh.2023.1215648).
16. Musa S, Aliyu A, Obinna A , Udeh F. Knowledge and Practice of Healthcare Waste Management among Healthcare Workers at Yusuf Dantsoho Memorial Hospital (YDMH), Kaduna, Nigeria . *ejclinimed* .2023;4(2):31-36. <https://doi.org/10.24018/clinimed>. ISSN: 2736-5476.
17. Deress T, Jemal M, Girma M, Adane K. Knowledge, attitude, and practice of waste handlers about medical waste management in Debre Markos town healthcare facilities, Northwest Ethiopia. *BMC Res Notes*. 2019; 12(8):1–7. doi: [10.1186/s13104-019-4174-7](https://doi.org/10.1186/s13104-019-4174-7).
18. Hangulu L, Akintola O. Health care waste management in community-based care: experiences of community health workers in low resource communities in South Africa. *BMC Public Health*. 2017; 17(4):1–10. doi: [10.1186/s12889-017-4378-5](https://doi.org/10.1186/s12889-017-4378-5).
19. Letho Z, Yangdon T, Lhamo C, Limbu CB, Yoezer S, Jamtsho T, et al. Awareness and practice of medical waste management among healthcare providers in National Referral Hospital. *PLoS ONE*.2021; 16(1): e0243817. <https://doi.org/10.1371/journal.pone.0243817>.