Assessment of the awareness and practices of medical waste management among healthcare and supporting providers in Al-Graifa Rural Hospital, Obari, Libya

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تقييم مدى وعي العاملين بمستشفى الغريفة القروي بتطبيق الطرق الصحيحة لإدارة المخلفات الطبية، دراسة مقطعية

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Abstract:
This study was focused of on assessing the awareness of healthcare and other supporting providers for medical waste management (MW) and practices in Al-Graifa Rural Hospital. A cross sectional observational research was done targeting 109 samples. Verbal consent was obtained from each individual participant, and all participants asked for demographic, waste awareness, observational checklist. Participants belonged to seven departments/ wards: emergency, laboratory, radiology, pharmacy, surgery, obstetrics and gynecology, dental. Of 109 participants, 40 (36.69%) were male, and 69 (63.30%) were female; mean age was 42 years, ranged 20 to 48 years, and their age groups (20 - 25; 26-35; 36-45; >45 year), (6.4%; 18.4%; 64.2%; 11.0%), respectively. Majority 95.4% (104/ 109) of the participants received no training/ education about waste management and practices. Statistically, participants who already knew the correct waste management and practices were significantly ($p < 0.05$) lower 11/109 (10.1%), compared to those had no knowledge 98/109 (89.90%). Interestingly, all study participants were aware that the maximum period of keeping waste inside hospital premises is 48 hours. Observational data were also recorded regarding waste segregation practices, and only 20% of the observed premises followed the standard guidelines of segregation practices. All visited departments/ wards (n=7) followed standard transportation and treatment time, before 48 hours. A significant reduction (only 20%) of the participants utilizing specific trollies for each waste type. A number of interesting differences in (WM)/ practices recorded in hospital staff targeted in this work highlighted the necessity of future research targeting broader health and medical premises in South Libya.

Keywords: medical waste, Al-Graifa Hospital, awareness assessment, cross sectional study, southern Libya.

الملخص

ركزت الدراسة الحالية على معرفة مدى وعي العاملين بمستشفى الغريفة القروي بالطرق الصحيحة لإدارة المخلفات الطبية، دراسة مقطعية ترصديه استهدفت (= 109 مشارك). جمعت بينات الدراسة من خلال مقابلة رسمية للمشاركين مزودي الخدمات الطبية والخدمات الداعمة الأخرى بعد الحصول على موافقة لفظية من كل مشارك. تم استهداف العاملين بالأقسام: الإدارة، الطوارئ، المختبر، الصيدلة، الأشعة، النساء والولادة، الاسنان، والجراحة وكذلك بعض الوحدات الداعمة كالنظافة والإعاشة. صنفت البيانات الى 3 أجزاء ديموغرافية، توعوية، وأخرى اعتمدت على الملاحظة العينية للباحث خلال الزيارة.

من 109 مشارك، بلغ عدد الذكور 40 (36.69%)، بينما الإناث 69 (63.30%)، ومتوسط أعمارهم 42 بمدى 23 - 48 سنة، كما صُنفت الى أربعة فئات عمرية (20-25؛ 26-35؛ 36-45؛ > 45 سنة)، (6.4%؛ 18.4%؛ 64.2%؛ 11.0%)، على التوالي. أظهرت النتائج أن 109/104 (95.4%) لم يتلقوا أي تدريبات حول إدارة المخلفات الطبية. 10.1 % (11/ 109) فقط لديهم معرفة كافية بالطرق الصحيحة لإدارة المخلفات الطبية. وعلى العكس، 93 % كانوا مدركين لأهمية لبس معدات الوقاية الشخصية. بيانات الملاحظة العينية، أظهرت 100% من العاملين يتخلصون من النفايات قبل 48 ساعة. نتائج الدراسة كانت أيضاً مهمه جوهرياً حول ممارسات الفصل الصحيح للمخلفات الطبية (20 % فقط كانت ممارساتهم وفق المعايير الدولية). عدد الأقسام التي تستخدم عربات مخصصة لكل نوع من النفايات والتي تمارس عملية النقل خارج أوقات العمل تجنباً للعدوى كان منخفضاً جوهرياً (20% كانت ممارساتهم صحيحة). نتائج الدراسة أظهرت عدة فروقات جوهرية في طرق وأساليب إدارة المخلفات الطبية لدى العاملين بمستشفى الغريفة القروي. عليه، فإن ذلك يستدعي ضرورة أجراء دراسات أوسع واشمل تستهدف نطاق أوسع من العاملين بمرافق صحية مختلفة بالمنطقة الجنوبية.

الكلمات المفتاحية: النفايات الطبية؛ مستشفى الغريفة، تقييم المعرفة، دراسة مقطعية، جنوب ليبيا.

Introduction

Wastes in general (GW), and medical wastes (MW) in particular regard as central health and environmental problems worldwide, and healthcare premises persistently generate medical wastes due to patients attending these facilities. Healthcare providers (doctor, nurses, technicians, pharmacists, other supporting staffs are the only personnel responsible for handling (managing) patients and health premises' wastes [1]. Hospital management of medical wastes according to the standard guidelines is a crucial practice to ensure full protection and safety for patients, health providers, and also the environments. These practices involve waste collection, segregation, transportation, and treatment [2]. According to a report issued by [3], the economic growth rate in (MW) costs is expected to be raised 11 billion dollars in 2018 to 17 billion dollar in 2026. Medical wastes are mainly classified into 3 classes based on their compositions and infectivity: (1) infective (dangerous) wastes constitute 10% (2) medical/ radiological (dangerous) wastes (5%) (3) general wastes (none dangerous) constitute 85% of overall wastes generated [1], [2], [4], [5] (figure 1).
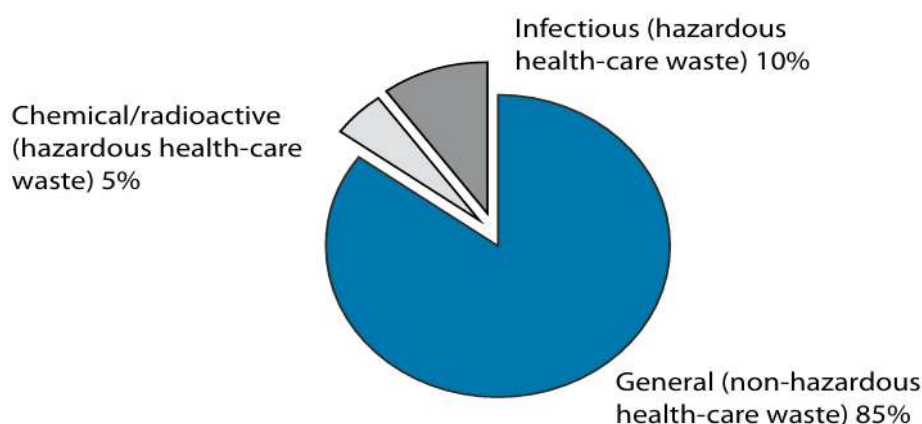

Figure 1 Typical waste composition in health-care facilities

World Health Organization reported that health authorities are directly responsible for regular awareness, and training of health staff on how to correctly manage and practice medical wastes starting from utilizing specified waste pens to final treatment of wastes [2]. Moreover, healthcare authorities like hospitals, medical centers, central and reference laboratories, pharmacies, .. et al, inevitably required to publish and enforce their health personnel to adhere to these international standard guidelines and regulations (Emmanuel et al., 2012). In developing countries, for instance, underestimation of the minimum level for applying these international regulations inside the health premises has exacerbated the general health concerns [1], [5]. Until 2015, Libya was one of the developing countries found to have no general and medical waste management regulations, and practices of theses wastes were randomly performed. In 2016, although the medical regulation of wastes was issued in Libya [6], [7], implementation of these regulation still underestimated inside health facilities. More importantly, Libyan authorities ranked as a fourth African country (after Nigeria, Ethiopia, Tanzania, respectively) generated largest (production rate=1.3 kg per bed) quantity of medical wastes [3]. There was a paucity of data highlighted the assessment the awareness of healthcare workers in terms of medical waste management in Libya in general, although offering such information regards as a crucial step toward establishing proper and effective strategies

for MWM inside Libyan health premises [6], [8]–[12]. All of these studies done in North and East Libya, and to our knowledge, no work has been performed to assess the awareness of healthcare personnel for medical waste management (MWM). Therefore, this study was centrally focused to assess the practices of healthcare providers for MWM in Al-Graifa Rural Hospital, Obari/ South Libya.

Material and methods

This cross-sectional observational study was undertaken to assess the awareness of healthcare providers and other supporting staff in Al-Graifa Rural Hospital for medical waste management (MWM). Al-Graifa hospital is one of the governmental general hospitals in South Libya, and it belongs to Al-Graifa municipality. The total number of staff working in the hospital reaches 237 employee. Of this (n=237), 146 (61.60%) were health and medical-care workers, and 91 (38.39%) were other supporting staff (waiters and cleaning staff). The hospital comprises 9 departments/ units (laboratory, radiology, pharmacy, emergency, surgery, dental, obstetrics and gynecology, cleaning, and waiting).

The current study was designed to target 109 (45.99%) of the healthcare and other supporting staff working in different departments/ units in Al- Graifa Rural Hspital during the period between 13/10/2024 and 27/12/2024 Table (1).

To ensure that targeted participants were statistically represented the Al-Graifa Hospital' staff, sample size calculation was performed according to Krejci and Morgan, 1970 [13] as follows:

$$S = \frac{X2NP(1-P)}{d2(N-1)+X2P(1-P)}$$

S= sample size; X= Z value 1.96 at 95% confidence intervals; N= population size; P= 50%; d= accuracy value 0.5%.

Table 1 Distribution of study questioners on the study participants

Item	Distributed questioners	Returned questioners	Not returned questioners (%)	Ruled out questioners	Valid questioners (accepted for study analysis)
Number	150	109	41	0	109
Percent	100%	73%	27%	0%	73%

Data were collected based on formal meeting carried out, after a verbal consent obtained from each individual study participant to take part in the study. Participants were distributed on the following departments/ units (laboratory 15, radiology 2, pharmacy 7, emergency 32, surgery 10, dental 5, obstetrics and gynecology 23, cleaning, and waiting 5). Present study was designed as questioner based study (observational study), hence, to achieve the maximum reliability and consistent response of the participants, study data were classified into 3 sections: (1) demographic data (age- sex- profession- educational level- work experience); (2) medical waste awareness data (medical waste management awareness); (3) observational checklist data (based on observed practices in the targeted hospital departments/ units). Spilt half reliability test (split half method, Guttman test SPSS version 26, 2019) was also utilized to assess the internal consistency between participants' responses (see appendix).

Selection of both genus, and different age categories was also considered in this work. 40/ 109 were male, whereas 69/ 109 were female, and their age ranged from 20- older than 45 years.

All data obtained from the targeted participants (n=109) were subjected to arrangement, filtration, initial calculation utilizing Microsoft Software (Microsoft Excel, 2010). Statistical analysis to explore whether or not differences between study variables were significant was applied using statistical software program SPSS, version 26 [14] and WinPepi, version 11.6 [15], where the differences considered significant if probability value (P value) less than or equal 0.05.

Results and discussion

Out of overall 237 healthcare and supporting staff working in Al-Graifa Rural Hospital, 109 (45.99%) were successfully selected to take part in the study. All study participants subjected to provide demographic data. Interestingly, statistical comparison of study responses regarding receiving medical waste management (MWM) training revealed significant difference, and that resulted to the significant raise (95.4%; P>0.05) of those received no training. It was even obvious that the majority (55%) of the study participants worked in nursing (P>0.05) (Table 2).

Table 2 Distribution of study samples based on demographic data

Demographic data		Number	% (CI)
Sex	Male	40	36.7 (27.7-46.5)
	Female	69	63.3 (53.5-72)
Age groups	20-25	7	6.4 (3-13)
	26-35	20	18.4 (12-27)
	36-45	70	64.2 (55-73)
	Older than 45	12	11.0 (6-18)
Qualification	Secondary	40	36.7 (28-46)
	University	60	55.0 (45-65)
	Postgraduate (MSc or PhD	1	0.9 (0.02-5)
	Not qualified	15	13.8 (8-22)
Work experience/ years	4 -0	5	5 (2-10)
	8 -5	24	22 (15-31)
	12 -9	56	51 (42-61)
	More than 12 years	24	22 (15-31)
Profession	Doctor/ physician	5	5 (2-10)
	Lab technician	15	14 (8-22)
	Radiology technician	2	2 (0.2-6)
	Pharmacist	7	6 (3-13)
	Nurse	60	55 (45-65)
	Supporting staff (waiters/ cleaning)	3	3 (0.5-8)
	Supporting staff (Administrative)	17	16 (9-24)
Receiving training course on MWM	Yes	5	4.6 (2-10)
	No	104	95.4 (90-98)

CI= confidence intervals; MSc= master of science; PhD= doctor of philosophy.

With respect to participant' knowledge about international standard regulation for medical waste management, all 109/ 109 (100%) replied to the given awareness questions. It was noticeable that the majority (72.7%) of the targeted staff were fully aware of the importance of wearing Personal Protective Equipment (PPE). Conversely, just 7% and 10% of them aware of the correct and safe handling in case of any leakage or injuries due to MW and aware of the infective medical wastes, respectively. No significant difference was recorded between participant' responses about awareness of correct MWM (Table 3).

Table 3 Assessment of the participant' knowledge/awareness about international standard regulation for medical waste management

Questions	Replies	Number (%); CI
Awareness of correct management of MWM	Yes	[A] 55 (50.5); 41-60
	No	[A] 54 (49.5); 40-59
Receiving training course on MWM	Yes	[B] 5 (4.6); 1.5-10
	No	[B] 104 (95.4); 90-98
Awareness of infective MW	Yes	[C] 11 (10.1); 5-17
	No	[C] 98 (89.9); 83-95
Awareness of wearing PPE	Yes	[D] 101(92.7); 86-97
	No	[D] 8(7.3); 32-14
Differences between dangers and dangerous MW	Yes	[E] 92 (84.4); 76-91
	No	[E] 17 (15.6); 9-24
Knowing the correct and safe handling in case of any leakage or injuries due to MW	Yes	[F] 8 (7.3); 3-14
	No	[F] 101 (92.7); 86-97

CI= confidence intervals; MWM= medical waste management; MW= medical waste; PPE= personal protective equipment. A, B, C, D,E, and F stands for pairwise statistical comparison of each variable: A= P > 0.05; B, C, D, E, and F= P<0.05.

Data of the present work were also allowed assessing of study participants during MW segregation and transportation in the hospital departments/units. Statistical analysis of the replies of each question revealed significantly decreased in number of participants who did not wear PPE 83 (76.1%; P>0.05). Those who transporting MW out of work hours statistically raised 80/109 (73. 4%); P>0.05 over those who did not (Table 4).

Table 4 Assessment of the participant practices during MW segregation and transportation.

Segregation and transportation practices	Replies	Number (%)
Wearing of PPE	Yes	26 [A](23.9%)
	No	83 [A] (%76.1)
Segregation of medical wastes in the specified coded containers and bags	Yes	61 [B] (56.0 %)
	No	48 [B](44.0 %)
Waste transportation during work hours	Yes	80 [C](73.4 %)
	No	29 [C](26.6 %)
Leaving waste containers more than 48 hours	Yes	0 [D](0.00 %)
	No	109 [D](100 %)
Transportation of medical wastes in specified trollies	Yes	61 [E](56.0 %)
	No	48 [E](44.0%)
Utilizing specified containers for each sharp and infective MW	Yes	61 [F](56%)
	No	48 [F](44 %)
Segregation of Medical Wastes from General Wastes	Yes	61 [G](56%)
	No	48 [G](44 %)
Premises of waste collection comply with standard international requirements (ventilation, out of children and visitors access, et al..)	Yes	6 [H](5.5 %)
	No	103 [H](94.5 %)
Specific signals drawn in the waste collection sites indicate each type of waste container/ bag/ basket	Yes	3 [K](2.8 %)
	No	106 [K](97.2 %)

A, B, C, D, E, F, G, H, K indicate Pairwise statistical comparison of the responses of each variable (segregation and transportation): A, C, D, H, and K= P<0.05; B, E, F, and G= P>0.05.

Analysis of the study data was extended to explore whether or not participants' demographic data associated with their awareness of MWM. Participants who has gotten university qualification seemed to be more adherent to the standard international guideline compared to those had nursing profession, although both variables comprises largest sample size (60/109, 55%; 60/109, 55%) (Table 5).

Table 5 Association between demographic data of the targeted healthcare and supporting staff and their knowledge of MWM

Demographic data		Awareness/knowledge of medical waste managements (MWM)							
		Knowing standard regulation of MWM (%) Number		Receiving MWM training (%) Number		Knowing infectious medical wastes (%) Number		Knowing the importance of wearing PPE (%) Number	
		Yes	No	Yes	No	Yes	No	Yes	No
Age	20- 25	(%28.6)2	(%71.4)5	(%14.3)1	(%85.7)6	(%57.1)4	3	(%71.4)5	(%28.6)2
	26-35	(%5)1	(%95)19	% (0)0	(%100)20	(%30)6	(%70)14	(%90)18	(%10)2
	36-45	(%9)7	(%91)71	(%5.1) 4	(%94.9)74	(%53.8)42	(%46.2)36	(%94.9)74	(%5.1)4
	>45	(%25)1	(%75)3	(%0)0	(%100)4	(%75)3	(%25)1	(%100)4	(%0)0
Sex	Male	(%7.5)3	(%92.5)37	(%5)2	(%95)38	(%45)18	(%55)22	(%85) 34	(%15)6
	Female	(%11.6)8	(%48.4)61	(%4.3)3	(%56.7)66	(%53.6)37	(%46.4)32	(%97.1)67	(%2.9)2
Work experience	0-4	(%20)1	(%80)4	(%0)0	(%100)5	(%20)1	(%80) 4	(%80)4	(%20)1
	5-8	(%0)0	(%100)20	(%5))1	(%95)19	(%45)9	(%55)11	(%90)18	(%10)2
	9-12	(%3.4)1	(%96.6)28	(%0)0	(%100)29	(%62.1)18	(%37.9)11	%(93.1)27	(%6.9)2
	>12	%(14.3)8	(%85.7)48	(%47.1)	(%92.9)52	(%76.7) 43	(%23.2)13	(%94.6)53	(%5.4)3
Profession	physician	(%60)3	(%40)2	(%40)2	(%60)3	(%80) 4	(%20)1	(%100)5	(%0)0
	Lab technician	(%20)3	(%80)12	(%6.7)1	(%93.3)14	(%60)9	(%40)6	(%100)15	(%0)0
	Pharmacist	(%14.3)1	(%85.7)6	(%0)0	(%100)7	(%28.6)2	(%71.4)5	(%100)7	(%0)0
	Nurse	(%5)3	(%95)57	(%1.7)1	(%98.3)59	(%65)39	(%35)21	(%100)60	(%0)0
	Radio technician	(%0)0	2(%100)	(%0)0	(%100)2	(0%)0	(100%)2	(%100)2	(%0)0
	Supporting staff	(%0)0	3(%100)	(%0)0	(%100)3	(0%)0	(100%)3	%(66.7)2	(%33.3)1
	Others	(%5.9)1	(%94.1)16	(%5.9)1	(%94.1)16	(%5.9)1	(%94.1)16	(%62.5)10	(%37.5) 6
Qualifications	Secondary	(%6.3)2	(%93.7)30	(%0)0	(%100)32	(%40.6)13	(%59.4)19	(%93.8)30	(%6.2)2
	University	(%11.5)7	(%88.5)54	(%4.9) 3	(%95.1)58	(%63.9)39	%(36.1)22	(%38.4)60	(%1.6)1
	Postgraduate	(%100)1	(%0)0	(%100)1	(%0)0	(%100) 1	(%0) 0	(%100) 1	(%0) 0
	Not qualified	(%6.7)1	(%93.3)14	(%6.7)1	(%93.3) 14	(%13.3)2	(%86.7) 13	(%66.7)10	(%33.3)5

Lab= laboratory; Radio= radiology

Table (6) represented the results of observational checklist applied to assess some practices noticed on researcher visit to each targeted department. Compared to all MW practices assessed in this work, the only practices that registered 1 score or less (unsatisfactory) were associated with MW transportation. On the other side, all department targeted recorded to be 100% (4 score) complied with standard international MWM in terms of treating MW before 48 hours.

Table 6 Assessment of study participants in relation to their adherence to standard practices of MWM.

Hospital departments/ units	Assessment of observational data (0-4)				
	Wearing PPE	Treating MW before 48 hours of collection	Segregation, and collection of MW in specified containers	Transportation of MW in specified trollies	Transportation of MW out of work hours
Medical laboratory	2	4	0	0	1
Medical radiology	1	4	3	0	1
Surgery	3	4	1	0	1
Emergency	2	4	2	0	1
Obstetrician and gynaecology	3	4	1	0	1
Pharmacy	2	4	2	0	0
Waiters	1	4	0	1	0
Cleaning staff	3	4	1	0	1

0-4 indicates: 0= not applied, 1= 25% applied, 2= 50%, 3= 75%, and 4= 100%.

 The present study highlighted the assessment of MWM and practices among healthcare and other supporting staff working at Al-Graifa Rural Hospital, Obari/ South Libya. 109 of the hospital staff were selected to be taken part in this research based on their willingness for study participation. Out of 199, more than half (66%) were nursing staff, followed by medical laboratory technicians (15%). However, lowest number of participants were radiology technician 2% and other supporting staff 3%. The majority of the targeted staff were aged 35- 40 (64.2% of overall study participants), and female were more engaged (63.3%) than male (36.7%) in this work. Approximately, just above half of the targeted hospital personnel were university qualified. Demographic findings of this study were in concurrence with other work performed by Letho et al., (2021). It was worth noticing that number of research participants who received MWM training was significantly decreased (only 5/109; 4.6%), and these data contrasted of other studies [1], [16]. Significant differences were also revealed between staff who replied 'yes' they aware of the correct standard practices of MWM, in particular awareness of differences between dangerous and in-dangerous MW (84.4%), and availability of specific protocol for MW treatment in the hospital premises (66.1%). On contrary, participants who replied that they had no knowledge on: MW segregation based on distinct colored containers (100%); correct handling of any accident during work (leakage or broken glass or sharp tools) (92.7%) according to the standard guidelines [2]. No significant difference recorded among targeted staff' replies on their knowledge about (1) the correct handling of needles and sharp materials, and (2) the importance of wearing PPE.

Significant increase in staff' awareness about existence of specified protocol for MWM was also revealed in another study [1]. Potential reason for that may owe to the failure in establishing continuous training or educational workshops by their authorities (hospitals) particularly infection and control office. Most importantly, infection control office require to develop a specific manual for MWM policies and protocols for implementation.

Letho et al., (2021) and Windfeld E.S., (2015) recorded satisfactory results on the correct segregation of color-coded MW container, and majority (80% and 84%), respectively. of healthcare and supporting providers adhered to the standard regulation. Presence of opposite findings in Al-Graifa Rural hospitals may owe to the underestimation of strictly applying these practices under supervision of infection and control office. To ensure health and environmental safety, transportation and treatment of MW in hospital and related health premises must comply with international standard guidelines [18], [19]. Although international standard practices of MW transportation and PPE existed [1], [17], observational data in this study indicated that health-care facilities in Al-Graifa Rural Hospital failed to achieve minimum correct practices in MW transportation, and just half (50%) of the healthcare workers had utilized their PPE. Similar data were also reported elsewhere [1], [17], [20].

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Conclusion

To our knowledge, this is the first work focused on assessing practices of medical waste management in South Libya. This study targeted Al-Graifa Rural Hospital since pilot study confirmed the availability and readiness of enough participants to be taken part in the work. Present study data highlighted a number of significant unsatisfactory medical waste management and practices among healthcare personnel. Approximately, 40% of these practices were not adhered with standard international guidelines [2]. Hence, enhancement and development of health and supporting staff via provision of intensive training and awareness workshops is highly recommended. Study data suggest that the hospital infection control team are highly required to implement a monthly regular assessment of the hospital' units/departments/ wards and their personnel to ensure persistent correct medical waste practices.

Compliance with ethical standards
Disclosure of conflict of interest
The authors declare that they have no conflict of interest.

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