

## Evaluation of the Quality of Health Care Waste Management in Hospitals, Among Care Directors and Nursing Staff in Four Lebanese Hospitals

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### Abstract

**Objectives:** The objective of this study is to assess the quality of hospital healthcare waste management among managers and nursing staff in four hospitals located in the Mount Lebanon region and in northern Lebanon.

**Methods:** This is a cross-sectional, descriptive analytical study conducted in September 2022, among care managers and nursing staff in four participating hospitals. The survey was conducted using a questionnaire distributed to nurses and another one distributed to care directors. In addition, the researchers completed a standardized field observation checklist during hospital visits. The collected socio-demographic data, questionnaire answers, checklist observations, and waste management scores were analyzed using SPSS.

**Results:** The survey was conducted among 25 nurses in the four selected hospitals. According to 76% of the participants, the risk of error in waste sorting is always or often present, and 50% confirmed that the containers are not labeled in an identifiable way. The study showed that the quality of waste management varied between average and good. Hospitals in Mount Lebanon had a higher quality score than those in the North, but this difference was not statistically significant. Four waste management managers reported that waste sorting is useful for management, waste collection is done regularly, and staff receives training in hospital waste with risk of infection (HWRI) management. However, only two establishments vaccinate staff against HBV. Wheeled trolleys and elevators are used to transport waste from services to the central storage room, but they are not always cleaned, disinfected, or ventilated. The central waste storage duration exceeds 72 hours in two hospitals. Based on the collected data, major shortcomings identified include non-compliance of nursing staff with the triage protocol and blood exposure accidents (BEA) prevention precautions, insufficient equipment for waste management, non-post-

ing of protocols and instructions related to waste types and destination, non-use of waste traceability sheets, and non-estimation of HWRI quantity. Most nurses and managers have undergone training, which was significantly associated with better management quality.

**Conclusion:** This study highlights the need for strengthening hospital waste management, updating protocols, and ensuring sufficient availability of equipment and material for the well-being of patients and hospital staff.

**Keywords:** Waste management, prevention, BEA, hospital, Lebanon.

## Introduction

A healthcare facility inevitably produces medical waste that can be hazardous to health (Adogu, et al., 2014). Thus, healthcare waste (HW) corresponds to all biological and non-biological materials that are eliminated but not intended for another use. In hospitals, these types of waste are generated for various reasons, such as patient diagnosis, care, vaccination, and related biomedical research (Lakbala & Mahesh, 2011).

The management of HW becomes a major issue because it leads to risks to human well-being and damage to the environment, which have a strong tendency to trigger epidemics (Awodele, et al., 2016). The World Health Organization (WHO) reports that more than 50,000 people die every day from communicable diseases due to poor waste management (Chartier et al., 2014). Specifically, the WHO has estimated that injections using contaminated syringes were responsible for 33,800 new cases of Acquired Human Immunodeficiency Virus (HIV) infections, 1.7 million cases of Hepatitis B (HBV), and 315,000 cases of Hepatitis C (HCV) (WHO, 2018).

In the Middle East and North Africa (MENA) region, the healthcare sector is growing rapidly, leading to a massive increase in the amount of healthcare waste generated by hospitals, clinics, and other institutions. Improper disposal methods, limited physical resources, and lack of research on medical waste management exacerbate this case (Tfaily & Moussa, 2020). This hazardous waste is combined with municipal and industrial waste in many MENA countries, turning it into a mixture of hazardous substances that lead to disease transmission and contamination of water, soil, and air (Yazie et al., 2019).

In fact, effective management and proper disposal of HW are important to reduce infections or illnesses when they come into contact with discarded products and to prevent environmental contamination (Tfaily & Moussa, 2020). However, HW management is a challenge in most developing countries (Yazie, et al., 2019). In particular, the proportion of healthcare establishments that incorrectly dispose of their HW is 18 to 64% (WHO, 2004). The implementation of this care waste management is still due to technological, economic, social difficulties and insufficient training of personnel responsible for han-

dling this waste (Adogu et al., 2014).

Hence, WHO has prepared various biomedical waste management guidelines to ensure the safe management of healthcare facility waste (Letho et al., 2021). Several studies have evaluated healthcare waste management in hospitals in Bhutan (Letho et al., 2021), Nigeria (Awodele et al., 2016), and Lebanon (Tfaily & Moussa, 2020). They showed gaps in the presence or the correct application of policies and procedures, as well as a lack of awareness among healthcare providers.

In Lebanon, according to the Lebanese organization Arc-en-ciel, there are 13,500 beds in hospitals that produce an average of 8100 kg/day of infectious risk HW (HWRI), of which only half are properly treated. In addition, 70% of small hospitals are unable to invest in the treatment of their waste to comply with the standards of the Ministry of Health and the Environment. The management of these wastes faces both an environmental problem and a global health threat due to the lack of regulations, knowledge, and advanced treatment and disposal systems (Tfaily & Moussa, 2020), as well as the economic crisis. Indeed, the increase in the rate of waste generation in most hospitals in Lebanon suggests that this waste is unregulated and that there is a poor auditing system (Maamari, et al., 2015).

In fact, good management of medical waste in the hospital depends on a team dedicated to accomplishing this mission, good administration, careful planning, good organization, underlying legislation, adequate funding and full involvement of trained staff (Letho et al., 2021). Thus, it is relevant that before adopting any of these options, hospitals and medical institutions should assess the problems and come up with a management strategy suitable for their economic situation and also sustainable to use, based on local technology (Letho et al., 2021). Therefore, the main objective of this study is to assess the quality of hospital care waste management, with care directors and nursing staff working in four hospitals located in the Mount Lebanon region and North Lebanon.

## Methods

### *Study design*

This is a cross-sectional, descriptive, analytical study conducted in September 2022, to assess the quality of waste management in four hospitals located in the Mount Lebanon and North Lebanon regions, among nursing directors and staff.

### *Target population and sampling method*

The target population consists of 4 directors, represented by hygienists or waste management personnel, or nursing directors, and 25 nurses working in the 4 hospitals participating in the study, who were selected by convenience sampling. The inclusion criteria

for nurses are Lebanese nationality and a nursing degree or nursing assistant qualification, while the exclusion criteria are hospital employees on sick leave or with less than 3 months of experience.

The sampling method adopted is non-probabilistic convenience sampling. The population studied is composed of directors and all nurses working in the 4 recruited hospitals who have agreed to participate.

### *Study procedure*

After selecting the hospitals, the chosen hospital directors must be contacted by official letters addressed from the Lebanese University, Faculty of Public Health, Section 5 - Saida. Once approval is given, students must visit the hospitals. Eligible directors and nursing staff present at the time of data collection are invited to participate in the study, and questionnaires are distributed. In addition, during the service visits, students must also fill out a standardized checklist.

### *Data collection methods*

This study includes two data collection methods:

- An inquiry during which two questionnaires are to be distributed: one for nurses and one for directors.
- Observation made by researchers to fill out a standardized checklist.

The data collection instruments for this study are three: two questionnaires and a standardized observation checklist.

#### *• Questionnaire for nursing staff*

This is a modified version of a standardized self-administered questionnaire (WHO, 2009) that was previously used during the WHO national survey in 2009 concerning the health risk related to healthcare waste disposal. It consists of several sections of analysis: hospital identification, sociodemographic characteristics, waste management, waste sorting, packaging and storage, healthcare waste treatment, blood exposure accidents, disposal of healthcare waste, and nursing staff training on waste management.

#### *• Questionnaire for directors*

This is a standardized questionnaire taken from the WHO manual in 2005 (WHO, 2005) for waste management. It includes two parts, including sociodemographic characteristics

and waste management strategy.

#### • *The checklist*

This is a standardized checklist based on international criteria (Infection Control Association, 2021). It is to be filled out by the student investigators in the 4 hospitals in Mount Lebanon and the North. It includes hospital identification and evaluation grids that were filled out after direct observation of the premises. The average duration of the visit and checklist completion is estimated at one hour for each hospital.

#### *Data analysis plan*

Data analysis will be performed using SPSS version 26 software. A p-value less than 0.05 will be considered statistically significant.

First, sociodemographic data, questionnaire and checklist responses, and the calculated waste management score will be described using the frequencies and percentages of categorical variables as well as the mean and standard deviation for continuous variables. In particular, a score of the quality of waste management as reported by the nursing staff will be calculated proportionally to the quality of management (a higher score indicates better management quality).

Next, the relationship between the hospital waste management score of nurses with some sociodemographic data and attendance at training sessions will be tested. The Student t-test will be used in the case of comparing two means. If the variances are not equal between the two compared groups, the adjusted t-test should be used, while the non-parametric Man-Whitney test should be used if the variable with a sample size less than 30 does not have a normal distribution.

#### *Ethical considerations*

The ethical considerations of this study have been respected. In particular, approval from an ethics committee is not required as it is an observational study. Then, authorization from the hospital nursing care management was obtained following a letter addressed by the Lebanese University explaining the purpose of the study in order to distribute the questionnaires.

Participation was voluntary in such a way that participants had the freedom to participate or not in the study after understanding all necessary information. Their informed consent was obtained, anonymity was respected, and confidentiality of information was guaranteed.

## Results

### *Questionnaire addressed to nursing staff*

Twenty-five nurses were present at the time of data collection in the 4 selected hospitals and agreed to participate. The age of the participants ranged from 22 to 50 years with an average of  $30.80 \pm 7.72$  years. The majority were female university-educated registered nurses (80%). The number of years of experience in the hospital and overall was  $8.70 \pm 7.98$  and  $9.80 \pm 8.27$  years, respectively. 24% of participants work in the dialysis unit, 20% in the medical surgical or emergency department, and 12% work in the endoscopy, palliative care, and intensive care unit. Thus, this study showed that 80% of participants reported that they received training on waste management, and 84% reported the presence of a person responsible for waste management (Table 1). The Infection Control Committee (ICC) took this responsibility according to 39.1% of participants, followed by the Quality Office (34.8%) and registered nurses (RN) (17.1%). It should be noted that 7 participants (30.4%) do not know who is in charge of waste management, and 4 participants mentioned collaboration between the RN, ICC, Quality Office, and Nursing Administration. Furthermore, all participants confirmed that healthcare waste exposes health personnel to health risks (data not shown).

Table 2 presents the quality of waste management as reported by nursing staff participating in this study. In fact, the results showed that 76% of participants considered the risk of errors in waste sorting to be always or often present, while 48% reported that sorting is often or sometimes respected. Specifically, 83% (n=20) of participants who considered sorting to not always be respected reported either the presence of waste similar to household waste in yellow bags or, conversely, the presence of healthcare waste in black bags. Additionally, the majority of participants confirmed that sharp object collectors (88%) and bags of different colors are present in sufficient quantity (68%), as well as bags conform to standards. 64% of participants reported the existence of posters specifying the different types of waste and their destination, but they are not displayed, and 17 participants confirmed that waste removal is done regularly. Regarding personal protective equipment (PPE) specific to waste management, masks were present in hospitals (96%), followed by waterproof gloves (92%) and gowns/aprons (88%). However, boots (56%) and goggles (48%) are not always present. Sorting procedures for glass, cardboard, and plastic bottles exist in 56% of cases. Sharps containers are securely closed before collection transport (84%), infected waste is eliminated in double packaging (60%), but not labeled compared to more than half of participants (56%).

Regarding the quality of waste packaging and storage, more than half of the participants confirmed that the containers are not labeled in an identifiable way (56%), and the quantity of sharps waste is not estimated at the service level (60%), with most participants not knowing the quantity (60%).



As for the quality of treatment of sharp objects waste, almost half of the participants noted that the waste is treated by an incinerator or autoclave, while 20% noted the use of traditional burning. Additionally, 44% of nursing staff indicated either the presence or absence of an incinerator in the hospital where they work. If an incinerator is present, more than half of the participants do not know the number of incinerators present, their location, their control, etc. It should be noted that three participants indicated the presence of only one incinerator in the hospital, two participants indicated that it is located in the center of the hospital, and four indicate that it is functional.

Table 3 represents the quality of management of occupational exposures. In fact, 80% of the participants know that there is a risk to their health in case of occupational exposure. Thus, HIV is the virus most noted by these participants (92%), followed by HBV (68%). Notably, 68% of the participants had an occupational exposure in the previous year, with 53% having had an exposure 2 or more times. These exposures were mainly needle stick injuries (70.6%) or blood splashes (58.8%), mainly during patient care (94%). In particular, 41.1% of accidents occurred due to recapping a needle. Additionally, 16% of participants reported that they were not wearing gloves at the time of the exposure, and 60% were not wearing personal protective equipment (PPE), although 88% confirmed that PPE is present in the service. Similarly, 76% confirmed that safety equipment for occupational exposures is available in the service. Cleaning, disinfecting, and protecting the wound were the most frequently noted actions taken by participants (96%) following an occupational exposure. The majority of participants received serology following an exposure and were fully vaccinated against HBV. Additionally, 84% of participants attended one or two seminars on the prevention of occupational exposure risks, and most confirmed the existence of protocols on this subject (88%) as well as their availability in the service (76%). However, only 10 participants (40%) noted that these protocols are not displayed.

Eighteen participants (72%) noted the existence of waste that requires special disposal in their service (Table 3). The methods of collecting and treating this waste are presented in Figure 1. Notably, yellow bags are mainly used to dispose of sharps waste, placenta, liquid biological waste, and hazardous pharmaceutical products. On the other hand, household waste is disposed of in black bags. It should be noted that some participants dispose of household waste in yellow bags and, conversely, sharps waste in black bags (Figure 1A). Thus, incinerators are mainly used to treat sharps waste, sharp objects, placenta, hazardous pharmaceutical products, and liquid biological products. However, household waste and thermometers are treated by an autoclave. Finally, it should be noted that household waste is treated either by an autoclave or by an incinerator (Figure 1B).

In total, the score for waste management quality ranges from 15 to 29 with an average of  $22.7 \pm 3.9$  (data not presented). Bivariate analysis showed that those with higher education (master's degree or higher), as well as those who attended training, had a higher score for waste management quality than others ( $p < 0.05$ ). It should be noted that hospitals in Mount Lebanon have a higher quality score than those in the North, but this difference is

not statistically significant ( $p = 0.059$ ) (Table 4).

### ***Questionnaire addressed to Directors of Care / Hygienists***

All hospitals where the study was conducted were of medium size, with a number of beds ranging from 50 to 150. In each hospital, a questionnaire was filled out by the person responsible for waste management. All participants ( $n=4$ ) were women, with an average age of  $42.75 \pm 9.7$ , higher education (master's degree or above), and more than 10 years of professional experience. Similarly, all of these participating managers had training in waste management. The quality of waste management in these hospitals is described in Table 5. In fact, hospitals produce at least 4 types of waste, and their sorting is always or often respected. All managers confirmed that sorting is useful for waste management; cleaning staff responsible for waste collection in the facility and personnel receive training on the management of infectious medical waste. However, only managers in 2 hospitals indicated that staff are vaccinated against HBV. The means of transport used to move waste from the floors to the central storage area are a wheeled cart and an elevator, which are not always cleaned (25%). All hospitals have a closed central storage area with a door and an identification poster. This area is not ventilated in one hospital, and is disinfected in only 2 hospitals. The amount of infectious medical waste is estimated in three hospitals, averaging 1800 kg per month, or around 20 bags per day. The duration of central waste storage exceeds 72 hours in 2 hospitals. In addition, waste is stored according to specific rules in all hospitals, and the most commonly used treatment process is autoclaving, with only one manager indicating the use of an incinerator. Audit is the main measure of waste disposal control present in all hospitals. Notably, the waste traceability form is present in all hospitals, but it is only used for control in one hospital. Finally, only half of the managers have an idea of the cost of medical waste management, which is around \$13,000.

### ***Results of on-site observation***

The results of the checklists filled during the hospital visits by observation are presented in Table 6. Specifically, the hospitals in Mount-Lebanon had a compliance rate of 72.7% and 90.9%, while the hospitals in the North had a compliance rate of 59% and 68.2%. The shortcomings in waste management in the hospitals, according to the students' observation, are mainly related to the lack of presence of signs (for sorting, different types of waste, etc.) in the departments and the inadequate application of sorting methods (for example, color coding of bags is not applied).

### **Discussion**

This cross-sectional study aimed to evaluate the quality of hospital waste management among nursing directors and staff working in two hospitals located in the Mount Lebanon region and two in northern Lebanon. Thus, the nursing staff and waste management



officials from these 4 hospitals completed a questionnaire. In addition, the collected data were associated with on-site observations.

Regarding the evaluation of the level of application of waste management protocols, this study showed that the waste management quality score ranged from 15 to 29 with an average of  $22.7 \pm 3.9$ , indicating a waste management quality ranging from moderate to good. This result is similar to that shown by Tfaily and Moussa in 2021, in a study conducted in southern Lebanon.

The shortcomings of waste management found in this study are consistent with those of Tfaily & Moussa (2020) and include: non-compliance with sorting, the lack of display indicating the different types of waste and their destination, the insufficient supply of certain materials necessary for waste management such as bags of different colors, PPE, and especially boots and goggles, the non-disposal of infected waste in double packaging, the non-labeling of infected waste as well as containers of sharp materials in an identifiable manner, the non-estimation of the quantity of medical waste, the absence of incinerators in most hospitals, the lack of knowledge of nursing staff regarding the treatment of medical waste when removed from the service, the non-compliance of nursing staff with standard precautions for the prevention of blood exposure accident, especially with regard to wearing PPE, the non-cleaning of the means of transport used for waste disposal, the non-disinfection of the storage room in some hospitals, and the long central storage time of waste exceeding 72 hours in some hospitals.

On the other hand, the strengths of the waste management quality include the presence of a person responsible for waste management in hospitals, the participation of most participants in training on waste management and the prevention of blood exposure accident risks, the secure closure of sharp containers before collection and transport in most cases, the existence of protocols on waste management and blood exposure accident prevention, and the central storage room that is closed with a door and has an identification sign.

These identified weaknesses and strengths of waste management quality were consistent between the data collected from the nursing staff, waste management officials, and investigator observations. Thus, the majority of participants were aware of the importance of waste management and sorting, which was consistent with the study by Letho et al. (2021).

### ***Recommendations***

Following our results, we suggest the following recommendations:

- All nurses and managers should receive regular training on waste types, risks, proper sorting and reduction methods.

- All hospital staff should be oriented on how to treat waste after it leaves their service.
- Posters, updated orientation boards, protocols should be displayed in all sectors and services to reflect coding systems, medical waste color-coding and new research (ISO, JCI, etc.).
- Prepare adequate material (small containers, bags of different colors, mercury thermometers, special boxes for batteries, etc.) to facilitate source separation.
- Reduce the workload that leads nurses to ignore sorting criteria due to lack of time.
- The Ministry of Health should organize educational campaigns in hospitals to enforce laws and ordinances on waste disposal inside and outside hospitals.
- A series of statements on incidents related to misclassification should be made to highlight shortcomings and weaknesses so they can be avoided. The hospital must take full responsibility for any accidents that occur.
- Hospital waste management systems must be strengthened through continuous monitoring and control. Regular audits and waste traceability records must be used as a control tool.
- Transport means used for waste disposal and the storage area must be regularly cleaned and disinfected.
- The duration of central waste storage must be reduced as much as possible.
- The amount of waste must be estimated at the service and hospital levels.
- Each hospital must have its own incinerator and autoclave. These machines must be regularly maintained.

### ***Limitations***

This study has some limitations. Indeed, we did not find a significant difference in the quality of waste management between hospitals in the North and Mount Lebanon, and our results are similar to those of the study by Tfaily and Moussa (2021), conducted in the South of Lebanon. However, the results of this study are not representative of all hospitals in Lebanon but give a general idea of the waste management situation in medium-sized

hospitals. Thus, the recommendations should be applied at the national level in all hospitals. Moreover, it should be noted that the sample size was relatively small, as the study was conducted on the field during the day shift. Other difficulties included finding available nurses to fill out the questionnaire, due to their workload.

## Conclusion

A triangulation of data collected from nursing staff, waste management officials, and investigator observations was performed. The results showed a quality of waste management ranging from average to good, and several shortcomings were identified. These results indicate a need to strengthen management control, update protocols, and ensure the necessary materials are available in sufficient quantities to meet this objective.

## Declarations:

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- Disclosure of interests: The authors state that they have no competing interests to disclose.

## References

- 1- Adogu, P., Ubajaka, C., & Nebuwa, J. (2014). Knowledge And Practice Of Medical Waste Management Among Health Workers In A Nigerian General Hospital. *Asian Journal of Science and Technology*, 5, 833.
- 2- Awodele, O., Adewoye, A. A., & Oparah, A. C. (2016). Assessment of medical waste management in seven hospitals in Lagos, Nigeria. *BMC Public Health*, 16(1), 269. <https://doi.org/10.1186/s12889-016-2916-1>
- 3- Chartier, Y., Emmanuel, J., Pieper, U., Pruess, A., Rushbrook, P., Stringer, R., ... Zghondi, R. (2014). *Safe management of wastes from health-care activities*. Geneva, Switzerland: World Health Organization (WHO).
- 4- Lakbala, P., & Mahesh, D. T. M. (2011). *Bio-Medical Waste Management in Shiraz City of Iran*. 9.
- 5- Letho, Z., Yangdon, T., Lhamo, C., Limbu, C. B., Yoezer, S., Jamtsho, T., ... Tshering, D. (2021). Awareness and practice of medical waste management among healthcare providers in National Referral Hospital. *PloS One*, 16(1), e0243817. <https://doi.org/10.1371/journal.pone.0243817>
- 6- Organisation mondiale de la santé. (2004). *Gestion des déchets d'activité de soins*. Retrieved from <https://apps.who.int/iris/rest/bitstreams/65147/retrieve>
- 7- Organisation mondiale de la santé. (2018). *Déchets liés aux soins de santé*. Retrieved November 25, 2022, from <https://www.who.int/fr/news-room/fact-sheets/detail/health-care-waste>
- 8- Réseau de Prévention des Infections Associées aux Soins. (2021, March 23). Interview—Guide DASRI (Déchets d'activités de soins et risque infectieux). Retrieved November 25, 2022, from Repias: Réseau de Prévention des Infections Associées aux Soins website: <https://www.preventioninfection.fr/interview-guide-dasri-dechets-dactivites-de-soins-et-risque-infectieux/>
- 9- Tfaily, M., & Moussa, S. (2020). Assessment Of Healthcare Waste Management In Hospitals Of South Lebanon. *BAU Journal - Health and Wellbeing*, 2(2). Retrieved from <https://digitalcommons.bau.edu.lb/hwbjournal/vol2/iss2/9>
- 10- Yazie, T. D., Tebeje, M. G., & Chufa, K. A. (2019). Healthcare waste management current status and potential challenges in Ethiopia: A systematic review. *BMC Research Notes*, 12(1), 285. <https://doi.org/10.1186/s13104-019-4316-y>

## Tables

**Table 1: Socio-demographic characteristics of participants (n=25)**

		Estimates	
<b>Age</b>		(m (ET	(7.72) 30.80
<b>Sex</b>	Women	(% n	(80%) 20
	Men		(20%) 5
<b>Level of education</b>	License	(% n	(80%) 20
	Masters or more		(20%) 5
<b>Function</b>	Registered nurse	(% n	(80%) 20
	Service Manager		(20%) 5
<b>Number of years of experience in the hospital</b>		(m (ET	(7.98) 8.70
<b>Number of years of total experience</b>		(m (ET	(8.27) 9.80
<b>Labor Department</b>	Internal medicine / Surgery	(% n	(20%) 5
	Dialysis		(24%) 6
	Endoscopy		(12%) 3
	Palliative care		(12%) 3
	Intensive care		(12%) 3
	Emergency room		(20%) 5
<b>Location of the hospital</b>	North	(% n	(44%) 11
	Mount Lebanon		(56%) 14
<b>Having received training in waste management</b>	Yes	(% n	(80%) 20
	No		(20%) 5
<b>Presence of a designated person responsible for waste management</b>	Yes	(% n	(84%) 21
	No		(16%) 4

**Table 2: The quality of waste management**

	(%) n
<b>Sorting quality</b>	
<b>Possibility of a risk of error in the sorting of waste</b>	
Always	(40%) 10
Often	(36%) 9
Sometimes	(20%) 5
Rarely	(4%) 1
<b>Sorting is respected</b>	
Always	(4%) 1
Often	(48%) 12
Sometimes	(48%) 12
<b>If the triage is not respected, there has been</b>	
Confusion in the color of the bags	(37.5%) 9
Presence of waste similar to household waste in the yellow bags	(83.4%) 20
Presence of wastes with infectious risk in the black bags	(83.4%) 20
<b>Availability of collectors for sharp and sharp objects</b>	
Not available	(8%) 2
Available in insufficient quantity	(4%) 1
Available in sufficient quantity	(88%) 22
<b>Availability of bags of different colors</b>	
Not available	(4%) 1
Available in insufficient quantity and meeting standards	(28%) 7
Available in sufficient quantity and meeting standards	(68%) 17
<b>Existence of posters specifying the different types of waste and their destination</b>	
Do not exist	(12%) 3
Exist but not displayed	(64%) 16
Exist and are displayed	(24%) 6
<b>Waste removal</b>	
Anarchic	(24%) 6
Regular	(68%) 17
I don't know	(8%) 2
<b>Availability of PPE that are used for wastes with infectious risk</b>	
Waterproof gloves	(92%) 23
Boots	(56%) 14



Combination	(60%) 15
Gown and apron	(88%) 22
Mask	(96%) 24
Eyeglasses	(48%) 12
<b>Existence of a sorting procedure for glass, cardboard, plastic bottles</b>	
Yes	(56%) 14
No	(44%) 11
<b>Spicy-sharp containers are securely closed before collection and transport</b>	
Yes	(84%) 21
No	(16%) 4
<b>Infected waste is disposed of in double packaging</b>	
Yes	(60%) 15
No	(40%) 10
<b>Packaging of infected waste is labeled</b>	
Yes	(44%) 11
No	(56%) 14
<b>The quality of packaging and storage of waste</b>	
<b>Containers are labeled identifiable</b>	
Yes	(44%) 11
No	(56%) 14
<b>The quantity of waste with infectious risk is estimated at the service level</b>	
Yes	(40%) 10
No	(60%) 15
<i>(The quantity is: (n=10</i>	
Between 1 and 3 Kg	(30%) 3
Between 3 and 5 Kg	(10%) 1
I don't know	(60%) 6
<b>Wastes with infectious risk processing quality</b>	
<b>Wastes with infectious risk are processed by</b>	
Incinerator	(56%) 14
Autoclave	(52%) 13
Traditional burning	(20%) 5
Pre-treatment (disinfection) and grinding device	(40%) 10
<b>Presence of an incinerator</b>	
Yes	(44%) 11

No	(44%) 11
I don't know	(12%) 3
<b><i>(The number of incinerators is: (n=11</i></b>	
1	(27.3%) 3
2	(9.1%) 1
and more 4	(9.1%) 1
I don't know	(54.5%) 6
<b><i>(Location: (n=11</i></b>	
Isolated on the outskirts of the hospital	(9.1%) 1
In the center of the hospital	(18.2%) 2
I don't know	(72.7%) 8
<b><i>(Condition: (n=11</i></b>	
Functional	(34.4%) 4
I don't know	(65.6%) 7
<b><i>(Object of maintenance or an interview (n=11</i></b>	
Yes	(45.5%) 5
No	(45.5%) 5
I don't know	(9%) 1
<b><i>(Last check-up (n=11</i></b>	
month 1 >	(9.1%) 1
months 2-3	(18.2%) 2
I don't know	(72.7%) 8
<b><i>(Provided with a dust collection system (n=11</i></b>	
Yes	(45.5%) 5
No	(45.5%) 5
I don't know	(9%) 1

Table 3: Quality of blood exposure accidents care

	(%) n
<b>Perception of a health risk in case of blood exposure accidents</b>	
Yes	(80%) 20
No	(20%) 5
<b>Viruses contracted as a result of a blood exposure accidents</b>	
HBV	(68%) 17
HCV	(48%) 12
HIV	(92%) 23
I don't know	(4%) 1
<b>Victims of blood exposure accidents</b>	
Yes	(68%) 17
No	(32%) 8
<i>(How many times in the past year (n=17)</i>	
1	(47%) 8
2	(35.3%) 6
2 <	(17.7%) 3
<i>(It was a (n=17)</i>	
Puncture or cut by needle or scalpel	(70.6%) 12
Blood splash	(58.8%) 10
I do not remember	(17.7%) 3
<i>(Circumstance of blood exposure accidents (n=17)</i>	
By practicing care	(94.1%) 16
By re- capping a needle	(41.1%) 7
_ By handling waste	(35.3%) 6
Handling garbage bags	(35.3%) 6
Accidentally by a colleague	(41.1%) 7
By cleaning the surfaces	(35.3%) 6
<b>Wear gloves during blood exposure accidents</b>	
Yes	(84%) 21
No	(16%) 4
<b>Wears PPE</b>	
Yes	(40%) 10
No	(60%) 15
<b>Availability of PPE in services</b>	
Yes	(88%) 22

No	(8%) 2
I don't know	(4%) 1
<b>Re- cap a needle after use</b>	
Yes	(20%) 5
No	(80%) 20
<b>Knowledge of security equipment regarding blood exposure accidents</b>	
Sharps collectors	(76%) 19
Needle shredders	(40%) 10
Needles	(68%) 17
None	(24%) 6
<b>The security material regarding the blood exposure accidents is available in the service</b>	
Yes	(76%) 19
No	(24%) 6
<b>The first gesture after an blood exposure accidents</b>	
Clean, disinfect and protect the wound	(96%) 24
Rinse the eye thoroughly with water in case of eye splash	(84%) 21
Go to declare an emergency in occupational medicine	(84%) 21
Nothing	(8%) 2
<b>Have a serology after an blood exposure accidents</b>	
Yes	(68%) 17
No	(32%) 8
<b>Receive a full HBV vaccination</b>	
Yes	(84%) 21
No	(16%) 4
<b>Attendance at one or two seminars on blood exposure accidents risk prevention</b>	
Yes	(84%) 21
No	(16%) 4
<b>Existence of a protocol concerning the action to be taken in the event of an blood exposure accidents</b>	
Yes	(88%) 22
No	(12%) 3
<b>Blood exposure accident protocol is available in the service</b>	
Yes	(76%) 19
No	(24%) 6
<b>The protocol is displayed in the service</b>	

Yes	(40%) 10
No	(60%) 15
<b>Existence of waste subject to special disposal</b>	
Yes	(72%) 18
No	(28%) 7

**Table 4: The waste management quality score calculated according to the characteristics of the participants**

		(m (ET	p-value
<b>Age</b>	30>	(7.72) 22.25	0.125
	30≤	(3.84) 23.15	
<b>Sex</b>	Women	(3.75) 22.80	0.226
	Male	(4.93) 22.40	
<b>Level of education</b>	License	(4.21) 22.95	0.045
	Masters or more	(2.39) 21.80	
<b>Function</b>	Registered nurse	(4.23) 22.85	0.635
	Service Manager	(2.39) 22.20	
<b>Number of years of total experience</b>	5 >	(4.40) 22.60	0.781
	5 ≤	(3.69) 22.80	
<b>Location of the hospital</b>	North	(2.36) 21.35	0.059
	Mount lebanon	(4.26) 22.98	
<b>Waste management training</b>	No	(2.95) 20.20	0.001>
	Yes	(3.91) 23.35	
<b>Seminars on blood exposure accident risk prevention</b>	Yes	(3.11) 19.50	0.001>
	No	(3.78) 23.33	

**Table 5: The quality of waste management as reported by those responsible for this management.**

	(%) n
<b>Number of categories of waste produced by the hospital</b>	
4	(50%) 2
5 ≤	(50%) 2
<b>Sorting is respected</b>	
Always	(25%) 1
Often	(75%) 3
<b>Sorting is useful for waste management</b>	
Yes	(100%) 4
<b>The person who collects the waste in the establishment</b>	
Cleaning personel	(100%) 4
<b>Staff training on wastes with infectious risk management</b>	
Yes	(100%) 4
<b>Staff are vaccinated against HBV</b>	
Yes	(50%) 2
No	(50%) 2
<b>Means of transport used to move waste from services to the central storage room</b>	
Trolley with wheels	(100%) 4
Elevator	(100%) 4
<b><i>These means are reserved solely for the transport of infected waste</i></b>	
Yes	(75%) 3
No	(25%) 1
<b><i>Carts are cleaned</i></b>	
Always	(25%) 1
Often	(75%) 3
<b>Existence of a closed central storage room with a door</b>	
Yes	(100%) 4
<b><i>Presence of a local identification poster</i></b>	
Yes	(100%) 4
<b><i>Ventilated</i></b>	
Yes	(75%) 3
No	(25%) 1



<b>Spacious</b>	
Yes	(100%) 4
<b>Presence of a water point</b>	
Yes	(100%) 4
<b>Floor and wall covering is suitable for cleaning and disinfection</b>	
Yes	(75%) 3
No	(25%) 1
<b>Is the subject of cleaning</b>	
Yes	(100%) 4
<b>Subject to disinfection</b>	
No	(50%) 2
Yes	(50%) 2
<b>Presence of waste water disposal</b>	
Yes	(100%) 4
<b>Presence of wheeled containers receiving the waste, labeled in an identifiable way</b>	
Yes	(100%) 4
<b>The quantity of waste with infectious risk is estimated at the hospital level</b>	
No	(25%) 1
Yes	(75%) 3
( <i>Estimated quantity (average</i>	Kg/month 1800
( <i>Volume (average</i>	bags per day 20
<b>Duration of central waste storage</b>	
hours except weekends 24	(50%) 2
72h <	(50%) 2
<b>Presence of an intermediate storage room</b>	
Yes	(100%) 4
<b>Location</b>	
service interior	(75%) 3
service exterior	(25%) 1
<b>Closed</b>	
Yes	(100%) 4
<b>Identified by a sign at the door</b>	
Yes	(100%) 4
<b>Cleaned up</b>	

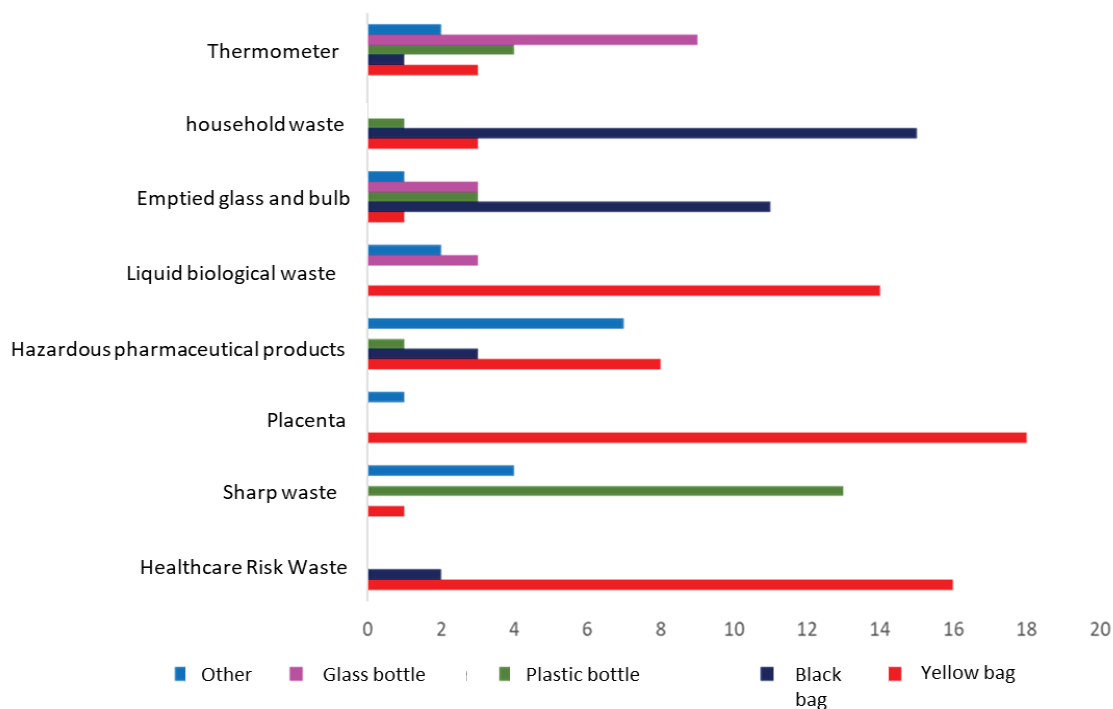
Always	(50%) 2
Often	(50%) 2
<b>Disinfected</b>	
Always	(25%) 1
Often	(75%) 3
<b>Rate of waste removal from the intermediate room</b>	
Daily even on weekends	(100%) 4
<b>Waste is stored according to specific rules</b>	
Yes	(100%) 4
<b>Association with other hospitals for the collection and treatment of waste</b>	
Yes	(25%) 1
No	(75%) 3
<b>Waste treatment process used</b>	
Incineration	(25%) 1
Autoclave	(75%) 3
Landfill	(25%) 1
Encapsulation	(25%) 1
<b>Presence of waste disposal control measures</b>	
Yes	(100%) 4
<b>?Which ones</b>	
Audit	(100%) 4
Surveillance	(25%) 1
Traceability sheet	(25%) 1
<b>Presence of a waste traceability sheet</b>	
Yes	(100%) 4
<b>Presence of a waste sector sheet in your departments</b>	
Yes	(75%) 3
No	(25%) 1
<b>Presence of an idea of the cost of waste management</b>	
Yes	(50%) 2
No	(50%) 2
<b>? How much</b>	for medical waste management - \$13,000

**Table 6 : Checklists completed during the hospital visit**

Hospital	ML1	ML2	N1	N2	Total
Presence of waste disposal and sorting procedures for healthcare activities	1	1	1	1	4
Training of employees regarding the correct and safe disposal of waste	1	1	1	1	4
Existence of evidence that staff sort waste correctly	1	1	0	1	3
The waste sorting procedure is known by all staff	1	1	1	1	4
Sorting procedures are displayed in services	0	1	0	0	1
Color coding is applicable	0	1	1	0	2
There are posters specifying the different types of waste and their destination	0	0	1	0	1
There is waste other than care activity waste in the yellow bags	1	0	1	0	2
Waste bags (DASRI) are marked and secured before disposal	1	1	0	1	3
There is no waste storage in the hallways	0	1	0	1	2
All bins used are pedal operated, with lids and in good working order	0	1	1	0	2
All bins are visibly clean both externally and internally	1	1	0	1	3
There is no emptying of clinical waste from bag to bag	0	1	1	0	2
There are no overfilled bags. The bags are not more than $\frac{3}{4}$ full	1	1	1	1	4
Waste bags are removed on a regular basis and when needed	1	1	0	1	3
Waste containers (DASRI) are kept clean, secure, inaccessible to the public	1	1	1	1	4
There is a cleaning traceability sheet for this room	1	1	0	0	2
There is a waste treatment traceability sheet	1	1	0	1	3
Presence of a slop sink in the services for liquid biological waste. If there is no protocol for specific disposal	1	1	1	1	4
The area dedicated to the storage of medical waste (outside the hospital) is locked and inaccessible to animals and the public	1	1	0	1	3
There is a monitoring convention for DASRI: (1) Number of boxes noted; (2) Number of kilograms noted; (3) Volume of cartons noted	1	1	1	1	4
There is a DASRI collection contract which is archived	1	1	1	1	4
<b>Total</b>	<b>16 (72.7)</b>	<b>20 (90.9)</b>	<b>13 (59%)</b>	<b>15 (68.2)</b>	

Figures

A. Collection



A. Treatment

