

Hospital Waste Management and the Associated Hazards

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Abstract

Generating waste from hospitals poses danger for public health and the environment around the world such as nosocomial infection, Covid-19, toxic and hazardous waste. the air pollution caused by burning waste at insufficiently high temperatures risks for affecting communities by the release of carcinogens. By 2030, the United Nations through the UNSDGs program projects to substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination in which hospital waste management plays an important role. Waste management in hospital around the world still a big challenge which needs a real effort for an efficient improvement. The aim of our study carried out over two months has targeted the general diagnostic of waste management in a local hospital at Tlemcen city (central laboratory, medical-surgical emergency and catering service). For that we have used a questionnaire that considers the infectious waste management and household waste, based on 162 questions extracted from a professional manual and focusing on Algerian regulation and international standards. After analyzing the causes of each nonconformity by cause-and-effect method and estimating their criticality, in fact, the obtained results have shown that the evaluation rate of the waste management in compliance with our questionnaire at the central laboratory is about 21%, at the medical-surgical emergencies about 16%, then for the catering service estimated to 29%. That led us to conclude that despite the deployed efforts by the hospital, the waste management according to the adopted managerial standards and regulation should be reviewed. Finally, we finished our study with improvement recommendations to resolve the observed noncompliances.

Keywords: hospital, waste management, hazards

1. Introduction

Healthcare activities generate an increasing quantity of waste; thus, they should be treated with specific restrictions linked in particular to their infectious nature. Regarding the Sustainable Development Goal and its target 3.9 (“Reduce the amount of deaths produced by dangerous chemicals and the pollution of the air, water and soil”), we came to point out that medical waste is one of the most serious public health concerns of the 21st Century (UN, 2022). The management of this waste is part of the policy of continuous improvement of the quality and safety of the healthcare. It also contributes to preventing adverse events related to the activities of health establishments, in particular the prevention of nosocomial infections (Binder et al, 2009).

Hospitals are responsible for their produced wastes. They must ensure that the handling, treatment and disposal of their waste will have no harmful consequences on health or the environment. For this, rigorous management of all waste from health care activities is essential to avoid accidents likely to occur throughout the disposal chain and to ensure the protection of the environment (ICRC, 2011 and ISO 14001).

According to the World Health Organization, inadequate management of healthcare waste can lead to serious illnesses for healthcare workers, waste disposal staff, patients and the general population. The most significant risk from infectious waste is related to the risk of accidental needlestick injuries, which can cause hepatitis B, hepatitis C or HIV infection. A considerable number of other diseases can, however, be transmitted by contact with infectious waste from health care activities (WHO, 2005).

The aim of our study within the Hospital of Tlemcen concerns the central laboratory, medical-surgical emergencies and catering, to make a general diagnosis of the current system for managing solid infectious risk health care waste, to detect points for improvement, to analyze the causes and finally to propose recommendations and solutions. The diagnosis is based on a questionnaire taken from Algerian regulations, the international standard ISO 14001 and the observations of experts such as the medical waste management manual of the International Committee of the Red Cross (ICRC,2011).

2. Methodology

2.1. Setting and sample size

Our diagnosis was carried out within Tidjani Damerdji University Hospital of Tlemcen among three services: the central laboratory, medical-surgical emergency, and catering. The targeted hospital is a non-profit public higher-education institution located in the city of Tlemcen (population range of 140.000 inhabitants in 2008), It insures many medical treatments and surgeries for patients. This hospital has a total of 2,536 employees. The tool used in our study is a set of 162 questions extracted from the Algerian regulations and the observations of the expert's manuals and guides (ICRC 2011). Questions constitute rules to respect throughout all the stages of the management system of medical waste and household waste. To calculate the estimated rate of the total compliance for the total rules, we attribute some used vocabulary herein below for our scale formula:

Total compliance rate (%) = $\frac{[instruction (\% oral + \% written) + \% achievement + \% control]}{4}$

4

2.2. Vocabulary

Herein below are some definitions and vocabulary used for our methodology to estimate the rate of the conformity or compliance regarding the rules.

- *Rule*: Questions of respect related to the management of hospital waste and/or technical system for preventing risks according to the Algerian regulation and the international standards and guides (ISO14001 and ICRC, 2011).
- *Instruction*: Measures taken by the hospital for eliminating and preventing waste risks and hazards. It could be communicated in the workplace orally or displayed as a written document.
- *Oral instruction*: Any type of waste management awareness, information, or training, with proof of participation (attendance sheets, training certificate, awareness monitoring register, etc.)

- *Written instruction*: Any written waste management instruction (e.g. written procedure, working method in document or software format, etc.)
- *Realization*: It is the execution of spoken and written instructions in the workplace.
- *Control or monitoring*: This is the monitoring of the implementation of oral and written instructions in the workplace, as well as the subsequent actions for the remedy of failures (ISO 14001, 2015).
- *Compliant (C)*: Corresponds to 60-100%, if the observed situation is fully in compliance with the rule.
- *Noncompliant (NC)*: Corresponds to less than 60 %, if the observed situation is not in compliance with the rule.
- *Not applicable (NA)*: If the observed situation is not relevant to the rule (ISO 14001, 2015).

3. Results

Estimated rates based on the diagnosis of the situation of the hospital waste management regarding the rules represented by the total of 162 questions are shown in table 1 below:

Table 1. Some questions and their evaluations of the compliance rates used among the diagnosis

Place : Central laboratory						
Question (Rule)	Diagnosis of the situation				Total %	Conformity
	Instruction		Realization	Monitoring and correction		
	Oral	Writing				
Is the waste collected in rigid containers, yellow in color and resistant to perforation?	75%	75%	90%	11%	60%	C
Do the containers bear the mention of the nature of the waste?	80%	90%	95%	5%	68%	C
Are workers wearing gloves ?	80%	80%	80%	1%	60%	C
Are the containers marked by the mention of the nature of the	80%	90%	95%	5%	68%	C

waste in an easily readable way?						
Is waste from infectious care activities incinerated?	95%	95%	95%	10%	74%	C
Does the facility have an incinerator?	95%	95%	95%	10%	74%	C
Rules regarding the protection measures						
Face protection – visor-Eye protection – goggles protection ?	80%	50%	80%	25%	59%	C
Respiratory protection – masks?	80%	50%	80%	25%	59%	C
Are personal hygiene measures respected? (Hand washing before and after each activity)	95%	95%	95%	25%	78%	C
Is the waste collected in holders or containers equipped with yellow plastic bags?	60%	85%	60%	1%	52%	NC
Is there a special burial pit designed on site? (Cover waste with lime)	1%	1%	1%	1%	1%	NC
Choice of products generating less	1%	1%	1%	1%	1%	NC

waste, less packing?							
Are the personnel in charge of pre-collection informed of the risks involved in handling waste?	10%	1%	50%	5%	17%	NC	

C: compliant ; CN: Noncompliant

Laboratory services.

The following graphs present the rate of evaluation of the management of the WHAIR (Waste from health activities with infectious risks) at the central laboratory of the studied hospital. First of all, we note that the sorting of waste (31%) requires improvement of the control or monitoring step which must be reinforced. As to the elimination of the sharp waste, the collection represents only 29% and storage (23%), and in this case the collect and storage system need more appropriate means to improve the situation. As well as the rate of evaluation of activities related to infectious waste, we note that the collection and storage system must be maintained and reinforced by appropriate means. For the treatment, we note a value of 7%. Figure 1 presents the weakest point in the management which requires a thorough revision. With regard to anatomical waste, the means of collection (7%) and storage (4%) show poor control of the situation, and the treatment rate (21%) is still insufficient. To conclude, Figure 2 shows the evaluation rate of the elimination of the WHAIR by the category, and it is revealed that all the values are lower than 50%, which implies to put in place several points of improvement of the situation.

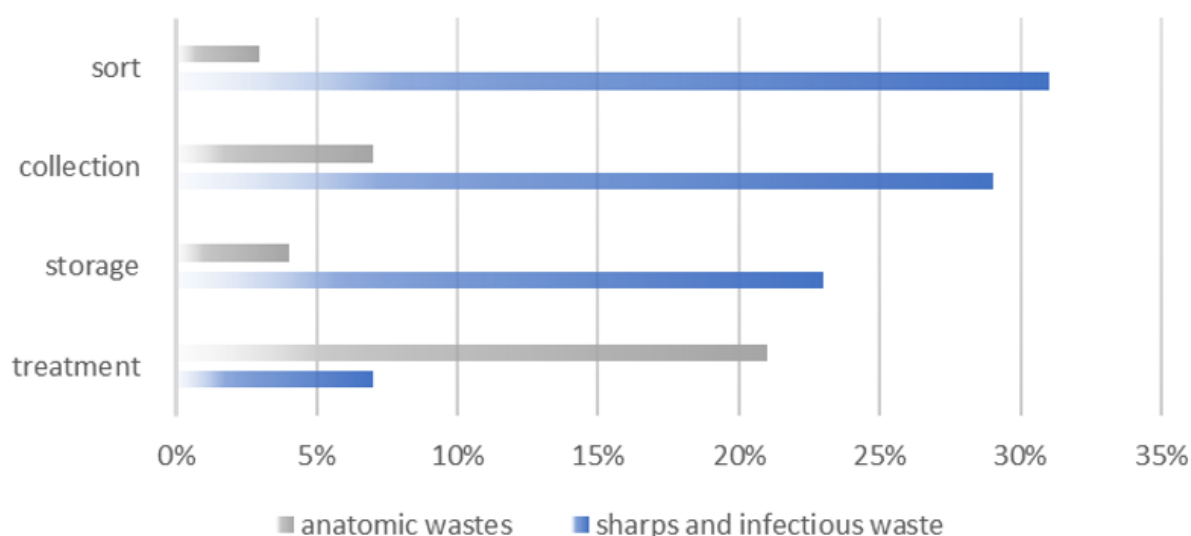


Figure 1. Evaluation rate of anatomic and sharps infectious wastes treatment

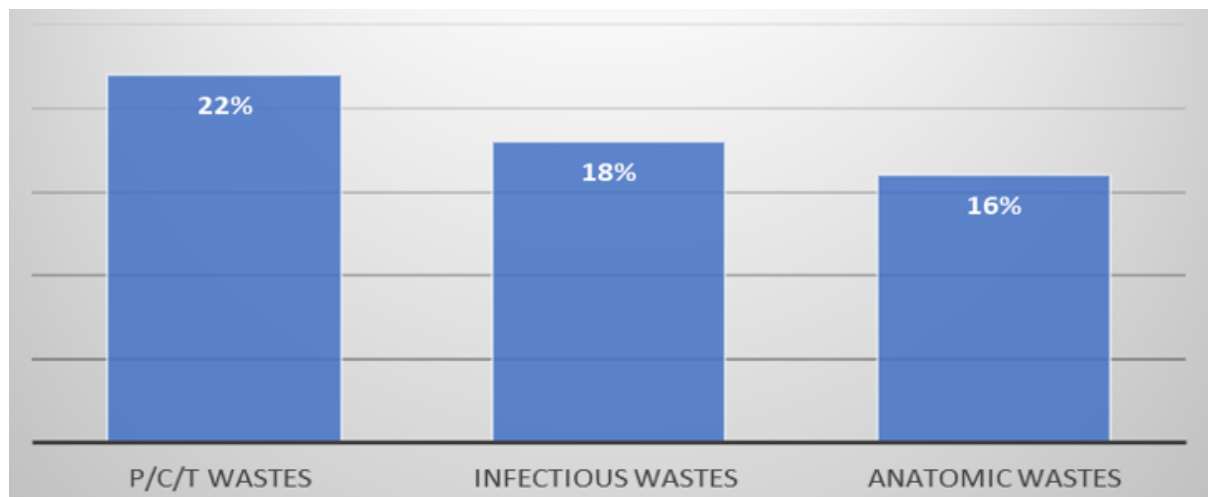


Figure 2. Evaluation of elimination rates of the WHAIR by category

The medico-surgical emergencies

In Figure 3, graphs present the rate of evaluation of the management of the WHAIR at the medico-surgical emergencies of the studied hospital. First of all, we note that the sorting of waste (17%) requires support and regular monitoring. For sharp and sharp waste, the collection system (29%) and storage (19%) must be filled by providing the necessary means. Considering the rate of evaluation of infectious waste, we note that the collection and storage system must be maintained and reinforced essentially by the awareness for instructions related to sorting, collection and storage. For the treatment we see a value of 5%; this very low figure presents the weakest point in the management which requires a thorough revision. Concerning anatomical waste, the means of collection (7%) and storage (7%) reveal poor control of the situation, and the treatment rate (39%) is still insufficient, also including an omnipresent deficit in the periodic control of the subcontractor whose ultimate objective is to improve the situation.

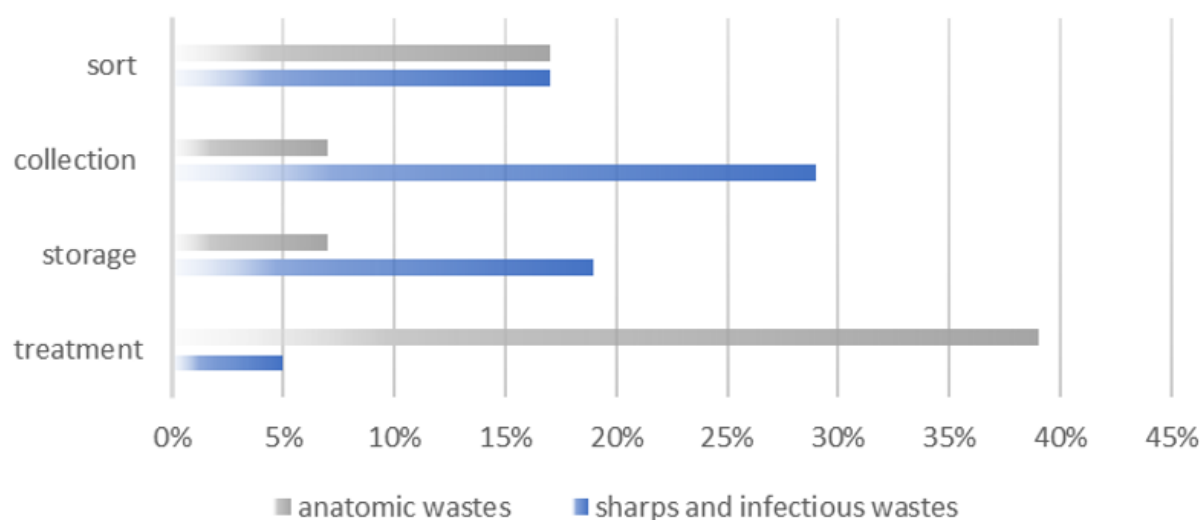


Figure 3. Evaluation rate of anatomic and sharps infectious wastes treatment from the medico-surgical services.

To conclude, Figure 4 shows the overall evaluation rate of the WHAIR management system is less than 50%, which implies putting in place several points to improve the situation. So, in general, we do not see a big difference between the two services, but there are some variations in certain stages of the waste disposal circuits.

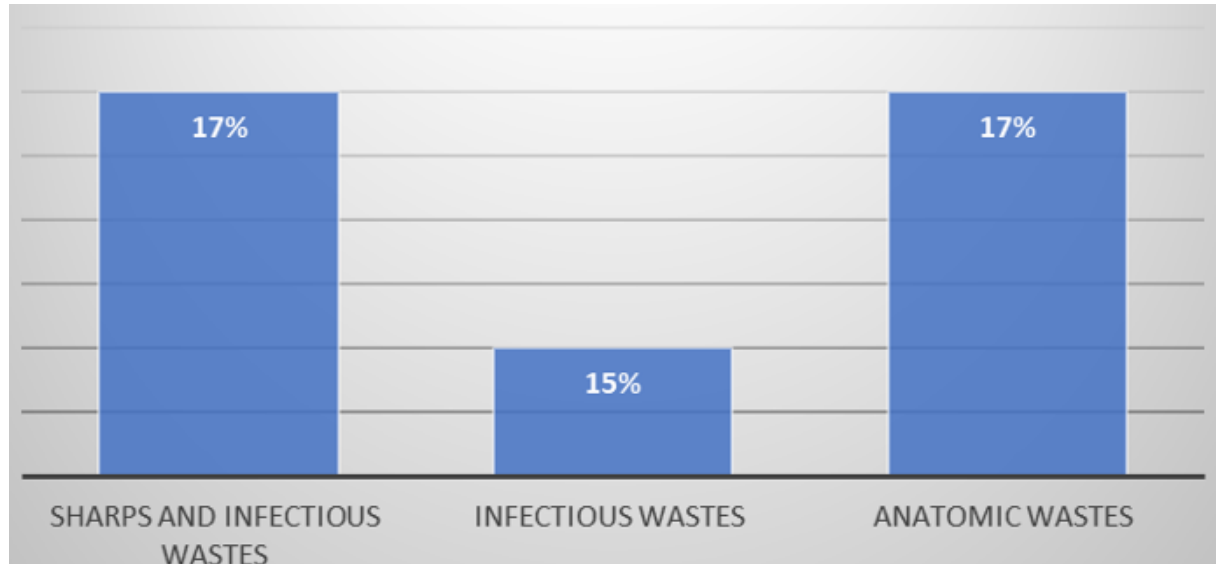


Figure 4. Evaluation of elimination rates of the WHAIR by category from the medico-surgical services.

Catering service:

Regarding the catering service, in Figure 5, we can note the inexistence of an efficient sorting of household waste apart from respecting the color code of the pre-collection bags (black) which are collected and transported in the same way as care waste and with the same means.

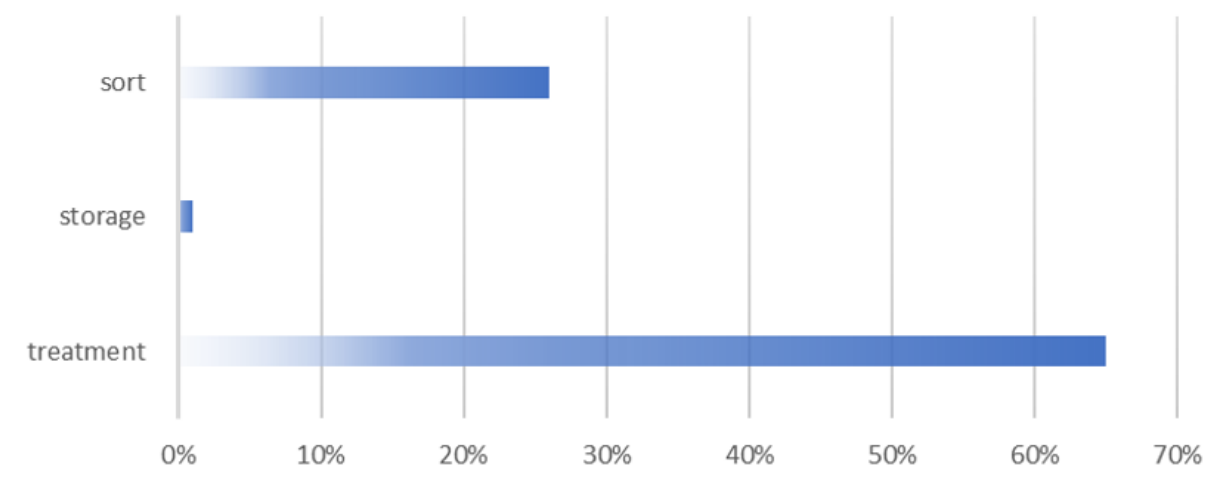


Figure 5. Evaluation of rates of the household wastes treatment.

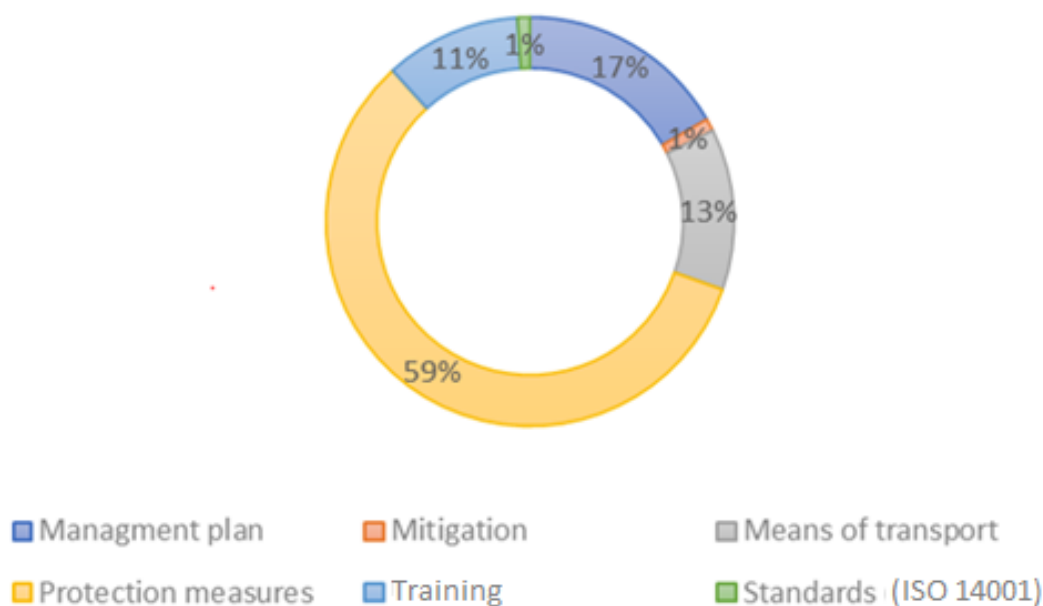


Figure 6. Overall waste management system rates

The graph in Figure 6 presents the overall percentages of the hospital waste management system at the studied hospital. According to these results, we note that only the availability of protective measures is higher than 50%, the development of a management plan (17%) requires planning and decisions to be set in place, the management of the means of transport with a value of (13%) reflects a need for financing and maintenance, and we note that the direction of the hospital must make more effort and provide support in terms of staff training (11%). Finally, we note that the management of waste and the protection of the environment at the hospital need more improvement to be in compliance with ISO 14001 environmental management system standard.

4. Discussion

In our study, we focused on the hospital of Tlemcen as a sample for diagnosis to evaluate the situation vis-à-vis the hospital waste management. Our results demonstrate positive points and negative points related to the waste management.

Firstly, in general, concerning the observed services, our diagnosis showed a weakness related to the sorting of waste; this needs to be more controlled because there is a lack of guidance on sorting and appropriate color codes for waste collection bags as required by the Algerian regulation (J.O n°35; n°77 and 78). Secondly, waste collection is itself influenced by sorting at the base; we have noticed that the collection does not follow the sorting chain because the bags of waste, in general, are mixed arbitrarily. The pre-storage place is not well equipped to satisfy the primary objective of waste treatment, so it is susceptible to the risks of contamination. Regarding household waste, we noted a deficit of sorting household waste. For example, the

waste is mixed (paper and boxes, food, bottle, etc.), only fragile bags are used which risks leaking, liquid discharges are retained with the solid waste in the bags, and sometimes boxes are used to accumulate waste. The pre-storage is close to the service where there is a risk of contamination, the rest of the food is mixed with the waste (plastics, glasses, etc.), and the place of pre-storage is accessible to any surrounding animals (cats, rats, etc.). Concerning the positive points, the situation from the past is improving, and those responsible try to find many solutions to improve the situation by engaging all inside the workplace to respect the minimum conditions to prevent risks, accidents and hazards related to the hospital waste (Larabi, 2015). To reduce the impact of the wrongful disposal and handling of the waste on the environment, several actions and improvements are highly required such as developing an awareness program for personnel involved in waste-generating activities and displaying posters in the work premises to raise awareness of the importance of sorting waste throughout the disposal chain and the risks associated with improper waste disposal. Concerning the management, it is recommended to take inspiration from the rules of standard ISO 14001 and make specific objectives to reduce hazards and negative impact on our environment and ensure periodic monitoring and controls to correct anomalies and achieve the objectives related to the protection of the environment. After that, all the non-compliances should be resolved by developing periodic reports of the situation, which will be reviewed and validated and improve the environmental management system by the leadership and the management as well as insure updating, developing and reviewing the documentation of the waste management and disposal system (drafting of procedures, energy, operating mode, etc.).

5. Conclusion

Hospital waste management involves many actions from all the staff in the workplace. Several countries struggle to maintain a clean system without risks and hazards generated by hospital waste. The big challenge is to be in compliance with rules referring to the international standards and the local regulation. Our study focused on the hospital of Tlemcen as a sample for diagnosis to evaluate the situation regarding the hospital waste management. Our results demonstrate positive points and negative points related to the waste management. The obtained results have shown that the evaluation rate of the waste management in compliance with our questionnaire at the central laboratory is about 21%, at the medical-surgical emergencies about 16%, then for the catering service estimated to 29%. That leads us to conclude that despite the deployed efforts by the hospital, the waste management systems should be reviewed according to the adopted managerial standards and regulations.

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