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Evaluation of Hospital Waste Management and Its Categorization in Valiasr Hospital, Mamasani Nurabad City, Fars

Zahra Elhamiyan,[1] Abooalfazl Azhdarpoor,[1,*] and Zakiyyeh Mousavi[2]

[1]Department of Environmental Health Engineering, Shiraz University of Medical Sciences, Shiraz, IR Iran
[2]Department of Health Education, Shiraz University of Medical Sciences, Shiraz, IR Iran

[*]*Corresponding author*: Abooalfazl Azhdarpoor, Department of Environmental Health Engineering, Shiraz University of Medical Sciences, Shiraz, IR Iran. Tel: +98-7117251001, Fax: +98-7117260225, E-mail: azhdarpoor@sums.ac.ir

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Abstract

The evaluation of both qualitative and quantitative factors regarding biomedical waste can help remedy the shortcomings of the current hospital waste management (HWM) system. The present study used a questionnaire and a weighing operation to investigate the perceived quality of HWM and the quantity of biomedical waste in Valiasr hospital, Nurabad district, Mamasani county, Iran, from July to September 2013. For 21 days, at the end of each shift, all hospital waste was weighed using scales. In addition, a 21-item questionnaire concerning perceptions of the quality of waste division, collection, storage, and transportation was administered to 40 hospital employees. The results of the weighing operation revealed that the hospital generated 417.99 kg of waste per bed per day (kg/bed-day). Considering that there are 96 beds actively used in the hospital, the average kg/bed-day of waste generated was 2.32 kg/bed-day of infectious waste, 0.03 kg/bed-day of sharps, and 2 kg/bed-day of household waste. The highest amount of infectious waste was generated in the emergency unit and the second highest in the operating rooms. In addition, analysis of questionnaire responses showed that most participants classified HWM activities as good, including waste division (65%), collection and transport to temporary waste storage (77.5%), and transport to the disposal zone (80%). Improper division of wastes by employees and visitors increased the volume of waste identified as infectious by mistakenly adding non-infectious waste to the bags of infectious waste. To reduce the volume of waste identified as infectious, division of wastes must be properly implemented and scrupulously maintained.

Keywords: Hospital Waste Management, Infectious Waste, Household, Sharps

1. Introduction

One requirement for human social development is the provision of healthcare centers and the enhancement of related services (1), the purposes of which are to provide healthcare, decrease health-related problems, eradicate potential hazards that threaten human life, and dispose of wastes that endanger human health (2). Wastes generated in hospitals and other healthcare centers are considered to be highly transmissible sources of infection due to their pathogen content. In addition to increasing the probability of multiple infections, these wastes pose many environmental hazards. A qualitative and quantitative evaluation of its management of infectious wastes can help a hospital propose, plan, and manage effective programs to divide, collect, store, and transport such wastes (3).

In the past few decades, the volume of various wastes, especially those in hospitals, have increased considerably worldwide (4). A major source of hospital waste is disposable surgical tools, including gowns, surgical drapes, gloves, sponges, and towels (5). Failure in one or more of the activities of hospital waste management (HWM), which includes dividing, transporting, and disposing of waste, can lead to widespread disease and even epidemics. Such events can expose society to various hazards and can incur huge cost burdens (6, 7). The world health organization (WHO) defines medical waste as follows: waste generated by healthcare activities, including a broad range of materials, from used needles and syringes to soiled dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices, and radioactive materials.

According to WHO reports, infectious and hazardous waste, which is a broad group, accounts for 10 [U+2012] 25% of all hospital waste. According to other research, developing countries generate the greatest amounts of problematic waste (8). Medical wastes contain various types of chemical compounds, including radioactive, pharmacological, infectious, and biological. In addition, medical wastes can transmit serious diseases, such as HIV and hepatitis, to hospital personnel. Given these facts, hospitals must recognize the critical importance of their waste-management systems (9).

Considering the serious hazards posed my medical

wastes, investigating HWM patterns is a priority for healthcare systems (9). The key to efficient HWM is to recognize both the qualitative and quantitative aspects of collecting, dividing, and recycling hospital wastes (10). The present study assessed both the quantity of hospital waste and the quality of the waste-management system in Valiasr hospital, Nurabad district, Mamasani country, Iran.

2. Materials and Methods

2.1. Data Collection/Analysis

This study investigated HWM in Valiasr hospital from July to September 2013. First, to investigate the processes of division, collection, and storage of wastes, interviews were conducted with staff in the waste-management unit and with the hospital management. Next, a weighing operation was conducted. All hospital units were included, and staff were provided the necessary training in collecting, dividing, packing, and so on. Yellow bags for collecting infectious waste and black bags for household waste were placed in each hospital unit. Each bag was labeled with the unit name and shift time.

Because the wastes generated differ from unit to unit and the wastes generated within units differ from day to day, the weighing operation was conducted for one week each month during the study period to increase the validity of the data obtained. After the end of the third weighing period, an average for each type of waste in each unit was calculated.

In addition, 40 hospital employees were administered a 21-item questionnaire asking about the quality of procedures used for waste collection, division, and transportation. Of the 40 respondents, 5% had diplomas, 50% cycle, and 45% were illiterate.

2.2. Sampling Method

Both observation and questionnaires were used to collect the study data. Employees in Nurabad Valiasr hospital work in two shifts: 7 AM to 6 PM and 6 PM to 7 AM. During each shift, the personnel in each unit carry infectious and household wastes to temporary storage. For 21 days during the study period, at the end of each shift, these wastes were weighed using scales.

Questionnaire responses were used to score participants' perceptions of each waste-management activity involved as good, average, or poor. The scores were arranged on an ordinal scale with three values: good (higher than 75%), average (51 - 75%), and poor (0 - 50%). This scale was then used to measure the HWM performance of each unit. The data were then statistically described and analyzed using Statistical Package for the Social Sciences (SPSS) v. 19.

3. Results and Discussion

Table 1 shows that 2.32 kg of infectious waste was generated per hospital bed per day (kg/bed-day). The greatest amount of infectious waste came from the emergency department, the operating rooms, and the dialysis unit, which generated 40.10 kg/bed-day, 27.86 kg/bed-day, and 24.43 kg/bed-day, respectively. These three departments also generated 0.41 kg/bed-day, 0.29 kg/bed-day, and 0.25 kg/bed-day, respectively. The least amount of waste was generated by the laundry and neonatal units, which generated 0.035 kg/bed-day and 0.06 kg/bed-day, respectively.

Table 1. Means and Standard Deviation of Types of Infectious Wastes Generated by Various Hospital Units[a,b]

	Mean ± SD, kg	Total
CCU	6.57 ± 1.28	138
Laundry	3.34 ± 0.75	72
Emergency	40.10 ± 10.44	842
Dialysis	24.43 ± 5.77	513
General surgery	16.71 ± 2.42	351
Paraclinic	7.14 ± 0.88	150
Pediatrics unit	17.07 ± 2.37	359
Unit	7.48 ± 1.45	157
Internal medicine unit	15.26 ± 2.01	321
Maternity unit	17.88 ± 1.69	376
Neonatal unit	5.76 ± 1.11	121
Gynecology	23.67 ± 3.42	497
Laboratory	9.50 ± 1.32	200
Operating rooms	27.86 ± 5.93	585
Total	222.86	4482

[a] Mean of wastes kg/bed-day (96 beds × kg) is 2.32.
[b] N = 21.

These data can be compared with the findings of Monavari et al. (3), whose study found that in hospitals in Iran, the greatest amount infectious waste was generated by the surgery and emergency units, which generated 2 kg/bed-day and 1.8 kg/bed-day, respectively. Their study also found that the least amount of infectious waste, 0.25 kg/bed-day, was generated by the pediatrics unit.

According to Table 2, in the present study, the greatest amount of household waste, 0.26 kg/bed-day, was generated by the pediatrics unit. In addition, according to Table 3, the greatest amount of sharps waste, 0.01 kg/bed-day, was generated by the dialysis unit. In contrast, Monavari et al. (3) found that the greatest amount of household waste was generated by the gynecology and pediatrics units, 3 kg/bed-day and 2.5 kg/bed-day, respectively.

The average amounts of infectious, household, and sharps wastes generated by Valiasr hospital were 222.86 kg/bed-day, 192.16 kg/bed-day, and 2.97 kg/bed-day, respectively, and the total amount of waste generated was 417.993 kg/bed-day. The averages waste amounts for infectious, non-infectious, and sharps were 2.32 kg/bed-day, 2 kg/bed-day, and 0.0309 kg/bed-day, which were comparable to the findings of Bazrafshan et al. (2009) in Sistan and Baluchestan province, in Iran (9).

Table 2. Comparing the Means and Standard Deviation of Household Wastes Generated in Different Hospital Units[a,b]

	Mean ± SD, kg	Total
Storeroom	3.88 ± 0.7	81.5
Administration	5.52 ± 1.3	116
Kitchen	21.3 ± 3.1	447
Hospital area	15.2 ± 1.57	319
Installations	4 ± 0.9	84
CCU	3.54 ± 0.8	74.5
Laundry	7.19 ± 0.9	151
Dialysis	11.47 ± 1.47	241
General surgery	6.69 ± 1.45	140
Emergency	21.9 ± 3.3	460.5
Paraclinic	3.57 ± 0.9	74
Culis	4.5 ± 1.4	96
Pediatrics unit	25.3 ± 2.1	532
Internal medicine unit	16.7 ± 2.4	351
Maternity unit	6.6 ± 1.62	140
Neonatal unit	7.64 ± 1.29	160
Gynecology	12.28 ± 1.82	258
Laboratory	3.7 ± 0.7	78
Operation room	10.9 ± 0.8	229
Total	192.16	

[a] Mean of wastes Kg/bed-day (96 beds × kg) is 2.32.
[b] N = 21.

The present study found that the percentages of wastes differed from those in other cities, which may be due to various factors, including to the types of services provided by the hospitals, cultural and economic factors, the number of actively used beds, the type of HWM, and so on. Diaz et al. (11) showed that the wastes generated in selected hospitals in developing countries ranged from 0.16 [U+2012] 3.23 kg/bed-day. The percentage of infectious waste in healthcare centers in developing countries is about 63%, and it ranges from 0.65 [U+2012] 0.01 kg/bed-day (11).

A study conducted by Jang et al. in Korea showed that

Table 3. Means and Standard Deviation of Sharps Waste Generated by Various Hospital Units[a,b]

	Mean ± SD, g	Total
Dialysis	292.52 ± 72.13	6143
General surgery	35.81 ± 8.95	752
Emergency	1024 ± 525.2	21520
Paraclinic	68.43 ± 17.8	1437
Laboratory	39.76 ± 2.2	835
Pediatrics unit	158.14 ± 20.2	3321
Neonatal unit	16.38 ± 3.65	344
Gynecology	97.14 ± 11.15	2040
Operating room	149.7 ± 37.24	3145
Maternity unit	933.9 ± 67.47	19613
CCU	25.38 ± 2.8	533
Internal medicine unit	88.5 ± 12.2	1859
Total	2973.13	

[a] Mean of wastes kg/bed-day (96 beds × kg) is 0.03097.
[b] N = 21.

the average hospital generated waste ranging from 0.14 [U+2012] 0.49 kg/bed-day (12). In their study of HWM in Brazil, Mattoso et al. found that more than 50% of the waste generated was non-infectious (13). Habib et al. studied Iranian cities, including Bukan, Mahabad, and Saghez, and found that 61% of hospital wastes were the general type, 23% were infectious, and 16% were sharps (14).

Taghipour et al. studied hospitals in Tabriz, Iran, and found that 70.11% of wastes were the general type, 29.44% were infectious, and 0.45% were sharps (2). According to Figure 1, in the present study, the percentages of infectious, household, and sharps wastes were 54%, 45%, and 1%, respectively.

As Figure 1 illustrates, the percentage of infectious wastes found by the present study was higher than that in other studies. One reason for this difference is the management system governing the hospital's wastes, and another reason is the way hazardous wastes are separated from ordinary ones. However, lack of awareness of hygiene on the part of those visiting patients and their carelessness in disposing of ordinary wastes in yellow waste bags, which were for infectious wastes, also contributed to the volume of waste classified as infectious. Considering the diversity and volume of hospital wastes, especially hazardous infectious wastes, and the high cost of managing infectious wastes, it is vital to closely supervise how wastes are managed to safeguard the health of patients, staff, and society.

The components of various types of hospital waste di-

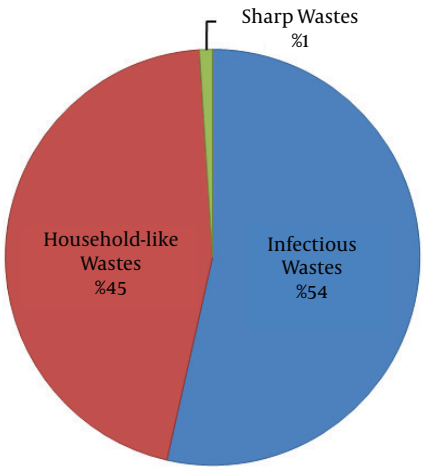

Figure 1. Percentages of Infectious, Household, and Sharps Wastes in Valiasr Hospital

rectly affect the collection and recycling operations. By promoting hygiene awareness, the recycling process can be efficient from the beginning. The placement of temporary storage and waste containers directly affects hospital hygiene and should be chosen according to hygienic principles.

In Valiasr hospital, all ordinary wastes were collected by sanitation workers and transported to the disposal zone. After being decontaminated in a Hydroclave, infectious wastes were also transported to the disposal zone. Two measures required to reduce hygienic, environmental, and cost-related problems are proper division of waste and supervision of the disposal process, both of which can benefit from increased awareness of HWM hygiene, which can be effected by employee education and training.

As previously mentioned, this study administered a 21-item questionnaire to identify perceptions regarding the quality of procedures for waste division, collection, storage, and transport. The questions were divided into three categories of seven questions each. Possible answers included good (higher than 75%), average (51 – 75 %), and poor (0 – 50%). Questions addressed maintenance of containers for sharps and their removal time, the color of bag used for each type of waste, collection times, the times when wastes were transported to temporary storage, hygienic aspects of temporary storage, and so on.

Table 4 shows the results obtained from the 40 questionnaires completed. For the procedures used to divide waste, 26 participants chose good, 13 chose average, and 1 chose poor. These responses were standardized as 65%, 32.5%, and 2.5%, respectively. For the procedures used to collect waste and transfer it to temporary storage, 31 participants chose good, 7 chose average, and 2 chose poor, and these responses were standardized as 77.5%, 17.5%, and 5%, respectively. Similarly, for procedures used to transport waste to the disposal zone, 32 participants chose good, 6 chose average, and 2 chose poor, and the responses were standardized as 80%, 15%, and 5%, respectively.

Table 4. Perceived Quality of Waste Division, Collection, Storage, and Transport Procedures

Stage	Frequency (%)
Division	
Poor	1 (2.5)
Average	13 (32.5)
Good	26 (65)
Total	40 (100)
Collection and transfer to temporary storage	
Poor	2 (5)
Average	7 (17.5)
Good	31 (77.5)
Total	40 (100)
Transport to disposal	
Poor	2 (5)
Average	6 (15)
Good	32 (80)
Total	40 (100)

Although 65% of respondents rated the process of dividing waste as good, the volume of infectious waste was too high. Reasons for this could include the HWM style, especially that regarding dividing hazardous waste from ordinary waste. During weighing, a significant amount of ordinary waste was observed to be included in bags for infectious waste. This is caused, at least in great part, by hospital visitors who are not conscientious about waste division disposing of ordinary waste in the bags designated for infectious waste and, thus, increasing the volume of waste labeled as infectious. This also potentially increases costs, as ordinary waste entering the Hydroclave system can damage it, necessitating repair or replacement. In addition, during weighing, infectious wastes were also observed in the bags for non-infectious waste, indicating a dangerous laxity in employees' division of waste that must be addressed by hospital training and policy.

4. Conclusions

The results of the present study show that in Valiasr hospital, infectious waste accounted for 54% of total waste. To reduce this volume of infectious waste, wastes must be divided correctly. One reason for the high volume of waste labeled as infectious is that hospital visitors are not conscientious about dividing different types of waste, thus increasing amount of non-infectious waste that is placed in the bags for infectious waste. This circumstance can be improved by enhancing general hygiene awareness with educational pamphlets in the hospital or face-to-face training. Such strategies can help address both the qualitative and quantitative aspects of managing hospital waste.

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Footnotes

Authors' Contribution: Abooalfazl Azhdarpoor developed the study's original idea and its protocol, abstracted and analyzed the data, wrote the manuscript, and is its guarantor; Zahra Elhamiyan and Zakiyyeh Mousavi contributed to developing the study protocol, abstracted the data, and prepared the manuscript.

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