



Original Article



Medical Waste Management in Private Hospitals in Tehran

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***Corresponding author:**Ali Hosseinzadeh,
Email: ali.hossein.zadeh@ut.ac.ir**Abstract****Background:** Solid waste management is one of the important aspects of the hospital management.**Methods:** In this study, we examined the quantity and composition of medical solid waste in eight private hospitals in Tehran. For this purpose, a checklist was used through interviews with hospital waste management staff as well as collecting information on hospital waste generation. The annual average of obtained data was analyzed in this study.**Results:** The results indicated that the private hospitals under study generated solid waste ranging from 24 to 1091 kg/day. The average medical waste generation in the studied private hospitals was 4 kg/bed/day equal to 5.09 kg/patient/day. Common waste accounted for 70.73% of total hospital solid waste, while infectious and sharp waste accounted for 31.04% of the hospital solid waste. Infectious wastes were disinfected using autoclave in all hospitals.**Conclusion:** Segregation of infectious waste from hospital waste mass reduces the environmental and health risk of hospital waste and reduces the cost of waste management in private hospitals.**Keywords:** Waste management, Hospital solid waste, Infectious waste, Chemical and pharmacy waste

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Introduction

The generation of medical waste in the world has increased in recent years.¹ This solid waste is generated due to health services in hospitals, clinics, medical laboratories, blood centers, etc.² One of the medical waste is infectious waste, which is contaminated with pathogenic agents.³ Private hospitals are of the most important sources of medical waste.⁴

Some factors such as the number of beds and the type of hospital affect the generation of medical solid waste.⁵ In some studies, conducted in Iran, the generation of medical waste has on average been reported between 3 to 4 kg/bed/day.⁶ However, in different hospitals, the waste generation may be more than 6 kg/bed/day.⁷ In general, solid waste in hospitals includes common waste, infectious waste, sharp waste, chemical and pharmacy wastes.⁸ Taking into account that hospital wastes can be categorized into two groups: hazardous and non-hazardous, it is estimated that 20% of medical wastes fall into the hazardous waste category.¹ Proper management of medical waste is effective in reducing its health and environmental consequences. For example, accurate segregation of the types of generated waste in hospitals will reduce the proportion of infectious

waste as well as their costs.⁶ The choice of disinfection method is also effective in emitting secondary pollutants and reducing the risk of infection transmission.⁹

Given the significant impact of effective solid waste management in hospitals on public health and environmental protection,⁹ the objective of this study was to assess the management processes of medical waste in private hospitals in Tehran, encompassing waste generation, segregation, storage, disinfection, and disposal.

Materials and Methods

In this descriptive study, the quantity and composition of medical waste in 8 private hospitals in Tehran were investigated. The studied hospitals were named from 1 to 8. A checklist was used for data collection (Table 1). This checklist was completed by waste management staff through interview in the hospitals as well as the data reported in the hospitals. The study categorized hospital wastes into four groups: general wastes, infectious wastes, sharp wastes, and chemical and pharmaceutical wastes.⁶ Figure 1 illustrates examples of the types of waste studied.



Results and Discussion

The results of this study showed that the average generation of medical waste in private hospitals was 3.62 kg/bed/day. The range of solid waste generation in the studied private hospitals was 24 to 1091 kg/day (Table 2). The results also showed that the generation of solid waste in private hospitals was 0.4 to 8.8 kg/bed/day. In previous studies in Iranian hospitals, the generation of medical waste was reported to be less than 2 kg/bed/day or more than 6 kg/bed/day.⁷ Some studies have also revealed that the average of medical waste generation in Iranian hospitals was 3.5 kg/bed/day, which was consistent with the results of this study.^{9,10}

As shown in Figure 2, the average generation of medical waste in the private hospitals was 5.03 kg/patient/day while in some Iranian hospitals it has been reported up to 10 kg/patient/day.¹¹ These values are higher than other medical waste generation centers such as laboratories because in other studies, the rate of medical waste

generation in medical laboratories was ranged from 0.5 to 0.6 kg/patient/day.¹² When comparing the results of this study with those of other studies, it becomes evident that waste generation in the studied private hospitals falls within the average range of hospital waste generation in the country. However, it is important to note that factors such as the type of hospital and the number of occupied beds can significantly affect waste generation in different healthcare facilities.⁶

The results showed that 56.3% to 91.6% of the solid waste in the studied private hospitals was common waste, which was the largest share in the hospital waste mass. After common waste, the largest share in the hospital waste mass was related to infectious waste, which was 4.1% to 43.2% of the total hospital solid waste. On the other hand, chemical and pharmacy wastes accounted for 0.5% to 4.1% of the studied medical wastes (Figure 3). The average share of different types of medical waste in studied private hospitals is shown in Figure 4. The chemical and

Table 1. The Checklist Used in This Study

Hospital	Bed (number)	Occupied Bed (%)	Common Waste (kg/day)	Infectious and Sharp Waste (kg/day)	Chemical and Pharmacy Waste (kg/day)	Total Waste (kg/day)
1						
2						

Table 2. Solid Waste Generation in Studied Privative Hospitals

Hospital	Bed (number)	Occupied Bed (%)	Common Waste (kg/day)	Infectious and Sharp Waste (kg/day)	Chemical and Pharmacy Waste (kg/day)	Total Waste (kg/day)
1	76	98	150	115	1	266
2	180	74	350	230	6.5	586.5
3	244	87	800	305	4	1009
4	50	64	80	50	1	131
5	124	62	800	283	8	1091
6	60	85	22	1	1	24
7	115	98	160	60	1.5	221.5
8	180	64	550	234	4	788

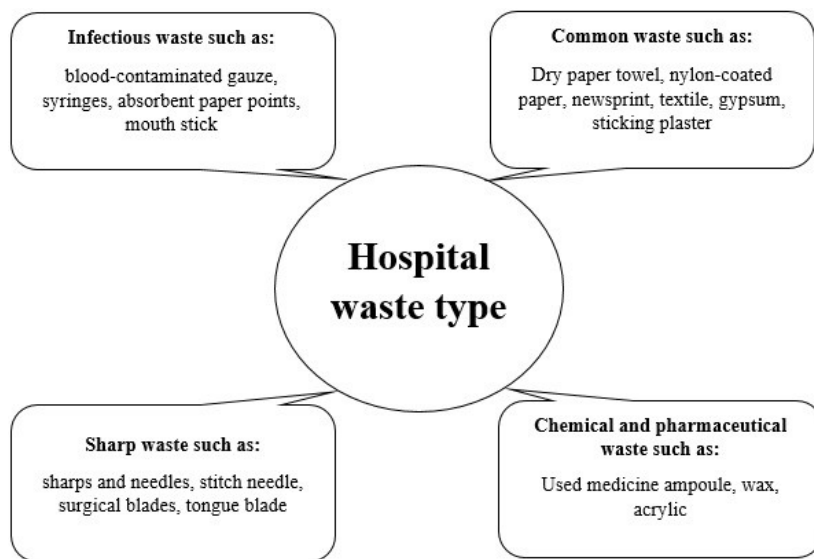


Figure 1. Type of Studied Wastes

pharmaceutical wastes were 0.65%, infectious and sharp wastes were 31.03%, and common wastes were 70.73% of the medical waste in private hospitals. Comparison of the results of this study with the average proportion of infectious waste in medical waste of Iran shows that in private hospitals the proportion of infectious waste was corresponds to the national average that was about 37% to 44%.⁶ However, it is worth noting that the proportion of infectious and sharp wastes can vary between different hospitals, as observed in this study. In other studies, for instance, the proportion of infectious and sharp wastes in two public hospitals in Tehran was reported as 21% and 24%,^{13,14} while in Shiraz, this proportion was reported as 48%.¹⁵ Therefore, the average proportion of infectious waste in different hospitals may be different. Another study also showed that the average proportion of infectious and sharp waste in the hospitals in 13 provinces was 37%.⁷

The key observation here is that there is a significantly

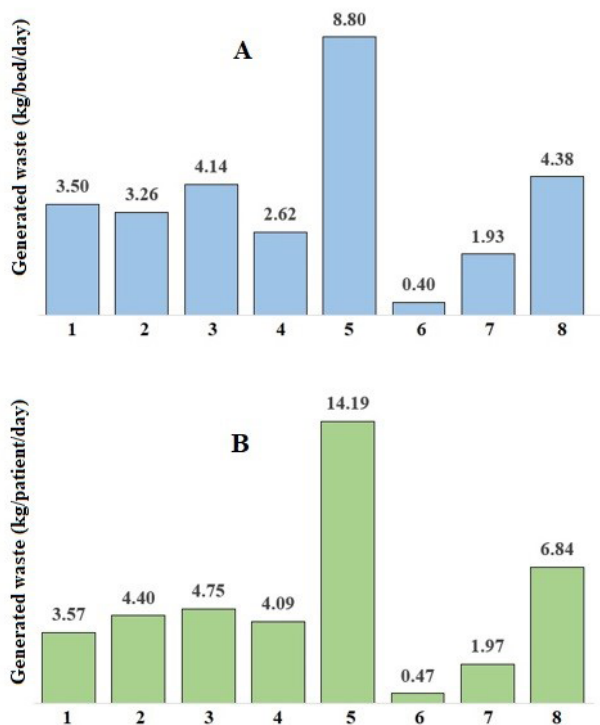


Figure 2. Average Medical Waste Generation in Studied Privative Hospitals

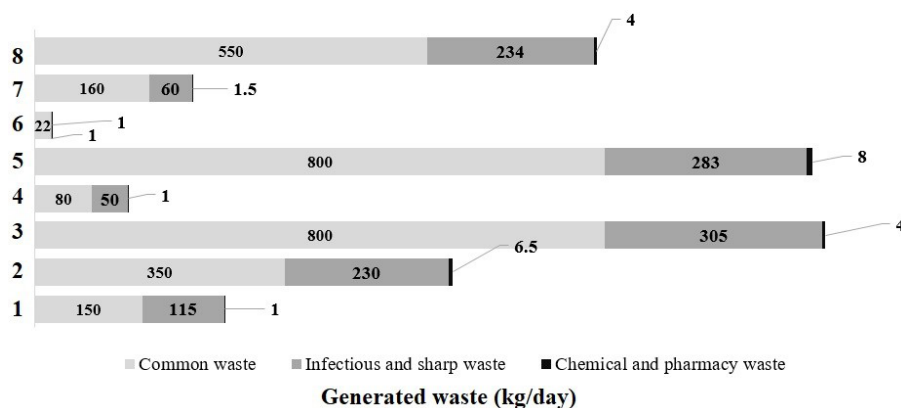


Figure 3. Composition of Studied Hospital Wastes

higher proportion of infectious waste in Iranian medical waste compared to sharp waste. In other studies, the proportion of sharp waste has been reported to range from 1 to 5 percent.¹⁵⁻¹⁷ As demonstrated by the results of this study, common wastes constitute the largest proportion within the total medical waste in Iran (Figure 4). In previous research, the proportion of common medical waste has been reported to exceed 50%, with a range spanning from 49% to 72%.¹²⁻¹⁶ One of the critical factors influencing the proportion of infectious waste is the degree of waste segregation within hospitals.⁶ Hospitals with higher rates of waste segregation tend to have a lower proportion of infectious waste within their overall medical waste. Similar findings have been reported in studies conducted in Iranian hospitals. For example, one study attributed a 13% reduction in infectious waste within the medical waste stream to improved waste segregation and proper storage practices.⁵

The results observed in this study can be compared with studies conducted in other countries. For example, 465 000 tons of biological waste are generated annually in the United States.⁵ Hospital waste generation in the United States and some European countries seem to be 0.25–7.0 kg/bed/day. This rate is consistent with our study’s findings, suggesting that the generation of medical waste will likely fall within the same range as observed in many developed countries. For example, the production of medical waste in 12 developed countries was about 0.4–5.5 kg/patient/day. On the other hand, in some countries such as Japan, Turkey, Canada, India, Thailand and Bangladesh the generation of hospital waste is estimated between 0.11–3.9 kg/bed/day.⁹ However, the generation of medical and infectious waste in private hospitals may be less than in public hospitals. Also, the generation of medical waste in hospitals may be different from other health centers. In Taiwan, for example, the generation of infectious wastes in blood centers has been reported to be different from that of laboratories as well as private centers.⁶

Given that the on-site disinfection method has been proposed as a suitable method for hospital waste,⁹ it was important to pay attention to this issue in the private hospitals. The private hospitals studied were equipped with autoclaves for disinfecting infectious waste. This

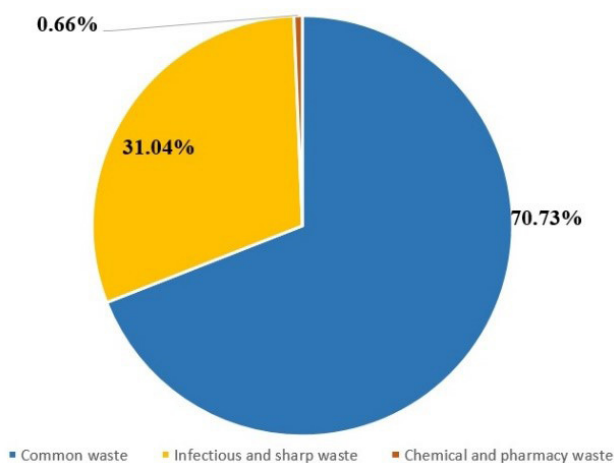


Figure 4. Average Proportion of Waste Types in Studied Privative Hospitals (%)

method and other methods such as incinerator, steam sterilization, autoclave, chemical, and microwave are the most important methods of disinfection of infectious waste in the world.⁸ In the United States, more than half of infectious wastes are managed by incineration, and autoclave is the second most common disinfection method.¹ In South Korea, about half of the infectious waste is disinfected using steam sterilization.¹⁷ In Japan, 82% of hospital waste is disposed using incinerators.¹⁸ In Iran, due to the environmental consequences of waste incineration, other methods such as autoclave⁹ are considered, which was also observed in the studied private hospitals.

Conclusion

Medical waste management was studied in 8 private hospitals. The average generation of hospital waste was estimated as 3.62 kg/bed/day which was equivalent to 5.03 kg/patient/day. Although the generation of medical waste in the studied private hospitals was consistent with other reports in Iran, but the proportion of infectious and common waste was different. In this study, the proportion of common wastes, infectious and sharp wastes and chemical and pharmacy wastes were 70.73%, 31.03%, and 0.65%, respectively. One of the ways to better manage hospital waste in the hospitals is to increase waste segregation which reduces the costs.

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Writing—review & editing: Ali Hosseinzadeh, Mir Amir Mohammad Reshadi, Morteza Nazaripour, Masomeh Rezaei.

Competing Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

There were no ethical considerations to be considered in this research.

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