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## SURVEY ON THE QUANTITY OF HAZARDOUS WASTES GENERATED IN ISFAHAN MEDICAL CENTERS, IRAN

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### Abstract

Development and expansion of health centers have increased infectious wastes production. This study aims at investigating the quantity of hazardous wastes generated in Isfahan medical centers. For this purpose, 377 available centers for producing hazardous wastes were selected and evaluated according to Cochran's sample size calculation formula by simple random sampling from statistical population of Isfahan in spring and summer consecutive seasons (in 2015). For more information about how to deal and eliminate hazardous wastes in aforementioned medical centers, Knowledge and Attitude questionnaire approved by Ehrampoush study was used. Results showed that the total amount of hazardous wastes produced in Isfahan Medical centers is around 2282.96 kg and the volume is 24044 liters per day. Among them dental clinics with 721.6 kg and the volume of 8226.24 liters per day are top of the table and urology centers with 0 kg of wastes contribute the least amount of waste production. Since dental centers produce more waste than other

centers. It is suggested to equip each dental clinic with a 50-liter autoclave and other health centers with a 20-liter autoclave. The results also showed that at least more than 50 percent of people in all centers have good knowledge of how to manage and eliminate hazardous wastes.

**Keywords:** Medical Centers, Solid Waste, Clinical Wastes, Hazardous Wastes, Isfahan

## **Introduction**

Rapid population growth and increasing health care needs of the communities have increasingly developed centers such as clinics, laboratories, injections, dressing centers, radiology and sonography centers, etc. day by day(1, 2). Doing high volume of health services by these centers has produced large amounts of hazardous wastes particularly infectious wastes(3). Due to numerous problems and other health hazards, hazardous wastes have been the topic of discussion in many scientific circles and have occupied executives' minds to manage, separate and for proper disposal(4). Some of environmental problems of treatment centers are the hazardous, toxic, pathogenic, radioactive, chemical, pharmaceutical and infectious agents (present in disposed wastes). Although the amount of hazardous wastes generated per patient is negligible in these centers, but taking into account the increasing number of patients and their referring, it should be said that all produced wastes is very sensible(5, 6). Industrial wastes in treatment centers can include many components. These components can be classified based on nature, potential hazards, production source and how to manage and other parameters(7, 8). Health care centers are scattered across the city and this makes managing them difficult and redoubles the importance of the issue. Distribution of medical centers and mismanagement of them will lead to mixture of household garbage with infectious wastes(9). And this changes all household garbage to hazardous wastes(10). In general, infectious wastes include all disposable materials and tissue and pathogenic wastes resulting from treatment sectors activity such as operating rooms, examination rooms, delivery room, emergency department, etc. Disposing and disinfecting these wastes are very different and complex and in some cases impossible (11). due to high pollution with conventional techniques of disposing household wastes and at least need to use costly and precise methods such as autoclave and burning, etc(12). Any policy-making and decision-making in relation to treatment wastes require recognition of the status quo in terms of quantity, quality, methods of storage, collection and disposal of solid waste treatment centers so that we can analyze the situation and make proposals to address the problem(13). In 2005, a study was carried out by Al-Omari and Al-Dwairi in relation to infection control in dental clinics in Jordan(14). In 1997, another study was done by Treasure in the field of disposing hazardous wastes in health clinics in New Zealand(15). In

2005, another study was carried out by Nazar et al in the field of waste management in dental clinics in Brazil(16). Given that determining the level and quantitative and qualitative characteristics of wastes are from basic steps effective in the proper management of disposing and disinfecting infectious wastes, this study aims at investigating quantitative characteristics of infectious wastes in treatment centers of Isfahan city.

## **Materials and Methods**

This study has been regularly carried out and presented in 2015 without any interfering in observations and wastes-recording data of medical centers of Isfahan. For this purpose, the required samples were prepared using Equation 1 from 377 out of 1600 available infectious waste producing centers of Isfahan (Iran) including offices, clinics, polyclinics, radiography centers, laboratories as well as rehabilitation, radiology and ultrasound centers by simple random sampling. According to the type of centers, they were divided into 12 groups. Then the required sample size in each group was prepared by stratified sampling (simple random sampling and drawing lots). When preparing samples, the necessary training was given to all staff on how to collect infectious wastes. Also for observing safety and health principles of staff in accordance with the guidelines of maintaining and collecting hazardous wastes, all wastes of the above centers were considered as infectious wastes. The wastes were separated, weighed and recorded in the spring and summer in terms of working conditions of medical centers under study each for 2 days. To carry out sampling, labels containing the profile of section name, wastes type, collection date and working shift and yellow garbage bags (to collect infectious wastes) and black garbage bags (for collecting non-infectious wastes) were prepared and delivered to different parts of the data center. In the next step, the samples were collected by corresponding service forces from aforementioned centers in afternoon, evening and night shifts and were transferred to places of temporary storage of medical wastes. All household wastes, infectious wastes, sharp cutting instruments, chemical-pharmaceutical and pathological substances were separately weighed by scales. Mettler Toledo ICS689 digital Scale was used for weighing wastes. In order to understand how to manage medical wastes within considered hospitals, a questionnaire method approved by the Ehrampoush and Baghiani Moghadam was applied(17). By visiting the centers in person, the questions were asked from the concerned officials and reported after analyzing and recording the results.

## **Results and Discussion**

Generated solid wastes are shown in Isfahan medical centers in Table (1). Accordingly, the amount of generated wastes per capita was achieved as 6 kg per center. In all centers, ordinary rubbish bin or bag were used for collecting affairs.

About 40% of the centers that have been dealing with injections have used needle cutter or special containers for isolating needle. Questionnaire results indicated that all doctors and nurse-aids had appropriate knowledge to the dangers of infectious wastes, 80% of doctors, 70% of nurse-aids and 50% of clerks and service workers knew the correct method of disposing infectious wastes. 90% of the centers delivered their collected rubbish once every two days, 5% of them every three days and 5% of them once a week. The containers for collecting and maintaining wastes of offices and medical centers were completely consistent with capacity and volume of generated wastes(18). The infectious wastes in 90% of offices in Isfahan city are collected and transported by machines for handling infectious wastes. In all centers, the wastes are transported in bins with distinct color but none of the centers disinfected or autoclaved their wastes. The maximum weight and volume of wastes is related to Dental Group with 721.6 kg and 8226.24 liters per day and at the next stage, to the Injections, Dressing and Circumcision Groups with 589.6 kg and the volume of 7650 liters per day. The lowest amount of hazardous wastes was related to Urology, Pathology and Gastroenterology Groups. According to Table (1), it is evident that the weight and volume of infectious wastes are also added in offices and centers that other services are provided in addition to examination. But hazardous wastes are not produced in the Centers of Urology because patients are simply examined and undergo surgery in hospital (if needed). The weight and volume of the infectious wastes in aforementioned centers are 2282.96 kg and 24044.35 liters respectively. The method of collecting wastes and disposing infectious wastes in Isfahan is rather desirable. It is proposed that an incinerator or hydroclave to be centrally established in waste disposal site of Isfahan in order to burn all flammable hazardous wastes. Since dental centers produce more hazardous wastes than other centers, in other studies have also been reported, it is suggested that continuing education towards reducing and separating wastes to be carried out staff according to related criteria(19, 20). It is also recommended to equip centers to an autoclave proportional to the amount of produced waste. It should be mentioned that waste incineration plant and hydroclave can be constructed by private companies with government support and be afforded for waste incineration or hydroclaving them.

**Table-1. Characteristics of Hazardous wastes in medical centers of Isfahan in 2015.**

No	Clinic or health center	weight (kg)	volume (L)	Number
1	Dentistry	721.60	8226.24	58
2	Injections, dressings and circumcision	589.60	7650.00	50
3	medical laboratory	248.00	1959.20	23
4	Dentist	240.00	2496.00	30
5	doctor	135.20	676.00	78

6	Gynecologist	124.80	748.80	35
7	Specialty General Surgery	122.40	1285.20	15
8	Dermatology, pediatrics, ENT	56.80	681.60	37
9	Radiology and Sonographic	12.00	108.00	12
10	Ophthalmology, Cardiology, Orthopedics	9.60	48.00	17
11	Urology, pathology, gastroenterology	0.0	0.0	7
12	Psychological, Social medicine, physiotherapy and rehabilitation	22.96	165.31	16
total		2282.96	24044.35	377

## Conclusion

The results showed that the total amount of hazardous wastes produced in in Isfahan Medical centers is around 2282.96 kg and the volume is 24044 liters per day. Among them dental clinics with 721.6 kg and the volume of 8226.24 liters per day are top of the table and urology centers with 0 kg of wastes contribute the least amount of waste production. Since dental centers produce more waste than other centers. It is suggested to equip each dental clinic with a 50-liter autoclave and other health centers with a 20-liter autoclave. The results also showed that at least more than 50 percent of people in all centers have good knowledge of how to manage and eliminate hazardous wastes.

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