

original article

Health-care waste management status in Iran (case study of Gachsaran County, 2012–2013)

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ABSTRACT

Aims: The quantity, composition and physiochemical characteristics of wastes are important factors in selecting an appropriate treatment method. Having knowledge about the current status of medical wastes in any region is necessary for the establishment of effective medical waste management.

Martials and Methods: In this field study, official data obtained from the national statistical center were used. The statistical population for sampling and physical analysis includes two hospitals and five health-care centers, selected randomly, and WHO standard procedures were followed for wastes segregation.

Results: Based on data obtained, 1335 kg of medical wastes is daily generated in Gachsaran County of which 563 kg are infected and 772 kg are noninfected. A minor part of medical wastes are incinerated or delivered to the municipality untreated. However, the major part is hydroclaved. The largest medical center in the region is Shahid Rajaei Hospital located in Dogonbadan city and infected wastes from the whole region are sent to this center to be hydroclaved.

Conclusion: In conclusion, the quantity of infected wastes in the region is higher when compared to other cities in Iran. The high quantity of infected wastes may be a result of poor separation of infected and noninfected wastes by personnel due to lack of required knowledge.

Key words: Gachsaran County, health-care wastes, hydroclave, infected wastes, physical analysis

INTRODUCTION

Solid waste is one of the main polluting materials. Increasing population and consequently increase in waste materials have made worries on resources decrement.^[1] Health-care waste management is a significant public health and environmental problem, particularly in developing countries.^[2,3] Health-care waste contains infectious pathogens, toxic chemicals, heavy

metals, and may contain substances that are genotoxic or radioactive.^[3]

In many other developing countries, despite the presence of regulations and guidelines concerning medical waste

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management, the lack of implementation, and poor inspection by the Ministry of Health and Medical Education has led to improper hospital waste management in Iran.^[4]

Health-care waste contains potentially harmful microorganisms which can infect hospital patients, health-care workers, and the general public.^[5] When hazardous health-care wastes are not properly managed, exposure to them could lead to infections, infertility, genital deformities, hormonally triggered cancers, mutagenicity, dermatitis, asthma and neurological disorders in children; typhoid, cholera, hepatitis, AIDS, and other viral infections through sharps contaminated with blood.^[6]

Medical wastes are classified into infected and noninfected wastes. Noninfected wastes may be disposed like other municipal wastes. Infected wastes should be appropriately treated before disposal. Separation, collection, transportation, and disposal guidelines of medical wastes, all medical and health-care centers are responsible for treatment of their generated wastes through one or a combination of the following methods:^[7]

- Incineration
- Disinfection methods (autoclave, hydroclave, etc.)
- Sanitary landfilling.

The characteristics of hospital waste vary based on the social and economic conditions of patients, and it also varies during the week.^[8] Reviewing previous studies in Iran shows that despite the waste laws and its executive regulations, hospital waste management does not take place properly due to inadequate monitoring. Lack of separation of semi-domestic and hazardous waste, lack of necessary facilities for treatment of infectious waste, inadequate training of staff and lack of foresight personal protective equipment, are the main problems in the hospital waste management and show that the medical waste management is an important subject in Iran.^[9] Farzadkia *et al.* in their research on the investigation on hospital solid waste management in Iran, Found that The hospital waste management in Iran, had been evaluated poor in term of the collection, transportation and workforce aspects, moderate in the separation and temporary storage aspects and good in the disposal aspect.^[9] Futhermore, Oli *et al.*, in investigate of health-care waste management in selected government and private hospitals in Southeast Nigeria, found that the availability of material for waste segregation at point of generation, compliance of health-care workers to health-care waste management guidelines and the existence of infection control committee in both hospitals is generally low and unsatisfactory.^[5]

The aim of this study is to investigate of health-care waste management Status in Gachsaran country. It is noteworthy that the current study was conducted as a part of integrated waste management plan of Gachsaran County and in the years 2012–2013 have been carried out.

MATERIALS AND METHODS

Study area

Gachsaran County is a county in the south of Kohgiluyeh and Boyer-Ahmad Province in South West of Iran. Gachsaran County has one central district (Dogonbadan), two cities and four rural districts. The total area of the county is 3131 km² and at the 2011 census, the county's population was 119,217, in 30,339 families, of which 91,739 people live in the city, and 27,478 people are rural population.^[10] Major medical waste generation centers in the region include two hospitals, health-care centers, and private doctor's offices.

Data collection

In this field study, official data obtained from national statistical center of Iran were used. The statistical population for sampling and physical analysis includes two hospitals from two hospitals and five health-care centers from seven health centers, selected randomly. To obtain data about quantity of medical wastes generated, a questionnaire that was answered by experts of Gachsaran health-care department were used. The WHO standard procedures^[11] were followed for wastes segregation.

To obtain data about quantity of medical wastes generated, statistics from Gachsaran Health Department were used. However, four medical centers from six medical centers were randomly selected to check the accuracy of provided data, and no significant differences were observed. To calculate the average daily generation rate, data from 2012 to 2013 were used. Also for physical analysis, two hospitals, and five medical centers were randomly selected and their generated wastes were analyzed. For this purpose, 1 day in each month was selected to collect, weigh, and analyze medical wastes.

RESULTS

Based on available data, 1335 kg of medical wastes is daily generated in Gachsaran County of which 563 kg are infected and 772 kg are noninfected. Data about percentages of medical waste components and per capita rates are shown in Table 1.

The largest medical center in the region is 136-bed Shahid Rajaei Hospital. Infected and noninfected wastes are separated into different bins. Currently, a hydroclave system is used to treat infected wastes in the Shahid Rajaei Hospital. The hydroclave system is made in France purchased with a cost of 600,000,000,000 US\$ [Figure 1]. The nominal capacity of the system is 15 kg per hydroclave cycle. The temperature of each cycle is 138°C, and the duration is 40–45 min.

Used sharps such as used blades and needles are collected in safety boxes to reduce the risk of injuries for personnel

Table 1: Medical wastes generation data in Gachsaran County

Medical wastes		Infected wastes		Noninfected wastes	
Amount (kg/day)	Per capita rate (g/day)	Amount (kg/day)	Percentage	Amount (kg/day)	Percentage
1335	11.20	563	42.18	772	57.82

**Figure 1:** Hydroclave system in Shahid Rajaei Hospital and safety boxes

caused by needle stick. Then, the boxes are sent to temporary storage room to be delivered to municipality workers after treatment. To ensure disinfection efficiency in hydroclave system, spore tests are performed in a monthly basis. These tests contain *Bacillus stearotherophilus* which indicates the level IV of disinfection.^[12]

The treatment procedure in 83-bed Besat hospital is also the same, and infected wastes are hydroclaved before disposal. As shown in Table 2, need a revise, separation process is better performed in Besat hospital than Shahid Rajaei Hospital, so that of all medical wastes, 25% are infected wastes.

In all medical centers, medical wastes separation procedures are performed and in all units, yellow bins, and blue bins are allocated for infected and noninfected wastes [Figure 2].

In most cases, infected wastes from other medical centers are sent to Shahid Rajaei Hospital for treatment. In few cases, infected wastes are either uncontrollably incinerated or buried. Table 2 shows the status of medical wastes before landfilling.

After receiving medical wastes from medical centers, municipality transports the wastes to the landfill site located at a distance of 15 km from the city in the access road to the Chamshir Dam, on a daily basis. There, some unauthorized segregation processes for recovery purposes are performed by private contractors.

Before segregation, the disinfectant solution (0.5% sodium hypochlorite) was sprayed on wastes.^[13]

**Figure 2:** Yellow and blue bins for infected and noninfected wastes, respectively

To prevent potential risks during segregation, protective masks, boots, and long gloves were used. Segregated wastes were separately weighted (Kg). Figures 3 and 4 show the composition of noninfected and infected wastes, respectively.

DISCUSSION

A minor part of infected wastes are not disinfected before landfilling. Uncontrolled incineration of infected wastes is also a threat to public health in the region. Due to the presence of chlorinated compounds in medical wastes, toxic emissions such as dioxins and furans may occur in addition to greenhouse gasses such as CO₂. Medical waste generation per capita in the region is 43.3 g/day/person. It is noteworthy that the average medical waste generation rate in Iran is 17 g/day/person. Figure 5 compares the medical waste generation rate in the region with some major cities in Iran.^[14,15]

As shown in Figure 5, the whole medical waste generation rate in the region is in a favorable condition. However, infected medical waste generation rate is in a poor condition and accounts for 47.6% of total medical wastes generated in the region. The high quantity of infected wastes may be a result of poor separation of infected and noninfected wastes by personnel due to lack of required knowledge. This may be improved by holding training sessions for personnel in charge to reduce both treatment costs and environmental risks. To ensure disinfection efficiency in hydroclave system, monthly conducted spore tests may not be enough and daily tests such as time, steam, temperature (TST) tests may be required, so that if TST tests were alarming in two consecutive cycles, then early spore tests could be conducted.^[16] Finally, corrective measures could be performed on hydroclave system.

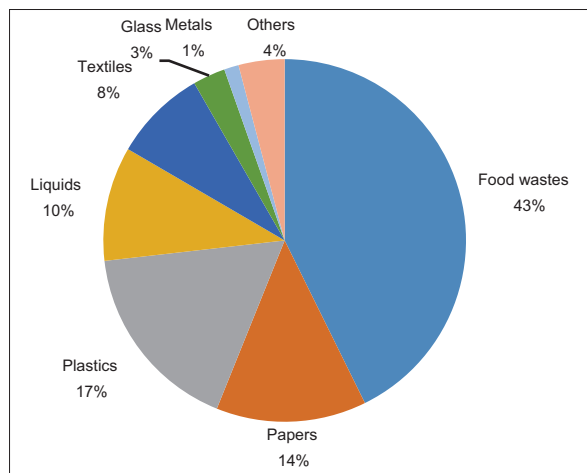


Figure 3: The composition of noninfected wastes in Gachsaran County

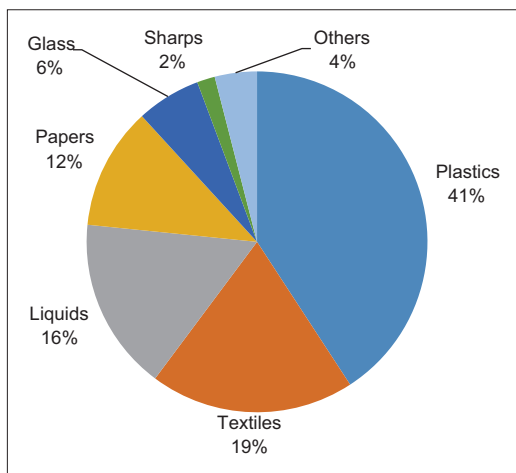


Figure 4: The composition of infected wastes in Gachsaran County

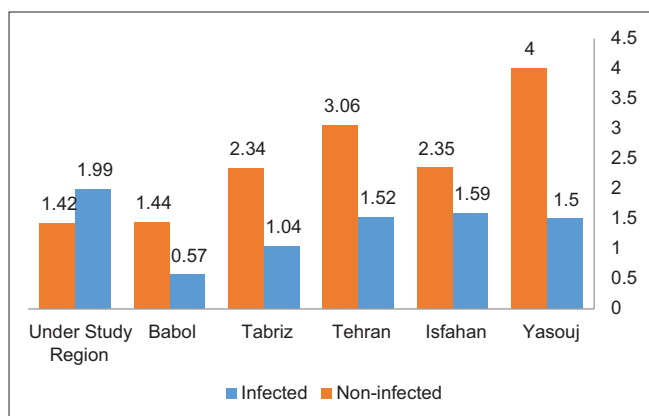


Figure 5: Medical waste generation rate in the region compared to major cities in Iran (kg/day/bed)

Recommendations

According to results obtained and considering the current situation of medical wastes management in Gachsaran County, following recommendations are made:

Table 2: The status of medical wastes in other medical centers before final disposal

Treatment method before landfilling	Uncontrolled incineration	Hydroclave	Delivery to municipality without treatment
The amount (kg)	3.0	81.9	6.7
Percentage	3.3	89.4	7.3

- Primarily, like any integrated waste management system, it is recommended to try to reduce the amount of waste generated using appropriate methods to reduce the wastes disposal costs
- A high percentage of infected wastes indicates the inappropriate waste segregation processes and the lack of knowledge among personnel in this respect. Thus, conducting training courses for personnel in charge is of great importance
- Workplace health policies must be implemented and epidemiological studies must be conducted to determine the risks staffs are facing with
- Financial liabilities must be allocated for integrated medical wastes management and to support internal producers of such facilities.

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Conflicts of interest

There are no conflicts of interest.

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