



Investigating the Quantity and Quality of Wastes in Shahid Chamran Hospital, Shiraz, in 2012-2013

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ABSTRACT

Hospital wastes are regarded hazardous waste. There are certain regulations for handling them and they should be collected and disposed with special care. One of the suitable methods is the effective control of the produced infectious wastes under a management and supervision system in accordance with international principles and regulations. The aim of this project is to examine the quality and quantity of Shahid Chamran Hospital wastes and to obtain the amount of hospital wastes for each bed for performing suitable management. The amounts related to hospital wastes were determined under the supervision of the hospital's environmental health expert and wastes collection personnel during a one-year period. The amounts were also recorded monthly (first week of each month), three times a day – in the morning, in the afternoon and at night- separately. The results of this study indicated that the daily per capita waste production separated by type- infectious, non-infectious and sharp- is respectively 452 kg, 714 kg and 4 kg. The per capita infectious waste produced in this hospital for each bed is 1.7 kg, and the per capita non-infectious waste produced for each bed is 2.69 kg. The total per capita production of wastes is 4.4 kg.

Keywords: waste, Shahid Chamran Hospital, infectious

1. INTRODUCTION

Expansion of cities, increase in population density, industrial progresses and the increase in per capita waste production have turned the wastes transportation and disposal to a complicated issue which needs a disciplined system and reinforcing special regulations. One of the important types of solid wastes in cities is the waste produced in healthcare and medical centers such as hospitals, clinics, medical diagnosis laboratories and dental and medical offices, out of which hospital wastes are very important in terms of quantity and quality. In many countries, hazardous medical wastes are still managed and disposed of along with household wastes, thus causing great hygienic danger for urban workers, the public and the environment (Da Silva et al., 2005). Proper collection and disposal of these wastes are especially important due to their direct and indirect dangers for the health of humans and the environment. Failure in following the required standards for disposal of these wastes not only decreases the level of health in society, but also increases the burden on the healthcare system (Askarian and vakili, 2003). The higher the size and complication of medical wastes, the higher the risk of spreading of diseases through incorrect management and disposal operations (Almuneef and Memish, 2003). Medical wastes have a high amount of infectious wastes which are potentially hazardous, because they contain pathogenic factors. Collection and disposal of these wastes are very important, as they can have direct effects on public healthcare and environmental hygiene (Birpınar et al., 2009; Abdulla et al., 2008). Most of hospital wastes are produced in large medical centers. Unlike large medical

centers, in small medical centers the data about handling wastes is not recorded because it is difficult. The composition of medical wastes varies depending on the region, type and size of the medical center, the quality of the medical center and the practical approaches (Cheng et al., 2009). Hospital wastes comprise about 1-2% of the municipal solid wastes. This is very important in terms of health, because they are categorized as hazardous wastes. One of the characteristics of these hazardous wastes is that the method of their collection and disposal follows special rules and regulations and should be performed by experts. Problematic hospital wastes, whose carrying can spread infection and cause injuries, should be separated and burned by authorities or be prepared and transported to the disposal area according to the respective regulations (Omran, and Alavi, 2007). The World Health Organization is the advocate of taking and discarding hospital wastes as special wastes. The Environmental Protection Agency of the United States has also defined medical wastes as hazardous wastes (Rushbrook et al., 2000; Bdour et al., 2007). Quantitative and qualitative knowledge of hospital wastes is necessary for selecting the correct and accurate methods of collection, storage, transportation and disposal of these wastes. This group of wastes is regarded as hazardous wastes, because they contain hazardous chemicals and hazardous pathogenic microbes (Mostafae et al., 2004). According to investigations conducted in 1980, the amount of hospital wastes in the U.S. had been in the range 1.5-3.9 kg/day for each bed, while in 1999, this number was 9 kg/day on average. The amount of hospital wastes in India in 2001 was in the range 0.5-5 kg/day for each bed (Patil and Shekdar,

2001). The first step for proper waste management is to determine the quantity and quality of wastes in order to determine the collection stages and final disposal. The aim of this research is to investigate the wastes produced in Shahid Chamran Hospital in Shiraz in terms of quantity, so that a comprehensive planning may be done to manage hospital wastes and dispose of them properly.

2. MATERIALS AND METHODS

This study was conducted in Shahid Chamran Hospital, Shiraz, Fars province. There are 300 beds in the hospital out of which 265 are being used. There are 11 medical wards: Emergency, Orthopedics, Gynecology, Maxillofacial surgery, Neurosurgery, ICU, Neurology and also independent clinic,

pharmacy, MRI, rehabilitation, laboratory, physiotherapy, kitchen, radiotherapy, radiology and administrative division are among the areas being studied in the hospital. The information about the rooms, beds and number of bins in each room and the total number of bins (infectious, non-infectious and sharp wastes) in each ward is mentioned separately. White bins are for ordinary wastes, yellow bins for infectious wastes and their number is given in Table 1, separated by ward. The produced wastes were separated by their type and put into three groups of infectious, non-infectious and sharp wastes from the origin. Measuring the quantity of the hospital wastes was done under the supervision of the hospital's environmental health expert and the personnel responsible for gathering wastes, during a one-year period (first week of each month) and three times a day – in the morning, in the afternoon and at night-the amount of wastes was measured by scale in a 70 days period.

Table 1: Number of bins in each ward of the hospital

Section name	Ordinary Bin (White)	Infectious bin (yellow)
emergency	49	22
Orthopedics	68	40
Gynecology	24	8
ICU	7	17
Neurosurgery	19	9
Maxillofacial surgery	23	7
Neurology	8	0
clinic	42	6
pharmacy	3	0
MRI	27	6
laboratory	5	16
physiotherapy	17	0
kitchen	3	0
radiology	14	3
administrative	75	0

3. RESULTS AND DISCUSSION

Due to the variety and volume of hospital waste, infectious waste generated from hospitals and also with regard to the risk of such hazardous wastes generation, accurate and continuous monitoring over hospital management to provide, maintain and improve the health of patients, staff and other community members will be necessary. This study gave information to production rates of hospital wastes to facilitate improvement of hospital waste management framework. According to studies in Shahid Chamran Hospital, Shiraz, in 2012-2013, the following information about the quantity and quality of wastes was gained. Table 2 is the quantity of wastes produced in different wards of the hospital measured during 70 days, 3 times a day-in the morning, in the afternoon and at night- and in terms of infectious, non-infectious and sharp wastes. The amount of daily infectious wastes was an average of 452 kg, daily non-infectious wastes an average of 714 kg, and the

amount of sharp objects was 4 kg. In terms of percentage, they are respectively 38.6%, 61% and 0.3%. Also, the daily amount of infectious and non-infectious wastes produced in this hospital for each bed is 1.7 kg and 2.69 kg, respectively. In total, the daily amount of produced wastes for each bed is 4.4 kg. According to studies in Kashan in 2002, the daily amount of produced wastes for each bed in the hospitals of this town was 3.44 kg (Mostafaei et al., 2004). Another study in 2004 on hospital wastes in southern Brazil showed that the average of total daily amount of produced wastes for each bed was 3.24 kg and the amounts of infectious biologic wastes were 0.570 kg/day for each bed (Da Silva et al., 2005). In Iran, there are 750 hospitals with about 85000 beds and each bed produces an average of 2.7kg of wastes which constitutes 0.5% of municipal wastes (Omran and Alavi, 2007). In other parts of the world, the daily amounts of produced wastes are as table 3 (Askarian et al., 2010).

Table 2: Daily amount of hospital waste production in Shahid Chamran Hospital in different sections

	morning			afternoon			night		
	infectious	non-infectious	sharp	infectious	non-infectious	sharp	infectious	non-infectious	sharp
Operating room	35.7	10.7	0.58	35.7	8	0.12	31.4	5.7	0
emergency	35.6	35.15	0.46	30.8	28.7	0.157	29.3	26	0
Orthopedics 1-2	27.9	26.2	0.3	20.23	18.5	0	29.7	26.6	0
Gynecology	35.2	29.2	0.5	23	20.5	0.16	0	0	0
Neurology	34.7	28.3	1	27.2	23.6	0.23	24.5	19.5	0
rehabilitation	4.6	6.5	0.1	3.7	5	0	3.9	4.24	0
physiotherapy	0	6.64	0	0	0	0	0	0	0
laboratory	7.76	9	0.38	0	0	0	0	0	0
radiology	0	9.25	0	0	0	0	0	0	0
yard	0	97.7	0	0	17.6	0	0	0	0
administrative	0	9.2	0	0	0	0	0	0	0
MRI	4	8	0	2.84	6.11	0	0	0	0
clinic	4.25	11.7	0	0	0	0	0	0	0
kitchen	0	119.2	0	0	97.7	0	0	0	0
total	189.7	407	3.3	143.5	369	0.7	118.8	82	0

Table 3: The amounts of hospital wastes for each bed in various regions of the world

Region	Hospital waste (kg /bed)
North America	7-10
Western Europe	3-6
East Asia: high-income countries	2.5-4
East Asia: low-income countries	1.8-2.2
Eastern Europe	1.4-2
Eastern Mediterranean	1.3-3

Table 4: Daily amount of waste production separated by infectious, non-infectious and sharp (70–days average), (kg/day)

	infectious	non-infectious	sharp
Operating room	102.8	24.4	0.7
emergency	95.7	89.85	0.617
Orthopedics 1-2	77.83	71.3	0.31
Gynecology	58.2	49.7	0.66
Neurology	86.4	71.4	1.23
rehabilitation	12.2	15.74	0.1
physiotherapy	0	4.64	0
laboratory	7.76	9	0.38
radiology	0	9.25	0
yard	0	115.3	0
administrative	0	9.2	0
MRI	6.84	14.11	0
clinic	4.25	11.7	0
kitchen	0	216.9	0
total	452	714.7	4

The daily fluctuations of infectious waste generation were studied by investigating the rate of waste generated from daily records as shown in Figure 1. The results show that, daily generation rates are not constant. These values ranged from 148 to 555 kg that can result from number visits and of occupied beds. On the basis of this research, most of infectious wastes are produced in operation rooms, that account for 22.74% of the total infectious wastes produced daily in the hospital with an average of 102.8 kg/day. The least amount of infectious wastes is produced in the clinic that comprises 0.94% of the total infectious wastes produced daily in the hospital with about 4.25 kg. The largest part of non-infectious wastes which mostly includes food remains and garbage from cleaning the hospital area is produced in the kitchen, constituting 25.28% of the total non-infectious wastes produced daily with 216.9 kg/day. The least amount of non-infectious waste is produced in the physiotherapy ward, comprising 0.54% of the total non-infectious wastes with 4.64 kg/day. The highest numbers of sharp objects are produced in the orthopedic 4 and neurosurgery wards, constituting 30.75% of the total sharp objects with 1.23 kg/day. A study in Tabriz

in 2007 indicated that the average weight of daily produced wastes for each bed for all the wastes, hazardous-infectious and ordinary wastes were respectively 3.48, 1.039 and 2.439 kg, 70.11% ordinary wastes, 29.44% hazardous-infectious wastes and 0.45% sharp objects (Taghipour and Mosaferi, 2007). In a study in 2006 in northern Jordan, the total daily amount of wastes for each bed was 3.49 kg, out of which 3.14 kg were ordinary wastes and 1.88 were for private hospitals and maternity centers (Bdour et al, 2007). In 2008, in a study in Taiwan on 150 hospitals and medical centers, it was found that the amount of ordinary wastes in hospital wastes varies between 2.41 to 3.26 kg/day for each bed and also the amount of infectious wastes varies from 0.19 to 0.88 kg/day for each bed (Cheng et al, 2008). It appears that components of hospital waste are influenced by various factors such as hospital waste management, social, cultural and economic situation, type and size of hospital. It was concluded that, in order hospitals to be able to manage hospital waste properly they are required to investigate daily, monthly and seasonal variations of waste generation and understand better the maximum and minimum values of waste generation variations.

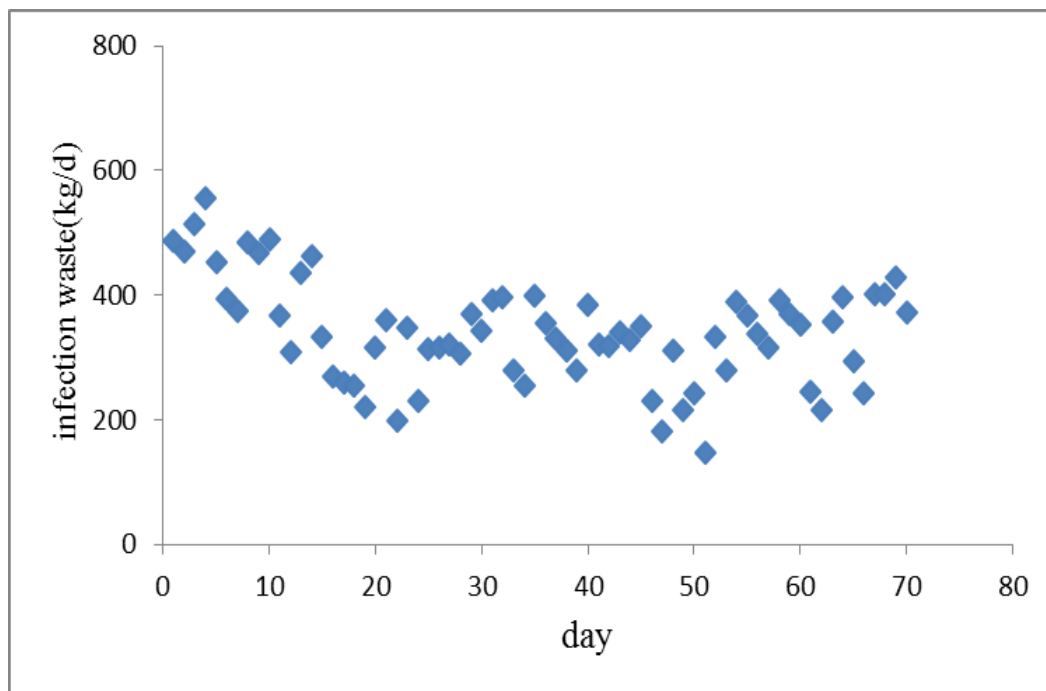


Figure 1: Average production of infectious wastes in Shahid Chamran Hospital in different days (kg/day)

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