

## Qualitative and Quantitative Survey of Waste Management System Case Study: Qods Hospital, Paveh-Iran (2015)

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**Abstract:** Among different sources of medical wastes, hospitals are one of the main and biggest sources. Hospital wastes including pathological, radioactive, pharmaceutical, chemical and infectious materials and medical equipment are known for their many hazardous, poisonous and pathogenic factors. The descriptive and cross-sectional study was carried out in Qods Hospital-Paveh City in 2015. The wastes were categorized in four categories of household, infectious, sharp objects and chemical/pharmaceutical. Based on the number of active beds in hospital waste volume per day/bed was computed. The data analyses were performed in EXCEL. On average waste production level in Qods Hospital of Paveh City was 102 kg/day. Nominal bed number of the hospital is 70 and 64 beds were active on average every day. Waste production rate per active beds in the hospital was comparatively less than Tehran-based (2.71 kg/day.bed) and Zanzan-based (2.402 kg/day.bed) hospitals.

**Key words:** Waste, management, gods, hospital, Paveh

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### INTRODUCTION

One of the issues in public health and environment preservation domain is waste management. This problem is an indispensable aspect of man's life. Wastes produced in hospitals including pathologic, radioactive, pharmaceutical, chemical and infectious materials and consumable medical equipment are featured with hazardous, poisonous and pathogenic specifications (Adsavakulchai, 2002). Any decision with regard to hospital waste must be made with an eye on quality and quantity of the waste and waste management system (aggregation, piling and disposing of) (Alagoz and Kocasoy, 2008). Medicine science and medical services have experienced notable advances over the last few decades. However, it appears that the area of hospital waste management in the developing countries in particular has been neglected in the development programs so that in many cases hospital wastes are processed along with urban wastes (Almasi *et al.*, 2016; Askarian *et al.*, 2004).

Among different source of medical wastes, hospitals produce the largest portion of the waste (Coad, 1992). Hospital wastes in general are categorized as infectious (hazardous) and normal (semi-household) waste; the former constitute 10-25% of waste produced by medical

centers and the latter constitute 75-90% (Adsavakulchai, 2002; Do *et al.*, 1999). Medical waste management is one of the vital issues of environment health management (Ebrahimi *et al.*, 2016). According to WHO (2000), poor hospital waste management is shockingly the main cause of 32% of total cases of hepatitis B, 40% of total cases of hepatitis C and 5% of total cases of HIV (Habib Zadeh *et al.*, 2007). Human activities and changes in consumption patterns have led to an increase in waste production (fang *et al.*, 2006). Hospital wastes represent 1-2% of urban solid waste material which is a serious health issue. One of the main issues about hospital wastes is that they cannot be processed along with urban wastes due to health and environmental concerns (Koushiar *et al.*, 2006).

Norris estimated in this study on quantity of hospital wastes in Maryland, USA that daily hospital waste production is 3.5 kg/bed (Koushiar *et al.*, 2006). Askarian *et al.* (2004) conducted a study in Fars Province hospitals and reported 3.93 kg/d.b waste production (MHME., 2008). Hospital waste production in European countries ranges from 2-6 kg/b.d and this range in Iran is 2-9 kg/bed/day (Koushiar *et al.*, 2006).

Qods hospital is the only hospital in Paveh City and there has been no similar study in this hospital. Therefore, the present study is an attempt to examine waste

production in this hospital from qualitative and quantitative viewpoints. In addition waste management system in the hospital was surveyed and analyzed.

## MATERIALS AND METHODS

The study was carried out as a descriptive cross-sectional work in Qods Hospital, Paveh, Iran in 2015. Following the categorization of the Iranian Ministry of Health, the wastes produced in the hospital were categorized in four categories of semi-household, infectious, sharp and chemical/medical wastes. Produced waste of one week was weighed every month from April 2015 to March 2016 and based on number beds in the hospital waste production rate per day and bed was estimated. Data analyses were performed in Excel. To collect information about waste management process of the hospital, a checklist with 75 questions categorized into production, disintegration, packaging, collecting, piling, transportation and disposal categories was used. Reliability of the checklist was confirmed by the Iranian Ministry of Health (Malek Ahmadi, 2010). The checklist collects general and specialized information so that the latter information is about waste management processes as follows.

Forty-five questions on production, disintegration and separation process, 21 questions on piling and storing the waste and nine question on transportation and disposal process (Malek Ahmadi, 2010).

To convert the collected data into numerical values, questions with correct answers (as per the regulations) were scored one and questions with incorrect answers were scored zero. The obtained scores were expressed as percentage. Afterward, different stages of hospital waste management were weighed based on their relative importance. (Table 1). Then, to rank the waste management system, inferential ranking technique was used (Table 2).

Table 1: Weight of waste management elements in Qods Pave City hospital (Marinkovic *et al.*, 2008)

Waste management stage	Relative weight
Production, disintegration, separation and collection	60
Temporary piling	28
Transportation, disposal and disinfection	12
Total	100

Table 2: Medical waste management ranking (Marinkovic *et al.*, 2008)

Rank	Score
Excellent	91-100
Good	71-90
Average	51-70
Poor	26-50
Very poor	0-25

## RESULTS AND DISCUSSION

Table 3 lists waste production data in Qods Hospital, Paveh. As the data showed, mean waste production in Qods Hospital, Paveh is 102kg/d and with 70 nominal beds and 64 active beds on average, daily waste production per bed is 1.593 kg/d.b. Table 4 lists the main results obtained from the collected data by the checklist.

Observing health standards in hospital environment and proper waste management are of imperative importance in hospitals knowing that these facilities are home to many pathogenic factors hospital wastes are of the main sources of disease and they must be managed in a manner so that health of the public and staff and the environment are preserved. As listed in Table 3, daily waste production rate in Qods Hospital was 102kg/d or 1.593kg/d.b. In addition, 74.28% of total hospital waste was semi-household, 14.71% was infectious, 1.96% was chemical/pharmaceutical and 9.8% was sharp objects. Quantity of produced waste depend on factors such as number of active wards, type of services, quality of consumable products, economic/cultural condition, system management and level of skill of the employees. Type of services provided in education and non-educational hospitals and also type of the services and management system in the hospital are of the factors effective on amount of produced waste (Mohammadian Fazli *et al.*, 2013). A similar study in Zanjan Hospitals showed an average waste production of 1.432kg/d.b. So that semi-household, infectious, chemical/pharmaceutical and sharp objects constituted 95.98, 31.62, 1.02 and 1.38% of the waste, respectively (Oweis *et al.*, 2005). Tsakona *et al.* (2007) in Greece reported that average rate of medical waste production was 1.9kg/d.b (Pirsaheb *et al.*, 2016). In addition, a study in Jordan-based hospitals showed that waste production rate in public and private hospitals were 2.21 and 0.776kg/d.b respectively (Qdais *et al.*, 2007).

Table 3: Waste production based on four categories (2015)

Categories	Semi-household	Infectious	Chemical-pharmaceutical	Sharp	Total waste
Waste production (kg/d.b)	75.000	115.000	22.000	10.000	102.0
Production rate (kg/d.b)	01.172	0.234	0.031	0.156	1.593
	73.530	014.710	1.960	9.800	100.0

Table 4: Consistency of waste management system with the checklist

Waste management stages	Consistency rate
Production, disintegration, package, and collection	68.33
Piling and storing	57.14
Transportation, disposal, and disinfection	58.33
Average	61.26

Our data showed that total amount of hazardous waste (including infectious, chemical/pharmaceutical and sharp objects) was 26.47% while this figure in studies in other countries ranges from 10-25% (Marinkovic *et al.*, 2008). A study by Habib Zadeh *et al.* (2007) in Bukan, Mahabad, Miandoab and Saghez showed that 61% of hospital wastes were semi-household wastes and 39% were of hazardous wastes (infectious, chemical/pharmaceutical and sharp objects). Taghipour and Mosaferi (2009) reported that 29.99% of hospital wastes in Tabriz-based hospitals was constituted by hazardous wastes and 70.11% was constituted by usual wastes (Mohammadian Fazli *et al.*, 2013).

Clearly, the rate of hazardous wastes in this study is slightly less than that of other hospitals in other countries reported by the mentioned studies. One explanation is the way of disintegration of medical wastes in the hospital under study. In addition, proper education provided to service staff, effective supervision of their performance and disintegration at the source (hazardous waste are disposed in yellow bags) explain this finding. One of the ways to decrease waste production is to promote efficient procurement, warehousing, distribution and utilization of the materials and goods.

Our findings indicated 68.33% consistency with the regulations and codes in production, disintegration, packaging and collecting; 57.14% consistency in piling and temporary storage; and 58.33% in transportation, disposing of and disinfecting. Waste management system in different areas of production, disintegration, packaging and aggregating, piling and temporary storage, transportation, disposal and disinfection were rated at average level. Mohamadi and Fazli studied Zanj-an-based hospitals and showed consistency with codes and regulations in production/disintegration/packaging/aggregating, piling/temporary storage and transportation/disposal/disinfection equal with 53.93, 52.72 and 76.42%, respectively (Pirsaheb *et al.*, 2016). Comparing with Mohammadian Fazli's results waste management system in Qods Hospital was better than those in Zanzan-based hospitals.

The key to achieve an efficient waste management system is in determination of qualitative and quantitative specifications of hospital waste, disintegration, collection, treatment and proper disposal of the waste (Tchobanoglous *et al.*, 1993). Among hazardous hospital waste, chemical/pharmaceutical wastes could create serious public health threats (carcinogenic, poison, mutation risks), environmental risks and considerable economic loss if not properly managed (Tsakona *et al.*, 2007). Chemical/pharmaceutical waste are highly

hazardous and must never enter sewage system after dumping. One of the main ways to disinfect and dispose of wastes is to return the expired medicine to the producers, incineration ( $>1200^{\circ}\text{C}$  for 5s at least) and chemical decomposition. Vahedi *et al.* (2006) some of the risk assessment methods must be used in hospital for assessing health risk factor (Vatankhah *et al.*, 2014; Verma *et al.*, 2008). Technical committee of nosocomial infections is useful in management of solid waste and etc., (Yarmohammadi *et al.*, 2016). Knowledge, attitude and performance of staff of hospital in relation to job's environmental health must be useful in waste management.

## CONCLUSION

Waste production rate per active bed in Qods Hospital was far less than that of Tehran-based (2.71 kg/d.b) and Zanj-an-based (2.402 kg/d. b) hospitals. The fact that 26% of the wastes are comprised of infectious and hazardous waste is acceptable based on WHO's recommendations. Although, there is a serious need for surveying and improving some of waste management methods to cut the environmental effect of hospital waste management system in the hospital is at near good condition. We recommended Effects of Administrative Interventions on Improvement of Safety and Health in Workplace is proven must be done in waste management.

## REFERENCES

- Adsavakulchai, S., 2002. Study on waste from hospital and clinics in Phitsanulok. Online S. Health Allied Sci., Vol. 1.
- Alagoz, A.Z. and G. Kocasoy, 2008. Determination of the best appropriate management methods for the health-care wastes in Istanbul. Waste Manage., 28: 1227-1235.
- Almasi A, Mohamadi M, Poursadeghiyan M, Sohrabi Y, Mohamadi S and Komijani M, 2016. The survey of knowledge, attitude and performance of female barbers in relation to job's environmental health: A case study of Malayer city. Iran. S. Health Safety Environ., 3: 573-577.
- Askarian, M., M. Vakili and G. Kabir, 2004. Results of a hospital waste survey in private hospitals in Fars province, Iran. Waste Manage., 24: 347-352.
- Coad, A., 1992. Managing medical waste in developing countries. Report of a Consultation on Medical Waste Management in Developing Countries, Geneva, Switzerland.

- Do, A.N., B.J. Ray, S.N. Banerjee, A.F. Illian and B.J. Barnett *et al.*, 1999. Bloodstream infection associated with needleless device use and the importance of infection-control practices in the home health care setting. *J. Infect. Dis.*, 179: 442-448.
- Ebrahimi, M.H., M. Abbasi, M. Khandan, M. Poursadeghiyan, M. Hami and H. Biglari, 2016. Effects of administrative interventions on improvement of safety and health in workplace: A case study in an oil company in Iran (2011-2015). *J. Eng. Applied Sci.*, 11: 346-351.
- Habib Zadeh S., M. Adib Hesami and Y. Mahmoudfar, 2007. Hospital waste management in Bukan, Mahabad, Saghez and Miandoab hospitals in 1384 Persian. *Sci. Res. J.*, 9: 52-67.
- Sang, Y.C., C. Lee, O. S. Yoon and H. Kim, 2006. Medical waste management in Korea. *J. Environ. Manage.*, 80: 107-115.
- Koushiar, G., R. Nabizadeh, G. Omrani, H. Nikoomaram and M. Monavari, 2006. A comprehensive survey on the present status of hospital waste management in Iran: A case study of Rasht. *J. Applied Sci.*, 6: 721-725.
- MEELVIE., 2008. Criteria and methods of executive management of medical waste and related waste. Ministry of Health and Medical Education, Tehran.
- Malek Ahmadi, F., 2010. Survey of medical solid wastes in Tehran Hospitals. Tehran University of Medical Sciences, Tehran.
- Marinkovic, N., K. Vitale, N.J. Holcer, A. Dzakula and T. Pavic, 2008. Management of hazardous medical waste in Croatia. *Waste Manage.*, 28: 1049-1056.
- Mohammadian Fazli, M., J. Nassiri and R. Nabizadeh, 2013. Qualitative and quantitative assessment and management of hospital waste in Zanjan, Iran in 2011. *Iran. J. Health Environ.*, 6: 55-64.
- Oweis, R., M. Al-Widyan and O. Al-Limoon, 2005. Medical waste management in Jordan: A study at the king Hussein medical center. *Waste Manage.*, 25: 622-625.
- Pirsaheb, M., H. Yarrnohammadi, R. Rostami and Y. Sohrabi, 2016. The evaluation of safety, health and environmental risks in waste unit of Imam Reza hospital in Kermanshah based on William Fine's method. *IJPT*, 8: 10910-10917.
- Qdais, H.A., A. Rabi and F. Abdulla, 2007. Characteristics of the medical waste generated at the Jordanian hospitals. *Clean Technol. Environ. Policy*, 9: 147-152.
- Taghipour, H. and M. Mosafari, 2009. Characterization of medical waste from hospitals in Tabriz, Iran. *Sci. Total Environ.*, 407: 1527-1535.
- Tchobanoglous, G., H. Theisen and S. Vigil, 1993. *Integrated Solid Waste Management: Engineering Principles and Management Issues*. 2nd Edn., McGraw-Hill, New York, ISBN: 9780070632370, Pages: 978.
- Tsakona, M., E. Anagnostopoulou and E. Gidarakos, 2007. Hospital waste management and toxicity evaluation: A case study. *Waste Manage.*, 27: 912-920.
- Vahedi, M.S., B. Ahsan, M. Ardalan and S. Shahsavari, 2006. Prevalence and Causes of needle stick injuries, in medical personnels of Kurdistan University's hospitals and dealing with such injuries due to contaminated sharp tools in 1383. *Sci. J. Kurdistan Univ. Med. Sci.*, 11: 43-50.
- Vatankhah S, Mokarami H, Karchani M, Hosseini Z, Izadi B and Moradi F, 2014. Effect of executive programs of infection control committees on the prevalence of nosocomial infections in Kermanshah's hospitals (2010-2011). *Electron. Physician*, 6: 768-770.
- Verma, L.K., S. Mani, N. Sinha and S. Rana, 2008. Biomedical waste management in nursing homes and smaller hospitals in Delhi. *Waste Manage.*, 28: 2723-2734.
- Yarmohammadi H, Poursadeghiyan M, Shorabi Y, Ebrahimi M.H, Rezaei G, Biglari H and Rostami R, 2016. Risk assessment in a wheat winnowing factory based on ET and BA method. *J. Eng. Applied Sci.*, 11: 334-338.