Review of hospital waste management in Iran

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ABSTRACT: Hospital waste due to their environmental pollutants and hazardous waste, are so important in waste management system. The nature of hazardous medical waste and problems caused by inconsistent management such as lack of planning in production And chemicals consumption. Failure to manage the separation and segregation, Storage and collection, Shipping and handling and disposal Cause environmental and health problems in the community. In this paper, according to the research that has been done in the country, in the Beginning there is an explanation of Waste Management, the Status of Waste Management Based on hospital waste regulations Approved by the Ministry of Health in 2008 has been studied. After established Waste Management regulation in 2005, And the Waste Management Regulations in 2008, Hospital waste management situation in the country has improved. But the guidelines of these regulations have not been properly implemented and this has resulted that the hospital has not reached an ideal point in term of sanitary.

Keywords: Hospital Waste, Management, Review, Iran

INTRODUCTION

Rapid population growth and increasing healthcare needs of human societies causes expansion of different facilities that provide healthcare services such as hospitals, Public and private clinics and laboratories in the world that in turn, This increases the production of infectious waste resulting from hospitals, Healthcare centers, Clinical laboratories and Other similar centers (Pearson et al., 2003). Due to the existence of hazardous agents, toxins and disease-causing such as Biological waste, radioactive, chemical and drugs, infectious and Containers of medical supplies in Hospital waste, a special sensitivity should be considered and it has a risk potential for patients, Visitors, hospital personnel and others(Jang, Lee, Yoon, & Kim, 2006; Tsakona, Anagnostopoulou, & Gidarakos, 2007). According to the definition of world health organization, Hospital waste is defined as each solid waste that used for diagnosis, curing, Immunization of human beings or animals or can also be used in Research or biological test (El-Salam & Magdy, 2010). As a matter of fact, due to the existence of environmental Hazardous contaminants in Hospital waste, they have a special importance in Waste management system. The hazardous nature of these wastes And adverse environmental impacts persuade Health officials to perform some actions in terms of their duties and responsibilities. In addition to provide health services, they should focus on environmental issue In the framework of the implementation of the waste management in hospital(Prüss, Giroult, & Rushbrook, 1999). Inefficient management of hospital waste, Caused environmental pollution, Unpleasant odor, Proliferation of insects, Rodent and Worms and Lead to transmission of some disease such as Typhoid, cholera, hepatitis and AIDS resulting from Needles and syringes that contaminated by human blood(Askarian, Vakili, & Kabir, 2004). It estimated that almost 5.2 million people (Including 4 million children) died because of waste-related diseases annually (Akter, 2000). In this regard, waste management laws has been established in 2005 and in Article 11 of this Law, the Responsibility for supervision on hospital waste Was assigned to the Ministry of Health and also in
2008 in order to an Appropriate Supervision on hospital waste, Medical Waste Management Regulations by Commission of fundamental task, Industry and environment and suggest of environmental department has been established. So in this research, first of all, there is a description in relation to waste management and then Current status of hospital waste in the country has been examined.

**The quantity of hospital waste**

One of the most basic prerequisites for design and implementation of a proper program for hospital waste management, Awareness of the quantity and quality of hospital wastes in any city. According to report of WHO (1999), The amount of waste produced daily in hospitals university was 4.1-8.7, in General Hospital was 2.1-4.2 and in Regional Hospital was 0.5-1.8 KG per each bed. According to studies, Capitation of hospital waste in Tehran educational hospital was 2.5-3 (Farzadkia, Moradi, Mohammadi, & Jorfi, 2009), Tehran Private Hospitals was 3.406 (Monavari M, Winter 2009), Sistan and Baluchistan was 2.76 (Edris Bazrafshan 2009), zanjana was 2.402 (Mohammadian M F, 2013), Kurdistan was 2.7(Samadnenejad F & K, 2011) and Tabriz 3.48(Taghipour & Mosaferi, 2009) kilo per bed for each day. So it indicates that the Amount of waste produced in our country's hospitals Compared with the values that be presented by WHO was fair, although we should try best to lessen the values. But Hospital Waste production in recent years has been the growing trend. According to the data of Tehran recycling organization, Production of Hospital Waste from 1998 to 2005 Increased as follows:

![Graph](image)

**Table 1.** The annual production of waste at Tehran hospitals (recycling organization and material conversion in 2005). if demonstrating with graph, we see that waste production in recent years has been increased.

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The situation is the same as the rest of the country. The results shows that Capitation of hospital waste per each hospital bed and in addition the Amount of waste production has been increased significantly in recent years. For example in 2007 Capitation rate of hospital waste in west Azerbaijan was 0.95 KG per bed (Nanbakhsh H, 2002) although in a study in 2012, it increased 3 KG per bed. Hospital waste can be divided into two categories based on the hazardous potential: the first type is non-hazardous waste (domestic like) that include 75-90% of generated waste in Medical Centers and the main sources are Management activities, Administrative and maintenance and Rob went yard of this centers. The second type include Hazardous waste that 10-25% of the remainder of the total hospital solid waste are considered as Hazardous waste(Katoch, 2007). In developing
countries 15% of waste are pathological and infectious, 1% are Sharp and keen, 3% are chemical and drug, and less 1% are radioactive, under pressure container, Broken thermometers and batteries. Such material that are classified as hazardous wastes, are considered hazardous waste, that has its own regulations and special Care should be done during their Collection and disposal (Wong, Narasimhan, Kashyap, & Fu, 1994). but According to a research conducted in Tabriz, 70.11% of wastes were typical, and 29.4% were infectious and 0.45% were sharp and keen (Taghipour & Mosaferi, 2009). According to the same study in Tehran educational hospitals, The amount of ordinary waste was 85-90% and The amount of infectious waste was 10-15%. (Farzadkia et al., 2009) also, The ratio of infectious waste in Ahvaz was 22.99%, west Azerbaijan was 31.5%, Bandar Abbas was 34.65%, and Kerman was 18.4%, and the amount of sharp and keen waste in Ahvaz was 4.79%, Bandar Abbas was 6.79%, in west Azerbaijan was 4.5% and in Kerman was 16.3% (Nami M), that has shown the amount of waste produced in the country is the same as WHO division. Although the amount of waste produced for each bed in different cities and countries are different. The reasons for this difference Apart from the accuracy of the method are: Lack of proper waste segregation, Number of clients and visitors and their social and economic status, number of visited days and which season the research has been completed (Rezaei F & Gh, Autumn, 2007).

**Hospital waste management**

Any policy and decision making in conjunction with hospital waste Requires an understanding of the current situation in relation with Quantity, quality, storage methods, Collection and disposal of hospital waste, so with that we can analyze the requirements and give recommendations to solve the problem (Jang et al., 2006; Oweis, Al-Widy an, & Al-Limoon, 2005). Although hospital waste represents a small amount of the total waste generated in the community, Management of that is a significant issue. Management procedures, treatment and disposal of medical waste shall be in accordance with the most stringent standards (Cheng et al., 2009). Studies has shown that improvement of the management of medical waste should be done by Setting national regulations, Internal management systems and safety education programs, assurance of Safety related personnel and also establishing Programs to estimate the amount of generated waste and Assessment of Disposal methods (Ali & Kuroiwa, 2009). Despite the fact that the Management of medical waste vary from hospital to hospital, Areas problem, for all health care units and all management procedures including separating, Collection, packaging, storage, transportation, treatment and disposal is similar (Tsakona et al., 2007; Yong, Gang, Guanxing, Tao, & Dawei, 2009). The general concept of waste management in hospitals in total includes public education, reducing production, Storage, collection, transportation, processing and disposal of such waste Within political, economic, social, cultural and technical consideration and having integrated and Efficient rules in the society have positive impact on reducing the production of such waste On the one hand, and Increase national productivity and decrease the Adverse effects of waste disposal of non-normative on public health and the environment (Rezaei F & Gh, Autumn, 2007). Many countries have established laws and recommendation for displacement and disposal of medical waste from hospitals. All types of solid waste generated by health centers require a proper displacement, transportation, disposal and a controlled method in order to maintain public health and prevent environmental pollution. This is just adopted by administrative enforced rules and can be achieved by use of the guidelines in all aspects of displacement, storage, transportation and disposal of waste products. In developed countries, Definition of medical waste and the various methods of collection, transportation, storage and disposal of these wastes is provided in the rules and guidelines. Also, best available technologies for the development of procedures for the proper disposal of medical waste with minimal risk to human health and the environment have been used (Tudor, Noonan, & Jenkin, 2005). However, no comprehensive effort hasn’t been done to learn how to manage the waste generated by hospitals. Waste management is usually delegated to ordinary workers and they do more things without proper instructions and insufficient support (Diaz, Savage, & Eggerth, 2005). According to research of Asgarian, Hospital waste is managed in an inappropriate manner. These wastes are buried across the country without any regard to environmental issue and can be considered a significant threat associated with environmental pollution (Askarian et al., 2004). Also farzad kia said that many hospitals have no proper waste management system in Iran or do not have any system for hospital waste management (Farzadkia et al., 2009). As mentioned above, the general concept of waste management in hospitals in total includes public education, Decrease in the production, storage, collection, transportation, processing and disposal of such waste. Thus, each of these steps individually has been assessed According to the research that has been done in the country.

**Public Education**

Medical waste management plan is one of the major needs of societies and staff training is one of the factors for its successful implementation. Based on Definition of medical waste management, one of the items of medical waste management is Staff awareness regarding waste management. In this regard, two documented
Reduced production

Today Waste Management in the world has an important role and approach to the prevention and reduction of waste production and until now, considerable studies and research have been conducted in this area. In this regard, in hospitals, reduction in waste generation source. Recycling and segregation is the first effective strategy in reducing the production of hospital waste, Should further be considered. According to waste management regulation, Medical waste before disposal should be minimized and safe storage and then should be removed from the hospital for Final disposal. For this purpose, using methods that lead to the minimization of waste production, And especially dangerous infectious and hospital waste are so Important and consider as an economical and health waste management and Leading to reduced production of waste and ultimately reduce the cost of waste management. In relation to waste reduction, in a study of masoum baigh et al, Hospital waste reduction techniques divided into three parts: "Effective ways to reduce generated home-like waste ", Effective methods to reduce the production of infectious waste " And "reduce the production of waste through recycling has been studied. In term of reduce the home liking waste production, they suggested Modification pattern of drug use and equipment needed and providing the highest quality materials and the necessary amount and Optimal use and avoid waste putrescible materials Compliance with preventive measures. In line of decreasing production of infectious waste, some factors such as purchasing of Consumable items more than the required amount like drugs that Shortly the expiration date finished, Variation in consumer purchasing medical equipment, Sometimes poor quality of purchased items, Lack of staff awareness of how to use them causes indiscriminate use and increased Perth and Production quantities of infectious waste. Distribution of Pharmaceutics, Medical equipment and supply items has been done Based on needs and expertise demands in order to prevent Perth and indiscriminate use and distribution of new medical devices along with instructions on how it should be done. In part of reduction in waste by recycling, Recyclable manufactured components are used in service and administrative sectors (Masoumbeigi H., 2009).

Storage

A Good place to store the waste in hospitals in a Separate atmosphere should be determined in proportion to the amount and frequency of collection. Also, in order to prevent access of unauthorized persons, this place must have door and locks and to prevent the spread of pathogens, and it should be washed and disinfected in accordance with health regulations(Williams, 2005). According to the Waste Management Regulations, Waste storage keeping time in Moderate temperature 72 hours in the cold season and 48 hours in the hot season and in hot temperature in the cold season was 48 hours and for hot season was 24 hours. After approval of medical waste management regulations, Waste storage conditions has been improved , Among them is Karaj hospitals that results showed that 81.8% of hospitals have temporary waste standing with Good condition and adequate space(Fazili). In similar studies in Mashhad(Ariyae M, 2010) , Ardabil("Check the status of hospital waste management, case study: public hospitals Ardabil in 2008," zazoli MA , Ardabilian MB) , amol, babul, and babolsar (Zarei A), they had a good condition in term of waste storage. But a research in Yasoj in 85 has shown that Waste storage period was 2-4 days and one-third of hospital were without temporary waste standing and the rest was in opposite with health standard (Raygan Shirazi AR, Mari Oryad H, & JM, 2006).

Waste collection and transportation

Usually the transportation of hospital waste assess according to the use of convenient cars, Methods for waste transport (Separately or mixed waste transfer) and the time of transportation. In Tehran, Motor Services Organization of Tehran Municipality is responsible for collection of hospital waste and also include private hospitals. One study has shown that transportation of trash in private hospitals in Tehran has been done by a car and as a mixed method that is the most unsuitable method for carrying out of hospital waste(Fatemeh Rezaei* & Omrani, 2007) . Within the collected hospital, we can use Tralee or cars for transport in minimum time. Daily
According to Farzad Kia (2006) in Tehran private hospitals Waste collection system in hospitals is done in two stages: First, gather at the hospital to transfer to a temporary storage area and then transferred from temporary storage area to permanent disposal location. The results showed that 50% of hospitals were in poor Disposal situation and 50% of the them were in mediocre situation (Farzadkia et al., 2009). In term of Waste collection, you should note that Increase the number of employees in these sectors will contribute to improve employee performance.

**Processing and disposal**

One of the most common methods of removing infectious hospital waste which has been used for many years, was installation of Incinerators. The disadvantages of such devices is such as High initial investment, air pollution, Problems with the operation, maintenance, and top depreciation requirement of trained personnel. For this reason most of the medical waste incinerators has not a proper performance, and also in many cases the device remains disable(Farzadkia M, 2013). To this goal, more recently, through the Ministry of Health and Medical Education, Autoclave is proposed for disinfecting medical waste and many of them have been installed in hospitals across the country. Apparatus for disinfecting the waste are in different types and can be classified as follows:

**Moist heat sterilization machine**

Steam sterilization, a Standard process in the hospital is used for sterilization of reusable instruments, and is used to deal with medical waste. There are two types of old equipment to deal through Steam: Autoclave and distillation chambers. The autoclave consists of a metal chamber that has a charging door that the steam surround it. The steam is located outside and inside the room and is designed to withstand the high pressure. Heating the outer chamber reduces condensation on interior walls and allows steam to be used at low temperatures. Because air is an effective insulator, Air transport from room is needed for a definite penetration to the waste. This is done in two ways: weight Shifting or pre-vacuum, if ventilation is not adequate, the bad odor is a problem of autoclave and distillation chambers.

**Dry heat sterilization machine**

The processes used of dry heat, we use heat without adding water or steam. Instead the waste heating with Natural Convection, or artificial or thermal radiation. In artificial thermal convection, Air heated by natural gas heaters in a room that a current is streaming. In some technologies, hot bedroom walls are being heated by conduction and natural convection. Other technologies uses Thermal radiation by means of infrared radiation and Quartz heaters to heat the waste. As a general rule, dry thermal processes uses more heat and less time than Steam-driven processes, the time and temperature required depends on the characteristics and quantity of waste. The amount of contaminate existing in external air has been decreased since the wastes are properly segregated and Hazardous chemicals have been prevented from entering the room. Residual waste are dry and indistinguishable. With crushing and pressing, the waste volume is reduced to 80% and is ready to eliminate.

**Chemical sterilization system**

Types of wastes that can be treated with a chemical technologies include: microbes Cultured in the laboratory, Limited amount of contaminated blood and fluids, Isolation and surgery wastes, Laboratory waste (including chemical wastes), Soft waste (gauze, fabrics, bandages, clothing and bedding). With enough time and temperature, The mechanical system for indistinguishing the waste ,Technically it is possible to deal with anatomical lesions, But the ethical, cultural, legal and other considerations can be prevented. Apparatus for crushing and disinfect and reduce waste volumes are required. By crushing all wastes into quite small pieces, by Preceding Spores disinfectants, Bacteria and viruses are completely destroyed and uses the preceding as the king of disinfectants, and finally preceding transformed into water, oxygen and carbon dioxide. A gap that cause reduction in the volume of most wastes, providing the best environment for germs and bacteria to be eliminated. Results of a survey in Tehran private hospitals in 86 has showed that none of the hospitals did not use the Safe construction devices (Monavari M, Winter 2009). According to another study of Subspecialty hospitals in Tehran, there is no Safe construction devices on wastes and this wastes has been brought to disposal site by municipal (Farzadkia M, 2013). And also the survey by majlesi in hospital covered by Shaheed Beheshti University in 2008 has shown that none of the hospital use the Safe construction system (Majlesi M, Kashitarash Esfahani Z, Alizadeh S, Forutani F, & Gachkar L, 2007). But results of various studies show that after the adoption of the Waste Management Regulations, Many of the nation’s hospitals are equipped with safety devices such as west Azerbaijan that more than 70% of them are equipped with safety devices.
CONCLUSION

Unfortunately, the research that has been done in the field of Hospital Waste Management in Iran was more in Tehran and major cities And a lot of academic research has not been done in small-town cities and This research may not also help to solve the problem of hospital waste. Studies has shown the situation before the adoption of the Waste Management Regulations There have been a very unpleasant situation as in west Azerbaijan(Nanbaksh H, 2002) and in jasoj(Raygan Shirazi AR et al., 2006) ... It has not been a coherent management But the regulatory situation has changed. As research in the city of Karaj (Fazili), Mashhad(Ariyae M, 2010), Qom (Jonidi, Jafaripour, & Farzadkia, 2010)... Waste management guidelines is able to change the hospital status of waste management unfortunately, this regulation has not been fully implemented.

REFERENCES


Farzadkia MAA, Emamjomoh M.2013. Review of hospital waste management in one of the highly specialized hospitals. The Journal of Qazvin University of Medical Sciences, 16(4), 107-109.


Fazili EA. Study of Hospital Waste Management in Karaj, Ecolody. 36(53), 99-106.


Nami M.2012. a. a. Waste compared to health centers in Ahvaz and other cities of the world. 16th National Conference on Environmental Health Center - October


Zarei A. 2013. Study of Hospital Waste Management in the city of Amol, Babol and BABOLSAR in 1391. 16National Conference on Environmental Health Center