

ASSESSMENT OF MEDICAL SOLID WASTE MANAGEMENT IN MISRATA HEALTHCARE CENTERS AND HOSPITALS

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ABSTRACT:

BACKGROUND: The management of medical waste is of great importance due to its infectious and hazardous nature that can cause risks on public health and environment. **AIMS:** The aims of the study were to assess medical waste management practices and to determine types of medical waste generated in healthcare facilities of Misrata City. **METHODS:** A survey questionnaire obtained from WHO was modified and used in collecting the required data, relating to the type of generated waste, process of segregation and handling, storage, transportation, treatment and final disposal, in addition to interviews with administrators and healthcare staff using questions composed of both open and close-ended questions. SPSS software was used to analyze data. **RESULTS:** This study indicated that HCFs do not quantify medical waste; 100 % of HCFs have a partial segregation of their medical waste types. Hands were used to transfer waste and the workers did not wear complete PPE. Only 3% of HCFs had partial sanitization practices of storage areas, which were not secured, and without any labeling with a bio hazardous symbol in 100% of the facilities. Waste collection happened randomly between 24 hours and 72 hours in 91.2% of HCFs in Misrata, only 8.8% of surveyed HCFs collect and transport the waste outside the hospital daily. No incinerators for medical waste in all HCFs at Misrata city; all HCFs disposed of their domestic and medical waste at the same site as the municipal waste. **CONCLUSION:** The process of medical waste management of government HCFs at Misrata city is poor and not received adequate consideration, since

there is inadequate and inefficient segregation, collection, transportation and storage of medical waste, in addition to absences of incinerators and treatment of hazardous medical waste.

KEYWORDS: Assessment, Medical waste, management, HCFs, Misrata.

Introduction:

Healthcare activities like diagnostic, medical treatment, surgical operation, and laboratory examinations are very important for saving human health and lives, however, different types of waste produced by healthcare activities is extremely hazardous to the human health and the environment if it is not managed properly (Hachicha et al., 2014). Progress in medical science and technology worldwide, in addition to and the increase in the number of healthcare facilities and institutions have accompanied by the increasing amount of hazardous medical waste. The management of medical waste is of great importance due to its infectious and hazardous nature that can cause risks on public health and environment (Al-Emad, 2011). The solid waste generated by healthcare facilities includes used syringe, bandages, intravenous drip bottles, blood bags, biomedical waste such as body organs, medical instruments etc. Medical solid waste management different from the domestic solid waste due to its harmful effects, and affected by many of the cultural, social and economic circumstances (Kumar et al., 2010). In developing countries, medical waste management still faces many problems; these problems are results of uncontrolled dealing, transportation, storage and disposal of these wastes, which contain causing of diseases and toxic contents. Improper management of medical waste can cause direct and indirect effects on human health and the environment (Hachicha et al., 2014). According to World Health Organization (WHO), waste generated from healthcare activities consists of about 80% of general waste (non-hazardous), and 20% medical waste or hazardous waste. Non-hazardous waste is waste relating to food products and residues of administrative activities, In general this type of waste is similar to household waste (Khalaf, 2009).

"The term medical waste includes all the waste generated within healthcare facilities, research centres and laboratories related to medical procedures, in addition it includes the same types of waste originating from minor and scattered sources including undertaken in the home like home dialysis, self-administration of insulin, etc." (Chartier, 2014). In general, medical waste classified to hazardous medical waste and non-hazardous medical waste. Hazardous medical waste types includes sharps waste, infectious waste, pathological waste, Pharmaceutical waste, cytotoxic waste, chemical waste, radioactive waste. Non-hazardous medical waste it is waste that does not have any particular biological, chemical, radioactive or physical hazards (Twinch, 2011). All persons who are in contact with medical waste are potentially exposed to the various risks either inside or outside healthcare establishments during the waste generation and handling if there is no medical waste management or if the management is inadequate (Lekwot et al., 2012). Medical waste management (MWM) includes all activities involved in the waste generation, segregation, transportation, storage, treatment and final disposal of all types of waste generated in healthcare facilities (Manyele and Lyasenga, 2010). Moreover, it is process that helps ensure proper hygiene in the health institutions and safety of healthcare workers and communities (Kudoma, 2013). The inefficient MWM is more likely to cause problems such as blood borne pathogens to the healthcare staff, scavengers, and municipal workers. Generally, infection with HIV, HBV, and HCV has a strong evidence for transmission via medical waste through the injuries from the syringe needle and other sharps contaminated by body fluid. In 2010, unsafe injections were still responsible for 33800 new HIV infections, 1.7 million HBV infections, and 315000 HCV infections (WHO, 2015). In addition, it has established that worldwide 5.2 million people (including 4 million children) die each year from medical waste related diseases (Babanyara et al., 2013).

World Health Organization (WHO) reports mentioned that many developing countries lack national laws, regulations and legislation governing the management of medical waste. Libya is one of these countries, where the environmental laws have not addressed the problem of medical waste in terms of definitions, collection, treatment or disposal. There were no clear

procedures for regulating medical waste by health facilities, which called the General Authority for the Environment, to consider this problem and formed a committee to establish an executive regulation governing the management of medical waste in Libya. The draft was prepared after reviewing several international laws in addition to the recommendations made by the World Health Organization to regulate waste from healthcare establishments (Altabet, 2016).

This study aims to assess medical solid waste management practice in Misrata city hospitals. Specific objectives of this study were to develop a comprehensive vision of healthcare waste management system in Misrata city hospitals and to determine the components, classification of medical solid waste in Misrata city hospitals.

Display problem:

With a constant increase in the number of hospitals, waste management has become a critical issue because of increase in the quantity of medical waste generated, which has high risks on health and environment. Lack of regulation and legislation about the true management practices give chance to illegal dumping and incineration of medical waste in unknown areas.

Materials and Methods:

Misrata is the third largest city in the north-west region of Libya, 210Km east of Tripoli,

with a population of over 500,000, and an area 3637km² (Misurata University, 2016). This study was carried out in 34 governmental healthcare facilities (HCFs), primary healthcare centers, polyclinics, general and specialized hospitals in Misrata from August 2016 to May 2017. A survey questionnaire for waste management obtained from WHO was modified and used in collecting the required data, relating to the type of waste generated, process of segregation, collection and handling, storage, transportation, treatment and final disposal. In addition to interviews with key informants, using questions composed of both open and close-ended questions. Data was

extracted from the survey questionnaires, observations and personal interviews. Statistical Package for Social Science (SPSS) version 17 was used to analyze data, Chi-square test was used to identify the relationship between questionnaires questions, and graphs were produced using Microsoft Excel.

Results

Generation, sources, types and classification of medical waste

The amount of medical waste generated in HCFs depend upon various factors such as size of establishments, number of beds, types of healthcare services provided, waste segregation options available, economic and general condition of the area where the HCFS are situated. In this study, we did not have an opportunity to measure the amount of medical solid waste due to the lack of possibilities, difficulty of weight and sorting of waste. However, during our interviews, there was not any information about the amount of medical solid waste generated from healthcare establishments, and whether departments produce the highest and lowest amount of waste. The source of medical solid waste at different healthcare establishments wards (male, female, children), delivery units, laboratories, ICU, theaters, X-ray units, outpatient clinics, pharmacies, surgery, dialysis, blood bank, dressing and injection room. Data analysis showed that the big hospitals both (general or specialized) are responsible for producing a large amount of waste (p value = 0.000) $p < 0.05$. Therefore more beds lead to increase in the rate of waste.

All visited places have generated medical solid waste such as dressing swab, cotton pads, used gloves, and sharps (cannula, needles, surgical blades, vials injection and syringes), in addition to general non-medical waste. In our study, Outpatient clinics wear present in 91.2% of HCFs, injection room and dressing room were responsible for generating waste like sharps, dressing pads, swab cotton, used gloves and waste related to medicines, 88.2% of HCFs had medical laboratories services that generate waste like (sharps, gloves, subjects contaminated with residues of blood and urine specimens and microbial culture), 38.2% of HCFs generated waste related to vaccination (empty vials of vaccines, cotton pads, syringes, needles), while there was no radiological

waste generated but 29.4% of HCFs produce waste from radiology services, 8.8% of HCFs provide services that generate waste like human organs and tissue (pathological waste), 5.8% of HCFs provide services that generate waste related to kidney dialysis (tubes contaminated with body fluids, plastic fluids bottles). Pharmaceutical waste was an expired medicine, most of it was stored in a stock rooms and returned to the main store. Table 1 shows the classification of medical waste at Misrata HCFs.

Table 1: Classification of medical solid waste generated from surveyed HCFs

Waste category	Components
Pathological waste	Human tissue waste, placenta, body organ, body parts.
Absorbent cotton	Items like cotton bad, bandages, which saturated or stained with human blood, pus, secretion.
Discarded medical plastic	Disposable gloves, syringe, IV bag, blood bag, tubes, or any contaminated plastic subject.
Infectious waste	Culture and stocks of infectious agents from test or examination, culture dishes, discarded blood fluids and containers, items that were in contact with infectious agents, such as used slides and cover glass.
Sharp waste	Discarded sharps, hypodermic needles, syringes, surgical blades.
Pharmaceutical waste	Expired medicine and genotoxic waste, vials contaminated with medicine.
Waste mixed with infectious waste	General or domestic waste, which was mixed with infectious waste usually.

Segregation, collection, handling and on-site transportation of waste

One of the healthcare staff's responsibilities is a proper management of medical waste that can be implemented by understanding how waste should be segregated, handled, treated, transported and stored. During our observation, segregation of medical waste in all of HCFs was not conducted

according to definite rules or standards. Segregation was done only for sharps, which was segregated at the point of generation. According to the information provided, 88% of HCFs used a yellow proof puncture containers or cardboard boxes for sharps, while 12% depends on drinking water bottles (fig.1).

Bins and basket with black bags were used in all HCFs to receive different types of waste generated from medical services provided. Black bags were placed every where waste was generated, in patient's rooms, offices, bathrooms, the corridors and rest areas. Waste bags were collected only if filled up or after shift finish, that could lead to puncture of the collection bag and cause injuries to the waste handlers during on-site transportation, 76.5% of questionnaires answers mentioned that they collect medical waste less than 3 times per one working shift working. The statistical analysis indicated that there was a direct relationship between type of HCF and the number of waste collecting times per shift (p value = 0.000 (< 0.005)).

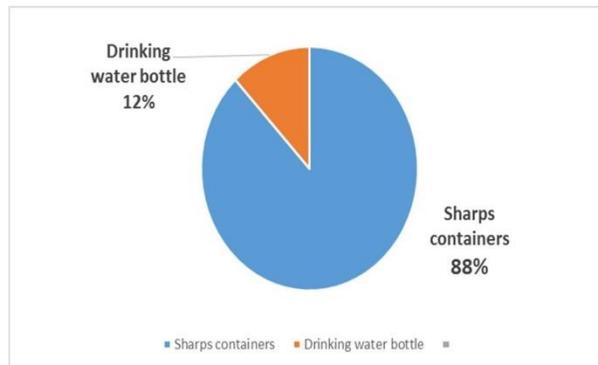


Figure 1. Types of sharps containers used

Medical waste handling was random (unplanned), cleaners were carrying medical waste bags with their hands to the storage bins without complete use of personal protective equipment (PPE), which especially happened in primary healthcare centers. Workers in 11.8% of HCFs did not use PPE when they were dealing with medical waste; moreover, 88.2% of HCFs workers were using different types of PPE. Gloves were worn in 82.4% of HCFs, 67.6% wearing apron and 8.8% were wearing shoes (fig.2).

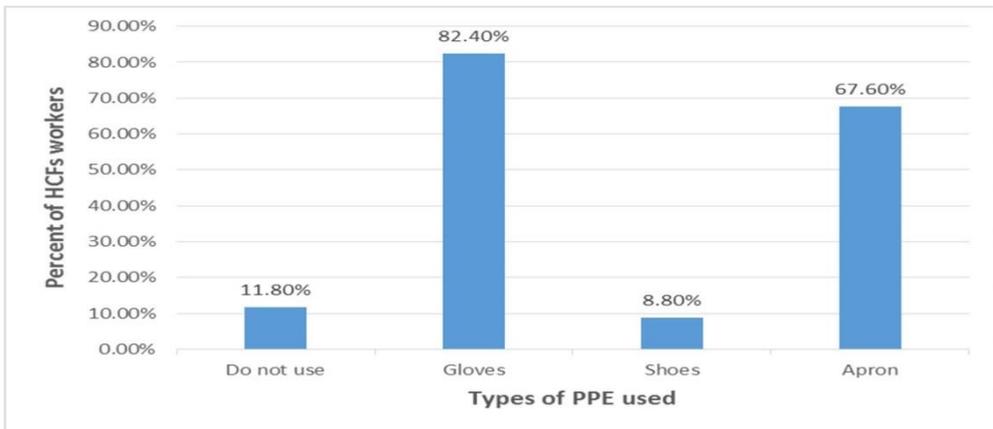
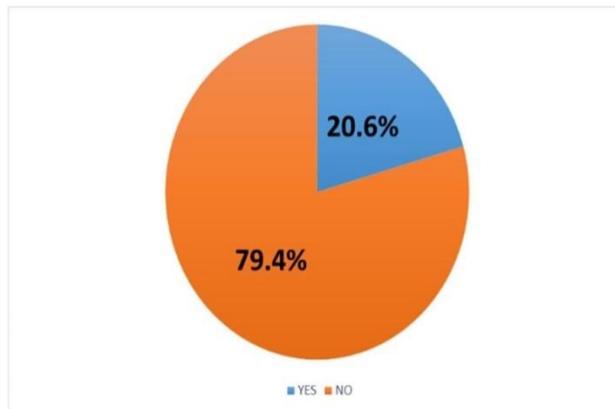


Figure 2. Types of PPE used by healthcare staff

Storage and off-site transportation of medical waste

Storage area of medical waste consists of large wheeled metal and plastic bins, which lacked labeling with bio hazardous symbol and were not secured. The storage area in 79.4% of HCFs had a paved ground (fig.3). Sanitation of storage areas is poor, only Misrata central hospital (MCH) had a way of cleaning and sanitization of temporary storage area in every 3 months with the



changing of storage area place.

Figure 3. Paved storage area

Open trucks were used for off-site transportation of waste to the final disposal site. Misrata municipality cleaning Services Company dose the off-site waste transportation from HCFs, and waste handlers were not well instructed about the collection and transportation of this type of waste. Waste collection happened randomly between 24 hours and 72 hours in 91.2% of HCFs in Misrata, only 8.8% of surveyed HCFs collect and transport the waste outside the hospital daily that was due to the large amount produced daily by these healthcare establishments (fig.4).

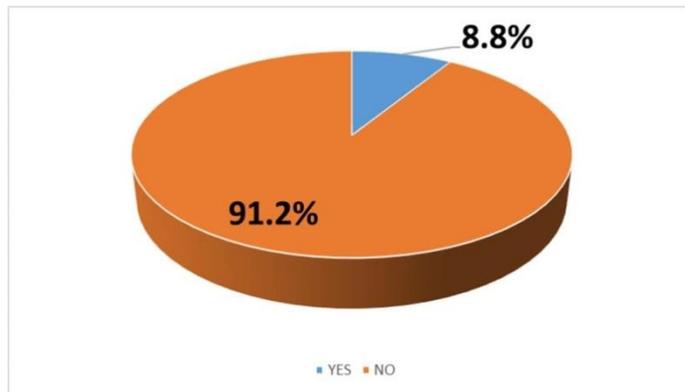


Figure 4. Off-site transportation of medical waste

Treatment and final disposal of medical waste:

There are incinerators for medical waste in Misrata HCFs; all hospitals disposed of their domestic and medical waste at the same site as the municipal waste. There is no treatment of medical waste at 94% of HCFs while 6% have a partial treatment for pathological waste such as human organs and tissues, by incineration (fig.5), Also there was one of the primary healthcare centers in the border of the city incinerate sharps and some other waste in a hole in the courtyard of the establishment. Medical solid waste was disposed along with general domestic wastes at open dumpsite 45 km outside of the city.

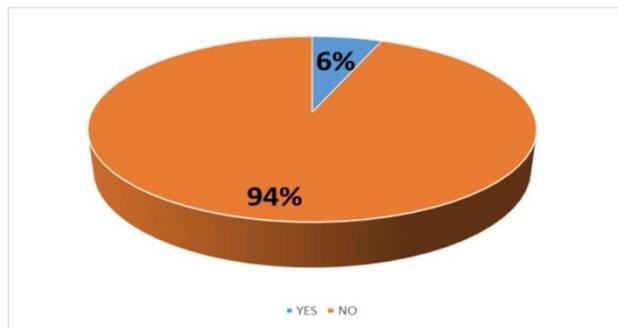


Figure 5. Treatment of medical waste

Training of workers on medical waste management:

This study indicated that workers in 61.8% of HCFs did not receive any training programs related to medical waste management practices; while 38.2% of HCFs had limited training (fig.6).



Figure 6. Training and education programs related to medical waste

Workers knowledge and awareness about potential risks associated with medical waste

Exposure to medical waste poses potential risks to healthcare workers, the public and the environment. Therefore, HCFs need to protect human health and the environment from the risks associated with inappropriate management of medical waste. In this study, workers in 67.7% of HCFs were familiar with the risks associated with medical waste and 32.3% of HCFs employs were not familiar with this hazard (fig.7). The most common risks knowledge cited by workers was human health risks, such as injuries from needlestick and sharps in addition to transmission of infectious diseases.

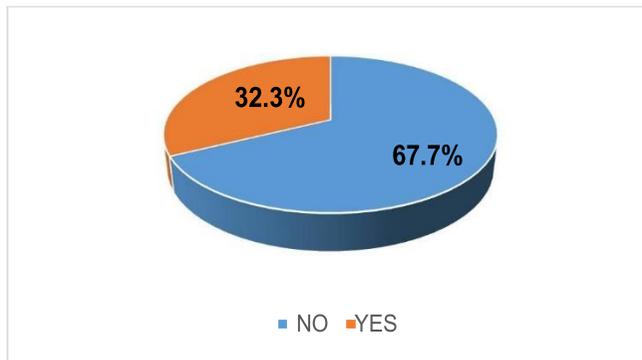


Figure 7. Workers Knowledge about MW risks

Discussion:

Generation rate of medical waste is different depends upon healthcare establishment and services provided, in addition to the capacity of HCF and number of beds. In Misrata, AL-hamrosh (2006) stated that 44 tons of medical solid waste produced per year, 28% were infectious waste, 72% were general waste and Misrata central hospital was producing about 46% of the total amount of waste. Another study included three parts of Libya; Sawalem et al. (2009) stated that the average generation rates of hospital waste were 1.3kg/bed/day, and the medical waste mixed with domestic waste and disposed of in the similar way of disposal. Mabrouk (2015) study stated that,

the average generation rate of the medical waste at the eight hospitals in northeastern part of Libya was 1.45 kg/patient/day.

Partial segregation procedure was observed in all HCFs that was generally ineffective, in addition to lack of special bins or bags for infectious waste except for sharps, Moreover absence of waste labeling with biohazardous symbols decreases the segregation efficacy. Healthcare staff in some HCFs lack experience in dealing with medical waste and consider it as domestic waste. A Study by El-Salam (2010) at El-Beheira Governorate hospitals showed that segregation of various medical waste types was carried out in all of the surveyed hospitals, none of them conducted it properly according to consistent rules and standards. Alwabr et al. (2017) stated that a lack of segregation processes of sharp and infectious/hazardous waste in all the studied hospitals in Yemen. The Use of PPE by workers dealing with waste is rare that is because of a shortage in supply of this equipment, in addition to workers neglecting to wear it, which agrees with study in Bangladesh by Patwary et al. (2012) where most of the workers 73% did not wear PPE regularly due to the shortage in supply. Mbarki et al. (2013) mentioned that only 28.6% of workers in handling and collecting of waste use appropriate equipment in Morocco. Storage areas in all HCFs lack of fencing that is due to lack of inconsistent buildings to have a good storage, and lacking of staff knowledge and familiarity about good practice of medical waste storage. In all HCFs, the storage areas were not sanitized, secured and easy for reach by visitors and animals, in Benghazi city, Libya study by Boushaala and Dihoma (2017) indicated that there were no rooms for waste storage, whether general or hazardous, storage containers are exposed to rain, sun, and winds, it is easy accessible by individuals, insects and birds. All types of waste were mixed together in storage containers. Vehicles used for off-site transportation failed to meet the safety requirements and there is a need for safe regional and marked transportation facility for this type of waste. Absence of incinerators leads to poor treatment of waste generated, there was not any treatment of waste and all waste generated was disposed of in open dumping site together with domestic waste, even those segregated sharps, These results and similar to Boushaala and Dihoma, (2017) study in the city

of Benghazi. Clear feedback got about lack of workers awareness in all HCFs about medical waste management importance. The training programs of healthcare workers is very important for health and safety at workplace in order to minimize risks, therefore healthcare workers should be trained and oriented on the health and safety measures in dealing with medical waste. Increasing awareness about medical waste will dissolve many problems and decrease workers exposure to the medical waste risks. The infection control office was responsible for the lectures and training programs at Misrata central hospital. Lacking of information, and shortage of financial resources were the reasons four the absence of no training.

Conclusion

The process of medical waste management of governmental HCFs at Misrata city is lack and not received adequate consideration, since there is inadequate and inefficient segregation, collection, transportation and storage of waste, in addition to absence of incinerators and proper treatment of waste.

After deep questions with healthcare staff, answers revealed that segregation applied only for sharp waste, which was collected in special sharp boxes at the beginning after usage. Typically, handling of medical waste in the surveyed HCFs was assigned to healthcare workers who performed all activities without proper training and with insufficient protection. Collection done first by nurses and cleaners then transported with other types of waste mostly by cleaners. A collection of medical waste was made in plastic sacks as well as domestic waste disposed in the same way, the common mode of medical waste transporting to the storage containers was by hands, this indicated a lack of training and awareness of potential risks associated with medical wastes. In some HCFs, which produce large amount of waste, not labelled wheels trolleys were used to transport medical waste to the storage area. The waste storage containers were not labelled and there were not marked to show place of storage, in addition to lack of secure and sanitization. Besides that, training courses and awareness programs about medical waste management for healthcare workers were very limited. The main treatment method used before final disposal of pathological waste was incineration; other type of waste is disposed of in open land. Misrata

municipality cleaning services company do the final disposal of the medical waste. Accordingly, HCFs should pay more attention towards policies for the proper management and disposal of wastes, additionally, there is need to be incorporated into regular worker training, continuing education, and management evaluation processes for systems and personnel.



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