

## Assessments case of medical waste management in hospitals in Iraq



Sagvan A. Mohamed\*, Najmadin E. Hassan, Najlaa M. Ali

Department of Environmental Science, Faculty of Science, Zakho University, Zakho, Iraq

### ARTICLE INFO

#### Article history:

Received 27 July 2017

Received in revised form

2 November 2017

Accepted 26 November 2017

#### Keywords:

Medical waste management

Medical waste treatment

Incineration and autoclaving

Safety disposal of medical waste

### ABSTRACT

This study describes the evaluation case of medical waste management in the largest hospital in terms of the number of sections and the number of patients and visitors to Shaabaniya and Bidar Hospital in Zakho city, Iraq's Kurdistan region. Found through this study the number of the patients referred to hospital for the various tests of males and females in different ages is about (706958 patients) and the number of the patients who remained is about (32926) which lasted for two years as of (15/06/2015-30/05/2017). The number of varies surgical operation in the hospital of Shaabaniya is about 12801 operation during the same years (2015-2017), this leads to increases the amount of hazardous medical waste that was reported at the above mentioned clinics 27250 Kg and 5711 Kg, respectively. The aim of this study is to activation the role of medical waste in the separation, collection, storage, transport, and treatment of these wastes. And reduce the rate of medical waste generation, both in terms of quantity and quality, by developing the technology used, adopting clean technology, and selecting substitutes or primary materials that are less invasive of the environment and public health. But the result of study show the existence of administrative practices of improper disposal of medical waste in terms of the separation of hazardous and non-medical waste operations and this is due to the negligence and carelessness in the instructions issued by the authorities of administrative supervising the application of the collection, separation, transport and storage of the waste temporarily inside hospital pending transfer to operations final treatment with municipal waste. In addition to the lack of environmental awareness among workers in the field of hygiene and lack of provision of required equipment for personal protection and the lack of a program or plans to train workers in hygiene and how to deal with the medical waste and Prevention, note that the continuous production of waste per day throughout the year, so it is necessary to work hard to improve the administration consistently and effectively and to work hard to provide the infrastructure necessary for the success of the administrative process required.

© 2017 The Authors. Published by IASE. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### 1. Introduction

Medical waste from health care to patients in the hospital mentioned a medical waste resulting from the analysis of pathological and medical laboratories, diagnostics and surgical procedures in the various section and others considered hazardous waste. And have negative effects on the various workers in these health institutions and various visitors if it is not addressed properly as this waste is infectious and contain viruses and microbes spread fast and also sharp objects contaminated fluids of patients. In

addition to containing hazardous chemicals on humans, this could cause mutations and deformities of the revival of the surrounding environment (Prüss-Üstün et al., 1999; Subratty and Nathire, 2005). Where there are many diseases that can be transmitted through medical waste such as (Lever Inflammation virus B), (Lever Inflammation virus C) and other diseases through exposure to injury wounds from sharps in the waste such as sharp needles contaminated with the blood of patients living with these germs. So you have to take these risks into account in waste treatment and reduction of the risk system (Anderson, 1995; Hasan, 1998). Developed countries produce quantities of medical waste much larger than those produced by the developing countries because of technology used in these various centers of medical waste which makes

\* Corresponding Author.

Email Address: [sagvan.mohamed@uoz.ac](mailto:sagvan.mohamed@uoz.ac) (S. A. Mohamed)

<https://doi.org/10.21833/ijaas.2018.01.017>

2313-626X/© 2017 The Authors. Published by IASE.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

a real critical problem that needs more attention (Cross et al., 1990).

And more exposed directly to these risks are working in the health centers and, in particular, all of the works in the field of nursing and various health centers in addition to the crew cleaning outside the hospital, and also to visitors and residents adjacent to places of final disposal of medical waste, such as cemeteries and places of final treatment, such as incinerators (Cole, 1995; WHO, 2000; Cocchiarella et al., 2000).

There are risks to public health and the environment is created through the modes of transport of dangerous and infectious waste in addition to the resulting spectrum of the air, water and soil pollution. This study was conducted in general hospital of Zakho city during 2015-2017. The major goals of this study are environmental impact assessment of medical waste management in general hospital of Zakho city /Kurdistan region/Iraq. And also to reduce the rate of medical waste generation both in terms of quantity and quality by developing the technology used, adopting clean technology, and selecting substitutes or primary materials that are less invasive of environment and public health. As well as to ensure execution of law, regulation and education awareness to protection the environment.

### 1.1. Forms of waste

Solid and liquid and gaseous and radioactive wastes, this waste is usually produced through techniques and methods of prevention and analysis, diagnosis or treatment of the ongoing research in the field of special human being and animal diseases and annually produces millions of tones amounts graduated from health care centers in the world (Cole, 1995).

## 2. Research methodology

The results of this study are mainly dependent on the effort by a component of a team of three people in addition to the advantage of some of the evidence issued by the Department of Statistics at the head of the health of the city of Zakho in relation to the field of study. The primary goal of this study was to take advantage of these findings is to provide researchers statistics-where the results were analyzed and subjected to many of the discussion to come out as a realistic treatment of medical waste in hospitals above-mentioned data were collected by field work team, where the data was checked and analyzed through Organizer statistical analysis.

## 3. Results

The results of the study showed that the number of the patients referred to hospital for the various tests of males and females in different ages is about (706958 patients) and the number of the patients who remained is about (32926 patients) according

to Table 1 (Fig. 1), which lasted for two years as of (15/06/2015 - 30/05/2017). Addition to the number of varies surgical operation in the hospital of Shaabaniya is about (12801) surgical operation during the same years above according to Table 2 (Fig. 2), this leads to increases the quantity of solid medical waste from health care in the hospital of Shaabaniya (The refugee camps in Percvy, Jamsko and Pajd Kendal) and of the General Hospital in Zakho during the years (2015.2016.2017) is about (27250 Kg), are more than the waste in the hospital of Bidar during the same years it is about (5711Kg) according to the Table 3 and Fig. 3, data and figures declared from the 15/06/2015-30/05/2017 that treated at Bidar hospital was very small compared to those medical waste treated at Shaabaniya hospital due to the following reasons:

1. Where the various numbers of surgeries and laboratory tests is few in Bidar hospital compared to those in Shaabaniya hospital this means that the amount of medical waste produced at Bidar hospital is also small compared to those in Shaabaniya hospital for the period time mentioned below according to table and data and statement.
2. There is a lack of environmental an awareness among those involved in separation, collection, storage and transfer of medical waste and lack of knowledge of health risk that may be produce from them.
3. The absence of a special temporary storage room for medical waste in both inside hospital mentioned above and specifications required in terms of ventilation until transfer to the final treatment.
4. The device incineration of medical waste in Shaabaniya hospital is old and the treatment capacity is limited up to the (80kg) at various temperatures, addition to the operation of required device to about (2000-3000) liter of fuel (diesel), which means that burning of those wastes lead to emission of polluting gases to the atmosphere.
5. Residues of treated waste (ash) are mixed with municipal waste than transferred to open landfill site, this is a negative indicator of environmental management of hospital because its affects health and environment safety.
6. The absence of closed special landfill site and international standards for its, which in turn affects the aquifers on the one hand, and public health, as of the result of the unpleasant odors that emanate from them.

### 3.1. Medical waste separation

Results of the study showed that the hazardous medical waste are more separated in the hospital of Shaabaniya up to (27250 Kg), and in the hospital of Bidar up to (5711 Kg) according to the Table 3 (Fig. 3).

### 3.2. Medical waste treatment inside the hospitals

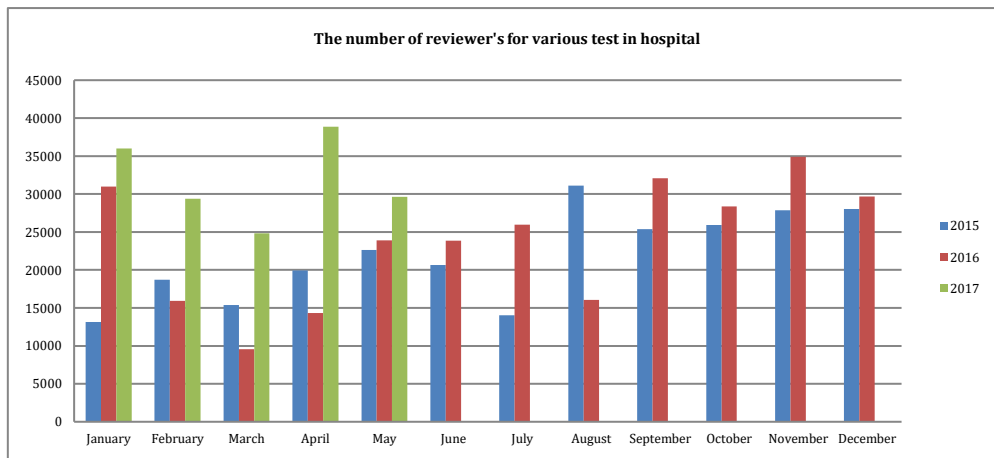
The periodical wastes that have been separated and collected in the hospital of Shaabaniya, the results show that solid waste will be collected by more than times a week season while the periodical wastes that have been separated and collected in the

hospital of Bidar, the results show that solid waste will be collected by more than five day a week season

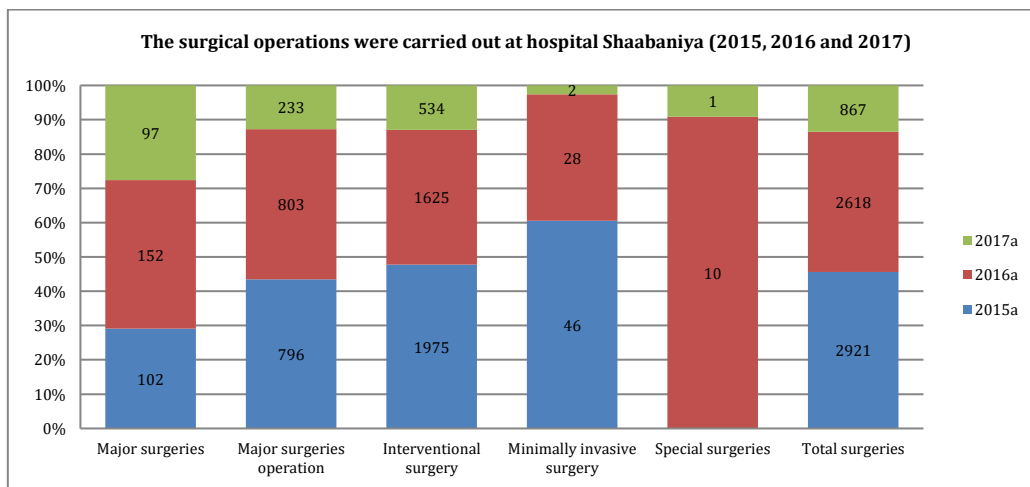
But in terms of how the transfer of medical Hazardous waste is transported from the source of the various sections by workers to a room close to the final treatment room (incinerator).

**Table 1:** Total number of reviewer's patients for various tests in the hospital (2015, 2016 and 2017)

Months	The number of reviewers for various tests in hospital			The number of patients remained in hospital		
	2015	2016	2017	2015	2016	2017
Jan	13146	30964	36011	7909	0424	0665
Feb	18715	15911	29383	2355	0525	0973
March	15384	9558	24811	0695	0107	0545
April	19945	14308	38855	1185	0178	0336
May	22645	23909	29616	1689	0220	0449
June	20659	23836		3641	0612	
July	14020	25956		2335	0210	
Aug	31092	16061		0788	1179	
Sept	25359	32079		0687	2069	
Oct	25920	28372		0819	0601	
Nov	27857	34886		0558	0273	
Dec	28012	29688		0410	0489	
Total	262754	285528	158676	23071	6887	2968
Mean	21896	23794	31735	1923	573.9	593.6
Std. Deviation	5898	8079	5633	2120	552.6	244.3
Std. Error	1703	2332	2519	612	159.5	109.2
C.V.	26.94%	33.96%	17.75%	110.26%	96.28%	41.15%



**Fig. 1:** Total number of reviewer's patients for various tests in the hospital (2015, 2016 and 2017)



**Fig. 2:** The surgical operations were carried out at hospital Shaabaniya (2015, 2016 and 2017)

### 3.3. Medical waste treatment

The quantity of solid medical waste from the Hospital of Shaabniya and Bidar are (27250Kg),

(5711Kg) according to Table 3 (Fig. 3), respectively, and the method used in the waste treatment in the hospital of Shabaniya is the incineration, but in the Hospital of Bidar the method used in the waste

treatment is the Autoclaving. After the incinerations and Autoclaving of solid waste the remained ash

after incineration will be collected and transported to the place of final disposal.

**Table 2:** The surgical operations were carried out at hospital Shaabaniya (2015, 2016 and 2017)

Month	Major surgeries			Major surgeries operation			Interventional surgery			Minimally invasive surgery			Special surgeries			Total surgeries		
	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017
Jan	5	9	28	75	84	34	142	195	105	5	2	-	-	-	-	227	290	167
Feb	10	4	24	67	62	55	158	80	135	8	-	2	-	-	1	243	146	217
March	7	1	12	56	50	41	145	78	95	3	3	-	-	-	-	211	132	148
April	11	10	19	51	65	43	182	97	95	4	3	-	-	-	-	248	175	157
May	15	3	14	74	53	60	197	131	104	7	5	-	-	-	-	293	192	178
June	15	1		74	78		159	135		-	5	-	-	-	-	248	219	
July	6	2		57	62		160	99		2	-	-	-	-	-	225	163	
Aug	4	46		69	100		154	263		5	7	-	6	-	-	232	422	
Sep	9	20		86	43		189	118		5	-	-	1	-	-	291	182	
Oct	8	1		55	67		139	126		1	-	-	1	-	-	203	195	
Nov	8	25		48	67		140	149		-	2	-	1	-	-	196	244	
Dec	4	30		84	72		210	154		6	1	-	1	-	-	304	258	
	102	152	97	796	803	233	1975	1625	534	46	28	2	-	10	1	2921	2618	867
Mean	8.5	12.67	19.4	66.33	66.92	46.6	164.6	135.4	106.8	4.6	3.5	2	-	2	1	243.4	218.2	173.4
Std.																		
Deviation	3.754	14.55	6.693	12.77	15.49	10.64	24.07	52.17	16.47	2.171	2	0.0	2.236	0.0	35.81	79.22	26.82	
Std. Error	1.084	4.2	2.993	3.685	4.471	4.760	6.948	15.06	7.365	0.6864	0.7071	0.0	1.0	0.0	10.34	22.87	11.99	
C.V.	44.16%	114.87%	34.5%	19.25%	23.15%	22.84%	14.62%	38.53%	15.42%	47.18%	57.14%	0.00%	111.8%	0.00%	14.71%	36.31%	15.47%	

### 3.4. Final disposal of medical waste

The medical waste treatment (ash) will be transported mentioned above to the place of final disposal, a random garbage in most cases The environmental and health conditions required are not available.

### 4. Discussion

It produces large quantities of solid medical waste from the hospital, but there is a disparity in terms of the amount of solid waste produced by the hospital of Shaabaniya is much larger compared with the Hospital of Bedar and this is due to the following reasons are not taken to treat patients in Bidar hospital, except in special cases, and this reduces the amount of solid waste to some extent, Add to that more cases of patients, Add to that more cases of patients and emergencies are, diagnosis, surgery and childbirth treatment done in the hospital of Shaabaniya and this means that solid medical waste is more compared with Bidar, on other hand, hospital patients in the emergency department after settling the health status of them are sent to Bidar Hospital also it reduces the amount of medical waste generated in Bidar Hospital.

Where not being complete separation of medical waste process in the Shaabaniya hospital with its various sections in an integrated and clear parameters for the piece, the amounts that have been collected and separated and stored and transferred to incineration there are low quantity of the medical waste solid and the total cost of the treatment is also low, and this contrasts with reality so that the percentage of the total separation of solid medical waste in various hospitals is different. Preferably no solid medical waste collection on a daily basis this cannot happen in the hospital of Shaabaniya and this exacerbates the risk of such waste because most of the collection of such waste containers are open, leading to the presence of insects it may cause transmission of microbes, some

of the diseases to visitors and worsen the situation in the summer due to high temperatures. The transfer of the waste from the temporary storage location within the hospital process are transported manually and this is incompatible with the professional integrity to the cleaners so it was essential that this process is done by a private transport vehicles so that the waste remains far from the bodies of the cleaners during transportation to avoid their exposure to any harm or infection patients likely to reach them by viruses. The treatment Open burning of municipal waste in an improper manner and method of its many risks and most important emissions toxic gases such as Dioxin and other toxic gases. Where there is no perfect one way to treatment of all medical waste, where there are many Alternatives and options for the treatment of solid medical waste each has features that must be studied in detail by choice.

There is a way to treatment their solid medical waste incineration and is a way to burn a regulator at elevated temperatures. There is a method that deal with solid medical waste incineration and is a way to burn organizer for those wastes in the high temperature of 800-1200 degrees a percentage, but this method results in direct air pollution And that the filter is not available for the purification of the resulting gases, All of this leads to health risks for people who live near it.

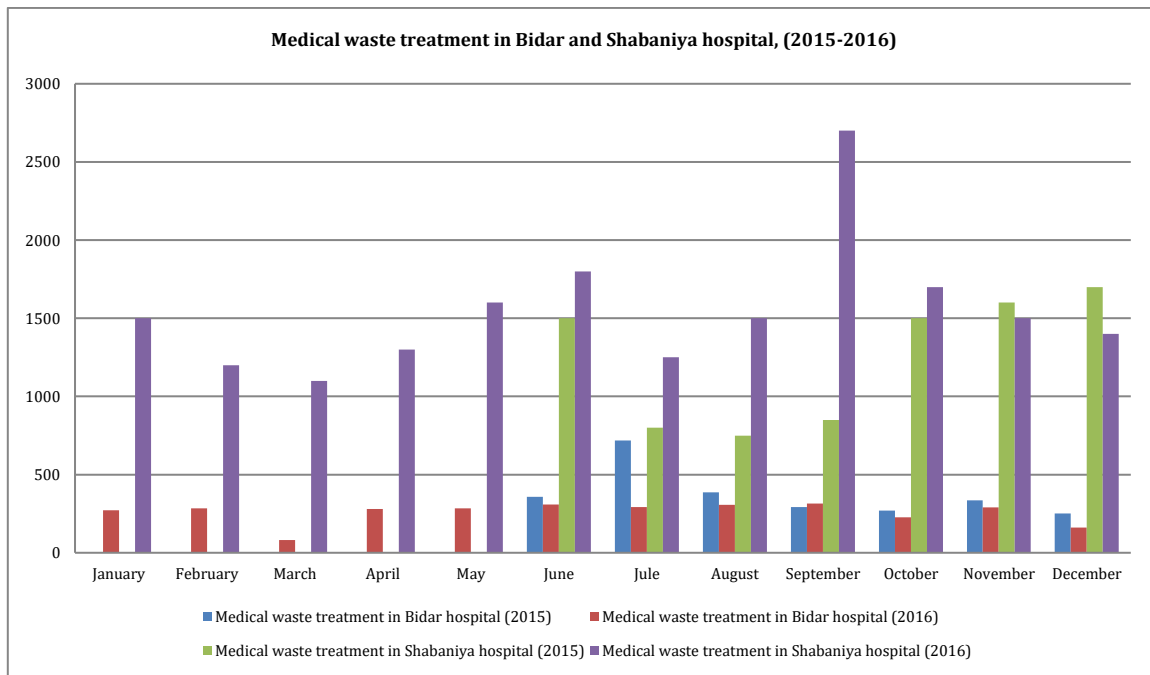
Another way of treatment is the disinfection method is divided into three ways, including, Autoclaving, Microwave irradiation disinfection, Chemical disinfection. This method is effective in killing microbes and viruses and bacteria, as well as effectively killed by natural chemical processes of all living organisms capable of causing infectious diseases .This method is expensive and is not suitable for all kinds of solid waste, but it is fast treatment. Preferably the container waste collection are closed tightly all the time except for times of packing or unloading and be in a place dedicated to the piece that does not allow for one entry to the area and its presence except authorized to enter, and

also are not exposed those dedicated medical waste for rain water containers, And the area of control and custody subject as much as possible, The process of transfer of the waste to the place of final disposal by the local municipal authorities, is random dumps unhealthy mostly Unprotected it increases the risk that medical waste in addition to pet animals that attend to those landfills each of these solutions is totally unacceptable process of landfill without

treatment be dangerous and leave the negative effects hazardous to the environment and public health, As well as the soil as a result of leakage of toxic leachate into groundwater aquifers. There are no notation information dealing with medical waste and there are no specific plans and programs about opening training and educational courses on medical waste treatment and final disposal so as to ensure the health and environmental safety.

**Table 3:** Medical waste treatment in Bidar and Shabaniya hospital, (2015-2016)

Month	Medical waste treatment in Bidar hospital		Medical waste treatment in Shabaniya hospital	
	Weight/kg 15/06 2015-31/12/2015	Weight/kg 01/01 2016-31/12/2016	Weight/kg 15/06 2015-31/12/2015	Weight/kg 01/01 2016-31/12/2016
Jan		271		1500
Feb		284		1200
March		81		1100
April		280		1300
May		284		1600
June	357	309	1500	1800
July	718	292	800	1250
Aug	386	307	750	1500
Sept	292	314	850	2700
Oct	270	226	1500	1700
Nov	336	290	1600	1500
Dec	252	162	1700	1400
Total	2611/kg	3100/kg	8700/kg	18550/kg
Mean	373	258.3	1243	1546
Std. Deviation	159.5	69.99	420.7	417.5
Std. Error	60.28	20.21	159	120.5
C.V.	42.76%	27.09%	33.85%	27.01%



**Fig. 3:** Medical waste treatment in Bidar and Shabaniya hospital (2015-2016)

**5. Recommendations**

The following recommendations are the outcome of this work:

1. The definition of medical waste, such as its types, dangers methods of collection, transport, storage and proper treatment methods that do not harm the health and environment.
2. Choose the required specification of the treatment tools
3. Follow the separation, collection, transport and storage system and proper disposal of medical waste each step must be clearly described.
4. Reduce the volume and weight of medical waste at sources.
5. Demand the training for worker how has direct contact with medical waste.
6. Wear protection clothing and gloves during separation transport of medical waste to avoid potential hazards.

7. Develop a periodic program to monitor and control the various vocabularies of ecosystems.

### Acknowledgment

The authors would like to thank Zakho health president and its staff for providing institutional and personal support to achieve this work.

### References

- Anderson GK (1995). Incineration as a waste disposal option in EMRO. World Health Organization Regional Office for the Eastern Mediterranean, Amman, Jordan.
- Cocchiarella L, Deitchman SD, and Young DC (2000). Report of the council on scientific affairs: Biohazardous waste management: What the physician needs to know. *Archives of Family Medicine*, 9(1): 26-2.
- Cole EC (1995). *Medical waste management, a basic guide for Central and Eastern Europe*. DynCorp, Biotechnology and Health Division, Durham, North Carolina, UK.
- Cross FL, Hesketh HE, and Rykowski PK (1990). *Infectious waste management*. Technomic, Lancaster, UK.
- Hasan SE (1998). *Geology and hazardous waste management*. Prentice Hall, Upper Saddle River, USA.
- Prüss-Üstün A, Giroult E, and Rushbrook P (1999). *Safe management of wastes from health-care activities*. World Health Organization, Geneva, Switzerland.
- Subratty AH and Nathire MH (2005). A survey on home generated medical waste in Mauritius. *International Journal of Environmental Health Research*, 15(1): 45-52.
- WHO (2000). *Wastes from health activities*. World Health Organization, Geneva, Switzerland.