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Article *in* Environmental Earth Sciences · January 2011

DOI: 10.1007/978-3-540-95991-5_49

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Solid Medical Waste Management in Healthcare Centers in Palestine

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Abstract: This paper discusses the current situation of solid waste management in healthcare centers in Palestine. The monthly estimated quantity of solid waste produced by the healthcare centers in Palestine was 472.9 tons. There is very little separation of solid waste in primary healthcare centers (38.1%) as compared to secondary healthcare centers (71%). Only 17.3% of the healthcare centers in Palestine perform treatment of their solid waste. The place of final disposal of healthcare waste is an unsanitary dumping site owned by the local authority, and is used by 87.2% of the healthcare centers. Collection, storage and disposal of healthcare waste constitutes an environmental problem that poses an important health risk and calls for immediate attention and intervention. Healthcare centers have inadequate refuse collection services, lack of storage and disposal facilities. Special efforts should be made to improve the healthcare management in an effective and integrated manner.

Key words: Palestine, healthcare solid waste, management, health effects

Introduction

The term waste refers to discarded or unwanted materials. Healthcare facilities are one of the major producers of solid wastes in nature. Healthcare solid waste includes both non-hazardous and hazardous waste constituents. According to WHO (2002), almost 80% of healthcare wastes are benign and comparable to domestic waste while the remaining approximately 20% are considered hazardous, as it may be infectious, toxic and/or radioactive (Subratty and Hassed 2005). The non-hazardous waste includes wool, kitchen wastes, etc. that do not constitute any special handling problem, risk to health or to the environment. The hazardous waste includes pathological, infectious, sharps and chemical wastes (Mato and Kasenga 1997).

Improper management of wastes generated in healthcare facilities causes direct health impacts on the community, the personnel working in healthcare facilities, and on the environment. Lack of adherence to standards for the disposal of waste not only reduces the quality of health and welfare of the entire society but also increases the workload of health services, which both obstruct health management policies and affect the national economy (Askarian *et. al.* 2004).

The characteristics of waste from healthcare centers are similar in all countries except for amounts generated due to standard procedures executed in the healthcare field. The quantities of waste generated from healthcare services among other factors depend on the status of the healthcare center, level of instrumentation, and sometimes location of the healthcare facility.

Legislation on the safe disposal of healthcare wastes may vary from one country to another (Hagen *et. al.* 2001).

Healthcare centers often generate significant quantities of wastes containing materials of biological origin. These biological wastes may be subject to special management requirements because they contain: a) biohazardous (infectious) agents; b) blood or other body fluids; c) toxins; d) pathological wastes, solid human or animal tissues; and e) needles, scalpels, syringes, and other sharp objects that form physical hazards and may be contaminated with biohazardous agents (Mato and Kaseva 1999).

Poor management of healthcare waste can cause serious diseases to healthcare personnel, waste workers, patients, and to the general public. The greatest risk posed by infectious waste is accidental needle stick injuries and the reuse of syringes. WHO estimated that in 2000, worldwide, injections undertaken with contaminated syringes caused about 23 million infections of hepatitis B, Hepatitis A, and AIDS infections, in addition to other diseases. During the handling of wastes, injuries occur when needles or other sharps have not been collected properly in rigid containers. Conditions such as inappropriate design of waste collection, overflow of existing sharp containers, unprotected pits, improper dumping, and easy public access to healthcare wastes are risk factors increasing the public risk exposure to needle stick injuries. Children are particularly at risk to exposure to healthcare wastes (World Health Organization (WHO) 2005).

In addition to health risk derived from direct contact, healthcare waste can adversely impact human health by contaminating water bodies and polluting the air during waste management (Rau *et. al.* 2000).

Segregation of wastes is in some way a minimization of wastes by the separation of wastes. For healthcare wastes, the main aim of treatment is to disinfect infectious waste, to destroy disposable healthcare devices which should not be used (Massrouji 2001).

The aim of this research was to assess health care waste (HCW) management practices in the Palestinian territory including segregation, collection, storage, transport, treatment and final disposal, in addition to identifying quantities of solid wastes generated by healthcare centers.

Methodology

The target population of this survey are all healthcare centers in the Palestinian Territory. The sample size included all governmental and non-governmental healthcare centers, totaling 663 (adding up 116 centers of hospitals, 420 centers of healthcare and dental practices, 127 centers of other human health activities. The sample of the survey is a single-stage stratified cluster random sample.

The data was collected from two sources, and each one of these followed a particular method: 1) the data obtained from administrative record sources (governmental and non-governmental healthcare centers), where they apportion the questionnaires to the respondents who fill them by themselves; 2) the data obtained from the private healthcare sector that was collected by well trained field workers.

The tool of data collection was a questionnaire. The questionnaire included questions about 1) the amounts of HCW collected, 2) HCW collection service availability, 4) frequency of

HCW collection, 3) HCW collection equipment and vehicles, 4) HCW treatment, 5) HCW final disposal methods, and others.

All questionnaires were edited both in the field and in the office. Data were entered into the computer, using Microsoft Access, and analyzed using other statistical analytical system SPSS version 12.0.

Results

The results of the environmental survey of healthcare centers conducted by the Palestinian Central Bureau of Statistics (2005) were utilized, analyzed and conclusions and recommendations were derived.

Quantity

The monthly estimated quantities produced by the healthcare centers in the Palestinian Territory were about 472.9 tons including 374.9 tons in the West Bank and 98.0 tons in Gaza Strip. Out of the total, the estimated quantities produced by the secondary healthcare centers in the Palestinian Territory were about 198.2 tons, as shown in figure 1.

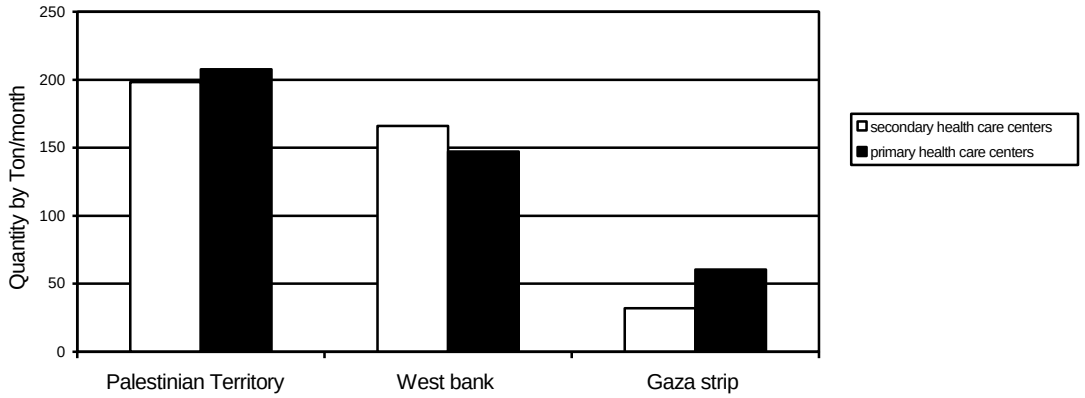

Figure 1. Estimated quantities of produced solid waste from healthcare centers estimated by tons/month

Separation

Only 34.1% of the healthcare centers in the Palestinian Territory perform separation of healthcare waste components, as shown in table 1. Out of the centers that separate healthcare waste, 70.1% of them partially separate the waste, while 29.9% of them completely separate the waste into its components.

Transportation

The transportation in the healthcare centers in the Palestinian Territory that perform separation of solid waste into its different components is done manually in 90.2%, 94.3%, and 97.0% of the healthcare centers for general waste, infectious waste, and sharp waste respectively, as shown in table 2. Special carriages used for the transportation of the different components of separated solid wastes are found in low percentages. The periodicity of collecting general, infectious and sharp healthcare wastes of more than 6 times per week was

15.4%, 31.2%, and 7.8% respectively in the healthcare centers of the Palestinian Territory as shown in table 3.

Table1. Percentage distribution of healthcare centers in the Palestinian Territory by existence of solid waste separation and type of separation and region

Region and type of Healthcare center	**Existence of separation**	**Type of separation**		
		Partial	Completely	Total
Palestinian Territory	**34.1**	**70.1**	**29.9**	**100**
Secondary	71.3	62.2	37.8	100
Primary	34.5	73.3	26.7	100
Other	19.0	25.9	74.1	100
West Bank	**37.8**	**66.3**	**33.7**	**100**
Gaza Strip	**25.1**	**84.4**	**15.6**	**100**

Table 2. Percentage distribution of healthcare centers in Palestinian Territories by the solid healthcare waste transportation method

Region and type of Healthcare center	**Type of waste and transportation method**											
	General waste				**Infectious waste**				**Sharp waste**			
	Manual	Special Carriage	Both Methods	total	Manual	Special Carriage	Both Methods	total	Manual	Special Carriage	Both Methods	total
Palestinian Territory	**90.2**	**1.9**	**7.9**	**100**	**94.3**	**2.1**	**3.6**	**100**	**97.0**	**1.6**	**1.4**	**100**
Secondary	83.4	8.3	8.3	100	84.2	2.0	13.8	100	6.6	3.3	90.1	100
Primary	89.9	1.6	8.5	100	95.7	2.2	2.1	100	1.1	1.5	97.4	100
Others	100.0	0.0	0.0	100	100.0	0.0	0.0	100	0.0	0.0	100	100
West Bank	**88.5**	**2.1**	**9.4**	**100**	**94.4**	**2.5**	**3.1**	**100**	**96.9**	**1.7**	**1.4**	**100**
Gaza Strip	**97.6**	**1.2**	**1.2**	**100**	**93.9**	**1.0**	**5.1**	**100**	**97.2**	**1.1**	**1.7**	**100**

Table 3. Percentage of healthcare centers by weekly periodicity of general waste, infectious waste, and sharp waste collection, by region and types of healthcare centers that separate the healthcare waste.

Region and type of Healthcare center	**Type of waste and weekly periodicity of collection**											
	General waste				**Infectious waste**				**Sharp waste**			
	More than 6 times	4-6 times	1-3 times	total	More than 6 times	4-6 times	1-3 times	total	More than 6 times	4-6 times	1-3 times	total
Palestinian Territory	**15.4**	**47.7**	**36.9**	**100**	**31.2**	**29.3**	**39.5**	**100**	**7.8**	**22.9**	**69.3**	**100**
Secondary	78.5	17.0	4.5	100	62.4	13.3	24.3	100	37.9	14.9	47.2	100
Primary	11.5	49.8	38.7	100	26.2	32.5	41.3	100	5.3	23.7	71.0	100
Others	11.5	46.8	41.7	100	28.3	15.2	56.5	100	28.9	16.0	55.1	100
West Bank	**16.1**	**38.1**	**45.8**	**100**	**25.6**	**23.6**	**50.8**	**100**	**7.8**	**20.1**	**72.1**	**100**
Gaza Strip	**12.4**	**86.9**	**0.7**	**100**	**46.5**	**44.7**	**8.8**	**100**	**8.2**	**33.7**	**58.1**	**100**

Treatment

The percentage of the healthcare centers in the Palestinian Territory that do perform treatment of healthcare waste is about 17.3%, of which 32.9% in secondary healthcare centers, 16.7% in primary healthcare centers and 17.7% in the other human health activities as shown in table 4.

For those healthcare centers that perform treatment, the most common treatment methods are open burning, chemical disinfections, and thermal disinfections with percentages of 56.5%, 17.2% and 11.3% respectively.

Table 4. Percentage of healthcare centers that treat waste by region, type of treatment and type of healthcare center

Region and type of Healthcare center	**Existence of Treatment**	**Type of treatment**								
		Disposed in the sink With water	Incineration	Insulation	Mechanical treatment	Radiation Disinfections	Thermal Disinfections	Chemical Disinfections	Open Burning	total
Palestinian Territory	**17.3**	**4.1**	**5.2**	**5.1**	**0.4**	**0.2**	**11.3**	**17.2**	**56.5**	**100**
Secondary	32.9	0.0	18.7	0.0	0.0	0.0	22.8	21.6	36.9	100
Primary	16.7	0.5	4.8	6.0	0.2	0.3	7.9	18.8	61.5	100
Others	17.7	37.8	0.0	0.0	2.8	0.0	34.3	0.0	25.0	100
West Bank	**20.7**	**4.5**	**3.9**	**0.0**	**0.3**	**0.3**	**6.5**	**19.3**	**65.2**	**100**
Gaza Strip	**9.0**	**1.3**	**12.5**	**33.8**	**1.8**	**0.0**	**38.4**	**4.9**	**7.3**	**100**

Disposal

The generated waste from healthcare centers is compiled in a certain place, and then transferred to a place of final disposal: 69.4% of the healthcare centers compile waste in a local authority open container, 12.7% of the healthcare centers compile waste in local authority provided closed containers, and 3.4% of the healthcare centers compile waste in an open container of the center, while 5.2% of the healthcare centers compile waste in a closed container of the center, and 9.3% of the healthcare centers do not use a container as shown in table 5. The place of final disposal was a dumping site owned by the local authority for 87.2% of the healthcare centers in the Palestinian Territory as shown in table 6.

Discussion

As demonstrated in figure 1, the monthly estimated quantity of solid waste produced by primary healthcare centers in West Bank (147.3 tons) is significantly higher than in Gaza strip (60.4 tons). This difference can be attributed to the higher number of primary healthcare centers (PHCC) in West Bank (606 PHCC) than in the Gaza strip (125 PHCC) at year 2004 (Ministry of Health (MoH) 2005a).

Table 5. Percentage distribution of healthcare centers in thePalestinian Territory by the solid waste collection mean inside the healthcare center and region.

Region and type of healthcare center	Collection mean					
	Without container	Healthcare center closed container	Healthcare center open container	Local authority closed container	Local authority open container	Total
Palestinian Territory	**9.3**	**5.2**	**3.4**	**12.7**	**69.4**	**100**
Secondary	1.4	17.4	2.6	36.9	41.7	100
Primary	9.6	4.4	3.4	12.9	69.7	100
Others	9.2	8.1	3.8	2.7	76.2	100
West Bank	**9.1**	**5.9**	**3.3**	**16.3**	**65.4**	**100**
Gaza Strip	**9.7**	**3.3**	**3.8**	**3.8**	**79.4**	**100**

Table 6. Percentage distribution of healthcare centers in the Palestinian Territory by the waste final disposal place and region

Region and type of Healthcare center	Waste final disposal place				
	Disposed randomly	Private dumping site	Local authority dumping site	Others	Total
Palestinian Territory	**0.1**	**10.1**	**87.2**	**2.6**	**100**
Secondary	0.0	18.4	80.7	0.9	100
Primary	0.1	7.9	90.0	2.9	100
Others	0.0	28.1	63.4	8.5	100
West Bank	**0.1**	**10.5**	**85.9**	**3.5**	**100**
Gaza Strip	**0.0**	**9.0**	**90.4**	**0.6**	**100**

The low percentage (34.1%) of solid healthcare waste separation in Palestinian Territory as shown in table 1 may be related to the high prevalence of hepatitis B in Palestine, estimated at (3.4%), due to higher risk of exposure to contaminated solid healthcare waste (MoH 2005b; Carvalho and Silva 2002). Moreover, there is significantly less separation of

solid healthcare waste in primary healthcare centers (38.1%), which are mainly concentrated in the rural areas, than in secondary healthcare centers (71%), which are mainly available in urban areas. This difference can also explain the higher prevalence of Hepatitis B and other infectious diseases among the rural population compared to the urban population. The currently prevailing separation practice is not sufficient to assure enough safety and avoid community and environmental hazards. The appropriate separation of healthcare solid wastes is necessary for the safeguard of waste handlers inside and outside the healthcare centers

against the risk of injuries by sharp instruments and contamination from pathological wastes in addition to the environmental concerns. The low proportion of healthcare waste separation can contribute to higher environmental irradiation pollution. This exposes the health workers and the community to more risk of irradiation pollution with higher rates of cancers. Cancer is becoming an increasingly important factor in the global burden of disease for the future. The estimated number of new cancer cases in the year 2000 was 10 million, and some 60% of those occur in the less developed part of the world. Most of these cases are related to different types of environmental pollution (Al-Najar and Awad 2002). In Palestine, malignant neoplasms constituted 9.3% of the death causes among the population in the year 2000. Among neoplasms, Limphomas, which are closely related to high environmental irradiation pollution, constitute the second leading cause of cancer morbidity in the general male population, with the highest percentage (35.2%) among the active age group of 25-29 years (Al-Najar and Awad 2002).

Healthcare wastes should be collected every day due to their hazardous nature. More than 7 times weekly waste collection practiced in only 11.5% of the primary healthcare centers in Palestine. This can be attributed to the lack of specialized waste collection teams in the primary healthcare centers compared to secondary services. Usually, health workers in the primary healthcare centers carry out this work themselves, while in most secondary healthcare centers there are specialized waste collection teams. It is known that less frequent solid healthcare waste collection can lead to more exposure of the health staff and the patients to hazardous risks such as injuries, infections and chemical harm.

The predominant method of waste transportation by healthcare centers in the Palestinian Territory is manual, as 90.2%, 94.3%, and 97.0 of the healthcare centers that separate healthcare waste collect general waste, infectious waste and sharp waste, respectively (table 3.) This may indicate a significant lack of transport facilities probably due to financial reasons, concerns of the waste collection teams, and lack of compliance. The absence of specialized collection and transportation teams leads to inappropriate healthcare waste handling due to the lack of knowledge of the hazardous effects of these wastes on human health and on the whole environment.

The percentage of the healthcare centers in the Palestinian Territory that do perform treatment of healthcare waste is only about 17.3%. This low percentage of healthcare waste treatment can expose the Palestinian people to hazards, as about 10-25% of healthcare waste is regarded as hazardous if it: it may contains infectious agents, sharps, toxic or hazardous chemicals or if it is radioactive. Infectious health-care waste, particularly sharps, has been responsible for most of the accidents reported in the literature (Carvalho and Silva 2002). Open burning is the most popular treatment method as it is used by 56.5% of the healthcare centers that treat their waste. This method of treatment is not a proper method because it causes pollution of the surrounding environment with toxic agents such as dioxin and furans (Prüss and Rushbrook 1999; Al-Khatib and Alshanableh 2000).

More than 82% of healthcare centers compile waste in an open container or do not even have a container, as shown in table 5. This means that the healthcare waste is exposed to contact with insects, flies, rodents and other intermediate vectors that may transmit different types of dangerous diseases.

The most common method used for healthcare waste final disposal was open dumping (97.3%). Dumping without treatment, uncontrolled incineration and open burning can cause

environmental pollution and public health problems, as solid healthcare wastes are considered hazardous and require special treatment, sanitary landfills or hazardous waste landfills for safe final disposal. The existing practices pose potential risks of contamination with tetanus, AIDS, typhoid, hepatitis, and other diseases to scavengers, dump site operators, as well as the general public.

Conclusion and Recommendations:

The existing system of healthcare waste management in the Palestinian Territory is not operated properly and exposes the environment to pollution and the public to many health risks. There is a lack of necessary supplies and facilities, a lack of knowledge among health workers and a lack of coordination among different related ministries and authorities.

In order to enhance healthcare management more adequately and effectively, the following general recommendations are proposed:

- The Environmental Health Department at the Ministry of Health (MoH) should be activated in coordination with the other related departments, the Ministry of Local Government and the Environment Quality Authority, to work closely with the healthcare centers through supervising, monitoring, and forcing them to implement an appropriate system for healthcare waste management.
- Creation of legislations and national standards to organize and control healthcare waste management.
- Adequate supplies and facilities needed for healthcare waste management (such as receptacles, special areas for final disposal of healthcare wastes, and proper and effective protective gear) should be available inside and outside the healthcare centers wherever necessary.
- Health education and awareness should be provided for health workers as well as for the community, about the hazards of healthcare waste and how to minimize them.

References

Al-Khatib I. A. and Alshanableh T. A. M. (2000) healthcare waste management in the Turkish Republic of Northern Cyprus (TRNC), a case study: Dr. Burhan Nalbantoglu Governmental Hospital. Proceedings of the Third International Congress for Cyprus Studies, Eastern Mediterranean University, Famagosta, TRNC, 13-17 November, 2000.

Al-Najar K., Awad R. (2002) Cancer 1995-2000. Ministry of Health, Ramallah, Palestine.

Askarian M., Vakilli M., and Kabir G. (2004) Hospital waste management status in university hospitals of the Fars province, Iran. *International Journal of Environmental Health Research*, 14**(4)**: 295-305.

Carvalho, S.M.L. and Silva M.G.C. (2002) Preliminary risk analysis applied to the handling of health-care waste. *Brazilian Journal of Chemical Engineering*, **19**(4): 377 – 381.

Hagen D.L., Al-Humaidi F., Blake M.A. (2001) Infectious waste surveys in a Saudi Arabian hospital: an important quality improvement tool. *American Journal of Infection Control*, **29**(3): 198-2002.

Massrouji H.T. (2001) Healthcare waste and health workers in Gaza governates. *Eastern Mediterranean Health Journal*, **7**(6): 1017-1024.

Mato R.R.A.M., Kasenga G.R. (1997) A study on problems of management of healthcare solid wastes in Dar es Salaam and their remedial measures. *Resources, conservation and recycling*, 21: 1-16.

Mato R.R., Kaseva M.E. (1999) Critical review of industrial and healthcare waste practices in Dar es Salaam city. *Resources, Conservation and Recycling*, **25**: 271–287.

Ministry of Health (MoH) (2005a) Health status in Palestine, annual report. Gaza, Palestine.

Ministry of Health (MoH) (2005b) Sero-survey for measles, rubella and hepatitis B. Ramallah, Palestine.

Palestinian Central Bureau of Statistics (PCBS) (2005) Environmental survey for healthcare centers, 2005: main findings. Ramallah, Palestine.

Prüss, E. G. and Rushbrook P. (1999) Safe management of wastes from healthcare activities. Geneva, World Health Organization.

Rau H.E., Alaimo R.J., Ashbrook P.C. (2000) Minimization and Management of Wastes from Biohealthcare Research. *Journal of Environmental Health Perspectives*, **108**(56): 953-977.

Subratty A.H, Hassed N.M.E. (2005) A survey on home generated healthcare waste in Mauritius. *International Journal of Environmental Health Research*, 15**(1)**: 45-52.

World Health Organization (WHO) (2005) Management of solid healthcare waste at primary healthcare centers: a decision making guide. Geneva, Switzerland.