



## Assessment of health-care waste management in a humanitarian crisis: A case study of the Gaza Strip



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### ABSTRACT

Health-care waste management requires technical, financial and human resources, and it is a challenge for low- and middle income countries, while it is often neglected in protracted crisis or emergency situations. Indeed, when health, safety, security or wellbeing of a community is threatened, solid waste management usually receives limited attention.

Using the Gaza Strip as the case study region, this manuscript reports on health-care waste management within the context of a humanitarian crisis. The study employed a range of methods including content analyses of policies and legislation, audits of waste arisings, field visits, stakeholder interviews and evaluation of treatment systems. The study estimated a production from clinics and hospitals of 683 kg/day of hazardous waste in the Gaza Strip, while the total health-care waste production was 3357 kg/day. A number of challenges was identified including lack of clear definitions and regulations, limited accurate data on which to base decisions and strategies and poor coordination amongst key stakeholders. Hazardous and non-hazardous waste was partially segregated and treatment facilities hardly used, and 75% of the hazardous waste was left untreated. Recommendations for mitigating these challenges posed to patients, staff and the community in general are suggested. The outputs are particularly useful to support decision makers, and re-organize the system according to reliable data and sound assumptions. The methodology can be replicated in other humanitarian settings, also to other waste flows, and other sectors of environmental sanitation.

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### 1. Introduction

Palestine is divided into two geographical entities, the West Bank and the Gaza Strip. Although theoretically managed by the same government and regulated by the same legislative framework, they are de facto autonomous entities, and administered respectively by the Palestinian Authority (Fatah), and Hamas. In the Gaza Strip the situation is quite different from the West Bank. For example, the management of waste differs between the two regions (Caniato et al., 2015a).

*Abbreviations:* BOR, bed occupancy rate; EQA, Environmental Quality Authority; ER, emergency room; HCF, health-care facility; HCWM, health-care waste management; IPC, infection prevention and control; LMIC, low- and middle-income country; MoH, Ministry of Health; MSW, municipal solid waste; PMMS, Palestinian Military Medical Services; UNRWA, United Nations Relief and Works Agency for Palestine Refugees; WHO, World Health Organization; w/w, % weight per weight.

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A number of studies have been conducted across the Middle East on waste management (Abd El-Salam, 2010; Aghapour et al., 2013; Alhumoud and Alhumoud, 2007; Askarian et al., 2012; Bdour et al., 2007; Ciplak and Barton, 2012). More specifically, research has examined waste management in the West Bank (Al-Khatib, 2008; Al-Khatib et al., 2009; Al-Khatib and Sato, 2009), some of which are focused on social factors such as the opinions of staff from health-care facilities (HCF) (Massrouje, 2001; Sarsour et al., 2014). However, there are various limitations of these studies, including the fact that in some cases they refer to Palestine in general, some are based on quite old data, and there has been limited large scale study of the Gaza Strip specifically.

Since Hamas reinforced its power in Gaza in 2007, there have been three large-scale conflicts with Israel. However, the 2014 war was the most deadly and devastating, with more than 2200 Palestinians (mostly civilians) killed, and 11,231 Palestinians injured. On the Israeli side, 67 soldiers and six civilians were killed, and 1600 people wounded. About 170,000 homes and 360 factories in Gaza were damaged or lost, key infrastructure hit, and

thousands of acres of farmland were ruined (Schabas et al., 2015). In a similar context access to and quality of health-care are a particularly critical issue, as well as the management of by-products, like the waste generated.

Therefore, a study focused on the Gaza Strip is important and timely. Similar contexts are usually characterized by shortage of accurate and coherent data, and information is even conflicting or based on the personal opinion of different stakeholders. Using health-care waste management (HCWM) as the key focus, this study aimed to understand the management of waste during a humanitarian crisis and to develop effective recommendations to address the issues identified. It aims to show that is possible to overcome such challenges with a combination of different qualitative and quantitative methods in order to draw evidenced-based conclusions.

## 2. Methods

The Gaza Strip is such a small area that the national and local administrative levels are almost overlapping. The governorates and municipalities are very small and do not play an important role concerning HCWM. Thus the study was focused on the entire Gaza Strip.

The analysis included the following topics:

- Regulation, legislative framework and guidelines;
- Background information at the Gaza Strip level (e.g. identification of available treatment options, market opportunities);
- HCWM at the health-care facility level (rapid assessment);
- Quality of HCW segregation and estimation of waste production;
- Identification of stakeholders (role, importance, relationships, and communication networks);
- Identification of challenges and evaluation of stakeholder priorities.

Some methods were often applied together. For example, while assessing a HCF, staff were also interviewed, and questions about different topics submitted.

### 2.1. Regulation, legislative framework and guidelines

Some thirty officers from departments of the Ministry of Health (MoH), municipal solid waste (MSW) service providers, and staff from HCFs were interviewed to examine the regulations concern-

ing HCWM. The research was extended to the guidelines and laws concerning public health and infection prevention and control (IPC), in order to have a picture of all the pieces of regulation potentially of interest. Some laws were officially available also in English, while the other documents were translated by COOPI – COOPERAZIONE INTERNAZIONALE (COOPI) staff. COOPI is an international NGO which acted as partners in the study.

### 2.2. Background information at the Gaza Strip level

One of the most complete databases about HCFs was developed by the World Health Organization (WHO) in April 2009 (WHO and EMRO, 2010). It provides information about each HCF, including utilization statistics, GPS coordinates, and health services. This information was used as the main baseline (Table 1). The data were checked as much as possible during meetings and visits, to confirm that they were still representative of the Gaza Strip situation. However, in some facilities, utilization statistics and other information were not easily available, and staff did not have the data. Therefore, it is possible that they were either collected with different definitions, or some facilities simply were not used to have a data recording system. It is important to note that official documents report different numbers of beds and bed occupancy rates (BOR) in MoH hospitals (Home Engineering Unltd et al., 2005a; Ministry of Health, 2011a; WHO et al., 2011; WHO and EMRO, 2010). Other information was collected from online documents, the MoH website, and interviews with MoH and WHO officers, HCF staff and local experts in 2011 and 2012.

In the Gaza Strip, hazardous HCW were either incinerated or disposed of in a dedicated landfill. Qualitative and quantitative data about incinerators were collected with a simple form during field visits. All of the three incinerators in the Gaza Strip were visited several times, in order to understand the practices discussed with operators and the responsible officers. The hazardous waste landfill was visited as well, and its manager interviewed.

### 2.3. HCWM at the health-care facility level

HCFs were assessed adapting the 1st version of the rapid assessment tool developed by WHO and UNEP/SBC (2011). The 2nd edition was published in November 2011 only, after the first field mission in the Gaza Strip. Waste segregation was surveyed in different departments/wards in each HCF visited. Some 16 HCFs were assessed, 10 public and 6 non-governmental respectively.

**Table 1**  
Hospitals and clinics in the Gaza Strip.

HCFs	Reference		Reference		
	WHO et al. (2011)		WHO and EMRO (2010)		
	# of facilities	# of beds	# of facilities	# of beds	# of patients <sup>a</sup>
<b>Hospitals</b>	<b>27</b>	<b>2697</b>	<b>28</b>	<b>2697</b>	1,685,265
MoH	13	2009	13	2040	1,325,658
PMMS	–	–	1	45	56,720
NGOs	14	688	11	549	302,887
Private			3	63	N.A.
	# of facilities	Facilities with buildings in bad conditions	# of facilities	# of visits <sup>b</sup>	
<b>Clinics</b>	<b>131</b>	<b>9</b>	<b>110</b>	6,493,704	
MoH	54	9	56	2,735,716	
UNRWA	20	N.A.	20	3,449,316 <sup>c</sup>	
NGOs	57	N.A.	34	308,672 <sup>d</sup>	

N.A.: not available.

<sup>a</sup> # of patients includes admissions, outpatient and ER visits.

<sup>b</sup> # of visits includes general practitioner and specialized visits.

<sup>c</sup> Data from 3 clinics are missing.

<sup>d</sup> Data from 8 clinics are missing.

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