

Management of Clinical Solid Wastes Generated from Healthcare Facilities in Yemen

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ABSTRACT

The clinical wastes are drawn serious attention from the society in the recent years, because it contains large numbers of pathogenic microorganisms such as bacteria, viruses and parasites. In Yemen, o previous studies about the quantities of clinical wastes generated from healthcare facilities. In this study, the quantity of clinical wastes generated has estimated based on number of the beds in the public hospitals. The quantities of the clinical wastes generated from public health establishments in Yemen ranged between 9565.92 to 10600.38 tons of clinical wastes per year during the period from 2008 to 2012. The infectious wastes represent 22% of those wastes. These quantities are lower than other Middle East countries, however, the clinical waste represent a serious risk for the human and environment in Yemen, because the clinical solid wastes are collected with garbage wastes and are not subjected for any treatment before the disposal to the environment. The workers are not aware of the potential hazards of clinical wastes and are not found to take requisite protective measures. In most cases they do not wore plastic aprons, sturdy gloves mask and shoes during collection and transportation of the wastes. The clinical wastes are collected into the black colour plastic bags and it not the biohazard waste bags (yellow and red colour bags). In the last two years, the country allocated specific vehicles for the transfer of hospital waste. However, these vehicles used occasionally to transfer the garbage wastes. New regulations for the treatment and disposal of clinical wastes should be performed by the Ministry of Health in Yemen to protect the human health from the infectious pathogens living in the clinical wastes.

Key words: Clinical wastes, pathogens, management, Yemen

INTRODUCTION

Yemen is located on the Arabian Peninsula in Southwest Asia. It is bordered on the north by Saudi Arabia, on the south by the Arab Sea and the Gulf of Aden, on the east by the Sultanate of Oman and on the west by the Red Sea. The total population of Yemen are 24,526,703 PE, distributed on 22 Governorates. Number of inhabitants per physician is 3,733 and number of inhabitants per bed is 1,458 (MPHP, 2012).

Clinical waste is defined as any waste generated from medical, dental, nursing, skin penetration, pharmaceutical or other related clinical activity and includes waste containing human tissue, bulk body fluids or blood and laboratory specimens or cultures. Clinical waste has the potential to cause infection due to the presence many of pathogens such as bacteria, viruses and fungi. The clinical waste are designated in the following categories; isolation waste from patient with communicable disease; cultures of infectious agent; human blood and blood products; pathological waste from surgery, autopsy and biopsy; contaminated needles, scalp, syringes and glass and contaminated animals and bedding (U.S. EPA, 1990). According to WHO (2005), the clinical wastes are classified into ten categories as shown in Table 1.

Table 1 Clinical waste categories (WHO 2005)

Category	Clinical waste
Category I	Human anatomical waste
Category II	Animal waste
Category III	Microbiology & biotechnology waste
Category IV	Sharps
Category V	Medicines and cytotoxic drugs
Category VI	Solid waste (Blood and Body fluids)
Category VII	Solid waste (disposable items)
Category IIX	Liquid waste (blood & body fluids)
Category IX	Incineration Ash
Category X	Chemical waste

Current status of solid clinical wastes in Yemen

The rapid growth of communities and cities during the last decade in Yemen has led to increase the health establishments and thus increase the clinical wastes generated from these establishments at a rapid pace. The clinical wastes have drawn serious attention from the society, therefore, the need to manage those waste safely increased accordingly, because clinical wastes contain a large number of pathogenic microorganisms such as bacteria, viruses and parasites. In Yemen, there are 6618 public health and 14414 private health establishments, which generate different clinical wastes (MPHP, 2012). These establishments are presented in Figure 1 and 2.

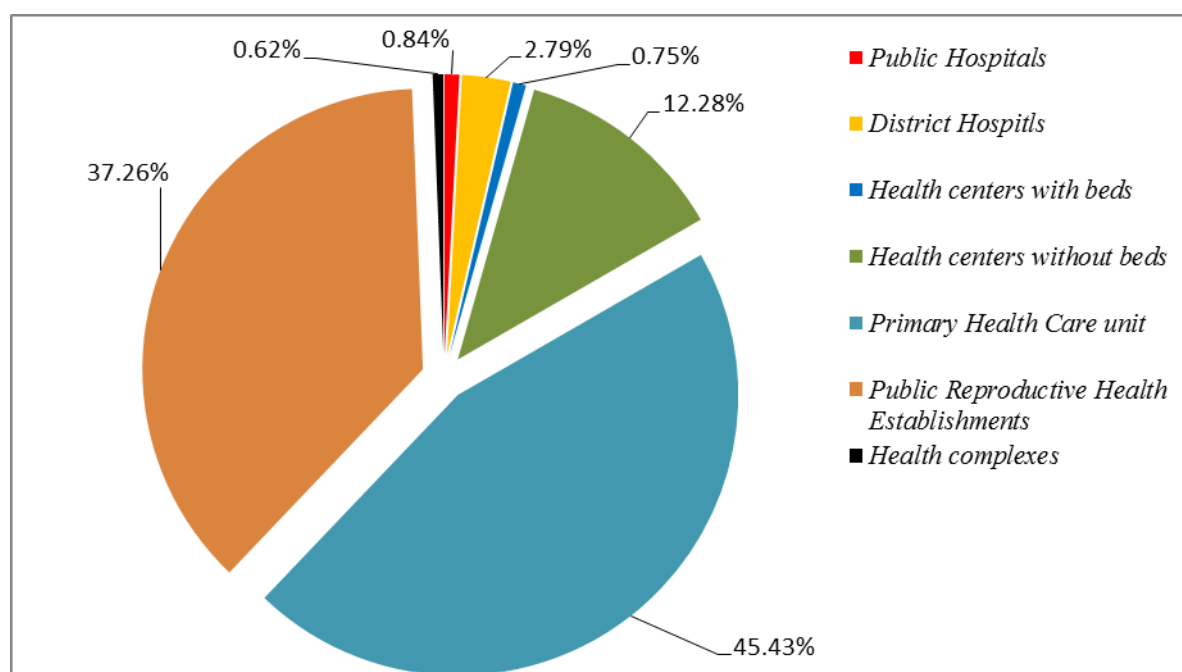


Figure 1 Public health establishments in Yemen

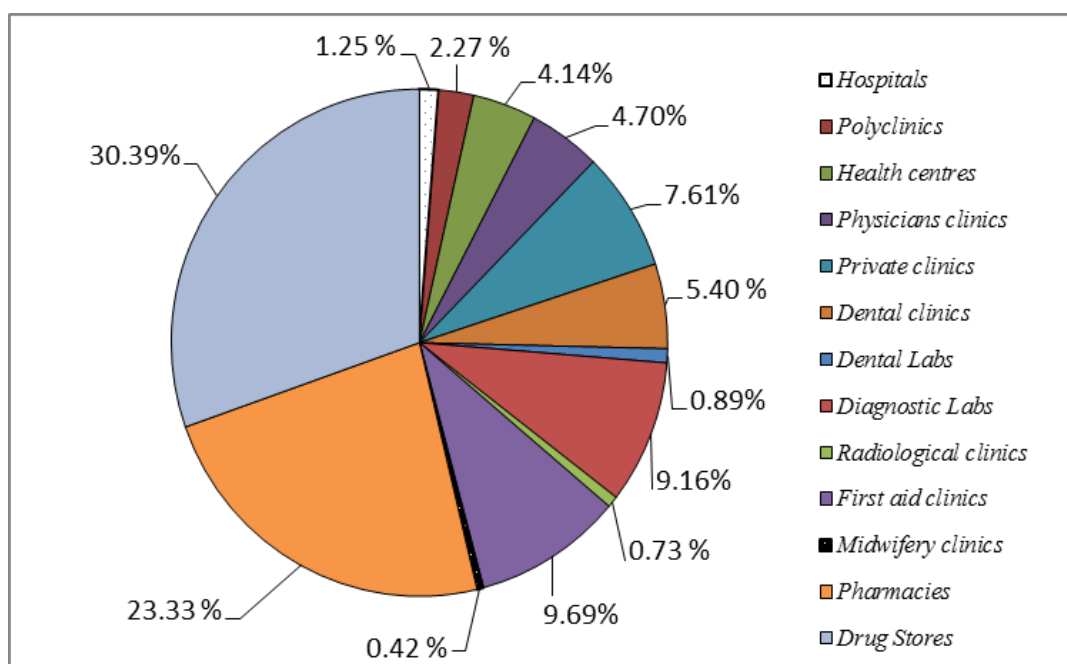


Figure 2 Private health establishments in Yemen

The amount of clinical waste generated from the health establishments in Yemen has not reported before. However, WHO (2000) estimated the quantities of clinical wastes generated from the healthcare facilities in the developing countries between 0.5-3 kg/bed/day. In Yemen, there are 16,826 beds in the public health establishments (MPHP 2012). Therefore, the mean of quantities of clinical wastes generated from these establishments might be estimated between 9565.92 to 10600.38 tons of clinical wastes per year during the period from 2008 to 2012 (Figure 3). In the comparison to the quantities of clinical wastes in the same region, Al-Shallash and Sherif (2007) found that the amount of clinical wastes generated from Saudi Arabia was more than that in Yemen; it was estimated to be 50,500 ton/year. These differences could be because the quantities of clinical wastes in Yemen and which were estimated here represent only those generated from public healthcare facilities, and there are no information about the numbers of beds in the private healthcare facilities.

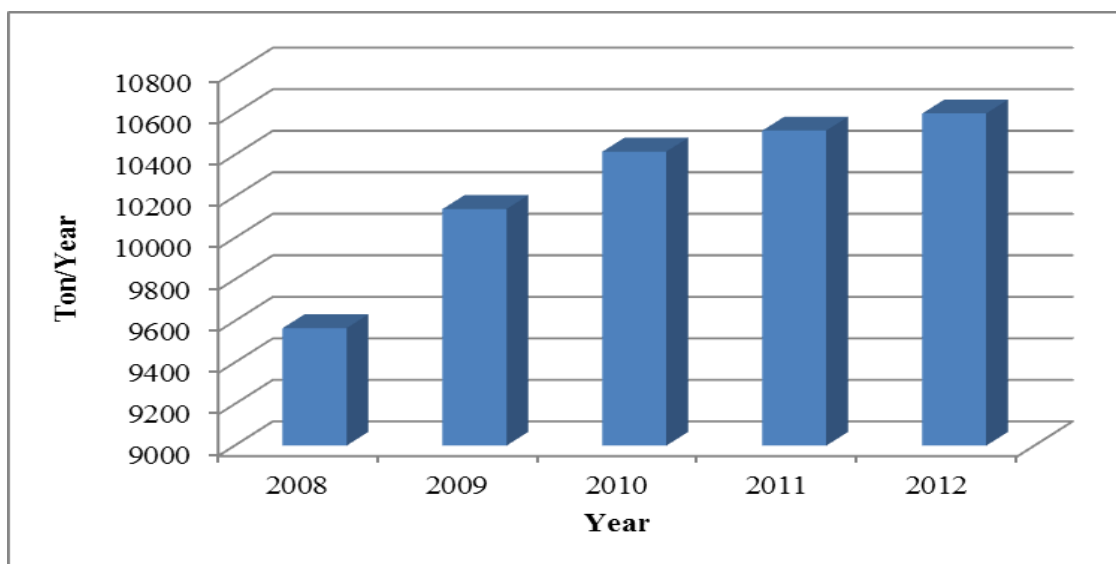


Figure 3 clinical wastes generated from public health establishments in Yemen during the period from 2008 to 2012

The clinical waste generated from health establishments in Yemen did not subject to the segregation process before the disposal. However, the clinical wastes generated from healthcare facilities might be divided as presented in Table 2, 3 and 4. The infectious wastes represent 22% of total clinical wastes generated from the healthcare facilities; this percentage was estimated based on the numbers of beds and the cases that were diagnosed in 2011 as well as the type of the clinical specimens used for the diagnostic process (Figure 4).

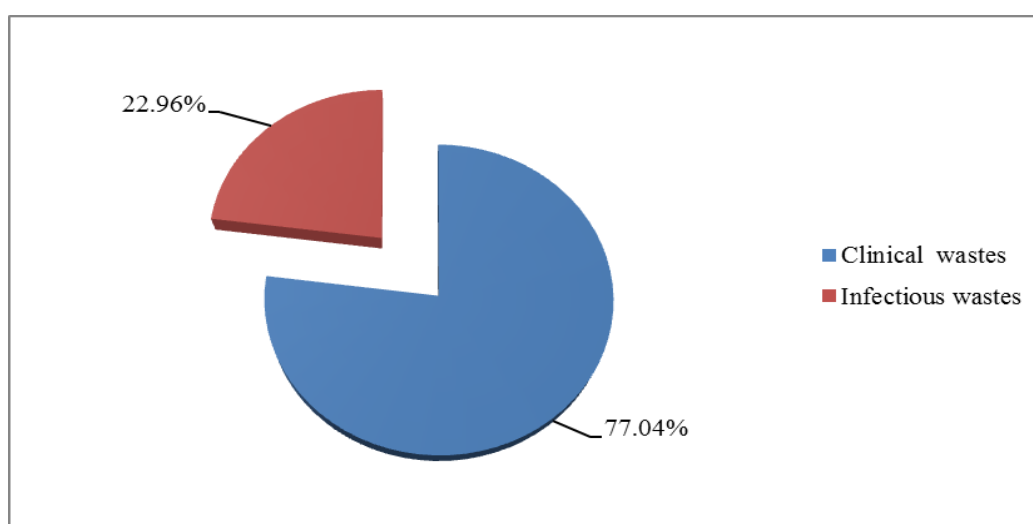


Figure 5 Percentage of infectious wastes to total clinical wastes generated from healthcare facilities in Yemen.

Pathogens in solid clinical waste

Clinical wastes are considered as biohazard waste because it contains many pathogens (Saini et al., 2004; Park et al., 2009). It may be capable of spreading infectious diseases in humans and the environment. For example, it can be the source of diseases like acquired immune deficiency syndrome (AIDS), hepatitis, tuberculosis, and other transmissible diseases (Alagoz and Kocasoy, 2008).

It has estimated that the numbers of infected cases that have diagnosed in Yemen during 2011 were 421,078 cases, among them 269,947 cases were recorded as epidemic cases caused by different pathogens as depicted in Figure 5 (MPHP, 2011). No previous works on the pathogens in the clinical wastes of Yemen. However, it is demonstrated that the pathogens in the clinical specimens used during the diagnostic process will be in the clinical wastes, thus these pathogens would be the dominant species in the clinical wastes (Table 2). The actual species of pathogens in clinical wastes depend on public health, the size of the local community and presence of hospitals, these variations occurs not only geographically but also over time at the same site.

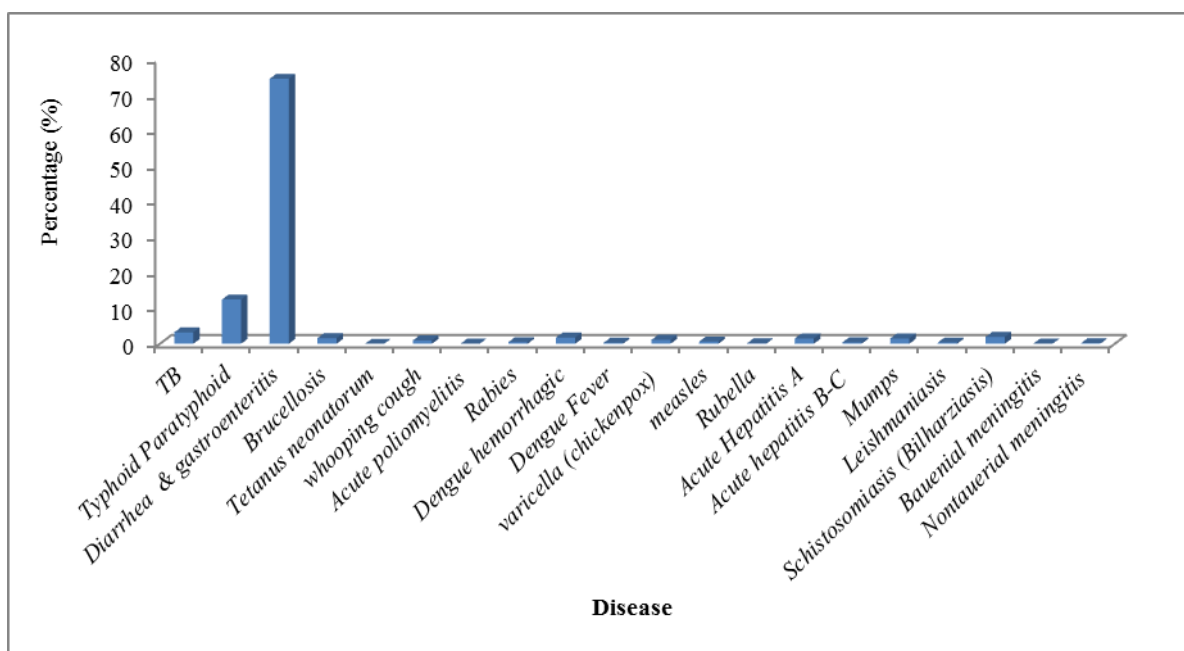


Figure 6 Surveillance of epidemic diseases recorded in Yemen during 2011

Table 2 Expected pathogens in the clinical wastes generated from healthcare facilities in Yemen

Bacteria	Parasites	Fungi	Viruses
<i>Arcobacter</i> spp.	<i>Giardia</i> sp.	<i>Aspergillus</i> spp.	Norovirus virus
<i>Brucella</i> sp,	<i>Leishmania</i> sp.	<i>Blastomyces</i>	Polio virus
<i>Clostridium</i> spp.	<i>Schistosoma</i> sp.	<i>dermatitides</i>	Rabies virus
<i>Campylobacter</i> spp.	<i>Amoeba</i> sp.	<i>Candiada</i> spp.	Dengue fever virus (DENV)
<i>Citrobacter</i> spp.		<i>Coccidioides</i>	Varicella-zoster virus (VZV)
<i>E. coli</i> (pathogenic strains)		<i>Crptocococcus</i>	Measles virus (MeV)
<i>Enterobacter</i> spp.		<i>Histoplasma</i> sp.	Rubella virus
<i>Klebsiella</i> spp.		<i>Hortaea werneckii</i>	Hepatitis A virus (HAV),
<i>Listeria</i> spp.		<i>Malassezia furfur</i>	Hepatitis B virus (HBV),
<i>Mycobacterium</i> spp.		<i>Mucoromycotina</i>	Hepatitis C virus (HCV)
<i>Pseudomonas</i> spp.		<i>Penicillium</i> spp.	Mumps virus
<i>Providencia</i> spp.			Human Immunodeficiency
<i>Staphylococcus</i> spp.			Virus (HIV)
<i>Streptococcus</i> spp.			
<i>Salmonella</i> spp.			
<i>Shigella</i> spp.			
<i>Yersina</i> spp.			

Transmutation of infectious pathogenic organisms into rivers and water bodies during the final sewage effluent discharge may increase the contamination by these pathogens especially, bacteria and fungi for bacteria. This is because bacteria and fungi, unlike either viruses or parasites, can actually increase in numbers during the treatment processes of sewage because bacteria do not require a host cell for replication (Ceustermans et al., 2007). Therefore, the pathogenic bacteria and fungi may cause disease for the workers and people who live near of official dumps.

Management of solid clinical waste

The management of the ever-increasing volume of clinical wastes has been one of the prime environmental issues in Yemen. The disposal of clinical waste is imperative for the recognition of the right to safety and to protect public health from the pollutants that clinical wastes contain. Several countries have standards, which regulate the clinical waste disposal on the basis of risk to the public health and the environment. In Yemen, the country has not yet to adopt a practical, economic and acceptable approach in managing and disposing

clinical waste. Present practice is co-disposal it with garbage wastes at landfill sites. The solid garbage quantity generated in 2011 were estimated to be 3,682,669 ton, this represent 40% only of the total quantity of estimated garbage (MLA 2011).

The collection of clinical wastes in most healthcare facilities in Yemen is undertaken with the solid garbage; the workers are not aware of the potential hazards of clinical wastes and are not found to take requisite protective measures. In most cases they do not wore plastic aprons, sturdy gloves mask and shoes during collection and transportation of the wastes. The clinical wastes are collected into the black colour plastic bags and it not the biohazard waste bags (yellow and red colour bags). In the last two years, the country allocated specific vehicles for the transfer of hospital waste. However, these vehicles used occasionally to transfer the garbage wastes.

Treatment and disposal of clinical waste

There are no treatment processes of clinical wastes generated from healthcare facilities in Yemen, except of the cultures, which are autoclaved before the disposal with the garbage wastes. In most cases, the yellow and blue tips and plastic test tubes used in the collection process of specimens are washed by tap water and reuse again.

The most common methods of clinical and garbage wastes disposal in Yemen is open dump, there are 18 official dumps, the wastes is being buried at dumps (MLA 2011). These practices are also applied in some of developing countries such as, South Africa (Nemathaga et al., 2008), Al-Geria (Bendjoudi et al., 2009), and Egypt (Abd El-Salam, 2010), whereas, in the developed countries such as USA the treatments of clinical wastes are performed by microwave plasma sterilization and incineration (Lee et al., 2004). The open dump is less expensive and there is no other alternative methods are available at this reasonable cost. However, it has been reported that the open dumping represent potential infection source of public health and environmental pollution (Al-Khatib and Sato, 2009). The official dump locations in Yemen were chosen since 40 years ago, these dumps were located away from the population community. However, with increasing of population in the cities during the last decade the official dumps became near of population community. Therefore, the potential infection of public health has increased accordingly.

In Yemen, the open burning for garbage and clinical wastes use to reduce the volume of the wastes and stopping the spread of papers and plastic. However, the burning is a

potential source of generating toxic emission. The toxic chemicals like dioxins and furans generated from burn the plastic, syringes and paper, can spread to air and cause respiratory infections among the people, which live near of the open burn (Nemathaga et al., 2008).

CONCLUSIONS

1. There are no information for the quantities of clinical wastes generated from public and private healthcare facilities and the treatment and disposal processes in Yemen.
2. The clinical wastes in the healthcare establishments in Yemen are collected with garbage waste
3. The healthcare facilities in Yemen did not take pertinent steps on safe management of clinical wastes in accordance with the WHO guidelines.
4. The healthcare facilities are not preserve a safe environment for staffs and patients within the hospitals, because these regulations requiring high financial investments for the clinical waste managements
5. The clinical waste generated from health establishments in Yemen are not subject of treatment process before the disposal process, thus, the infectious wastes have serious risk to the workers and environment

RECOMMENDATIONS

1. Ministry of Health and population in Yemen need to regulate the clinical wastes management and treatment before the disposal process
2. Clinical waste should be subjected to treatment process before the disposal to the environment. Therefore, the researchers in Yemen should focus on the dangers of clinical waste and the quantities produced as well as the search of the safe treatment methods for clinical wastes before the disposal in the environment.
3. Healthcare facilities need to carry out workshops for the staffs and workers to provide them with the safe method for collection and management of the clinical wastes and the risks of infectious wastes.

ACKNOWLEDGMENTS

I would like to thank Ministry of Health and Population, Ministry of Local Administration and Natural Information Centre for the information that help me to estimate the quantities of clinical waste generated from healthcare facilities in Yemen.

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