

Clinical Waste Segregation: Towards Implementation and Obstacles in Malaysian Private Clinics

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Abstract: *Clinical waste poses a major threat to human health and the environment if the management practice of this kind of waste is not conducted appropriately. In order to achieve sound management of clinical waste, a clear and scientifically-based definition needs to be established to understand what is meant by clinical waste, what its components are and what comprise the steps in its management. Segregation of clinical waste at the source is the basic step within appropriate management of clinical waste. The aim of this paper is to overview the existing research on the implementation and effectiveness of clinical waste segregation practice in healthcare facilities and it seeks to identify the issues and obstacles which hinder healthcare facilities from carrying out effective practice of clinical waste segregation and management. Several factors were found to act as obstacles such as lack of knowledge and awareness, lack of financial resources and insufficient budget allocation as well as a lack of comprehensive rules, regulations and standards.*

Keywords: *Clinical waste, Segregation, Obstacle, Implementation, Private Clinics, Malaysia, Developing Countries.*

I. Introduction

Clinical waste management is a serious environmental concern especially in developing countries. The increasing amount of clinical waste generated due to rapid urbanization and the growing number of private health care facilities in developing countries are usually not properly managed. Lack of knowledge and awareness about the health hazards of clinical waste is among the main reasons for the mismanagement of clinical waste [1-3].

As discussed elsewhere[4, 5] all individuals dealing with hazardous healthcare waste are potentially at risk, with nurses and healthcare staffs among the main groups at risk. Therefore the effective need for proper knowledge among this group is obvious. Proper techniques and methods for handling the waste and the practising of safety measures can go a long way towards the safe disposal of clinical waste and protection of the community from various adverse effects of the hazardous waste [6]. In the last few years, many researchers in developing countries have conducted studies on healthcare and clinical waste management in general [7-14]. However, there is an increasingly amount of research on clinical waste but there is no focused research on the effectiveness of the clinical waste segregation practised by healthcare facilities and related obstacles in developing countries in particular. Taking all of this into consideration, this paper attempts to provide an overview of the existing research as well as to investigate different findings regarding the implementation of clinical waste segregation and identify the related obstacles which hinder healthcare facilities from carrying out effective clinical waste segregation practice, and finally to identify the current practice of clinical waste segregation in Malaysian private clinics.

II. Strategic Steps in Mainstreaming Clinical Waste Management

Clinical waste management improvement should start in large hospitals and then be extended to smaller healthcare establishments and finally to the diverse source of small quantities of waste [4]. The basic principles of each country's strategy about clinical waste is highly dependent on its policies and various management plans in terms of the key elements such as awareness, collection, storage system, transportation, disposal and also minimization and recycling which have to be conducted by appropriate technology considering environmental conditions of each country. To achieve a sustainable waste management policy, social progress is necessary for everyone via regeneration of communities, efficient protection of the environment, cautious usage of resources and cleaner environmental activities [15]. The various categories of healthcare waste should be segregated and collected in specific containers. Table 1 represents the recommended colour coding for healthcare waste.

Table 1: Recommended colour coding for healthcare waste

Type of waste	Colour of container and markings	Type of container
Highly infectious waste	Yellow, marked 'HIGHLY INFECTIOUS'	Strong, Leak-proof plastic bag, or container capable of being autoclaved
Other infectious waste, pathological and anatomical waste	Yellow	Leak-proof plastic bag, or container
Sharps	Yellow, marked 'SHARPS'	Puncture-proof container
Chemical and pharmaceutical waste	Brown	Plastic bag or container
Radioactive waste	–	Lead box, labelled with the radioactive symbol
General health-care waste	Black	Plastic bag or container

Source: WHO safe management of wastes from healthcare activities, 1999[4]

According to guidelines on the handling and management of clinical waste in Malaysia (2009) [34], all healthcare establishments in Malaysia must adopt the following standard colour coding which is widely accepted:

Black: General waste

Yellow: Clinical waste for incineration only

Light blue: Waste for autoclaving or equivalent treatment before ultimate disposal

All clinical waste that needs to undergo autoclaving, or similar treatment, prior to disposal shall be stored in light blue autoclave bags and yellow plastics bags before and after such treatment respectively. The blue and yellow containers/bags shall only be used for the disposal of the clinical waste and not for the transportation of other items, such as heavily contaminated linen to the laundry. In order to avoid confusion with other sorting systems, care should be taken through the use of colour coding.

Sound management of waste includes all practical steps for human health and environmental protection from hazardous waste such as clinical waste [8]. In order to achieve sound management of clinical waste, the strategic steps for mainstreaming clinical waste should be taken. Waste segregation is an essentially necessary step for reducing the volume of clinical waste and therefore a key step to achieve sound clinical waste management and reduce health hazards from clinical waste [16].

Appropriate segregation can be accomplished as a result of education, which is an obvious requirement, in addition to stricter enforcement. Sufficient education and training need to be provided to all workers by health professionals in order to enhance their understanding of the risks and hazards from clinical waste. It is vital for health workers to know how to protect themselves and how to manage clinical waste and, more importantly, how to segregate the waste adequately. As some great benefits of segregation are realized, a secure internal and external collection and transportation system for clinical waste needs to be established. Development of comprehensive management plans and policies for adequate clinical waste management and disposal should be provided in order to ensure clarification in management practices. Personnel training should be incorporated, along with continuing education in addition to management operations assessment programs for system and health workers.

Along with these steps, the training of healthcare facilities for clinical waste handling (CWH) should cover the following main points:

- Include training for housekeeping staff, nurses, administrators, purchasers, technicians, engineers and all doctors.
- The importance and hazards of clinical waste must be emphasized along with case histories and studies. A mechanical approach would not give the desired results.
- Tailor different approaches to training for each of the aforesaid categories of hospital personnel. Include training in local languages for workers and in English for senior staff.
- Involve the hospital acquired infection (HAI) committee members, usually the microbiologists, or let them lead the CWH drive.
- Have CWH meetings every week, separately for each department of the hospital.

III. The Importance of Clinical Waste Segregation

Segregation is known as the basic and fundamental step to facilitate subsequent safe and effective clinical waste management. It shall be performed at the origin of waste generation. Appropriate segregation can contribute significantly to the safe and effective management of clinical waste. The insignificant segregation of clinical waste has become a challenge to be focused upon in many healthcare facilities [11]. Negligence of segregation and inadequate clinical waste management practices by the healthcare facilities may result in the inappropriate disposal of clinical waste and therefore may cause health hazards to community members and

adverse effects to the environment. It is stated under the Environmental Quality (Scheduled Waste) Regulations (1989) that, by adding clinical waste and general waste together, the waste status will change to clinical waste and should be treated exactly as clinical waste. This practice will only increase the fee for the waste treatment. Protection of the health workers and patients should be considered as a fundamental step in developing waste management options. In this regard, a series of control measures shall be developed in relation to clinical waste handling [17]. The effectiveness of segregation starts at the beginning of the clinical waste generation process. According to Hamadan [12], segregation is the responsibility of the nurses and health-workers based on the guidelines published by the Ministry of Health. They need to make sure that all clinical waste generated is segregated from general waste and disposed of in the appropriate containers. Segregation of waste would result in a clean and safe waste stream which would be easy, safe and cost effective to manage [18].

IV. Current Status of Clinical Waste Segregation and Related Obstacles in Developing Countries

A literature survey was carried out to find out the effectiveness of the segregation practised by healthcare facilities and the related challenges and obstacles.

According to Prem et al.[19], the major obstacle to achieving better healthcare waste management was failing to differentiate between various categories of waste as different they are. Therefore, the segregation of waste, especially hazardous waste such as clinical waste, is an essential step for the safe disposal of clinical waste.

A survey research conducted by Dehghani et al.[7] to assess clinical waste management in the medical sciences educational hospitals at Tehran University revealed that a lack of control measures for the management of clinical and hazardous waste existed and that, in some cases, clinical waste was disposed of in the same containers as the general waste. The findings of their study found, however, that all the hospitals had been provided with a sufficient and appropriate amount of plastic bags and plastic containers for infectious waste, though only 58% of the hospitals segregated the infectious waste from other types of waste. A lack of continuity in terms of dealing with waste segregation, a lack of knowledge and awareness among hospital personnel about health hazards of infectious waste and their impact on the environment and also a lack of comprehensive guidelines and legislation on medical waste management and segregation were mentioned in this study as problems and obstacles in practising appropriate medical waste management and segregation.

Research was conducted by Manyele and Lyasenga,[8] to evaluate medical waste management systems in low-level healthcare facilities in Tanzania. They investigated the use of colour coding system, the availability and type of containers and also the average filling capacity of the bins. The results from their study revealed that, in some facilities, segregation was not perfectly performed; however, the specific containers for waste collection and handling were available. Lack of awareness and poor management were identified as the main reasons for the mismanagement of medical waste and lack of proper segregation practices.

In a study by Pant[20], clinical waste management in 100 small hospitals in Dehradun, India were evaluated using 13 focus questions. The results from the study showed that hospitals were not following appropriate practices of segregation of waste generated. The colour coding system was not being followed and waste was not segregated into infectious and non-infectious categories. A lack of knowledge on rules and regulations among staff and health workers was also found as the main obstacle and problem.

Bdour et al. [21] conducted a survey for assessment of medical waste management in the northern part of Jordan. 14 healthcare facilities were surveyed. According to the results from their study, poor and improper segregation and classification procedures of the generated waste were noticed by the researchers in all the surveyed facilities. Improper implementation of medical waste segregation and management of these wastes was found during this study.

Mbarki et al.[22] analysed clinical waste management practices in Morocco. The results of their survey on the separation of medical waste revealed that the knowledge of the staff on waste segregation was low. They concluded that having daily contact with waste and specific training on the handling of waste are the important factors needed to increase knowledge and therefore the appropriate practice of segregation of medical waste.

Yong et al.[23] in their study in China evaluated the existing situation of clinical waste management at a regional level. The results of their investigation showed that 73% of the hospitals practised the segregation of waste. In term of obstacles, the majority of the respondents in this study were confused in terms of differentiating clinical waste and general waste. A lack of financial resources was discussed as the major barrier to the practice of sustainable clinical waste management.

Askarian et al.[24] conducted a survey in the private hospitals of Fars province, Iran. In this study they discussed the segregation of radioactive waste, infectious and sharp waste from general waste. A lack of appropriate protective gear, a lack of knowledge on the adequate use of protective gear and a lack of relevant understanding among the staff were highlighted as the main obstacles to the proper handling and separation of clinical waste. In addition, a lack of policy and sufficient budget at provincial and hospital level, a lack of rules

and regulation, a lack of proper training for hospital workers and also a lack of control and supervision were identified as the major obstacles.

In order to determine the most appropriate management method for healthcare waste, Alagöz et al.[25] conducted a study in Istanbul, Turkey. Their study investigated the different aspects of healthcare waste management as well as the segregation practice and related challenges and obstacles. Insufficient budget allocation, a lack of training and a lack of clear definition of waste generated in the healthcare facility were identified in the study as needing to be improved.

An assessment of management practice in four hospitals in Nigeria was conducted by Longe and Williams [16]. No uniformity in colour coding of medical waste and storage of infectious waste together with general waste in black containers and without appropriate labelling were found in terms of the results of the study. Not enough monitoring of handling practice was identified as the possible reason for mismanagement of clinical waste.

Mohamed et al.[9] during their site visits observed that 57% of the surveyed healthcare facilities in Bahrain were using improper bags for hazardous healthcare waste collection. In this study, limited documentation of the generation of waste and also handling of waste were discussed as the main obstacles to the appropriate practice of healthcare waste management. In addition, clear and defined responsibilities for each health workers group handling hazardous healthcare waste were not available and also there was no country level healthcare waste management plan or one at the surveyed facility level.

The study conducted by Patwary et al.[26] found that in the many healthcare facilities the workers were observed using inappropriate containers without labels and biohazards signs. Hazardous medical waste was not segregated and collected but was disposed along with litter into the general bins which were located outside the facility. This study revealed that there was no monitoring program on the handling of waste and some of the waste handlers were not concerned about accidents due to the mismanagement of clinical waste.

El-Salam and Magdy[27] carried out a survey to evaluate the healthcare waste management practices and segregation of clinical waste. Their study concluded that segregation of clinical waste was done in all the surveyed hospitals but none of them practised it according to specific standards. Sharps waste was segregated in all the hospitals, while infectious waste was found to be disposed together with the general waste stream and pharmaceutical and pressurized containers were not segregated from general waste.

Graikos et al. [28] conducted a survey to determine the composition and production rate of clinical waste generated from small producers in Greece. A lack of information on clinical waste handling in small producers was identified and, due to the small quantity of clinical waste generated, the management practices and segregation of clinical waste were neglected in the small generator.

The practice of healthcare waste management was investigated by Sefouhi and Aouragh[29] in Algeria. In the results of this study, it was indicated that the segregation practice of clinical waste was not done properly. A lack of specific collection services was identified as the main issue.

Nemathaga et al.[30] conducted a case study of healthcare waste management in two hospitals within South Africa. In the results of the study, they found that the sharps waste were the only types of clinical waste which had been collected according to specific rules in appropriate containers. Red containers were found to be used for infectious waste, pathological and chemical wastes. The reason for using red plastic bags was because they cost less and were more accessible.

V. An Overview of Malaysian Practices

Healthcare facilities in Malaysia are continually expanding. Asian patients are believed and expect to get a better standard of healthcare service and treatment from Malaysian healthcare facilities. Moreover, the cost of treatment is still cheaper than in other countries in this region [31, 32]. The number of foreign patients who come to be treated in Malaysia is increasing every year. The increasing number of healthcare facilities and patients has caused an increase in the amount of clinical waste and, thus, clinical waste management systems must operate correctly.

Clinical waste in Malaysia is categorised under the Environmental Quality (Scheduled Wastes) Regulations (2005) that consist of:

- i. SW403 - Discarded drugs containing psychotropic substances or containing substances that are toxic, harmful, carcinogenic, mutagenic or teratogenic;
- ii. SW404 - Pathogenic and clinical wastes and quarantined materials;
- iii. SW421 - A mixture of scheduled wastes;
- iv. SW422 - A mixture of scheduled and non-scheduled wastes.

The Department of Environment (DOE) is sanctioned under the Environmental Quality Act (1974) to prevent and control contamination as well as to protect and improve the environmental quality. While with regards to handling the hazardous waste, a set of directives that control the processes involved in managing such waste for example: storage, treatment, and disposal was put into effect since May 1989: Environmental Quality

(Scheduled Wastes) Regulations, (2005) (to replace the Environmental Quality (Scheduled Wastes) Regulations (1989)); Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) Regulations, (1989); and Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) Order, (1989).

In Malaysia, the Ministry of Health is responsible for clinical waste [33] and concession companies are responsible for providing all the equipment and appropriate containers for clinical waste to healthcare facilities. In October 1996, the Ministry of Health and three concession companies have signed concessionaire agreements for clinical waste management in health care facilities whereby all clinical waste generated in all healthcare facilities are managed by three concession companies. These concession companies are as follows:

- Faber Medi-Serve SdnBhd for states of Perlis, Kedah, Penang, Perak, Sabah and Sarawak;
- Radicare (M) SdnBhd for Wilayah Persekutuan Kuala Lumpur and Putrajaya, Selangor, Pahang, Kelantan and Terengganu;
- PantaiMedivestSdnBhd for Negeri Sembilan, Melaka and Johor.

The findings of a study on clinical waste handling and related obstacles done by Razali and Ishak [14] on hospitals in Selangor state in Malaysia revealed that, despite there being a management system of clinical waste handling in Malaysia, several obstacles were outlined for the improper practice of clinical waste segregation, such as the attitude of healthcare staff towards clinical waste and an example was given of doctors who mainly throw needles everywhere and only sometimes in the yellow bag.

A cross-sectional comparative study was conducted by Omar et al. [13] to investigate the clinical waste management in three district hospitals of Johor in Malaysia. An insufficient number of waste containers available for the amount of waste which is generated by hospitals were highlighted in this study as the major issue as well as the obstacle of staff misusing the containers and exceeding the average filling capacity of the containers.

Hamadan et al. [12] discussed the segregation of clinical waste handling in hospital SAJB in Malaysia. They identified the disposing of general waste into the black plastic as the most practised activity and the disposing of infectious waste into the blue bag as the least practised. Their study investigated the implementation of segregation of clinical waste in the hospital and also the implementation of collection and transportation practices.

VI. Implementation of segregation in Malaysian private clinics

Apart from review of existing literatures on clinical waste segregation practices and obstacles in developing countries and Malaysia in this paper, preliminary interview and survey approaches has been used as a part of a larger study of clinical waste management in private clinic of Selangor, Malaysia. The respondents were from selected private clinics in Selangor state, Malaysia and concession companies who were responsible for clinical waste management in private clinics. The respondents were divided into: clinical waste management officers from concession companies, Doctors of the private clinics (Dental and Medical), Nurses and also staffs of the private clinics. The number and information of private clinics was collected from the list of registered private medical and dental clinics in Selangor provided by Ministry of Health. Site observation base on WHO rapid assessment tool for healthcare waste management and exploratory interviews were conducted as an important procedure to know the current status of clinical waste segregation implementation and related obstacles in private clinics. Following contents were taken in consideration:

- Appropriate type of containers used in collection of clinical waste and availability of the containers all the time for use;
- The average filling capacity of the bins and the number of containers present for clinical waste collection per section;
- Availability of special equipment for clinical waste handling in health facilities;
- Training of the healthcare workers
- Approaches that play an important role in achieving adequate clinical waste management

Segregation of clinical waste in private clinic is the responsibility of doctors and staffs who are directly involved with clinical waste. This study revealed that segregation of clinical wastes from general waste was practiced by private clinics. Sharps waste deposited into sharps bin. However site investigation showed that segregation of clinical waste was not according to special rules and standards in some of the clinics. Clinical waste deposited into yellow bins in some case were exceeds the specific limit of less than $\frac{3}{4}$ full. In Malaysia concession companies are responsible to provide all the equipment and appropriate containers for clinical waste to private clinics. It was revealed during the research that the most segregation practice in private clinics was disposing sharps waste into sharps bin and the least practiced activity was disposal of high risks waste into blue container. It can be concluded from the responses that the current practice of clinical waste segregation in private clinics is not well developed. Table 2 summarize the responses from the interviews.

Table 2: Interview Responses Summary

	Current Practice	Obstacles
Segregation of waste into different categories	The most practiced activity of clinical waste segregation is only disposing of sharps waste into sharps bin	Insufficient knowledge of workers, Health workers attitude towards safe management of clinical waste, lack of clinical waste management plans in private clinics
Safe handling of clinical waste	Current practice of safe handling of clinical waste is not sufficient	Lack of awareness regarding health hazards of improper clinical waste management, not enough trained worker, lack of time, Lack of control, supervision and monitoring
Training of the healthcare workers	Insufficient training of all health workers	Insufficient budget and financial resources
Awareness of healthcare workers on different categories of clinical waste	Insufficient knowledge and awareness about different categories of clinical waste	Lack of proper training programs for healthcare workers

VII. Future Challenges

The reviewed articles determined the implementation and effectiveness of clinical waste segregation practices in different healthcare facilities. Several factors have been extracted from the review of the presented literature as obstacles which create a bottleneck to the practising of effective segregation practices and the sound management of clinical waste. The focus of this paper was on two main questions: how effective is the implementation of clinical waste segregation in different healthcare facilities and what are the obstacles that hinder healthcare facilities from appropriate segregation practice? The following factors are among the most important elements that are challenging the overall practice of clinical waste segregation and management of clinical waste in an appropriate manner:

- Failing to differentiate clinical waste from general waste and different types of clinical waste from each other;
- Lack of control, supervision and monitoring;
- Lack of continuous clinical waste segregation;
- Lack of knowledge and awareness towards clinical waste;
- Lack of knowledge and awareness towards the adverse impact of clinical waste on public health and environment;
- Lack of rules and regulations;
- Lack of policy and legislations;
- Health workers' attitudes toward effective clinical waste segregation;
- Lack of appropriate containers available for the amount of waste generated;
- Insufficient budget and financial resources;
- Lack of proper training programs for healthcare workers;
- Lack of clear definition of clinical waste;
- Lack of clear defined responsibilities for healthcare workers who deal with clinical waste;
- Lack of information on clinical waste handling;
- Lack of clinical waste management plans in healthcare facilities

There is not much study and enough information on clinical waste management and segregation practices in Malaysia. An adequate and proper set of segregation practices in dealing with clinical waste in healthcare facilities requires comprehensive knowledge and understanding of the possible hazards of clinical waste, appropriate equipment and materials for clinical waste handling and trained staff. In addition, a lack of information on clinical waste characteristics and lack of indicators to ensure effective clinical waste management in Malaysia are among the major challenges. Therefore, there is an obvious need for more studies on every aspect of clinical waste management and challenges in Malaysia to enable clear conclusions to be drawn. Awareness of legislative system in managing clinical waste and integration of monitoring and enforcement activities are the most important factors to achieve effective clinical waste management practices.

VIII. Conclusion

Appropriate clinical waste segregation practices have a significant role to play in the proper and safe management of clinical waste. The main aim of this paper was to identify the key factors that become obstacles to the practising of adequate clinical waste which is important to minimizing the impact of clinical waste on the people health as well as the environment. This paper provides an overview of existing research on clinical waste management in different healthcare facilities in different countries with a special focus on Malaysian private clinics. Different factors such as a lack of awareness, a lack of knowledge, health workers' attitude and financial factors were identified as the major issues. The exploratory interview approach in this paper helped to provide clarification on the actual implementation and obstacles of clinical waste segregation. Inappropriate managing of clinical waste will have major impacts on public health and environment. All of those who are involve in the managing of clinical wastes, need to take their part properly to achieve sound management of clinical waste and

therefore to improve the current situation and its aspects on environment, economics and also public health. The findings of this paper integrate and enhance the accessibility of the obstacles associated with clinical waste segregation and therefore will be useful for other researchers and whoever may be dealing with clinical waste and may be interested in improving their existing clinical waste management strategies and standards.

References

- [1]. Hossain, M.S., et al., *Clinical solid waste management practices and its impact on human health and environment—A review*. Waste management, 2011. **31**(4): p. 754-766.
- [2]. Coker, A., et al., *Medical waste management in Ibadan, Nigeria: obstacles and prospects*. Waste management, 2009. **29**(2): p. 804-811.
- [3]. Sawalem, M., E. Selic, and J.-D. Herbell, *Hospital waste management in Libya: A case study*. Waste management, 2009. **29**(4): p. 1370-1375.
- [4]. Prüss, A., E. Giroult, and P. Rushbrook, *Safe management of wastes from health-care activities*. 1999: World Health Organization.
- [5]. Marinković, N., et al., *Management of hazardous medical waste in Croatia*. Waste management, 2008. **28**(6): p. 1049-1056.
- [6]. Mathur, V., et al., *Knowledge, attitude, and practices about biomedical waste management among healthcare personnel: A cross-sectional study*. Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine, 2011. **36**(2): p. 143.
- [7]. Dehghani, M., et al., *Assessment of medical waste management in educational hospitals of Tehran university medical sciences*. Iranian Journal of Environmental Health Science & Engineering, 2008. **5**(2).
- [8]. Manyele, S. and T. Lyasenga, *Factors affecting medical waste management in lowlevel health facilities in Tanzania SV*. African Journal of Environmental Science and Technology, 2010. **4**(5).
- [9]. Mohamed, L., S. Ebrahim, and A. Al-Thukair, *Hazardous healthcare waste management in the Kingdom of Bahrain*. Waste management, 2009. **29**(8): p. 2404-2409.
- [10]. Hassan, M.M., et al., *Pattern of medical waste management: existing scenario in Dhaka City, Bangladesh*. BMC Public Health, 2008. **8**(1): p. 36.
- [11]. Mbongwe, B., B.T. Mmereki, and A. Magashula, *Healthcare waste management: Current practices in selected healthcare facilities, Botswana*. Waste management, 2008. **28**(1): p. 226-233.
- [12]. Hamadan, N., et al., *The Implementation of Clinical Waste Handling in Hospital Sultanah Aminah Johor Bahru (HSAJB)*. Procedia-Social and Behavioral Sciences, 2012. **65**: p. 802-807.
- [13]. Omar, D., S.N. Nazli, and S.A. Karuppannan, *Clinical Waste Management in District Hospitals of Tumpat, Batu Pahat and Taiping*. Procedia-Social and Behavioral Sciences, 2012. **68**: p. 134-145.
- [14]. Razali, S.S. and M.B. Ishak, *Clinical waste handling and obstacles in Malaysia*. Journal of Urban and environmental Engineering, 2010. **4**(2): p. 47-54.
- [15]. Tudor, T., S. Barr, and A. Gilg, *Linking intended behaviour and actions: A case study of healthcare waste management in the Cornwall NHS*. Resources, conservation and recycling, 2007. **51**(1): p. 1-23.
- [16]. Longe, E. and A. Williams, *A preliminary study of medical waste management in Lagos metropolis, Nigeria*. Iranian Journal of Environmental Health Science & Engineering, 2006. **3**(2).
- [17]. Ogbonna, D.N., A. Chindah, and N. Ubani, *Waste management options for health care wastes in Nigeria: A case study of Port Harcourt hospitals*. Journal of Public Health and Epidemiology, 2012. **4**(6): p. 156-169.
- [18]. Ngwuluka, N., et al., *Waste management in healthcare establishments within Jos Metropolis, Nigeria*. African Journal of Environmental Science and Technology, 2009. **3**(12).
- [19]. Prem Ananth, A., V. Prashanthini, and C. Visvanathan, *Healthcare waste management in Asia*. Waste management, 2010. **30**(1): p. 154-161.
- [20]. Pant, D., *Waste management in small hospitals: trouble for environment*. Environmental monitoring and assessment, 2012. **184**(7): p. 4449-4453.
- [21]. Bdour, A., et al., *Assessment of medical wastes management practice: A case study of the northern part of Jordan*. Waste management, 2007. **27**(6): p. 746-759.
- [22]. Mbarki, A., et al., *Medical Waste Management: A Case Study of the Souss-Massa-Drâa Region, Morocco*. Journal of Environmental Protection, 2013. **4**(9).
- [23]. Yong, Z., et al., *Medical waste management in China: A case study of Nanjing*. Waste management, 2009. **29**(4): p. 1376-1382.
- [24]. Askarian, M., M. Vakili, and G. Kabir, *Results of a hospital waste survey in private hospitals in Fars province, Iran*. Waste management, 2004. **24**(4): p. 347-352.
- [25]. Alagöz, A.Z. and G. Kocasoy, *Determination of the best appropriate management methods for the health-care wastes in Istanbul*. Waste management, 2008. **28**(7): p. 1227-1235.
- [26]. Patwary, M.A., W.T. O'Hare, and M.H. Sarker, *Occupational accident: An example of fatalistic beliefs among medical waste workers in Bangladesh*. Safety science, 2012. **50**(1): p. 76-82.
- [27]. El-Salam, A. and M. Magdy, *Hospital waste management in El-Beheira Governorate, Egypt*. Journal of environmental management, 2010. **91**(3): p. 618-629.
- [28]. Graikos, A., et al., *Composition and production rate of medical waste from a small producer in Greece*. Waste management, 2010. **30**(8): p. 1683-1689.
- [29]. Sefouhi, L., M. Kalla, and L. Aouragh, *Health care waste management in the hospital of Batna City (Algeria)*. in *Singapore International Conference on Environment and BioScience, Singapore*. 2011.
- [30]. Nemathaga, F., S. Maringa, and L. Chimuka, *Hospital solid waste management practices in Limpopo Province, South Africa: A case study of two hospitals*. Waste management, 2008. **28**(7): p. 1236-1245.
- [31]. Chee, H.L., *Medical tourism in Malaysia: international movement of healthcare consumers and the commodification of healthcare*. 2007.
- [32]. Pocock, N.S. and K.H. Phua, *Medical tourism and policy implications for health systems: a conceptual framework from a comparative study of Thailand, Singapore and Malaysia*. Globalization and health, 2011. **7**(12): p. 1-12.
- [33]. Manaf, L.A., M.A.A. Samah, and N.I.M. Zukki, *Municipal solid waste management in Malaysia: Practices and challenges*. Waste management, 2009. **29**(11): p. 2902-2906.
- [34]. DOE. (2009). *Guidelines on the Handling and Management of Clinical Wastes in Malaysia*. Putrajaya: Ministry of Natural Resources and Environment.