

Understanding Clinical Waste Management and the Risk of Cross-Contamination Diseases in Malaysian Public Healthcare Facilities

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Abstract

Clinical waste management in the hospital plays a considerable role in healthcare facilities, as it serves as the frontline that deals with clinical disposal, where zero cross-contamination exposure to the public must be ensured. In this paper, a preliminary study was conducted to investigate the biohazard container etiquette in a selected Malaysian healthcare facility. The yellow bin is a designated container used to dispose of contaminated clinical waste that could spread pathogenic microorganisms to humans. The findings show that several biohazard bins were positioned in non-restricted pathways containing general plastic, papers, and rejected medical parts. It is assumed that a lot of effort is required to educate both the public and the staff regarding biohazard bin etiquette. To date, more inspections are still being conducted to determine the impact of misusing the biohazard bin. Nevertheless, the authors are currently developing descriptive statistics to investigate the public awareness of biohazard bin etiquette in hospitals. A new strategy to improve clinical waste management sustainability in a healthcare facility is also being proposed.

Keywords: *Malaysia, biohazard, clinical, contamination, healthcare.*

INTRODUCTION

Clinical waste management in the hospital is essential to healthcare facilities, as it is the frontline that deals with clinical disposal. For instance, waste deemed as “clinical waste” consists of human bodily waste such as faeces, blood, semen, hydrocele, and other minuscule cells. Occasionally, hospital clinical waste management receives full arms, breast, kidney and/or other defected organs for disposal (received from amputation surgery; to prevent cancer progression, hernia, or necrosis). Other than bodily fluid and full organs, clinical waste management will also dispose of infectious agents such as bacteria, parasite, virus, and fungi that have been isolated from infectious cells or organs for diagnosis and treatment strategies. Clinical waste has a signature odour, which is emitted from the infected cell or blood, and a strong chemical odour (e.g. formaldehyde, alcohol, and enzyme). Therefore, waste disposal activities are concealed from the public eye and have a designated pathway to guarantee zero contamination risk to humans. Efficient clinical waste disposal will preserve the “sterile” facilities of the hospital such as the operation room, the ICU, the clean linen room, the Paediatric ward (due to the children’s susceptibility to infection), and other facilities.

Upon entering a healthcare facility, the public should notice several yellow bins provided in the building. This yellow bin is designed only to accept biological waste such as blood smears, sputum, saliva, vomit, and urine containers, all of which usually carry significant health risks (“Biohazard Containers” n.d). In the public eye, this waste may seem harmless, but judging from the prevalence of healthy and sick communities that are seeking diagnosis and treatment daily, there is a risk of a virulent virus or other infectious agents accruing inside the yellow bin and its surroundings (WHO 2011). This paper discusses the current clinical waste management in healthcare facilities, the issues of cross-contamination infection, and presents preliminary findings on the yellow bin utilisation etiquette in selected public healthcare facilities in Malaysia.

CLINICAL WASTE MANAGEMENT IN HEALTHCARE FACILITIES

Sustaining a safe healthcare facility requires that healthcare management incorporate accreditation programmes that could measure clinical waste quality. For example, the Centre

of Medicare and Medicaid Services (CMS), specifically CMS §482.42 Conditions of Participation, states that:

“The hospital must provide a sanitary environment to avoid sources and transmission of infections and communicable diseases. There must be an active program for the prevention, control, and investigation of infections and communicable diseases.”

The Occupational Safety and Health Administration (OSHA) requires that every Healthcare facility that handles blood and other potentially infectious materials (OPIM) abide by the Bloodborne Pathogens Standard, 29 CFR 1910.1030 (and California OSHA’s Safety Order 5193). Healthcare facilities must also maintain an exposure control plan (ECP) that should include the disposal of biohazardous waste (Lillis 2014; 1910.1030 - Bloodborne pathogens, n.d).

The Yellow Bin

A yellow bin, also known as a biohazard container, is a designated container used for the disposal of contaminated waste that could convey the risk of a pathogenic infection to people and the environment. Biohazards are referred to as biological substances that pose a threat to the health of living organisms, primarily that of humans. A biohazard container should be labelled with the appropriate colour-coded label. It should also be fully closed and free of leakage during handling, transport, and storage (“Biohazard Containers” n.d). Historically, the clinical waste bin has a designated symbol, specifically the Biohazard symbol (☠) designed by Charles Baldwin back in 1966 (Symbol Making 2001). The biohazard symbol serves as a warning to the public or the healthcare staff that there is a risk posed by a harmful biological sample in the bin that could be contracted via a microorganism, virus or toxin (from a biological source), which could affect human health.



Figure 1 Three yellow bins (biohazard) in comparison to a general waste bin in Hospital A (Image courtesy of the author)



Figure 2 The biohazard symbol (Image courtesy of Offiikart; Wikimedia Commons, the free media repository)

According to Safeopedia.com, OSHA requires that biohazard waste be disposed of according to specific EPA regulations. The type of biohazard container employed may vary according to the type of waste. For instance, needles and blades, both of which are sharp items should be disposed of in a container that cannot be punctured by both inside and outside sources. Meanwhile, contaminated wipes, gloves, and disposable PPE should be disposed of in a closable bag. Beyond the healthcare industry, first-aiders must be trained in the proper handling and disposal of biohazard materials such as blood (1910.1030 - Bloodborne pathogens, n.d).

Clinical Waste Management

Kualiti Alam Waste Management Centre and Clinwaste (M) Sdn. Bhd. (306486-H) are the main companies that manage clinical waste in Malaysia. Based on the company service report, both companies offer consultancy, on-site collections, transportation, and the manufacturing of clinical waste containers. They also provide a comprehensive treatment facility consisting of an incinerator and a Microwave Treatment Section. The incinerator plant is designed to comply with all the legislation stipulated by the Department of Environment Malaysia and observes strict safety standards. A high temperature that is maintained at the primary and

secondary combustion chambers will safely incinerate all types of clinical waste. A stack emission testing is performed and monitored regularly to ensure the impurities released from the plant are controlled within the regulated standards; thereby protecting the environment (Clinwaste, 2016).



Figure 3 Combustible Incinerator Plant in the Clinwaste facility (Image courtesy of Clinwaste (M) Sdn. Bhd.)

The Microwave Treatment Section (MTS) is one of the new-generation technologies that use a proprietary shredder designed for biohazardous waste. The MTS is intended to improve treatment efficiency by using onboard steam to moisten the waste for decontamination. A hopper directs the infectious material to a shredder where it is shredded and conveyed through a Microwave Treatment Section (MTS) for disinfection and discharge (Clinwaste, 2016)



Figure 4 The AMB Ecosteryl 250 model in the Microwave Treatment Section in the Clinwaste facilities (Image courtesy of Clinwaste (M) Sdn. Bhd.)

FREQUENCY OF CLINICAL WASTE SERVICES IN PUBLIC HEALTHCARE

Based on the preliminary study conducted in January 2019, the majority of Malaysian public healthcare facilities required clinical waste disposable services at least three to seven days a week to dispose of biological waste. This enormous amount of waste is accumulated from daily outpatient/in-patient treatment, systematic surgeries, post-mortems, blood bank facilities, and diagnostic laboratories. Nevertheless, these numbers do not significantly reflect clinical waste management in the private healthcare sector, as it usually receives a lesser number of outpatient/inpatients and has fewer samples for laboratory diagnoses. In specific circumstances, Islamic practice prohibits the disposal of human organs by incineration, as it mimics the cremation process (Sarhill et al., 2001). Therefore, dis-attached flesh such as the foetus, arms, and/or organs should be treated and sealed by designated healthcare staff (Lawrence and Rozmus 2001), before releasing them to the rightful patient/or families for burial in accordance to Islamic rites.

PRELIMINARY FINDINGS OF MISUSED BIOHAZARD BINS

The biohazard bin should only be filled with samples that have been biologically contaminated, for example, tissue papers with bloodstains, sputum, faeces, and other bodily fluid. Besides, the staff must also dispose of used microbe culture plates (agar, slant, enzyme, swab, etc.). Prohibited items that are usually disposed of in the biohazard bin are general plastic, newspapers, cigarette butts, beverages, and, electronic/metal devices. To understand a person's habitual misuse of the yellow bin, the authors decided to identify the type of waste contained in a biohazard bin located in Hospital A. Based on a preliminary visit to Hospital A in Kedah, Malaysia (early May 2019), several biohazard bins were observed to be positioned in non-restricted pathways and were filled with plastic and papers. For instance, Figure 5 shows a biohazard bin filled with paper scraps, syringe pack seals, and a rejected intravenous drip. Figure 6 shows an autoclave paper (turquoise) with a "zebra" strip tape indicator inside a yellow bin. An autoclave strip indicator is shown in Figure 7. An apparatus wrapped in autoclave paper signals that it has been sterilised. Therefore, the used autoclave paper should be considered sterile and disposed of in a general trash bin.

In principle, any sample discarded in the yellow bin is prohibited from being reused to prevent the risk of cross-contamination. Contaminated needles and syringes represent a

specific threat, as the failure to dispose of them safely may lead to dangerous recycling and repackaging, which then leads to unsafe reuse. Contaminated injection equipment may be scavenged from waste areas and dumpsites and either reused or sold to be used again (Lillis 2014; WHO 2011; Polan et al., 2013). Once the yellow bin content is full, the responsible unit—equipped with proper PPE—will directly seal the plastics inside the yellow bin. Biomedical waste re-segregation, especially in a sharp yellow container (refer to Figure 6), will pose a risk of cross-contamination to the responsible staff. For instance, the responsible staff might get themselves pricked by contaminated hypodermic needles and other sharp items (Maina 2018). Also, if bodily fluid inside the bin contains an airborne microorganism, the staff could be easily exposed to infection via inhalation (Salkin & Kennedy 2001).



Figure 5 The picture shows a misused biohazard bin in Hospital A. Paper scraps can be seen on the left side, together with a syringe pack seal (not contaminated) and an expired intravenous tube.



Figure 6 The image shows used autoclave paper discarded in the biohazard bin, which should have been discarded in the general waste bin on the far right.

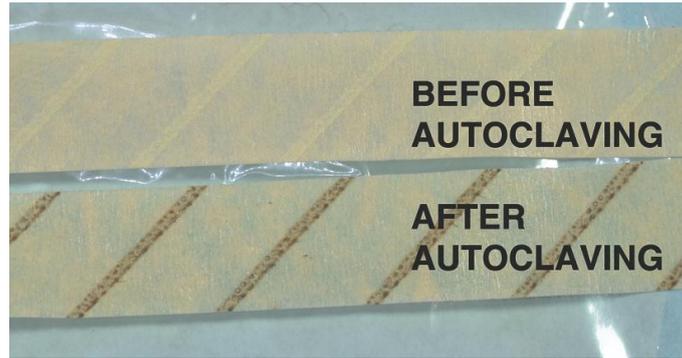


Figure 7 An autoclave tape (Brand: Surgical System). A bright zebra stripe indicates a complete sterilisation process (Image courtesy of Surgical Systems, South Africa)



Figure 6 An example of a designated biohazard bin for sharp items. Due to cross-contamination risks, the authors could only examine the content visually from the outside.

Based on the findings, it is worth speculating that both the public and the healthcare staff should be educated on the etiquette of using yellow bins in a hospital. To date, the authors are still conducting more inspections to determine the impact of misusing the biohazard bin. Based on the feedback received, Hospital A occasionally needs to re-segregate trash in the biohazard bin before sending it for final disposal. As per usual practice, clinical waste disposal does not comprise a recycling process. Therefore, clinical waste management has the right to impose extra charges if non-clinical waste were identified upon collection and processing (WHO 2018).

ACT OF NEGLIGENCE: ILLEGAL CLINICAL WASTE DUMPING

In March 2019, the Negeri Sembilan Department of Environment (DOE) received public complaints regarding issues of clinical waste dumping activities in an illegal landfill located in Kampung Sendayan, Seremban. Based on the DOE and State Health Department

investigations, eleven suspected clinical waste types were identified, namely dialysers/filters, and dialysis blood tubes. The investigation found that an appointed contractor had illegally disposed of the waste. To date, further investigations are still on-going to identify the dialysis treatment centres and contractors involved in the above activities.

The State Health, Environment, Cooperatives, and Consumerism Committee Chairman, S. Veerapan, stated that:

“DOE has also issued a notice by Section 31 and 37 of the Environmental Quality Act 1974 to order suspected premises to carry out the cleaning of the clinical waste until the investigation is completed. If the waste is not cleaned, we fear that it can endanger wild animals such as monkeys and dogs that roam around the area as well as pose risks to nearby residents.”

The case was investigated under Section 34B (1) (a) of the Environmental Quality Act 1974, which imposes a jail term of up to five years and a maximum fine of RM500,000 if convicted (Raja Rahim, 2019).

INFECTIOUS DISEASE FROM CROSS-CONTAMINATION IN HEALTHCARE FACILITIES

The World Health Organisation (WHO) is now flagging the occurrence of infectious disease spread through cross-contamination as a serious issue. In 2000, WHO estimated that contaminated injections because of contaminated syringes had caused 21 million hepatitis B virus (HBV) infections (32 per cent of all new infections); 2 million hepatitis C virus (HCV) infections (40 per cent of all new infections); and at least 260 000 HIV infections (5 per cent of all new infections). In 2002, the WHO found that 18% to 64% of healthcare facilities in 22 developing countries did not use proper waste disposal methods (WHO, 2011).

RESEARCH DEVELOPMENT

Based on the preliminary findings of this study, the authors are currently developing new sets of questionnaires to investigate the public awareness of biohazard bin etiquette in hospitals.

The authors are also developing a proposal to establish a new strategy or a recommendation for healthcare facilities to improve clinical waste management sustainability based on exercising knowledge of clinical waste by developing a fundamental, quantitative waste baseline.

CONCLUSION

The preliminary findings suggest that more effort is needed to educate both the public and the healthcare staff on how to use the yellow bin appropriately. Although Malaysia is still a developing country, it has still demonstrated a great effort towards increasing this awareness by introducing state-of-the-art clinical waste treatment plants. However, without continuous activity to educate the community about clinical waste management or, at least, how to utilise the yellow bin appropriately, healthcare officers might have to continually deal with staggering waste re-segregation works, which carry underlying risks of infectious diseases.

AUTHOR BIOGRAPHY

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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