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## CLINICAL WASTE HANDLING AND OBSTACLES IN MALAYSIA

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### Abstract:

As in many other developing countries, the generation of clinical waste in Malaysia has increased significantly over the last few decades. Even though the serious impact of the clinical waste on human beings and the environment is significant, only minor attention is directed to its proper handling and legal aspects. This study seeks to examine the management of clinical waste in Selangor's government hospitals as well as problems that arise from the current practice of clinical waste management. A depth interview with the responsible concession who handles the clinical waste management in those hospitals also has been taken. In general, it was found that the consortium's administration was reasonably aware of the importance of clinical waste management. However, significant voids were presented that need to be addressed in future including efficient segregation, better handling and transfer means, as well as the need for training and awareness programs for the personnel. Other obstacles faced by consortiums were to handle the clinical waste including the operational costs. Waste minimizing and recycling, as well as the alternative treatment methods for incineration are regarded to be major challenges in the future.

**Keywords:** clinical waste, management, obstacles

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## INTRODUCTION

Medicine is one of the important sectors showing enhancement throughout the recent decades (Birpinar *et al.*, 2008). A hospital is midpoint that supplies various healthcare services to the community. Its activity may include curative, rehabilitation, preventive, and promoting of health education. In undertaking the activities, the hospital may also generate waste (Chaerul *et al.*, 2008). However, the fraction of waste generated at medical institutions has not attracted the level of attention as other types of wastes, especially in developing countries (Birpinar *et al.*, 2008). Even though concrete steps like proposing a policy and laws to regulate clinical waste management, there is still problems presence due to several factors. Lack of training, awareness, and financial resources had been seemed as factors contribute to the mismanagement of clinical waste.

Clinical wastes differ from any other wastes that being produced in hospitals. Sharps, human tissues or body parts and other infectious materials contain in clinical waste poses potential health and environmental risks (Bareja *et al.*, 2000). By weight, approximately 15 – 25% of clinical waste is considered infectious (Shinee *et al.*, 2008). Even though the current practices of clinical waste management are different from hospital to hospital, the problematic are similar for all healthcare institutional from segregation, collection, packaging, storage, transport, treatment and disposal (Tsanoka *et al.*, 2007).

Environmental pollution, unpleasant odors encourages insects, rodents and worms to breed that may lead to transmission of disease like cholera, hepatitis or typhoid through injuries from contaminated sharps (Abdulla *et al.*, 2008).

Proper manner of clinical waste management is greatly important to avoid health risks and damage to the flora, fauna and the environment (Yong, *et al.*, 2009).

### Clinical Waste Management in Malaysia

Up until 1980s, Malaysia has no proper system for the management of clinical waste. With the emergence of HIV, Ministry of Health in collaboration with Department of Environment took an initiative to revise policies and guidelines for prevention and control of infectious disease and clinical waste handling.

It is estimated that total bed's strength is about 47 000 and 35 000 came from government's hospital with the occupancy rate 65%. Clinical waste in Malaysia may be defined as:

i. Any waste which consist wholly or partly of human animal tissue, blood or other body fluids, excretions, drugs or other pharmaceutical products, swabs or

being waste which unless rendered safe may cause hazardous to any person coming into contact with it.

ii. Any other waste arising from medical, nursing, dental, veterinary, pharmaceutical or similar practice, investigation, treatment, care, teaching or research, or the collection of blood for transfusion, being waste which may cause infection to any person coming into contact with it.

Currently, clinical is reported together with pharmaceutical waste. The total clinical waste generated is about 8000 tonnes per year and DOE (2005) estimated that the generation rate for clinical waste varies from 0.3 to 0.8 kg per occupied bed per day.

### Clinical Waste Problems and Obstacles

In Brazil, law of environment No. 7 (1982), law of the atmospheric and air protection (1992), and law of transport of hazardous materials (2005) deals with clinical waste management, but problems such as waste transported to on-site storage containers via uncovered trolleys, containers placed near the main street within the hospitals buildings or located outside at the street curb, waste simply dumped in the corner of hospital room until it could be transported off-site, use of open trucks and lack of training (Sawalem, 2008).

Same goes to Korea. Korea National Assembly customized the Waste Management Act in 1999 to enhanced control from the generation of medical waste to its final destination. The Korea Ministry of Environment (MOE) had given the responsibility for implementing the act. The Korea MOE spread several regulations for definition, segregation, packaging, tracking, and disposal of medical waste but yet, the mismanagement still arise that medical waste was often mixed and waste minimization and recycling are still not well-promoted (Jang *et al.*, 2006).

In 2002, Croatia endorsed the Directive on the management of waste produced during healthcare (Republic of Croatia, 2000). The Directive portrays an overall system of waste management; sorting at the point of generation, collection, transportation, storage and treatment but only a small number of medical institutions report their waste to the Registry due to the weakness of Registry function.

These deprived management sides are due to the lack of sensitivity from the management of the facilities, meaning there seems to be some lack of awareness concerning health risks towards the community members as well as environmental issues, and due to economic problems in the country that prevent the government from adequately supporting a healthcare policy (Silva *et al.*, 2005; Abdulla *et al.*,

Concerning this, this paper aimed to:

- (a) To examine the clinical waste management in Selangor (one of the state in Malaysia) government's hospitals.
- (b) To analyze problems faced in the management means.

## METHODOLOGY

The methodological framework can be described as follows (**Fig. 1**):

### Study site

The study took place in Selangor, Malaysia. Located on the west coast of peninsular Malaysia and covering 8000 square kilometers, Selangor is bounded on the north by Perak, on the east by Pahang and Negeri Sembilan, and on the west by the Straits of Malacca.

Selangor has been called the gateway of Malaysia. It is also the industrial hub of Malaysia; the country's largest industrial site is located in Shah Alam, the states capital, just 25 kilometers from Kuala Lumpur. It is the most populous state in the country with a total population of 2.7 million inhabitants. Despite being industry-based, the state is blessed with natural forests, waterfalls, hills, and lakes to complement its many man-made attractions.

There are 10 government hospitals in Selangor, which are located at Kajang, Serdang, Kuala Kubu Bharu, Ampang, Selayang, Sungai Buloh, Banting, Sabak Bernam, Klang and Tanjung Karang.

### Data Collection

The first step in collecting the data was to determine the panelists. The panelists were the clinical waste supervisor in each hospital. Panelists were then interviewed. Interviews were helpful in obtaining information about common practices in the management of the waste (Bdour, *et al.*, 2007). Questions were asked basically about the management of clinical waste in terms of collection, transportation, treatment, disposal and training. The informants were also asked about the clinical waste management during H1N1 acute and the challenges involved as well as the problems faced. The number of wastes generated was also asked.

A form for the panelists to provide the information regarding clinical waste generation and training was also distributed.

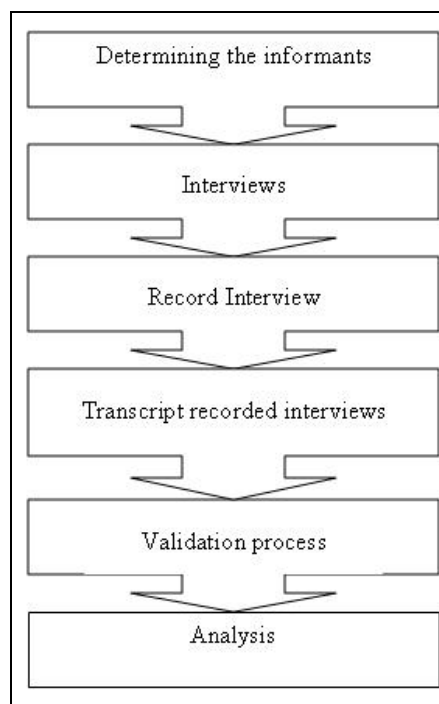
### Data Analysis

The recorded interviews were then transferred into transcripts. Then, the transcripts were sent back to the interviewees for the process of validation. In this process, the panelists may make any correction if they wish to.

## RESULTS AND DISCUSSION

### Background information and clinical waste generation

The quantity of clinical waste depends upon several factors such as the size of hospital, the segregation program of clinical waste and the medical activities. **Table 1** and **Fig. 2** presents clinical waste generated from all general hospitals in Selangor throughout the year 2009. There are 10 government hospitals in Selangor and the number of beds ranges from 93 to 864 with a mean of 335.9. However, in this study, we will look upon to just nine hospitals because one of the hospitals refused to give cooperation. Considering the occupancy bed is 100%, the average generation rates of total clinical waste in Selangor's government hospitals were estimated to be 1.355 kg/bed/day.



**Fig. 1** Research framework.

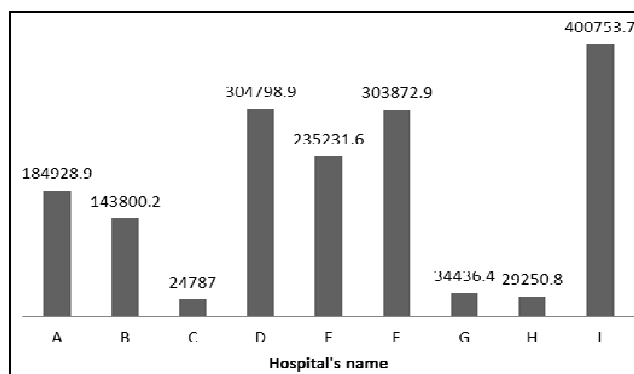
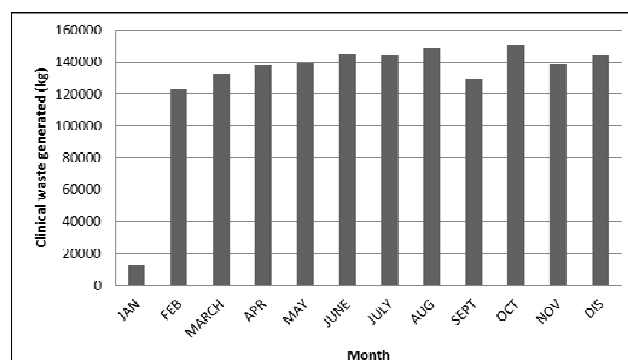
**Table 1** Generated clinical waste for Selangor's government hospital for 2009 (in kg)

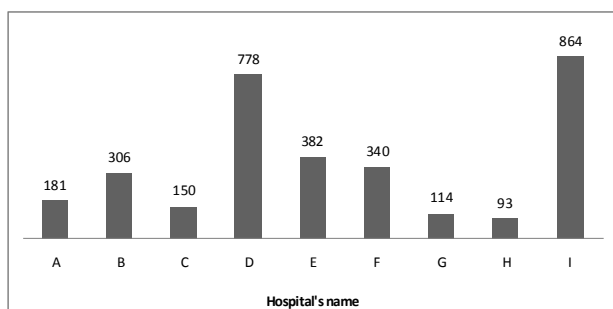
	A	B	C	D	E	F	G	H	I
Jan	13 022.6	10 935.3	2 184.2	24 749.37	16 978.1	23 304.2	2 672.0	2 253.3	30 424.0
Feb	12 866.5	10 932.7	1 904.0	23 506.5	17 202.1	22 451.3	2 362.5	1 985.8	29 549.9
March	14 683.3	11 871.6	2 001.7	26 101.3	18 539.6	21 095.4	2 813.4	2 210.8	33 020.4
Apr	1 470.7	11 898.1	2 126.8	25 939.3	20 259.4	23 611.2	2 950.3	2 290.7	34 368.2
May	14 878.3	11 553.5	1 688.8	25 233.0	20 482.9	25 452.5	2 965.2	2 535.1	34 787.3
June	14 298.3	10 366.3	2 077.1	24 002.3	19 600.1	36 896.3	2 739.1	2 415.4	32 917.0
July	17 397.3	11 490.7	2 286.9	25 363.7	20 958.1	27 572.3	3 154.9	2 495.4	34 164.5
Aug	1 6906.0	12 848.1	2 465.0	27 630.9	20 361.5	26 459.0	3 073.1	2 597.9	36 435.4
Sept	14 587.5	11 498.8	1 676.7	23 141.3	18 306.3	23 121.2	2 840.5	2 519.0	31 556.9
Oct	17 701.8	13 953.3	2 383.9	26 959.6	21 693.7	25 528.7	2 999.1	2 685.4	36 815.7
Nov	16 498.9	12 753.2	1 981.0	25 414.1	19 948.7	23 678.4	2 853.2	2 595.9	33 005.9
Dec	17 381.4	13 698.6	2 010.9	26 757.5	20 901.1	24 702.4	3 013.1	2 666.1	33 709.1

**Table 2.** Specialties in each hospital

Services	Hospital								
	A	B	C	D	E	F	G	H	I
Anaesthesiology									
Dermatology									
Herpetology									
Nephrology									
Paediatric									
Psychiatry									
Haematology									
Obstetric and Genecology									
Orthopaedic and Traumatology									
Ophthalmology									
Teeth & Mouth Operation									
Radiology									
Haemodialysis									
Otorhinolaryngology (ENT)									
Urology									
Cardiothoracic									
Ear, Mouth & Throat									
Plastic Surgery									
Paediatric and Neonatology									
Rehabilitation									
Neurosurgery									

■ indicates the service available at the hospital.

**Fig. 2** Reported generation of clinical waste in Selangor's



**Fig. 4** Number of beds in Selangor's government hospital.

**Figure 4** illustrates the number of beds in Selangor's government hospitals.

Almost all hospitals offer same services; general medical, general surgery, emergency, pathology and maternity. Hospital F offers a lot of specialties that are not available in other hospitals. **Table 3** presents the specialties offered in all hospitals.

From the table, the number of waste generated is depending on the number of beds and departments in the hospitals. Hospital J, which has the highest number of beds (864 beds), produced the highest amount of clinical waste (406 753.7 kg). Also, the location of the hospital influenced the number of waste produced. For example, Hospital D, H and I produced wastes less than 50 000 kg because they are located at the rural area, compare to other hospitals that are located in urban area.

There is no specific reason to why the number of wastes decreased in September but H1N1 outbreak could be the possible explanation of why the number of wastes increased and became the month with the highest production of clinical wastes throughout the whole year.

According to the clinical waste Supervisors, there are a few units that had been identified to generate the most wastes.

Abu: Usually GOT (General Operation Theatre), maternity, and ICU (Intensive Care Unit). But the rest is normal; however, it is hard to say that. It depends on the patients. Sometimes, there is no patient entering ICU, which means there is no waste.

Ahmad: Ward 2 (dengue cases), labor room, GOT, emergency.

Based on the interview, it can be concluded that high production of clinical wastes comes from Operation Theatre, maternity, Intensive Care Unit, Emergency and dengue cases ward.

#### Clinical waste collection, storage, transportation and incineration

The collection usually starts at 08:30 am until 11:30 am. Porter with well-equipped Personal Protection

Equipment (PPE) then pushes the yellow cart and start doing collection from unit to unit. The PPE that are being used include apron, glove and boot. The fully-filled yellow bags with the wastes will then be transferred to the cart and the process will be repeated until all the waste has been collected. Then, they will send the waste to the cold storage. Here, they will wait for the liaison officer or the hospital verifier to witness the weighing process. The weighing process is usually conducted from 11:30 am to 12:30 pm. While doing the collection, there are some porters that are being assigned to clean the bin. They will change the used bin with a new bin. To clean the bin, 100 ml of a chemical named SteriQuat were mixed with 250 L of water. Then, the bin will be dried. The bin must be washed daily.

While for the disposable sharps and needles, a specific bin that is called sharp bin was used. After it is  $\frac{3}{4}$  filled, porter will close the cap and it will be collected and transferred to the cart. Unlike other yellow bins, this sharp bin will not going to be washed. It will be incinerated and the wastes inside it are not going to be transferred to other place.

For a small hospital which produces less clinical waste, the waste will be store in a refrigerator with the temperature range of -1 to -5°C while for the hospital which produce large amount of clinical waste, there is no refrigerator provided. This is because for the hospital which produce small amount of waste, the lorry will collect the waste three times per week while for the hospital which produce large amount of waste, the lorry will come daily to collect the waste. The lorry will send the waste to the incinerator plant in Teluk Panglima Garang. The time for the lorry to come and collect the waste is from 12:00 noon to 05:30 pm.

During the H1N1 outbreak, the management of clinical waste in the H1N1 ward is slightly different. The hospital briefed to the porter who was assigned to collect the waste. Only one person can be assigned. At one time, he then will be given a H1N1 immunization. The wastes that have a H1N1 contact will be placed in a yellow bag and being stored in a labeled yellow cart. When the lorry comes, this yellow cart has the priority to be collected and incinerated when they reach the incineration plant at Teluk Panglima Garang.

A flowchart of the incineration system is being described in **Fig. 4**. The system consists of a waste feeder, a primary combustion chamber (rotary type), a secondary combustion chamber, a waste heat boiler, dry air pollution control, and a 24-h gas-emission monitoring device. The melting of the ash occurs in the secondary combustion chamber at 1 200°C (Azni *et al.*, 2005).

With the capacity of 500 kg/h, this incinerator operates 24 hours. **Table 3** summarizes the specification of the incinerator.

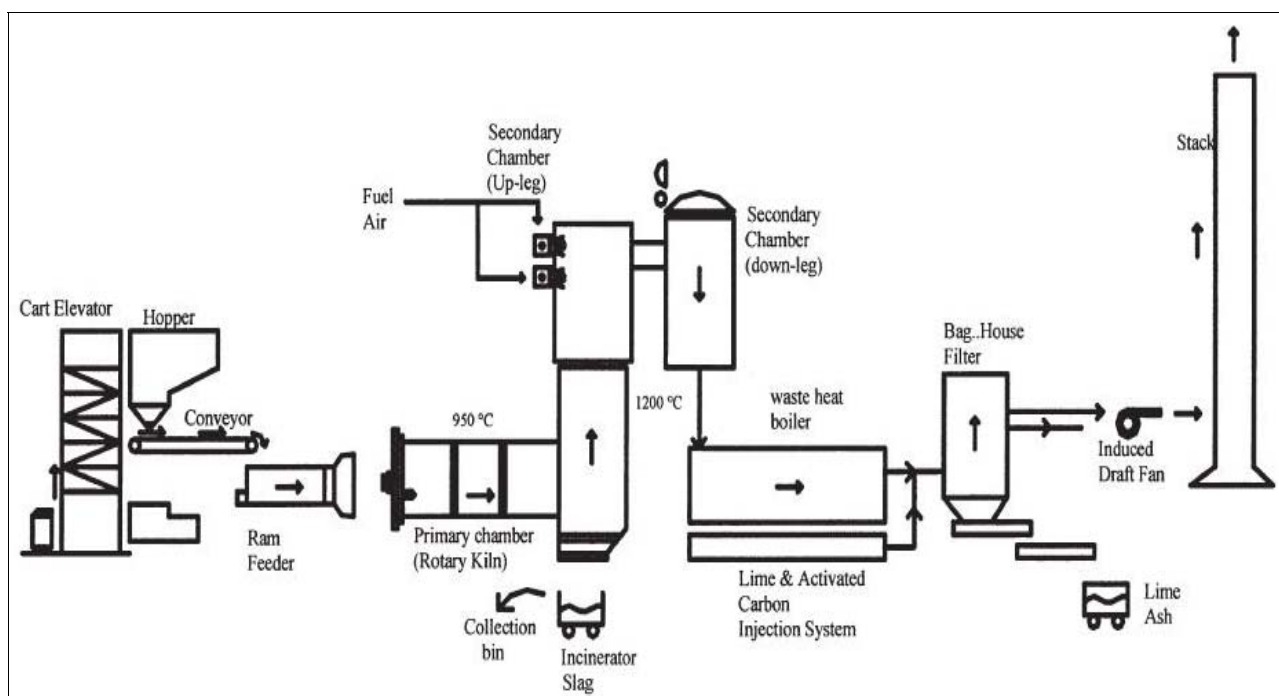


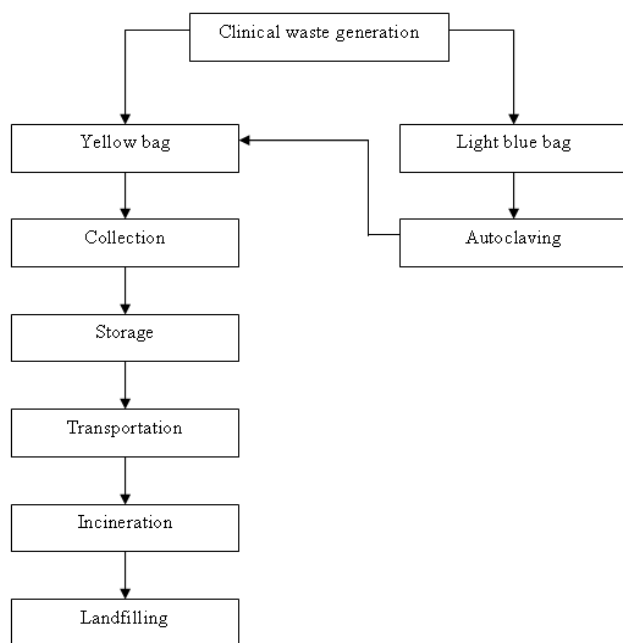
Fig. 5 Flow diagram of clinical waste incinerator.

Table 3 Specifications of the incinerator

Operation time	24h
Type of fuel	Diesel
Type of feed	Hospital waste
Treatment capacity	500 kg/h
Amount of flue gas	20 000 m <sup>3</sup> /h
Amount of slag produced	10%
Temperature in Primary Chamber	950° C
Temperature in Secondary Chamber	1 200° C

Source: Azni *et al.* (2005).

The clinical waste management in Selangor's government hospital can be simplified as follows:



## Training and Awareness

The concession company is the one who is responsible to conduct the trainings. There are two groups of people who are involved in the trainings. They are the porter and the user (hospital staffs). The porter will go for trainings at least three times a year. The training involves clinical waste collection procedure, procedure on wearing Personal Protection Equipment (PPE), clinical waste service management, procedure on washing the bag holder, procedure on filling the record sheet, procedure on filling bag holder washing form, customer relationship program, clinical waste segregation, procedure on handle the accident and health. The training will be given throughout the year or when accident occurs.

For the user, the training will be given three times a year or upon request. Usually, the hospital will ask the concession company to conduct training for user when there is a new staff. The trainings involve identifying the types of waste, clinical waste segregation, clinical waste handling, safety and health.

Unfortunately, there is no specific training for the public. The only way to educate the public, especially on the segregation of waste is through posters. The poster will be pinned-up on top of the bin to give awareness to the public regarding the segregation.

## Problems and Obstacles

Although there is a management system in clinical waste handling in Malaysia, there are several problems and obstacles that had been found throughout the study.

Ahmad: Usually, doctors always throw needles everywhere, sometimes in the yellow bag. That will cause problems.

Ali: The problems arise while we are doing the collection, the people from the district clinics come, and the problem is that they like to store the waste outside the fence but they are not allowed to do so.

Abu: If every user is being given a room to place the bins and do the cleaning process, it would be easier, avoiding transportation in the elevator and contact with public, which would cause trouble to publics.

Abu: The price should be increased because the groceries' price is increasing, plastic and all the bins. The price is not the same as 10 or 15 years ago. Look at the current economy; I think we should increase the price.

Abu: There is no drying machine.

Aini: Porters have no infectious control towards patients or hospital. They open the door and collect the waste by using the same hand.

Aini: The problem we face now is that even we had given the training, not all patients know about it. In the yellow bin, they are not allowed to throw the clinical waste. We cannot open the bag back because it is already mixed. There is no awareness from the public.

Adila: If we do the collection in the ward, we will carry the plastic bag to the outside. The large wheel bin cannot be pull inside the ward. That is the weakness because we have to carry the yellow bag to the outside. It would spill on the floor.

Mala: for the clinical waste, there are too much procedures and too much contact. There are too much things that we need to follow.

From the interview, there are several problems in managing clinical waste. The user's attitude has been identified as one of it. Even though training had been given, their self awareness still considered as low. The second problem is regarding the waste from district health centre. For district health centre, there is no specific concession company to manage clinical waste as government hospitals does. They need to send their waste to the nearest government hospital by their own. The problem arises when they tend to put the waste outside the fence of the clinical waste storage. This is dangerous because it will expose the waste to the public as well as animals such as dogs and cats. The vaporized waste might spread the infectious disease through the

air. Space had been identified as one of the problems in managing clinical waste.

There is no enough space provided for the hospital support services in the hospital. For clinical waste, they need a large space especially to wash and dry the bin. Because of this limitation, some bins are not being washed properly or not being washed at all. Also, using a traditional approach to dry the bins proved to be a major problem too. A drying machine for the bins is needed especially for the hospitals which produces high amount of wastes.

When the agreement was first signed, both parties agreed to update the service charge from time to time. Unfortunately, since it was signed in 1992, there is no revision made regarding the price. The current price is RM5.20 per kilograms. The price should be revised due to the increasing price of raw materials and transportation costs.

The problem also occurs from the handling of the clinical waste. By using the same hand to collect the waste and to open the door, the probability for the infectious disease to spread becomes higher. When the porter carries the bags to the clinical waste cart outside the ward, there is a probability of the infection spreading through the spillage on the floor occurs.

Public awareness has been identified as one of the problem. Because of the low public awareness on the management or handling of clinical waste, they tend to mix up the clinical waste and the general waste. This will increase the disposal cost because the general waste will be treated as clinical waste once it is contacted with the clinical waste.

There are several agencies that responsible to the clinical waste management. Due to this, a lot of requirements and procedures need to be followed. This seems as the problems to the concession company in dealing with clinical waste management.

## CONCLUSION

This study helped in establishing database, information and statistics on the clinical waste sources, generation, collection, transportation, treatment and disposal. It also highlighted the problems and obstacles faced during its handling. Also, it has provided suggestions for policy makers and further information to facilitate policy development and improve clinical waste management.

The management of clinical waste has been of major concern due to its potential high risks to human health and the environment. The current practices for the handling, transportation, storage and disposal of wastes generated at the hospitals needs to be changed and improved. Generally, the problems and obstacles arise from the handling of clinical waste are non-segregated



waste, awareness and attitudes among hospital's staffs and patients, collection of waste from district healthcare centre, facilities and spaces provided, service charge and documentations.

Hospital's design is very important. It is the first step to allocate spaces for the clinical waste management; either from collection, storage and disposal. Abu had stated before, "If every user is being given a room to place the bins and do the cleaning process, it would be easier. No elevator's problem, contact with public and causing trouble to publics". It seems that training and supervision is very important to educate not only the porter, hospital's staff but also all the patients to make sure there's no misuse of bins that had being provided. Other than that, improvements and research and development activity (R&D) should be carried out continuously to combat the problem that might not occur before but tend to be hazard such as what has being highlighted by Ani and Adila about infectious control. The policy also should be revised to make it more understandable and will not cause the difficulty as what Mala had told, "For the clinical waste, there are too much procedures and too much contact. There are too much things that we need to follow."

Improvements of clinical waste management require all parties to involve. It also requires strategic and systematic planning that aim the goal to controlling costs, educate the users and publics, understandable policy and to manage the clinical waste in proper manner as it can reduce the hazards and risks to the ecosystem and the community.

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