

Hospital Waste Management in Queensland, Australia, 2010: A Case Study for Sustainable Hospital Waste Management in Indonesia

Pengelolaan Limbah Rumah Sakit di Queensland, Australia tahun 2010: Studi Kasus Bagi Pengelolaan Limbah Rumah Sakit yang Berkelanjutan di Indonesia

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Abstract

A case study was conducted in Queensland State, Australia, in 2010 to gain information about methods and technology practiced in hospital waste management (HWM) that can be adopted by Indonesian hospitals. The method of the study is a qualitative inquiry through in-depth interviews with hospital personnel and observations of HWM practices in The Royal Brisbane and Women's Hospital (RBWH). The study also elicits information on regulations and policies governing solid waste within Queensland State. Data were analyzed descriptively based on the contents of waste management hierarchy including collection, treatment and final disposal. The study revealed that Queensland hospitals have a comprehensive on-site policy and strong leadership that focus on waste reduction and safe waste handling to prevent waste management costs as well as preventing waste related diseases and injuries. The State also implements a new strategy to achieve a low-waste Queensland, under a strong legislative framework by an application of resource recovery strategy including reduce, reuse and recycle (3Rs) to significantly reduce the environmental, social, economic, and health impacts of waste, and in turn, enhance sustainability. The study suggests that Queensland's experience can be adopted by Indonesian hospitals, particularly in implementing 3Rs approach and appropriate waste handling under a clear on-site policy and leadership to minimize the incidence of waste related diseases and injuries.

Keywords: case study, good practice, hospital waste management, 3Rs

Abstrak

Suatu studi kasus telah dilaksanakan di Negara Bagian Queensland, Australia tahun 2010 untuk memperoleh informasi tentang metode dan teknologi yang diterapkan dalam pengelolaan limbah rumah sakit (RS) yang berkelanjutan agar dapat diadopsi oleh RS di Indonesia, yang sampai dengan saat ini masih belum mengelola limbahnya secara berkelanjutan. Masih banyak RS yang tidak memilah limbahnya agar limbah medisnya dapat diolah sesuai persyaratan pengelolaan limbah bahan berbahaya dan beracun (B3). Teknologi pengolahan limbah di Indonesia yang paling banyak digunakan adalah insinerasi yang dapat menimbulkan pencemaran lingkungan dan gangguan kesehatan. Metode dalam pengumpulan data adalah kualitatif melalui wawancara mendalam dengan pengelola limbah RS dan pengamatan terhadap praktik pengelolaan limbah di Royal Brisbane and Women's Hospital (RBWH). Studi ini juga mempelajari peraturan perundang-undangan dan kebijakan tentang pengelolaan limbah di Queensland tersebut dan dianalisis secara deskriptif berdasarkan hirarki pengelolaan limbah meliputi pengumpulan, pengolahan, dan pembuangan akhir. Hasil studi ini menunjukkan bahwa RBWH maupun RS lainnya mempunyai kebijakan lokal yang menyeluruh dan RBWH mempunyai kepemimpinan yang tegas dengan fokus pada minimisasi limbah dan keamanan dalam penanganan limbah untuk menghemat biaya sekaligus mencegah terjadinya penyebaran penyakit dan kecelakaan karena limbah. Negara bagian ini juga menerapkan strategi baru dengan kerangka peraturan yang berorientasi pada strategi "mengurangi, menggunakan kembali, dan mendaur-ulang dalam rangka pemulihan sumber daya dan mengurangi dampak lingkungan, social, ekonomi menuju kelestarian lingkungan. Studi ini menyarankan bahwa praktik pengelolaan limbah di RBWH ini dapat menjadi contoh untuk pengelolaan limbah RS di Indonesia, terutama dalam penerapan pengurangan limbah, kebijakan lokal RS dan pencegahan penyakit dan kecelakaan karena limbah RS.

Kata Kunci: studi kasus, praktik, manajemen pengelolaan limbah, B3

Introduction

Hospital waste (HW) is a by-product of hospital service activities. A small proportion of HW poses great risks to the health of hospital workers, waste operators, the community and the environment; hence, it needs to be managed safely¹. Although the proportion of medical waste that falls into the category of hazardous waste is only 15-25%, it certainly poses a great risk, as it can spread infectious diseases and causes injuries. For example, WHO² predicted the risk of sharps waste, which was only 1% of the total healthcare wastes in 2000, to be as big as being able to spread hepatitis B (HBV) infections in as many as 21 million cases (32% of new cases), 2 million hepatitis C (HCV) cases (40% of new cases), and 260 thousand HIV infections (5% of new cases). Runner also found that there has been unsafe handling of bodily fluids from patients.³

Health care waste management (HCWM) in Indonesia has not been given the attention it deserves by the management team of health care providers, the government, and the general public.⁴ There was never a HCW audit in each representative hospital class as an input to establishing a comprehensive and sustainable HCWM plan. Ananth and colleagues found that among 12 Asian countries, Indonesia was at the stage of low status of safe HCWM, since it only partially followed the stages of waste management hierarchy and many hospitals managing their wastes using incinerators have not been following the best practice.⁵

In line with the health sector decentralization policy since 2000, the number of hospitals in Indonesia is increasing.⁶ Therefore, there is a need for constant monitoring of the quality of service of hospitals to ensure the safety of patients, workers, and the surrounding community. This need gets more emphasized, as the rising number of hospitals means a greater use of disposables, and it is easy to predict that the amount of HW generated will be even higher.⁷

In order to improve HWM practices in Indonesia which is currently unsustainable, there is a need to elicit information on good practices of hospital waste management from a developed country, like Australia. Therefore, this paper presents the results of a case study conducted in Queensland State, Australia, to study the experience of Queensland State and the Royal

Brisbane and Women's Hospital in managing HW since the HCWM system was homogenous amongst Queensland hospitals. Several aspects concerning HWM were studied as to elaborate the good practices implementing in a biggest tertiary hospital. The results can be used to develop a guideline for the improvement of current HWM in Indonesian hospitals.

Materials and Methods

This study applied a qualitative inquiry as suggested by Creswell⁸ and Boeije.⁹ Since Queensland State only has one single policy in HWM using on-site and off-site systems, hence, the researchers chose only one hospital among three tertiary hospitals, which is RBWH for the case study. Also, the researchers assumed that HWM systems were the same amongst Queensland hospitals. The RBWH is the largest tertiary hospital which can cover all relevant components of inquiries concerning good practice of HWM in Queensland State.¹⁰ Components of the study include waste collection, segregation, containment, on-site transportation, 3Rs system, off-site transportation, treatments, and infection control. The researchers also visited a private company operating hospital waste treatment using centralized incineration system to observe waste treatment processes.

A checklist was prepared for on-site observations and a semi-structured questionnaire was used to guide the interviews. For the purpose of studying HWM policy, the researchers collected all relevant documents which were available online and then triangulated with the in-depth interviews with selected hospital staff, ranging from the Head of Waste Management Division, waste management officers, nurses, and waste handlers. Totally, there were seven days of on-site visits and observations to bring about the relevant information on good practices of HWM in Queensland State, which consisted of two days in September and five days in October 2010. The researchers were granted a Human Research Ethics Clearance from Griffith University (ENG/07/10/HREC, 24 June 2010) and obtained entry permit from RBWH office to collect data regarding HWM at RBWH. The collected data were manually analyzed to fulfill the best practice components of waste management hierarchy and presented in narrative style.

Results

Regulations and policies related to HCWM

Hospitals in Australia play significant roles in providing health services to Australians. Of 1,326 hospitals in Australia, Queensland State has 276 hospitals; ranking second amongst eight states and territories.¹⁰ Several regulations and policies cover HCWM in Queensland. These include the regulations and policies on solid waste and regulated wastes (clinical and related wastes), and other regulations governing health care related activities. A fraction of HCW that need to be regulated, include clinical and related wastes. Clinical waste is waste that has the potential to cause diseases including animal waste, discarded waste, human tissue waste and laboratory waste and associated waste directly resulting from the processing of specimens. Whereas, related wastes are wastes including chemical, cytotoxic, human body parts, pharmaceutical and radioactive wastes.¹¹

Since 2009, all regulations regarding waste management like Environmental Protection (Waste Management) Regulation, 2000, and Environmental Protection (Waste Management) Policy, 2000, are administered by the Department of Environment and Resource Management (DERM), which were previously administered by Queensland Environmental Protection Agency (EPA) separated from DERM.¹² The hospital wastes were categorized into regulated wastes, including clinical and related wastes.

Waste Management System in RBWH

The RBWH is the largest tertiary hospital in Queensland and since 2008. It is a teaching hospital located in Herston area comprising 53 buildings and 929 beds with the occupancy rate of 86.77% in 2010, and providing an array of medical services.¹³ This hospital is just similar to other Indonesian teaching hospitals which are categorized as class-A hospitals. In terms of environmental performance, it is the first hospital in Queensland to introduce an integrated waste tracking system, internally, and to reduce energy consumption, and introduce a waste recycling system (see Figure 1). The hospital has also implemented a sharps waste reduction and safety program to minimize the risk of needle-stick injuries and reduce sharps waste management costs as included in Clinical and Related Waste

Management Plan 2007-2012.¹⁴ These activities were based on relevant regulations and policies from the State, emphasizing the philosophy of zero waste for sustainable development.

Solid waste generation and segregation

The hospital implements waste minimization management, in accordance with the WMH, preferring waste avoidance and 3R practices, over waste treatment and disposal. The hospital manages its waste that is inevitably produced, by emphasizing segregation at source into four major wastes, seeking to save natural resources and reduce the cost of treatment and disposal. The four major types of wastes generated by the RBWH are: clinical and related wastes, cytotoxic waste, recyclable wastes, and general wastes. All these wastes are segregated, using the color code determined by Environmental Protection Agency (Waste Management) Regulation and Policy 2000.¹² Clinical wastes are identifiable where blood, blood products or body fluids is flowing, dripping, oozing, liquid or expressible from material, and containers of blood or free flowing body fluids, e.g. urine bags, tubing, suction canisters, and sputum mugs. Moreover, material that is not saturated or dripping blood or body fluid is general waste, unless it is waste from isolation rooms used by infectious patients.

Wastes generated from each ward are sorted there and collected in small bins, according to the waste type. The generation of each type of waste varies, and it is estimated that the proportion of clinical and related wastes is about 20-25% and the remainder is recyclable and general wastes.¹ The generation of clinical wastes is about 20-30 bins daily, which is collected by an assigned contractor, thrice per day. The production of sharps wastes is about 60 boxes, and the contractor collects these, twice a week. Generally, the three types of small bins with relevant color coded plastic bags are placed underneath the sinks. The green bins with transparent bags are for general wastes, and the yellow bins with yellow bags are for clinical wastes.

For sharps wastes, a yellow bin is usually hung on the wall of each ward, which is high enough to avoid contact by children. There are two kinds of sharps containers; the old one is a yellow box with a lid that could be manually

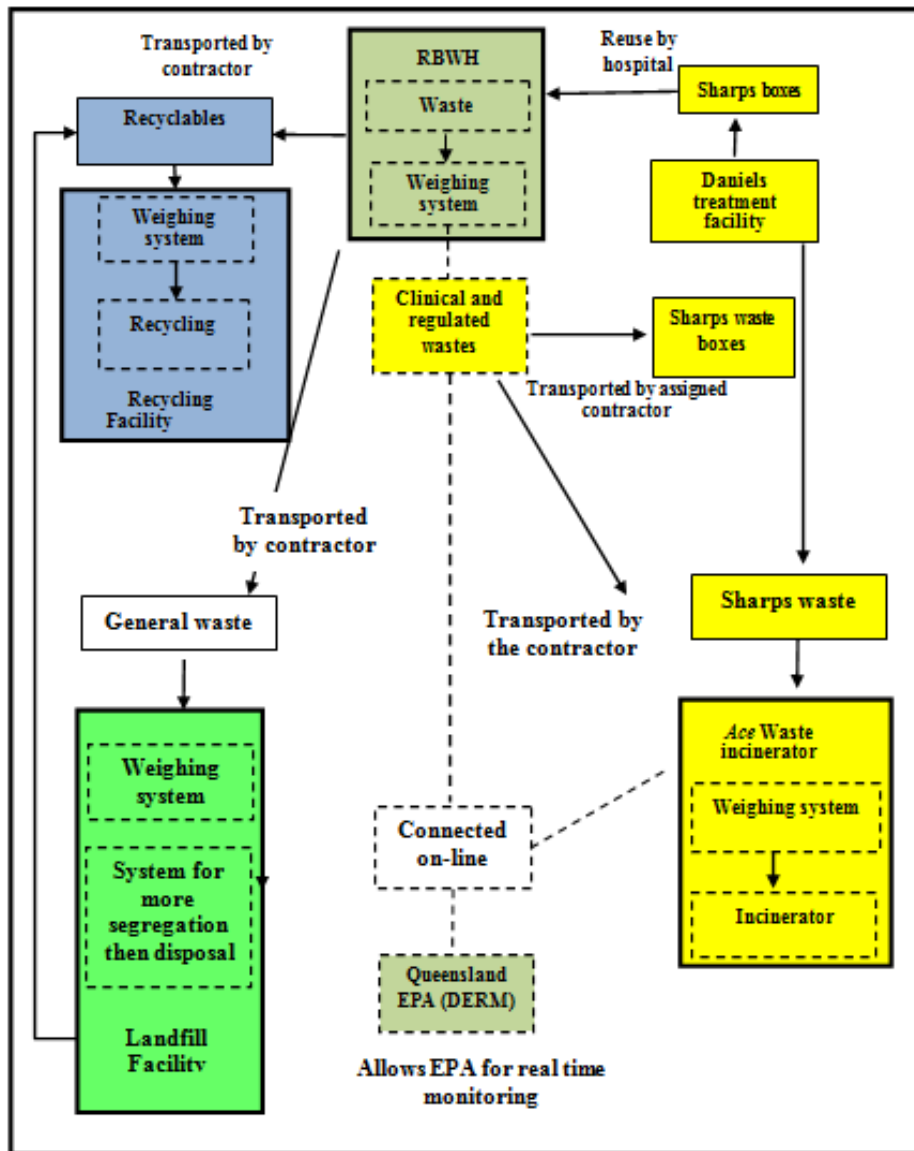


Figure 1. Regulated Waste Tracking System at RBWH (Modified by Hashim (2006) and revalidated by the author, 2010)

closed every time the waste is collected. The new one is the sealed sharps container which is more effective in avoiding overfills as it is automatically shut off after reaching the optimum or full capacity (Figure 2). In contrast, the old design is less effective, increasing the risk of sharps injuries, if overfilled. More importantly, the use of the new model is more efficient as they are reusable too, significantly reducing the costs of provision of sharps containers.

When handling hospital wastes, waste collectors should observe universal precautions by wearing disposable gloves and close bin liners prior to removing from containers. More importantly, they should avoid coming in contact with wastes by keeping containers away from their bodies when transferring waste bags, and washing hands afterward.

Solid waste collection, containment, on-site transport and storage

Wastes which have already been collected in ward bins according to the wastes types are collected by designated cleaning staff using wheelie bins, to be put in similar but larger bins, in a disposal/holding area, located on each floor of the hospital. The wastes are usually collected 3-4 times in a day shift, and three times in a night shift.

There are six types of larger bins in the holding areas on each level, to accommodate the wastes generated from the wards. Sorting of recyclable wastes is done in the holding areas. The additional bins in the holding areas are for plastic bottles and cardboards. Cytotoxic wastes are contained in purple bins with the symbol of



Figure 2. New Model of Sharps Containers

a cell in telophase. Different waste collectors are assigned to replace the full bins in the holding areas with empty bins, and take the full ones to the loading dock in another area, which can be accessed by the assigned contractor staff for off-site bin cleaning, recycling, treatment and disposal.

The hospital hires four contractors for different assignments like incineration, and disposal of infectious and related wastes, recyclable waste recycling, sharps waste treatment and reuse of sharps containers, and disposal of general waste. The hospital hires four certified contractors. *Ace Waste* is for clinical and related wastes treatment, *Trans Pacific Cleanaway* is for general and other recyclable wastes, *Daniels Group* is for cleaning sharps waste containers, and *ISS World Australia* for cleaning services. All contractors have responsibilities for providing quality services to comply with Environmental Protection (Waste Management) Regulation and Policy 2000.¹² Therefore, they are also liable to supply the cleaned bins and clean the used bins at their own costs and risks, as stated in their contract agreements.

Regarding partnership with third party and the cost of infectious waste treatment and transport, Mr. Butler said in the interview as follows:

“...The costs of waste management are charged to each building, according to the record of each waste-bin equipped with bar codes. The cost of infectious waste and cytotoxic wastes treatment per kilogram is approximately AUD 76 cents. However, the hospital is not charged for cardboards and papers, as these are recycled

by the contractor for economic benefit. Other recyclable wastes like plastic bottles are managed the same as cardboards and paper...”

The general wastes that cannot be recycled in the hospital is collected once a day by the assigned contractor and are disposed of in the sanitary landfills after further sorting for segregation of valuable material. About 40–50 bins of general wastes are collected per day from the hospital.

The hospital also generates pathological wastes containing human body parts and tissues, particularly from emergency and operation rooms, and from the laboratory. The pathological waste is collected in separate bins and kept refrigerated until collected by assigned contractor for incineration.

Related wastes, such as pharmaceutical wastes, which are expired medicines and other unused drugs, are also collected by the same contractor to be incinerated. Likewise, mercury waste, generated by the hospital from medical devices and from used lightings, is collected by the contractor for further treatment. There is a special device for catching the mercury from unused lights so as to avoid mercury spills. However, the hospital provides mercury spill kits for cleaning any accidental mercury spills. Radioactive wastes are also managed in accordance with the regulation by storing and shielding the wastes in a secure room to achieve their complete decay process depending on their half-lives. The radioactive wastes are by-products of diagnostic and therapeutic medicines.

Solid waste tracking system

The RBWH has implemented an electronic

waste tracking system since 1 July 2003, to responsibly comply with the Environmental Protection (Waste Management) Regulation 2000, as the hospital is a regulated waste generator. The hospital must provide prescribed information to the assigned contractor as transporter, and to the Queensland EPA (within the DERM), on the approved form, or in a prescribed way, and be subject to the application of the polluter pays principle. Therefore, all costs resulting from waste management are borne by the hospital.

The regulation also states that waste handlers, consisting of generators, transporters and receivers, have waste tracking responsibilities. The regulation also defines a generator as a commercial or industrial organization, which produces, or stores, trackable waste, and arranges for this waste to be sent for storage, recycling, treatment or disposal, at another location via an authorized transporter. The prescribed tracking system assigns a unique load number to each load transported by the waste transporter, and the transporter must carry a document containing the information received from the generator. The document can be an electronic record.

Reduce, reuse and recycle system

The hospital has implemented the 3R system, as directed by Queensland Government through DERM, to reduce the costs of waste management and preserve natural resources. To achieve an effective 3R program, the hospital provides an on-site policy, guidelines, and standard operating procedures (SOP), combined with necessary facilities, regular training, and

induction program, so that each hospital personnel will be aware of the duty to be responsible for appropriate waste handling and management.

The researchers observed the implementation of the 3R policy, during visits, especially the practices of waste segregation and the displays in each room at each level, emphasizing the importance of safe HWM (Figure 3). The Waste and Environment Unit within the hospital importantly, provides regular consultation in case of inquiry, or to support decisions in cases of doubt about proper segregation of certain types of wastes, etc. Therefore, doctors, nurses or any other hospital personnel are enthused to be involved in the 3R program. The provision of transparent/white plastic bags for general waste in each room/ward has also increased the good practices of hospital staff in segregation, as mistakes like disposing clinical wastes in the plastic bags, can be traced back to the offending department/ward.

Occupational Health and Safety

The occupational health and safety program, and infection control program (ICP) established to protect staff from suffering occupational illnesses and injuries from sharps wastes, provides an important learning point.

Leadership in Health Care Systems and HWM

In implementing health care systems that accommodate challenges to improve health care services, a supportive leadership is required to



Figure 3. Examples of 3R Application Facilities

ensure that available policies are implemented to achieve improved health outcomes. In the case of Queensland, the health care system has been put in place in accordance with relevant regulations, both, from federal and state (Queensland) governments, under supportive leadership. In promoting appropriate segregation at source, the RBWH disseminate slogan as stated by Mr. Keith Porter as follows:

"...we promote the motto: know which bin to throw it in"...

This kind of slogan encourages any hospital staff to be familiar with waste containment, thus comply with on-site policy. Combining with the use of different color for each type of waste, the collection system can be established and it will be sustainable.

Discussion

Indonesia and Australia, and e.g., Queensland, have similar institutions, with similar roles and responsibilities in terms of healthcare services and environmental protection; the Ministry of Environment (MoE), and the Ministry of Health (MoH) at central level, and the Environmental Protection Agency, e.g., Queensland EPA, and its counterpart, *Badan Pengelolaan Lingkungan Hidup Daerah (BPLHD)*, at local or State level. A significant difference is, e.g., Queensland updates laws, regulations and policies to accommodate latest conditions and changes, without changing the year of its first issuance, and by providing the date of enforcement. In contrast, Indonesia changes the year and the name of regulations when they are updated, thus, confusing relevant stakeholders. The researcher believes that this goes beyond a mere matter of 'style,' as the Australian practice reduces confusion, while the Indonesian one can confuse and discourage compliance.

Moreover, the most important thing is that all the regulations and policies highlighted the philosophy of waste reduction and recycling. The latest amendment of Waste Reduction and Recycle Act 2011 addressed all matters regarding waste reduction and recycle and provided detail requirements for waste producers to comply with the Act.¹⁵

In Indonesia, only few hospitals were familiar with the concept of WMH. This term is coined from the environmental philosophy of

"cradle to cradle," emphasizing that "waste" is not the end of by-products, but that it could be used as raw material for other purposes.¹⁵ Indeed, Solid Waste Act No. 18/2008 also stated the importance of waste minimization through the concept of 3Rs, however, this has not fully implemented even in the area of municipal waste.¹⁶ As such, the concept has not implemented as well in the area of healthcare waste management, which is more than half is general waste that can be reduced, reused or recycled. As can be seen from the availability of waste management plans in the hospitals' studied by Sasimartoyo,¹⁷ only 43.67% out of 76 hospitals studied, have waste management plans that include the principles of reduce, reuse, and recycle of waste generated from the waste stream. Moreover, the majority of hospitals do not have a system of waste minimization to reduce the cost of waste management.¹⁷ They have never performed a waste audit to determine all the types of HCW generation, as to plan waste treatment and disposal, in a way that complies with the Health Ministerial Decree of Hospital's Environmental Health Standards.¹⁷

According to the findings of Sasimartoyo,¹⁷ only 55.3% of Indonesian hospitals studied, implement segregation at source. Hence, segregation practice at source of waste streams should be introduced to all health care personnel, and it will be the main phase of the WMH. Segregation practice will be sustainable, if there are sufficient skilled personnel, infrastructure and facilities, like trained operators, color-coded bins, special trolleys, color-coded plastics, SOPs, and adequate storages. Moreover, the segregation and collection based on color coding should be followed by treatment and disposal units, using appropriate methods and technologies with regard to the WMH.

Similarly, Irianti found that more than half of the sample hospitals segregated their wastes into two types of waste: general and medical wastes.¹⁸ Only two hospitals mixed their general and medical wastes together, failing to segregate waste, at all. The remaining hospitals sorted their wastes into three or more categories.¹⁸ Moreover, good practices, grouped from three categories and more, were seen in 48.10% or 114 hospitals that were already separating their wastes into general, sharps and infectious wastes.¹⁸ The good practices were performed by four hospitals only.¹⁸

Dealing with color-coded system for waste containments, only 33.33% Indonesian hospitals confirmed that they fully complied with the decree, and collected waste in color coded containers, 84 (35.44%) hospitals partly complied with the decree, and the remaining 31.22% of hospitals did not provide such containers.¹⁸ Most confirmed that color coded bins and plastic lids were rare and expensive. Others significantly stated that they only separated their wastes into two categories, and so, did not provide their rooms with correct color coded containers, and that there was no budget available for those requirements.¹⁹

The implementation of 3R system in the RBWH has significantly reduced the wastes generated, and the incidence of sharps injuries among hospital staff, so that the system produces economic benefit by reducing the costs of waste management and the reduction of occupational injuries. An example of the efficiency resulting from the 3R system is the reduction of waste handling costs of drink containers and cardboard boxes of about 200,000 dollars annually, by providing compactors. Systematic waste reduction in Indonesian hospitals has not been implemented, since there is no data regarding this activity and its outcome in the sample hospitals. Only 11.39% hospitals reused a few types of general wastes, like used packages of medical devices and supplies.

In achieving off-site system of hospital waste treatment and disposal, the Indonesian hospitals can also learn from the collaboration between the RBWH and the four licensed private companies with specific functions. This collaboration is based on the performance of the four companies which satisfies the needs of the RBWH, favoring cost efficiency without undermining the regulations and policies.

When comparing the current privatization of waste management in Indonesia, the system in Queensland is more cost effective. e.g., the cost of medical incineration in Australia is AU76 cents per kg, compared to AU\$1.10 per kg in Indonesia. One possible reason is the limited number of licensed waste contractors in Indonesia, which does not promote price competitiveness. Another reason could be the relative novelty of the waste management sector, meaning that the length of investment has not been enough for contractors to

reach breakeven point, considering they are profit oriented companies. Therefore, policy makers should consider reducing the cost of waste incineration. This could promote compliance of hospitals to manage their medical wastes in a safe manner.

This cannot be fully adopted in Indonesian hospitals due to limitation of resources; but can certainly be adapted to introduce surveillance of waste related injuries, recording, reporting and monitoring of such accidents, etc., which are not consistently followed at present. Its official introduction will help overcome the reluctant attitude of staff, who ignore reporting sharps related injuries.¹⁹

The researchers also found that, in keeping with the importance of visionary and supportive leadership, the successful HCWM in RBWH grew from the roles of dedicated waste management team members, under the supportive leadership of managers concerned. The most important lesson is the success of the segregation and containment system, following the 3R approach, and involving all hospital staff in each ward, prompted by the motto '*know which bin to throw it in.*' This kind of leadership can be adopted in Indonesian health care settings, with suitable resources. Concerning this motto, Mr. Porter said that this motto is a kind of energizer for staff to comply with segregation at source using appropriate color-coded bins. In this regards, Irianti, et al. also found that the good practice of segregation and containment is a proof of compliance with existing regulations and policies.¹⁹

Conclusion

There are many aspects of healthcare system including HWM in Queensland that can be regarded as lessons of good practices, including waste segregation at source, colour-coded collection, 3Rs practices, on-site transport and off-site treatment and disposal. These aspects comprise sustainable HWM, health and safety, collaboration with other sectors in HWM, and strong and visionary leadership. Therefore, the implementation of sustainable HCWM is evident and cost-effective as it has been successful about a decade since the enforcement of waste regulation in 2000. Finally, waste tracking system is the latest method of sustainable HWM as to effectively monitor the generation of waste in a

real time.

Recommendations

The implementation of HWM in RBWH can be adopted by Indonesian hospitals to achieved sustainable HWM, focusing on waste segregation at source and colour-coded collection as to minimise the production of medical waste. These practices can be combining with the application of 3Rs wherever possible, such as the recycle of general waste as to reduce the cost of medical waste management. Moreover, the importance of strong leadership can be imitated in the implementation of waste segregation at source in each ward of the hospital and waste weighing system, since it allows cost calculation of waste generation. Nonetheless, an appropriate on-site policy can also be introduced in Indonesian hospitals through hospital manager policy in sustainable HWM.

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