Chapter

Management of Healthcare Waste in Healthcare Emergencies

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Abstract

Proper management of waste in healthcare emergencies is key to preventing spread of infections within an emergency. The risks of poor waste management are varied with the risks of spreading infectious diseases being the most important to consider. Chemical pollution should also be considered as water sources can easily be polluted. Careful thought and planning including a risk assessment should be carried out and the results should be publicized to create a common understanding of the problem at hand. This will also inform the methods to be used for the management of waste. Training of healthcare workers is key to creating common understanding of the problem at hand. The different types of waste to be generated should be well understood and methods to manage it should be well thought out before implementation. The decision on the different methods used to manage waste should be informed by the risk assessment and the available resources. However effectiveness to deal with the waste produced should be considered above all factors. Proper healthcare waste management is imperative to preventing further infections that might not be part of the original healthcare emergency. Planning to manage waste is a process that requires information before implementation.

Keywords: Waste management, Risk Assessment, healthcare emergency, infections, chemical pollution

1. Introduction

Correct disposal of waste is critical in public health and even more critical in healthcare emergencies to improve safety. Existing collection and disposal systems can also be disrupted when there are unexpected volumes of certain types of health care waste as a result of healthcare emergencies. In some cases like, non-healthcare settings (quarantine centers, holding areas, designated hotels, households and refugee camps for displaced people) there might not be any provisions for managing healthcare waste. If healthcare waste is not dealt with quickly and appropriately enough it has the potential to worsen the situation. Waste from healthcare settings can be varied and includes used needles, syringes, soiled dressings, body parts, dead bodies, pharmaceuticals, medical devices, and laboratory related waste.

In order to better manage healthcare waste strict segregation is key as the bulk of the waste is non-infectious waste that can be managed by simpler methods. Poor segregation might lead to an increase in the volume of infectious waste as once mixed you cannot separate the waste and all the waste will now be treated as infectious. In general non-infectious waste constitute 75–90% of all healthcare waste while only 10–25% of the waste is clinical waste. The focus is on the 10–25% of the

waste produced that is infectious. Depending on the type and cause of health care emergency the clinical waste can be sharps, chemicals, radioactive waste, genotoxic waste, pathological waste, pharmaceutical waste and dead bodies.

Healthcare emergencies as a result of an infectious diseases outbreak can lead to increased amount of infectious waste. In the event of a disease that is of a respiratory nature (like TB and COVID-19) surgical masks will be needed to reduce human to human transmissions in everyday life as well as to reduce infections from patients to healthcare workers. The disposal of the face masks in non-healthcare settings requires a different perspective as the waste is now being generated even at household level. Use of latex or plastic gloves can also be encouraged in cases where diseases are spread by contact. This also significantly rises the amount of waste produced outside of healthcare settings. How this waste is managed needs special attention and strong policies. In order to better manage this level of waste production it is important to make sure that new lines of waste management are also opened beyond the usual hospital set up.

In non-emergency situations, the amount of waste produced is stable and easily managed with usual routes and methods. The integrated management of healthcare waste that comprises segregation, collection, storage, transportation and treatment should be significantly enhanced when there is a healthcare emergency. The entire chain should be adequately monitored in order to secure the waste at all stages. In order to better manage the waste introduction of mobile treatment facilities use of microwaves, steam disinfection can be used as innovations. The best available waste treatment technologies should be selected together with transitional methods that can be used to manage healthcare waste on an interim basis. However incinerations remains one of the most important ways of managing waste.

1.1 Risks of poor waste management

In emergency situations the major issues are generation of high volumes of healthcare waste in healthcare settings or generation of health waste in non-healthcare settings. This can overwhelm the existing settings leading to improper management of waste.

The immediate effects of improper healthcare waste management is visual nuisance and serious smells. Healthcare waste is known to be a source of contamination and forms a part of the transmission routes of certain diseases through

i. Direct contact: this can result in needle stick injuries, direct ingestion. The risk with needle stick injuries is the transmission of Hepatitis B, C and HIV which are the most commonly transmitted blood borne pathogens. Injection drug users who do not normally have access to sterile needles can end using any sharps they find in their way leading to transmission of diseases. In areas where people scavenge waste sharps, drugs and other disposables can end up being repacked and being resold. Depending on the route of transmission and type of healthcare emergency other pathogens also become important. During the Ebola outbreak management of dead bodies became key as contact with dead bodies became a significant route or transmission further exacerbating the healthcare emergency. Corona viruses are known to survive outside of the body for days.

ii. Transmission by air: smoke emissions containing pathogens ad hazardous by products like carbon monoxide, dioxin, furans heavy metals and more specific chemicals when expired drugs are burnt.

iii. Pollution of water and environment: Untreated waste can contaminate surface and ground water from pathogens and chemicals. Organisms like Hepatitis A virus, clostridium tetani, polio viruses and fecal coliforms survive in water and soil.

iv. Contact via vectors: Flies carry diseases from one place to another and poorly managed waste can be a source of the pathogens that will be carried by the flies. There are also animal vectors like rodents who carry dangerous pathogens like yersinia pestis (Plague), tularemia and Lassa fever viruses among others [1].

It is important to avoid creation of another healthcare crisis as a result of poor management of waste. Some of the diseases like cholera, plague and Lassa fever have epidermic potential making it important to prioritize healthcare waste management. This chapter explores available methods of managing healthcare waste in healthcare emergencies. The efficacy of the different methods of managing waste are described fully.

2. Preparing to manage waste

In order to protect the environment the waste management hierarchy is a useful tool in guiding how waste is managed. In healthcare emergencies however, it is not always possible to follow this hierarchy. Disposal becomes a common way of dealing with health care waste in healthcare emergencies as either the waste is produced in non-healthcare settings or the amount of waste overwhelms the usual healthcare settings (**Figure 1**).

The modern methods of medicine are such that it is not possible to completely prevent the generation of waste. It is very important that the generation of waste be minimized to the lowest possible level. The types of waste generated most healthcare settings are described below.

2.1 Categories of waste

Waste can be categorized as follows:

Management of waste is highly dependent on knowing the type of waste that is being generated. It is important that facilities take time to evaluate the type of waste that is being generated and to create the necessary awareness about the waste being produced.

The advent of a healthcare emergency should call for a comprehensive risk assessment that Is all encompassing. This needs to be carried out by competent health and safety professional together with other health care professionals.

2.2 Risk assessment

Healthcare emergencies present with risks of exposures to different types of health hazards. It is recommended that a full risk assessment be carried out and all possible exposure scenarios assessed and controlled. The exposure analysis should focus on healthcare workers, waste handlers, the public and the environment.
All types of healthcare waste should be assessed (refer to **Table 1** above) and best ways of handling it described. In some cases a waste needs assessment might be useful [3].

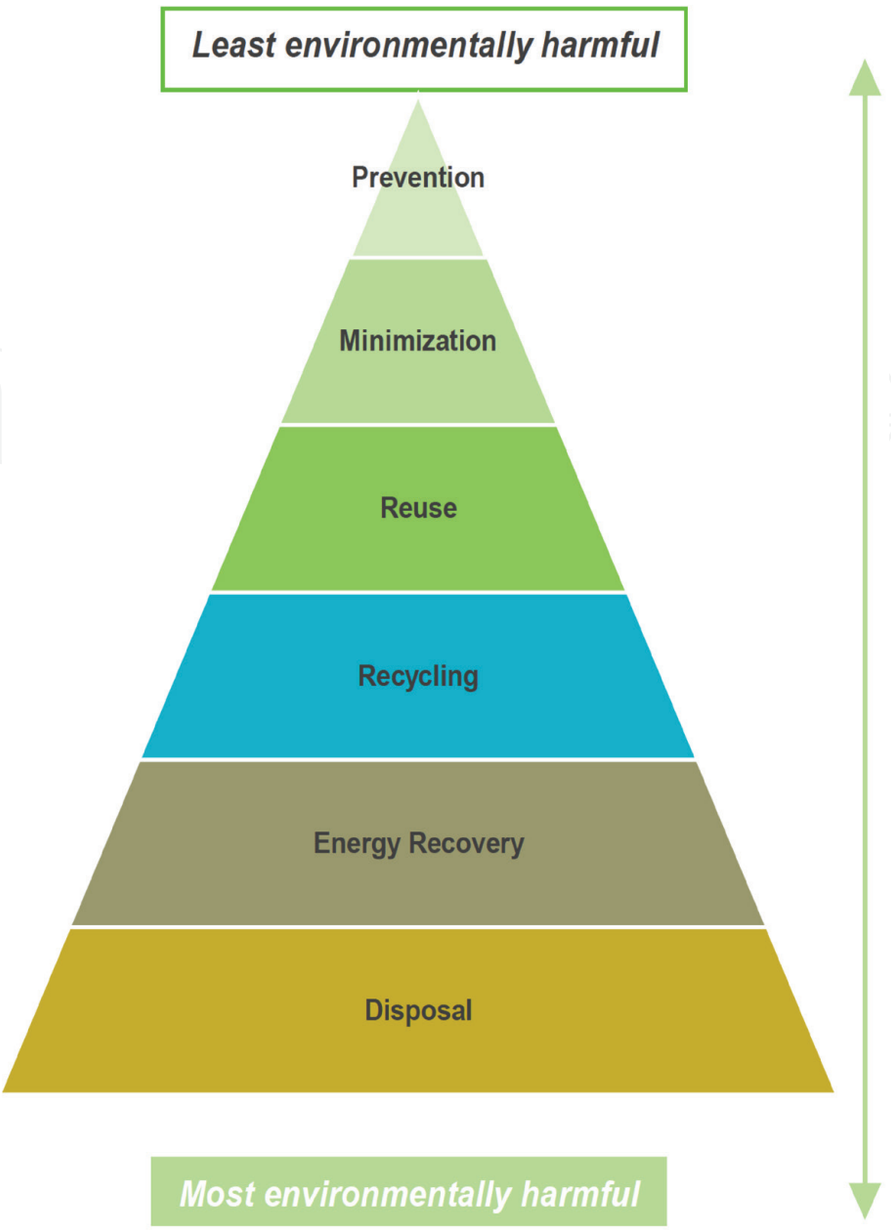

Figure 1.
Waste management hierarchy [2].

The results of the risk assessment should be publicized. If big gaps are identified, waste handling policies and procedures need be updated to adequately address the risks identified. Risks assessments are an important part of anticipating dangers and preventing any accidents and exposures before they happen. Risks assessments are key in elevating awareness and ownership of the waste management procedures in health care emergencies. In most cases the existing policies and procedures might not be able to cover all the types of waste that come with emergencies.

A risk assessment typically involves risk identification, risk quantification, control, implementation and verification. It is recommended to carry out a risk assessment whenever conditions change in facilities and this can cover increased waste production, outbreaks, new procedures and new personnel.

Data to inform the risk assessment can be collected through:

- Interviewing key informants in the healthcare emergency: this helps to get relevant information about the existing healthcare waste management processes and procedures

- A walk through the health facilities, camps, quarantine centers and all places used to manage the health care emergency helps with the familiarization with the physical context of the situation at hand

- Processes involved can be mapped to visualize the situation and this will be complemented by spot checks to verify

2.3 Creation of awareness of the different types of waste being produced

In order to better manage waste in the healthcare emergencies it is critical that everyone involved in the production and eventual management of the waste is aware of the type of the waste that is produced by the healthcare activities. Creating awareness is critical in making sure that everyone is aware of the methods of managing waste that will be used the manage the waste. In healthcare emergencies the most sophisticated and usual methods of managing waste might not be available hence the need to define the available methods.

The awareness can be created by short training sessions, development of SOP's and illustrative job aids on how to manage the waste. Due to the fact that waste is managed by people of different professional backgrounds the trainings need to be in language that is easily understood by everyone who is involved in the management of the waste. Training in vernacular language will be encouraged. Depending on the situation handwritten instruction can suffice. All these interventions can be informed by the risk assessment.

2.4 Training of health care workers and waste handlers

Formal training on waste handling can become a necessity to all healthcare workers in emergencies as it facilities and managers try to avoid transmission of

Category	Waste
Category 1	Human Anatomical Waste (human tissues, organs, body parts)
Category 2	Animal Waste (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals, colleges, discharge from hospitals, animal houses)
Category 3	Microbiology & Biotechnology Waste (Wastes from laboratory cultures, human and animal cell culture, infectious agents from research and industrial laboratories, wastes from production of biological, etc)
Category 4	Waste Sharps (needles, syringes, scalpels, blade, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)
Category 5	Discarded Medicines and Cytotoxic drugs (Waste comprising of outdated, contaminated and discarded medicines)
Category 6	Soiled Waste (Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, linens, bedding, other material contaminated with blood)
Category 7	Solid Waste (Waste generated from disposable items other than the sharps such a tubing, catheters, intravenous sets etc.)
Category 8	Liquid Waste (Waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)
Category 9	Incineration Ash (Ash from incineration of any bio-medical waste).
Category 10	Chemical Waste (Chemicals used in production of biologicals, chemicals used in disinfection, as insecticides, etc.)

Table 1.
Healthcare waste categories.

infections within the healthcare settings. It is however important to train further the waste handlers as they are integral in the management of waste. They are mostly recruited as general hands in the healthcare facilities. It is important that they get training on the management of the different classes of waste that might come in the facilities, Trainings in most cases should emphasizes the risks involved with the different types of waste and how that can protect themselves from the different exposures. The level of technical depth need to be adjusted appropriately to aid comprehension. in most cases local languages are recommended.

3. Available methods to manage healthcare waste

The results of the formal risk assessment forms the basis of interventions. The report should detail identified risks and mitigation measures put in place. Mitigation measures should be revaluated for effectiveness. The identified risks should also inform training of the health care workers and waste handlers. Following careful consideration of the risks and the type of waste that is being produced different ways of managing it need to be described. According to the waste management hierarchy it is important minimization is the first step towards managing the waste. The management of healthcare waste is contextual and should be guided by relevant legislations, regulations, available technology, costs and environmental and occupational health and safety factors [4].

3.1 Minimization

The reduction of waste at point of production should be applied to the furthest extent possible. It includes rational and risk-based PPE's usage, choice of materials with minimal packaging, unpacking at areas of low risk of contamination with infectious agents. Use of materials that can be cleaned or disinfected can greatly reduce amount of healthcare waste [2].

3.2 Segregation

Healthcare activities produce different types of waste. It is always safe to assume that only waste produced in administrative areas is considered non-hazardous. A risk assessment however should inform how you manage the waste throughout the emergency setting. The table below shows a typical color coding of bags under normal non-emergency settings. If these waste management and treatment options are available in emergency situations they should be adopted (**Table 2**).

The three-bin system is the most commonly used and segregates waste into three categories namely general waste, infectious waste and sharp waste. This also simplifies the work of the waste handlers as they will only deal with a small number of waste types. However it is not always the case all the waste can easily be categorized into these three categories (**Figure 2**).

Based on information obtained in the risk assessment the more categories might be needed as per the first table. In emergency situation this might be adequate depending on the type of waste predominantly being produced.

3.3 Collection transportation and storage

After generation and segregation of the waste it needs to be transported from the point of generation either the final disposal point or the temporal holding place. All infectious waste should be collected in clearly labeled lined containers and sharp

Color	Type of Container	Waste Category	Treatment options
Yellow	Plastic Bag	Categories 1, 2, 3 & 6	Incineration deep burial
Red	Plastic Bag	Categories 3, 6, 7	Autoclaving/Micro-waving Chemical Treatment
Blue/White Translucent	Plastic Bag/ puncture proof containers	Categories 4, 7	Autoclaving/Micro-waving/ Chemical Treatment & Destruction / shredding
Black	Plastic Bag	Categories 5, 9, 10	Disposal in secured landfill

Table 2.
Color coding of waste bags.

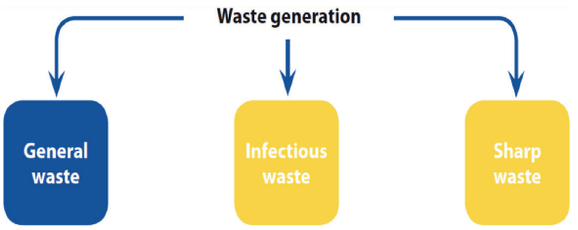

Figure 2.
Three bag waste segregation [5].

waste in sharp boxes. In cases where people are in quarantine centers, holding centers, camps and other non-healthcare settings, waste like used masks, tissues, and other non-biodegradable waste is collected in double bagged red bags. It will be ideal to have the bags sealed and labeled with a date and time.There is no need to treat these materials with disinfectant first but tying and wiping the outside with 0.5% chlorine should be sufficient as an additional measure to reduce spread of diseases. The collection of the waste should take place at times that are least busy to prevent exposure to people from the carts that might be used to transport the waste. Full PPE should be provided to the waste handlers. Transportation of hazardous and non-hazardous waste should always be done separately using the principle of clean to dirty places with hygienically sensitive areas being the areas to start from followed by the other places.

Waste holding areas should be designated wherever possible. When new building are being built it should be incorporated in building design. The size of the holding areas should be according to the amount of waste that is anticipated to be produced. The holding areas should be totally closed off and separated from essential areas like supply areas or food preparation rooms and only authorized staff should have access to that space. The floor of the holding area should be of material that is easy to clean like vinyl.

Waste that is highly infectious like waste contaminated with blood and other bodily fluids, microbiological cultures, stocks of infectious agents from laboratory, swabs,bandages, medical devices and pathological waste must be selected sealed to allow easy disinfection and need to be identified as infectious waste area using the biohazard sign. The time from generation of waste to treating it should not exceed 24 hours in the warm climate areas in the summertime. In temperate climate 72 hours can be allowable in winter and 48 hours in summertime. Refrigerated storage if available can allow for waste to be stored for up to a week. This might be relevant where pathological waste involved. Pathological waste is considered biologically active and gas production might be expected in storage.

If pharmaceutical waste is to be stored it should be separated from other waste. In general pharmaceutical waste can be hazardous and non-hazardous in solid and liquid form. Local and international regulations should be followed to better manage this waste. If chemical waste is anticipated the characteristic of the waste need to be considered in terms of the reactivity of the chemicals. Under normal circumstances this should be a different area from the other waste. In emergency settings there might significantly differences as there might not be all these different spaces to hold waste.

The staff who handles the waste should be given the appropriate personal protective equipment like thick Gloves, boots and aprons. In addition, appropriate training should also be offered. The waste holding centers should be easy to clean, safe and locked up, well ventilated and most importantly protected away from animals, rodents and insects.

When the waste is to be transported offsite the labelling on the waste should be non-washable, the date and time of production should be clear, the name of the person sending other waste should be clearly stated, the category of the waste, and the contact details of a person in case of emergency.

3.4 Treatment

This waste should be treated on site before safe disposal. If the waste is to be moved off-site it is critical to understand where and how it be transported, treated and disposed. Waste should be treated prior to final disposal if non-combustion methods of disposal are to be used. The preferred methods include This can be useful in places where it is difficult or expensive to have an incinerator.

3.4.1 Autoclaving

Use of combination of steam, heat, and pressure to disinfect waste and equipment. The combined effect of saturated steam under pressure and heat kills microorganisms. To guarantee that the process is working well chemical and biological indicators need to be added to be process on a regular basis or with every autoclaving cycle. In combination with shredding, grinding, mixing the volume of the waste can be significantly reduced. Autoclaves can also be easily moved to sites they are needed depending on size in the process increasing access to waste treatment to the different sites for this method of disposal.

3.4.2 Microwaving

This is a recent technology in healthcare waste management. Microwaving technology heats the water in the waste. Some microwaving devices include transformation devices like shredders or blenders. It is however not suitable in waste that might contain metallic items like surgical equipment. It can be done in batches or in a continuous manner (an automated process). However microwaving might not be suitable for all types of waste like anatomical waste. Chemical disinfection should be considered depending on circumstances [6].

3.4.3 Chemical disinfection

The most common and readily available method of chemical disinfection is use of hypochlorite solution. It has oxidizing properties and removes most of the microbial burden in the waste.

3.5 Destruction of the waste

Incineration is the commonest way of destroying most healthcare waste. If it available especially in formal healthcare settings is the most commonly used method of getting rid of the healthcare waste. Incineration involves a high temperature (850–1100 degrees Celsius) dry heating process that reduces organic and combustible waste to inorganic incombustible matter. It highly efficient in reducing weight of the waste. However it produces toxic emissions if the equipment is not well functioning. Dioxins and furans are generated by the combustion process which contains chlorine. They are highly toxic and bio accumulative. They can cause reproductive developmental problems, damage to the immune system, interference with hormones, and also can be mutagenic [6].

It is costly to have the High temperature incinerators. Incinerators use high heat to destroy waste. The De Montfort Incinerators can be rapidly deployed to emergency settings as they are small. In some cases single-chamber drum and brick incinerators can be designed to meet the healthcare emergency needs where resources are limiting. Transition to more sophisticated incinerators can be planned depending on the length of the healthcare emergency. Depending on setting, mobile incinerators can also be availed to add to the waste management strategies in the developed world in response to healthcare emergencies.

More sophisticated types can be deployed with time as they offer the option of polluting the environment less. The sophisticated ones include the dual chamber incinerators, and the co-incinerators. Dual Chamber incinerators burn waste at temperatures as high as 850 degrees Celsius in the primary chamber. The temperatures are maintained by multiple gas and oil burners with the vapors from the primary chamber being directed to the secondary chamber with one or more burners that raises the temperatures to 1100 degrees Celsius. Flue gas treatment is recommended to reduce air pollution. Other incinerators can also allow for multiple types of waste to be dealt with at the same time [6].

The incinerators must be ideally located approximately 61 meters away from habitable buildings, 46 meters from water sources and 300 meters from agricultural site. The waste management site should always be enclosed. In urban settings these waste management centers should be offsite. The ash from the incinerators should be removed safely from the site and appropriately disposed in a pit.

In most healthcare emergencies it might not be possible to have the incinerators in all possible places where healthcare waste is being produced. In addition, the available incinerators are easily overwhelmed due to the increased volumes of waste produced during emergency settings.

4. Other alternatives in healthcare emergencies

4.1 Onsite burial of waste

Onsite burial of waste can be considered in cases where the resources are limiting, and the amount of waste produced is also small and also if it is for a limited of time. The pit should be 1–2 meters wide and 2–5 meters deep. The bottom of the pits should be 2 meters above the ground water level to avoid contamination of ground water (**Figure 3**).

A fence should be constructed around the pit to stop wild animals and people from gaining access to the pit. Alternatively the waste can be burnt to reduce the volume of the waste.

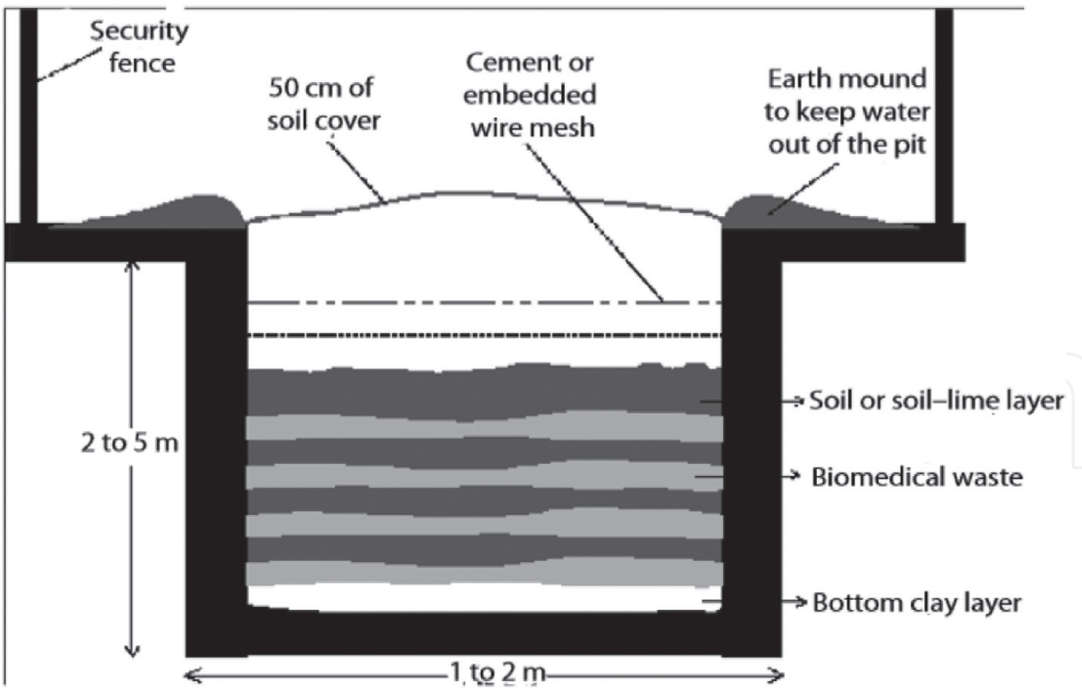

Figure 3.
Waste disposal pit [7].

In cases where pathological waste is also being produced placenta pits can also be used to dispose to dispose pathological waste. These placenta pits need to be located in specific places with the view of avoiding contamination of ground water. Natural degradation and draining of liquid into subsoil will greatly reduce volume of waste.

Sharps need to be disposed in concrete lined pits after decontamination (**Figure 4**).

4.2 Washing, cleaning and disinfection

Existing cleaning and disinfection procedures for healthcare settings should be followed consistently. In most cases 705 ethyl alcohol and 0.1% sodium hypochlorite are sufficient to disinfect most surfaces.it is recommended that all individuals in charge of environmental cleaning laundry and dealing with soiled bedding, towels and clothes from patients should wear appropriate PPE. Soiled linen should be placed in appropriately labeled leak proof bags or containers after carefully removing any solid excreta.

It is recommended that utility gloves or heavy-duty reusable plastic aprons are cleaned with soap and water and decontaminated with 0.5% sodium hypochlorite each time they are used.

5. Management of dead bodies

The number of deaths in most healthcare emergencies can significantly increase. Management of dead bodies has to be considered from a cultural point view as different cultures view dead bodies in differently. Burial has to be done by the relatives of the deceased, but it can be dangerous in cases of death from an infectious disease that is transmitted by casual contact. Most cultural practices involve dressing dead bodies, and this can significantly lead to an increased transmission of diseases like Ebola (and other viral hemorrhagic fevers). Communities need to be educated on the dangers of handling dead bodies in these type of healthcare emergencies. There might need to train

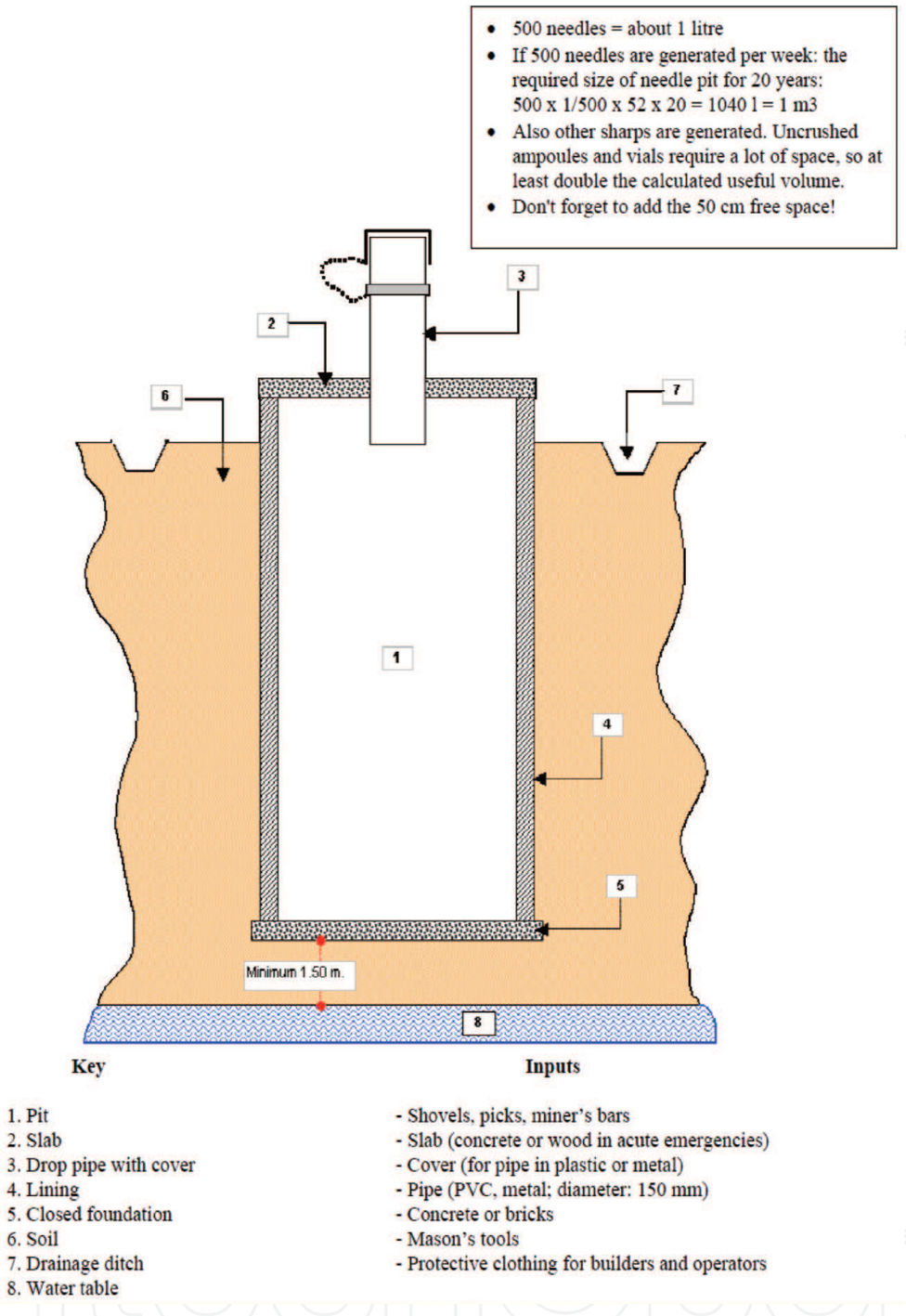

Figure 4.
Sharps disposal pit.

workers at morgues on how to handle dead bodies in cases of disease outbreaks. During the Ebola outbreak management of dead bodies became a significant source of spread and this management of dead bodies was taken over by health care professional up to burial. Traditional practices like body viewing were not practiced and the dead bodies were taken to the burial sites with minimal delay and no gatherings.

In case of natural disasters like earthquakes, volcanic eruptions and floods were there are mass deaths the need to identify the dead bodies before burial becomes a critical step. This has the potential of overwhelming mortuaries as pathology services are not usually decentralized in most countries. The delays in DNA analysis in most settings is due to a limited number of laboratories that offer this high specialty service. Culturally close families prefer to bury their families after accurate identification.

6. Management of chemical pharmaceutical waste

Chemical waste can be produced from increased laboratory testing. In managing chemical waste it is important to consider the risks associated with the chemicals which should be informed by the risk assessments. The chemical incompatibilities of the different chemicals involved together with their anticipated volumes to be produced. It might be necessary to have specific storage spaces for the chemical waste being produced. In most infectious disease outbreaks use of polymerase chain reaction (PCR) to confirm infections can lead to increased production of dangerous chemicals like ethidium bromide. However, the use of the chemical in medical laboratories is decreasing due to its mutagenic nature. Use of mercury-based measuring instruments can also lead to mercury waste which is dangerous. The impending ban on use of based thermometers and sphygmomanometers will great reduce the risk of having mercury as hazardous chemical waste in healthcare settings.

Pharmaceutical waste includes expired drugs, contaminated pharmaceutical products, drugs, vaccines and sera that is no longer needed. Items used in the handling of pharmaceuticals is also included in this class of waste and includes bottles gloves, masks, vials, and tubing contaminated with pharmaceutical residues.

7. Conclusion

Management of healthcare waste should be highly prioritized in healthcare emergencies. Recent healthcare emergencies like the Ebola outbreak in west Africa and now the covid 19 pandemic have improved awareness and need to invest in innovative ways of managing waste. The EBV outbreak also highlighted the risks associated with traditional/cultural norms of burying dead bodies. This was extended to covid 19 as people in full PPE gear could be seen burying dead bodies in most countries. Lessons learnt in the different types of healthcare emergencies are very important for the next emergency.

Risk assessment has become a very important concept in the management of biosafety issues (including waste management). It is important to have a formal way of anticipating for potential exposures and making sure that the potential risks of exposure are removed from the from the facility. If systematically done in different emergencies it can adequately prevent exposures. Involvement of everyone who has a role to play in waste management significantly improves its effectiveness.

Training of healthcare workers is of paramount importance. in some cases, due to the nature of the emergency it might be important to reorient people on how the waste is going to be managed. Different emergencies present different risks and it Is important to customize the training on order to make sure that it is effective. Consideration of the different levels of employees is key if there is to be prevention of exposures. The EBV out breaks restricted orderlies from doing many duties as the danger of exposure increased especially from dead bodies. This coupled with the expensive PPE meant that the healthcare professionals had to be heavily involved. Use of appropriate technical language is key to making use that there is transfer of usable skills. Additionally evaluation of the trainings in this case need to be done to make sure that people understand what they have been taught. A retraining can be organized in case people did not fully understand.

The sudden increase in healthcare waste generation or generation of healthcare waste in non-healthcare settings means there is need to mobile resources to manage the waste. In high income settings alternatives can include use of mobile incinerators to completement the onsite incinerators or to take care of healthcare waste in places where it is not possible to have incinerators like camps, quarantine centers

and other non-healthcare settings. The reaction of the Chinese to the covid 19 pandemic has highlighted innovative ways of managing waste like the mobile incinerators that can be deployed to the places where the waste is being generated [8].

On the other hand, in low resource settings transitional methods can be applied as an interim measure as systems and resources are being put together to have more advanced technologies in place. The selection of the transitional methods needs to be made on the basis of adaptability to the setting. The methods should be readily available and adaptable with a known efficacy reducing the risk to public health by controlling the spread of infections and hazardous chemicals through healthcare waste. Technical options on the management of healthcare waste need be presented in the process of making a choice based on the resources that are available.

Expired drugs need to be disposed of as per the regulations of the country but incineration is the most common practice in most countries. Other classes of drugs are described as high risk and their disposal need to be monitored.

Proper healthcare waste management is imperative to preventing further infections that might not be part of the original healthcare emergency. Planning to manage waste is a process that requires information before implementation. Resource availability is key as some of the waster might require specific ways to manage it. The impending ban on mercury-based measuring instruments in healthcare will reduce the risks involved with their breakage in instruments like thermometers and sphygmomanometers. Risk assessments should inform all the waste management activities and should be carried out with everyone in mind.

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References

[1] WHO, Solid Waste Management in emergencies. 2013

[2] The Global Fund 2020 Technical brief: Sustainable healthcare waste management. 2020

[3] WHO, Overview of technologies for the treatment of infectious and sharp waste from health care facilities. 2019

[4] UNEP, Compendium of technologies for treatment/ destruction of healthcare waste. 2012

[5] WHO Safe Management of Wastes from Health-care activities, A Summary. 2017

[6] United Nations Office for the Coordination of Humanitarian Affairs, Environmental emergencies section (2011, Disaster waste management guidelines. 2011

[7] Government of Nepal. Healthcare waste management in the context of COVID-19 emergency. 2020

[8] Lie Yang, Xiao Yu, Xiaolong Wu, Jia Wang, Xiaoke Yan, Shen Jiang, Zhuqi Chen, Emergency response to the explosive growth of health care wastes during COVID-19 pandemic in Wuhan, China, Conservation and Recycling, Volume 164, 2021