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Performance of Healthcare Facilities of Different Levels towards Safe Healthcare Waste Management as Linked to Infection Prevention and Control Standards in Tanzania

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Abstract

The aim of this study was to ascertain performance of Healthcare Facilities on safe healthcare waste management practices. To achieve this, a national assessment was conducted country wide to assess performance of various healthcare practices related to waste materials management, WASH, and Hygiene practices as linked to infection prevention and control. The assessment of healthcare waste management in the facilities was conducted in all the 26 regions of Tanzania Mainland for one month. A standardized checklist and tools were used to assess and monitor various aspects related to healthcare waste management using open source software for data collection (ODK). Data were analyzed using SPSS computer software. It was observed that most of permanent staff (88%) in the Healthcare facilities had knowledge on hand hygiene, but the gap was observed to the waste handlers (12%) who were not equipped with the hand hygiene knowledge. About 89% of the hand washing stations were available at mortuary units, followed by 75% at main entrance and the lowest was 3% at waste zone areas of the healthcare facilities. Hand washing materials like soap were mainly found at theaters (64%) followed by mortuary (60%) and last at waste zones. It was concluded that handling of HCW is not properly practiced to the expectations, necessitating strengthens of supervision. The findings provide evidence for those engaged in improving HCF conditions to develop evidence-based policies and efficient programs, enhance service delivery systems, and make better use of available

resources.

Keywords

Healthcare Waste, Air Pollutants, Toxic Gases, Incineration, Bottom Ash, Fly Ash, Healthcare Facilities

1. Introduction

Healthcare waste (HCW) is defined as the waste generated from healthcare facilities, which includes chemicals, expired pharmaceutical products and radioactive materials, sharps and infectious materials like bandages [1]. According to Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal [2], healthcare waste is classified into five categories; Non-risk (recycled, biodegradable), HCW requiring special attention (human anatomical waste, sharps, blood and body fluid), infectious and highly infectious waste, radioactive waste and other hazardous waste. Generally HCW can be classified into two main categories namely hazardous waste and non-hazardous waste. Surveys show that eighty percent (80%) of healthcare waste produced in healthcare facilities is non-hazardous waste, while the remaining 20% to 25% of the total waste generated is regarded as hazardous [3].

Most aspect of the HCW stream contains highly toxic and hazardous materials that are injurious to both human health and the environmental quality by contaminating ground water, soil, waterways and the atmosphere and if not handled carefully, the entire volume of healthcare wastes (HCW) becomes Healthcare Risk Waste (HCRW) [1].

Healthcare waste has been posing a growing problem worldwide that causes health effects to healthcare facility staff, patients, and waste handlers often coming into contact with hazardous materials. For instance, according to World Health Organization [3], it is estimated that about 8 to 16 million new cases of Hepatitis B virus (HBV), million cases of Hepatitis C virus (HCV) and 80,000 - 160,000 cases of Human Immunodeficiency Virus (HIV) occur due to unsafe syringes management and poor disposal system.

It is important for the health-care worker to understand different categories of hazards related to medical wastes (MW), because some of these hazards may contain biological or infectious materials in nature like pathogens such as bacteria and viruses. Pathogens have the ability to penetrate in human body as well as to remain in the air within the hospital environment for a long period, in the form of spores. This can result in hospital-acquired infections (health associated infections) and occupational health hazards for healthcare workers (HCW) [4].

In many developed countries, specific rules and regulations have been implemented for hospital waste management systems and, thus, these systems are more effective than those in many developing countries. In Europe hospital wastes are properly segregated at the point of generation. Contaminated items

are incinerated at source, although new technologies, such as microwave disinfections are gaining popularity. For effective waste management, the European Commission, in 1990, under the Environmental Protection Act, imposed strict controls and instituted statutory duties. Ignorance or defiance of these can result in severe fines and custodial sanction [5].

Medical waste problems in the developing world are associated with poor funding and the lack of national regulations for the sanitary disposal of waste (and/or lack of oversight). Most of the countries surveyed lacked specific regulation on healthcare waste management. For example, Eritrea, Lesotho, and Ghana have no legislation for healthcare waste management, while Kenya, Nigeria, and Gambia are signatories to the Stockholm Convention and have some relevant laws governing medical waste [5]. Again Kenya and Zambia dispose healthcare waste in crude dumpsites while, Tanzania have so far managed to construct 8 sanitary landfills in few municipalities. It is estimated that in Africa there are more than 1000 incinerators but majority of them are operating below standards [5].

The situation of poor medical waste management in African countries is the same. For example, in South Africa, Mozambique, Swaziland, Kenya, and Tanzania, the same situation exists [4]. Dumping of healthcare waste is a severe problem in most developing countries. Almost all the countries recognized poverty as an underlying factor that suppresses the achievement of African efforts in the field of environmentally sound control of harmful wastes. An extra challenge was the state of the medical waste incinerators of the low operating temperatures (~200˚C), resulting in the extra generation of toxic gases like HCl, CO, organics, dioxins, and furans. Since the places of these services (in health centers) are generally situated in communities, the emissions from the incinerators present a severe health risk to the same community which the hospital is meant to serve [6].

Tanzania is one of the countries that still face challenges on medical waste management and that the overall awareness of issues concerning medical waste management is missing among generators and handlers [4]. According to a survey conducted in Tanzania in different lower level healthcare facilities (LLHFs) in two municipalities of Ilala and Kinondoni respectively [7], about the factors affecting medical waste management, the study showed that the process of medical waste management is poor. Majority of the health facilities has no specific sites for medical wastes disposal, the disposal methods is not safe (wastes are burnt in open areas), no designated vehicles for waste transportation, etc. it is found that minority of the surveyed health facilities have vehicles for transportation of medical waste, some of the waste collectors carry the waste on hands and just few of the surveyed health facilities using wheelbarrows for transportation of waste. In some healthcare facilities infectious wastes were buried in shallow pits in areas with high water table.

Therefore, there is a need for prompt intervention to include on-job training on medical waste management (MWM) and specialized training for new em-

ployees to cover this gap. All new employees in the medical/health sector need to attend a course on medical/hazardous waste management to equip them with the knowledge to tackle problems associated with MWM in their workplaces. In principle, the responsible ministry must provide training for all strata or ranks of healthcare workers because they are involved in one way or the other in the MWM [8] [9].

A study on medical waste management systems in the low-level health facilities (LLHFs) in Dar es Salaam [7], showed that the segregation of waste in some of the surveyed LLHFs follows the national guidelines and are performed properly, even though sharp wastes are mixed with general waste during incineration and in some facilities, segregation is not perfectly performed despite the availability of specific containers for waste collection.

2. Methodology

A team of National and Regional level Assessors was formed to assess regional and respective district hospitals including lower healthcare facilities within the region. The team consists of members from different institutions. The assessment of HCWM in the HCFs was conducted in all the 26 regions of Tanzania Mainland. From each region, at least four district/municipal/town councils were physically reached by the assessors, and the remaining councils were reached by mobile phones.

A standardized checklist and tools were used to assess and monitor various aspects related to healthcare waste. These were in form of Open Data Kit (ODK), which is open-source software for collection, managing, and using data in resource-constrained environments. The software was opted due to its ability to easily handle data, and it allows for offline data collection with mobile devices in remote areas. It also provides a room for data submission to a saver when internet connectivity is available. There were three tools developed; a checklist for Regional Health Management Team (RHMT), a checklist for Council Health Management Team (CHMT) and the survey tool for facility assessment.

The survey tool was accompanied by direct observation, where several pictures were taken to complement the information collected through other tools.

Since data sets were electronically prepared, they were coded with variable names, variable descriptions, variable format etc. Thereafter, data were entered into a Statistical Package for Social Sciences (SPSS) computer software, or EXCEL sheet for further processing. This was followed by data cleaning process. This process involved checking the data carefully for errors, accuracy, and identifying and handling missing values. Checking data for accuracy responded to questions such as are the responses legible? Are the responses complete? Are the important questions answered? Is all relevant contextual information (e.g., data, time, place) included. Lastly, descriptive statistics such as frequencies, percentages, and means were performed and presented in tables and charts.

3. Results and Discussion

3.1. Waste Segregation

The key to minimization and effective management of HCW is segregation and identification of waste. Segregation means the separation of the HCW into different categories. Wastes are separated to reduce risks associated with HCW and minimizing costs of waste treatment and disposal by reducing the volume of infectious waste generated. Segregation is most effective when done at the site of waste generation. The correct segregation of waste at the point of generation depends on a clear protocol for the identification of different categories of waste and disposal methods.

To encourage the segregation at source, reusable waste containers or baskets with liners of the correct size and thickness should be placed as close as possible to the point of generation (Table 1). They should be color-coded and have specific symbols marked on them, for example, yellow or red for infectious waste [1].

Separating hazardous from non-hazardous waste one can dramatically reduce the volume of waste that requires specialized treatment. Other elements of healthcare waste management include waste classification, waste minimization, containerization, colour coding, labeling, signage, handling, transport, storage, treatment and final disposal. To maintain such a system requires continuous training, planning, budgeting, monitoring, evaluation, documentation and record-keeping.

Direct observation revealed that waste was collected in different types of waste bins. There was no form of color coding to indicate the type of waste to be deposited in a particular waste bin. There was no provision of weighing scales for

Table 1. Color coding system of waste segregation.

Waste categories	Color of container and marking	Type of container	Collection frequency
Infectious waste	Yellow with biohazard symbol (highly infectious waste should be additionally marked highly infectious.	Leak-proof strong plastic bag placed in a container (bags for highly infectious waste should be capable of being autoclaved)	When three-quarters filled or at least once a day
Sharp waste	Yellow, marked sharps with biohazard symbol	Puncture-proof container	When filled to the line or three-quarters filled
Pathological waste	Yellow with biohazard symbol	Leak-proof strong plastic bag placed in a container	When three-quarters filled or at least once a day
Chemical and pharmaceutical waste	Brown, labeled with appropriate hazard symbol	Plastic bag or rigid container	On demand
Radioactive waste	Labeled with radiation symbol	Lead box	On demand
General health-care waste	Black	Plastic bag inside a container or container which is disinfected after use	When three-quarters filled or at least once a day

Source: [10].

measuring the weight of wastes generated at any of the wards or locations that waste were collected. As a result it is impossible to determine precisely the quantity of waste generated in the health facility. Sharp waste segregation was done in the wards. No other form of waste segregation occurs at any level and no strategy is in place for waste minimization. Temporal storage of waste occurs in the receiving receptacles or waste bins which are emptied daily or more frequently depending on the filling rate. Waste is collected daily by ward attendants and cleaners for dumping directly from storage receptacles or bins (**Figure 1**).

According to the results that was conducted during the survey most of the facilities at all levels had containers for three categories of HCW that is, highly infectious, infectious and non-infectious. A good observation was among the regional hospital (100%), followed by district facilities (94%) and finally health centres (92%) (**Figure 2**).

It was further observed that even though HCW sorting at the point of generation was fairly practiced, safe management is still challenged by the lack of consistent color coding for separate waste types and disposal mechanisms separately. Therefore there is a potential for diseases infection at the wards and units and also at the storage points when sorted by waste handlers, as well as at disposal points by scavengers. A study conducted on two hospitals in Tanzania showed that at least 25% of the medical waste in the two hospitals was not sorted at the source [11].

Figure 1. Expected standard waste bin in HCF.

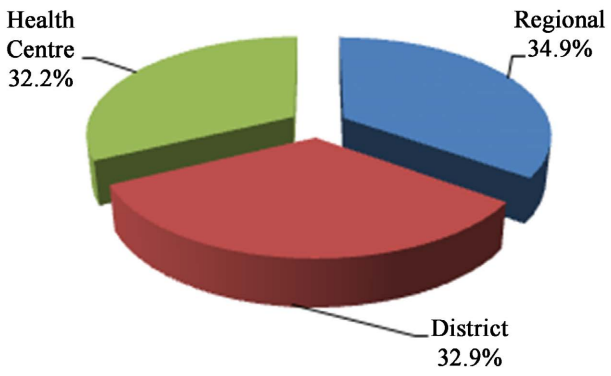

Figure 2. Compliance with waste segregation protocol.

3.2. Standard Waste Bins in the Healthcare Facilities

The findings from Figure 3 show that there were variations between the number of facilities and availability of standard waste bins. The standard waste bins according to the assessment guide were those which are color-coded.

The situation was not good in Simiyu and Shinyanga Regions where availability of standard waste bins was below 50% of the facilities (40.4%) and (40.3%) respectively. The situation was worse in Pwani Region as only 22.4% of the facilities had standard waste bins. Most of the waste bins observed were coded into red colour (for highly infectious waste), yellow color (for less infectious waste), and black colour (for non infectious waste), as well as safety box (sharps). However, there were a few cases where blue bins were used for black bins. In Kilosa District Hospital, there were even green waste bins for black or green colour coded bins. There were also cases of improvised waste bins in some hospitals like Mtwara DC in Mtwara and Kalambo DC in Rukwa region.

Alongside standard waste bins, assessing the availability of bin liners also was of a great importance due to the role they play in healthcare waste management. Figure 2, capture distribution of bin liners in the surveyed facilities. The availability of bin liners is not different to the distribution of waste bins in the healthcare facilities assessed.

This can be evidenced from the regions like Kigoma, Geita, Tanga and Arusha. However, Pwani, Ruvuma and Lindi regions were the most vulnerable to shortage of bin liners (30.7%, 23.3%, and 12.7% respectively) compared to the rest of the regions. The shortage of bin liners risks healthcare management practices as waste handlers had to use waste bins to carry the generated healthcare wastes.

3.3. Observed Compliance to Healthcare Waste Segregation Protocols in Facilities

The assessment on adherence to national standards and guidelines on waste segregation was extended to onsite verification, where assessment team conducted

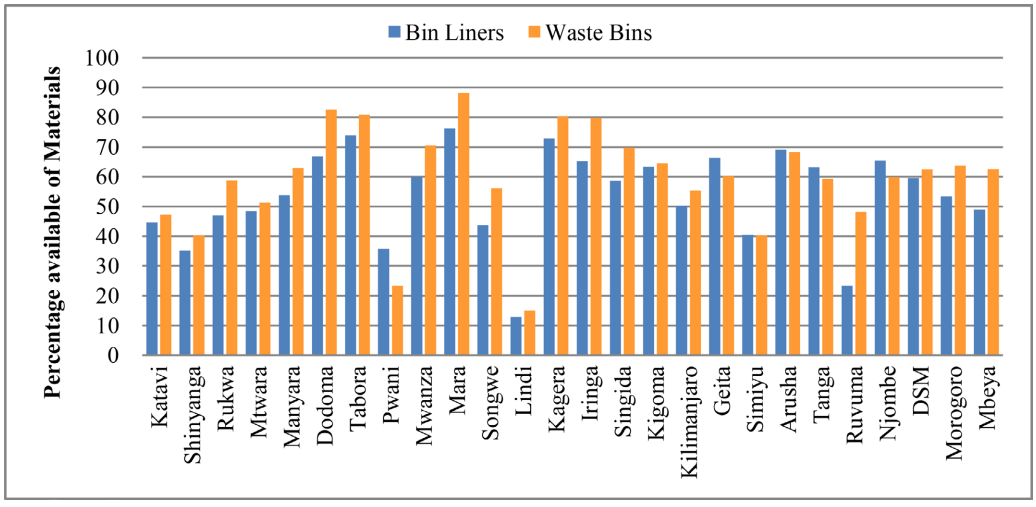

Figure 3. Availability of bin liners and waste bin in the healthcare facilities.

visual inspection of compliance practices on site. In the overall 64.3% of facilities were in compliance with national protocols was; of the remaining facilities 5.3% did not comply with the protocols at all and the remaining complied partly only. Table 2, present assessors' judgment on adherence to segregation protocols in visited facilities.

Observations of non-adherence to waste segregation protocols are in line with other similar studies [12] [13]. A well-functioning waste segregation protocol provides no chance for sorting through waste before disposal after it has been placed in a bin. A study done to healthcare workers from five hospitals in Southern Ethiopia found that only 53.8% of healthcare workers practiced healthcare waste segregation [12]. It was also noted that, the self-reported practice of healthcare waste segregation is correlated with the presence of onsite waste segregation receptacles. Similar practice was observed in a study done to five hospitals in Ghana, where colour coding practice was also inconsistent across the health facilities [13].

In addition, a survey conducted on medical waste management systems in the low-level health facilities (LLHFs) in Dar es Salaam [9]. The results showed that the segregation of waste in some of the surveyed LLHFs follows the national guidelines and are performed properly, even though sharp wastes are mixed with general waste during incineration and in some facilities, segregation is not perfectly performed despite the availability of specific containers for waste collection.

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3.4. Treatment and Disposal of HCW

After the transportation of healthcare wastes to the disposal site, the wastes should be disposed properly to avoid the risk of environmental pollution and public health problem. Each class of HCW requires specific treatment. Infectious

Table 2. Categories of waste segregated in different HCF levels

	Regional	District	Health center
Infectious and Non-infectious	0	1.9	0.0
Highly infectious, Infectious, Non-infectious	25.0	13.0	23.1
Infectious, Non-infectious and Sharps	0.0	9.3	15.4
Highly infectious, Infectious, Non-infectious and Sharps	75.0	75.9	61.5
The percentage of response on use a color-coded system			
Public	100	95.5	100
Private	0.0	100	0.0

HCW can be treated to reach the level of infectiousness that is considered acceptable. Infectious waste can be treated on-site or off-site.

The most preferable solutions for safely disposal of all forms of hazardous, pharmaceutical, and medical waste is having functioning and effective incinerator for preventing the transmission of blood borne pathogens from exposure to needle stick injuries. **Figure 4** shows the percentage distribution of the surveyed health facilities using incinerator for waste treatment methods in Region, District hospital and Health centers.

In this Study it was revealed that some HCFs use disposal methods that are not recommended by the national guidelines. Some HCFs use improper methods to dispose of HCW such as burning the waste in an unprotected environment. They did not have a specific designed ash pit, and they dispose off either in placenta pit, latrine opening, or open dumping [14]

Findings of the study (**Figure 4**) have shown that some of the surveyed facilities have incinerators for medical waste treatment and disposal. The highest numbers of incinerators were found in Region Referral level (75%) and the lowest was in District hospital level (40.7%) while in Health centres (45%). This was assumed to be due to availability of resources either from Ministry or donors who inject funds to Regional levels and not district or healthcare facilities. This also was observed a large number of the health facility used open pit burning for HCW (39%), which is not advisable. due to the fact that this is an expensive technology therefore, it is not easy for the Government to supply incinerators to all facilities at district and lower level facilities [4]. Though the study shows availability of incinerators at all levels the survey intends to determine if the incinerator in respective HCF is functioning or not. The surveyed health facilities have an incinerator either high tech or De Montfort Mark II for healthcare waste treatment and disposal (**Figure 5**).

The findings of the study show that majority of the surveyed HCFs in the three levels of health facilities which indicated to have an incinerator most of the incinerators are not functioning within the respective health facilities. At region level only 41.7% are functioning, while at district level only 29.6% and health centre 38.27% have incinerators which are functioning.

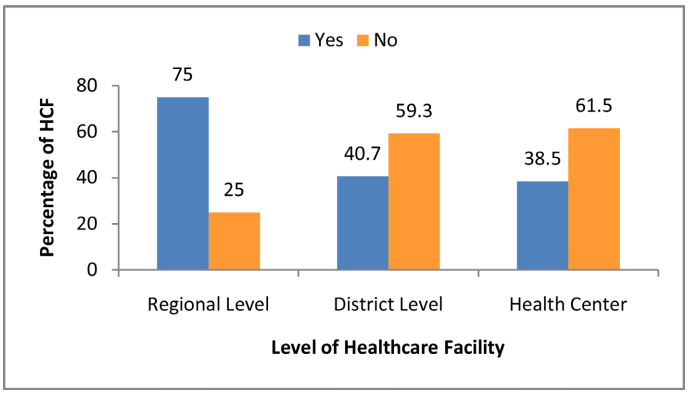

Figure 4. Availability of incinerator in different HCF levels.

However, the capacity of these incinerators is very low compared to volume of healthcare waste generated per day. In the study another study conducted earlier (Honest *et al.*, 2020), indicated that majority of incinerators used in Tanzania have low waste holding capacity with an average of 125 kg/hour, while the rate of healthcare waste generated in all hospitals goes up to 3,250 kg/day. Therefore, to minimize the healthcare waste generated in the surveyed facilities the management opt for other alternatives including burning structures and opening air burning (**Figure 6(a)** & **Figure 6(b)**).

For the pathological waste most of the facilities used the placenta pits (**Figure 7(a)**

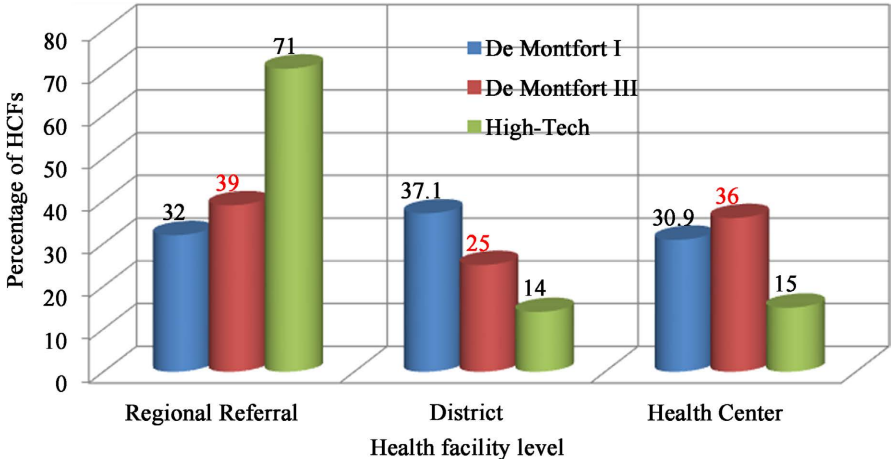

Figure 5. Model of available incineration.

(a) (b)

Figure 6. Different Burning Structures in Healthcare Facilities. (a) Burning Structure in one HCF in Sumbawanga Town Council; (b) Open Air Burning in one HCF at Nkansi DC.

(a) (b)

Figure 7. Different Placenta Pits in Healthcare Facilities. (a) HCF Standard Placenta Pit (Nkasi DC Hospital); (b) HCF Defective Placenta pit without a Lid (Laela HC)

& Figure 7(b)).

Treatment of medical wastes aims at minimizing exposure of workers to hazards and infections from the point of generation to disposal [6] [14] [15]. This observation calls for the need of allocating funds for waste management from either from the Ministry of Health or donor agency on the importance of treating infectious wastes in order to safeguard environmental and public health. It also calls for enforcement of waste management regulations, which require that infectious wastes are treated before disposal.

3.5. Functioning Incinerators

Most of the incinerators have worn out chimneys or were made without chimneys, and most of the incinerators lack covers for the waste feeding door and in the ashes removing door. It is just in few facilities in which the disposal sites with incinerators are fenced and located far from the human settlement areas. Most of the incinerators have no ash pits for ashes collection, thus 46.7% of the surveyed facilities. In practice it is contrast to the standard specified by guidelines incinerators usually are located within 10 to 30 m of clinics/hospitals for reasons of convenience, management, etc., and they often are located adjacent to or within populated areas. Only 19.4% have ash pit and only 28.6% are accessible to users (Figure 8).

Figure 9 shows that, majority of incinerators 82.1%, 87.1% and 83.9% (Regional, district and Health center respectively) have non-functioning incinerators which give an indication of unsafe treatment and disposal practices for healthcare waste management. Unsafe HCW treatment and disposal practices are the root cause cross contamination and infection which pose a high risk to health of the community and healthcare workers.

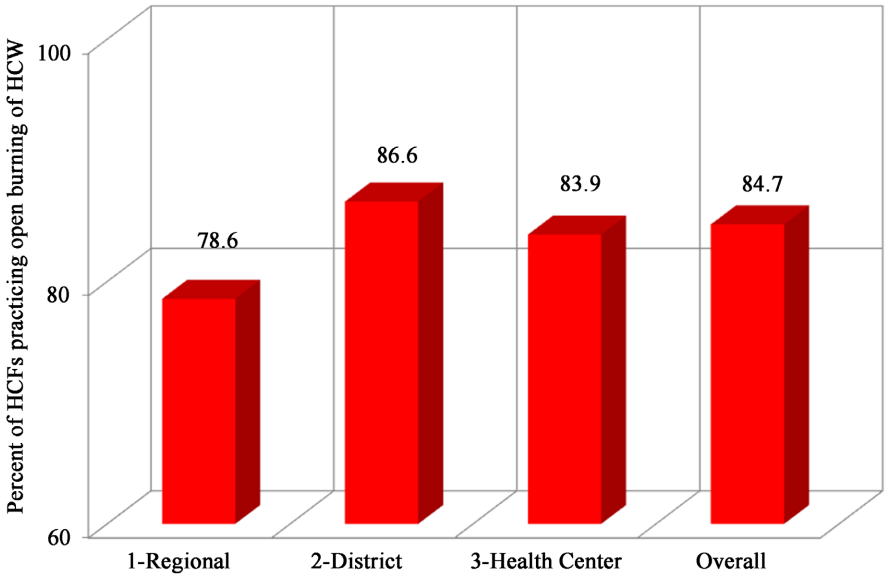

Figure 8. Open burning practices in different health facility levels.

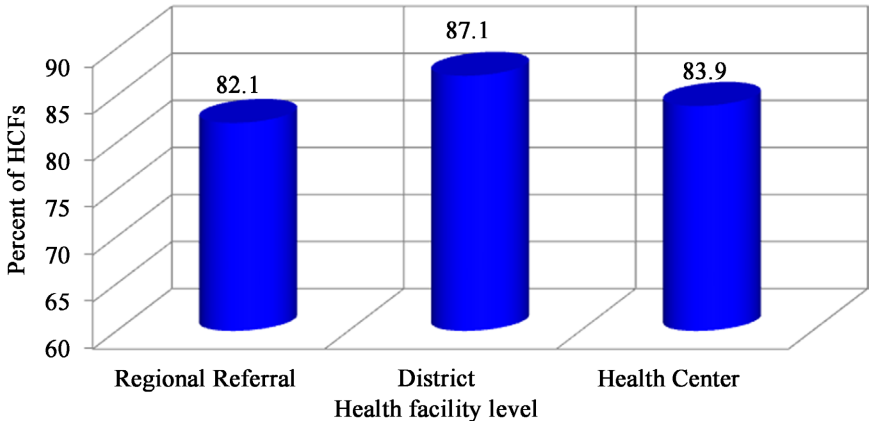

Figure 9. Non-functioning incinerators in different health facility levels.

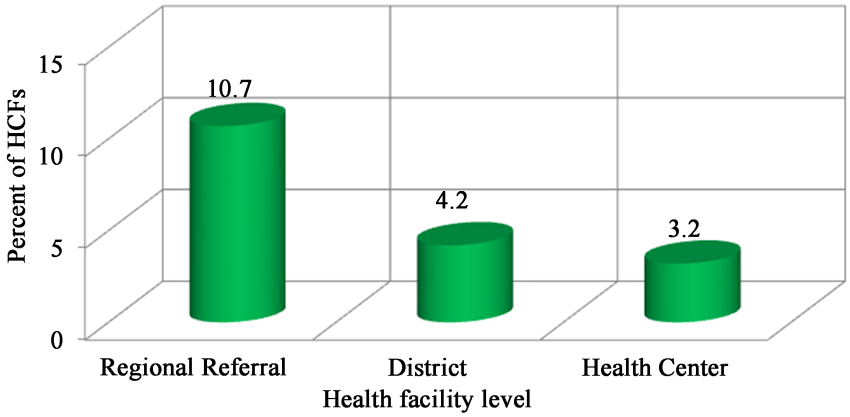

Figure 10. HCFs transporting municipal waste generated to the municipal dumpsite.

Figure 10 indicated that very few 3.2%, 4.2% and 10.7% (health center, district and regional respectively have means of transporting municipal waste generated in the respective HCFs to dumpsite.

These unsafe practices are unacceptable and do not comply with the National Policies and Standards for Managing HCW. It is the duty of the HCFs to ensure waste generated during healthcare services are treated and disposed of in a safe method. This unsound practice usually happens when the hospital incinerator is not functioning and, in most cases, the available option could be open burning or take it to dumpsite. Majority of the dump site are uncontrolled and thus invite for scavengers who sort valuable items for safe or recycling. This pose a high risk through cuts, needle stick injuries, spills and site/surface contamination. Figure 11 indicated that few (5.1%) Transport HCW to Offsite Treatment and Disposal. The approach and Method are currently widely advocated as the best approach as it minimizes cost of HCW handling and disposal. However currently the method is not currently available in many hospitals thus few have access to offsite/centralized healthcare waste treatment and disposal.

Another study elsewhere indicated that the main disposal methods comprises of open pit burning (50%) and burying (30%) of the waste [16]. Furthermore, in

that study it was revealed that a large proportion (71%) of the hospital use dust bins for transporting the waste from generation point to disposal site without plastic bags and most hospitals had low incineration capacity, with few of them having fire brick incinerators (Table 3 and Table 4).

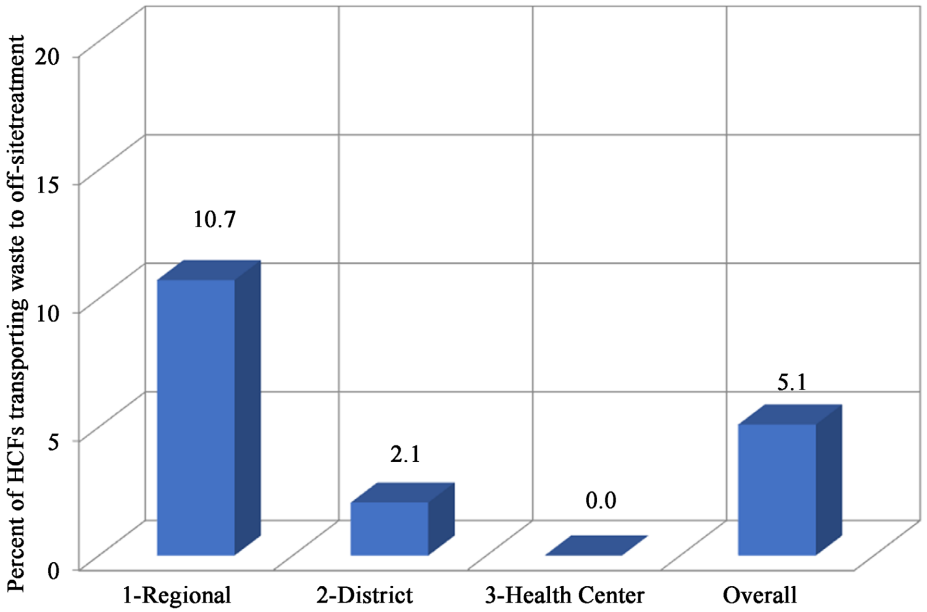

Figure 11. Offsite Transportation of HCWs for treatment and disposal.

Table 3. Assessment results for physical conditions of the incinerators.

Physical condition	Regional	Districts	Health centers
Is the door available?	100.0	95.2	60.0
If available does it cover properly?	88.9	76.2	60.0
Is the door cover rusted?	22.2	33.3	20.0
Chimney	55.6	47.6	60.0
Top plate	55.6	38.1	60.0
Grate	55.6	38.1	60.0
Housing parts	55.6	38.1	100.0
Signs of failure due to high temperature	55.6	23.8	40.0
Is the top plate rusted?	22.2	28.6	20.0
Is the sand clean?	66.7	81.0	40.0
Are there visible blood droplets on the sand?	22.2	14.3	
Is the plaster intact?	77.8	95.2	40.0
Are there any cracks?	33.3	23.8	20.0
Is the plaster intact?	77.8	90.5	40.0
Are there any cracks?	22.2	23.8	20.0

All hospitals that were involved in this study had placenta pit. However studies indicate that anaerobic digestion process of pathological waste like human placentas can be used as an alternative source of energy (biogas generation) while digesting the solid pathological waste activated with food staffs (food remains) [17].

Use of Personal Protective Equipment during HCW Handling

Figure 12 indicated majority of the HCFs assessed has shortage of PPEs supply for use by waste handlers.

The inadequate supply of PPEs put Healthcare workers at risks due to nature of work. The shortage of PPEs supplies is more critical at regional and district level attributed by high consumption of PPEs compared to Lower level facilities.

Table 4. Other condition of incinerators (multiple responses).

Other incinerator conditions	Regional	District	Health center
Cleanliness	87.5	70.0	80.0
Floor	100.0	75.0	60.0
Walls	87.5	80.0	80.0
Ventilation	100.0	100.0	100.0
Roof posts/support structures rusted?	62.5	25.0	40.0
Roof iron sheets	37.5	40.0	40.0
Fire bricks wall condition	87.5	90.0	80.0
Floor condition	100.0	80.0	80.0

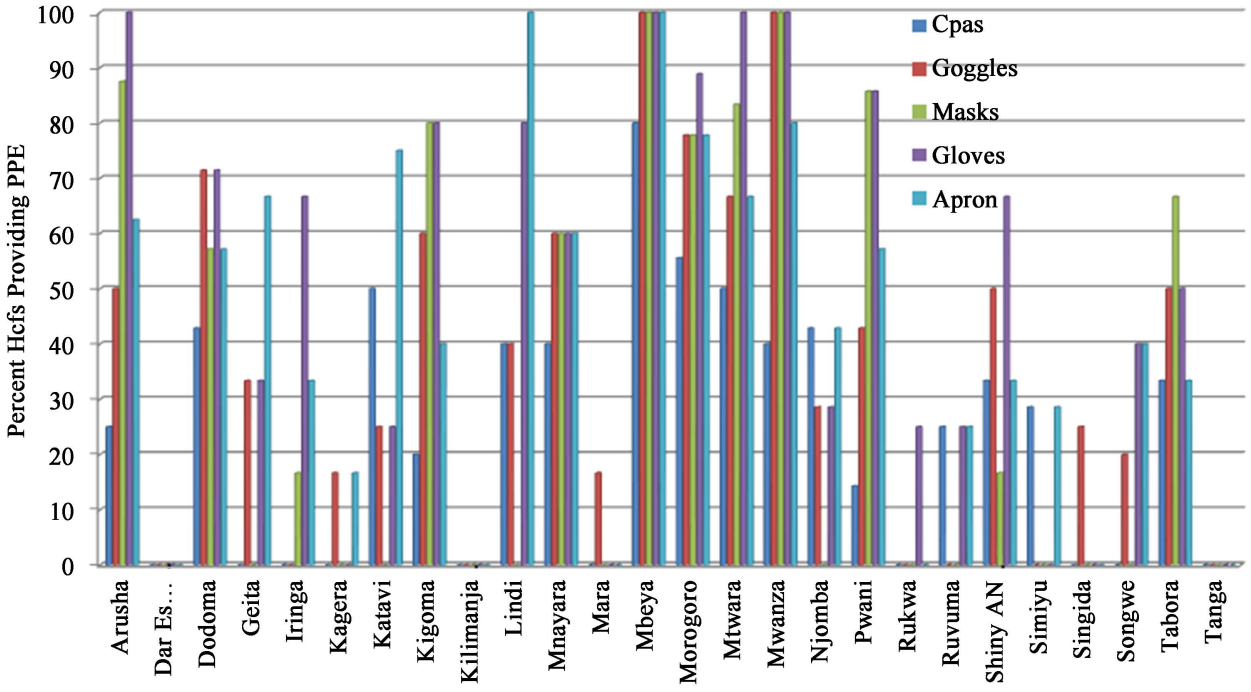

Figure 12. Availability of personal protective equipment for waste handlers.

The percentage of PPE available per different categories is shown in Figure 13. With respect to the use of personal protective equipment (PPE), all the respondents reported use of gloves, Apron, Caps, google, Masks were the most common protective gear used. The provision of the PPEs was observed at 76% followed by appron (91.7%) and aprons (90.2%). However, all respondents reported that there was shortage of PPE in their facilities, implying that the workers are exposed to occupational hazards or risks due to inadequate protection during handling hazardous wastes.

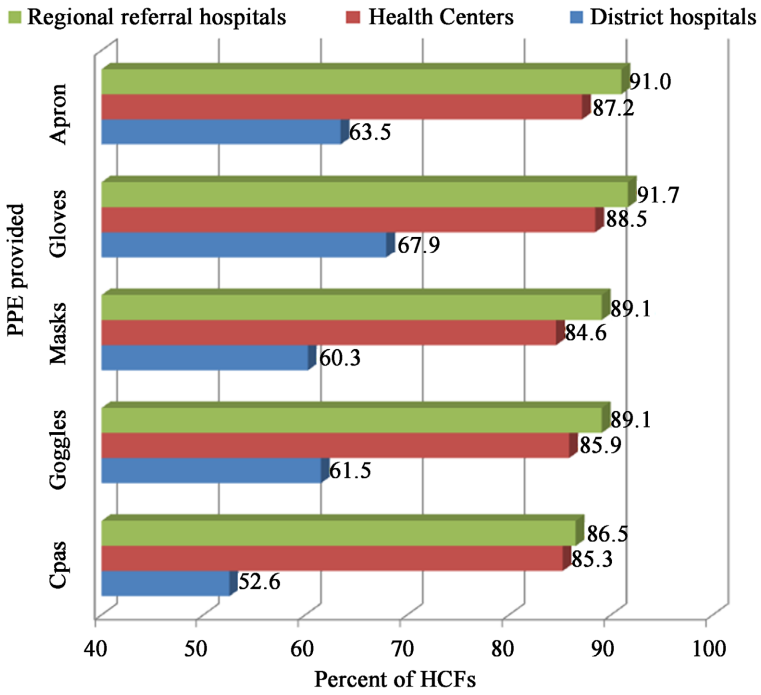

Figure 13. Provision of PPE to the waste handlers according to HCF levels.

4. Conclusion and Recommendations

4.1. Conclusion

The study indicates that majority in the overall 64.3% of facilities were in compliance with national protocols and the remaining facilities 35.7% did not comply with the protocols at all and the remaining complied partly only. The highest numbers of incinerators were found in Region Referral level (75%) and the lowest was in District hospital level (40.7%) while in Health centres (45%). This was assumed to be due to availability of resources either from Ministry or donors who inject funds to Regional levels, not district or healthcare facilities. This also was observed that a large number of the health facility used open pit burning for HCW (39%), which is not advisable.

4.2. Recommendations

The study concluded that there was low compliance with standard HCW management. It was recommended that possession of HCW management guidelines,

staff training on HCW disposal and provision of requisite equipment for proper treatment of HCW would promote environmental safety in HCW disposal. MoHCDGEC in Collaboration with partners should support and provide capacity building in all HCFs across the country on HCWM and WASH services. There is therefore the need for creation of more awareness and devotion of more resources to the management of HCW among healthcare facilities in Tanzania. Due to high volume of HCW that is daily generated, healthcare facilities must have workable and sustainable means of managing their large spectrum of wastes in a way that ensures utmost environmental and human safety. Finally, ensuring adequate supply of power and water is critical for HCW management in Tanzania. Specifically, incinerators cannot be functionally utilized if electricity supply is erratic. Similarly, several processes that are associated with waste disposal would require regular supply of water.

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Ethical Approval and Consent to Participate

The Tanzania Ministry of health commissioned the study. All the required ethical clearances and approvals were granted by the Tanzania Ministry of health. Also, none of the participants was coerced to participate. Some aspects of the data had been made available by the Ministry of health for public use by permission and authorization. The data were made available for use by Ministry of health at the instance of the permission that was granted to them by the WHO in Tanzania.

Authors' Contribution

Both authors conceptualized the study. Honest Anicetus and Josephat Saria analyzed the data and wrote the introduction, results and discussions section, while Samwel Mwanyele was involved in the conceptualization and review of necessary literature for the study. Both authors have read and approved the final version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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