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Evaluating Medical Waste Sorting Methods and Ultimate Disposal Across Various Health Units at Kampala International University Teaching Hospital

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ABSTRACT

Globally, the surge in medical and healthcare waste is evident, primarily driven by population growth, expanding healthcare facilities, and increased usage of disposable medical products. This study employed qualitative data collection methods, utilizing direct observation and daily review of completed questionnaires to ensure accuracy. Data sets were meticulously organized using an Excel spreadsheet and the Statistical Products and Service Solution (SPSS) data entry module. The assessment focused on waste segregation practices within various health units at KIU-TH. It was observed that healthcare officers in specific units predominantly managed waste segregation, with 95% of units employing color-coded waste bins. Black bins were the most prevalent, followed by red and yellow bins. Notably, a significant percentage indicated that containers for healthcare waste transportation consistently had securely covered lids (96%). The transportation of waste primarily relied on manual methods, either through hand-pushing containers or via vehicles. The study highlighted the implementation of Standard Operating Procedures (SOPs) and guiding documents across all health units and disposal sites. Overall, the findings underscored the prevalence of healthcare waste segregation using color-coded collection bins. However, instances of non-hazardous waste mixing with hazardous waste in general containers were observed, alongside the widespread presence of instructive posters in nearly all visited health units.

Keywords: medical waste, segregation practices, disposal

INTRODUCTION

Healthcare facilities generate and reject material regularly, and improper management of these wastes leads to public health hazards or environmental pollution [1]. Globally, medical and health-care wastes have sharply increased in recent decades due to increase in population, number, and size of health care facilities, as well as the use of disposable medical products.

Solid medical waste has remained a source of concern because of the potential to transmit diseases, contaminate soil, surface and ground water with pathogenic microbes, toxic and heavy metals often present in it [2]. Diseases associated with poor medical waste management include nosocomial diseases, typhoid, skin disorders, intestinal parasitosis and hepatitis [3]. In addition, there is a potential risk of HIV transmission to a susceptible human host from percutaneous injury by infected sharps [4]. Therefore, inadequate handling and disposal of medical waste has consequences for patients, relatives, healthcare workers, waste workers, scavengers, the public and the environment. A study conducted in Garisa state in Kenya indicates that the persons living around waste dumpsites are exposed to a health risk including injuries from contaminated sharps, ground water and food poisoning as well as skin

infections. The most vulnerable category is that of young children who play around and scavenge the dumpsites [5].

A study in South Africa shows absence of a national policy to guide all the provinces in applying uniform practice of medical waste management may have contributed much poor HCWM, however, in the provinces and health facilities where guidelines have been developed to manage medical wastes, the guidelines are either not being enforced or there is no sufficient equipment to manage the waste as recommended by the guidelines. This shows a need for formulation and enforcement of the national policy, the adequate budget for medical waste by the national government and the provincial government, regular training of health staff and waste handlers as well as construction and monitoring of treatment facilities [6].

Developing countries, on the other hand, are found to be resource constrained when it comes to effective hospital waste management (HWM). Lack of accessible guideline, waste management utility, adequate training, financial constraint, and poor managerial supports were identified as the main challenges. There should be sufficient resource allocation, periodic training, and strict supervision by the stakeholder [7]. Poor sanitation practices might result in the mixing of hazardous waste with the general waste which may increase the problem of waste management by increasing the cost of treatment and disposal [8]

Uganda in relation to other developing countries and specifically within the sub-Saharan African region has been reported to have inadequate healthcare waste management (HCWM) systems besides; there is no strong system which has been put in place to manage this waste. Due to poor segregation practices, about 80% of the waste generated is considered and treated as hazardous due to mixing of non- hazardous waste with hazardous waste that results in the entire stream being treated as hazardous [9].

Despite continued efforts legal and institutional, which are in place to enhance proper waste management in Uganda, a study established that 38% of the health facilities visited had sharps and other wastes on ground or in other unsupervised areas, thereby exposing the community to needle stick injuries [10]. A study in Bushenyi district revealed that segregation of healthcare waste by health workers was carried out only on sharps which were collected in special sharp boxes, a few had adequate color-coded waste collection bins. Moreover, infectious waste was seen mixed up with noninfectious waste in general containers while availability of instructive posters was observed to be absent in almost all the health facilities visited [11].

METHODOLOGY

Research Design

The research design used was descriptive cross-sectional [12].

Study area

The study was conducted in different health units at Kampala International University teaching hospital which is in Ishaka Town, a major town in Bushenyi district, and located in the north of Bushenyi district, south west of Mbarara district and around 78km from Mbarara town which is the biggest city in Western Uganda.

Study population

The study population comprised of different health units including histopathology, clinical chemistry, microbiology, hematology and blood transfusion, serology and parasitology laboratories plus main and maternity theaters, wards like accidents and emergency, surgical, maternity, internal medicine, paediatrics, orthopedics, private and psychiatry. Also, dental, ophthalmology, ENT (Ear, Nose and Throat) and chai clinic. Other areas include intensive care unit and the disposal site. They were divided into laboratories, wards and special clinics for easy analysis of the data.

Sample size and sampling technique

The sample size was calculated using the Krejcie and Morgan's sample size calculation based on $p = 0.05$ where the probability of committing type I error is less than 5 % or $p < 0.05$.

$$s = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P)$$

Where;

(s) required sample size.

X^2The table value of chi-square for 1 degree of freedom at the desired confidence level (0.05 = 3.841).

N is the population size.

P is the population proportion (assumed to be 0.50 since this would provide the maximum sample size.

d is the degree of accuracy expressed as proportion (0.05).

N=21

Therefore;

n was 20 as from Morgan's table

Sampling technique

Purposive sampling technique was used to sample the health units, this was where I selected participants that are representatives of the population. Each of the sampled health units in KIU-TH was visited on different days to obtain data.

Inclusion criteria

Inclusion criteria included all units that generate medical wastes within the hospital plus the disposal site.

Exclusion criteria

Exclusion criteria included all health units that do not generate medical wastes like offices for medical officers, radiology department, dermatology clinic, semiprivate ward and units outside KIU-TH.

Ethical considerations

Permission was sought and granted by the responsible personnels like Executive Director of KIU-TH and Institutional Research Ethics Committee before undertaking this research. Ethical approval was also sought from various sources to ensure that the study adhered to acceptable ethical guidelines.

In addition, the researcher explained the purpose of the study to each unit leader or Head of department after which an informed consent was obtained before participating in the study. To further avoid bias and misinformation, the researcher and his assistants were the only ones knowing the contents of the checklists [13]. Furthermore, no person was put forth as a source of information.

RESULTS

Table 1: Medical waste segregation practices seen in different units in KIU-TH

Category	Unit	Frequency (N= 20)	Percentage (%)
Point of segregation	Yes	14 (0.70)	70
	No	6(0.30)	30
Color coded waste containers present	Yes	19 (0.95)	95
	No	1 (0.05)	5
Bins have lining	Yes	16 (0.80)	80
	No	3 (0.15)	15
Lining securely fitted	Yes	15 (0.75)	75
	No	4 (0.20)	20
Waste containers properly marked	Yes	12 (0.60)	60
	No	7 (0.35)	35
Biohazard symbol on the bins	Yes	3 (0.15)	15
	No	16 (0.80)	80
Waste containers leaking	Yes	1 (0.05)	5
	No	18 (0.90)	90
Emptied at the end of each day	Yes	2 (0.10)	10
	No	17 (0.85)	85
Overfilled containers	Yes	4 (0.20)	20
	No	15 (0.75)	75
Handlers have appropriate PPE	Yes	3 (0.15)	15
	No	17 (0.85)	85

Table *2:* Transportation of wastes

CHAIN		Occasions, n=78	Percentage (%)
Transports the waste	Cleaner	74	95
	Courier	3	4
	Local government	1	1
Vehicle or covered container	Yes	75	96
	No	3	4
Mixing of wastes	Yes	54	69
	No	24	31
PPEs	Yes	76	97
	No	2	3

Table 3: Transportation of wastes

PPE	Occasions	Percentage (%)
Uniform	73	
Gloves	53	
Aprons	32	
Gumboots	57	
Facemasks	14	
Number of PPES used	***Occasions, n=78***	
None	5	6
1	25	32
2	46	59
3-5	2	3

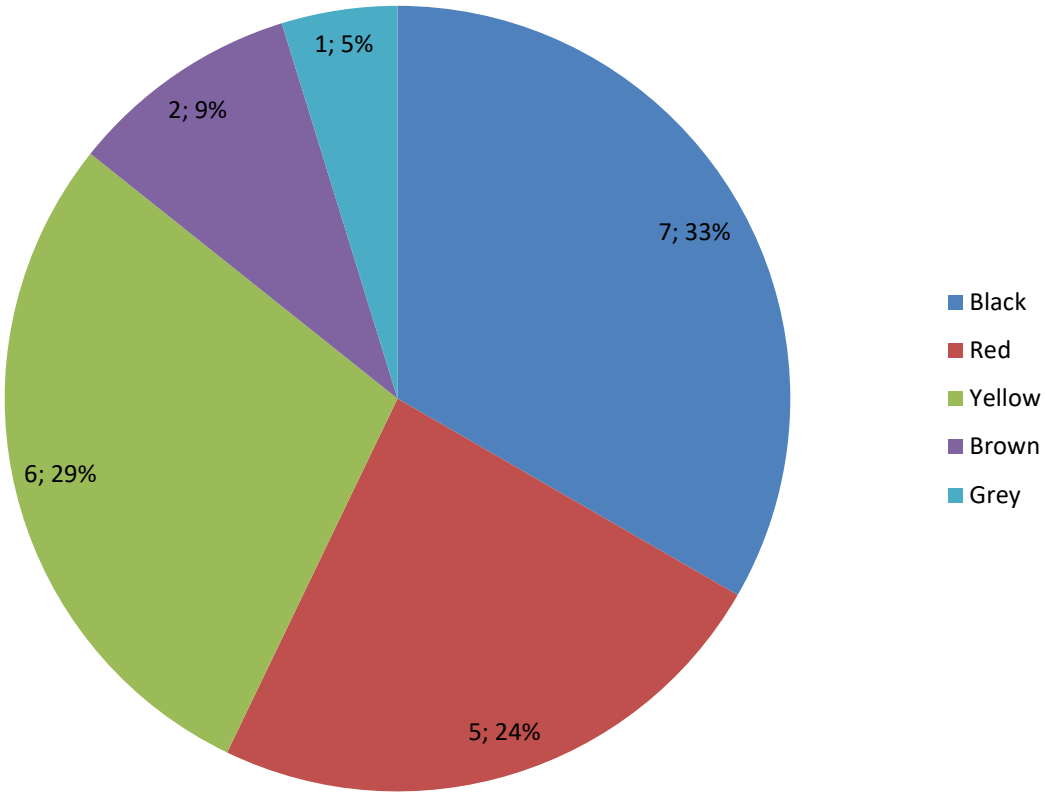
For those that met the inclusion criteria, 95% of all units had color coded bins with only 15% having biohazard symbols labeled on them and only 30% had a point of segregation at site.

This study as from Tables 1 and 2 has been able to establish that waste segregation practices seen in KIU-TH health units was majorly done by the health officers in specific units and 19 out of the 20 (95%) units had color coded waste bins. However, results from observations done in the field showed that bins lacked biohazard symbols (15%) and were not emptied at the end of the day rather the next morning (10%). Only 30% had a point of segregation at site. And of the coded bins, 15% did not have bin linings and those that had them (80%), 75% were securely fitted. 10% of the bins were emptied at the end of the day while the rest were emptied the next morning between 5:00 a.m and 6:30 a.m. At the time of emptying, only 3 units had overfilled bins and 1 unit had a leaking bin.

Also shows that handlers in 17 units did not have appropriate personal protective equipment during segregation (85%) and those that did not have during transport were 3%. They either had one (32%) or two (59) while few had 3 of the 5 (uniforms, aprons, gloves, gumboots, face masks) (3%). However, 6% had no PPEs during transport. This study also shows that SOPs and guiding documents were put in place in all health units and even at the disposal site. Laboratories had the most documentation with 43% while wards also had documentations of 20% as special clinics covered 14%. The disposal site had documentations on handling, disposal and usage of personal protective equipment. The numbers of trainings in KIU-TH as per the study period were majorly updated in laboratories in the months of January and April with trainings done. Special clinics had one training monthly.

Findings of this study from table 3 show vehicles and covered containers were used. A large percentage indicated that the containers for transporting of

Figure 1 Color codes for waste bins in laboratories



healthcare waste all have well covered lids (96%). In this study we see that there was a 69% rate of mixing medical wastes during transport. These included non-hazardous and hazardous wastes.

Figures 1, 2 and 3 show color codes used in the different units. All health units had black bins as the majority followed by the red and yellow bins. Labaratories had only 1 grey bin and so did the special clinics.33% of waste bins in laboratories were coloured black. The 5% seen in the laboratories was because the pharmaceutical products were being discarded into other bins like black and this could explain why the black bins were the majority. 32 % of the bins in wards were coloured black, 30% were red while the next majority were coloured yellow. Only 4% for the brown and grey waste bins was noted on all the wards. All special clinics had more black and red with 32% each while yellow bins also covered a greater percentage at 26%. Green and brown bins covered 5%.

***Figure* 2 Color codes for waste bins in wards**

***Figure* 3 Color codes for waste bins in special clinics**

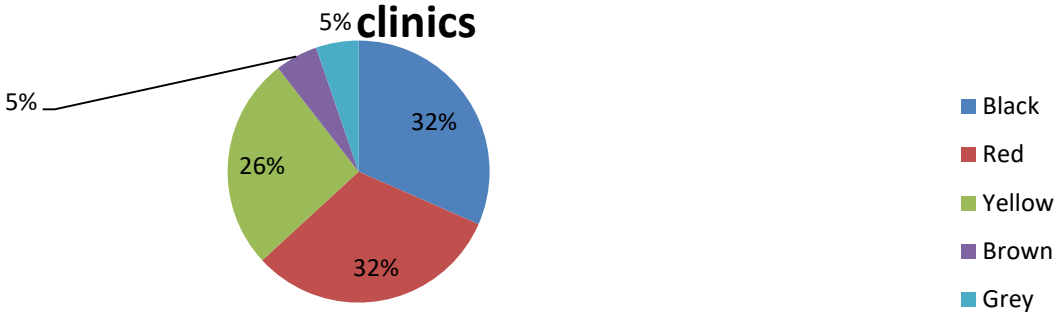
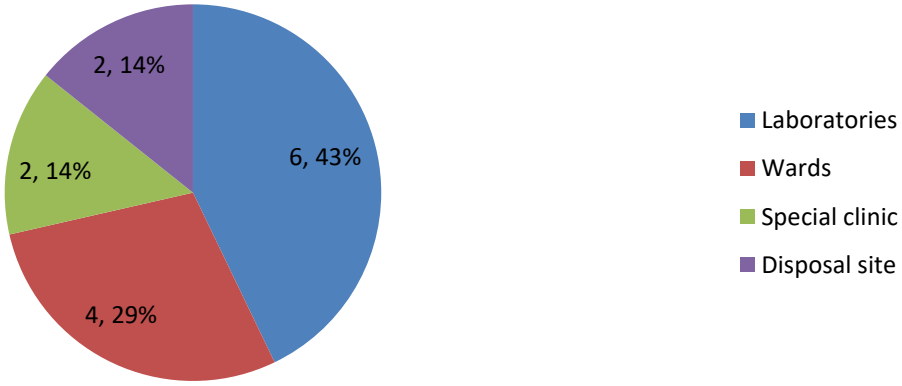


Figure 4: SOPs and documentation in each unit



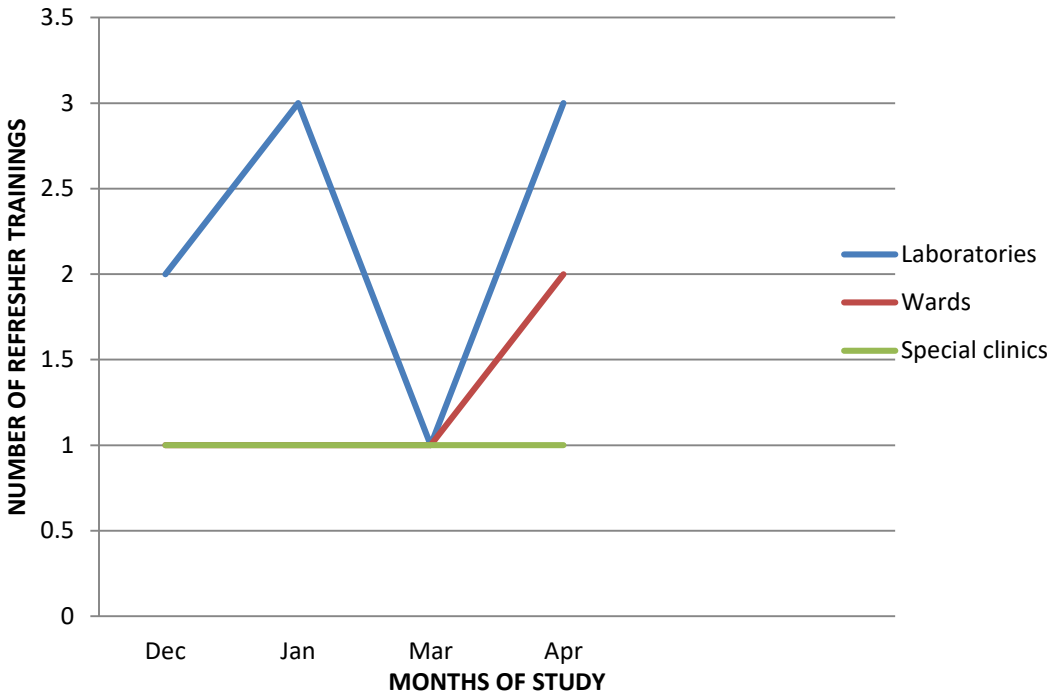


Figure 5: Number of Trainings Carried Out

DISCUSSION

A large percentage indicated that the containers for transporting of healthcare waste all have well covered lids (96%). This practice upholds the WHO guidelines which recommend that for transportation of healthcare waste over a long distance, waste should be carried in closed rigid well labeled containers.

In this study we see that there was a 69% rate of mixing medical wastes during transport. These included non-hazardous and hazardous wastes. The study carried out by [11] revealed that non- infectious waste was seen mixed up with infectious waste in general containers in majority of the hospitals thus explaining they had 104 (30.6%) of the respondents denying the existence of color-coded containers in their respective health facilities.

This study shows use of one or two PPEs to be 91% which has a range similar to a study by [11] which revealed that majority of the healthcare workers (86.2%) make use of one or more protective equipment when handling healthcare waste while only few 47 (13.8%) do not use protective equipment.

The Michigan Medical Waste Regulatory Act, Part 138 of Act 368 (MWRA), defines medical waste not to include pharmaceuticals which is contradictory to the study definition which includes pharmaceuticals. However, the study definition is consistent with the WHO definition [2].

The study findings revealed that segregation of healthcare waste by health care units was carried out using color coded waste collection bins. Non-hazardous wastes were seen mixed up with hazardous waste in general containers while availability of instructive posters was seen to be present in almost all the health units visited. Also waste handlers were provided with uniforms, a few were provided with gumboots, aprons and masks where applicable while the gloves provided were mostly latex gloves

thus exposing the handlers to needle stick and other injuries.

Furthermore, transportation of waste was commonly done by the use of hands as either pushing a container or in a vehicle. Some bins had linings subject to tear and leakages. And storage rooms were lacking in majority of the studied facilities where healthcare waste was observed kept at open unprotected areas exposed to insects and patients. The commonest method of disposal was open pit burning.

Wearing personal protective equipment (PPE) such as gloves, masks, clinical coats, shoes help to minimize exposure to infections and injuries. In this study, most health unit workers wore appropriate (PPE) which is a good practice since it minimises risk of contact with the waste. Our findings did not corroborate with findings of a cross sectional study conducted in a Tanzanian Municipality in which most health workers did not wear appropriate personal protective gear [14-15]. The low usage in the aforementioned study was attributed to the fact that health workers were not provided with protective gear by their employees. It is appropriate to ensure adequate provision of PPE and then supervision for proper and consistent use.

CONCLUSION

Training on HCW management is considered critical to success of any waste management programme; Improves knowledge of health workers, increases their cooperation with HCW programmes and also impacts on their practices on HCW management. It is therefore important to intensify training for all health unit workers with emphasis on implications of proper HCW management on costs and risks to human and environmental health.

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