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HEALTH CARE WASTE HANDLING PRACTICES AMONG HEALTH CARE WORKERS AT KENYATTA NATIONAL & REFERRAL HOSPITAL - KENYA
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ABSTRACT

The world Health Organization (WHO) estimates that an average of 0.5 kilograms of hazardous waste per hospital bed per day and 0.2 kilograms or more are produced by high income countries and low-income countries respectively. Health-care waste management requires increased diligence to avoid adverse health outcomes associated with poor practice, including exposure to infectious agents and toxic substances. The aim of the study was to determine the medical waste management handling practices among health care workers. A descriptive cross-sectional design was adopted. A total of 297 doctors, nurses, laboratory technicians and supportive staff were randomly selected using departments as strata. Data was collected using self-administered questionnaires. Data was entered in Microsoft Access and exported in SPSS Version 23.0 for analysis. Descriptive statistics were performed, and results presented as text, tables and charts. The waste generated was mostly general waste. About 67.3% (n=182) of health care workers used correct color codes while segregating waste, 89.6% maintained a routine schedule in medical waste collection. Personal Protective equipment was available to 89%, (53%) experienced an injury while handling medical waste among whom 57% sustained needle stick injuries. However, 78% (n=113) did not seek post exposure prophylaxis (PEP) management. The results identified gaps in waste management practices and low adherence to safety measures. Creating awareness on risks, mitigation measures associated with handling medical waste and timely repairs of the treatment plants are recommended.

INTRODUCTION

Medical waste is any waste which is generated during diagnosis, treatment or immunization of human beings or animals. The World Health Organization (WHO) has categorized waste into general waste which forms (80%) of the generated waste, infectious waste (15%) and sharps (5%). Health care waste contains harmful microorganisms that have potential to infect patients, health workers and the general population. Other potential hazards include drug resistant microorganisms which can spread from health care facility to the environment. [1]

Globally, there are differences in the way medical waste is handled with poor practices often noticed in low and middle-income countries.[2] Proper segregation of waste is very crucial in making medical waste disposal cost-effective in a risk-free environment.

The effective management of medical waste has been a major challenge considering the existing diverse guidelines that health institutions employ. Waste management entails effective waste management generation, segregation, collection, handling and treatment. The inability to understand the underlying waste management protocol leads to development of major risks.

Globally injuries associated from needle pricks and patients body fluids have been confirmed to cause 1.7 million (45%) cases of Hepatitis B (HB) and Hepatitis C (HC) viruses, 400,000 (9%) new HIV infections, 10 million annual TB infections with estimated 3 million cases among health workers in the hospitals and from home-based care givers due to mishandling of medical waste.[3]

Recognizing the magnitude of the problems in developing countries and the Sub- Sahara, have responded through establishment of regulatory frame works, polices and medical waste plans but a challenge towards management of medical waste that exposes health care workers to hospital acquired infections.[4]

In Kenya, a third of public and a fifth of private hospitals manage medical waste unsafely leading to health risks to both health workers and the population that makes a living through scavenging along the waste stream.[4] Taking into account that KNH is the largest national referral hospital in Kenya with a bed capacity over 2000 and over 1000 outpatient clients per day, it generates 2 tons of medical waste daily.[5]

Medical waste is an important part of hospital hygiene that leads to prevention and control of risks and infections. Improper waste management causes harm to health care workers, patients and the environment. Trends from records of health workers at KNH showed that those who sought for post exposure prophylaxis treatment in 2017 were 32% while those vaccinated against Hepatitis B infection were 22%. Both services are free for staff.[5]Both PEP and HB vaccination are key safety measures for medical waste handlers in case of needle prick injury or spillages associated with medical waste.

Therefore, the study intended to determine medical waste management practices among health workers and subsequently align the findings together with recommendations to comply with the National Environmental Management Authority (NEMA) standard of total management of hospital infectious waste.[6]

MATERIALS AND METHODS

The study was conducted at Kenyatta National Hospital (KNH) which is a level 6 public

teaching and referral hospital. The study population comprised of health care workers at KNH involved in medical waste practices. A descriptive cross-sectional study design that adopted qualitative and quantitative approaches was used. The sample size was determined by the standard Fisher's formula (Fisher *et al* 1999). A prevalence of 60% was used which represents the health workers at risk from non-compliance on medical waste practices (PACE) project for USAID/MoH (MoH and USAID, 2012). Probability proportionate to size sampling was used with various departments considered to form strata. A total of 297 HCW's who included 27 doctors, 152 nurses, 53 laboratory technicians and 65 ssupport staff were selected. The Distribution of health care workers at KNH departments was as shown below (Table 1).

Table 1

Showing departments used for sampling, total number of staff (N) and number of staff recruited in the study (n) from the various departments

KNH	A/E	Ortho	G.S	RH	Med	Paeds	Inc.	Labs	Total	
Doctors N(n)	14 (4)	10 (3)	14 (4)	20 (6)	18 (5)	14 (4)		5 (1)	95	27
Nurses N(n)	117 (35)	70 (21)	66 (20)	110 (33)	58 (17)	87 (26)			508	152
Lab Tec N(n)								180 (53)	180	53
Support staff N(n)	33 (10)	27 (8)	30 (9)	35 (10)	24 (7)	29 (9)	26 (8)	13 (4)	217	65
Totals N (n)	164 (49)	107 (32)	110 (33)	165 (49)	100 (29)	130 (39)	26 (8)	198 (58)	1000	297

Abbreviations A/E-Accident and Emergency, Ortho- Orthopaedic, G.S- General Surgery,- RH- Reproductive Health, Med- Medicine, Paeds-Paediatrics, Labs-Laboratories, Inc-Incinerator, Lab Tec - Laboratory Technician

***SOURCE**: (Duty Rosters in Departments/units –June 2018)*

Self-administered questionnaires and a developed checklist were used to collect data. The filled questionnaires were coded, filled and locked up in a safe cupboard. The laptop that was used in the analysis of the data had a password to ensure limited access by authorized personnel only. Consent forms and questionnaires were stored in lockable cupboards. The collected data was cleaned, coded and analysed using the SPSS Version 23.0. Descriptive statistics were used to calculate proportions and percentages. Results were presented in tables, graphs and pie-charts. Ethical approval was issued from KNH-UoN Ethics Review Committee (P469/07/2018). Permission to collect data was sought from hospital authorities and from the department/unit. All respondents signed an informed consent form. To maintain confidentiality, initials and coded numbers were used to identify the participants.

RESULTS

This section provides an understanding on the results from the analysis based on the

objectives. A sample of 297 respondents was recruited for the study.

Categories of medical waste generated among health care workers:

The analysis showed that majority, 67% (182) of waste generated was general waste while the least 46% (124) was sharp waste (Figure 1)

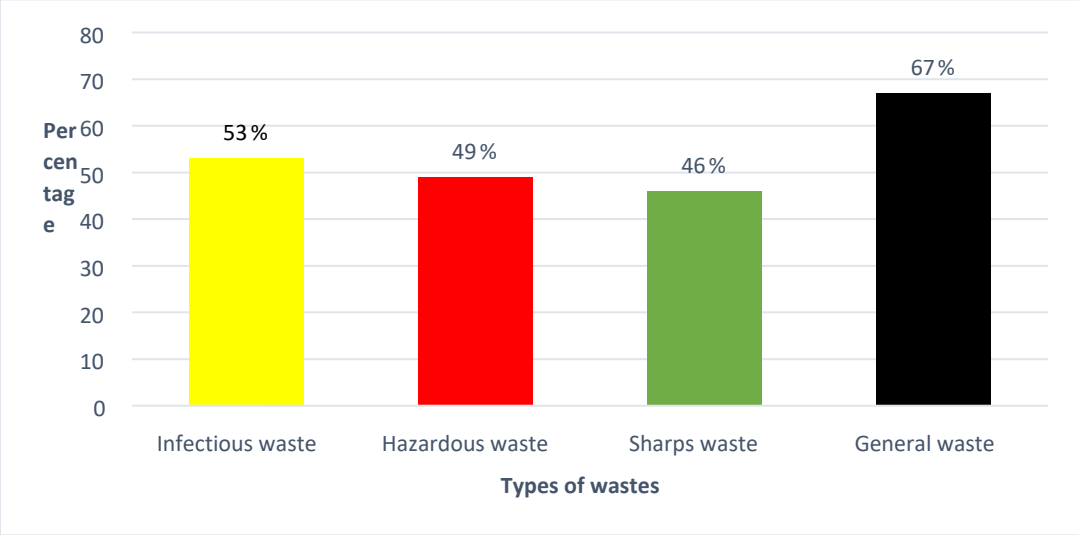

Figure 1: Categories of wastes of medical waste generated.

Distribution of generated medical waste as per department: Accident and Emergency department produces more infectious wastes (34%), Sharps (34%) and general wastes (25%). Orthopedic department produces more sharps (29.7%), infectious wastes (28.7%), 23.8% general waste and 17.8% hazardous waste. General surgery produces more infectious wastes (36.3%), 22.5% general waste and 5% hazardous wastes (Table 1).

Use of color codes when segregating medical wastes: Majority, 67.3% of the respondents referred to the color codes when segregating wastes all the time, only 1.1% rarely used color codes when segregating different types of wastes (Figure 2).

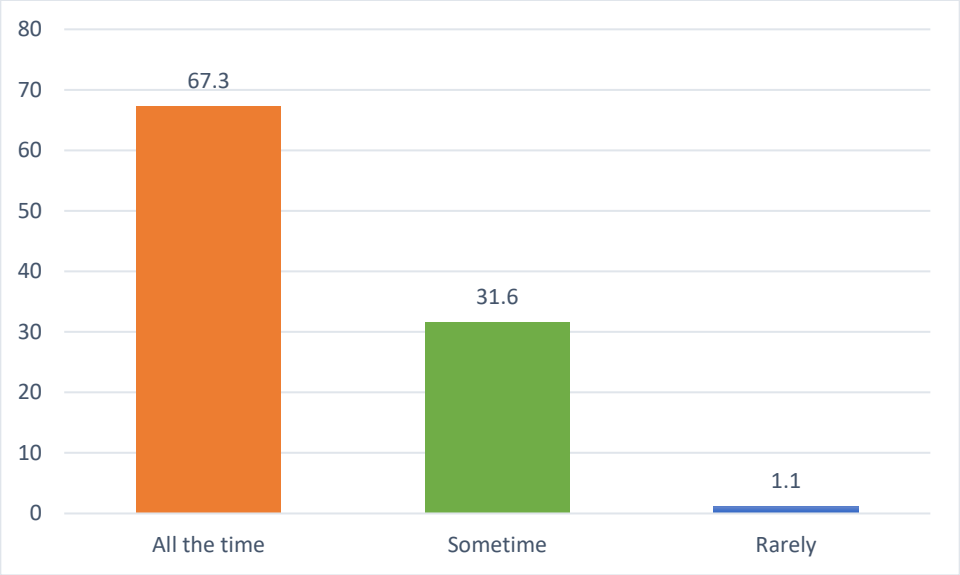

Figure 2: showing respondent's frequency in use of color codes during segregation of waste

Reasons for failure to use color codes during segregation of medical waste among respondents Among the respondents, 76%(n=179) reported not using the recommended color-coded bags citing inadequacy, 21 % (n=73) reported that the coded bags were not provided for use while 3 % (n= 20) cited inaccessibility (Figure 3).

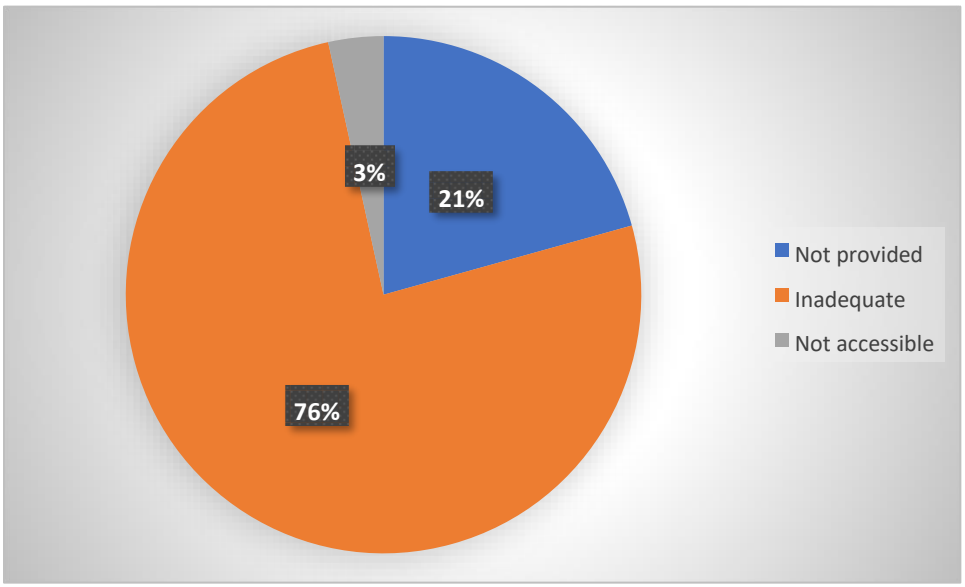

Figure 3: Pie chart showing reasons for failure to use color coded bags by health care workers (%)

Frequency, level and routine for collection of medical waste among health workers: Majority, 89.6% (242) of the study respondents indicated they had a routine schedule for collecting waste from generation points with only 8.5% (23) asserting they were not aware of any routine schedule, 97.9% (230) stated that they collect waste every day. Majority 85.6% (231)

of the respondents emptied the waste containers when three-quarter full while14.4% (39) emptied when the waste containers were over three-quarters full (Table 2).

Table 2

Table showing Frequency, level and schedule for collection of medical waste among health workers

Collection	Frequency (%n)	Percentage (%)
Routine schedule for the collection of medical waste		
Yes	242	89.6
No	5	1.9
Don`t know	23	8.5
Level to empty the waste containers in the service areas Over 3/4	39	14.4
3/4 full	231	85.6
Frequency of waste collection		
Once a day	230	97.9
More than 1 day	5	2.1

Treatment methods for medical waste among health care workers: The most common method used for treatment of waste was reported to be incinerator 92% (n= 60), while 8% (n= 5) used microwave. Majority of the respondents 95% (n= 62) highlighted the operational condition of the treatment method was in poor working condition while only 5% (3) pointed it to be in good working conditions.

Table 3

Table showing treatment methods of medical waste used by health care workers

Methods of treatment	n=65	%
Incinerator	60	92
Open burning	0	0
Microwave	5	8
Autoclave	0	0
Landfill	0	0
Others	0	0
The operational condition of the method		
In good working conditions	3	5
In poor working condition	62	95

Incidence type of injuries and seeking of Post exposure prophylaxis management while handling medical waste among health care workers: Majority of the respondents reported experiencing an injury while handling medical waste 53% (n= 145). Among these injuries, 57% (n= 83) were needle stick injuries. Most respondents, 78% (n=113) did not seek post exposure prophylaxis management **(Table 4).**

Table 4

Table showing Incidence, type of injury and seeking for post exposure prophylaxis management among health care workers

Incidence of injury while handling medical waste	**n =272**	**%**
Yes	145	53
No	127	47
Type of injury experienced while handling medical waste	**n=145**	%
Needle prick injury	83	57
Cut	49	34
Bruises	10	7
Others	3	2
Sought for PEP treatment	**n=145**	%
Yes	32	22
No	113	78

Tagging of medical waste among health workers: Majority of the respondents 62% (n=40) noted that the collected medical waste had been tagged with a sticker/tag while 38 %(n=25) were not able to identify the sticker/tag on the collected waste. Among those in agreement, 98 % (n =39) noted the sticker/tag was fully filled (Table 5).

Table 5

Table showing safety tracking by use of stickers and tags among health care workers

Medical waste with a sticker/tag	**n=65**	**%**
Yes	40	62
No	25	38
Sticker/tag having full details of the waste.	n=40	
Yes	39	98
No	1	2

Use of Personal protective equipment among health workers: A higher number of the study respondents 89% (241) indicated they are provided with PPE. Among these, 84% (202) reported using them when handling medical waste. Among the remainder, 16% (39) who don't use, 64% (25) indicated the PPE were uncomfortable, 26% (10) had medical challenges, 8% (3) religion restriction and only 2% (1) believed that PPE never gives protection **(Table 6).**

Table 6

Table showing use of personal protective equipment among health care workers

Provided with PPE	**n=272**	**%**
Yes	241	89
No	31	11
Use of PPE when handling medical waste	**n=241**	**%**
Yes	202	84
No	39	16
Reason for not using the PPE when handling waste	**n=39**	**%**
Uncomfortable to wear PPE	25	64
Medical challenge	10	26
Religious stops the staff	3	8
Fail to give protection	1	2

DISCUSSION

Our study found out that waste generated was mostly general waste. According to WHO reports, of the total amount of waste generated by health-care activities, about 85% is general, non-hazardous waste. Findings reveal that approximately 15% consider waste as hazardous, infectious, toxic or radioactive.[1] These traditional estimates are not consistent for many developing countries. In Kenya, due to poor segregation practices, it is common to find that up to 50% of the generated medical waste in some health facilities is infectious.[6] A cross-sectional study conducted in Ethiopia in 2011 to quantify health waste generation rate and evaluate its management system in governmental health centers in Addis Ababa revealed that the mean health waste produced was 0.5 kg/patient/day and 1.6 kg/bed/day.[9]

Our study found that 67.3% (n=182) of health care workers used correct color codes while segregating waste, 89.6% maintained a routine schedule in medical waste collection. According to Ranjan[10], when medical waste is not managed properly, the health workers are exposed to contamination risks, occupational accidents and illnesses for being constantly exposed to microorganisms, some of the examples of infections caused by exposure to infectious waste are gastro enteric, skin and genital infections, anthrax, acquired immunodeficiency syndrome, hemorrhagic fever and hepatitis A, B and C. Environment problems may also arise due to foul odors, flies, cockroaches, rodents and vermin, with poor treatment of medical waste leads to emissions of toxic and persistent compounds such as dioxins and furans.[6]

Personal Protective equipment was available to 89%. The personal protective equipment protects the user against health risks at work. They include items such as safety helmets, gloves, eye protection, high visibility clothing, safety footwear and respiratory protective equipment. The employers have duties concerning the provision and use of PPE at work for free.[11] The PPE provides a physical barrier between microorganisms and the wearer thereby preventing microorganisms from contaminating hands, eyes, clothing, hair and shoes. It should be understood that PPE is the last option in hierarchy of hazard controls and should only be used if elimination,

engineering controls and or changes to work practices do not adequately remove/reduce the risks.[11] Due to infections, injuries and foul smell arising from medical waste; it is necessary for health workers to wear personal protective equipment and gears.[12]

A study by Wafula,[13] reported that 98% of health workers at health centers in Nairobi county use gloves and 95% use mask, only 40% wear an apron and 30% use laboratory coats. This is contrary to findings of a study in Ghana where 90% of the health workers/waste handlers in the hospital failed to use gloves as protective wear during medical waste handling.[12] In Gondar town, Northwest Ethiopia, the majority 93.1% of the health workers use gloves during medical waste handling.[14]

Findings from the current study reveal that the waste had identification tag/stickers. A descriptive cross-sectional study carried out in Nairobi County Kenya on the awareness and practice on medical waste management where (92.3%) of the respondents reported they have a routine schedule for collecting medical waste, higher (99%) noted that collection was done daily then (53.3%) of the respondents noted they empty the containers when (3/4) full.[15] The most appropriate way of identifying the categories of medical waste is by sorting the categories of waste into color-coded plastic bags or containers. For the bins to be used well it is necessary to ensure clear labeling of bags and containers, to differentiate between waste categories by the use of posters and stickers or printed bins and liners should help the members of staff, patients and their visiting relatives to segregate the waste.[16]

Collection of medical waste on-site requires the responsible staff to tie up the medical waste bags when they are three-quarters full by tying the neck or by sealing the bag. Routine program for their collection should be established as part of the medical waste management plan with recommendations to ensure that medical waste is collected as frequently as required, transported to the designated site or storage areas and to ensure daily requirements for medical waste bags supply.[16]

A study conducted in Akure Nigeria on medical waste management in 7 hospitals reported that 94% (n=120) of the respondents had not used or seen the tagging on medical waste bags.[17] Further an assessment conducted by (MOH and USAID under the PACE project in 2012) revealed that 88.7% (n=80) had not labelled/tagged the generated waste, only 12.3% n=20 facilities had complied posing serious challenges in tracing the medical waste. [7]

More than half of the respondents (53%) experienced an injury while handling medical waste among whom 57% sustained needle stick injuries. Every year an estimated 16 billion injections are administered worldwide, but not all of the needles and syringes are properly disposed.[1]

Our study found that the most common method used for treatment of waste was incineration 92% (n= 60), while 8% (n= 5) used microwave. Open burning and incineration of health care wastes can, under some circumstances, result in the emission of dioxins, furans, and particulate matter.[1] In advanced countries, the common methods used for medical waste treatment include steam, sterilization, autoclave and incineration.[18] In the UK, treatment technologies fall into two main categories, high-temperature incineration/combustion and no-burn or low-temperature alternative technologies.[2] In Canada, there has been a shift from on-site incinerators towards centralized facilities that handle medical waste generated over a wide geographical area. The approach

aims to reduce air pollution resulting from on-site incineration.[19]

A study conducted in Turkey determined that concentration in combustion gas were higher from the sampled incinerators with 93 to 710 times higher than the EU –legal limits (0.1 ng TEQ/M^2). It further recommend the use of catalytic filter technology that removes dioxins and furans along with particulate matter which is cost-effective.[20]

Small scale locally built incinerators appear unlikely to meet emission limit for carbon monoxide particulate matter, dioxin, furans, hydrogen chloride and possibly several metals and other pollutants.[21] Proper operation and maintenance will improve equipment reliability and performance, prolong equipment life and help to ensure proper ash burnout Regardless of how well equipment is designed wear and tear during normal use and poor operation and maintenance practices will lead to the deterioration of components resultant decrease in both combustion quality and increase in emissions and potential risks to the operator and public. Operation and maintenance also affects reliability, effectiveness and life of the equipment. Essentially all components of small-scale incinerator are prone to failure and require maintenance schedule.[22]

An additional challenge is when the incinerator machines operate in low temperatures <200^0C resulting in the excess generation of toxic gases like CO, HCL, dioxins, and furans. Since these facilities are located close to community areas, the emissions from the incinerators present a serious health risk to the same communities and localities which the hospital is meant to serve.[17] Despite the large number of injuries, we found that 78% (n=113) did not seek post exposure prophylaxis management.

CONCLUSION

The type of waste commonly generated is general waste. Accident and emergency department generates more infectious waste while general surgery produces most sharps. Only 63.3% of the respondents used correct colour codes to segregate waste and sited inadequate provision of the coded bins. Many staff members were exposed to injuries while handling waste especially needle pricks and did not get post exposure prophylaxis management. This data may be underreported by the affected staff. Majority of the waste handlers reported using incinerators and reported that it was in poor working conditions.

The results identified gaps in waste management practices and low adherence to safety measures.

RECOMMENDATION

There is need to reinforce policy on waste handling, use of PPE and other standard precautions by the health care workers. Creating awareness on risks and mitigation measures associated with handling medical waste is recommended to the hospital management. Timely repairs of the treatment plants and maintenance is also recommended. More research on why many staff do not seek post exposure prophylaxis is recommended so as to improve adherence

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