IBOM MEDICAL JOURNAL
Vol.14 No.1 January, 2021. Pages 34 - 45
www.ibommedicaljournal.org

Assessment of knowledge and practices of healthcare waste management among health workers in a general hospital in southern Nigeria

Ekanem AM[1*], Ijezie AE[2], Undie MU[1], Etuk JJ[1], David AE[1], Peter OI[1], Paul UM[1], Agwu CE[1]

[1]*Department of Community Health, Faculty of Clinical Sciences, University of Uyo, Nigeria.*
[2]*Department of Community Health, University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria.*

Abstract

Background: Poor management of health care waste exposes healthcare workers, waste handlers and the community to infections, toxicity and injuries. The objective of this study was to determine the level of knowledge and practices of HCW management among health workers in a general hospital in Uyo, Akwa Ibom State, Nigeria.
Methodology: A descriptive cross-sectional study was conducted among 158 health workers. Data was collected using a structured questionnaire, checklist for a facility walk-through assessment and a key informant interview and analysed using STATA statistical software version10.0
Results: The majority (88.6%) of the respondents had good level of knowledge of HCW management and its effect on health. More than half (58.9%) of the respondents had good HCW management practices. Predictors of poor knowledge of HCW management were lack of training on HCW management (OR 0.24, 95%CI 0.06-0.95, P=0.04) and not seeing instructive posters on health care waste management (OR 0.16, 95%CI 0.04-0.64, P=0.01). Being a nurse (OR 0.15, 95%CI 0.04-0.59, P=0.007) and not seeing an instructive HCW management poster (OR 0.26, 95%CI 0.12-0.57, P=0.001) predicted poor practice of HCW management. All wards had sharps containers and waste bins which were not of the standard colour coding. Thirty percent of the waste bins had lids.
Conclusion: Training and seeing of HCW management posters predicted knowledge and practice. Hence periodic training, supervision and display of instructive posters is vital in ensuring good knowledge and practice of safe health care waste management in health facilities to reduce the risk of infections and injuries to workers and the general public.

Key words: Knowledge, Practice, Healthcare waste, Health worker

Introduction

Health-care waste (HCW) constitute all wastes generated by healthcare establishments, research facilities, and laboratories.[1-3] It includes any waste which is generated in the diagnosis, treatment or immunization of human beings or animals or in research.[4] Waste originating from minor and scattered sources such as health care undertaken in the home such as dialysis, self-administered insulin injections and recuperative care are also included.[2] About 85% of HCW is general, non-hazardous waste which is similar to domestic waste; while 15% is considered hazardous material that may be infectious, toxic or radioactive.[5] Furthermore, the hazardous components include infectious waste, pathological waste, cytotoxic waste, chemical waste, pharmaceutical waste, sharps, radioactive waste.[1,2,6]

HCW management is a principal component of healthcare service delivery. In the absence of standard prescriptive guidelines for timely disposal, HCW may pose significant health hazards by

Corresponding Author: Dr. Ekanem, Anyiekere Morgan

Department of Community Health,
Faculty of Clinical Sciences,
University of Uyo, Nigeria.
E-mail: dramekanem@yahoo.com

polluting the environment and leading to some diseases, injuries and outbreaks of epidemics in the community.[2,4,5,7,8] The World Health Organization (WHO) estimates 8 to 16 million new Hepatitis B virus (HBV) cases, 2.3 to 4.7 million Hepatitis C virus (HCV) cases and 80,000 to 160,000 new cases of Human Immunodeficiency Virus (HIV) cases yearly due to unsafe injection disposal and poor waste management systems.[5]

The first step in any waste management is to minimize waste and to ensure that it is properly segregated at source by those who generate the waste while the healthcare facility management is responsible for making sure there is a suitable segregation, transport and storage system, and that all staff adhere to the correct procedures.[1-3] Mixing of general waste with any infectious or hazardous waste contaminates the waste thereby making segregation difficult and such waste must be treated as though it is infectious or hazardous.[9] The segregation of waste is achieved using a uniform colour-coding system to categorize the collected waste and also provides a visual indication of the potential risk posed by the waste in the container.[2,3] It also makes it easier for hospital workers to put waste items into the correct container as well as maintain segregation of the wastes during transport, storage, treatment and disposal.[2] The containers for collection and storage are meant to be leak-proof. In the minimum recommended standard of segregation by the WHO, the "three-bin system", general non-hazardous waste is collected in one bin, sharps waste are collected in another bin and potentially infectious waste collected in another bin, each having a different colour code and labelled for easier identification by those who generate the waste.[2]

The various methods of HCW disposal include incineration, wet and dry thermal treatment, chemical disinfection, irradiation and biological degradation including the sanitary landfill and burial of the waste.[3] Final disposal method is influenced by several factors including waste characteristics, quantity of wastes, capability of the healthcare facility to handle the quantity of waste, occupational health and safety considerations, public acceptability, options available for final disposal and cost considerations.[1] In many countries, HCW is collected with the rest of the waste stream, mixed with municipal waste in roadside collecting bins and disposed of similarly, thereby posing a great health risk to municipal workers, the public and the environment.[10,11] Given that the sixth target of the eleventh Sustainable Development Goals (SDG) emphasizes that countries should by "2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management",[12] more has to be done to ensure proper healthcare waste management.

Various studies have reported on knowledge and practice of HCW management by health workers.[13,14] In a tertiary care hospital in India ,the awareness regarding disposal of items in red, yellow and puncture proof containers was 32.7%, 51.8% and 60.9% respectively with 35.4% of health care workers having undergone training on biomedical waste management and 31% unvaccinated against hepatitis B infection.[14] In a study on selected hospitals in the West Bank, Palestine, 23% of respondents were trained on management of medical waste while 60% knew that hazardous and medical waste were still handled and disposed together with domestic wastes and segregation was applied only for sharp waste.[10] A related study revealed that materials for healthcare waste disposal were more available in government than private hospitals and the compliance of healthcare workers to HCW management guidelines as well as the existence of Infection Prevention and Control committees in both categories of hospitals was generally low and unsatisfactory.[15]

The absence of studies on HCW management in secondary health facilities in Akwa Ibom State, Nigeria formed the basis for this study.

Material and Methods

Settings

This study was carried out in St. Luke's Hospital, Anua, a general/missionary hospital in Akwa Ibom State, south- south Nigeria. The health facility is the only secondary health facility in Uyo LGA, the capital of the state. This 360-bed capacity hospital has 10 wards. Other health facilities in Uyo include 15 public primary health centres, 2 tertiary health facilities and many private clinics. The projected population of Uyo, the most densely populated local

government area (LGA) in the state, as at 2018 was 1,057,170[16] in a state with a 2018 projected population of 5,867,871 people.[16] The study was conducted between October 2017 and May 2018.

Study Population

The study population were health workers who were likely to generate hazardous health care waste. They included doctors, nurses, laboratory scientists and ward orderlies

Study Design

The study used a descriptive cross-sectional design.

Sample Size Determination

The sample size was determined using the formula for descriptive studies: $n = z^2pq/d^2$ where n represents the minimum sample size; z the standard normal deviate; p the proportion of respondents with good knowledge of use of colour coded bins for waste segregation, which was 54.8% from a previous study[17]; q the proportion of respondents without the condition being studied; and d the degree of precision (sampling error). The calculated minimum sample size was 380. Since the study population was less than 10,000, the modified formula for sample size determination, nf = n/1+ n/N was used, where nf = final sample size, n = initially calculated sample size (380), N =Estimated total population of health care workers (235). The final minimum sample size was 144. To compensate for improperly filled questionnaires, a non-response rate of 10% was added to the calculated minimum sample size to achieve the total 158 participants.

Inclusion and Exclusion criteria

Staff on leave or unavailable at their duty post for various reasons during data collection and those who declined consent were excluded from the study.

Sampling technique

Multi-stage sampling was used to select participants.

Stage 1: A sampling frame consisting a list of all staff was obtained from the Human Resources unit of the hospital. Staff were categorized into clinical (health service providers) and non- clinical (management/support) staff. Only the clinical staff were included in the study. Thus a total of 235 clinical staff were in the employ of the hospital as at the time of the study consisting of 150 nurses, 31 doctors, 4 laboratory scientists, 2 physiotherapists and 48 ward orderlies

Stage 2 involved selection of clinical staff from each of the categories to make up the minimum sample size using proportional allocation method. The proportional allocation fraction was calculated thus: minimum sample size/ total number of clinical staff in the hospital = 158/235 = 0.672. The number of staff in each category was multiplied by this fraction to determine the number of participants selected per category. Hence, 21 doctors, 102 nurses, 3 laboratory scientists and 32 health attendants/ward orderlies were selected.

Stage 3 involved the consecutive recruitment of consenting staff until the number per category was obtained. This was conducted at the various duty stations of staff so as not to interfere unduly with their activities. Data were collected during daytime working hours by research assistants who were medical students previously trained on the methodology of the study.

Data was collected using a mixed data collection approach. Quantitative data was obtained using a pretested self- administered questionnaire developed according to the specific objectives of the study. The instrument was pretested in a general hospital in Abak, another LGA in the state to ensure that the content was adequately understood. The questionnaire consisted of three sections viz: socio-demographic data, knowledge of the health effects of poor HCW management on workers, patients and community and HCW management practices of respondents. Qualitative data on HCW practices of participants were observed and recorded on a pre-designed checklist which was also pre-tested. A key informant interview was conducted with the head of the hospital waste management unit using a question guide on waste disposal methods.

Eight questions assessed knowledge. Each correct response was awarded 1 point and 0 point for incorrect response. The maximum total score was 8 points while the minimum was 0. Scores of 0-4 (less than or equal to 50%) were regarded as poor level of knowledge while 5-8 (above 50%) was regarded as good level of knowledge. Three questions assessed

practice of HCW management and each correct response was awarded 1 mark and 0 mark for incorrect response. A score of 3 was regarded as good practice while scores of 0-2 were regarded as poor practice.

Data obtained was analyzed using Statistics/Data Analysis statistical software version 10.1 by StataCorp. LLC, College Station, Texas, USA. Categorical data were summarized using frequencies and percentages while quantitative data were summarized using mean and standard deviation for normally distributed data. The association between socio-demographic characteristics and level of knowledge of effect of HCW on health and its practice was determined using Chi Square test at a significant level of $P < 0.05$. Multivariate logistic regression was used to determine factors that predicted good level of knowledge and practice of HCW management by the respondents. Thematic analysis was used to analyze qualitative data.

Ethical approval with reference number UUTH/AD/S/96/VOL.XX1/145 was obtained from the Ethical Review Committee of the University of Uyo Teaching Hospital, Uyo, Akwa Ibom State. Permission to conduct the study was obtained from the Hospital Administrator of the General Hospital. Written informed consent was obtained from respondents after a careful description of study objectives, methods, risks and benefits of the study. Participants were assured of confidentiality. They were free to withdraw from the study at any time they wished.

Results

The mean age of the respondents was 36.7±12.7 years, 139 (88.0%) had tertiary education and 102 (64.6%) were nurses. One hundred and three

Table 1: Socio-demographic and training characteristics of respondents (n=158)

Variables	Frequency, n (%)
Age	
Less than 40 years	107 (67.7)
40 years and above	51 (32.2)
Mean ± Standard deviation	36.7 ± 12.7
Gender	
Male	27 (17.1)
Females	131 (82.9)
Level of Education	
Primary	2 (1.3)
Secondary	17 (10.8)
Tertiary	139 (88.0)
Staff Category	
Doctor	21 (13.3)
Nurse	102 (64.6)
Health Attendant	32 (20.3)
Laboratory scientist	3 (1.9)
Years in practice	
Less than 2	16 (10.1)
2 -10	116 (73.4)
10 and above	26 (16.5)
Trained on HCW Management	
Yes	103 (65.2)
No	55 (34.8)
Seen Instructive Posters on HCW management	
Yes	92 (58.2)
No	65 (41.8)

(65.2%) respondents had been trained on HCW management and 92 (58.2%) had seen instructive posters on HCW management [Table 1].

Table 2 displays respondents' knowledge of HCW management and its effect on health. One hundred and nine (69.0%) respondents reported that there is a hospital plan on HCW management, 144 (91.1%) knew that all types of HCW should not be collected in the same waste bin, 147 (93.0%) knew that HCW should not be disposed in the same receptacle as municipal waste and 100 (63.3%) said that used swabs should be put in black waste bins. Overall, majority (88.6%) of the respondents had good level of knowledge of HCW management and its effect on health.

Regarding the practice of HCW management among respondents, 109 (69.0%) respondents always dispose HCW in specific containers, 121 (76.6%) always disposed sharps into specified puncture proof containers and 132 (83.5%) respondents reported that they wear suitable gloves when handling HCW. Self-reported practice of HCW management was good 93 (58.9%) among respondents [Table 3].

Table 2: Knowledge of HCW management and its effect on health by respondents

Variables	Frequency, n (%)
There is a national policy on health care waste management in Nigeria	
Yes	107 (67.7)
No	11 (7.0)
Don't know	40 (25.3)
This hospital has a waste management plan	
Yes	109 (69.0)
No	13 (8.2)
Don't know	36 (22.8)
Appropriate latex gloves should be worn when handling healthcare waste	
Yes	156 (98.7)
No	2 (1.3)
All types of health care waste should be collected in the same waste bin	
Yes	14 (8.9)
No	144 (91.1)
Healthcare waste should be disposed into the same waste receptacle as other municipal refuse/waste on the streets	
Yes	11 (7.0)
No	147 (93.0)
General health care waste should be stored in yellow colored waste bins	
Yes	84 (53.2)
No	74 (46.8)
Used swabs and cotton wools should be put into black colored waste bins	
Yes	100 (63.3)
No	58 (36.7)
Poorly handled healthcare waste can cause disease in health workers, patients and communities	
Yes	157 (99.4)
No	1 (0.6)
Level of Knowledge	
Poor (0-4)	18 (11.4)
Good (5-8)	140 (88.6)
Mean Knowledge score ± Standard Deviation	5.98 ± 1.17

Table 3: Health care waste management practices by health workers

HCW management practice	Frequency, n (%)
I always dispose waste in specified containers	
Yes	109 (69.0)
No	49 (31.0)
I dispose sharps in specified puncture proof containers	
Always	121 (76.6)
Sometimes	33 (20.9)
Never	4 (2.5)
I wear suitable gloves (latex, rubber) when handling waste	
Always	132 (83.5)
Sometimes	26 (16.5)
Level of Self-Reported Practice of HCW management	
Poor	65 (41.1)
Good	93 (58.9)

Table 4: Predictors of good knowledge of HCW management and its effect on health among respondents

Variables	Univariate Models			Multivariate Models		
	Crude OR	P value	95%CI	Adjusted OR	P value	95%CI
Age groups (years)						
Less than 40	Ref			Ref		
40 and above	1.77	0.34	0.55-5.67	2.68	0.277	0.45-15.98
Gender						
Male	Ref			Ref		
Female	0.58	0.48	0.12-2.66	0.34	0.28	0.05-2.44
Staff Category						
Doctors	Ref			Ref		
Nurses	1.25	0.75	0.32-4.88	1.73	0.54	0.30-10.12
Health Attendant	1.61	0.58	0.29-8.86	1.78	0.62	0.18-17.45
Years of practice						
Less than 2	Ref			Ref		
2-10	5.40	0.009*	1.54-18.99	4.27	0.058	0.95-19.15
Above 10	2.5	0.23	0.56-11.21	0.74	0.789	0.78-6.92
HCW Management Training						
Yes	Ref			Ref		
No	0.16	0.001*	0.05-0.49	0.24	0.04*	0.06-0.95*
Seen Instructive posters						
Yes	Ref			Ref		
No	0.12	0.001*	0.03-0.42	0.16	0.01*	0.04-0.64*

* *P*? 0.05

Table 5: Predictors of good HCW management practices among respondents

Variables	Univariate Models			Multivariate Models		
	Crude OR	P value	95%CI	Adjusted OR	P value	95%CI
Age groups (years)						
Less than 40	Ref			Ref		
40 and above	0.786	0.485	0.40-1.54	0.76	0.56	0.31-1.88
Gender						
Male	Ref			Ref		
Female	0.812	0.635	0.35-1.93	1.16	0.79	0.39-3.44
Staff Category						
Doctors	Ref			Ref		
Nurses	0.25	0.02*	0.08-0.81	0.15	0.007*	0.04-0.59*
Health Attendant	0.44	0.23	0.12-1.66	0.23	0.073	0.05-1.14
Lab Scientist	0.47	0.575	0.03-6.57	0.16	0.202	0.01-2.69
Years of practice						
Less than 2	Ref			Ref		
2-10	2.26	0.130	0.786-6.524	2.47	0.153	0.713-8.613
Above 10	1.30	0.879	0.314-3.858	1.36	0.704	0.274-6.782
Training on HCW Management						
Yes	Ref			Ref		
No	0.428	0.013*	0.22-0.84	0.446	0.064	0.190-1.046
Seen Instructive posters						
Yes	Ref			Ref		
No	0.273	0.000*	0.139-0.532	0.260	0.001*	0.119-0.568*
Level of Knowledge						
Poor	Ref					
Good	1.930	0.382	0.718-5.38	0.724	0.604	0.214-2.451

* *P*? 0.05

Table 6: Facility walk-through assessment of the provision made for HCW management practice

Variables	Frequency, n (%)
No. of wards with waste bins	10 (100.0)
No. of wards with standard colour-coded bins	0 (0.0)
Number of wards where waste bins had lids	3 (30.0)
No. of wards with weighing scale for HCW	0 (0.0)
No. of wards with sharps containers	10 (100.0)
No. of wards with temporary storage bins	6 (60.0)
No. of wards with instructive posters on HCW	0 (0.0)

Predictors of poor knowledge of HCW management and its effect on health were the lack of HCW management training and not seeing instructive posters (OR 0.24;95%CI 0.06-0.95, P=0.04 and OR 0.16; 95%CI 0.04-0.64, P=0.01) respectively. The predictors of poor HCW management practice were being a nurse and not seeing an instructive HCW management poster respectively (OR 0.15, 95%CI

0.04-0.59, P=0.007 and OR0.26, 95%CI 0.12-0.57; P=0.001) (Tables 4 and 5).

A facility walk-through assessment using a checklist demonstrated that all wards had waste bins but these bins were not of the standard colours for waste segregation. Also, only 30% of these bins had lids and only sharps were segregated at source. Furthermore, weighing scales were not available for weighing generated waste and only 60% of the wards had temporary storage bins for HCW before being transported to the disposal site. (Table 6)

Findings from the key informant interview on waste disposal methods were that the hospital had a waste management plan and the majority of HCW generated in the hospital is usually burnt in an open pit. The head of the infection control unit of the hospital puts it thus: "the health care waste is collected by cleaners and burnt in an open pit behind the hospital''. She opined that some health care wastes like human parts from surgical procedure and placenta are usually buried in a pit.

Discussion

The study set out to determine the level of knowledge of HCW management and its effect on health, as well as the HCW management practices (segregation, storage and disposal) of health workers in a secondary health facility in Uyo, Akwa Ibom State, Nigeria.

In this study, more than half of respondents received training on management of HCW, a finding higher than proportions reported in other studies.[4,10,14,17,18,19] In addition, more than half of respondents had seen instructive posters on HCW management and disposal in the index study. This may follow from the fact that posters are usually part of the materials used in training of health workers on management of HCW. The higher proportion trained in this study reflects the health facility's commitment to getting her staff well informed on management of health care waste. On the other hand, the fact that these responses on training were self-reported and could not be verified may also account for the higher proportion reported. Health facilities that train their staff were more likely to have a high safe non-sharp disposal indices when compared with those that do not.[20]

Health care waste (HCW) management policies and plans are important factors influencing knowledge and practice of HCW management among healthcare workers. In this study, an almost equal proportion of respondents were aware of an existing national policy on HCW management and a HCW management plan in the hospital respectively. A slightly lower proportion of respondents in an Enugu study were aware of a waste management plan in their facility.[17] A survey on the role of national policy in improving health care waste management in 1,921 health facilities in Nigeria, reported that 44.8% had HCW management plans, and about half of secondary health facilities had a HCW management plan.[21] Gaitu et al in the study of the issues affecting correct practice of HCW management in Papua New Guinea, found that only 19% of workers in a general hospital were aware of any legislation applicable to HCW management.[18] Workers awareness of the existence of specific policies and strategic plans on HCW management at the national level and work plans in the health facility is a crucial initial step towards the achievement of a minimum level of HCW management practice.

In this study, the majority of respondents had good level of knowledge of effect of health care waste on health. Our findings agree with reports from similar studies in Enugu and Anambra states in Nigeria respectively.[15,17] The majority of respondents in this study knew that all types of HCW should not be stored in the same waste bins, a finding similarly reported in a study in Enugu, Nigeria.[17] Almost all respondents in this study reported that poorly managed health care waste can cause diseases in workers, patients and communities, a proportion higher than the reported values for various cadre of health workers in similar studies in Nigeria.[17,22] The greater level of knowledge identified in this study may be due to the previous training of health workers on HCW management in the facility.

Despite the overall good level of knowledge, unsatisfactory knowledge was identified in segregation of HCW. Less than half of respondents knew that general (non-hazardous) HCW should not be stored in yellow-coloured bins and an even smaller proportion knew that used swabs and cotton wool should not be stored in black-coloured bins. This finding differs from reports in a Nigerian and a Kenyan study where slightly more than half and three quarters of respondents respectively knew the

use of colour-coded containers for waste disposal.[17,23] An Indian study reported a mixed level of awareness as regarding disposal of items in red, yellow and puncture proof containers of 32.7%, 51.8% and 60.9% respectively.[14] Knowledge of use of colour-coded containers was slightly higher in the studies in India and Enugu probably because these were tertiary health centres with better facilities, manpower and more regular trainings as these are teaching and research centres compared to the present study in a general hospital.

A good proportion of respondents reported that they always dispose health care waste in specified colour coded containers provided in the service areas. This was about 3 times higher than the value reported by the Uchechukwu et al study in Nigeria.[17] However, observations from a walk-through assessment of HCW management practices in the facility revealed that although all the wards had waste bins, they were not with the standard colour coding, a finding similarly reported in other Nigerian studies.[24,25] None provision of colour-coded bins in the wards may have hindered the appropriate waste segregation practice despite a good level of knowledge and this has also been suggested by Gaitu et al and the WHO.[2,18] In the interim, the hospital management could procure inexpensive locally available plastic containers in the standard waste segregation colours or purchase bins of the same colour and insert colored labels to indicate the various categories of waste to be deposited there in.

More than three quarters of respondents reported they always dispose sharps in sharps containers. An observation of waste management practices in the various wards in this study showed that all the wards had sharps containers and sharps were segregated in this study. Ezirim et al equally reported that almost all the secondary health facilities they surveyed had sharps containers available for use[21] while and Oli et al[15] in Anambra state, Nigeria and Gupta et al in India[26] reported similar proportions of their respondents dispose sharps in specified puncture proof containers. The wide availability of sharps containers in this study may be responsible for the larger proportion of appropriate sharps disposal. However, about a quarter still did not dispose sharps in the provided sharp containers. This gap can be corrected by more trainings and monitoring.

Also, the majority of respondents in this study reported that they always wear appropriate gloves when handling health care waste, a finding similarly reported by Hayleeyesus and Cherinete in Ethiopia but was slightly higher than the proportion reported from by Uchechukwu et al in Enugu, Nigeria.[26,17] The analysis of solid waste management practices in a district community hospital by Aryal et al. in Nepal even reported a higher percentage of respondents using gloves when handling waste.[27] The high proportion of respondents, in this index study, who use gloves may be explained by the equally high proportion who were trained on HCW management, those with good knowledge of management of HCW and the facility's commitment to providing gloves for her workers.

The importance of providing instructive posters as tool to promote effective practice of segregation of HCW was reported by Hagen et al in their study of infectious wastes in a Saudi Arabian hospital.[28] In our study however, all wards were observed not to have instructive posters on HCW management displayed. This may be due to a longer period in the past when the training on health care waste was done, hence the poster may have torn. In addition, the absence of posters may also explain the poor practice of waste segregation in the hospital except for sharps. The provision of this simple and inexpensive chart is necessary to promote waste segregation. On the whole, more than half of respondents had a good self-reported practice of HCW management.

The observation of few of the waste bins having lids was made and is consistent with findings in a similar study in Ethiopia.[25] This practice of storage of HCW in open bins could lead to the breeding of vermin and the spread of infections. Injuries from sharps stemming from overflow could also result from this practice. Hence, provision of waste bins with lids should be done by the hospital management for the safe management of HCW.

More than half of the wards also had temporary waste storage receptacles. Temporary storage of waste occurs in the receiving receptacles or waste bins which are emptied by ward attendants and cleaners daily or more frequently depending on the filling rate to final disposal sites. This was a good observation in the study area and should be replicated in all the wards in the hospital.

Our study reported lack of training and not seeing instructive posters as predictors of poor knowledge, which is in agreement with the study by Hakim et al in Egypt.[29] Training have been significantly associated with knowledge and practices of healthcare waste management.[30,31] Hence, periodic training is needed to keep health care providers abreast with effective waste management practices to reduce the risk of infections and injuries to workers and the general public.

Furthermore, this study demonstrated that not seeing instructive posters and being a nurse predicted poor HCW management practice. On the contrary, other studies in Egypt, South Africa, Ghana and India reported that nurses had a better HCW management practice score than physicians.[29-34] The less likelihood of nurses to have better HCW management practices in this study may be as a result of the absence of instructive posters displayed in the wards and the non-availability of standard colour coded bins for waste segregation in the practice areas.

A key informant interview conducted with the Head of Waste Management Unit in the health facility, a nurse by designation, revealed that in terms of waste disposal, the HCW generated in the hospital is usually not treated but are burnt in an open pit/area partially separated from the other sections of the hospital, a finding similarly reported by Oyekale et al.[20] This practice is reported to pose health risks to patients and communities close to health facilities.[35] The hospital also has a makeshift incinerator which is sometimes used for burning hazardous wastes like gloves, dressings and sharps Other studies have reported incineration as the major method of final waste disposal.[20,23,36]

Conclusion

This study revealed overall good level of knowledge, some knowledge gap in disposal of HCW in colour coded bins and good practice of health care waste management in the facility. Lack of training, not seeing instructive posters predicted poor level of knowledge while being a nurse and not seeing instructive posters predicted poor HCW management practice. Periodic trainings, provision of colour coded bins and instructive posters are strongly recommended to improve HCW management in the facility.

Conflict of interest

We declare that we have no conflict of interest.

References:

1. World Health Organization. Safe management of wastes from health-care activities. Edited by Chartier Y, Emmanuel J, Pieper U, Pruss A, Rushbrook P, Stinger R, Townend W, Wilburn S, Zghondi R. 2nd ed. Geneva: 2014. Available at http://www.searo.who.int/srilanka/documents/safe_management_of_wastes_from_healthcare_activities.pdf?ua=1 [Accessed: 24th September 2017].
2. World Health Organization. Safe management of wastes from health-care activities: a summary. Geneva. 2017. Available from: https://www.who.int/water_sanitation_health/publications/safe-management-of-waste-summary/en/ [Accessed 20 April 2020].
3. Airlina I. Medical Waste Disposal – The Definitive Guide 2020. Available from: https://www.biomedicalwastesolutions.com/medical-waste-disposal/ [Accessed 10 July 2020].
4. Mugabi B, Hattingh S, Chima SC. Assessing knowledge, attitudes, and practices of healthcare workers regarding medical waste management at a tertiary hospital in Botswana: a cross-sectional quantitative study. Niger J Clin Pract. 2018; 21:1627-38.
5. World Health Organization. Health-care waste: key facts. 2018. Available from: https://www.who.int/news-room/fact-sheets/detail/health-care-waste [Accessed 22 April 2020].
6. Healthcare Waste Management Technical Working Group. National Healthcare Waste Management Plan. Available from: http://documents.worldbank.org/curated/en/164291468110649200/E16340NHCWMP10Sophie0version0170April.doc [Accessed 23rd October 2017].
7. Atnafu DD, Kumie A. Healthcare waste composition and generation rate in Menellik II Referral Hospital, Addis Ababa, Ethiopia: a cross sectional study. International Journal of Sustainability Management and Information Technologies. 2017; 3(2): 10-19.
8. Healthcare Waste Organization. Guidance for

healthcare waste management in LICs. Available from: https://healthcare-waste.org [Accessed 21 October 2017].
9. Health Care without Harm. Waste treatment and disposal. Available from: https://noharm-global.org/issues/global/waste-treatment-and-disposal [Accessed 21 October 2017].
10. Sarsour A, Ayoub A, Lubbad I, Omran A, Shahrour I. Assessment of medical waste management within selected hospitals in Gaza strip Palestine: A pilot study. International Journal of Scientific Research in Environmental Sciences. 2014; 2(5): 164-173
11. Otu RA and Doo IA. Hospital solid waste management at Tetteh Quarshie memorial hospital, Akuapem-Mampong, Ghana. International Journal of Environment and Waste Management. 2015;16 (4): 305–314.
12. United Nations. Sustainable Development Knowledge Platform, Goal 11. Available from: https://sustainabledevelopment.un.org/sdg11 [Accessed 23 October 2017].
13. Kumar R, Samrongthong R, Shaikh T. Knowledge, attitude and practices of health staff regarding infectious waste handling of tertiary care health facilities at metropolitan city of Pakistan. J Ayub Med Coll Abbottabad, 2013;2525(1212):109–12.
14. Kumar M, Singh RK, Umesh V, Rawat V. Awareness and practices about bio-medical waste among health care workers in tertiary care hospital of Haldwani, Nainital. National Journal of Medical Research. 2015; 5(1): 47 - 51
15. Oli AN, Ekejindu CE, Adje DU, Ezeobi I, Ejiofor OS, Ibeh CC et al. Healthcare waste management in selected government and private hospitals in Southeast Nigeria. Asian Pacific Journal of Tropical Biomedicine. 2016; 6(1): 84-89.
16. National Bureau of Statistics. Report on the 2018 Nutrition and Health Situation in Nigeria.
17. Uchechukwu EE, Omotowo BI, Ndu AC. Investigating Knowledge, Attitude and Health Care Waste Management by Health Workers in a Nigerian Tertiary Health Institution. Global Journal of Health Science. 2017; 9(4): 222. Available from: DOI: 10.5539/gjhs.v9n4p222 [Accessed 29 May 2020].
18. Gaitu K, Muduli K, Apana H, Aich S, Pumwa J. The issues affecting the correct practice of healthcare waste management in Lae's Angau Memorial General Hospital. Indian Journal of Public Health Research & Development. 2019; 10 (12):399-405.
19. Gupta NK, Shukla M, Tyagi S. Knowledge, attitude and practices of biomedical waste management among health care personnel in selected primary health care centres in Lucknow. Int J Community Med Public Health. 2016; 3(1):309-313.
20. Oyekale AS, Oyekale TO. Healthcare waste management practices and safety indicators in Nigeria. BMC Public Health. 2017; 17:740. DOI 10.1186/s12889-017-4794-6. [Accessed 30 May 2020]
21. Ezirim I, Agbo F. Role of national policy in improving health care waste management in Nigeria. J Health Pollution. 2018; 8(19):1-8.
22. Adogu POU, Ubajaka CF, Nebuwa JE. Knowledge and practice of medical waste management among health workers in a Nigerian general hospital. Asian Journal of Science and Technology. 2014; 5 (12): 833-838.
23. Njue PM, Cheboi KS, Shadrak O. Adherence to health care waste management guidelines among nurses and waste handlers in Thika sub county Kenya. Ethiop J Health Sci. 2015; 25(4): 295-304.
24. Umar AB, Yahaya MN. Hospital waste management practices: a case study of primary health care centers, in Fagge Local Government Area, Kano State. IOSR Journal of Nursing and Health Science. 2014; 3(6): 26 - 33.
25. Abah SO, Ohimain EI. Health care waste management in Nigeria: A case study. Journal of Public Health and Epidemiology. 2011. 13 (3): 99-110
26. Hayleeyesus SF, Cherinete W. Healthcare waste generation and management in public healthcare facilities in Adama, Ethiopia. J Health Pollution. 2016; 10: 64–73.
27. Aryal M, Adhikary S, Aryal V, Adhikari R. An analysis of solid waste management practices in Lamjung District Community Hospital, Nepal. Journal of Wastes and Biomass Management. 2019; 1(2): 9-13.
28. Hagen DL, Al-Humaidi F, Marthin A. Infectious waste surveys in a Saudi Arabian hospital. An

important quality improvement tool. Am. J. Infect. Control. 2001; 29: 198-202.
29. Hakim SA, Mohsen A, Bakr I. Knowledge, attitudes and practices of health-care personnel towards waste disposal management at Ain Shams University Hospitals, Cairo. Eastern Mediterranean Health Journal. 2014; 20(5): 347-354.
30. Mahasa PS, Ruhiiga TM. Medical waste management practices in North Eastern Free State, South Africa. J Hum Ecol. 2014; 48(3): 439-450.
31. Thakur V, Ramesh A. Healthcare waste management research: a structured analysis and review 2005–2014. Waste Manage Res. 2015;33(10):855–870.
32. Olaifa A, Govender RD, Ross AJ. Knowledge, attitudes and practices of healthcare workers about healthcare waste management at a district hospital in KwaZulu-Natal. S Afr Fam Pract. 2018; 60(5): 137-145.
33. Adu RO, Gyasi SF, Essumang DK, Otabil KB. Medical waste-sorting and management practices in five hospitals in Ghana. Journal of Environmental and Public Health. Vol.2020; Article ID 2934296.14 pages Available from: https://doi.org/10.1155/2020/2934296. DOI: 10.1155/2020/2934296 [Accessed 9 August 2020]
34. Rao D, Dhakshaini MR, Kurthukoti A, Doddawad VG. Biomedical waste management: A study on assessment of knowledge, attitude and practices among health care professionals in a tertiary care teaching hospital. Biomed. & Pharmacol. J. 2018; 11(3): 1737-1743.
35. Kuroiwa C, Suzuki A, Yamaji Y, Miyoshi M (2004). Hidden reality on the introduction of auto-disable syringes in developing countries. Southeast Asian J. Trop. Public Health, 35: I0-1023.
36. Uwa CU. Assessment of healthcare waste management practices in Enugu Metropolis, Nigeria. International Journal of Environmental Science and Development. 2014; 5(4): 370-374.