



# **Knowledge, Risk Perception, Protective Practices and Pattern of Accidental Exposures to Hazards of Healthcare Wastes among Workers in Primary Healthcare Centers in Sokoto, Nigeria**

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## **Authors' contributions**

*This work was carried out in collaboration between all authors. Authors ZA and KJA gave the study concept and design and drafted the manuscript. Authors MTOI, MY and AMN gave the study concept and design and performed the data collection, analysis and interpretation. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Introduction:** Healthcare waste (HCW) includes all the waste generated within health-care facilities, research centers and laboratories related to medical procedures; it carries high risk for infection and injury than any other type of waste. Inadequate and inappropriate handling of health-care waste may have serious public health consequences and a significant impact on the environment. This study was conducted to assess the knowledge, risk perception, protective practices and pattern of accidental exposure to hazards of health care waste among health care workers in Primary Healthcare Centers in Sokoto, Nigeria.

**Methods:** A descriptive cross-sectional study was carried out among 248 subjects. Informed consent was obtained and information was collected using a semi-structured, interviewer

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administered questionnaire. Data was analyzed using IBM SPSS version 20.

**Results:** The mean age of the respondents was  $35.0 \pm 9.1$  years. Majority of the respondents demonstrated good knowledge of hazardous HCW (95.2%), on the job training was poor (45.6%), and knowledge of color coded waste bins was suboptimal (ranging from 29.4% to 69.6%). Majority of the respondents (89.1%) also perceived themselves to be at risk of the hazards of improperly managed HCW. Segregation of HCW into appropriate color coded waste bins was poor among the respondents (19.4%), but a large proportion of them (83.9%) dispose sharps in safety boxes. The prevalence of accident/injury while handling HCW among the respondents was 16.5% with majority (82.9%) having needle stick injury.

**Conclusion:** Although, majority of the respondents had good knowledge of hazardous healthcare waste, on the job training and compliance with safe HCW disposal practices were poor; and a substantial proportion of respondents experienced accident/injury while handling HCW. It is therefore recommended that the management of health facilities should train their workers on safe HCW collection, storage and disposal, and also monitor them for compliance periodically.

*Keywords: Risk perception; practices; hazards; healthcare waste.*

## 1. INTRODUCTION

Healthcare waste is defined as the total waste stream (solid and liquid) from healthcare establishments, research facilities, laboratories and emergency relief donations, which is generated during diagnosis, treatment and immunization of humans or animals [1]. It therefore carries a higher risk for infection and injury than any other type of waste [2]. Inadequate and inappropriate handling of health care waste may have serious public health consequences and a significant impact on the environment [3]. Healthcare waste is categorized into non-hazardous which constitutes approximately 75-90% of the healthcare waste and is as harmless as any other municipal waste, this type of waste comes mostly from the administrative and housekeeping functions of healthcare establishments such as paper, trash, boxes, bottles [4]. The remaining 10-25% of healthcare waste is regarded as hazardous and poses a risk to human health and the environment [5]. Health care waste generation differs not only from country, to country but also within a country. Waste generation depends on numerous factors such as established waste management methods, type of health care establishment, hospital specializations, proportion of reusable items employed in health care, and proportion of patient treated on day-care basis [2].

Appropriate management of HCW helps to ensure proper hygiene in the health institution and safety of healthcare workers [6]. The knowledge of health care personnel regarding healthcare waste management is vital in its practices for the prevention of related hazards.

Although there is an increased global awareness among health professionals about the hazards and also appropriate management techniques, the level of awareness in some developing countries is low [1]. Adequate knowledge about the health hazard of hospital waste, proper technique, and methods of handling the waste could go a long way towards the safe disposal of hazardous hospital waste and protect the community. There has been an increase in public concern about the risks associated with healthcare wastes on a global basis and many efforts have been directed to raise awareness of health care workers about the risk associated with healthcare wastes, particularly infectious wastes by different organizations [3]. HCW management completely depends on the commitment of the entire staff in the health care facilities, and this is only possible if the staff are properly trained and made aware of the risks that this particular type of waste poses. It is therefore important to make sure the curricula of medical and para-medical staff includes this important public-health issue [7]. Generally, lack of awareness about the health hazards, poor management practices, insufficient financial and human resources and poor control of waste disposal are the most common problems connected with medical waste management in developing countries [8]. Most of these countries do not have appropriate regulations to cover medical waste and where these regulations exist they are not effectively enforced. A major issue is the lack of clarity on whose responsibility is it to handle and dispose medical waste. According to the 'polluter pays' principle, this responsibility lays with the waste producer i.e. the health-care provider such as hospitals, maternity homes etc [8]. Healthcare waste is the second most

dangerous waste in the world that needs to be properly disposed by trained health care staff [9]. Its management is an imperative environmental and public safety issue, due to the waste's infectious and hazardous character. The mismanagement of healthcare waste poses risks to people and the environment. Healthcare workers, patients, waste handlers, waste pickers, and the general public are exposed to health risks from infectious waste (particularly sharps), chemicals, and other special HCW. Improper disposal of special HCW, including open dumping and uncontrolled burning, increases the risk of spreading infections and of exposure to toxic emissions from incomplete combustion [1]; this can create harmful effects and reduce the overall benefits of health-care. Infectious healthcare waste can transmit more than 30 dangerous blood-borne pathogens, but those of primary significance to HCWs are hepatitis B, hepatitis C and Human immune deficiency virus (HIV) [1,10]. There is particular concern about infection with human immunodeficiency virus (HIV) and hepatitis viruses B and C, for which there is strong evidence of transmission from injury by syringe needles contaminated by human blood, which can occur when sharps waste is poorly managed [3]. The re-use of infectious syringes represents a major threat to public health. In 2000, the World Health Organization (WHO) estimated that at world level, accidents caused by sharps accounted for 66,000 cases of infection with the hepatitis B virus, 16,000 cases of infection with hepatitis C virus and 200 to 5,000 cases of HIV infection among the personnel of health-care facilities [11].

Studies carried out across the world showed wide variations in the knowledge and risk perception of healthcare workers concerning HCW and its management. A study in Penamaluru Mandal PHC, Krishna district, India, in 2011 on bio-medical waste management and universal precautions among healthcare personnel working in a PHC area found that, only 34 (53.9%) had proper knowledge regarding all the categories of HCW, 26 (41.2%) had knowledge about hazards of improper disposal of HCW and only 32 (50.7%) had correct knowledge regarding proper disposal of syringes [12]. Akum in his study titled "Assessment of Medical Waste Management in Bawku Presbyterian Hospital of the Upper East Region of Ghana", found that a good proportion of health workers (80%) were aware of the risks they could be exposed to during handling medical waste [13].

The practice of healthcare waste management varied widely in various part of the world. A study conducted in Nigeria by Azuikie et al. [14], reported good practice of healthcare waste management among the study subjects, and 72% of them reported discarding sharps into the safety box "always". A study in western Nepal reported that only 62% of Basic Health Workers (BHW) reported always using gloves, 72% had never used decontaminated instruments, majority of respondents (93%) wash their hands before and after attending to patients, only 55% of workers reported having a disposal container in their workplace, and even fewer respondents (38%) reported proper disposal of blood and blood products with solid waste, while (55%) of the BHWs reported not having proper bio-hazard disposal containers [15]. Another study on the Assessment of Health Care Waste Segregation Practice and Associated Factors of Health Care Workers in Gondar University Hospital, North West Ethiopia, found that of the 374 respondents, 173 (46.3%) practiced health care waste segregation correctly and 201 (53.7%) practiced incorrectly; of these, (73.5%) segregated infectious healthcare waste from the general waste stream. Majority, (98.9%) of the respondents used plastic containers and carton safety box to segregate healthcare waste, only 25.4% of the respondents used containers with bio-hazard symbol labeled for infectious health care waste [16]. This study was conducted to assess the knowledge, risk perception, protective practices and pattern of accidental exposure to hazards of health care waste among healthcare workers in Primary Healthcare Centers in Sokoto, Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Design

This cross-sectional descriptive study was carried out among health care workers in primary health care centers in Sokoto metropolis in July and August 2015. All health workers in the Primary Health Care Centers serving in clinical duty sections and have been in employment for at least six months were considered eligible and enrolled into the study. Non clinical duty staff (record officers and security guards), and those that have spent less than 6 months were excluded.

### 2.2 Ethical Consideration

Ethical clearance was obtained from the Ethical committee of Sokoto State Ministry of Health,

Sokoto, Nigeria. Permission to conduct the study was obtained from the Sokoto State Ministry for Local Government and Community Development, Sokoto, Nigeria, and from the respective LGA authorities. Informed written consent was also obtained from the participants before data collection.

### 2.3 Sample Size Estimation and Sampling Technique

The sample size was estimated at 384 using the Fisher;s formula for calculating the sample size for descriptive studies [17]:

$$n = \frac{Z_{1-\alpha/2}^2 pq}{d^2}$$

The level of significance was set at 5% ( $\alpha = 0.05$ ).

Where:  $n$  = minimum sample size for a population greater than 10,000;  $Z_{1-\alpha/2}$  = two-sided percentage point of the normal distribution corresponding to the required significance level ( $\alpha = 0.05$ ) = 1.96;;  $p$  = null prevalence of knowledge of hazardous HCW = 0.5 [18];  $q$  = complementary probability of  $p_1 = 1 - p = 0.5$ ,  $d$  = precision (or margin of error) of 5% = 0.05.

Since the total population of health workers in the PHCs in Sokoto metropolis was less than 10,000, the sample size was estimated at 237 using the formula [17]:

$$n_f = \frac{n}{1 + \frac{n}{N}}$$

Where:  $n_f$  = the desired sample size in a population < 10,000;  $n$  = minimal sample size (for a population > 10,000);  $N$  = Total population of health workers under study = 620 (obtained from institution record).

The sample size was finally adjusted to 249 based on an anticipated response rate of 95%.

The Local Government Areas (LGAs) in the study area were identified (Dange Shuni, Sokoto North, Sokoto South and Wamakko), and also all the Primary Health Care centers in each of these metropolitan LGAs were identified and listed to provide the sampling frame. A two stage sampling technique was used to select the study subjects. At stage one, four PHCs were selected

in each of the respective LGAs by simple random sampling using the balloting technique. At stage two, all the eligible health workers on duty in the respective health facilities were enrolled into the study by universal sampling.

### 2.4 Data Collection

A semi-structured, interviewer-administered questionnaire was used to obtain information on respondent's socio-demographic characteristics, knowledge of hazardous health care waste, risk perception on the hazards associated with exposure to HCW, healthcare waste management practices, and accidental exposures/injuries while handling HCW. The questionnaire was adapted from a World Health Organization (WHO) rapid assessment tool [19], and instrument used in previous studies [20,21]. The questionnaire was pretested among 20 health care workers at PHC Kware (a PHC located outside Sokoto metropolis). The questions were well understood by the respondents and no modification was necessary after the pretesting. Three students of the School of Health Information Management (SHIM), Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria, assisted in questionnaire administration after pre-training on conduct of survey research, the study objectives, and questionnaire administration.

### 2.5 Data Analysis

Data was analyzed using the IBM Statistical Package for the Social Sciences (SPSS) Version 20 statistical computer software package. Respondents' knowledge of hazardous healthcare waste was scored and graded on a 20-point scale. One point was awarded for a correct response, while a wrong response or a non-response received no points. This gives a minimum score of '0' and a maximum score of '20' points. Those that scored  $\geq 12$  of 20 points were considered as having 'good' knowledge, while those that scored < 12 of 20 points were graded as having 'poor' knowledge. Frequency runs were done for further editing and cleansing of the e-data. Frequency distribution tables were constructed; and cross tabulations were done to examine relationship between categorical variables. Chi-square and Fisher's exact tests of independent association was used to test for relationship between categorical variables. All levels of significance were set at  $p < 0.05$ .

### 3. RESULTS

#### 3.1 Socio-demographic Characteristics of Respondents

Two hundred and forty-eight questionnaires were completely filled and retrieved, giving a response rate of 99.6%. The ages of the respondents ranged from 20 to 59 years (mean = 35.0 ± 9.1). The largest proportion, 95 (38.3%) of the 248 respondents were in the 30-39 years age group. More than half of the respondents were females 136 (54.8%) with a large proportion 239 (96.4%) being Muslims. Most of the respondents 169 (68.1%) were married, and majority, 226 (91.1%) of the 248 respondents had formal education. The duration of working experience of the respondents ranged from 1 to 35 years (mean = 8.69 ± 9.1). Most 171 (69.0%) of the respondents have worked for less than 10 years, while only 77 (31.0%) have worked for more than 10 years (Table 1).

**Table 1. Socio-demographic characteristics of respondents**

Variables	Frequency (%) n = 248
<b>Age group (in years)</b>	
20-29	80 (32.3)
30-39	95 (38.3)
40-49	59 (19.8)
≥50	24 (9.7)
<b>Sex</b>	
Male	112 (45.2)
Females	136 (54.8)
<b>Marital status</b>	
Single	61 (24.6)
Married	169 (68.1)
Divorced	10 (4.0)
Widow/Separated	8 (3.2)
<b>Educational status</b>	
Informal	22 (8.9)
Formal	226 (91.9)
<b>Working experience (in years)</b>	
<10	171 (69.0)
≥10	77 (31.0)
<b>Cadre</b>	
CHO	4 (1.6)
CHEW	99 (39.9)
Nurse/Midwife	20 (8.1)
Laboratory Technicians	40 (16.1)
EHA	27 (10.9)
Cleaner	58 (23.4)

Key: CHO: Community Health Officer, CHEW: Community Health Extension Worker, EHA: Environmental Health assistant

#### 3.2 Respondents' Knowledge of Hazardous Healthcare Waste

Majority, 236 (95.2%) of the 248 respondents demonstrated good knowledge of hazardous healthcare waste. The respective hazardous HCW in the different categories were known to most of the respondents as shown in Table 2. There was no statistically significant association between good knowledge of hazardous HCW and any of socio-demographic variables (Table 3).

**Table 2. Respondents' knowledge of hazardous healthcare waste**

Hazardous healthcare waste	Correct response frequency (%) n = 248
<b>Infectious waste</b>	
Used gloves	240 (96.8)
Used gauze/dressing	241 (97.2)
Blood and body fluid	231 (92.4)
Used specimen container	225 (90.0)
Linen soaked with blood/body fluid	214 (86.3)
<b>Pathological waste</b>	
Body parts	206 (83.1)
Human tissue	205 (82.7)
Unused blood products	201 (81.0)
Fetuses/placenta	177 (71.4)
<b>Pharmaceutical waste</b>	
Expired pharmaceutical product	234 (94.4)
Contaminated pharmaceutical products	238 (96.0)
Vaccines/Sera (no longer needed)	227 (91.5)
<b>Chemical waste</b>	
Expired laboratory reagent	222 (89.5)
Expired disinfectant	238 (96.0)
Waste with high content of heavy metals (e.g., broken thermometer)	234 (94.4)
<b>Sharps</b>	
Needles	244 (98.4)
Infusion set	240 (96.8)
Scalpels	238 (96.0)
Broken glasses	237 (96.5)
Auto disable syringes	236 (95.2)
<b>Knowledge grade</b>	<b>Frequency (%)</b>
Good	236 (95.2)
Poor	12 (4.8)

**Table 3. Distribution of knowledge of hazardous HCW by respondents' socio-demographic variables**

Variables	Knowledge of hazardous HCW n = 248		Test of significance
	Good frequency (%)	Poor frequency (%)	
<b>Age group (years)</b>			
20-29	77 (96.3)	3 (3.7)	Fex <sup>2</sup> = 2.012 p = 0.553
30-39	88 (92.6)	7 (7.4)	
40-49s	47 (95.9)	2 (4.1)	
≥50	24 (100)	0 (0.0)	
<b>Sex</b>			
Male	104 (92.9)	8 (7.1)	χ <sup>2</sup> = 2.355 p = 0.125
Female	132 (97.1)	4 (2.9)	
<b>Educational status</b>			
Formal	224 (99.1)	2 (0.9)	Fex <sup>2</sup> = 0.196 p = 1.000
Informal	22 (100)	0 (0.0)	
<b>Cadre</b>			
CHO	4 (100)	0 (0)	Fex <sup>2</sup> = 1.103 p = 0.989
CHEW	93 (93.9)	6 (6.1)	
Nurse/midwife	19 (95.0)	1 (0.5)	
Lab. Tech	38 (95.0)	2 (0.5)	
EHA	26 (96.3)	1 (3.7)	
Cleaner	56 (96.6)	2 (3.4)	
<b>Working experience (in years)</b>			
≤10 years	163 (95.3)	8 (4.7)	Fex <sup>2</sup> = 0.131 p = 1.000
>10 years	73 (94.8)	4 (5.2)	

Key: CHO: Community Health Officer, CHEW: Community Health Extension Worker, EHA: Environmental Health assistant, Fex<sup>2</sup> = Fisher's Exact chi square

**Table 4. Training on healthcare waste collection, storage and disposal**

Variables	Frequency (%)
<b>Ever attended training on HCW collection, storage and disposal (n = 248)</b>	
Yes	113 (45.6)
No	135 (54.4)
<b>Number of times attended training (n = 113)</b>	
Once	73 (64.6)
Twice	20 (17.7)
Three times or more	20 (17.7)

### 3.3 Training on Healthcare Waste Collection, Storage and Disposal

Less than half, 113 (45.6%) of the 248 respondents had attended training on HCW collection, storage and disposal. Of these, majority 73 (64.6%) had attended the training once, 20 (17.7%) had attended it twice and 20 (17.7%) had attended the training three times or more (Table 4).

### 3.4 Respondents' Perception of Risks Associated with Healthcare Waste

Majority, 221 (89.1%) of the 248 respondents perceived themselves to be at risk of the hazards of improperly managed health care waste and most 235 (94.8%) of them believed that they could contract infections such as HIV/AIDS and Hepatitis from improperly managed HCW. Most, 226 (91.1%) of the respondents also believed that improperly managed HCW could transmit infections such as HIV/AIDS and Hepatitis to patients. A high proportion, 207 (83.5%) of the respondents also believed that they and their patients are at risk of exposure to contaminated soil and ground water due to improperly managed HCW. With regard to separating the waste into various categories, majority, 236 (95.2%) of the respondents believed that this can reduce their risk of getting injured with sharps. Majority, 236 (95.6%) of the respondents believe that receiving treatment immediately following injury with sharps while handling HCW can reduce their risk of contracting diseases (Table 5).

**Table 5. Respondents' perception of risks associated with healthcare waste**

Perception of risk	Frequency (%) (n = 248)
I think I am at risk of danger of improperly managed HCW	221 (89.1)
I think I can get infections (HIV/AIDS) from improperly managed HCW	235 (94.8)
I think improperly managed HCW can cause infection to patients	226 (91.1)
I think workers and patients are at risk of exposure to contaminated soil/water from improperly managed HCW	207 (83.5)
Separating HCW into categories can reduce the risk of getting injured with sharps	236 (95.2)
Receiving treatment following injury with sharps can reduce the risk of getting diseases	237 (95.6)

**3.5 Respondents' Protective Practices**

Majority, 221 (89.2%) of the 248 respondents stored collected wastes in non -color coded (general) waste bin, only a few 48 (19.4%) used separate color coded waste bins for different categories of wastes. Most, 208 (83.9%) used sharp boxes for the storage of sharps (Fig. 1).

Majority, 229 (93.9%) of the 248 respondents reported using hand gloves while handling HCW, 206 (84.4%) use face mask, while 182 (74.6%) use apron/gown. Only 63 (25.8%) use eye goggle, with the least used type of PPE being head cover while handling HCW (22.5%) as shown in Fig. 2.

Majority, 184 (74.2%) of the 248 respondents reported washing their hands always after handling HCW, and 64 (25.8%) wash their hands occasionally. A half of respondents, 124 (50.0%) use soap, water and disinfectants, 100 (40.3%) use soap and water only, and 24 (9.7%) reported using only water to wash their hands after handling HCW (Table 6).

**Table 6. Frequency and materials used for hand washing after handling HCW**

Variables	Frequency (%) n = 248
<b>Frequency of hand washing after handling waste</b>	
Always	184 (74.2)
Sometimes	64 (25.8)
<b>What was used to wash hands</b>	
Water only	24 (9.7)
Soap and water only	100 (40.3)
Soap, water and disinfectant	124 (50.0)

Majority, 163 (65.7%) of the 248 respondents reported cleaning their re-usable equipment with water, detergent and then disinfection and or sterilization as applicable, 68 (27.4%) use water

and detergent only, with just a few 16 (6.5%) using only water to clean their re-usable equipment after use as shown in Fig. 3.

**3.6 Prevalence and Pattern of Accidents / Injuries among Respondents**

Forty-one (16.5%) of the 248 respondents reported accidents /injury in the course of handling HCW in the past one year. Of these, majority, 34 (82.9%) had needle-stick injury, 13 (31.7%) had cuts, 6 (15.2%) sustained burns while burning the waste, and 2 (4.9%) had their food/drink contaminated (Table 7).

**Table 7. Prevalence and pattern of accidents / injuries among respondents while handling HCW**

Variables	Frequency (%)
<b>Experience accident / injury while handling HCW in the past 1 year</b> (n = 248)	
Yes	41 (16.5)
No	207 (83.5)
<b>Type of accident / injury sustained</b> (n = 41)	
Needle-stick injury	34 (82.9)
Cuts	13 (31.7)
Burns	6 (15.2)
Contamination of food	2 (4.9)

**4. DISCUSSION**

Majority of the respondents in this study (95.2%) had good knowledge of hazardous HCW; this is similar to the finding of a study conducted in Nnewi, Nigeria, in which 93.0% of the workers were able to identify correctly the hazards of healthcare wastes [14]. Training and continuing education are integral parts of the health-care waste-management system [3]. Only 45.6% of the respondents had training on HCW collection,

storage and disposal; similarly, the findings of a study in Penamaluru Mandal PHC, India showed that only 33.3% underwent training on HCW management [12]. Another study in Ethiopia,

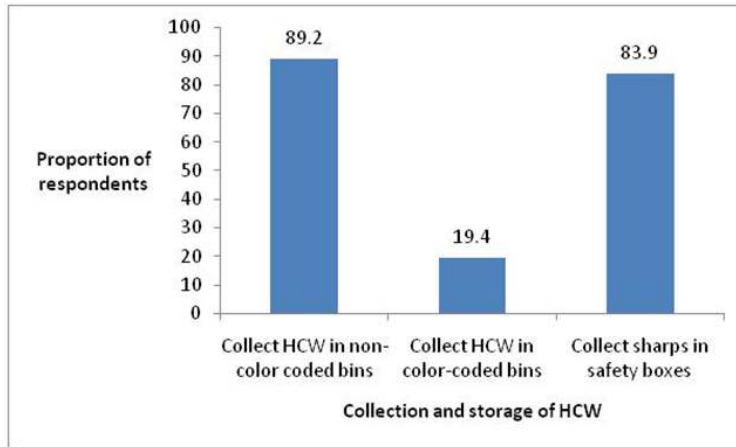


Fig. 1. Healthcare waste collection at the point of generation

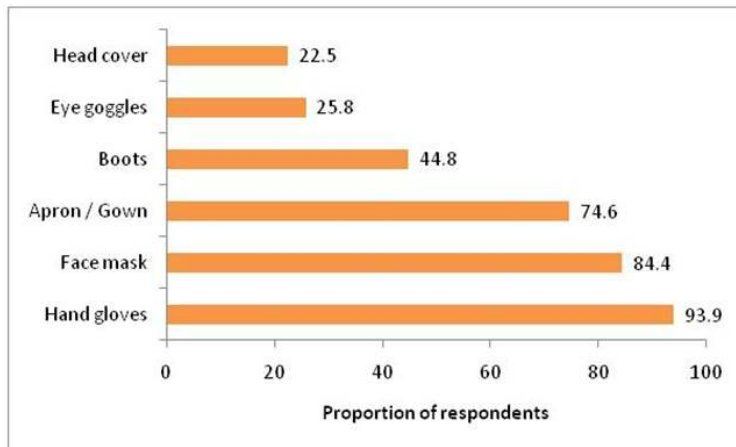


Fig. 2. Use of personal protective equipment (PPE) by respondents

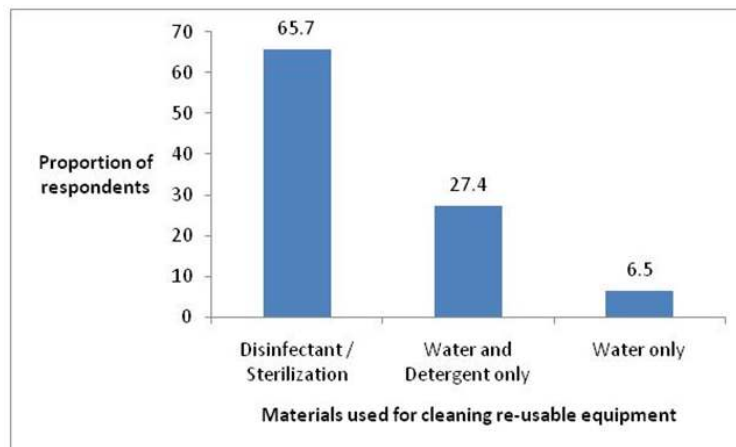


Fig. 3. Cleaning re-usable equipment after use



also reported similar findings in which only 46.9% of the Health Care Workers were trained on healthcare waste management [20]. This is in contrast to the findings in a study in Rawalpindi, Pakistan that reported 65.0% prevalence of training on management of HCW among the nursing staff [9].

Healthcare waste can cause serious diseases for healthcare personnel, who are responsible for waste disposal, patients and the general population. Majority of the respondents in this study (89.1%) perceived themselves to be at risk of the hazards of improperly managed health care waste and most of them (94.8%) believed that they could contract infections such as HIV/AIDS and Hepatitis from improperly managed HCW. This agrees with the findings in a study among sanitary workers in Combined Military Hospital in which 92.5% believed that they were at risk and could contract a dangerous disease from handling hospital waste [21]; and also the findings of another study in Ethiopia where 60.0% of the study subjects showed adequate risk perception on the hazards of HCW and 97.7% of respondents agreed that HIV/ AIDS could be acquired through contact with infectious waste [21]. This is at variance with the findings of a study in Agra, India where only 42.6% of the waste handlers were aware of the risk they are exposed to while handling HCW [22]. A high proportion of respondents (91.1%) in this study believed that improperly managed HCW can transmit infections to patients, as reported in another study where 99.2% of respondents reported that improperly managed healthcare waste may cause transfer of infections to patients.

Regarding practice of HCW management, this study showed poor storage of collected waste in which a majority (89.2%) of the respondents store collected wastes in non-color coded (general) waste bin, only a few (19.4%) use separate color coded waste bins for different categories of wastes, and (83.9%) use sharp boxes for the storage of sharps. These findings are in conformity with the findings in a study in Inđija, Serbia where 89.0% of the participants dispose sharps in containers with solid sides, i.e. so-called safety boxes [23]. In another study in Souss-Massa-Drâa Region, Morocco, it was reported that management of medical wastes had not been conducted properly, only 28.6% used appropriate equipment for their collection and 57.1% had appropriate bags for the collection of medical wastes [24]. Use of

Personal Protective Equipment (PPEs) plays a very important role in protection against the hazards of HCW. In this study, 93.9% of the respondents reported using hand gloves while handling HCW, 84.4% use face mask, 74.6% use apron/gown. Only 25.8% use eye goggles, with the least used type of PPE used while handling HCW being head cover. These findings agree with the findings in a study in Serbia where around 73.0% used gloves but differ with respect to use of face masks (11.0%), while only 2.0% used glasses regularly [23]. A contrast to these findings was reported in Kano, Nigeria where the waste collected daily by majority (62.2%) of the hospital attendants and cleaners was transported with bare hands [25].

A large proportion of respondents (74.2%) in this study reported washing their hands always after handling waste and half of them use soap, water and disinfectants. This is in conformity with the findings in a study in Nepal where 63.0% of health workers interviewed reported washing their hands regularly before and after attending to each patient [15]. One of the greatest risks of HCW to health workers is accident and or injury, in this study the prevalence of accident/injury among respondents was found to be (16.5%) in which majority (82.9%) sustained needle stick injury and 31.7% had cuts. This finding is similar to the finding of a study in Algarve, Portugal that reported 21.8% prevalence of accidents/injuries [26]. In contrast to the finding in this study, a study in Rawalpindi, Pakistan reported a higher prevalence of 48% of the workers that had injuries from sharp objects [21]. The substantial proportion of respondents that reported accidents/injuries while handling HCW in this study could be related to the sub-optimal practice of safe HCW management among them, and it underscores the need for management of health facilities to train their workers on safe HCW collection, storage and disposal, and also monitor them for compliance periodically.

## 5. CONCLUSION

Although, majority of the respondents had good knowledge of hazardous healthcare waste, on the job training and compliance with safe HCW management practices were poor; and a substantial proportion of respondents experienced accident/ injury while handling HCW. It is therefore recommended that the management of health facilities should train their workers on safe HCW collection, storage and

disposal, and also monitor them for compliance periodically.

## CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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