VOLUME 20 NO 9 PP 1162–1170 SEPTEMBER 2015

Ebola virus disease – gaps in knowledge and practice among healthcare workers in Lagos, August 2014

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Abstract

OBJECTIVE Healthcare workers (HCWs) play pivotal roles in outbreak responses. Ebola virus disease (EVD) outbreak spread to Lagos, Nigeria, in July 2014, infecting 11 HCWs (case fatality rate of 45%). This study was conducted during the outbreak to assess HCWs' EVD-related knowledge and practices.

METHODS A health facility-based cross-sectional study was conducted among HCWs across Lagos State using stratified sampling technique. An interviewer-administered questionnaire was administered to elicit respondents' socio-demographic characteristics, knowledge and practices. A checklist assessing health facility's level of preparedness and HCWs' EVD-related training was employed. HCWs' knowledge and practices were scored and classified as either good or poor. Multivariate analysis was performed with confidence interval set at 95%.

RESULTS A total of 112 health facilities with 637 HCWs were recruited. Mean age of respondents was 40.1 ± 10.9 years. Overall, 72.5% had good knowledge; doctors knew most. However, only 4.6% of HCWs reported good practices. 16.6% reported having been trained in identifying suspected EVD patient(s); 12.2% had a triaging area for febrile patients in their facilities. Higher proportions of HCWs with good knowledge and training reported good practices. HCWs with EVD-related training were three times more likely to adopt good practices.

CONCLUSION Lagos State HCWs had good knowledge of EVD without a corresponding level of good practices. Training was a predictor of good practices.

keywords Ebola virus disease, healthcare workers, infection control, knowledge, Nigeria, practices

Introduction

Ebola virus disease (EVD) is a viral haemorrhagic fever with potential for human-to-human transmission and onset of large nosocomial outbreaks [1]. The disease has an incubation period of 2–21 days causing an acute, severe illness which is often fatal if untreated [2]. The largest epidemic of the disease documented so far in history is currently ravaging west Africa since December 2013. EVD constitutes a major occupational risk to healthcare workers especially in hospital settings with a low index of suspicion or inadequate infection control measures. Transmission occurs by direct contact with infected body fluids and through direct inoculation by instruments such as needles, pins and razor blades [3]. In a hospital with low standards of hygiene and sanitation, one case can amplify into an epidemic, especially if barrier-nursing techniques and universal hygiene measures are not observed by health workers [4].

An imported case of the EVD disease was seen and confirmed in a private health facility in Lagos State, Nigeria, in July 2014. The healthcare providers of this index case were infected and died. This study was therefore conducted during the outbreak to assess healthcare workers' knowledge and practices in managing a case of EVD, a disease so far unknown to health professionals in Nigeria.

Methods

The study was conducted in both private and public health facilities across the 20 local government areas (LGAs) of Lagos State, using a cross-sectional study design, at the end of August 2014, 1 month after the introduction of EVD in Nigeria. Healthcare workers (doctors, nurses, laboratory workers, clinic health attendants, community health workers) were respondents. A sample frame of the private and public health facilities in the 20 LGAs was obtained from the State Ministry of Health.

A stratified sampling technique was employed. Using the proportionate probability method, primary healthcare centres (PHCCs) were randomly selected based on the number in each LGA. One PHCC was selected from each LGA with ≤ 5 PHCCs, two PHCCs from LGA with 6–10 PHCCs, three PHCCs from each of those with 11–15 PHCCs and four from those with ≥ 16 PHCCs. Selection of private health facilities was also based on the proportionate probability method. One private health facility was selected by random sampling from LGA with 1–10 private hospitals; two were selected from those with 11–20 private hospitals, three from those with 21–30 private hospitals, four from those 31–40 private hospitals, five from those with 41–50 private hospitals and six from those with ≥ 51 private hospitals.

For each PHCC selected and visited, a minimum number of four healthcare workers were interviewed, 13 at secondary facilities and 19 at tertiary facilities. The number of healthcare workers interviewed at private facilities was dependent on the facility capacity to fit into a primary, secondary or tertiary.

A team of 13 research assistants comprising N-FELTP residents was trained on the study protocol and the use of the study tools. A semi-structured interviewer-administered questionnaire was loaded on Android phones using Open Data Kit (ODK) technology for mobile data collection. A list of essential items for outbreak preparedness at health facility level was put together and used in assessing their true availability at these facilities. Interviews were conducted in English. Data were collected from 26 August to 1 September 2014 at real time on a safe password-secured server located at the Ebola Emergency Operation Centre (EEOC) in Lagos State.

Knowledge scoring

The HCWs were asked about the cause of Ebola, its incubation period, period of infectivity, modes of transmission, possible clinical symptoms and signs, and knowledge of burial methods. The knowledge score was, however, based on the responses on incubation period, period of infectivity, modes of transmission, possible clinical symptoms and signs, and knowledge of burial methods. Five was the maximum, and zero was the minimum overall knowledge score possible based on these five areas assessed.

On incubation period, a read-out list of four options, (i) few hours to 1 day, (ii) 2 days to 3 weeks, (iii) greater than 3 weeks and (iv) 'I don't know', was read out. The respondents picked their answer. A correct answer was scored 1 mark, while wrong answers or 'I don't know' option was scored zero.

Concerning the period of infectivity, the list of four options with one correct answer was (i) … when without symptoms (ii) … 3 days before the onset of symptoms (iii) … 1st day of symptoms and (iv) 'I don't know'. The correct answer was scored 1 mark, while wrong answers were scored zero.

The assessment of knowledge of modes of transmission of EVD was based on five commonest means: (i) from infected animals (non-human primate) to man; (ii) by having direct physical contact with an infected person with symptoms; (iii) by coming in contact with body fluids (saliva, urine, stool, blood) from an infected person with symptoms of the disease; (iv) by coming in contact with the clothing, lining, beddings and materials of a symptomatic Ebola disease patient; and (v) by participating in the burial of an infected individual.

Respondents who mentioned two or fewer of these above modes of transmission were scored zero, while those who mentioned 3 or more were scored 1.

EVD presents with a wide range of non-specific symptoms and signs; however, the first seven listed below were the commonest experienced during the outbreak in Nigeria. These seven were used in assessing the respondents' knowledge of the disease's symptoms and signs. Respondents who mentioned fewer than four of the seven were scored zero, while those who mentioned four or more of the seven were scored 1 mark.

Symptoms	Symptoms
Fever	Conjunctival injection
Muscle pain	Abdominal pain
Vomiting	Sore throat
Watery diarrhoea	Lymph node enlargement
Headache	Gum bleeding
Profuse sweating	Haematemesis
Tiredness/malaise	Haematuria
Nausea	Rashes (facial, truncal, limbs)
Dehydration	Coma
Hiccups	No bleeding at all
Others, specify…..…..….	

Assessing the knowledge of the HCWs on disposal of an infected corpse, five options which included 'I don't know' were read out. Respondents who selected disposal through cremation of burial in a sealed bag were scored 1. Overall, a maximum of 5 marks was possible for the knowledge score of the HCWs. HCWs with overall 0–2 marks were categorised as having poor knowledge, while those with 3–5 marks were classified as having good knowledge of EVD.

Practice scoring

The HCWs' reported practices were based on three self-reported areas. These areas included the practice of standard precautions, adaptation of measures/practices to identify a potential suspected case of EVD and adoption of measures or practices that will prevent spread of the infection in situations where a suspected case has been identified. The HCWs' practices were scored based on these three areas. Nine standard precaution practices were assessed: (1) hand washing before and after touching a patient, (2) wearing of gloves, (3) use of face masks, (4) use of goggles, (5) avoid recapping of needles, (6) use of sharp boxes, (7) safe waste disposal, (8) disinfection of patient care equipment before use for another patient and (9) others. Respondents who reported practising 0–4 of the measures were scored zero on standard precautions, while those who reported practising 5–9 of the measures were scored 1 mark.

Like the standard precaution subscoring, nine items were also assessed under measures self-reported by the HCWs in identifying a suspected case of EVD: (i) we have a special triage area for feverish patients, (ii) measure temperature of every patient, (iii) every incoming patient is asked if he has fever, (iv) every incoming patient is asked about a set of symptoms (fever, diarrhoea, vomiting, sore throat), (v) every incoming patient is asked about exposure to an EVD patient, (vi) every incoming patient is asked about travel to Liberia, Sierra Leone, or Guinea, (vii) full physical examination, (viii) draw blood for Ebola testing, and (ix) nothing more than the usual was done. HCWs who reported practising 5–9 of these measures were scored 1 mark, while those who reported practising four or less were scored zero.

The third aspect of practice assessed was the adoption of measures to prevent spread by the HCWs after identifying a suspected case. Eleven items were assessed; with respondents mentioning 0–5 measures scoring zero and those with 6–11 scoring 1 mark. The eleven items assessed were as follows: (i) isolation of the patient in holding area, (ii) keeping a metre distance from patient, (iii) observe universal precaution measures, (iv) notify clinician, (v) obtain history of exposure or contact, (vi) take temperature without touching patient, (vii) physical examination, (viii) wear mask, gloves, (ix) wear full PPE, (x) notify Ebola Incident Centre and (xi) refer patient.

Overall, the aggregate score in these three areas was used in classifying the HCWs into having good or poor practices. The maximum score possible was three. HCWs who scored one mark in any two or more of the three areas were classified having good practice, while those who scored one mark in one or none of the areas were classified as having poor practices in controlling the EVD outbreak.

A checklist based on Ebola fever case management supervision checklist adapted from the checklist used by the Ministry of Health and Sanitation, Sierra Leone, was adapted to assess the preparedness of the healthcare sector. The checklist was completed by the interviewers by direct observation.

Data were analysed using Epi Info 7. 95% Confidence Intervals was calculated for proportions. Chi-square test was used to compare proportions. Adjusted odds ratio and 95% CIs were calculated to assess the association between knowledge of Ebola virus disease and practice of standard precaution measures.

The study was conducted as part of the response to the ongoing EVD outbreak in Lagos State; thus, written ethical permission was not obtained. However, informed consent was obtained from the respondents who were assured of voluntary participation, confidentiality of their responses and the opportunity to withdraw at any time without prejudice in line with the Helsinki Declaration [5]. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Results

Of the 126 health facilities proposed for the study, 14 (11.1%) were unreachable due to reasons ranging from facility relocation from already known sites to refusal by facility management to participate in the survey. Of the 110 facilities visited during the period of study, 51 were private, 42 primary healthcare centres (PHCCs), 15 secondary facilities (general hospitals) and two tertiary health institutions. From these health facilities, 637 healthcare workers (HCWs) were recruited (Table 1). Two hundred and thirty-eight (37.4%) of HCWs were employees of various private health facilities, 188 (29.5%) were government employees working at the PHCC, 178 (27.9%) were workers at the secondary health facilities, and 33 (5.2%) were tertiary health

Table 1 Selected health facilities and number of healthcare workers from each type included in the survey, Lagos State, August 2014

Health Facility Type	No. of health facility *n* (%)	No. of HCWs *n* (%)
Public		
PHCC	42 (38.2)	188 (29.5)
Secondary HF	15 (13.6)	178 (27.9)
Tertiary HF	2 (1.8)	33 (5.2)
Private	51 (46.4)	238 (37.4)
Total	110	637

PHCC, primary healthcare centre; HF, health facility.

facility workers (Table 2). The mean age of the HCWs was 40.1 ± 10.9 years; 474/637 (74.4%, 95% CI: 70.4–78.1%) were female.

All interviewed HCWs were aware of the disease and its outbreak. The majority (498/637; 78.2%, 95% CI: 74.9–81.5%) knew that a virus was the cause of EVD. However, the majority of the health attendants (104/151; 68.9%, 95% CI: 62.5–75.8%) admitted not knowing the cause of the disease. Direct physical contact with an infected symptomatic person was the means of transmission of EVD mentioned by most of the Lagos State HCWs (444/637; 69.7%; 95% CI: 65.9–73.3%). Contact with body fluids of infected symptomatic persons was mentioned by 375 HCWs (58.9%, 95% CI: 54.9–62.5%), while contact with an infected non-human primate was mentioned by 279 interviewees (43.8%, 95% CI: 40.0–47.4%). Few healthcare workers (85/637, 13.3%, 95% CI: 10.8–16.2%) knew of the possibility of the virus transmission through contact with clothes, beddings and personal belongings of an infected symptomatic person, while far fewer (41/637, 6.4%, 95% CI: 4.6–8.3%) knew about participation in the burial of an infected person involving touching the corpse as a means of transmission of Ebola. Overall, knowledge of the modes of transmission of Ebola was known to 163 HCWs (25.6%, 95% CI: 22.1–28.7%).

Four hundred and ninety-five (77.7%, 95% CI: 74.4–80.9%) of the HCWs knew the incubation period of the disease to be 2–21 days, and 449 (70.5%, 95% CI: 67.0–73.9%) knew the period of virus transmission as the first day of occurrence of symptoms in an infected person. Fever was the commonest known clinical presentation of an individual with Ebola, as reported by 572 (89.8%, 95% CI: 87.3–92.0%). Four hundred and ninety-six (77.9%) and 423 (66.4%, 63.0–69.9%) knew vomiting and diarrhoea, respectively, as ways of presentation of Ebola. Two hundred and eighty-one (44.1%, 95% CI; 40.3–48.2%) knew patient with EVD can present with headache, and 214 (33.6%, 95% CI: 30.1–37.0%)

Table 2 Socio-demographic characteristics of the healthcare workers by professional type participating in the survey, Lagos State, August 2014

Socio-demographic characteristics	Doctors (*N* = 141) *n* (%)	Nurses (*N* = 241) *n* (%)	Lab. workers (*N* = 75) *n* (%)	CHW (*N* = 29) *n* (%)	Health attendants (*N* = 151) *n* (%)	Total
Sex						
Male	101 (71.6)	7 (2.9)	30 (40.0)	4 (13.8)	21 (13.9)	163 (25.6)
Female	40 (28.4)	234 (97.1)	45 (60.0)	25 (86.2)	130 (86.1)	474 (74.4)
Age (in years)						
≤30	25 (17.7)	47 (19.5)	22 (29.3)	2 (6.9)	43 (28.5)	139 (21.8)
31–40	62 (44.0)	67 (27.8)	30 (40.0)	11 (37.9)	40 (26.5)	210 (33.0)
41–50	22 (15.6)	66 (27.4)	20 (26.7)	10 (34.5)	48 (31.8)	166 (26.1)
51–60	21 (14.9)	58 (24.1)	3 (4.0)	5 (17.2)	17 (11.2)	104 (16.3)
>60	11 (7.8)	3 (1.2)	0 (0.0)	1 (3.5)	3 (2.0)	18 (2.8)
Educational status						
Secondary education and below	0 (0.0)	18 (7.5)	1 (1.3)	2 (6.9)	138 (91.4)	161 (25.3)
Tertiary education	141 (100.0)	223 (92.5)	74 (98.7)	27 (93.1)	13 (8.6)	476 (74.7)
Years in practice						
≤5	50 (35.5)	47 (19.5)	33 (44.0)	5 (17.2)	65 (43.0)	200 (31.4)
6–10	34 (24.1)	52 (21.6)	19 (25.3)	7 (24.1)	50 (33.2)	162 (25.4)
>10	57 (40.4)	142 (58.9)	23 (30.7)	17 (58.7)	36 (23.8)	275 (43.2)
Health facility type						
Public HF	83 (58.9)	148 (61.4)	50 (66.7)	27 (93.1)	91 (61.6)	399 (62.6)
Private HF	58 (41.1)	93 (38.6)	25 (33.3)	2 (6.9)	60 (38.4)	238 (37.4)

reported muscle pain. Gum bleeding was mentioned by 233 (36.6%, 95% CI: 32.8–40.3%), haematemesis by 207 (32.5%, 95% CI: 29.2–35.9) and haematuria by 116 (18.2%, 95% CI: 15.2–21.4%) (Figure 1). In all, half of the HCWs (316) (49.6%, 95% CI: 46.0–53.5%) had a good knowledge of the symptoms and signs of the disease.

Majority of the HCWs knew cremation was the best method of disposal of an Ebola-infected corpse; 114 (17.9%, 95% CI: 14.6–20.9%) mentioned burial in a sealed bag. In all, 574 (90.1%, 95% CI: 87.6–92.3%) knew the appropriate burial method of an Ebola-infected corpse.

The best knowledge scores were documented among doctors (131/141; 92.9%, 95% CI: 87.8–96.8%) and the poorest among health attendants (43/151; 28.5%, 95% CI: 21.5–35.7%; Table 3). Overall, the mean knowledge score of healthcare workers was 3.1 ± 1.4 marks; 462 (72.5%, 95% CI: 68.8–76.3%) had good knowledge of the disease.

Male healthcare workers had a higher prevalence of good knowledge than female HCWs (130 (79.8%) *vs.* 332 (70.0%), $P = 0.02$). The prevalence of poor knowledge was highest among the non-professional hospital workers, that is the health attendants, cleaners, etc., with the least found among the doctors (108 (71.5%) *vs.* 10 (7.1%); $P < 0.01$). HCWs who had spent >20 years in practice had the highest prevalence of good knowledge, with the lowest prevalence found among those who have 5 years or less in practice (129 (83.8%) *vs.* 131 (65.5%), $P < 0.01$). Female sex, being a health professional, more than 20 years of practice and working in a public health facility were associated with good knowledge of EVD (Table 4).

Assessing the practice of standard precautions, 534 (83.8%, 95% CI: 81.0–86.8%) of healthcare workers reported wearing gloves when dealing with patients' body fluids, while 509 (79.9%, 95% CI: 76.8–82.9%) reported washing their hands before and after touching a patient. A total of 382 (60.0%, 95% CI 56.0–63.7%) HCWs reported wearing face masks and 111 (17.4%, 95% CI: 14.6–20.7%) protective goggles when the need arose. Only 55/637 (8.6%, 95% CI: 6.7–10.5%) of HCWs reported avoiding recap of used needles, while 52/637 (8.2%, 95% CI 6.3–10.4%) reported having access to sharp boxes. Disinfection of patients' care equipment before use for another patient was reportedly practised by 76 (11.9%, 95% CI: 9.6–14.6%). In all, practice of standard precautions was reported among 62 (9.7%, 95% CI: 7.4–12.2%) health workers. Forty-six of the 399 (11.5%, 95% CI: 8.3–14.7%) HCWs at public facilities reported practising standard precautions compared with 16/238 (6.7%, 95% CI: 3.7–9.9%) working in private facilities.

Assessing the adoption of practices among the HCWs that would enable identification of a suspected case of EVD, only 78 (12.2%, 95% CI: 9.7–15.2%) reported having a triaging area for patients presenting with fever within their health facilities. Three hundred and one (47.3%, 95% CI: 43.6–51.0%) reported measuring the temperature of every patient coming into their facility during the outbreak. One hundred and seventy-one (26.8%, 95% CI: 23.2–30.1%) asked questions about symptoms of fever, diarrhoea and vomiting, etc., and 54 (8.5%, 95% CI: 6.4–10.7%) took history of possible contact with someone with EVD, while 62 (9.7%, 7.5–12.3%) elicited travel history among the patients. In all, only 62/637 (9.7%, 95% CI: 7.5–12.3%) of the health-care workers adopted measures to identify suspected case (s) of EVD during the outbreak; 10 (4.2%) were private facility employees, while 52 (13.0%) were government hospital employees ($P < 0.01$).

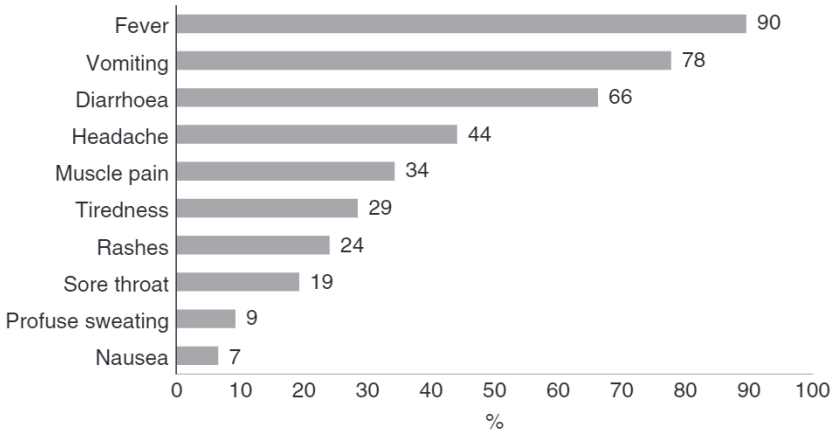

Figure 1 Possible symptoms and signs an EVD patient can present with, as reported by the health-care workers in private and public health care facilities in Lagos State, August 2014.

Table 3 Ebola-related knowledge and practices among the various categories of healthcare workers in Lagos State, August 2014

	Knowledge				Practice			
	Good		Poor		Good		Poor	
Categories of HCWs	*n* (%)	95% CI	*n* (%)	95% CI	*n* (%)	95% CI	*n* (%)	95% CI
Doctors (141)	131 (92.9)	87.8–96.8	10 (7.1)	3.2–12.2	17 (12.1)	6.4–18.7	124 (87.9)	81.3–93.6
CHW (29)	25 (86.2)	74.2–97.1	4 (13.8)	2.9–25.8	0 (0.0)	0.0–0.0	29 (100.0)	100.0–100.0
Nurses (241)	202 (83.8)	78.5–88.1	39 (16.2)	11.6–21.4	1 (1.3)	0.0–4.3	74 (95.7)	95.7–100.0
Laboratory workers (75)	61 (81.3)	69.8–90.8	14 (18.7)	9.2–30.2	0 (0.0)	0.0–0.0	151 (100.0)	100.0–100.0
Health attendants (151)	43 (28.5)	21.5–35.7	108 (71.5)	64.3–78.5	11 (4.6)	2.2–7.2	230 (95.4)	92.8–97.8

CHW, community healthcare worker.

Table 4 Factors associated with good knowledge on Ebola virus disease and good practice in infection control and prevention of healthcare workers in Lagos State, August 2014

		Good knowledge		Good practices	
	N (%)	Adjusted OR	95% CI	Adjusted OR	95% CI
Sex					
Female	474 (74.4)	**1.7700**	1.1906–2.6314	0.5790	0.1625–2.0628
Male	163 (25.6)	Reference		Reference	
Job cadre					
Medical staff	486 (76.3)	**1.5277**	1.0112–2.3079	2.210	0.2665–18.3239
Non–medical staff	151 (23.7)	Reference		Reference	
Years of service					
> 20 years	154 (24.2)	**2.1327**	1.3124–3.4655	2.6580	0.8085–8.7385
≤ 20 years	483 (75.8)	Reference		Reference	
Management type					
Public health facility	399 (62.6)	**1.9010**	1.3165–2.7450	1.6207	0.4135–6.3521
Private health facility	238 (37.4)	Reference		Reference	
Training on EVD					
Yes	106 (16.6)	**3.7611**	1.9830–7.1334	**7.5595**	2.2973–24.8754
No	531 (83.4)	Reference		Reference	

Statistically significant adjusted OR are bolded.

Assessing the actions the HCWs take, on identifying a suspected case of EVD, only 185 (29.0%, 95% CI: 25.9–32.5%) said they would have isolated such patients. Eighty-three (13.0%, 95% CI: 10.4–15.7%) would have kept one metre distance away from the patient, 74/637 (11.6%, 95% CI: 9.1–14.3%) would have observed standard precautions, 8/637 (1.3%, 95% CI: 0.3–2.2%) would have performed a physical examination, 11/637 (1.7%, 95% CI; 0.8–2.8%) would have worn full personal protective equipment (PPE), 238/637 (37.4%, 95% CI: 33.9–41.4%) would have informed the Ebola Incident Centre, and 177/637 (27.8%, 95% CI: 24.3–31.4%) would have referred the patient. In all, only 26 (4.1%, 95% CI: 2.7–5.7%) of the respondents would have adopted appropriate measures to prevent spread of the disease after identifying a suspected case. Seven of these 26 (2.9%) worked in private facilities and 19 (4.8%) worked in public facilities ($P = 0.26$).

Having assessed the practice of standard precautions, adoption of measures to identify a suspected case of EVD and adaptation of control measures after identification of a suspected case, only 29 (4.6%, 95% CI: 3.0–6.3%) of Lagos State healthcare workers had practices that could prevent spread of EVD in hospital. The prevalence of good practices by designation was 17/141 (12.1%, 95% CI: 7.2–17.9%) among doctors, 4.6% (95% CI: 2.0–7.9%) among nurses, 1.3% (95% CI: 0.0–4.4) among laboratory workers and 0% among community health workers and clinic health attendants/cleaners. Twenty-five (6.3%) of the HCWs who reported good practices were government employees compared with 4 (1.7%) in private facilities ($P = 0.01$).

A total of 106 (16.6%, 95% CI: 14.4–19.5%) reported been trained on how to identify a suspected patient with EVD. Fourteen of the 106 (13.2%) HCWs trained had good practices compared with 15/531 (2.8%) who reported not having been trained ($P < 0.001$).

Although the adoption of measures to identify suspected case(s) was low in both health facility types (private and public), public health facility HCWs who had adopted measures to identify suspected EVD case(s) were thrice the proportion of HCWs in the private facilities (12.8% *vs.* 4.3%, $P = 0.001$). Likewise the proportion of public health facility HCWs who reported good practices was four times the proportion of those in private health facilities (6.3% *vs.* 1.7%, $P = 0.01$).

However, professional background, sex, years of working experience and knowledge management type of the healthcare facility were not associated with reported good practice, and only training on EVD was a significant factor associated with reported good practices (Table 4).

Of the health facilities where the use of the checklist was employed, 33/99 (33.3%) had operational plans in place should there be a case of EVD. Information, education and communication (IEC) materials were available in 45/99 (45.5%) of the health facilities, with 15/99 (15.2%) having a prepared isolation room should a case of EVD be identified. Only 12/99 (12.1%) had full PPE at the time of the survey. The public health facilities had more items of preparedness than the private health facilities (Figure 2).

Discussion

The study showed a wide discrepancy between knowledge of EVD and practices to reduce risk of transmission of EVD in healthcare facilities in Lagos State 1 month after the introduction of EVD in Nigeria. Although a significantly high proportion of HCWs had good knowledge of EVD, this did not translate to good practice. Training on EVD was crucial for good practices of standard health precautions and infection control.

Medical doctors were found to have good knowledge and good practices, but they do not make up the entirety of the workforce potentially coming into contact with patients with EVD and/or fomites. Laboratory workers and health attendants may not need to know about the symptoms and signs of EVD, but need to know about its modes of spread and precautionary measures for infection prevention. Similar knowledge difference among healthcare workforce was reported by Sheikh *et al.* in their study on the knowledge, attitude and practices regarding Crimean–Congo haemorrhagic fever among healthcare workers in Balochistan, Pakistan [6].

The practices reported by the HCWs were verified with the use of checklists at the health facility level. The checklist revealed the absence of the essential equipment and structures for these HCWs to execute their jobs and protect themselves and other patients [7]. Of importance was the fact that operational plans for the management of a suspected EVD case were in place only in the minority of the health facilities. Isolation is a key measure when a patient is suspected to have EVD; however, there was low availability of designated holding areas/isolation rooms in both health facility types. Furthermore, the availability of personal protective equipment was low, which actually makes it difficult/impossible for the HCWs to examine a suspected patient with EVD [8]. These findings are similar to the findings documented in the Assessment of Ebola Virus Disease, Health Care Infrastructure, and Preparedness in four counties of southeastern Liberia [9].

The discrepancies documented in the self-reported practices of the HCWs and the checklist findings most

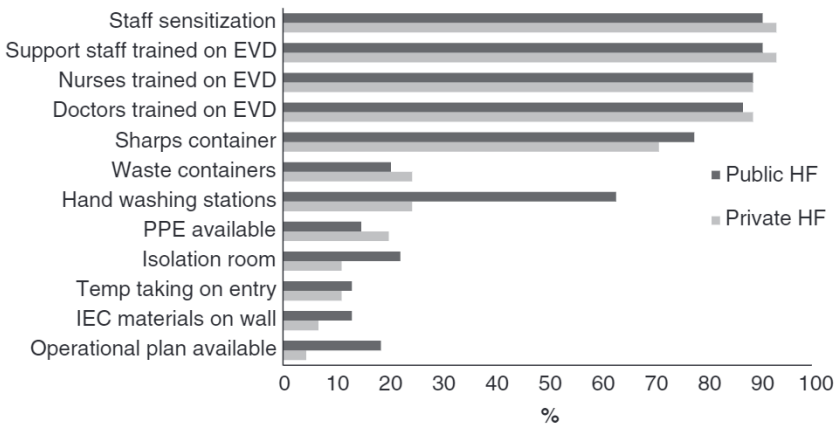

Figure 2 Health facility (HF) Ebola preparedness checklist findings in private and public health care facilities in Lagos State, August 2014.

especially with the low response on the use of sharp boxes and a non-corresponding degree of availability might be explainable in two ways. Firstly, the questionnaire was designed not to give away expected answers to the respondents with a 'do not read out options' instruction to the interviewers. As such, respondents might have responded with the practices that come readily to their minds as at the time of interview. Also the checklist instruction is to sight the items of preparedness in question before ticking them as truly available. Documentation of the availability of these items might, however, not translate to the accessibility of the items to the HCWs especially when there is a need for use.

A well-established necessity in the response to and containment of outbreaks such as EVD is good synergy of policy, strategies and technical service delivery ensuring efficient and effective utilisation of all resources. At the health facility level of these containment/control measures is not just the need for the presence of experts with technical know-how, but infrastructures that ensure and enhance safe delivery of their expertise [10–12].

Factors influencing poor prevention practices despite good knowledge of the HCWs need to be addressed to prevent future occupational risk of acquiring EVD and other epidemic-prone diseases. Sustaining a good level of preparedness (training of all cadre of HCWs, repeated exercises at the hospital level, making available needed protective devices/equipment, reinforcement of universal precaution measures) at health facility level is crucial to the containment of future outbreaks in the country and has proven in EVD outbreaks to reduce the number of healthcare workers contracting EVD [2]. Priority needs to be given not only to government-owned (public) hospitals but also to private hospitals in outbreak preparedness and response. A preparedness assessment might also be needful in Nigerian states without cases to sensitise them to an appreciable level of preparedness.

This survey was essential in providing a true situation report of the health facilities and healthcare workers of the state during the Ebola outbreak in Lagos State. It assisted the emergency operation team to identify gaps and respond appropriately. The survey is, however, not without limitations. Self-reporting of practices sometimes tends towards exaggeration of the usual. This was, however, verified with the use of the checklist and the design of the interview not to read out the possible response answers to the respondents. Also the HCWs were assessed as a unit despite their variation in educational/training exposure and job description – bearing in mind that not all workers are responsible to and for patients at same level. We did not assess the possibility of panic and fear which has been documented to occur in similar outbreaks of this magnitude [12]. Qualitative data collection methods (focus group discussions or in-depth interviews) might be required in future surveys to identify the cause of the gap documented in the knowledge and practice of these workers.

Conclusions

Knowledge of EVD did not translate to good practices to prevent the spread of the disease across all job cadres in public and private healthcare setting. Training on EVD and re-enforcement of universal precautions cannot be overemphasised and are crucial to prevent spread of EVD. On-the-job training by repeated exercises might help to translate acquired knowledge into good practice and thus building confidence of healthcare staff to be able to manage a suspected EVD case and to continue to attend to patients seeking help for other reasons than EVD. We developed standard operating procedures (SOPs) for EVD active surveillance and patient management. EVD-related information, education and communication (IEC) materials were also developed and used in training the HCWs towards containing the outbreak.

Acknowledgement

The survey was funded by the Ebola Containment Trust Fund/Association of Public Health Practitioners of Nigeria (APHPN) Lagos State Chapter, and the Nigeria Field Epidemiology and Laboratory Training Programme (N-FELTP), Abuja, Nigeria.

References

1. Ftika L, Maltezou H. Viral haemorrhagic fevers in healthcare settings. *J Hosp Infect* 2013: **83**: 185–192.
2. World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. *Bull World Health Organ* 2001: **79**: 373–374.
3. Kerstiens B, Matthys F. Interventions to control virus transmission during an outbreak of Ebola hemorrhagic fever: experience from Kikwit, Democratic Republic of Congo, 1995. *J Infect Dis* 1999: **179**: S263–S267.
4. Muyembe-Tamfum JJ, Mulangu S, Masumu J, Kayembe JM, Kemp A & Paweska JT. Ebola virus outbreaks in Africa: Past and present. *Onderstepoort J Vet Res* 2012; **79**: Art. #451.
5. World Health Organisation. Ebola virus disease WHO Factsheet. (Available from: http://wwwwhoint/mediacentre/factsheets/) 2014.
6. Sheikh NS, Sheikh AS, Sheikh AA. Knowledge, attitude and practices regarding Crimean – Congo haemorrhagic fever

among healthcare workers in Balochistan. *Headache* 2004: **30**: 20.

7. Raabe VN, Mutyaba I, Roddy P, Lutwama JJ, Geissler W, Borchert M. Infection control during filoviral hemorrhagic fever outbreaks: preferences of community members and health workers in Masindi, Uganda. *Trans R Soc Trop Med Hyg* 2010: **104**: 48–50.
8. Hooker L, Mayes C, Degeling C, Gilbert GL, Kerridge IH. Don't be scared, be angry: the politics and ethics of Ebola. *Med J Aust* 2014: **15**: 352–354.
9. Forrester JD, Pillai SK, Beer KD *et al.* Assessment of Ebola Virus Disease, Health Care Infrastructure, and Preparedness — Four Counties, Southeastern Liberia, August 2014 - MMWR Early Release on the MMWR website (Available from: http://www.cdc.gov/mmwr).
10. Borchert M, Mutyaba I, Van Kerkhove MD *et al.* Ebola haemorrhagic fever outbreak in Masindi District, Uganda: outbreak description and lessons learned. *BMC Infect Dis* 2011: **11**: 357.
11. Yakubu A, Folayan MO, Sani-Gwarzo N, Nguku P, Peterson K & Brown B. The Ebola outbreak in Western Africa: ethical obligations for care. *J Med Ethics* 2014: doi: 10.1136/medethics-2014-102434 [eprint ahead of publication].
12. Hewlett BL, Hewlett BS. Providing care and facing death: nursing during Ebola outbreaks in central Africa. *J Transcult Nurs* 2005: **16**: 289–297.

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