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Original Article

Are healthcare workers ready for Ebola? An assessment of their knowledge and attitude in a referral hospital in South India

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Abstract

Introduction: The World Health Organization (WHO) declared the Ebola virus disease (EVD) epidemic to be a public health emergency of international concern. Healthcare workers (HCWs) are at the highest risk of infection, as they may come into contact with patients' blood or fluids. This study was conducted to assess knowledge and attitudes of HCWs towards EVD in India.

Methodology: A descriptive, cross-sectional study was conducted in a multispecialty public sector referral hospital of Telangana, India. Knowledge and attitude of HCWs were evaluated using a pre-validated questionnaire. A sample of 278 participants was selected to participate in this study. The Chi-squared test was used to assess the relationship between attitudes and demographic characteristics. Logistic regression was used examine the association between knowledge and study variables.

Results: Of 257 participants who responded (92.4% response rate), 157 (61.1%) were females. The majority of the respondents were physicians (n = 117, 45.5%). Radio and television were the major sources of information about EVD reported by participants (89%). Overall knowledge of HCWs was poor (mean knowledge score: 6.57 ± 2.57). Knowledge of physicians and experienced workers (≥ 10 years) was significantly higher than their respective groups. The overall attitude of the participants was positive (mean attitude score: 1.62 ± 0.57). Significant positive correlations between knowledge and attitude were observed.

Conclusions: The findings indicate that participants lack basic understanding of EVD. We recommend future studies be conducted across India to identify and subsequently bridge the knowledge gaps among HCWs.

Key words: knowledge; attitudes, ebola; healthcare workers; India.

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Introduction

Ebola virus disease (EVD), also known as Ebola haemorrhagic fever, is a rare and severe infectious disease caused by Ebola virus species in humans and nonhuman primates (monkeys, gorillas, and chimpanzees) [1,2]. EVD belongs to the family *Filoviridae*, genus *Ebolavirus*, and has five identified species, of which first four can cause infections in humans, namely *Zaire ebolavirus*, *Sudan ebolavirus*, *Taï Forest ebolavirus*, *Bundibugyo ebolavirus*, and *Reston ebolavirus* [2].

Outbreaks of EVD have appeared at irregular intervals in Africa since the virus was first discovered in 1976 near Ebola River in the Democratic Republic of the Congo [2]. Currently, this virus has penetrated into countries in and near West Africa [1,2]. However, on 8 August 2014, the World Health Organization (WHO) declared Ebola an international emergency, stating that the spread of the disease demands a massive coordinated response [3]. Since the last update on 15 November 2015, 28,634 cases have been confirmed globally and a total of 11,314 deaths have been reported [4].

It has also been reported that many EVD victims are healthcare workers (HCWs) [5]. Several cases and deaths associated with Ebola indicates the transmission of the disease from patients to HCWs [5,6]. According to a Centers for Disease Control (CDC) report, transmission of EVD takes place through direct contact with infected patients' body fluids including feces, saliva, urine, vomit, breast milk, or semen, and through other means such as needles and syringes that are

contaminated with the virus [1,2]. The occurrence of asymptomatic and subclinical EVD in community or in healthcare settings could have major public health implications. In view of this, HCWs are at great risk of acquiring this infection or becoming a source of transmission to patients and their colleagues. The presence of this fatal virus among HCWs demonstrates the urgent need for developing a thorough awareness program by initiating infection control measures to cut down the rate of this rapidly prevailing disease.

In the recent past, many suspected EVD cases have been reported in India. A 26-year-old Indian male came from Liberia to the New Delhi airport carrying documents stating that he had undergone successful treatment for EVD and had recovered successfully. However, after investigations, his semen was found to be EVD positive. Although he had been declared free of any symptoms and his blood tests were also clear, Indian authorities placed him in isolation for further investigation [7]. The CDC advises Ebola survivors to avoid sexual activities for three months or to use condoms because the virus can continue to be found in semen for seven weeks after recovery from the disease [2]. Similar suspected cases were identified in India where three Nigerians who were 79, 37, and 4 years of age reported to a hospital with symptoms related to Ebola. They were later referred to the Ram Manohar Lohia Hospital for further screening. However, the results of their tests were negative [8,9]. Other similar cases are also reported from various cities in India, such as Bhilai (Chhattisgarh), Chennai (Tamilnadu), Hyderabad (Telangana), and Imphal (Manipur) [8,10].

The government of India declared high alerts on 25 major airports for the screening of EVD, including the state of Telangana (Hyderabad). The government is working closely with the corporate hospitals in the state that frequently receive patients from foreign countries, including African nations. According to Foreign Ministry, Government of India, approximately 45,000 Indians work in West Africa [5,11]. The majority of these emigrants are from different states of south India, including Telangana. These statistics may put India, especially the southern region, at high risk of EVD, as the majority of these workers make frequent visit to their hometowns in India [5].

Several steps have been taken by the Government of India to counter the threats of the transmission of this deadly virus to India, including the implementation of screening procedures at major airports for suspected individuals, development of guidelines for educating HCWs based on WHO recommendations, and the gearing up of surveillance procedures to track suspected travellers for four weeks [12]. HCWs are the mainstay of all these activities. Efforts have been made by the government to issue guidelines relating to personal protective practices of HCWs and clinical case management of EVD, including treatment approaches and prevention of EVD in hospital settings [2,13]. However, evidence suggests that preparedness for the consequences of Ebola is far from satisfactory [14]. Therefore, this study was conducted to assess the knowledge and attitudes of HCWs towards EVD in the state of Telengana, India.

Methodology

Study site, design, and participants

A descriptive, cross-sectional study was conducted for the period of two months (February–March, 2015) in a tertiary care, public sector teaching hospital in Warangal, Telangana. This 1,200-bed hospital is one of oldest hospitals in the region and serves the majority of the area due to its multispecialty and provision of clinical services in the departments of internal medicine, surgery, psychiatry, obstetrics and gynaecology, physical medicine, rehabilitation, and radiology. The hospital follows the guidelines given by Indian Public Health Standards (IPHS) for the transfer of cases from one department to another. Low- and middle-income patients from the nearby rural areas, government dispensaries, and other private clinics are usually referred to this hospital. Since the hospital is run by the government, nominal fees are collected from the patients for consultations. HCWs including physicians, pharmacists, nurses, laboratory professionals, and others orderlies were considered eligible to take part in this study. Per the guidelines given by IPHS, all clinical and nonclinical staff in a hospital works on a rotation basis on an eight-hour shift in a day. Data were collected using a pre-designed questionnaire by a team of authors responsible for data collection. All the eligible participants were approached by the data collectors and were briefed about the objectives and the outcomes of the research.

Sample size calculations

A total of 278 healthcare professionals working in the selected hospital were selected to participate in this study. This sample size was calculated on the basis of Raosoft software; the population size was kept as 1,000, power as 80%, response distribution as 50%, while confidence interval and margin of error were set at 95% and 5%, respectively [15]. A convenience sampling approach was adopted, in which the respondents were recruited on ease of accessibility; however, efforts were

made to recruit ample numbers of HCWs from different departments of the hospital.

Study instrument

A supervised, self-administered questionnaire was designed and used as a tool to collect the data from the participants during the pilot study and the main survey. The questionnaire was designed after a thorough literature review of the related published studies [1,2,11,13,16,17], after which the questions were short-listed to be included in the final questionnaire. The first version of the questionnaire was sent to subject experts for content validity. The suggested corrections were made to the questionnaire before it was sent to a small sample of 10 HCWs for face validity. The amendments proposed by the participants were then made in view of other published literature. The internal consistency of the questionnaire was measured using SPSS version 20. Cronbach's alpha value of 0.72 was computed. The responses from the pilot study were not included in the final analysis.

The questionnaire consisted of 28 items divided into 4 sections. The first section refers to demographic information and comprises 4 questions about gender, age, profession, and experience. The second section, consisting of 12 questions, evaluated the knowledge of HCWs about EVD. Knowledge was assessed through questions about the virus, disease, signs and symptoms, incubation period, diagnosis, vaccine, and treatment. The third section examined the attitudes of HCWs towards EVD. This section included 11 questions. Statements on attitudes were used to assess the feelings and beliefs towards EVD and its measures. The last part explored the source of HCWs' information about EVD.

Analytical procedures

The responses of the participants were statistically analysed using SPSS version 20 (SPSS, Chicago, USA). Descriptive analysis was performed, and the results were expressed in frequencies and percentages. Chi-square tests were employed to determine the relationship between independent (demographics) and dependent (attitudes) variables. In cases where the conditions of Chi-squared were not met, Fisher's exact tests were executed. Knowledge was assessed by giving 1 mark to a correct answer and 0 to an incorrect answer. The scale measured knowledge from a maximum score of 12 to a minimum score of 0. A cut-off score of 8 was set based on the mean knowledge score of the participants. A score of < 8 was taken as poor knowledge, while a score of ≥ 8 was considered as good knowledge. Good knowledge was defined as better understanding of the participant of the different components of EVD. Logistic regression analysis was used to assess the association between demographic characteristics of participants and their knowledge. Attitude was assessed by giving a score of 1 to strongly disagree, 2 to disagree, 3 to agree, 4 to strongly agree. A cut-off score of 3 was set based on the median attitude score of the participants. A score of < 3 was taken as a negative attitude, while attitude was considered to be positive with a score of ≥ 3. Positive attitude was defined as positive beliefs of participants regarding EVD. Spearman's rank correlation coefficient was used to evaluate the association between knowledge and attitudes. P value of less than 0.05 was reported as statistically significant.

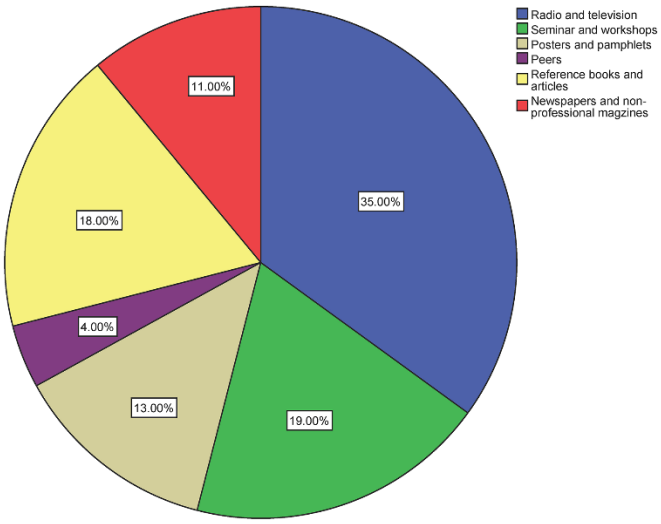
Ethics statement

This study was approved by the departmental research committee of the Vaagdevi College of Pharmacy. Permission from the heads of the departments of the selected hospital was also obtained before the study. Furthermore, the participation of HCWs in this study was voluntary, and signed consent forms were obtained from the participants prior to their participation in this study. High levels of confidentiality and anonymity were maintained throughout the study.

Results

Of 278 participants approached, a total of 257 responded to the questionnaire, giving a response rate of 92.4%. The results showed that 61.1% of the respondents were female. Physicians (45.5%), pharmacists (23.7%), and nurses (17.1%) were the major respondents in this study. Complete information

Figure 1. Healthcare worker's main sources of information about Ebola virus disease



about the participants' demographic characteristics is presented in Table 1. Participants reported that radio and television were their main sources of information about EVD (89%), followed by seminars and workshops (50%) and reference books and articles (45%), as shown in Figure 1.

Table 2 describes the knowledge of HCWs about EVD. Overall, 39.68% participants exhibited good knowledge of EVD. It was noted that poor knowledge was apparent regarding transmission (17.5%) and management (24.1%) of EVD. In contrast, 89.1% correctly recognized EVD as a fatal disease, while 78.6% participants were aware of the hallmark symptoms of EVD.

The results showed that male participants were 1.55 times (confidence interval [CI] = 0.8–2.8) more likely to have good knowledge as compared to their female counterparts. Similar results were obtained when participants younger than 50 years of age exhibited poor knowledge of EVD as compared to elder ones. It was noted that participants between 29 to 39 years of age were most likely to have poor knowledge as compared to older respondents (≥ 50 years) (odds ratio [OR] = 2.08, CI = 0.4–10.6, $p < 0.05$).

Table 1. Demographic information of the participants.

Demographic variables	N	%
Gender		
Male	100	38.9
Female	157	61.1
Age		
< 29	103	40.1
29–39	103	40.1
40–49	28	10.9
≥ 50	23	8.9
Profession		
Physician	117	45.5
Pharmacist	61	23.7
Nurse	44	17.1
Laboratory staff	11	4.3
Other orderlies	24	9.3
Experience (years)		
< 3	73	28.4
3-6	85	33.1
7-9	65	25.3
≥ 10	34	13.2

Table 2. Healthcare workers' knowledge about Ebola virus disease.

Knowledge questions	Correct answer N (%)	Incorrect answer N (%)
This is the first ever outbreak of Ebola*	113 (44)	144 (56)
There are 5 different species of the genus Ebola*	130 (50.6)	127 (49.4)
Ebola is airborne disease, as transmission of disease takes place through air	45 (17.5)	212 (82.5)
HCWs are at risk of Ebola virus disease (EVD) while treating patients	142 (55.3)	115 (44.7)
Sudden onset of fever, intense weakness, and muscle pain are hallmark symptoms of EVD*	202 (78.6)	55 (21.4)
Laboratory findings of EVD have decreased white blood cell counts and decreased platelet counts*	178 (69.3)	79 (30.7)
Incubation period of Ebola virus is 2–21 days*	146 (56.8)	111 (43.2)
ELISA and PCR are common diagnostic tool for Ebola virus*	143 (55.6)	114 (44.4)
EVD can be prevented by proper vaccination	127 (49.4)	130 (50.6)
Antivirals are the treatment of choice in EVD	62 (24.1)	195 (75.9)
EVD can be fatal*	229 (89.1)	28 (10.9)
EVD can be prevented by practicing infection control measures such as complete equipment sterilization and routine use of disinfectant	173 (67.3)	84 (32.7)

Note: Knowledge was assessed by giving 1 to correct answer and 0 to wrong answer. The scale measured knowledge of maximum 12 to minimum 0. A score of < 8 was taken as poor while ≥ 8 as good. Mean knowledge score was 6.57 ± 2.57; * P value derived from Chi-squared test was less than 0.05 in association with different categories of healthcare professionals; ELISA: enzyme-linked immunosorbent assay; PCR: polymerase chain reaction

Table 3. Association of demographic variables with healthcare workers' knowledge of Ebola virus disease.

Variables	Knowledge N (%)		Odds ratio (95% CI)	P value
	Poor	Good		
Gender				
Male	55 (55)	45 (45)	1.55 (0.8–2.8)	0.15
Female	100 (63.7)	57 (36.3)	Reference	
Age				
< 29	73 (70.9)	30 (29.1)	1.48 (0.23–9.51)	0.67
29–39	61 (59.2)	42 (40.8)	2.08 (0.4–10.6)	0.37
40–49	14 (50)	14 (50)	1.02 (0.25–4.07)	0.96
≥ 50	7 (30.4)	16 (69.6)	Reference	
Profession				
Physician	54 (46.2)	63 (53.8)	9.86 (2.63–36.99)	0.001
Pharmacist	43 (70.5)	18 (29.5)	6.07 (1.44–25.52)	0.14
Nurse	30 (68.2)	14 (31.8)	3.58 (0.81–15.73)	0.09
Laboratory staff	7 (63.6)	4 (36.4)	2.89 (0.47–17.54)	0.24
Other orderlies	21 (87.5)	3 (12.5)	Reference	
Experience (years)				
< 3	53 (72.6)	20 (27.4)	Reference	
3-6	55 (64.7)	30 (35.3)	1.49 (0.61–3.59)	0.372
7-9	36 (55.4)	29 (44.6)	2.52 (0.76–8.35)	0.129
≥ 10	11 (32.4)	23 (67.6)	7.82 (1.41–43.27)	0.018

Note: Overall predictive accuracy is 68.9%; Omnibus tests of model coefficients: Chi-squared value = 38.98, $p < 0.05$; -2 log likelihood = 306.28, Nagelkerke R square = 0.190; Hosmer and Lameshow test: Chi-squared value = 4.27, $p > 0.05$; CI: confidence interval.

Table 4. Attitudes of healthcare workers towards Ebola virus disease.

Attitude question	Participants' response N (%)				P value*			
	Strongly agree	Agree	Disagree	Strongly disagree	Gender	Age	Profession	Experience
EVD is a serious illness[a]	218 (84.8)	28 (10.9)	10 (3.9)	1 (0.4)	0.483	0.261	0.001	0.544
HCWs are very prone to EVD[b]	103 (40.1)	85 (33.1)	59 (23)	10 (3.9)	0.001	0.022	0.001	0.017
EVD is preventable[c]	119 (46.3)	80 (31.1)	23 (8.9)	35 (13.6)	0.044	0.464	0.005	0.65
Transmission of Ebola virus can be prevented by using universal precautions given by CDC, WHO, etc.[d]	164 (63.8)	68 (26.5)	9 (3.5)	16 (6.2)	0.037	0.162	0.001	0.067
Prevalence of EVD can be reduced by active participation of healthcare worker in hospital infection control program[e]	130 (50.6)	101 (39.3)	9 (3.5)	17 (6.6)	0.207	0.010	0.001	0.268
Any related information about EVD should be disseminated among peers and other healthcare workers[f]	161 (62.6)	54 (21)	11 (4.3)	31 (12.1)	0.004	0.419	0.001	0.516
Patients suffering from EVD should be kept in isolation[g]	179 (69.6)	44 (17.1)	7 (2.7)	27 (10.5)	0.539	0.033	0.017	0.934
Supportive therapy in a timely manner can help to save the life of a patient[h]	155 (60.3)	74 (28.8)	16 (6.2)	12 (4.7)	0.57	0.803	0.001	0.735
Healthcare workers must educate themselves with all the information about EVD[i]	198 (77)	39 (15.2)	7 (2.7)	13 (5.1)	0.006	0.421	0.001	0.335
Gowns, gloves, mask, and goggles must be used when dealing with EVD patients[j]	187 (72.8)	51 (19.8)	7 (2.7)	12 (4.7)	0.11	0.109	0.001	0.893
EVD patients should not be stigmatized and discriminated against[k]	125 (48.6)	71 (27.6)	23 (8.9)	38 (14.8)	0.597	0.008	0.366	0.647

* derived from Chi-squared test; Note: Attitude was assessed by giving 1 to SD, 2 to D, 3 to A, 4 to SA; Median scores: a, 4; b, 3; c, 3; d, 4; e, 4; f, 4; g, 4; h, 4; i, 4; j, 4; k, 3.

The knowledge of physicians was significantly higher as compared to other orderlies (OR = 9.86, CI = 2.63–36.99, $p < 0.05$). The results highlighted that the personnel with more than 10 years of experience were more knowledgeable as compared to ones with less than 3 years of experience (OR = 7.82, CI = 1.41–43.27, $p < 0.05$). The association of the demographic characteristics and knowledge of the participants is expressed in Table 3.

Overall, a positive attitude was shown by 63.2% participants. Profession was the major variable that appeared to be statistically significant in almost all the attitude questions, as physicians appeared to be more positive in their attitudes as compared to other participants ($p < 0.05$). The majority of participants (95.7%) strongly agreed or agreed that EVD is a serious illness. Similarly, 92.6% workers believed that protective measures must be used while dealing with EVD patients. In contrast, a negative attitude was observed when participants were asked whether HCWs are prone towards EVD, as only 40.1% of participants strongly agreed with this statement. Similarly, 48.6% subjects strongly agreed that EVD patients should not be stigmatized and discriminated. Older participants (> 50 years) were more positive in their attitudes compared to younger respondents. The responses of participants to the attitude statements are summarized in Table 4. The positive correlation between knowledge and attitude was determined using Spearman's correlation test. The relationship was also statistically significant ($r = 0.13$, $p < 0.032$).

Discussion

To the best of our knowledge, there are no reported studies that have evaluated the knowledge and attitude of HCWs about EVD in India. Therefore, our findings could be compared with those related to other related viral hemorrhagic conditions such as Crimean-Congo hemorrhagic fever and other related illnesses. The results suggest that the overall knowledge of HCWs is poor, especially with respect to transmission and management of EVD. Similar results were observed when awareness of viral hemorrhagic fever was evaluated among healthcare professionals in Pakistan [18]. This finding indicates the need to take essential measures to bridge this knowledge gap of HCWs by implementing effective interventions such as intensification of educational programs that may form one arm of this approach. Additionally, effective training of staff and development of standard operating procedures can also be effective approaches in view of the risk of EVD to HCWs. These strategies are also supported by Kilmarx *et al*. in their report on EVD in HCWs in 2014 [19]. The majority of participants in this study incorrectly answered that this was the first-ever outbreak of EVD. This probably indicates the lack of literature reading habits by the HCWs. However, the results were not different in a study conducted at the time of the swine flu epidemic in in Saudi Arabia [20]. The results highlight the need to promote health research among HCWs in India, as such research may provide important information about disease trends, risk factors, and public health interventions. Arranging research seminars on outbreaks of diseases and other health issues on a regular basis may aid in achieving the required objectives. Researchers have also shown that participation in research activities may bring positivity in the attitudes of HCWs regarding different disease conditions [21]. In the present study, participants' knowledge about the symptoms of EVD was considerably better compared to that of other aspects of the disease. However, this finding contradicts that of Matta *et al*., who reported that the knowledge of HCWs regarding the symptoms was well below par [22]. The discrepancy in this result could be due to more emphasis being placed on symptoms of EVD in the awareness programs than on other areas of EVD. This is better explained by a study that suggests that recognition of symptoms is essential for early diagnosis and subsequent management of EVD [23]. Interestingly, the findings show that respondents' knowledge about diagnosis and identification of EVD is good, while their knowledge about transmission and management of EVD is poor. We speculate that the information and education provided to HCWs may have focused more on early diagnosis and identification of EVD. The findings imply that attention must be given to all aspects of EVD when providing educational information to HCWs.

Physicians' knowledge was significantly higher than that of other orderlies. The results are in accordance with other studies that show the superiority of physicians in terms of knowledge of epidemic diseases [18]. This could be possibly explained by the current healthcare system in India where physicians are seen as more clinically oriented professionals than are other team members because of their in-depth clinical training and more opportunities for professional development [24]. However, it is equally important to educate other HCWs, as they are at equal risk of acquiring and transmitting infections such as EVD. There is a need to encourage these workers to educate themselves with updated knowledge about infections and other healthcare issues by participating in

educational and related programs. Policymakers and other concerned authorities should also take essential measures to ensure the participation of HCWs in infection control programs. It is also noteworthy to mention that experienced participants (> 10 years) were more knowledgeable as compared to junior ones (< 3 years). The results are in line with other studies that also reported the superior knowledge of experienced HCWs [25]. The possible reason for these findings could be the administrative positions held by senior workers that allow them to participate in different educational forums, conferences, and discussion panels. This may increase the overall knowledge of experienced workers about healthcare issues. This speculation can also be supported by a report that indicated that experienced workers are more effective in dealing with patients in healthcare settings [26]. This finding suggests that junior HCWs should be focused on and interventions should be customized to increase these workers' knowledge about EVD.

The mean attitude of the participants was positive. The attitudes of the physicians were more positive than those of other workers. Physicians' greater knowledge may have influenced their attitudes since the results showed a positive relationship between knowledge and attitude. This finding could be interpreted to mean that physicians are more aware of their patient's clinical condition, and are responsible for counselling patients, which may reflect positivity in their attitudes about the disease.

The results suggest that participants considered EVD a serious illness and acknowledged that protective measures must be used while dealing with affected patients. Another study reported the positive attitude of HCWs about protective measures; however, HCWs failed to translate them into practice [17]. Future studies could target the exploration of practices of HCWs about EVD. The findings highlight the need to encourage HCWs to adhere to standard guidelines to avoid any unwanted circumstances.

Although the National Centre for Disease Control has already issued a guideline in India reporting that HCWs are at risk of acquiring the infection and transmitting EVD, the results of this study are not encouraging, as HCWs do not consider themselves at risk of EVD. However, inconsistencies in the results highlight the need to replicate the study in larger settings to validate the findings of current study. Although radio and television are the highly preferred sources of information about EVD, no conclusion could be drawn with respect to effective sources of information, since some of the results are not consistent with each other. The strength of this study is that it has focused on the area where not much literature is available from India. The results of this study can help the stakeholders and other health officials to evaluate the effectiveness of their policies about EVD. However, the inclusion of a single referral hospital, use of convenience sampling, and potential of interaction between independent variables may limit the generalizability of the results. Moreover, we cannot ignore the tendency of participants to provide more socially desirable responses.

Conclusions

The findings of this study indicate that the HCWs' knowledge about EVD was not optimal; however, their attitudes about EVD were positive. Future studies should be conducted nationwide to validate these results. Interventions should be customized to target areas where participants showed lack of knowledge and negative attitudes.

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Authors' Contribution

AA contributed to concept development, questionnaire design, data analysis and interpretation, manuscript preparation and finalization. MUK contributed to concept development and data analysis, manuscript preparation and finalization. BDK contributed to data collection and manuscript finalization. GSK contributed to data collection, data analysis and interpretation. PGR contributed to data collection, data analysis and interpretation. SA contributed to manuscript preparation and finalization.

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