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Original Research

Response of undergraduates to institutional emergency strategies on Ebola virus disease in Kwara State University, Nigeria

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ABSTRACT

Background: The challenge of Ebola virus disease (EVD) outbreak prompted the need for the development and implementation of strategic alertness and emergency response intervention in prevention and containment of future threats and epidemics. **Objective:** This work was designed to assess knowledge, perception, attitude, behavioral practices, risk vulnerability, and effectiveness of some selected surveillance interventions strategic responses and measures among undergraduate students in prevention and containment of EVD epidemics. Also to analyze the associations among root causes, vulnerability, risk factors, mode of spread, symptoms, prevention, and response patterns. **Materials and Methods:** The study employed a carefully-structured, closed-ended, interviewer-administered, paper-based questionnaire designed to capture information on sociodemographic characteristics, active knowledge on EVD, perception, behavioral attitude and responses from undergraduate students to selected strategic surveillance and intervention measures toward containment of EVD in Kwara State University, Nigeria. This is expected to enhance qualitative understanding of perceived misconceptions, and bottlenecks in relation to EVD root causes, mode of transmission, prevention and control programs and strategies. Data were entered and analyzed using IBM® SPSS® Statistics version 22. Descriptive statistics were reported as frequencies and percentages, and presented graphically using bar graphs and pie charts. Data were analyzed further with Pearson's Chi-square test to determine associations between variables from which inferences were drawn and reported at a significance level of $P < 0.05$. **Results:** Based on respondents' general EVD causes and vulnerability risk factors, handling of corpse (87.3%) was most common, handshake with infected person (95.8%) was the most common mode of spread while regular hand washing with soap and water remained the most pronounced preventive measure. Practices of hand washing after toilet use (93.4%) was most common of the attitude of respondents to EVD, while (38.0%) will relate with EVD survivor. Use of hand sanitizer (83.6%) was a positive response to on - campus EVD intervention. 188 (88.3%) of the respondents' agreed that EVD presents varieties of signs and symptoms, notable among such includes vomiting, diarrhea and dysentery (34.0%); fever/high body temperature and headache (19.1%); profuse bleeding from nose, mouth and other parts of the body (17.0%); joint body and muscle pain (10.1%). Students at higher levels of study and those in the Colleges of Pure and Applied Sciences and Agriculture and Veterinary Medicine, Kwara State University tended to have significantly higher knowledge levels at $P < 0.05$. **Conclusion:** These findings serve as a prototype in EVD and other emerging epidemics awareness campaigns and community social mobilization activities, institutional and community health education and promotion in upholding and sustaining behavioral, cultural, social and ecological measures and guidelines imperative in guiding evidence-based EVD threat and epidemics knowledge and response delivery programs and best practices in the local setting, Africa and epidemics prone territories.

KEY WORDS: Ebola virus disease, intervention, knowledge, questionnaire, undergraduates

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INTRODUCTION

The Ebola Virus Disease (EVD) Phenomenon

Ebola hemorrhagic fever or EVD is the human disease caused by infection of the single-stranded RNA viruses of the genus "Ebola" and family "Filoviridae." Ebola virus was discovered in 1976, following coinciding outbreaks in Zaire, now Democratic Republic of the Congo, and Sudan [1,2]. EVD usually begins with an acute fever, causing death following hemorrhagic symptoms in up to 90% of cases depending on the viral species [1,2]. The known species include Bundibugyo ebolavirus (BEBOV), Sudan ebolavirus (SEBOV), *Zaire* ebolavirus (ZEBOV), *Reston e*bolavirus (REBOV), and Côte D'Ivoire ebolavirus (CIEBOV), also known as, Taï forest ebolavirus. The REBOV strain has caused no human deaths so far but has been lethal to chimpanzees, gorillas, and monkeys [3,4]. In terms of pathogenicity, SEBOV strain leads to case fatality rates of 40-60%, ZEBOV rates range from 60% to 90%, while the BEBOV strain is associated with fatality rates of 25%. The CIEBOV subtype has been implicated in a single nonfatal human case [2,4]. In general, this high fatality rate, the international spread of the virus across borders includes the possible use of the viral isolates as plausible tools for bioterrorism make EVD an important public health concern of global proportions. Consequently, Ebola outbreaks led to widespread fear, locally and internationally sorrow and hysteria including huge commerce, travel and tourism impact and cost [3,5]. The virus is transmitted to people from wild animals and spreads in communities through human-to-human transmission [6]. In humans, outbreaks usually occur following direct contact of person-to-person transmission involving mucous membranes or broken skin with contaminated blood, vomitus, urine, feces, and semen from infected persons [7,8]. During outbreaks, it has been shown that direct contact among humans occurs during traditional funerals practices, as part of ritual handling of corpses, as a major mode of interfamilial transmission [9,10]. In addition, health-care workers caring for Ebola patients without appropriate protective measures due to shortages and poor infrastructure or following exposure to patients with unrecognized EVD were at risk of infection [11,12].

The recent outbreak in West Africa began in Guinea in 2013 [13]. It is the largest and most complex EVD outbreak since the virus was first discovered [14,15]. By October 10, 2014, a total of 8397 cases with 4032 deaths were recorded in five West African countries namely Guinea, Liberia and Sierra Leone, Nigeria and Senegal. The highest reported case counts are from Liberia (4076 cases), Sierra Leone (2950 cases), and Guinea (1350 cases) [16]. The first EVD case in Nigeria was recorded on July 20, 2014, in an acutely ill traveler from Liberia [17]. Before the outbreak, Nigeria had not had an occurrence of the disease; hence the scenario created public fear, panic and confusion, as is usually seen in outbreaks of previously unknown diseases [18]. Furthermore, there was paucity of locally relevant information to guide the key public health measures, implemented to prevent community spread of the disease. The attendant fear associated with an outbreak of EVD is capable of undermining the outbreak control efforts [19]. The odds of the disease moving further to other African countries, especially along the West African coasts with cross boarder commercial and social activities were distressing. Fear of Ebola in densely populated cities like Lagos in Nigeria could spell huge catastrophe, given its history of a weak health system, poor planning and delayed emergency responses. Eventually, Ebola was reported in Lagos, Nigeria in July 2014. By August 31, the WHO epidemiology and surveillance report indicated there have been 21 cases and 7 deaths in Nigeria, while 3685 cases and 1841 deaths have been reported in Guinea, Liberia and Sierra Leone, and Senegal has only one case [20]. The disease was also confirmed in Port Harcourt with possible incidence in other states in the country. Although deadly, Ebola can be prevented by observing simple prevention procedures such as hand washing with soap, use of hand sanitizers, and avoiding contacts with infected patients or body fluids.

The Nigerian government has provided medical assistance for those infected, established isolation centers, while creating more awareness to the public to lessen further spread of the disease. While these steps are crucial, it is equally important to have baseline knowledge data bank which could assist in designing specific change interventions as well as for future assessment of the various interventions being used [20]. The EVD response in Nigeria also borrowed heavily from the good practices implemented in the polio program by establishing an emergency operation center (EOC), led by the Incident Manager, using an Incident Management System (IMS) to coordinate the response and consolidate decision-making. The EOC/IMS structure served as the overall implementing arm of the response for the Ministry of Health and the Nigerian Centre for Disease Control. All partners, donors and response teams should work through the EOC structure and report to the Incident Manager. Another practice adopted from the polio program is the use of dashboard to measure performance and smartphones for contact tracing, also as a way of receiving information as well as house-to-house team inspection [21]. Nigeria, a highly populated country of diverse ethnic, religious and cultural divides with huge percentage of her youth domiciles in various higher institutions of learning ranging from colleges of education, polytechnics and universities requires insight into their perceptions of public health issues as regards knowledge, attitude, and practices in relation to gaining better understanding of infectious diseases outbreak imperative for prompt, appropriate introduction, and routine implementation of intervention measures for surge protection and control of EVD on campuses.

Kwara State University - "the University for Community Development" plays a pivotal role in shaping its internal community as well as surrounding semi-urban settlements. Hence, during the EVD alert period, the university assumed a leading role in adapting universally sanctioned strategies for passive and active surveillance as well as interventions for prevention and potential containment of EVD within and outside the University environment. Notably, among such measures includes regular and consistent hand washing with soap and water, use of hand sanitizer in the school environment and hostels, disinfection and fumigation of the entire premises, infrared thermometer (IRT) for prompt detection of febrile illnesses among students and staff of the university.

In addition, on Friday, August 29, 2014, the College of Pure and Applied Sciences alongside with the University management, organized a public lecture titled "Taming the Vicious Ebola Disaster: How prepared is Africa?" delivered by Professor Oyewale Tomori, a seasoned virologist and regional laboratory coordinator of the World Health Organization (African Region). The guest lecturer stressed the need for communal aggressiveness, massive awareness, sensitization campaign, and eternal vigilance as major ways to contain the spread of the deadly EVD in Nigeria and other parts of West Africa.

The objective of this study is to assess awareness, perceptions or opinions, knowledge levels and attitude of undergraduates to possible EVD cases and effectiveness of some selected surveillance intervention strategic measures and responses of undergraduate students to containment of EVD. Furthermore, to determine plausible associations among variables from which inferences were drawn and reported at a significance level of $P < 0.05$.

MATERIALS AND METHODS

Study Design and Population

The study employed a semi-structured, interviewer-administered, paper-based questionnaire designed to capture information on sociodemographic characteristics, active knowledge on EVD, perception, behavioral attitude, and responses from undergraduate students to selected strategic surveillance and intervention measures toward containment of EVD in Kwara State University, Nigeria. This qualitative aspect was aimed to understand the perceived misconceptions, and bottlenecks in relation to EVD causes, mode of transmission, prevention and control responses.

Sample size determination

To calculate the sample size based on the sample required for this research, the following formula proposed by Yamane (1967) was employed [22]:

$$n=\frac{N}{1+N(e^2)}$$

Where n is the sample size, N is population size, and e is level of precision.

For this research, level of precision (e) was chosen to be 0.0626 (94% accuracy) and the total KWASU students as at 2015/2016 session is 11,525. Using the formula above the sample size was determined as follows:

$$n=\frac{11525}{1+11525(0.0626^2)}=249.65$$

$n \approx 250$

The questionnaires were administered to the determined sample size (250) using nonprobability sampling technique. A total of 213 respondents filled and returned the material while 37 failed to submit the administered questionnaire. This constituted 85% response rate and 15% nonrespondents between the period of March 25, 2014, and September 27, 2015.

Ethical Considerations

All aspects of the study were approved by Kwara State University Research Committee and Ethical Review Board. Verbal and written Informed consent was obtained from the students/respondents. They 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 was emphasized [23].

Data Collection and Analysis

Questionnaires were distributed daily and retrieved every 3 days' interval, and reviewed. Data were entered and analyzed using IBM® SPSS® Statistics version 22. Descriptive statistics were reported as frequencies and percentages and presented graphically using bar graphs and pie charts. The data were then analyzed using Pearson's Chi-square test to determine plausible associations between variables from which inferences were drawn and reported at a significance level of $P < 0.05$. Knowledge was graded based on four EVD domains: Causes/vulnerability risk factors; mode of spread; signs and symptoms; control and preventive measures. Students' attitude to known and unknown suspected cases of EVD and responses to some surveillance intervention measures introduced by the University management to contain EVD were assessed and presented in frequencies and percentages.

RESULTS

General Characteristic of the Studied Population

A total of 213 (94.4%) students' respondents successfully completed a semi-structured, pretested questionnaire. Of which 49.8% of whom were studying in both the College of Agriculture and Veterinary Medicine (AVM) and the College of Pure and Applied Sciences (PAS) with 300-level students being highly represented at 31.5% relative to the other five college categories [Figure 1]. Both genders were found to be equitably represented at 59.2%: 40.8% males to females, respectively. Based on other sociodemographic categories, however, most of the respondents were Yoruba (87.8%), Single (82.6%), and Muslim (56.3%). The age of the respondents ranged from 17 years to 31 years with most of them being 20 years old.

Three-quarters of the respondents lived at off-campus locations, while the rest are housed on campus [Figure 2].

Most of the respondents were aware of the causes and vulnerability risk factors of EVD with 78.9% acknowledging indiscriminate unprotected sex as a factor. Other cause and risk factors attributed to EVD included the consumption of barbecue (86.4%), handling of corpse (87.3%), and scratch or bite by bats or other similar primates [Table 1]. 188 (88.3%) of the respondents' agreed that EVD presents varieties of

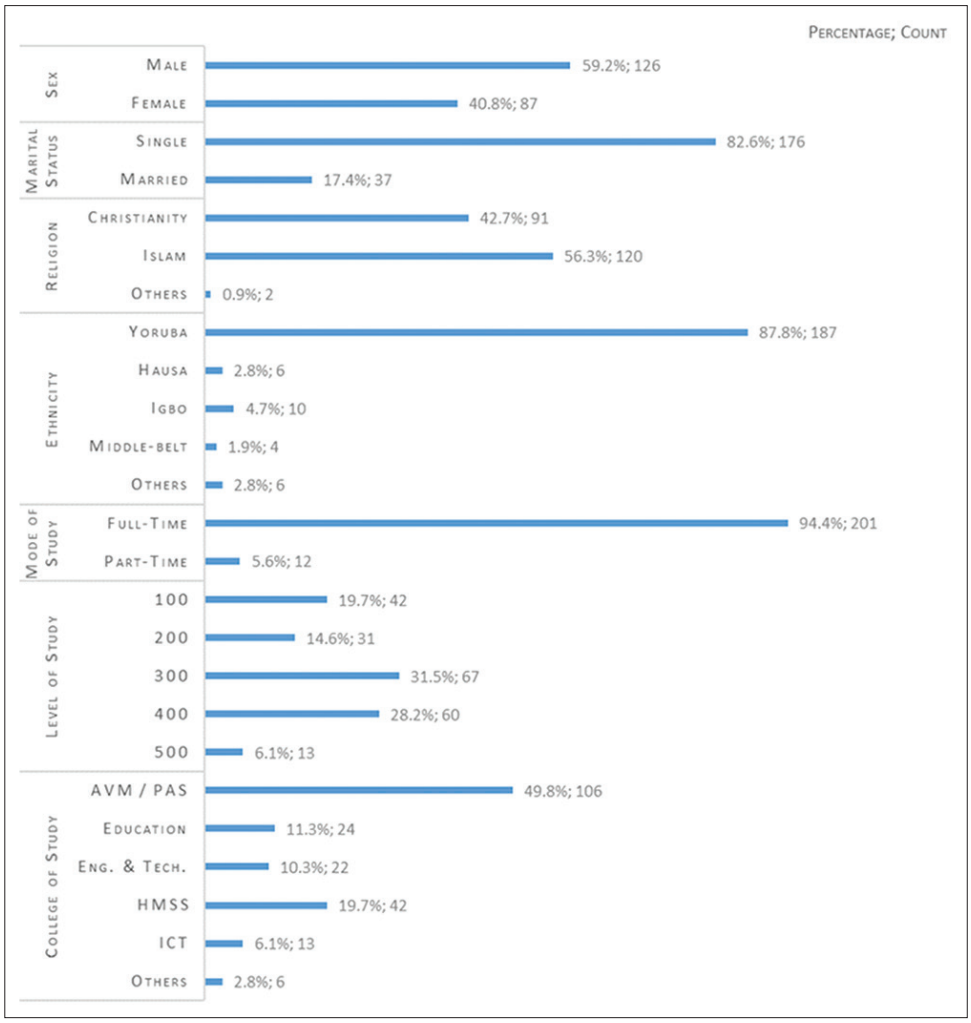

Figure 1: Selected sociodemographic characteristics and academic status of respondents

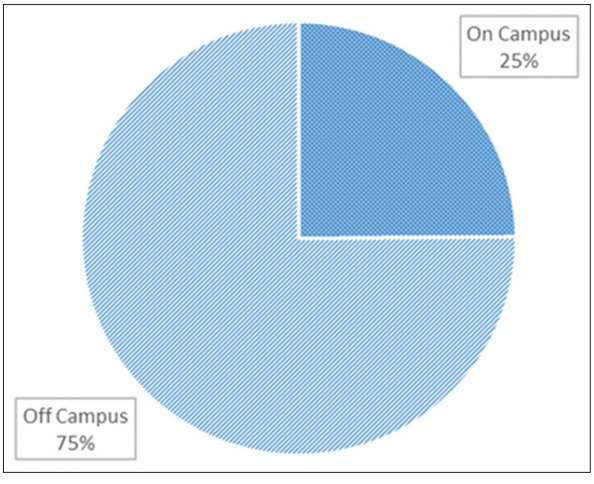

Figure 2: Locations of respondents' term-time accommodation

signs and symptoms, notable among such include: Vomiting, diarrhea, and dysentery (34.0%); fever/high body temperature and headache (19.1%); profuse bleeding from nose, mouth and other parts of the body (17.0%); joint body and muscle pain (10.1%). The respondents' knowledge of the mode of spread EVD was equally high with an average of 91.1% expressing satisfactory knowledge in this regard. Over 90% of them were aware that EVD may spread through contact with an infected person's body fluid, breastfeeding by an infected mother, sex with an infected person, and handshake with infected person. Contact with infected persons (87.3%), their clothing (82.6%), and sharing bed with them (89.7%) comprised the other three modes of spread satisfactorily known by most respondents [Table 1]. They also expressed relatively high knowledge levels in the preventive measures with most of them aware of handwashing or cleansing (88.7%), disinfection or fumigation (81.7%), avoidance of contact with cases (90.1%), and avoidance of consumption of bush meat (94.8%). Students' level of study was significantly associated with knowledge of scratch or bite by bats or similar primates being EVD risk factors (Pearson $x^2 = 10.761$, $P = 0.29$). Approximately, 66% of those with satisfactory knowledge about this were in their third year of studies or higher. The college of study a student is enrolled to is also significantly associated with his/her knowledge that consumption of bush meat is an EVD risk factor (Pearson $x^2 = 12.898$, $P = 0.24$). About half of the respondents who exhibited satisfactory knowledge level in this regard belonged to the Colleges of PAS and AVM.

Table 1: Evaluation of respondents' general EVD knowledge across three domains

Domain	Knowledge level count (%)	
	Satisfactory	Poor
Causes and vulnerability risk factors		
Indiscriminate unprotected sex	168 (78.9)	45 (21.1)
Consumption of barbecue or bush meat	184 (86.4)	29 (13.6)
Handling of corpse	186 (87.3)	21 (12.7)
Scratch or bite by primate or bat	184 (86.4)	29 (13.6)
Domain average (median)	184 (86.4)	29 (13.6)
Signs and symptoms		
Varieties of signs and symptoms are presented	188 (88.3)	25 (11.7)
Mode of spread		
Contact with infected person's body fluid	194 (91.1)	19 (8.9)
Breastfeeding by infected mother	194 (91.1)	19 (8.9)
Sex with infected person	195 (91.5)	18 (8.5)
Touching infected person	186 (87.3)	27 (12.7)
Contact with infected person's clothing	176 (82.6)	37 (17.4)
Sharing bed with infected person	191 (89.7)	22 (10.3)
Handshake with infected person	204 (95.8)	9 (4.2)
Domain average (median)	194 (91.1)	19 (8.9)
Preventive measures		
Handwashing/use of hand sanitizer	189 (88.7)	24 (11.3)
Disinfection and fumigation	174 (81.7)	39 (18.3)
Avoiding contact with cases	192 (90.1)	21 (9.9)
Avoiding consumption of bush meat	202 (94.8)	11 (5.2)
Domain average (median)	191 (89.7)	22 (10.3)

All categories show high levels of significant difference between satisfactory and poor knowledge at $P<0.01$ using nonparametric test of difference. EVD: Ebola virus disease

About 93% of the respondents practice hand washing after toilet use, while 60.1% of them wash their hands after shaking hands with others [Table 2]. Most (74.2%) of the respondents noted that they will not relate with suspected/known EVD cases on campus. Similarly, a relatively high proportion of respondents declared that they will not react favorably to suspected/known EVD cases on campus (63.8%), person(s) whose family member has EVD (58.2%), or will they relate with an EVD survivor (62%). The respondents' gender was significantly associated with their attitude in relating with suspected/known EVD cases on campus (Pearson $x^2 = 4.24$, $P = 0.39$). Whether respondents would relate or not with persons who recovered from EVD is also significantly associated with the respondents' college (Pearson $x^2 = 12.257$, $P = 0.031$) and location of accommodation (Pearson $x^2 = 7.162$, $P = 0.007$) - on campus or off. Most (83.6%) of the respondents claimed that they regularly use hand sanitizers with this attitude significantly associated with their college of study (Pearson $x^2 = 15.674$, $P = 0.008$) and gender (Pearson $x^2 = 7.532$, $P = 0.006$).

About 74% of the respondents believed that EVD leads to the death of victims [Table 3]. Most (79.3%) of them saw the use of hand sanitizer as healthful, 4.7% thought it is unnecessary in the prevention of EVD, while 11.3% thought hand sanitizers are a healthful but stressful interventions and measures. Over 50% of the respondents considered the use of IRTs as healthful surveillance strategies and measures that should be encouraged. However, 26.8% of them had negative perceptions of the use of IRTs, while 8.9% viewed it as healthful but stressful endeavor.

Table 2: Attitude of respondents' to EVD

Domain	Attitude count (%)	
	Positive	Negative
Practices hand washing		
After hand shake	128 (60.1)	85 (39.9)
After toilet use	199 (93.4)	14 (6.6)
Domain average (median)	164 (76.8)	50 (23.2)
Attitude to EVD cases		
Will relate with suspected/known EVD cases on campus	55 (25.8)	158 (74.2)
Reaction to suspected/known EVD cases on campus	77 (36.2)	136 (63.8)
Will relate with person whose family member has EVD	89 (41.8)	124 (58.2)
Will relate with EVD survivor	81 (38.0)	132 (62.0)
Domain average (median)	85 (39.9)	128 (60.1)
Response to on-campus EVD intervention		
Use of hand sanitizer	178 (83.6)	35 (16.4)

All categories show high levels of significant difference between positive and negative attitude at $P<0.01$ using nonparametric test of difference. EVD: Ebola virus disease

Table 3: Respondents' perception of EVD intervention and surveillance strategies

Domain	Attitude count (%)	
	Positive	Negative
EVD leads to victims' death*	55 (26)	158 (74)
Hand sanitizers are healthful and beneficial*	169 (79.3)	44 (20.7)
Infrared thermometers are beneficial	107 (50)	107 (50)
Disinfection is beneficial and effective*	155 (73)	58 (27)

*Categories showed high levels of significant difference between positive and negative attitude at $P<0.01$ using nonparametric test of difference. EVD: Ebola virus disease

Furthermore, about 73% of the respondents believed that the use of IRTs yielded positive results toward detection and control interventions against the emergence and spread of EVD. 61% of the respondents felt that extensive disinfection and fumigation activities previously conducted on campus were healthful, while 19.2% viewed this exercise negatively. Regardless of the foregoing, most (77.5%) believed that the disinfection and fumigation activities had been beneficial.

DISCUSSION

Causes and vulnerability risk factors, signs and symptoms, mode of spread and preventive measure domains were utilized to evaluate respondents' general EVD knowledge. The domain knowledge levels were satisfactory across board. All categories show high levels of significant difference between satisfactory and poor knowledge at $P<0.01$ using nonparametric test of difference [Table 1]. Of all the causes and risk factors attributed to EVD, handling of corpse (87.3%) was most pronounced [Table 1]. In the same vein, (34.0%) respondents' agreed that EVD presents vomiting, diarrhea, and dysentery as the most pronounced signs and symptoms while handshake with infected person (95.8%) occurred in highest frequency of all mode of spread of EVD highlighted [Table 1]. Substantial proportion of the respondent (94.8%) agreed that avoidance of consumption of bush meat was most embraced of the preventive measures

[Table 1]. This claim was in support of earlier publication by Samuel *et al.* [24] that the Ebola outbreak of 2014, in West Africa originated from Gueckedou in southeastern Guinea was linked to bush meat after it was learned that the first case came from a family that hunted two species of fruit bat, *Hypsignathus monstrosus* and *Epomops franqueti* [25]. A 2-year-old child from that family died from the disease on December 6, 2013. The campaigns then stated that if you know that the Ebola virus is introduced in one area, its probably an extra good time to stop eating bush meat.

Practice of handwashing after handshake and after toilet use are positive attitude embraced by the respondents. 55 (25.8%), a relatively lower proportion of the respondent will relate with suspected/known EVD cases on campus compare to 158 (74.2%) that will not. In the same vein, 81 (38.0%) will relate with EVD survivor while 132 (62.0%) will not. Understanding of the risk and the highly infectious nature of the disease warranted the clear-cut demarcation in the attitude demonstrated by the respondent [Table 2].

A high EVD knowledge level was generally expressed by the undergraduates indicating that literacy level could be an important factor when compared to study participants drawn from the general public with varying levels of education [6]. Findings from this study also highlight the need to improve cross-cutting education specifically on health, as student not in agricultural/veterinary medicine/natural and physical sciences-related programs exhibit some deficiencies in their knowledge levels [Figure 1].

The apprehension accompanying the recent EVD outbreak may have considerable implication in its management and that of other infectious diseases [19]. The majority of the respondents to this study generally expressed negative attitudes to EVD cases including the recovered ones. An opportunity for further enlightenment should be a focus on the potential transmission risk factors posed by recovered persons [3,5,6]. However, preventive measures such as the use of hand sanitizer, hand washing, disinfection and fumigation and IRTs made available through the University's surveillance and intervention strategies were well embraced by the undergraduates and should be sustained. This claim was substantiated by the fact that majority of the respondent 169 (79.3%) saw the use of hand sanitizer as being healthful and beneficial in the prevention of EVD, 155 (73%) accepted disinfection as beneficial and effective while over 50% of the respondents considered the use of IRTs as an early alert warning healthful surveillance tool that should be encouraged [Table 3].

Regardless of the foregoing, most of the respondent 174 (81.7%) believed that both disinfection and fumigation exercises had been beneficial [Table 1]. We found that high level of EVD awareness notwithstanding, the wide belief that infection with EVD leads to certain death still persisted. This may distort or over-shadow plausible information available about the disease and its control measures [19]. Indications have begun to emerge that such hysteria may extend to similar viral hemorrhagic fevers (VHFs) as evident in the recent 2015, resurgence of Lassa fever in Nigeria [26,22].

Findings from the research are expected to reveal possible avenues to strengthen the health system to prevent and control EVD and other allied infectious diseases especially at higher institutions of learning in the developing world. Furthermore, generated findings are expected to influence the institution of evidence-based decision and strategic policy making process involved in preventing transmission of EVD in Kwara State University and her environment [22-28].

CONCLUSION

The findings from this study underscore the importance of literacy in ensuring a healthful population. However, there is a need to direct more effort toward addressing prejudices that may be antithetical to strategic efforts aimed at controlling EVD and other infectious diseases. We recommend effective communication through media to be included in surveillance and intervention measures to ensure significant buy-in of target populations. Similar studies should be replicated in various community types to reveal unique features that may significantly influence performance of public health response strategies. In the same vein, health education and promotion programs and activities into the university curriculum most especially at lower level are recommended to brace up knowledge level of students' on EVD in the nonbiological science related disciplines would be of great support to strengthen EVD emerging threats and epidemics prevention and control activities.

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