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Awareness and Practice of Lassa Fever Prevention among Health Workers in a Tertiary Health Facility in a Southern Nigerian City

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Abstract
Background: The Lassa fever outbreak has claimed the lives of numerous healthcare personnel in recent years and this reflects the poor infection prevention control practices and ill-preparedness for such contagious epidemic. **Objective:** The aim of the study was to assess the knowledge and quality of practice with regard to prevention of Lassa fever transmission among health workers.**Methods:** In this cross sectional study 230 health workers including intern nurses & doctors were assessed using pretested self- administered questionnaire adopting the WHO & Nigerian Centre for Disease and Control (NCDC) recommended prevention protocols against the deadly virus. Data were analyzed using Statistical Package for Social Science version 25.**Results:** Two hundred and twenty-four completed questionnaire (97.4% response rate) were analyzed. A vast majority 172 (76.8%) possessed satisfactory knowledge about Lassa fever transmission and infection prevention whereas only 77(44%) actively practiced the recommended protocols for infection prevention against Lassa fever virus satisfactorily. In the regression analysis, duration of service was the only significant factor positively associated with satisfactory knowledge on Lassa fever infection prevention ($X^2_9(0.05)$ = 19.559, P value= 0.001)**.** Almost all the participants practiced hand washing before and after attending to patients. However, only 1.34% of the respondents utilized full personal protective equipment (PPE) kits consistently while attending to high risk patients. Overall, their infection preventive practices were not significantly influenced by their occupation designation (P=0.586), duration of service or training in years and demographic profile such as: gender (P=0.118), age (P=0.840), marital status (P=0.819) and residing in urban area (P = 0.561). There was a weak positive correlation between knowledge scores and practice scores (r=0.137).**Conclusion:** It is recommended that the standard infection prevention practice protocols be adopted consistently in caring for patients with suspected or confirmed endemic viral infection like Lassa fever. Hospital management and policy makers should provide adequate PPE to minimize nosocomial infection in healthcare workers. Regular hospital-based seminars on infection prevention is recommended.
Keywords: Nosocomial infection, hand washing, personal protective equipment, healthcare workers, endemic viral infection.
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BACKGROUND/INTRODUCTION

Emerging vector-borne viral diseases have imposed a significant threat to human lives and existence especially in low and middle income countries. [1, 2] Lassa fever has become one of the most dreaded viral infections due to high "case fatality" rate.[3, 4] Health workers who are involved in caring for the infected patients are at risk of being infected due to the high contagious characteristic of the virus. [5-7]Several cases of deaths among health care workers have been reported in Nigeria in the last five years.[8]

The Lassa fever disease was first described in the 1950s and the virus was identified in 1959 after 2 missionary nurses died from the disease in the Nigerian town of Lassa.[9] Lassa fever is now endemic in Nigeria with outbreaks almost every year in different parts of the country.[10] Yearly peaks are observed between December and February during the farming season where the rats are dislodged from bushes.[9] Primary infection is by contact or exposure to food or other substances contaminated by excreta, urine or saliva of the infected rodents.[11] Secondary human to human transmission occurs by direct contact with infected person and body fluid or blood of infected individual.[11,12]

Lassa fever virus is a single stranded RNA virus of the family Arenaviridae belonging to the genus Mammarenavirus.[13] The natural host is the rodent Mastomys natalensis, a common household rat in West Africa.[14] Recently other reservoirs have been described including Mastomys erythroleucus, (Guinea multimamate mouse) found in Nigeria and Guinea, and Hylomyscus pamfic (African wood mouse) found in Nigeria.[13] The annual outbreak of Lassa fever infection is estimated at 100,000 to 300,000 cases with about 50,000 mortalities.[4-6,15,16] Out of these cases 20% suffer severe disease while 80% are asymptomatic.[14,16]

Many infections are subclinical, a high index of suspicion, given the difficulties of clinical diagnosis, is

needed when travelers from West African countries present with a fever of unknown origin, with symptoms appearing up to 21 days after leaving the endemic area.[17] The main feature of the illness is impaired or delayed cellular immunity leading to fulminant viraemia.[18] It is a disseminated systemic primary viral infection.[18] The prevalence of antibodies to the virus in West Africa ranged from 4 to 55%. [19-21]

The possibility that Lassa fever virus could be used as a biological weapon has raised the need for greater understanding of Lassa fever and more effective control and treatment program with the aim of complete elimination.[18,22] Recently several deaths due to the virus have been reported among health workers who came in contact with the infected patients in the course of rendering care in hospitals.[9,10] Sadly in some of such situations the transmission from infected hospitalized patients to health workers who suffered significant morbidity and mortality was blamed on the ill-prepared state of the health facilities and the affected health workers.[9,10,23] Hence this study seeks to determine the level of consciousness and practices in battling with the deadly disease.

Hospital acquired infection is a serious problem that often times put the safety of the health workers at risk. The incidence of nosocomial infection is reported at between 5 and 35% of hospitalized patients.[24-26] Hospital acquired infection increases patients' mortality, length of hospital stay, and significant financial burden.[24] As the outbreaks of the deadly disease continue to surface in our hospitals every year and considering the vague symptoms especially in early stages of the infection, there is need to maintain high index of suspicion among health care personnel both staff and trainees. Also correct and consistent practice of standard infection precaution in line with WHO and Nigerian Center for Disease Control recommended protocols[23, 27] are important to prevent infection transmission and mortality by the emerging deadly viruses such as Lassa fever.

MATERIALS AND METHODS

Research design

The study design was a descriptive cross sectional health facility--based survey.

Research Setting and Study Population

The study was conducted among health workers in the University of Calabar Teaching Hospital (tertiary referral hospital) situated in southern Nigeria between 1st May 2019 and 30th September 2019. From records there are about 900 clinical staff mostly nurses and medical doctors including interns. This made the study population. Admissions to wards are usually done through 'outpatient' clinics or via accident and emergency unit. Nurses including intern nurses, doctors and house officers and other cadre of clinical health workers in these areas are usually the first contact healthcare personnel to attend to patients (first responders).

The research population comprised all these cadres of health workers who were directly involved in patients care and often come in close contact with patients in these units during the period of survey. Those on leave were exempted.

Inclusion criteria

- Being an intern (BSc) nurse
- Being an intern doctor (House officer)
- Being a staff nurse in the maternity, accidents and emergency unit and medical and family medicine out-patients departments
- Being a medical doctor in the units or departments above
- Other health workers involved directly in patients care in the units or departments above.

Sampling Technique

Systematic random sampling was employed to recruit the respondents. The first participant was selected by simple balloting. There after a sample interval was used in selection until the sample size was reached. The sample interval was derived by dividing the total number of the study population by the calculated sample size.

Instrument of data collection

Semi structured self-administered questionnaire was used to extract information. The questionnaire was pretested among 20 students of School of Health Technology located in Calabar to ensure reliability and validity. To further ensure the reliability and subsequently, the validity of the questionnaire, a Test-re-Test (intra-observer) reliability testing was also carried out. A reliability coefficient of 0.86 at an alpha level of 0.05 was realized.

Determination of sample size

The sample size was determined using Cochrane formula:

$n= (Z\alpha/2)^2 P(1-P)/d^2$

Where n is the sample size, Zα is the standard deviate, value of 1.96, P (57.3%) is the proportion of satisfactory infection prevention practice among health workers (from a previous study in Ethiopia) d=0.05 precision at

95%confidence interval. Allowing for at least 10% attrition, the sample size of 230 was adopted.

Methods of data collection

The questionnaire consisted of three different sections. The first part extracted information on the socio-demographic profile of the respondents. The second part assessed the level of knowledge including epidemiological and clinical information on the virus as well as its transmissibility and prevention. The third part evaluated their infection prevention practices regarding Lassa fever outbreak and control. The content of this section included contents from the Nigerian Center for Disease and Control (NCDC) infection prevention protocols[16] and the WHO (2017) guidelines[17] on Lassa fever prevention. Furthermore, a review of literature on the subject was done and the adopted protocols modified to suit the purpose and setting of the study[23, 24, 28-31]. The section also assessed their preparedness and immediate actions in case of the viral infection outbreak. The 2nd section has 28 items related to the virology, ecology, epidemiology, and transmissibility of Lassa fever. This section also assessed their knowledge of preventive measures regarding nosocomial infection which includes hand hygiene, utilization personal protection equipment (5 items) and safe injection and waste disposal practices (4 items). Knowledge of hospital preventive measures against transmission of viral hemorrhagic diseases which involves routine cleaning of floor and contact surfaces with 5% Sodium hypochlorite solution (4 items), safe waste handling and disposal (4 items), handling and disinfection of patients care equipment including linen (5 items).

Their knowledge scores were assessed using "Correct", "Incorrect" and "I don't know" options, while their practices were assessed using multiple scenario –based items with "Always", "Often" and "Rarely or never" options. Consistent practice refers to adopting a measure always in the preceding 3 months. In the different infection control practices, a zero score was given for each incorrect or "I don't know" response; 1 score was given for each correct response. The Correct answers were calculated to obtain the total score. Their total scores were computed differently and extrapolated and rated in percentages. A score below 50% was considered poor, 50 -60% average, 60 to 69% good and 70% and above was considered very good/excellent in each category. Those with excellent scores were considered satisfactory. In view of the highly contagious nature of the virus, scores below 70% were rated unsatisfactory.

NCDC Lassa fever case identification criteria[16]

1. **Alert case**
   Any person who has an unexplained fever (i.e. malaria and other common causes of fever have been ruled out) with or without bleeding.
   Or any person who died after an unexplained severe illness with fever and bleeding.
2. **Suspected case**
   Patient with fever for 3-21 days with a measured temperature at 38°c or more with one or more of the following: vomiting, diarrhea, sore throat, myalgia (muscle pain), generalized body weakness, abdominal bleeding ,abdominal pain.
   Any of the following scenarios should raise the index of suspicion:

a. Patient has not responded to standard anti-malaria treatment and treatment for other common infectious causes of fever within 48=72 hours.
b. History of recent contact with a probable or confirmed case of Lassa fever within 21 days of onset of fever.
c. Patient with history of fever and history of travel to high risk/burden area of Lassa fever.
d. Contact with body fluids or tissues of a dead patient with a febrile illness, symptoms and signs highly suggestive of Lassa fever leading to death.

3. **Probable case (Clinical)**
   A suspected case who has one or more of the following complications

a. Hearing loss
b. Facial or neck swelling
c. Seizures
d. Restlessness
e. Confusion
f. Hypotension (SBP< 90mmHg in adults and 70mmHg in children)
g. Oliguria (<0.5ml/kg/h for 6 hours)
h. Abnormal bleeding

And **any** of the following laboratory evidence:

a. Proteinuria and/or microscopic hematuria
b. Elevated urea ≥ 45mg/dl or creatinine ≥ 2 mg
c. Elevated transaminases (liver enzymes, ALT & AST)

d. Reduced platelets count ≤ 90000 cells/ml^3

Absence of the above listed complications and laboratory evidence does not rule out Lassa fever.

4. **Confirmed case**

A suspected case or probable case with a positive laboratory test using real time polymerase chain reaction.

Ethical consideration

Prior to the commencement of the study, a formal approval was obtained from the Cross River State Research Ethics Committee with approval number (CRS/MH/HREC/019/Vol.V1/167). Participation was voluntary. A written informed consent was obtained from each respondent and their identity was concealed.

Procedure for data analysis

All returned questionnaires were assessed for completeness. Data were then analyzed using Statistical Package for Social Science (SPSS) version 25. Categorical data were presented in simple proportion and percentages. An exploratory analysis was done that showed the nature of the distribution of the respondents by knowledge of Lassa fever and Prevention practices. A multinomial logistic regression was used to fit the data at P=0.05 level of significance. The response variable was re-coded to satisfactory and unsatisfactory. Pearson correlation test was performed to assess the relationship between knowledge and actual infection prevention practices.

RESULTS

Out of the 230 respondents surveyed, 224 (97.4% response rate) completed questionnaires were included in the analysis. Majority of them were medical house officer or doctors and nurses in their twentieth year of life and only about 10% were medical personnel of 10 years or more experience (table 1).

Table 1: Socio- demographic characteristics of the respondents

Variable	Frequency n=224	Percentage (100%)
Age		
15-20yrs	44	19.6
21-25yrs	129	57.6
26-30yrs	40	17.9
≥ 31yrs	11	4.9
Sex		
Male	38	17.0
Female	186	83.0
Marital status		
Single	184	82.1
Married	40	17.9
Residential Address		
Rural	24	10.7
Urban	200	89.3
Designation		
Nurse interns	92	41.1
Medical house officers	52	23.2
Staff nurses	70	31.3
Medical doctors	5	2.2
Health assistants	5	2.2
Years of postings/ experience		
Less than 1year	48	21.4
1-4 years	50	31.3
5-9 years	82	36.6
≥10year	24	10.7

The respondents' knowledge on epidemiological and clinical feature of Lassa fever as well as preventive protocols were assessed and rated below (table 2 & 3). Most of them, 216 (96.4%), knew that Lassa fever is a hemorrhagic viral disease transmitted by rodents while 109 (47.3%) possessed satisfactory knowledge on the NCDC case identification criteria. Whereas 172 (76.8%) possessed excellent/satisfactory knowledge on the virus characteristics and prevention but only 77 (44%) transform this into actual prevention practices against the viral infection at their work place. Their practices with regards to PPE is shown in figure 1 below.

The study revealed that all the participants (100%) regularly wash their hands with soap or use alcohol-based hand sanitizers before and after attending to high risk patients. Latex gloves was consistently utilized by

212 (94.6%) of the HCW, 186(83, 1%) used protective boots and other foot coverings, eye shields was utilized by 60 (26.8%) and 91 (40, 7%) wore aprons and gowns. However only 5(2.23%) used full PPE kits. Enquiry was made about their immediate personal action to minimize infection spread in the unfortunate situation of exposure to suspected or confirm cases of Lassa fever and their reactions were as follows: immediate hand-washing with soap or use of hand sanitizers 224 (100%), reporting to hospital authority 57 (24.1%), self-quarantine and regular temperature check 214 (95.5%) while only 15 (6.7%) considered prophylactic medication in addition to other precautionary measures.

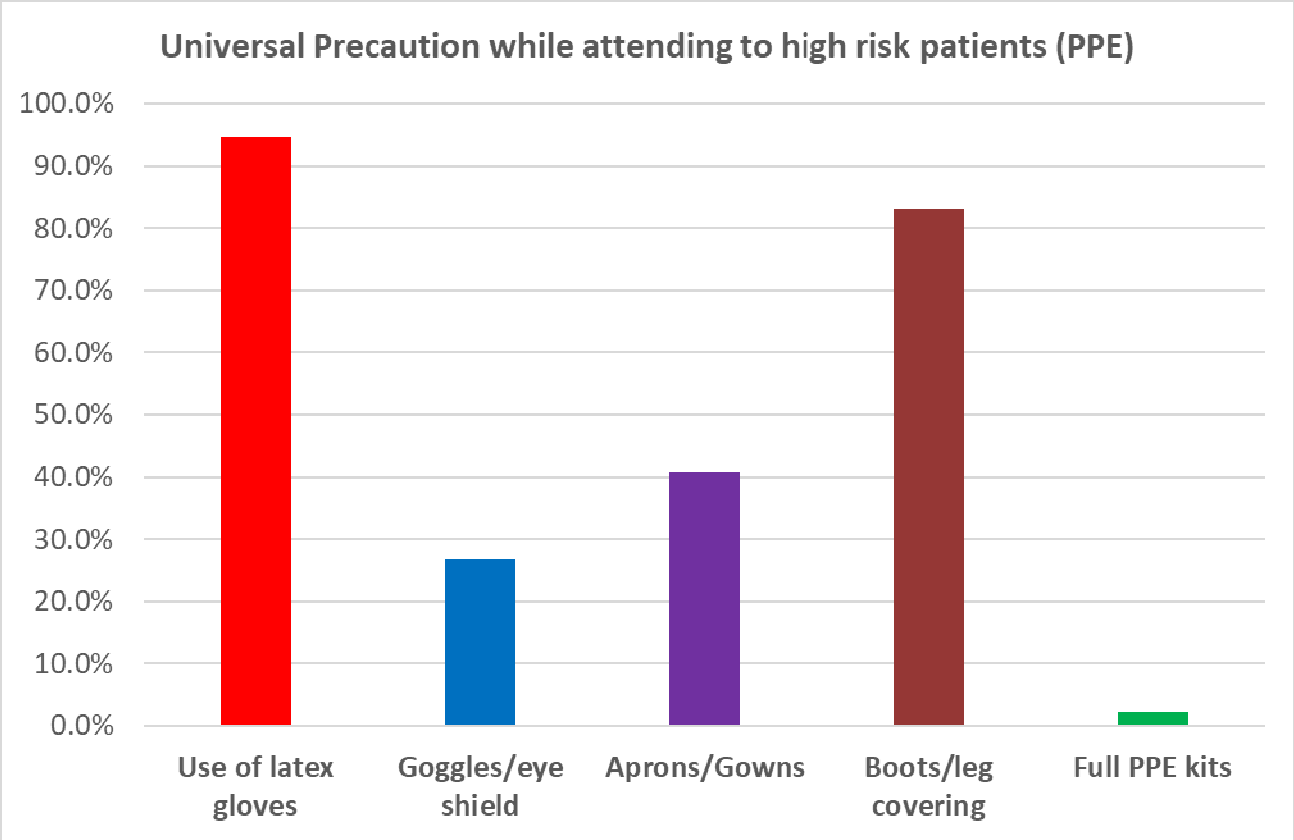

Fig. 1: Components of Personal Protective Equipment (PPE) consistently utilized

Table 2: distribution of respondents by knowledge of Lassa virus & prevention

KNOWLLEDGE ON LASSA VIRUS					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	POOR	2	.9	.9	.9
	AVERAGE	2	.9	.9	1.8
	GOOD	48	21.4	21.4	23.2
	VERY GOOD/ EXCELLENCE	172	76.8	76.8	100.0
	Total	224	100.0	100.0	

Table 3: distribution of respondents by practice of Lassa virus prevention

Knowledge on prevention					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poor	10	4.5	4.5	4.5
	Average	24	10.7	10.7	15.2
	GOOD	90	40.2	40.2	55.4
	VERY GOOD/EXCELLENCE	100	44.6	44.6	100.0
	Total	224	100.0	100.0	

To determine the factors that positively associated with satisfactory knowledge on the subject among the respondents, the likelihood ratios were compared. The “Model fitting information” table 4 contains a Likelihood Ratio chi-square test, comparing the fit of the model with all the complete set of predictors. It is Statistical significant, indicating that the full model represents a significant improvement in fit over a null model since the p-value=0.006 < 0.05.

Table 4: Model fitting for logistic analysis

Model Fitting Information						
Model	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC	BIC	-2 Log Likelihood	Chi-Square	df	p-value
Intercept Only	149.502	159.737	143.502			
Final	156.387	268.971	90.387	53.115	30	.006

These results contain likelihood ratio tests of the overall contribution of each independent variable to the model. Using α=0.05 level of significance, it can be seen from the table 5 that duration of service in years was the only significant predictor variable with $\chi_9^2(0.05) = 19.559$ and p-value of 0.001. Other variables were statistically insignificant.

Table: 5: Determinants of satisfactory knowledge on Lassa transmission &prevention among the respondents

Likelihood Ratio Tests						
Effect	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	df	p-value
Intercept	156.387	268.971	90.387[a]	.000	0	.
DESIGNATION	143.131	214.775	101.131	10.744	12	.551
Duration of service in years	157.946	239.825	109.946	19.559	9	.001
GENDER	156.034	258.384	96.034	5.647	3	.130
MARITAL STATUS	153.317	255.667	93.317	2.930	3	.403
RESIDENTIAL AREA	151.059	253.409	91.059	.672	3	.880
AGE	88.688	98.843	82.825	5.034	3	.122

Similarly, their infection prevention compliances with regards to Lassa fever prevention in the hospital were subjected to the same statistical model above to determine the contributing factors that influence their behavior. Table 6 summarizes the major factors and their statistical values.

Table: 6: Predictors of satisfactory preventive practice against Lassa fever infection.

Demographic factors		Estimate	Wald	p-value	95% Confidence Interval	
					Lower Bound	Upper Bound
	DURATION OF SERVICE	.146	.154	.695	-.584	.877
	DESIGNATION	-.170	.297	.586	-.780	.441
	SEX	1.106	2.441	.118	-.282	2.494
	MARITALSTATUS	-.203	.052	.819	-1.938	1.532
	RESIDENCE	.506	.339	.561	-1.199	2.211

Using α=0.05 level of significance, it can be seen from the table 6above that all the predictors (duration of service in years, gender, age, marital status, designation residential area) were not statistical significant with p<0.05.

To assess the relationship between knowledge and preventive practice against Lassa fever, the knowledge and practice scores were re-coded as satisfactory and unsatisfactory as described in the methods and then we performed bi-normal logistic regression. The result shows a positive but weak correlation between knowledge on Lassa fever and practice of prevention protocols (r=0.137 and P=0.041).

DISCUSSION

On the demographic features of the participants, we found that nurses cadre contributed more than 60%of the health personnel sampled .This reflects the distribution of clinical health staff cadres in most public hospitals in the country. This is similar to previous results reported by other studies in the sub-Sahara Africa and Asian countries.[26-28] Bulk of the respondents were in the twentieth years of life. Similar demography has been reported in a Middle East study. [29]A vast majority of the respondents, 186 (83.0%) were female indicating the female dominance in nursing care in most public hospitals in the tropics as also been shown by other studies.[30-32]

As Lassa fever infection among health workers carries a high fatality rate,[33,34] it is necessary to adopt practical measures that would protect this seemingly young population of health professionals from untimely demise that would not only be catastrophic to the families concerned but may worsen the deficit in healthcare

delivery especially in low resource setting. The CDC has demonstrated that Lassa fever has become a highly fatal disease in Nigeria with the young productive age group being most affected.[16,35] A total of 368 suspected cases of Lassa fever was reported in Northern Nigerian state between 2015 and 2018 with case fatality rate as high as 54.0%.[12]

The study revealed that about three-quarter of the respondents exhibited satisfactory knowledge on the Lassa viral ecology, transmissibility and prevention. However, only 44% could satisfactorily practice the prevention protocols regarding the infection control. This finding is similar to that from an Ethiopian study which reported that 57.3% of healthcare workers evaluated had good practice infection prevention in hospitals.[36] A recent report has shown that 73.7% of the health workers infected during the 2019 outbreak never had any form of training on general infection prevention and control or on Lassa fever specific personal protective equipment (PPE) in the preceded one year prior to them being infected.[10,12] Other studies had shown that a huge knowledge cap exists between knowledge accumulated over the years and implementation of infection control and this is worse in resource poor setting.[37,38]

Majority of the health workers infected by this deadly virus must have failed to adhere to infection prevention protocols or the institution was lacking basic personal protective devices. A previous study has suggested that inadequate knowledge of infection prevention may scare health workers from attending to patient with deadly infectious disease.[39] Reviewing medical and nursing students teaching curricula to include protocols for prevention and control of deadly emerging infectious diseases may enhance their performance during clinical practice.

The study revealed a week positive correlation between knowledge and actual practice. Similar finding was reported in North-Western Nigeria.[40] This cap between knowledge and actual practice regarding infection prevention in the face of a deadly contagious viral outbreak is a serious concern. The substandard practice especially with regards to PPE could have been influenced by inadequate supply, institutional policy and challenges in acquisition and distribution of basic consumables among other factors. Studies have shown that utilization of PPE is dependent on availability.[41-43] Another study had reported that only a minute proportion of healthcare workers had access to PPE due to limited supply which was blamed on administrative challenges.[44] The NCDC recommends that standard precaution be applied for all patients at all times.[17] In the unfortunate situation of accidental exposure to infected patients, only a minute proportion of the respondents (6.7%) considered prophylactic medication. The NCDC and WHO recommended among other precautions, the use of Ribavirin for post exposure prophylaxis.[16,17]

In assessing for the predictors of knowledge and practice among the participants, we found that only the duration of service was the only significant factor influencing the level of knowledge while their quality of the viral infection practices were positively related with other social factors such as residing in urban center, age, gender and marital status. This is in keeping with previous reports. [37,38] However, satisfactory practice of infection prevention was not influenced by their job cadre, designation or socio-demographic characteristics. This finding is contrary to many previous reports.[37,38,40.] The institution where the study was conducted is a tertiary training facility known to organize monthly seminars and workshops where topics such as infection control are discussed. Attendance to such clinical teaching meetings is usually mandatory and often not limited to only physicians.

CONCLUSION

Emerging endemic viral infections have continuously threaten human lives and existence and have become a major cause of death among. Healthcare workers are at risk of acquiring the infection during their duties. This study has revealed the cap between knowledge and actual practice have suggested factors that need to be improved to minimize nosocomial infection and untimely deaths among health personnel. Training and retraining of all cadre of health workers as well as provision of basic PPE by the hospital authorities may make hospital environment safer.

LIMITATION

The main limitation of this survey was its relying on information volunteered by the respondents. It is possible that some vital information might be concealed.

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ETHICAL APPROVAL

Formal approval was obtained from Cross River State Ministry of Health Research Ethics Committee before the

commencement of the study. Participation was voluntary and informed consent was obtained from every respondents and confidentiality was assured.

FUNDING AND CONFLICT OF INTERESTS
There was no external funding for the research. There is no conflict of interest.

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