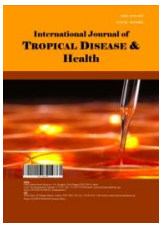

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Viral Haemorrhagic Fever Epidemics and Health Workers: Investigating the Level of Preparedness in a Tertiary Hospital in Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors contributed to the funding of the study. Authors COI, OEO and DSO conceptualised the study. Authors AAA, ECI, JIA and COI designed the study. Authors COI and OEO wrote the protocol. All authors participated in writing the draft of the manuscript. Authors COI, OEO and DSO performed the statistical analysis and managed the analyses of the study. Authors VIO, TJ and JA managed the literature searches. Authors FO and TVT collected Data for this study. Author DSO supervised this research work. All authors read and approved the final manuscript.

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ABSTRACT

Aim: This study assessed the state of infection prevention and control (IPC) with an emphasis on a hospital's preparedness for mitigating the spread of viral haemorrhagic fevers (VHFs) to staff.
Methods: This convergent parallel mixed-methods study obtained data on IPC using an observational checklist in clinical departments and units; key informant interviews of stakeholders; and a structured self-administered questionnaire with frontline health workers. Both qualitative and quantitative data analyses were conducted to determine the IPC practice and level of preparedness of the hospital for the threat of VHFs.
Results: The frontline clinical staff who responded to the questionnaires were aged 31 – 40 years (53.8%), male (50.3%) and medical doctors (72.2%). Some of the respondents had received training in hand washing (41.5%), use of PPE (35.1%) and standard precaution for VHFs (26.8%). Fewer respondents consistently used gloves (36.8%), face masks (8.6%), aprons (8.5%) and

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sharps containers (26.7%) during patient care. Amenities available for IPC varied across the 184 clinical service points in the hospital's 19 departments. More service points had waste bins (86%), washing sinks (80%) and running water (74%) while a few had a standard operating procedure for hand washing (6%) and cabinets for storing PPEs (12%). The most significant challenge to the use of IPC measures was the inadequacy of amenities such as full PPE gear, respirator, aprons, and face masks within the clinical service points.

Conclusion: There is a poor level of preparedness for outbreaks of VHFs and this calls for strengthening administrative, engineering and environmental control in health facilities to stem outbreaks among health.

Keywords: Haemorrhagic; epidemics; health workers; body fluids; ebola disease.

1. INTRODUCTION

Viral hemorrhagic fevers (VHFs) are epidemic-prone infectious febrile illnesses caused by several families of RNA viruses with attendant morbidity and mortality on the human population including health care workers (HCWs) [1]. VHFs result in potentially lethal disease syndrome characterised by bleeding from orifices, fever, malaise, edema, and shock. Humans are primarily infected through contact with urine, faecal matter, saliva, or other body excretions from infected rodents, while the secondary transmission is either through close contact with infected people and their body fluids or contact with objects contaminated with infected body fluids, [2] thereby making frontline HCWs particularly vulnerable. [3] The detection of a single case in a population constitutes an epidemic of VHF. [4] Health service institutions are expected to have the knowledge and capacity to effectively anticipate, respond to, and recover from the impacts of epidemic-prone conditions. [5] However, such epidemics can seriously undermine the health systems of many developing countries which are resource-constrained, and poorly prepared to deal with the current high burden of diseases and emerging health risks [6].

A report following the 2014 outbreak of Ebola disease in West Africa revealed that HCWs were 21 to 32 times more at risk of contracting these viruses compared to the general population. [7] The 240 deaths among HCWs during this outbreak in the region, [8] included 3 of the 19 HCWs infected in Nigeria [9,10]. During the more recent 2018 Lassa fever outbreak, four deaths were reported among the 16 HCWs infected in six states in Nigeria [11]. The significant risk of contracting VHF among HCWs underscores the need to strengthen IPC practices in health facilities.

Prevention remains the best approach in dealing with such outbreaks since treatment options are limited. This can be achieved by raising the level of hospitals' preparedness for VHF outbreaks, improving staff capacity to identify risks, and provision of critical infrastructure for the safe management of those affected. Hospitals' Infection Prevention and Control (IPC) measures are of central importance to the safety of patients, HCWs, and the environment. [12] The use of basic IPC precautions such as standard precautions are the cornerstone for providing safe health-care. [12]

The transmission of infection to HCWs is highly preventable where IPC strategies are in place. The drop in the proportion of infected persons in the last Ebola pandemic in West Africa from 12% in July 2014 to 1% in February 2015 was attributed to stronger IPC measures. [13] Gaps in IPC measures were reported in clinical settings where infected health workers were employed. [14] The frequently reported administrative, engineering, and environmental gaps in IPC measures included poor regulations, poor employment conditions, defective IPC practice, lack of PPEs and inappropriate use of PPEs [15,16].

2. OBJECTIVE

This study assessed the IPC measures and preparedness for epidemics of VHFs in all clinical service points in a referral hospital. The clinical service points are the clinics, injection rooms, theatres, wards, and laboratories. Specifically, this baseline study which assessed the structural provisions, environmental hygiene, health workers' training, and compliance with standard IPC measures is the initial phase for a planned intervention aimed at improving IPC practice in the hospital. The consistent use of IPC in this study meant the regular and appropriate utilization of IPC provisions in all conditions that warrant their use without default.

3. RESEARCH METHODOLOGY

3.1 Study Area

Rivers State is a major oil-producing state in Nigeria situated in the South-South geopolitical region of the country. [17] Healthcare in Rivers State like other parts of the country is delivered through primary, secondary, and tertiary health facilities which are largely administered under the local, state, and federal government respectively. [6] The tertiary health facilities in the state include the University of Port Harcourt Teaching Hospital (UPTH), Rivers State University Teaching Hospital, Kelsey Harrison Hospital, and Rivers State Dental and Maxillofacial Hospital. [18]

3.2 Study Site/Population

UPTH is a 950-bed tertiary health facility with sixteen clinical departments and over 2,800 clinical and non-clinical staff. It is in Obio-Akpor LGA and shares a boundary with the University of Port Harcourt. UPTH is a referral health facility that provides tertiary medical services to inhabitants of Rivers State and has in its employ, an infectious disease specialist. It also serves as a training facility for all cadres of HCWs,

3.3 Study Design

This mixed-method study involved the concurrent application of qualitative and quantitative research approaches to enhance the accuracy and comprehensiveness of the findings (Tashakkori and Teddlie, 2010). [19]

3.4 Sample Size

The minimum sample size of 205 was calculated for the quantitative questionnaire survey of HCWs while the qualitative interview recruited key informants until data saturation was achieved.

3.5 Sampling Technique

All clinical sections of the hospital were included in the walk-through survey using an observation schedule while participants for the questionnaire administration were recruited through simple random sampling from the listing of clinical staff in the major clinical department in the hospital. The key informants for the qualitative studies were current and past drivers of IPC activities in the hospital who were purposively selected to provide first-hand experiences of IPC in the hospital.

3.6 Data Collection

Data was collected in 2018 with the use of a pre-tested structured self-administered questionnaire, an observation schedule for the quantitative data, and a key informant guide for the collection of qualitative data.

A pretested questionnaire was used to collect information on staff socio-demographic characteristics, knowledge, skills, and compliance with infection control practices by trained research assistants.

The structured observation checklist was adapted from an existing validated template that had been used during previous walk-through assessments of IPC measures in the clinical service points in the hospital. The clinical service points are the clinics, injection rooms, theatres, and laboratories. The checklist comprised of 25 attributes along with five domains – provisions for hand hygiene, personal protective equipment, care of parenteral treatment, decontamination materials, epidemic preparedness training, and general housekeeping.

The face to face interview guide had open-ended questions and the interview process provided for the use of probes and prompts. Interviewees included key informants like the past leader of the IPC committee, a senior microbiologist, leaders in the emergency department - a gateway for all acutely ill adult patients accessing care in the hospital. The interviews provided opportunities to explore the various socio-cultural, behavioural, administrative, and environmental contexts related to IPC in the hospital. A trained interviewer and a note-taker handled the recorded interview sessions each of which lasted about 30-45 minutes.

3.7 Data Analysis

The quantitative data were analysed using the IBM Statistical Package for the Social Sciences (SPSS) version 21. The quantitative variables were summarized using descriptive statistics such as percentages, measures of central tendency, and dispersion. Digital records of the interviews were transcribed verbatim, coded, and categorised into broad themes.

The data analysis involved the determination of the proportion of clinical sections with facilities for hand hygiene, personal protective equipment, care of parenteral treatment, decontamination materials, epidemic preparedness training, and general housekeeping. The qualitative data explored the use and challenges with the use of PPEs in the clinical unit.

4. RESULTS

A total of 191 questionnaires were filled and returned representing a 93% response rate. The frontline staff who responded to the questionnaires were aged 31 – 40 years (53.8%), males were 96 (50.3%), females were 95 (49.7%), doctors (72.2%), 26% were nurses, 19% were laboratory scientist and 9% were ward maids. There were more service points from the Surgery department (13%, n = 24) while anaesthesia department had the least number of service points (0.5, n = 1).

From Table 3, the provisions for infection prevention and personal protection were low especially when it relates to full PPE gear, respirator, aprons, and face masks. The availability of IPC commodity mirrors the consistent use of these provisions by the frontline clinical staff.

From Table 4, structural provisions for IPC varied across the 185 clinical service points of the 19 departments. The availability of SOP for hand washing was noted in 11 service points (5.9%) while cabinets for storing PPEs were found in 13 service points (7%). However, more service points had waste bins (85.9%), hand wash sink (80%), and running water (73.5%).

From Table 5, Less than half of the respondents had received recent training on hand washing (41.5%), use of PPEs (35.1%), and standard precaution for VHFs (26.8%) in the last year. Relatively fewer respondents consistently used hand gloves (36.9%), face masks (8.6%), aprons (8.5%), sharp containers (26.7%), appropriate waste containers (15.0%) during patient care.

Three themes emerged from the analysis of the qualitative interviews and these are policy and training on IPC, administration of IPC, and challenges with IPC.

Table 1. Socio-demographic characteristics of respondents in the questionnaire survey

Variable	Frequency	Percentage
Age in years		
21– 30	23	11.7
31– 40	101	51.5
41– 50	53	27.0
>50	19	9.7
Gender		
Male	100	51.0
Female	96	49.1
Staff category		
Medical doctor	142	72.4
Nurse	26	13.3
Laboratory scientist	19	9.7
Ward maid	9	4.6
Departmental units		
Surgery	24	13.0
Internal medicine	15	8.1
Obstetrics & gynaecology	14	7.6
Paediatrics	14	7.6
Community medicine	13	7.0
Ophthalmology	13	7.0
Accident and emergency	12	6.5
Family medicine	11	5.9
Microbiology	10	5.4

Table 2. Awareness and use of standard operating procedures for IPC

Variable	Frequency (%)
Aware of any Standard Operating Procedure for –	
Hand hygiene	93 (47.4)
Use of PPE	67 (34.2)
Medical waste management	77 (39.3)
Had training in the last 1 year on –	
Hand hygiene	80 (40.8)
Use of PPE	68 (34.7)
Precautions for VHFs	51 (26.0)
Know when to –	
Sanitize hand	187 (95.4)
Use hand gloves	189 (96.4)
Use a face mask	178 (90.8)
Use an apron	166 (84.7)
Use a respirator	71 (36.2)
Use full PPE gear	105 (53.6)
Use a sharp disposal box	186 (94.9)
Identify febrile patients	165 (84.2)

Table 3. Availability and use of IPC measures

IPC Measure	Frequency (%)					
	Never	Rarely	Sometimes	Most times	Always	NA
Availability of provisions for-						
Hand sanitization	18(9.2)	7(3.6)	71(36.2)	63(32.1)	36(18.4)	1 (0.5)
Hand gloves	10(5.1)	8(4.1)	75(38.3)	60(30.6)	40(20.4)	3 (1.5)
Face masks	19(9.7)	43(21.9)	90(45.9)	25 (12.8)	17(8.7)	2 (1.0)
Aprons	53(27.0)	46(23.5)	51(26.0)	22(11.2)	18(9.2)	6 (3.1)
Respirators	118(60.2)	38(19.4)	15(7.7)	5(2.6)	7(3.6)	11(5.6)
PPE Gear	94(48.0)	48(24.5)	25(12.8)	11(5.6)	9(4.6)	9 (4.6)
Non-contact thermometers	102(52.0)	46(23.5)	22(11.2)	9(4.6)	4(2.0)	13(6.6)
Sharp containers	20(10.2)	15(7.7)	59(30.1)	46(23.5)	54(27.6)	2 (1.0)
Differentiated waste bins	75(38.7)	34(17.5)	28(14.4)	27(13.9)	27(13.9)	3 (1.5)
Frequency of doing/using –						
Hand sanitization	17(8.7)	9(4.6)	36(18.4)	64(32.7)	66(33.7)	4 (2.0)
Hand gloves	13(6.7)	9(4.6)	28(14.4)	71(36.4)	69(35.4)	5 (2.6)
Face masks	33(17.0)	45(23.2)	76(39.2)	21(10.8)	16(8.2)	3 (1.5)
Aprons	68(34.7)	42(21.4)	47(24.0)	20(10.2)	16(8.2)	3 (1.5)
Respirators	134(68.4)	25(12.8)	9(4.6)	6(3.1)	9(4.6)	13(6.6)
Full PPE Gear	116(59.2)	36(18.4)	18(9.2)	9(4.6)	12(6.1)	5 (2.6)
Sharp containers	24(12.2)	19(9.7)	49(25.0)	50(25.5)	50(25.5)	4 (2.0)
Differentiated waste bin	77(39.3)	33(16.8)	28(14.3)	26(13.3)	28(14.3)	4 (2.0)

NA – not applicable

4.1 Policy and Training on IPC

Respondents have no idea on the existence of an IPC policy and adherence to standard precautions for IPC is voluntary. According to a respondent, it is not clear if previous attempts at developing an IPC policy for the hospital was actualized:

"There was a time a committee was set up, to develop that infection control policy but whether the report was produced, I can't say for certainty, I am not sure, because such a policy should have been adopted and disseminated" (male, doctor).

Training of clinical staff on IPC had been done during an earlier outbreak of VHF but there is no follow-up training thereafter. One of the respondents commented that

"*there was a time the hospital carried out infection prevention and control training and we were part of it but ever since, we have not had another one"* (male, laboratory scientist).

4.2 Administration of IPC

Existence of the IPC committee with administrative and technical heads as one of the respondents explained:

"*IPC has an administrative head and a technical head. The technical head is the Head of Microbiology Department whereas the CMAC is the administrative head"* (male, doctor).

The IPC teams are operational units under the IPC committee, and they are more evident in clinical units such as the labour ward, special care baby unit, and intensive care unit. The hospital-wide teams are multi-disciplinary involving the epidemiologist involved in case finding, contact tracing, dissemination of information, follow-up, monitoring, and surveillance while the internists are meant to oversee clinical care. Clinical units in the hospital do not have focal persons for IPC.

4.3 Challenges with IPC

Both the committee and teams are faced with the challenge of poor leadership and poor funding and so are only functional during periods of outbreaks. This is vividly illustrated in the quotes from one of the respondents:

"*The committee was not funded and was not very functional. We [IPC committee] existed only when there is an outbreak, immediately after outbreak, everybody relaxes"* (male, doctor).

Table 4. Proportion of clinical service points with structural provisions for IPC

IPC essential (n = 185)	Frequency	(%)
Waste bin	158	85.9
Sink or basin for handwashing	148	80.0
Running water	136	73.5
Soap for handwashing	130	70.3
Hand dryer or disposable napkins	36	19.5
Non-contact thermometer	2	1.1
SOPs for hand washing	11	5.9
Availability of latex gloves	113	61.1
Availability of mask	54	29.2
Availability of aprons	33	17.8
Availability of respirator	8	4.3
Availability of PPE gear	16	8.6
Cabinet for storing PPEs	13	7.0
Sharps container	68	36.8
Differentiated bin for medical waste	21	11.4

Table 5. Self-reported training and adherence to IPC practices in the last year

Variable	N	Frequency (%)
1. Training on hand hygiene	193	80 (41.5%)
2. Training in the use of PPE	194	68 (35.1%)
3. Training on standard precautions for VHFs prevention	190	51 (26.8%)
4. Consistent use of available hand gloves	187	69 (36.9%)
5. Consistent use of available face masks	187	16 (8.6%)
6. Consistent use of available aprons	188	16 (8.5%)
7. Consistent use of available sharps container	187	50 (26.7%)
8. Consistent use of available differentiated bins for medical and non-medical waste	187	28 (15%)

There is also a human-resource constraint to IPC implementation with the dearth of professionals with reasonable training in IPC. Critical needs for IPC like water, soaps, sharps containers, and gloves are lacking and mostly available during accreditation visits while the available PPEs kept in the central store are not appropriate for use. Disinfectants are provided by the units are available only when the units have the required funds to purchase them. Autoclaves are available in central sterilization and emergency units, but this would require an uninterrupted power supply in the hospital and a good maintenance culture to function effectively.

"*I will say still our consumables like gloves which is not always enough, even the washing soaps, masks all these things, they are not always enough, we always run short of it because of inadequate supply or remittance of fund to the unit"* (Female, nurse).

5. DISCUSSION

This study explored the level of preparedness of a tertiary hospital for preventing outbreaks of viral haemorrhagic fevers among frontline clinical health workers in a developing country. The results show that most clinical staff were unaware of the existence of SOPs and have not had recent training on IPC. In the same vein, most respondents were not conversant with the use of full PPE gear and respirators. However, the respondents were mostly aware of the indications for the application of preventive practices. Structural provisions for IPC were lacking in most units and much clinical staff reported not consistently using required provisions for IPC while on clinical duties.

There is a low level of awareness of standard operating procedures on IPC and overall preparedness. An earlier multi-center study in the North-East zone of the country reported a high proportion of long-serving health workers being aware and applying standard precautions during hospital duties. [20] Improved awareness and use of IPC techniques can be achieved with the availability of institutional policy, staff training, and provision of critical supplies for IPC. Clinical staffs are vulnerable to VHFs infections in settings where relevant inputs IPC are lacking.

The finding of a low proportion of HCWs who had received recent training on IPC is like the findings from an earlier study in Eastern Nigeria where 40% of the health workers had such training [21]. The increasing threats of VHFs to health workers underscores the need for more training of frontline health workers. Training should encompass all aspects of IPC including hand hygiene, use of PPE, and medical waste management.

It was observed that only a tenth of service delivery points have the appropriate bins for medical waste. There is also evidence that the majority of health workers are not aware or not using such provisions where they are even available [22]. While the unavailability of appropriate waste collection bins is of concern in this and other settings, [23] there is also a need to have an effective hospital waste disposal policy and ensure HCW comply with such policy. Indeed, settings with policy and established systems for segregation of clinical waste from the general waste may still experience issues with compliance by HCWs [24].

Poor funding of public health institutions may be implicated for the low availability of critical provisions for healthcare waste management. This important finding which was uncovered from the analysis of the qualitative interviews was also corroborated by a previous report. [25] The absence of an effective hospital waste management system which poses a significant risk to staff and patients, is an indication for a coordinated intervention aimed at developing policies for hospital waste management. This is an addition to the provision of critical inputs to support this policy while educating HCWs on the need to adhere to the provisions of the available policies.

Attention should also be paid to the use of personal protective devices during the provision of routine services that expose the HCW to patient's body fluids. While this study revealed that non-sterile latex gloves were available in three-fifths of service points, a previous study had reported 31%-59% of HCWs affirming consistent availability of hand gloves at the service points [22].

Inadequate supply of hand gloves at service stations is not good for IPC and efforts should be made towards adequate and uninterrupted provision of hand gloves at all service stations in the hospital. Like the case of waste management, the provision of safety commodities like hand gloves does not guarantee use by HCWs. Indeed, this study observed that only a third of HCWs consistently

use hand gloves when undertaking medical procedures. A worse compliance level was reported among birth attendants where only a tenth consistently wore gloves during medical procedures. [26]

The finding that hand gloves were the most commonly used commodity for IPC corroborates earlier report among nurses in South-East Nigeria, where gloves were the most commonly used PPE and over half of these workers consistently used them during medical procedures. [27] The import of these findings call for greater efforts at promoting the consistent use of hand gloves and appropriate PPEs by HCWs when undertaking procedures that could expose the HCWs to patients' body fluids. This action would help safeguard HCWs from contracting VHFs and contagious infections from patients.

Four-fifths of the clinical service points have hand washing facilities but some lacked running water, soaps, and hand dryer/disposable napkins. These challenges which are not uncommon in this setting. [28] Emphasises the need to strengthen the maintenance and supply chain in health facilities in developing countries like Nigeria as means of controlling the spread of VHFs among health workers.

Less than two-fifths of HCWs consistently practice hand sanitization after each encounter with the patient. Although the training of HCWs has the potential to improve the practice of hand hygiene, [23,29] only about two-fifths of the participants in this study have received recent training on hand hygiene. The various professional medical councils in the country should accept this low level of training of HCWs as a challenge and institutionalize mandatory training of HCWs on IPC practices as part of the required annual training credits to be acquired by all HCWs before the renewal of practicing license.

Face masks were consistently used by less than a tenth of respondents in this study. This is not surprising as its use is strongly indicated when the need for control of the spread of airborne infection is the focus. However, the correct and consistent use of face masks including the N95 respirators by HCWs have been far from universal where these are strongly indicated and made available by the health authorities [30].

This survey was conducted at a time when members of the Joint Health Workers Union (JOHESU) were on industrial action. This resulted in the poor representation of other categories of clinical staff in this survey. Because of the complex nature of this study design, its implementation was tasking as it was time and resource consuming.

The findings of this study have far-reaching implications that cut across policy, practice, and future research. The challenges with implementing IPC in a tertiary hospital include poor training of healthcare workers, lack of SOPs, and inadequate supply of PPEs. As the level of preparedness for VHF epidemics in all the clinical departments was low, it suggests the need for the establishment of administrative, engineering, and environmental control for VHFs in health facilities to stem outbreaks among health providers.

6. CONCLUSION

This study showed inadequate provision of structural provisions compounded by some reluctance by HCWs to use IPC measures as well as inadequate IPC training, motivation, and monitoring. As part of measures to develop resilient health systems in developing countries that can absorb disturbances and respond to local needs, key stakeholders should strengthen the emergency preparedness for VHF epidemics in all the health care institutions. This can be achieved through the development of institutional policies/SOPs on IPC, ensuring structural provisions for IPC, and enforcing their use by the heads of clinical units. Training and retraining of health workers on IPC through regular workshops, conferences, and seminars should be a top priority and the various professional regulatory councils should include annual training on IPC as mandatory to ensure compliance. Finally, routine clinical audits on infection prevention and control should be conducted quarterly by individual departments while instituting clinical governance systems as the vehicle for implementing these reforms.

The limitations of this study are that it is of cross-sectional design coupled with the fact that it is a single-center study which makes the findings less generalisable. The purposive sampling method used in the selection of key informants was also a drawback for this study. However, these problems were addressed using the mixed-method approach which added breadth and depth to the study.

CONSENT AND ETHICAL APPROVAL

Approval for ethical clearance was obtained from the University of Port Harcourt Teaching Hospital. Permission was also obtained from the Chairman of the Medical Advisory Committee of the hospital and the respective heads of departments while individual consents were obtained from participants.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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