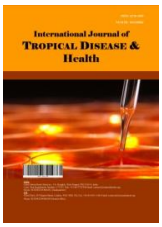

International Journal of TROPICAL DISEASE & Health

42(11): 17-27, 2021; Article no.IJTDH.71081
ISSN: 2278–1005, NLM ID: 101632866

COVID-19: Preventive Strategies among Workers in a Tertiary Health Institution in South-east Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJTDH/2021/v42i1130494
Editor(s):
(1) Dr. Shankar Srinivasan, Rutgers School of Health Professions, USA.
(2) Dr. Arthur V.M. Kwena, Moi University, Kenya.
(3) Prof. Romulo Dias Novaes, Federal University of Alfenas, Brazil.
Reviewers:
(1) Abdullahi Hassan, Federal Medical Centre, Nigeria.
(2) Iván Santolalla Arnedo, La Rioja University, Spain.
(3) Heru Supriyatno, Semarang Health Polytechnic, Indonesia.
Complete Peer review History: https://www.sdiarticle4.com/review-history/71081

Original Research Article

Received 10 June 2021
Accepted 26 July 2021
Published 04 August 2021

ABSTRACT

Background and Aim: Healthcare workers have the highest risk of exposure to COVID-19 infection due to the nature of their occupation which daily exposes them to infectious agents/people with COVID-19. The study aimed to determine the knowledge of healthcare workers towards COVID-19 infection prevention strategies and factors that affect infection prevention against COVID-19.
Materials and Methods: A hospital-based cross-sectional analytical study conducted in a tertiary health institution. One hundred and ninety-five participants were recruited consecutively into the study. Data was collected using a 13-question semi-structured self-administered questionnaire. The knowledge, perceptions and factors contributing to COVID-19 infection, prevention and control

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(IPC) were measured. Data was analyzed using SPSS version 23. The test of significance was set at p-value <0.05.

Results: The knowledge of COVID-19 Infection, Prevention and Control (IPC) was 31.8%, 63.6% of the participants were aware of IPC program at the hospital but majority (74.9%) had not received any training. There was no significant association between knowledge of COVID-19 IPC and sociodemographic characteristics. Less than half of the participants (37.4%) had a good perception of the hospital's readiness for COVID-19 pandemic, 52.8% reported that breeching IPC rules can cause an outbreak of COVID-19 in the hospital. Lack of resources to fulfil Infection, Prevention and Control need is the single most important contributory factor to the spread of COVID-19 infection.

Conclusion: The knowledge of COVID-19 infection, prevention and control was poor in the study and the majority of the healthcare workers had not received any training regarding Infection, Prevention and Control. Therefore, there is need for the hospital management with the financial backup from the government to train healthcare workers on Infection prevention and control strategies.

Keywords: Healthcare workers; risk; infectious agents; prevention; COVID-19.

1. INTRODUCTION

Coronavirus disease (COVID-19) is a novel disease that has affected the world all over. It was declared a pandemic by World Health Organization on the 11^{tth} of March, 2020 [1]. The COVID-19 has continued to be a global epidemic since its first discovery in Wuhan City in China in December 2019 [2]. As at 7th June 2021, about 174 million people worldwide were confirmed cases with 3.7 million deaths [3]. Currently in Nigeria, there are 167,467 confirmed cases with 2,119 deaths [4]. It has placed stress and strain upon the resources of the world.

COVID-19 is a zoonotic infectious disease that can be transmitted from animal to human and from human to human [2,5]. The major transmission route of COVID-19 isthrough respiratory droplets produced from an infected person while sneezing and coughing. It is also transmitted by infected surfaces and objects [5]. The main strategies for the management of COVID-19 infection are symptomatic and supportive care, such as keeping vital signs, maintaining oxygen saturation, blood pressure, and treating complications, such as secondary infections or organs failure [2].

The preventive measures as outlined by the Nigeria Centre for Disease Control (NCDC) and World Health Organization (WHO) include hand hygiene which is the most effective measure to prevent the spread of COVID-19 and other pathogens. Others are respiratory hygiene, maintain a safe distance at least 1 meter from anyone who is coughing or sneezing, wear mask, avoid crowded places, use of personal protective equipment, environmental cleaning, waste management and so on [3,6].

Globally, several Health care workers (HWs) have been infected by COVID-19 and some have lost their lives due to job-related infection with COVID-19. Health care workers (HWs) have the highest risk of exposure to COVID-19 due to the nature of their occupation which exposes them daily to infectious agents/people with COVID-19 [7,8]. They have double sources of infection unlike other people; from the community and from the hospital [7]. Hence, the need to pay a special attention to HWs and make their working environment safe so that the system will not lose many of the workers and compromise the capacity to fight COVID-19 and other infectious diseases worldwide [8]. The main reasons for acquiring COVID-19 among HWs include long-time exposure, shortage and poor quality of Personal Protective Equipment (PPE), heavy work load, co-morbidities, lack of regular training on infection preventionand control [8,9,10].

Recent study on infection prevention practices among HWs in China showed that 89% of the surveyed HWs had good knowledge of COVID-19, with 89.7% of the HWs who followed correct practices regarding COVID-19 [11]. Knowledge is a prerequisite for developing preventive beliefs; promoting positive behaviors towards disease affect the effectiveness of their coping strategies and also correct practices are associated with work experience, working time, and other factors [11]. Studies done in Ethiopia and Uganda observed that good knowledge about COVID-19 is a predictor of good infection prevention practices [8,12]. This finding is also collaborated by similar studies conducted within Nigeria [10,13]. There is dearth of studies on the preventive practice of HWs towards COVID-19 in South-East Nigeria, hence the need for this

study. The study is aimed to determine the knowledge and perception of HWs towards COVID-19 Infection, prevention and control strategies and the factors that affect infection preventive strategies against COVID-19.

2. MATERIALS AND METHODS

Study site and population: This was a hospital based cross-sectional analytical study conducted in Nnamdi Azikiwe University Teaching Hospital a multi-specialist tertiary institution that offers clinical and training services to the populace and health care workers located at Nnewi, South-east Nigeria. Nnewi is the biggest and second most populated city in Anambra State, South-east Nigeria, with a population of 155,443 located 37 kilometers from Awka; the capital city of Anambra State [14]. The inhabitants are mostly traders, industrial workers, subsistence farmers and few civil servants [15]. The study population include all workers in the teaching hospital (clinical and non-clinical). Each department had a maximum representative of 30 persons with exception of Nurses and Doctors that had maximum of 50 representatives.

Sample size and study procedure: The sample size of the study participants of one hundred and ninety-five (195) was calculated using the Cochran formula [16]. The study participants were recruited consecutively after obtaining informed consent. Data was collected using the semi-structured self-administered 13- question questionnaire from which information concerning the socio-demographic characteristics of the participants, the knowledge of COVID-19 infection prevention strategies, the perceptions of the HWs towards COVID-19 and factors contributing to the spread of infections were obtained.

Permission was sought and obtained from the Hospital management board of Nnamdi Azikiwe University Teaching Hospital in accordance with the Declaration of Helsinki.

Data Analysis: Data was collected, cleaned, coded and analyzed using Statistical Package for Social Science (SPSS) software version 23. Relevant proportions were calculated, test of associations was determined using the Pearson's chi-square test (and Fisher's exact test where appropriate) for bivariate analysis and independent association with multivariate logistic regression. The test of significance was set at p-value <0.05.

Definition of measurements: The participants' knowledge about COVID-19 Infection Prevention and Control (IPC) strategies was assessed using 13 questions that consisted of general knowledge about the control program, IPC strategies, policies and facilities in the institution. All the 13 questions had a value of 1 or 0 (yes had a value of '1' and no or don't know response had a value of '0'). Hence, the aggregate score for all the 13 knowledge questions ranged from 0 to 13 points. Participants' overall knowledge was categorized using modified Bloom's cut-off point, as good if the score was above 80% (11 points and above), poor if the score was below 80% (10 points or less). Similarly, perception of the hospital's readiness for COVID-19 infection outbreak was assessed using 2 questions. Both questions had a value of 1 or 0 (yes had a value of '1' and no or don't know response had a value of '0'). The aggregate score for both questions ranged from 0 to 2 points. Participants' overall perception of readiness was categorized as ready if the score was 100% (2 points), and not ready if the score was less than 100% (0-1 points).

3. RESULTS

Out of the 195 participants studied, 36.9% were males, while 63.1% were females. The mean age of the participants was 36.87±9.95 years. The most represented age group was those aged 41-50 years (37.4%). Most of the participants work in the main hub of the hospital, while about one-quarter works in the outstations. Nurses (24.1%) were the highest in proportion of the workers. Majority of the participants were married (82.1%), from Igbo tribe (95.4%) and had more than secondary education. The mean years of service was 13.25±7.51 years (Table 1).

3.1 Knowledge of COVID-19 Infection, Prevention and Control

Only 31.8% had good knowledge, while 16.4% had poor knowledge of COVID-19 Infection, Prevention and Control (IPC) (Fig. 1). More than half of the participants (63.6%) were aware of IPC program at the hospital facility but majority (74.9%) have not received any training about COVID-19 IPC in the hospital. About two third of the participants have knowledge of the presence of policies and guidelines on COVID-19 IPC in the hospital and an active infection control team. Majority (90.3%) of the participants knew about the policy of wearing face mask in the hospital but only two third (67.2%) agrees that there are adequate facilities for hand washing and

adequate quantities of alcohol-based hand sanitizers in the hospital. More than half of the participants (65.6%) have not undergone any training on donning and doffing of personal protective equipment (PPE) and temperature triaging. More than half of the participants (58.9%) are not aware of the presence of algorithm for triage and isolation of suspected cases of COVID 19 (Table 2). More males (33.3%) than females (25.8%) had good knowledge of the policy but this was not statistically significant P>0.05 (Table 3).

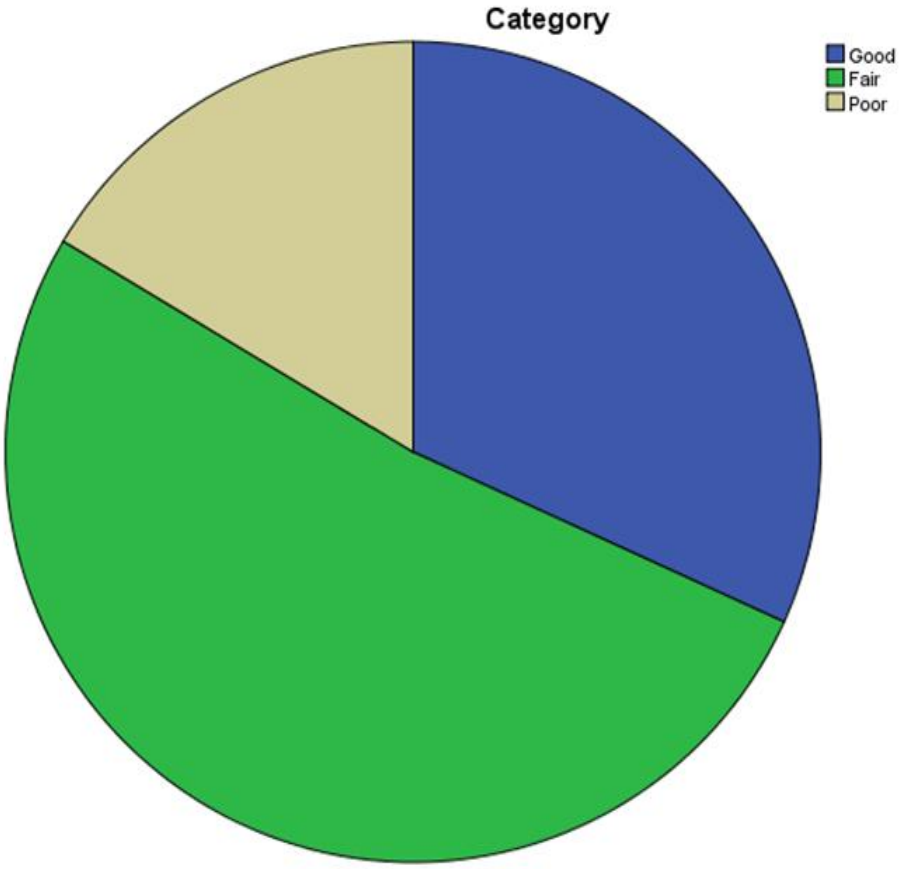
3.2 Perception of the Hospital's Readiness for Covid-19 Pandemic

Less than half of participants (37.4%) had a good perception of the hospital's readiness for COVID-19 pandemic, (42.1%) agreed that most staff is following the IPC guidelines. More than half of the staff (60.5%) does not know the Laboratory turnaround time for results of COVID-19 while only 30.8% is aware that the hospital has an isolation/protective case center (Table 4). Collectively, in the perception of the hospital's readiness for COVID-19 pandemic, more females (92.6%) responded that the hospital is not ready for the pandemic. There is no significant difference in the responses of both gender (P>0.05). Married staff (91.9%) also responded in the negative with no significant difference among the marital status (P>0.05). Tribe, educational level, Department and work station showed no statistical difference in their responses (P>0.05) (Table 5).

Table 1. Demographic characteristics of study participants

Variables		Frequency(N=195)	Percentage (%)
Age(years)	18-24	3	1.5
	25-30	7	3.6
	31-40	54	27.7
	41-50	73	37.4
	51-60	58	29.8
Gender	Male	72	36.9
	Female	123	63.1
Marital Status	Single	25	12.8
	Married	160	82.1
	Widowed	9	4.6
	Divorced	1	0.5
Tribe	Igbo	186	95.4
	Hausa	3	1.5
	Other	6	3.1
Highest Educational Qualification	JSCE	5	2.6
	SSCE	20	10.3
	OND	11	5.6
	Graduate	85	43.6
	Postgraduate	74	37.9
Department	Medical and Dental	35	17.9
	Nursing	47	24.1
	Laboratory	25	12.8
	Pharmacy	17	8.7
	Records	30	15.4
	Works	6	3.1
	Security, laundry, cleaners	14	7.2
	Physiotherapy	5	2.6
	Others (Dieticians, health education officers, medical social workers)	16	8.2
Place of work within the hospital	Main Hub	146	74.9
	Out Station	48	24.6
	Other	1	0.5
No. of years worked (Mean ±SD)		13.25±7.51	Range: 0.33-30

JSCE- Junior Secondary School Examination, SSCE- Senior Secondary School examination, OND- Ordinary National Diploma



Good=62(31.8%), Fair=101(51.8%), Poor=32(16.4%)

Fig. 1. Pie chart showing distribution of composite knowledge category of respondents

Table 2. Knowledge of the tertiary hospital's COVID-19 IPC strategies amongst health care workers in the hospital

Variables	Yes (%)	No (%)	Do not Know (%)
COVID-19 IPC program at facility	124(63.6)	46(23.6)	25 (12.8)
Received training about the tertiary hospital's COVID-19 IPC strategies	49(25.1)	146(74.9)	0 (0.0)
Presence of COVID-19 IPC policies and guidelines in the hospital	134(68.7)	44 (22.6)	17 (8.7)
Presence of active infection control team	122(62.6)	50 (25.6)	23 (11.8)
Presence of the hospital's policies on usage of face mask	176(90.3)	12(6.2)	7 (3.6)
Presence of adequate facilities for hand washing in the hospital	131(67.2)	58(29.7)	6 (3.1)
Presence of alcohol-based sanitizers	125(64.1)	69(35.4)	1 (.5)
Training on donning and doffing of PPE	60 (30.8)	128(65.6)	7 (3.6)
Training on temperature triaging	52 (26.7)	140(71.8)	3 (1.5)
Dedicated staff to ensure physical distancing in facility	102(52.3)	84 (43.1)	9 (4.6)
Presence of the tertiary hospital's COVID-19 algorithm for triage and isolation available in the hospital and accessible to all staff	52 (26.7)	115(58.9)	28 (14.4)

Table 3. Association between socio-demographic characteristics and knowledge of NAUTH IPC policy among the respondents

Variable	Poor	Good	Test statistic (x^2 square)	P-value
Age (years)				
18-24	2 (66.7)	1 (33.3)	7. 398*	0.804
25-30	5 (71.4)	2 (28.6)		
31-40	40 (74.1)	14 (25.9)		
41-50	50 (68.5)	23 (31.5)		
51-60	44 (75.9)	14 (24.1)		
Gender				
Male	48 (66.7)	24 (33.3)	0.037	0.347
Female	91 (73.4)	32 (25.8)	0.037	
Marital Status				
Single	16 (64.0)	9 (36.0)	2.798*	0.408
Married	116 (72.5)	44 (27.5)		
Widowed	6 (66.7)	3 (33.3)		
Divorced	0 (0.0)	1 (100.0)	.	
Tribe				
Igbo	136 (73.1)	50 (26.9)	5.060*	0.701
Hausa	1 (33.3)	2 (66.7)		
Others	4 (66.7)	2 (33.3)		
Education				
JSCE	0 (0.0)	2 (100.0)	12.855*	0.501
SSCE	3 (33.3)	6 (66,7)		
OND	0 (0.0)	3 (100.0)		
Graduate	10 (26.3)	28 (73.7)		
Postgraduate	18 (46.2)	21 (53.8)		
Department				
Medical Dental	0 (0.0)	1 (25.0)	18.649*	0.191
Nursing	10 (17.2)	22 (37.9)		
Laboratory	5 (50.0)	3 (30.0)		
Pharmacy	2 (12.5)	6 (37.5)		
Records	0 (0.0)	3 (30.0)		
Works	1 (14.3)	0 (00)		
Security	0 (0.0)	1 (33.3)		
Others (Dieticians, health education officers, medical social workers)	13 (15.9)	22 (26.8)		
Physiotherapy	1 (20.0)	3 (60.0)		
Work location				
Main Hub	23 (15.8)	53 (36.3)	4.939*	0.238
Out station	8 (17.0)	11 (21.3)		

*- *Fishers' exact test*

Table 4. Staff perception of the hospital's readiness for COVID-19 pandemic

Variables	Yes (%)	No (%)	Don't know (%)
Is the hospital prepared for COVID.19 infection outbreak	73 (37.4)	74 (37.9)	48 (24.6)
Are staffs promptly following IPC guidelines	82 (42.1)	86 (44.1)	27 (13.8)
Known turn-around time for lab-results of COVID.19 subjects	21 (10.8)	56 (28.7)	118 (60.5)
Is the hospital an isolation/protective case center	60 (30.8)	77 (39.5)	58 (29.7)

Table 5. Association between socio-demographic characteristics of staff and their perception of the hospital's Readiness for COVID-19 pandemic

Variable	Ready	Not Ready	Test Statistics (Fishers exact)	P-Value
Age (years)				
18-24	1 (33.3)	2 (66.7)	4.777	0.462
25-30	0 (0.0)	7 (100.0)		
31-40	1 (1.9)	53 (98.1)		
41-50	6 (8.9)	51 (91.1)		
51-60	1 (50)	1 (50.0)		
Gender				
Male	8 (11.1)	64 (88.9)	0.147	0.761
Female	9 (7.4)	113 (92.6)		
Marital Status				
Single	5 (20.0)	20 (80.0)	1.699	0.779
Married	13 (8.1)	147 (91.9)		
Widowed	3 (33.3)	6 (66.7)		
Divorced	0 (0.0)	1 (100.0)		
Tribe				
Igbo	13 (7.0)	173 (93.0)	2.147	0.434
Hausa	1 (33.3)	2 (66.7)		
Other	1 (16.7)	5 (83.3)		
Education				
JSSCE	1 (20.0)	4 (80.0)	5.394	0.490
SSCE	1 (5.0)	19 (95.0)		
OND	3 (27.3)	8 (72.7)		
Graduate	6 (7.1)	79 (92.9)		
Post graduate	5 (6.8)	69 (93.2)		
Department				
Medical Dental	0 (0.0)	4 (100.0)	6.814	0.442
Nursing	3 (5.2)	55 (94.8)		
Laboratory	1 (10.0)	9 (90.0)		
Pharmacy	0 (0.0)	16 (100.0)		
Records	2 (20.0)	8 (80.0)		
Works	1 (14.3)	6 (85.7)		
Security	1 (33.3)	2 (66.7)		
Others (Dieticians, health education officers, medical social workers)	6 (7.3)	76 (92.7)		
Physiotherapy	1 (20.0)	4 (80.0)		
Work location				
Main Hub	13 (8.9)	133 (91.1)	2.962	0.247
Out Station	2 (4.2)	46 (95.8)		
Other	0 (0.0)	1 (100.0)		

3.3 Knowledge of Perceived Causes of COVID-19 Outbreak in the Hospital

Table 6 showed the knowledge of staff on the causes of COVID-19 outbreak in the hospital. A little above half of the participants (52.8%) responded that breaching IPC rules can cause outbreak of COVID 19 infection, while only 37.4% stated that carelessness among healthcare workers can also be a cause of outbreak of the infection.

3.4 Factors Contributing to the Spread of Infection in the Hospital

Some variables like the hospital's infrastructure and design, lack/shortage of staff, no IPC training program, lack of resources and no IPC team were the factors listed that contribute to the spread of COVID- 19 infection in the hospital but majority of the participants (64.1%) stated that lack of resources to fulfill IPC need is the single most important contributory factor to the spread of infection (Table 7).

Table 6. Perceived causes of COVID-19 outbreak in the hospital

Variables	Yes (%)	No (%)
Breaching IPC policies rules and guidelines	103 (52.8)	92 (47.1)
No clear, IPC rules and guidelines	63 (32.3)	132 (67.7)
Carelessness of HCW	73 (37.4)	122 (62.6)
Shortage of appropriate PPE	91 (46.7)	104 (53.3)
Lack of IPC infrastructure	52 (26.7)	143 (73.3)

Table 7. Factors contributing to the spread of infection in the hospital

Variables	Yes (%)	No (%)
The hospital infrastructure and design	56 (28.7)	139 (71.3)
Lack and shortage of staffs	44 (22.6)	151 (77.4)
No IPC training program	95(48.7)	100 (51.3)
Lack of resources to fulfil IPC program and needs	125 (64.1)	70 (35.9)
No IPC team on call	38 (19.5)	156 (80.0)

4. DISCUSSION

Facility-based infection prevention and control program with a dedicated and well-trained staff is critical to limit and prevent transmission of COVID-19 in the healthcare settings.

4.1 Knowledge of COVID-19 Infection, Prevention and Control among Health Workers

Only 31.8% of the study participants had a good knowledge of COVID-19 IPC. This knowledge was more in the male participants than the female participants, though it was not statistically significant. This finding is similar to a study conducted within Nigeriawhere the authors also reported a poor knowledge of COVID-19 IPC strategies amongst healthcare workers [17]. This poor knowledge of IPC strategies maybe contributory to the increased prevalence of COVID-19 infection among healthcare workers. Similarly, two studies carried out in Ethiopia found that a low percentage ofhealthcare workers were knowledgeable towards COVID-19 IPC. [8,18]. However, Aljondo *et al* in their study found that there was a good knowledge of infection control measure against COVID-19 among the healthcare workers. This good knowledge was attributed to a prior training course about IPC to improve the knowledge of the healthcare workers [19].

Though, more than half of the study participants had knowledge of IPC program at the hospital facility, two-thirds were aware of an active infection control team in the hospital facility but majority (74.9%) had not received any training about COVID-19 IPC in the hospital. This finding is similar to another study conducted by Assefa *et al* in which the participant of the study reported not to have received training on IPC [20]. According to WHO, training and education is recommended as a core component for effective IPC program [21]. Training is beneficial and it has reduced hospital acquired infections considerably [22,23]. There is therefore, the need for the management of health care facilities to organize training sessions for all healthcare workers to improve their knowledge and subsequent level of compliance to IPC strategies.

The first IPC strategy to prevent or limit transmission in health care settings is triage, early recognition and source control isolating patients with suspected COVID-19 infection [21]. From the current study, more than half of the study participants were not aware of the algorithm of triage and isolation of suspected cases of COVID-19 in the hospital. This finding is also similar to a study conducted by Ilesanmi et al. in North central Nigeria [17]. This lack of awareness may contribute to the spread of COVID-19 infection among healthcare workers.

4.2 Perception of the Hospital's Preparedness for COVID-19 Pandemic

From the current study, 37.4% agreed that the hospital was prepared for COVID-19 infection outbreak and 42.1% agreed that the hospital staffs were following the IPC guidelines. The low proportion of the perceived preparedness maybe due to poor logistics put in place by the hospital management in case of eventual outbreak in the hospital. Igor et al. in their study conducted

among Italian physicians during the early outbreak of the COVID-19 pandemic reported that 82.1% of the physicians felt that their organization was not prepared for the COVID-19 pandemic [24]. On the contrary, a study carried out in Saudi Arabia among clinical nurses observed that the nurses had a high perception of their hospital preparedness in combating COVID-19 pandemic [25]. This finding implies that the hospital was playing its role in infection prevention; it also further shows that the hospital preparedness was based on the immediate action executed by the government in response to COVID-19 which includes allocation of sufficient funds to ensure the hospital's readiness in terms of medical supplies needed in the fight against COVID-19 [25].

4.3 Knowledge of Perceived Causes of COVID-19 Outbreak and Factors Associated with the Spread of the Infection in the Hospital

With regards to the knowledge of the perceived causes of COVID-19 outbreak in the hospital, 52.8% of the study participants reported that breaching the IPC rules while 37.4% reported that carelessness among health workers can cause outbreak of COVID-19 in the hospital. Healthcare workers have been known to get infected during disease outbreak due to poor compliance to the basic IPC measures [22].

Factors that were identified to contribute to the spread of COVID-19 infection in the hospital included lack of resources to fulfil IPC need; this was the most common factor identified, otherswere no IPC training program, shortage of staff and poor hospital infrastructure and design. These factors were also stated in other studies [8,17,26]. The provision of financial and material resources to meet the IPC need is critical to limit the spread of the infection in the hospitals. This can be achieved through the allocation of sufficient budget for IPC needs. This brings to the fore, the active role of political and government authorities in creating an enabling environment for foreign investment within the country so as to enhance access to the needed infection prevention control equipment, structures and trainings.

5. CONCLUSION

The knowledge of COVID-19 Infection, prevention and control was poor in the study. Majority of the healthcare workers had not received any training regarding IPC program. Lack of resources to fulfil the IPC need is the single most important contributory factor to the spread of COVID-19 infection. Therefore, there is need for the hospital management with the financial backup from the government to train healthcare workers on Infection prevention and control strategies.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. World Health Organization (WHO). Coronavirus Disease (COVID-19) Pandemic [Internet]. WHO. 2021 [cited 2021 June 7th]. Available:https://www.who.int/emergencies/diseases/novel-coronavirus-2019
2. Wu Y, Chen C, Chan Y. The outbreak of COVID-19: An overview. J Chin Med Assoc. 2020;83:217–20.
3. World Health Organization (WHO). Coronavirus disease (COVID-19) pandemic [Internet]. WHO. 2021 [cited 2021 June 7th]. Available:https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19
4. Nigeria Centre for Disease Control. COVID-19 Nigeria [Internet]. NCDC Coronavirus COVID-19. 2021 [cited 2021 June 7th]. Available:https://covid19.ncdc.gov.ng/faq/
5. Zhou L, Tong Y, Ren R, Chen Q, Li D, Liu T, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. N Engl J Med. 2020;382:1199–207.

6. Nigeria Centre for Disease Control (NCDC). Infection prevention and control recommendations during health care provision for suspected and confirmed cases of COVID-19. Niger Cent Dis Control Interim Guid (Version 2). 2020;20.
7. World Health Organization (WHO). Coronavirus disease 2019 (COVID-19) Situation Report 82. WHO. 2020;1–13.
8. Asemahagn MA. Factors determining the knowledge and prevention practice of healthcare workers towards COVID-19 in Amhara region, Ethiopia: A cross-sectional survey. Trop Med Health. 2020;48(1).
9. Wang J, Zhou M, Liu F. Reasons for healthcare workers becoming infected with novel coronavirus disease 2019. J Hosp Infect. 2020;105:100–1.
10. Afemikhe JA, Esewe RE, Enuku CA, Ehwarieme TA. Transmission Based Precaution Practices among Nurses in Edo State , Nigeria during COVID-19 Pandemic. Afr J Reprod Health. 2020;24(2):98–107.
11. Zhang M, Zhou M, Tang F, Wang Y, Nie H, Zhang L, et al. Knowledge, attitude and practice regarding COVID-19 among health care workers in Henan, China. J Hosp Infect. 2020;105(2):183–7.
12. Olum R, Bongomin F. Coronavirus Disease-2019: Knowledge, Attitude, and Practices of Health Care Workers at Makerere University Teaching Hospitals, Uganda. Front Public Heal. 2020;8:181.
13. Alao MA, Durodola AO, Ibrahim OR, Asinobi OA. Assessment of Health Workers' Knowledge, Beliefs, Attitudes, and Use of Personal Protective Equipment for Prevention of COVID-19 Infection in Low-Resource Settings. Adv Public Heal. 2020;2020:1–10.
14. Izuchukwu I, Okunna C. Population / Geography. In Okunna C., Izuchukwu I., editors 2011. Anambra state statistical year book. Department of Operations, Research and Statistics. 2011;7.
15. National Bureau of Statistics, Anambra state information. Available:http://www.nigerianstate.gov.ng/information/details/Anambra (cited 2021 July 18)
16. Cochran W. Sampling techniques. 3rd edition. New York: John Wiley & Sons, Ltd; 1977.
17. Ilesanmi OS, Afolabi AA, Akande A, Raji T, Mohammed A. Infection Prevention and Control during COVID-19 Pandemic: Realities from Healthcare Workers in a North Central State in Nigeria. Epidemiol Infect [Internet]. 2021 [cited 2021 Jun 9];149. Available:https://doi.org/10.1017/S0950268821000017
18. Negera E, Demissie TM, Tafess K. Inadequate level of knowledge, mixed outlook and poor adherence to COVID-19 prevention guideline among Ethiopians [Internet]. bioRxiv. bioRxiv; 2020 [cited 2021 Mar 8]. 2020.07.22.215590. Available:https://doi.org/10.1101/2020.07.22.215590
19. Aljondi R, Alghamdi SS, Abdelaziz I, Bushara L, Alghamdi S, Aljehani A, et al. Knowledge of COVID-19 infection control among healthcare workers in radiology departments in Saudi Arabia. J Radiat Res AppISci [Internet]. 2021[cited 2021 Jun 9];14(1):51–60. Available:https://www.tandfonline.com/action/journalInformation?journalCode=trra20
20. Assefa J, Diress G, Adane S. Infection prevention knowledge, practice, and its associated factors among healthcare providers in primary healthcare unit of Wogdie District, Northeast Ethiopia, 2019: A cross-sectional study. Antimicrob Resist Infect Control. 2020;9(1).
21. World Health Organization. Guidelines on Core Components of Infection Prevention and Control Programmes at the National and Acute Health Care Facility Level [Internet]; 2016 [cited 2021 Jun 23]. Available:http://apps.who.int/bookorders.
22. Alhumaid S, Al Mutair A, Al Alawi Z, Alsuliman M, Ahmed GY, Rabaan AA, et al. Knowledge of infection prevention and control among healthcare workers and factors influencing compliance: a systematic review. Antimicrob Resist Infect Control [Internet]. 2021[cited 2021 Jun 9];10(1):86. Available:https://aricjournal.biomedcentral.com/articles/10.1186/s13756-021-00957-0
23. Safdar N, Abad C. Educational interventions for prevention of healthcare-associated infection: A systematic review. Crit Care Med [Internet]. 2008[cited 2021 Jun 23];36(3):933–40. Available:https://journals.lww.com/ccmjournal/Fulltext/2008/03000/An_educational_intervention_to_prevent.39.aspx
24. Portoghese I, Meloni F, Galletta M, Piras I, D'Aloja E, Finco G, et al. Concerns, Perceived Impact, Preparedness in

Coronavirus Disease (COVID-19) Pandemic and Health Outcomes among Italian Physicians: A Cross-Sectional Study. J Prim Care Community Heal [Internet]. 2021[cited 2021 Jun 23];12. Available from: https://doi.org/10.1177/21501327211000245

25. Balay-odao EM, Alquwez N, Inocian EP, Alotaibi RS. Hospital Preparedness, Resilience, and Psychological Burden Among Clinical Nurses in Addressing the COVID-19 Crisis in Riyadh, Saudi Arabia. Front Public Heal [Internet]. 2021[cited 2021 Jun 23];8:573932. Available from: /pmc/articles/PMC7821043/

26. Wang J, Zhou M, Liu F. Reasons for healthcare workers becoming infected with novel coronavirus disease 2019 (COVID-19) in China. J Hosp Infect [Internet]. 2020[cited 2021 Jun 23]. Available:https://doi.org/10.1016/j.jhin.2020.03.002

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/71081