



ASSESSMENT OF COVID-19 SAFETY PRECAUTIONS IN RADIO-DIAGNOSTIC CENTERS IN PORT HARCOURT, RIVERS STATE

Ebbi Donald Robinson

Department of Radiology, Rivers State University Teaching Hospital, Port Harcourt, Rivers State, Nigeria.

Correspondence: Ebbi Donald Robinson **E-mail:** drebbirobinson@yahoo.co.uk

ABSTRACT

Background: The risk of exposure of patients and radiation workers to COVID-19 infection during radiologic investigations is of immense concern. The study is aimed to assess COVID-19 safety precautions in radio-diagnostic centers in Port-Harcourt.

Method: The study was a prospective survey using a self-administered questionnaire consisting of three segments which include level of knowledge of the COVID-19, availability of infection prevention and control protocol, and availability of personal protective equipment (PPE) in 27 radio-diagnostic centres with 5 respondents from each center in Port Harcourt metropolis. The data were analyzed using SPSS version 22.0 and presented in tables and charts.

Results: Majority of the respondents have basic knowledge about COVID-19 with reference to causative agent 88.15% (n=119), mode of infection 100% (n=135), diagnosis and symptoms 100% (n=135). There is no

facility based focal person in-charge of COVID-19 related matters in majority 96.30% (n=130) of the centres. Most centres do not have standard infection prevention and control protocol. No center has a dedicated ultrasound or radiographic machine for suspected or COVID-19 patients. Notwithstanding, the availability of running water, soap and hand sanitizers; regular decontamination of surfaces and seats in some facilities were not implemented.

Conclusion: There was unavailability of some PPE like the hazmat suite in many facilities. COVID-19 safety precautions were grossly suboptimal resulting from significant deficiency in policy implementation. This inadequacy in the face of the pandemic was a concern and provision of more PPE's, implementation of adequate IPC is advocated and recommended to mitigate the risks of COVID-19 infection.

Keywords: Covid-19, Safety Precautions, Radio-Diagnostic Centers, Port Harcourt.

INTRODUCTION

Coronavirus is a Ribonucleic Acid (RNA) virus which causes gastrointestinal and respiratory diseases in mammals.¹ The Coronavirus was first discovered in 1960; however the index human infection was confirmed in Wuhan, China^{2,3,4}. The

International Committee on Taxonomy of Viruses named the coronavirus disease SARS-CoV2,^{2,3} and the acronym of COVID-19 given to the disease by the World Health Organization (WHO) on February 11th, 2020.^{2,4} On the 11th March, 2020, the World Health Organization (WHO) declared the





coronavirus infection (Covid-19) a pandemic.² This declaration changed the healthcare delivery system worldwide, especially the patient and healthcare providers' interaction.¹⁻⁶ This change is occasioned by the increasing infection among healthcare providers such as Radiologist, public health physicians, surgeons, nurses, radiographers, medical laboratory scientist as well as other medical doctors. Being a highly infectious disease, the risk of exposure of patients and radiation workers to COVID-19 infection during radiologic investigations became an immense concern.²

According to the World Health Organization (WHO), over 10,000 health care providers in the frontline have been infected with COVID-19 in 40 countries,⁷ In some countries the infection is becoming very alarming wherein the healthcare delivery system is gradually being overwhelmed.⁵⁻⁸ The WHO has documented that 10% of the global infection is among health workers.⁷ This was attributed to inadequate availability of personal protective equipment which may be secondary to increasing global demand as well as restriction to travelling globally.⁷ The WHO also documented that the cause of increasing rate of infection among health workers is due to poor implementation of infection prevention and control protocols⁷. This claim was evident in the WHO survey among 30 000 facilities (clinics and hospitals) globally.⁷ The survey revealed that only about 16% of the facilities had a score above 75% in terms of availability of personal protective equipment and adherence to infection prevention and

control protocol.⁷ Majority of the facilities do not have isolation facilities and do not have the capacity to triage patients.⁷

One of the 210 countries globally affected by the COVID 19 pandemic is Nigeria^{5,6,9} and the index case of the infection in Nigeria was first confirmed in Lagos state.^{10,11} Before the confirmation of the index case of COVID 19 in Lagos, the government of Nigeria established a "Coronavirus preparedness group" to put in place protocols, guidelines and regulations concerning the screening, diagnosis and prevention of the infection as well as their implementation at the points of entries into the country.^{12,13}

Radiologic investigations have always played a very vital role in the diagnosis, management and follow-up of patients including COVID-19 patients especially those with respiratory symptoms. During radiologic investigation, the care providers are in close contact with the patient either during patient positioning for radiographic exposure, instrumentation for real time fluoroscopic evaluation, Doppler and vascular studies or during injection of radio pharmaceuticals by the Radiologist.

In the face of the COVID-19 pandemic, the challenges faced by radio-diagnosis are enormous¹⁴ and that medical imaging may be crippled by the pandemic.¹⁵ It was reported that, there is up to 90% reduction in radiologic services in the face of the pandemic.¹⁵ Since after the declaration of the coronavirus disease as a pandemic, strict safety measures and protocols have been put in place by different health institutions and



organisations to reduce or minimise the spread of the disease.

The safety guidelines of the Association of Radiologist in Nigeria for radiologic practice during the coronavirus (Covid-19) pandemic stipulates that the first safety step for radiologic departments is to develop a comprehensive working document in line with the overall hospital safety working guideline.¹⁶ This work chart should contain briefing, training and drilling for departmental staff, and proper channel of communication.¹⁶ The general guideline provided by the Association regarding radiologic centres across the Nigerian State include the provision of running water, soap and alcohol based hand sanitizer at the entrance of every radiologic centre or department.¹⁶ This is to be used by everyone entering or exiting the facility including patients, patient's relatives and staff. The seats in the waiting area of the facility should be spaced adequately (up to 2 meters apart) to ensure physical distancing. Notwithstanding, there should be constant decontamination of all surfaces and seats in the waiting area and examination rooms. The wearing of facemasks should be mandatory to all staff, patients and patients relatives.¹⁶

There is a great advocacy to schedule patient's appointments to reduce overcrowding at any one particular time while emergencies, elderly patients and children are being attended to as quickly as possible. There should be dedicated ultrasound and radiologic machines for infected patients with the availability of personal protective equipment like N95 nose

masks, protective aprons, face shield and appropriate gloves.¹⁶ Among others was also the need for ultrasound probe to be adequately decontaminated before removing the hand gloves after each procedure. The covering of the probes with transparent cellophane and removed after each use was also advocated.¹⁶ The increasing number of infection among health workers and care providers indicates that there is a gap in the IPC implementation in the facilities.⁸ It is reported that over 570,000 health workers have been infected, killing 2,500 of them in America.¹⁷ Therefore, it has become imperative to evaluate the implementation of COVID-19 safety precautions in radio-diagnostic centres in Port Harcourt.

METHODOLOGY

The study was a cross-sectional survey using a self-administered questionnaire consisting of three segments which included level of knowledge of the COVID-19, availability of infection prevention and control protocol, and availability of personal protective equipment (PPE). The content validity of the questionnaire was evaluated in line with Turner and Carlon¹⁸ methodology using the index of item-objective congruence (IOC). The index of item-objective congruence score was >0.7 which depict an adequate validity of the questionnaire content. The questionnaire was fashioned using Likert scale multiple questions of three options; YES, NO, and I Don't know; Aware, Somewhat aware and Not aware as well as Strongly agreed, Agreed and Not agreed.

Cluster sampling technique was used to select 27 radio-diagnostic centres with 5



respondents selected randomly from each centre in Port Harcourt metropolis. Five (5) respondents were used from each centre is to minimize principal officers' influence or bias¹⁹ in any one centre as the questionnaires are answered in anonymity. A total of 135 participants were recruited for the study which include Radiologist, radiographers, image technicians, administrative officers, cleaners, ancillary staffers and attendants.

The purpose of the study as enumerated in the questionnaire was disclosed to the participants to obtain an informed consent. After obtaining the consent the questionnaires were distributed to the participants in each of the centres and the completed questionnaires retrieved from the participants immediately. The author ensured that the confidentiality of the information provided by the participants was guaranteed and participation was completely voluntary. The participants were also assured that the information provided was used only for the purposes of this study. The data collected were entered into the spread sheet, using IBM Statistical Package for Social Sciences (SPSS) version 22.0 statistical software for windows and analysed statistically with descriptive statistics. The results were presented as percentages, and frequencies in tables and figures.

RESULTS

Demographic distribution of respondents shows that 42.22% are males while 57.78% are females. Majority of the respondents are within the ages of 30-39years accounting for 64 (47.41%) as shown in Table 1, and 78

(57.78%) has Secondary level of education (Figure 1). A total of 135 completed questionnaires were retrieved and analyzed. Concerning the participants' knowledge about COVID-19, all the participants (100%) responded to have heard about the coronavirus disease and 73.08% are aware of the disease with 88.15% knowing the causative agent to be a virus (Table 2). However, some of the respondents (43.70%) do not believe that the disease actually exist whereas 27.41% thought that it is synonymous with severe malaria (Table 2). This depicts that knowing is not the same as accepting the actual existence of the disease.

According to Table 3, majority of the respondents have basic knowledge about COVID-19 with reference to mode of infection and diagnosis 100% (n=130). All the respondents 100% also know the symptoms and clinical presentations of COVID-19 as Fever > 38°C, dry cough, nausea, diarrhea, fatigability as well as other respiratory features like difficulty in breathing, nasal congestion and sneezing as shown in Table 3. Table 3 also illustrates that 67.69% of the respondents are aware that the infection has an incubation period of up to 14 days. Concerning the cure 72.59% opined that there is no cure while 27.1% believed that there is a known curative agent for the diseases (Table 3).

Figure 2, enumerates that Nigeria Centre for Disease Control (NCDC) short message system (sms), radio, internet, television, bill boards, colleagues, flyers and religious centers were the sources of information concerning the pandemic. However, radio



(96.30%) and television (87.41%) were the greatest sources of information among others while internet (18.52%) and bill boards (22.22%) were the lowest sources of information.

Majority of the respondents were well informed about the mode(s) of transmission of the disease. Figure 3 shows that the modes of transmission range from close contact within people coughing (n=134), sneezing (n=134), and those returning from abroad. Avoiding crowded places (n=135), touching of eyes (n=134), ears and nose (n=100), were also documented as modes of transmission (Figure 3). According to the participants, being in crowded places (100%) is the most vulnerable mode of transmission of the disease.

The availability of infection prevention and control protocols were evaluated, and the result revealed that 86.67% of the participants affirmed the existences of physical distancing protocols in their facility, however 37.04% (n =50) documented there is no strict adherence to the protocol. Table 4 also showed that majority 70.37% (n=95) of the facility does not constantly decontaminate the surfaces and seats in the facility. Concerning the transmission of the disease, all the participants 100% (N=135) acknowledged that the COVID-19 can be transmitted from person to person.

Concerning the availability of infection prevention and control, Table 5 shows that there is a mandatory face mask wearing policy in the facilities (88.15%), with the availability disposable bed rolls for each

patient during procedures (88.15%). Table 5 also illustrates that non-contact infrared thermometers and running water with soap are used in all the facilities (100%). Majority (66.67%) of the facilities do not have protocol to triage patients, however 100% of the respondents are aware that healthcare providers are risk of being infected.

Figure 4 shows the availability of PPE's while Figure 5 shows the availability of different types of personal protective equipment in the facilities to a varying degree. Face mask 20% (n=27), face shield 0.89% (n=12), hand gloves 18.52% (n=25), goggle 17.04% (n=23), hazmat suite 7.41% (n=10), hair cover 22.22% (n=30), N95 mask 37.04% (n=55), and surgical mask 74.07% (n=100) as illustrated in Figure 5.

Comprehensive facility document/ guideline are not available in 74.07% of the facilities (Table 6). There is a regular briefing/ training and drilling in 44.44% of the facilities whereas such briefings do not take place in 48.15% of the facilities as also shown in Table 6. Concerning a focal person or representative in-charge of COVID-19 related issues (facility incidence manager), 92.59% of the facilities do not have a facility based incident manager likewise 92.59% of the facilities do not have a dedicated x-ray or Ultrasound machine for COVID-19 patients (Table 6).

Table 1. Age distribution of respondents

Age group (Years)	Frequency (N)	Percentage (%)
Up to 19	11	8.15
20-29	24	17.78
30-39	64	47.41
40-49	28	20.74
50yrs and above	8	5.93
Total	135	100

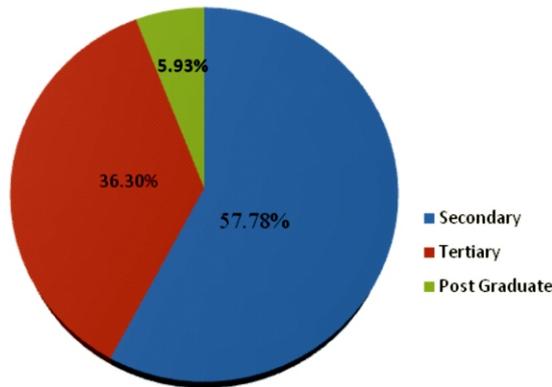


Figure 1. Education Level of Respondents

Table 2. Participants Level of knowledge about the COVID-19 pandemic

VARIABLE	RESPONSES	Frequency (N)	Percentage (%)
Have you heard of Corona virus disease (COVID-19)?	YES	135	100%
	NO	-	0%
	---	-	0%
	TOTAL	135	100%
What is your level of awareness of the disease?	Aware	95	73.08%
	Somewhat aware	35	26.92%
	Not Aware	-	0%
	TOTAL	130	100%
Do you believe that the disease actually exist?	YES	68	50.37%
	NO	59	43.70%
	I Don't know	8	5.93%
	TOTAL	135	100%
Do you know that COVID-19 disease is caused by a virus?	YES	119	88.15%
	NO	9	6.67%
	I Don't know	7	5.19%
	TOTAL	135	100%
How would you rate the level of infectivity of the virus?	Highly	110	88%
	Mildly	6	4.8%
	I Don't know	9	7.2%
	TOTAL	125	100%
Do you think severe malaria is the same as COVID-19?	YES	37	27.41%
	NO	89	65.93%
	I Don't know	9	6.67%
	TOTAL	135	100%

Table 3. Level of knowledge about the presentation, symptoms, diagnosis and treatment of COVID-19

VARIABLE	RESPONSES	Frequency (N=135)	Percentage (%)
Are you aware of the mode of transmission of the disease?	YES	130	100%
	NO	-	-
	I Don't know	-	-
	TOTAL	130	100%
The infection has an incubation period is up to 14 days	Aware	88	67.69%
	Somewhat aware	42	32.31%
	Not aware	-	-
	Total	130	100%
Is the diagnosis confirmed by laboratory test only?	YES	130	100%
	NO	-	-
	I Don't know	-	-
	Total	130	100%
The clinical presentations of COVID-19 includes Fever > 38°C, Dry cough, and Difficulty in breathing.	YES	130	100%
	NO	-	-
	I Don't know	-	-
	Total	130	100%
Does the disease have a known cure	YES	37	27.41%
	NO	98	72.59%
	I Don't know	-	-
	Total	135	100%

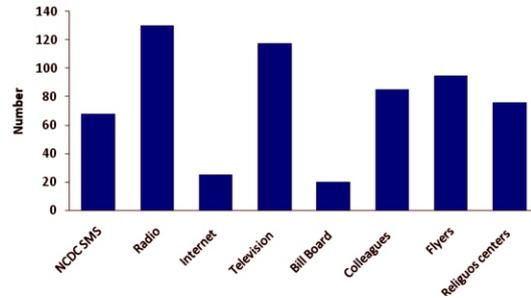


Figure 2: Source(s) of information concerning COVID-19

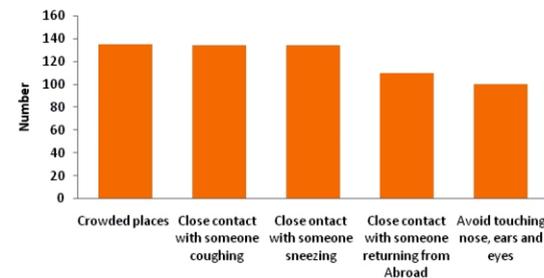


Figure 3: Responses concerning the modes of transmission of the disease

Table 4. Availability of infection prevention and control protocol

VARIABLE	Responses	Frequency (N=135)	Percentage (%)
Is there physical distancing in your facility?	YES	117	86.67
	NO	18	13.33
	I Don't know	-	0
	TOTAL	135	100
Is physical distancing protocol in the facility strictly adherence to?	YES	70	51.85%
	NO	50	37.04%
	I Don't know	15	11.11
	TOTAL	135	100
Is there constant decontamination of surfaces and seats in the facility?	YES	37	27.41%
	NO	95	70.37%
	I Don't know	3	2.22
	Total	135	100%
Can the disease be transmitted from person to person	YES	135	100%
	NO	-	-
	I Don't know	-	-
	TOTAL	135	100%

Table 5. Availability of infection prevention and control protocol continued

VARIABLE	Responses	Frequency (N)	Percentage (%)
Is there a mandatory face mask wearing policy in the facility?	YES	119	88.15%
	NO	9	6.67%
	I Don't know	7	5.19%
	TOTAL	135	100%
Is there disposable bed rolls for each patient during procedure	YES	119	88.15%
	NO	9	6.67%
	I Don't know	7	5.19%
	TOTAL	135	100%
Is non-contact infrared thermometers used in the facility?	YES	135	100%
	NO	-	0%
	I Don't know	-	0%
	Total	135	100%
Is there running water and soap for all at the entrance of the facility?	YES	135	100%
	NO	-	0%
	I Don't know	-	0%
	Total	135	100%
Are hand sanitizer available at the entrance of the facility for use by all	YES	135	100%
	NO	-	0%
	I Don't know	-	0%
	Total	135	100%
Any protocol to triage patients in the facility?	YES	35	25.93%
	NO	90	66.67%
	I Don't know	9	6.67%
	TOTAL	135	100%
The spread of the infection can be prevented	Strongly Agreed	118	87.41%
	Agreed	12	8.89%
	Not agreed	5	3.70%
	Total	135	100%
Do you know that as a health workers you are at risk of being infected?	YES	135	100%
	NO	-	0%
	I Don't know	-	0%
	Total	135	100%

Table 6. Responses concerning protocols based on each facility

VARIABLE	Responses	Frequency (N=135)	Percentage (%)
Is there a comprehensive facility document/guideline	YES	4	14.81
	NO	20	74.07
	I Don't know	3	11.11
	TOTAL	27	100
Is there regular briefing/ training and drilling in the facility	YES	14	51.85%
	NO	13	48.15%
	I Don't know	-	0
	TOTAL	27	100
Any focal person or representative in charge of COVID 19 related matter (facility incidence manager)?	YES	1	3.70
	NO	25	92.59
	I Don't know	1	3.70
	TOTAL	27	100
Any dedicated x-ray or Ultrasound machine for COVID-19 Patients	YES	-	82.29
	NO	25	92.59
	I Don't know	2	7.41
	TOTAL	27	100

DISCUSSION

Being a highly infectious disease, the risk of exposure of patients and radiation workers to the infection during radiologic investigations has become of immense concern with the consequent need to evaluate the implementation of COVID-19 safety precautions in radio-diagnostic centres in Port Harcourt.

All the participants have heard about the coronavirus disease and 72.59% are aware of the disease, this is similar to the survey conducted by Ogolodom et al.²⁰ In their study²⁰ to evaluate the Knowledge, Attitudes and Fears of HealthCare Workers towards the Corona Virus Disease (COVID-19) Pandemic in South-South, Nigeria revealed that 168 (56%) of the participants were highly aware of the pandemic. The higher level of awareness in the index study compared to the study by Ogolodom et al.²⁰ could be attributed to the disparity of the study population and site. The index study is a facility based study while their study is a not facility based with a wider coverage and higher study population.

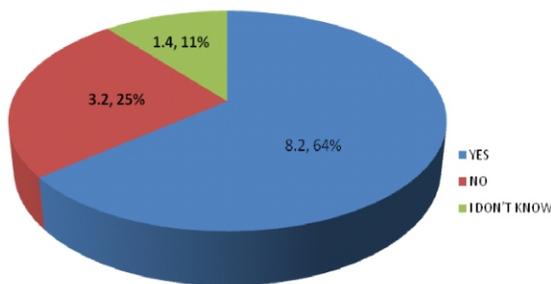


Figure 4. Availability of personal protective equipment (PPE).

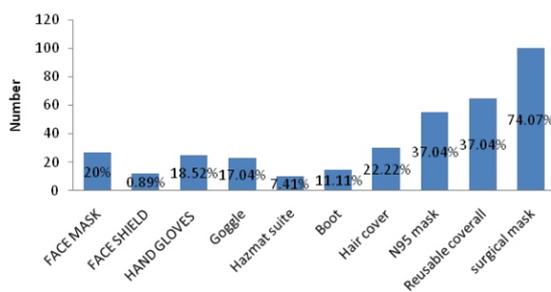


Figure 5. Types of personal protective equipment (PPE) available



Majority of the respondents accounting for 88.15% know the causative agent of the disease; this is in keeping with other studies as documented by WHO²¹, however, some of the respondents (43.70%) in the index study do not actually believe that the disease actually exists. This depicts that having heard of disease is different from internalizing and accepting the actual existence of the disease. This development is a source of worry because it may contribute to poor adherence to established extant protocols and guideline. This may have also contributed to thought by some of the respondents (27.41%) that COVID-19 is synonymous with severe malaria. No documentation has suggested that COVID-19 is synonymous with malaria however, there are different speculations that people in malaria endemic areas tend to develop some level of protection against the severe form of the Corona virus disease.²²

According to the report by Aurora Parodi and Emanuele Cozzani²², in African were malaria is one of the leading causes of significant morbidity and mortality, it is opined that anti-malarial immunity may have contributed to the less severity in the African Continent²². This hypothesis was drawn from the inference that individuals who have had malaria infection, whether they were symptomatic or asymptomatic have developed antibodies to Plasmodium specific antigens.^{22,23} The antibodies are targeted to Glycosylphosphatidylinositol (GPI), which are anchor molecules to some of the membrane proteins of Plasmodium which has the propensity to trigger anti-parasitic immune response.^{22, 23} This ideology was supported by the study conducted by Napoli

et al.²⁴ The study²⁴ documented that there is an epidemiological paradox between coronavirus disease (COVID-19) and malaria.²⁴ It was revealed that there was some level of protection against the coronavirus disease in malaria endemic areas, implicating both molecular and genetic variations.²⁴ These information's, in addition to the fact that the symptoms and signs of COVID-19 are similar to that of malaria as well as the alleged effectiveness of antimalarial agents (chloroquine and hydroxychloroquine) in its treatment²⁵ may have contributed to the misconstrued information that COVID-19 is similar to malaria.

The index study revealed that majority have basic knowledge about COVID-19 regarding the cause, mode of infection, transmission, diagnosis symptoms and clinical presentations of disease which is similar to the documentations in other publication.^{20,26-}

²⁸ This is attributable to the massive campaigns and education in the social media, television, radio, bill boards, clinical meeting and town criers etc. Radio and television were the greatest sources of information while other sources include the bill boards and internet. Contrary to the survey documented by Ogolodom et al²⁰ in which colleagues were the most common source of information concerning the pandemic followed by social medial platforms. It is worthy of mention that the novel and deadly corona virus evoked a cascade of different mechanisms of campaign, public enlightenment and education.

Physical distancing protocol is one of the frontline prevention tools in the fight against



the coronavirus pandemic. This is because the disease spreads principally from person to person and among close contact. The implementation of infection prevention and control protocols revealed that there is physical distancing protocols in the facilities however the implementation is suboptimal. Whereas other infection prevention protocols like constant decontamination of seats and surfaces are not strictly practiced. Mandatory face mask wearing policy was established in majority of the facilities and there is availability of disposable bed rolls for each patient during procedures. Non-contact infrared thermometers and running water with soap are used in all the facilities however, majority of the facilities do not have protocol to triage patients. There are personal protective equipment's (PPE) in the facilities to a varying degree. The PPE's available were face mask, face shield, hand gloves, goggle, hazmat suite, boot, hair cover, N95 mask, and surgical mask. Not all facilities have the all the PPE and they were not enough compared to the number of patients seen.

Training and re-training of personnel both at the national and facility level is one of the gold standards in effective implementation of IPC²⁸. Regular briefing and training takes place in about half of the facilities. Contrary to the WHO and ARIN guideline^{16,29}, there is meant to be regular briefing and training while observing other guidelines and protocols.

Majority of the facilities do not have comprehensive facility based document or guideline domiciled to meet the challenges of

radiologic practice. Although, there are IPC guidelines but these guidelines were not adhered to. This may be due to the unavailability of an incident manager or a focal person in charge of issues related to the pandemic³⁰. During a pandemic there is need for an incident manager or a focal person in-charge of the pandemic in every facility. The index study revealed that almost all the facilities do not have a facility based incident manager or a dedicated personnel in-charge of the pandemic. This is because it is the duty of the incident manager to coordinate the day to day activities concerning pandemic in the facility and to report same to the appropriate authority on a daily basis. The incident manager is to ensure risk assessment of the impact of the disease on the facility and develop a plan to mitigate such.

The corona virus is a very contagious one, which had affected so many persons across the globe. As contagious as the Coronavirus is, there is a need for a dedicated radiologic machines (conventional x-ray, and ultrasonography). This was strongly advocated by the Association of Radiologist in Nigeria proposed safety guideline.¹⁶ The study showed that no center has a dedicated x-ray or ultrasound machine for COVID-19 patients. The lack of dedicated machine could be due to lack of fund in procuring more machine when the existing ones are not even enough. Notwithstanding, the availability of running water, soap and hand sanitizers; regular decontamination of surfaces and seats within the facility is not implemented. These indicate inadequate preparedness of the radiologic facilities in curbing the spread of the pandemic.



CONCLUSION

There was unavailability of some personal protective equipment like the hazmat suite in majority of the facilities while those PPE's that were available were insufficient except for surgical face mask. Majority of the facilities do not have domiciled comprehensive facility based guidelines and there were inadequate safety precautions in almost all the radio-diagnostic centres. These put both patients and health care providers at risk of contracting the infection.

This inadequacy in the face of the pandemic is a concern; therefore, the provision of PPE and implementation of adequate IPC is advocated and recommended to mitigate the risks of COVID-19 infection.

REFERENCE

1. Pal M, Berhanu G, Desalegn C, Kandi V. Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2): An Update. *Cureus*. 2020;12(3):e7423. doi:10.7759/cureus.7423
2. Shazia Fatima and Zaheer Chiragh. Nuclear medicine practices in Pakistan in the times of COVID-19: steps to move forward. *Pakistan Journal of Nuclear Medicine*, 2020;10:54-59
3. Gorbalenya AE, Baker SC, Baric RS, de Groot RJ, Drosten C, Gulyaeva AA, et al. The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol*. 2020;5(4):536-44. <https://doi.org/10.1038/s41564-020-0695-z>
4. World Health Organization. Novel Coronavirus (2019-nCoV) Situation Report—22; 2020. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200211-sitrep-22-nCoV.pdf?sfvrsn=fb6d49b1_2&fbclid=IwAR0wvAWUxxQqYTvNcsUr3s5USzzj7C-kFuf2CmjZVeuo_5UxBaT94YDDZs. Accessed April 20, 2020.
5. COVID 19 pandemic in Nigeria. https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Nigeria. Accessed 22nd May 2020
6. "FIRST CASE OF CORONA VIRUS DISEASE CONFIRMED IN NIGERIA". Nigeria Centre for Disease Control. 28 February 2020. Accessed 10 March 2020
7. World Health Organization. Over 10 000 health workers in Africa infected with COVID-19. Available from: <https://www.afro.who.int/news/over-10-000-health-workers-africa-infected-covid-19> Retrieved 24 July 2020.
8. Islam, M. S., Rahman, K. M., Sun, Y., Qureshi, M. O., Abdi, I., Chughtai, A. A., & Seale, H. Current knowledge of COVID-19 and infection prevention and control strategies in healthcare settings: A global analysis. *Infection control and hospital epidemiology*, 2020. 41(10), 1196-1206. <https://doi.org/10.1017/ice.2020.237>
9. Ajisegiri, W.S., Odusanya, O.O. and Joshi, R., COVID-19 Outbreak Situation in Nigeria and the Need for Effective Engagement of Community Health Workers for Epidemic Response. *Global Biosecurity*, 2020.1(4), p.None. DOI:



- <http://doi.org/10.31646/gbio.69>
10. Nigeria Centre for Disease Control. First Case of Corona virus Disease Confirmed in Nigeria [Internet]. 2020 [cited 2020 Apr 1]. Available from: <https://ncdc.gov.ng/news/227/first-case-of-corona-virus-disease-confirmed-in-nigeria>.
 11. Nigeria Centre for Disease Control. COVID-19 Outbreak In Nigeria Situation Report S/N 54 Abuja; 2020. Available from : <https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID-19%20outbreak%20in%20Nigeria>. Accessed 23rd April, 2020.
 12. Ihekweazu C. Steps Nigeria is taking to prepare for cases of coronavirus. The Conversation. 2020. Available from: <http://theconversation.com/steps-nigeria-is-taking-to-prepare-for-cases-of-coronavirus-130704>. Accessed 8th May 2020.
 13. Adepoju P. Nigeria responds to COVID-19; First Case Detected in sub-Saharan Africa. *Nat Med*. 2020 Mar 11;26:444–8.
 14. Kate Madden Yee. Radiology volume, research will take COVID-19. Available from : [hit.https://www.auntminnie.com/index.aspx?sec=sup&sub=adv&pag=dis&ItemID=128734](https://www.auntminnie.com/index.aspx?sec=sup&sub=adv&pag=dis&ItemID=128734)
 15. Theresa Pablos. Pandemic paralysis: COVID-19 has major impact on imaging. Available from : <https://www.auntminnie.com/index.aspx?sec=sup&sub=imc&pag=dis&ItemID=128865> Accessed 6th October 2020
 16. Safety Guides for Radiologic Practice during the Coronavirus (COVID-19) Pandemic. A document of the Association of Radiologists in Nigeria (ARIN). 14th April, 2020, ARIN document - ARIN / M - 02/COVID/03/20, (Unpublished)
 17. Pan American Health Organization, <https://www.paho.org/en/news/2-9-2020-covid-19-has-infected-some-570000-health-workers-and-killed-2500-americas-paho>. Accessed 5th September 2020
 18. Turner RC, Carlson L Indexes of item-objective congruence for multidimensional items. *Int J Test* 2003;3:163-171.
 19. Research methods for the social sciences. Chapter 9, Survey Research. <https://courses.lumenlearning.com/suny-hccc-research-methods/chapter/chapter-9-survey-research/> Accessed 3rd September 2020.
 20. Ogolodom MP, Mbaba AN, Alazigha N, Erundu OF, Egbe NO, Golden I, et al. Knowledge, Attitudes and Fears of HealthCare Workers towards the Corona Virus Disease (COVID-19) Pandemic in South-South, Nigeria. *Health Sci J. Sp.* 2020; Iss 1: 002. DOI: 10.36648/1791-809X.S1.002
 21. World Health Organization. Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations. Scientific brief. 29th March 2020. Available from: <https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing->

- covid-19-implications-for-ipc-precaution-recommendations. Accessed 6th October 2020
22. Aurora Parodi and Emanuele Cozzani. Coronavirus disease 2019 (COVID 19) and Malaria. Have anti glycoprotein antibodies a role? *Med Hypotheses*. 2020 Oct; 143: 110036. Published online 2020 Jun 25. doi: 10.1016/j.mehy.2020.110036. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7314692/> Accessed 11th October 2020.
 23. Mendonça V.R., Barral-Netto M. Immunoregulation in human malaria: the challenge of understanding asymptomatic infection. *Mem Inst Oswaldo Cruz*. 2015;110:945–955. [PMC free article] [PubMed] [Google Scholar]. Accessed 11th October 2020.
 24. Napoli PE, Nioi M. Global Spread of Coronavirus Disease 2019 and Malaria: An Epidemiological Paradox in the Early Stage of A Pandemic. *J Clin Med*. 2020 Apr 16;9(4):1138. doi: 10.3390/jcm9041138. PMID: 32316118; PMCID: PMC7230338.
 25. Meo SA, Klonoff DC, Akram J. Efficacy of chloroquine and hydroxychloroquine in the treatment of COVID-19. *Eur Rev Med Pharmacol Sci*. 2020 Apr; 24(8): 4539-4547. doi: 10.26355/eurrev_202004_21038. PMID: 32373993.
 26. Adhikari, S., Meng, S., Wu, Y. et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infect Dis Poverty* 9, 29 (2020). <https://doi.org/10.1186/s40249-020-00646-x>
 27. Liu T, Hu J, Kang M, Lin L, Zhong H, Xiao J, et al. Transmission dynamics of 2019 novel coronavirus (2019-nCoV). *bioRxiv* 2020; 01.25.919787 doi: <https://doi.org/10.1101/2020.01.25.919787>. Accessed 3rd September 2020
 28. Huang C, Wang Y, Li X, Ren L, Zhao Jianping, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020; 395: 497–506. [https://doi.org/10.1016/S0140-6736\(20\)30183-5](https://doi.org/10.1016/S0140-6736(20)30183-5)
 29. Minimum requirements for infection prevention and control. Geneva: World Health Organization; 2019. <https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/> Accessed 4th September 2020.
 30. National Primary Healthcare Development Agency. Preparedness and response to coronavirus disease 2019 (COVID-19) at primary healthcare and community level. Available from: https://www.alnap.org/system/files/content/resource/files/main/guide_on_phc_preparedness_and_response-covid-19.pdf. Accessed 10th October 2020.