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Risk Assessment of Covid-19 Infection among Healthcare Workers at 3 Treatment Centres in Katsina State, Nigeria

Dr. Medinat Suleiman Ronke

Consultant, Department of Medical Microbiology, Federal Medical Centre, Katsina, Nigeria

Dr. Joan Ejembi

Consultant, Department of Medical Microbiology and Parasitology,
Ahmadu Bello University Teaching Hospital, Zaria, Nigeria

Dr. Halima Haladu

Consultant, Department of Chemical Pathology, Federal Medical Centre, Katsina, Nigeria

Dr. Taiwo Wulemot Oloyode

Consultant, Department of Chemical Pathology, Federal Medical Centre, Katsina, Nigeria

Dr. Jemila Suleiman

Consultant, Department of Haematology, Federal Medical Centre, Katsina, Nigeria

Dr. Raliya Aliyu

Consultant, Department of Internal Medicine, Federal Medical Centre, Katsina, Nigeria

Dr. Abdullahi Sanda

Consultant, Department of Medical Microbiology, Federal Medical Centre, Katsina, Nigeria

Dr. Yohanna Joseph

Consultant, Department of Otorhinolaryngology, Federal Medical Centre, Katsina, Nigeria

Dr. Abdulmajeed Suleiman

Consultant, Department of Otorhinolaryngology, Federal Medical Centre, Katsina, Nigeria

Abstract:

The Coronavirus disease 19 (Covid-19) has gradually spread all over the world becoming a serious public health problem. The pandemic has virtually affected the economic systems of both the developing and developed world. Health workers are the front-liners of the covid-19 outbreak and are exposed to hazards that put them at risk of the infection. The major reason for health care workers infection is their lack of understanding of the disease, unavailability of personal protective equipment's (PPEs), psychological stress to mention but few.

The aim of the study is to assess the exposure of healthcare workers to covid-19 and to improve Infection, prevention and control (IPC) practices at all level and contain the current covid-19 outbreak at Federal Medical Centre Katsina, Turai Maternal and Child Health and General AmadiRimi Specialist Hospital.

There were 28 positive cases and 56 controls in ratio 2:1. Males were 63 while females were 15. The mean age was 36. Doctors were mostly affected. Those adequately trained for covid-19 IPC were 47%. Those who knew what risk assessment was 23%. Health Care Workers with community exposure were 60.3% and those with occupational exposure were 35.9%. High risk group in this study were use of N95 or its equivalent (54%), removal of PPE according to protocol (71%), hand hygiene after touching patients surrounding (58%). Decontamination of high surfaces (74%). Protection of health care workers should be made a priority by regularly training and retraining them, making PPEs available, ensuring HCWs get tested.

Keywords: Covid-19, Health Care Workers, IPC, PPE, Katsina, Nigeria

1. Introduction

Thousands of health workers globally have been reported to be infected with the coronavirus caused by severe acute respiratory syndrome coronavirus (SARS-COV-2) the pandemic has challenged the health systems of most countries. It has affected no more than 11 million people with about 528,364 deaths and over 6 million recoveries in 187 countries as of 5th July 2020ⁱⁱ. The person-to-person transmission routes of covid-19 includes direct transmissions, such as cough, sneeze, droplet inhalation, transmission, and contact transmission, such as the contact with oral, nasal and eye mucous membranesⁱⁱⁱ.

Health workers are the front-liners of the Covid-19 outbreak response and are exposed to hazards that put them at risk of infection^{iv}.

In Nigeria, about 812 healthcare workers are infected 29 of these people work for NCDC^v.

Frontline health workers could be at high risk of infection because of close contact with an infected patient. HCWs with infection could cause secondary transmission among patients, family and the community. Hence, it is essential to investigate the infection risk of healthcare workers.

Therefore, it is a public health priority for policymakers to be aware of the vulnerable group's risk factors to prevent occupational transmission.

It is highly contagious. Its high transmissibility has resulted in many infections and hospitalization, even among health care workers. They are at risk of acquiring covid-19 due to increased occupational exposure to SARS-COV-2.

Insufficient access to personal protective equipment (PPEs) or weak infection prevention and control measures raise the risk of health workers infection; health workers can also be exposed to an asymptomatic patient in the health facility for a range of other services. The risk may also arise when health personnel repurpose for a covid-19 response without adequate breathing or a heavy workload, resulting in fatigue worn-out and possibly not entirely using the standard operating procedures. In most African countries, infection, prevention and control measures aimed at preventing infections in health facilities are still not fully implemented^{vi}.

In late July 2020, the World health organization announced that over 10,000 healthcare workers in Africa had tested positive for covid-19^{vii}. Only 16% of about 3000 facilities surveyed by WHO has assessment scores above 75%. Most healthcare centres do not have the infrastructure necessary to implement key infection, prevention measure or to avoid congestion. Only 7.8% (2213) had isolation facilities, and just one third could triage patient. 10% of covid-19 in Serria-Leone were among health workers, which has dropped to 9% in Cote d'Ivoire. The infection among health workers has dropped from 6.1% to 1.4%, scaling up IPC measures can further reduce infections among health workers.

WHO defines health workers as all people engaged in action whose primary intent is to enhance health: this includes doctors, nurses, midwives, paramedical staff, hospital administrators and support staff, and community workers who are at risk of infection with Covid-19 protecting HCW is challenging.

In most countries, where there is inadequate PPE, limited testing capacity produces early identification and isolation cases. But HCW is mostly at risk because the majority of patient with Covid-19 remain asymptomatic. Unmitigated, rising infection and mortality rates in Healthcare Workers paralyse a country response to Covid-19^{viii}. It is bound to have a significant long-term impact on the country's health care delivery. There is a shortage of HCW due to skilled labour migration and geographical mal-distribution even before the pandemic.

1.1. Aims

To assess the exposure of Healthcare workers to covid-19 and to improve Infection, prevention and control (IPC) practices at all level and contain the current covid-19 outbreak at Federal Medical Centre Katsina, Turai Maternal and Child Health and General AmadiRimi Specialist Hospital.

1.2. Objectives

- To assess and compare exposure among infected and non-infected HCWs who managed COVID-19 patients at Federal Medical Centre Katsina and the two other hospitals.
- To identify gaps in IPC practices among HCWs at Federal Medical Centre Katsina and the other two hospitals.
- To explore infection risk and discuss possible prevention measures.

2. Methods

2.1. Study Area

We conducted the operational research at three treatment centres. These were Federal Medical Centre Katsina, Turai Maternity and Child Centre and General AmadiRimi Specialist Hospital Katsina (G A R S H). Federal Medical Centre Katsina is one of the Treatment Centers for COVID-19 in Katsina, Nigeria.

2.2. Study Design

An unmatched case-control study at the ratio of 1:2 was conducted at this treatment facility. Screening of health care workers began with symptomatic ones and those that have contact with covid-19 patients. Testing for covid-19 was done using a deep nasopharyngeal swab by trained professionals; validated RT-PCR was performed at the reference lab to confirm infection.

A case was defined as HCW irrespective of cadre who tested positive for SARS CoV-2 by PCR after exposure to confirmed cases of COVID-19. In contrast, controls will be defined as HCW who tested negative for SARS CoV-2 by PCR after exposure or contact with confirmed cases of COVID-19.

For every SARS CoV-2 positive HCW, two controls who had contact with the index cases were selected, and the risk assessment of both cases and controls conducted.

2.3. Study Population

All cadre of HCWs at Federal Medical Centre Katsina, Turai Maternal and Child Hospital Katsina, General AmadiRimi Specialist Hospital Katsina (GARSH), who tested positive to SARS CoV-2 were selected as cases and controls were all cadres of HCWs at Federal Medical Centre Katsina and the two other hospitals, who tested negative to SARS CoV-2.

2.3.1. Inclusion Criteria

All healthcare workers (doctors, nurses, scientist, pharmacist, attendants, cleaners) at FMC Katsina, Turai Maternal and Child Hospital and General AmadiRimi Specialist Hospital.

2.3.2. Exclusion Criteria

Non-healthcare workers.

2.4. Study Measures

Community exposure to covid-19 was assessed using the WHO risk assessment tool, part one of the tools. Respondents are community exposed if they answer 'yes' to a history of staying in the same household or classroom with a confirmed Covid-19 patient. Travel history in close proximity (within one meter) with a confirmed covid-19 patient. Occupational exposure; This is assessed if healthcare workers respond 'yes' to section 4 of the WHO assessment tool; these provide direct care to a confirmed Covid-19 patient. Performing aerosol-generating procedures on confirmed covid-19 patient and had direct contact with the patient environment.

Risk categorization of health care workers exposed to covid-19. Health workers are considered high risk if their response is no to 'always as recommended' options to WHO HCWs risk assessment tool and low risk if their response is 'yes' to other options to the following IPC measures; wearing of single used gloves. Medical mask, face shield or goggles, disposable gown, removing and replacing PPE according to protocol, performing five moments of hand hygiene, aerosol-generating procedures, decontaminating high touch surfaces at least three times daily, and any accident with body fluid/respiratory^{ix}.

2.5. Data Collection Tools

This study utilized quantitative and qualitative data collection methods were.

The WHO adopted a risk assessment tool and a structured interviewer/self-administered questionnaire with closed and open-ended questions using the quantitative method. This questionnaire had sections on demography, index patients, exposure, IPC knowledge and practice^x.

Did a qualitative method via Focus group discussion (FGD) conducted among Cases and Controls using an FGD guide.

2.6. Ethical Consideration

- Consent: Obtained Verbal and written consent from all participants. Participation was voluntary, and participants were allowed to withdraw at any point during the study.
- Ethical approval: Sought ethical approval from the Federal Medical Centre Katsina Ethical committee.
- Data analysis: Data was analyzed using SPSS version 21

3. Result

Federal Medical Centre was the primary treatment centre with the highest number of positive cases. 22 Health care workers tested positive for covid-19 within six months. Turai Child and Maternity hospital Katsina had three health care workers that tested positive, but 2 HCWs volunteered for this study. In GARSH, five were tested positive only two volunteered for this study making 26 Healthcare workers that tested positive in all the three hospitals. 52 controls were used for the study, making a ratio of 1:2. Therefore, 78 participants were involved in the study.

Among the positive HCWS, most were asymptomatic but were hospitalized. Only one was admitted to the intensive care unit. There were two deaths, an attendant and an auditor at Federal Medical Centre Katsina. No death case was recorded in the other treatment centre.

There were 63 males (78.8%) and 15 (21.2%) females in this study TABLE 1:

Sex	Status				Total
	Cases	%	Control	%	
Male	22	84.6	41	78.8	63
Female	4	15.4	11	21.2	15
prefer not to answer	0	0.0	0	0.0	0
Total	26	100	52	100	78

Table 1: HealthCare Workers Gender

The mean age is 36.19. Those with no education were 3(3.8%). Those with secondary education were 6 (7.7%) Those with tertiary education were 65(83%). Respondents that were married were 51(65%), while those that were single were 27(35%). No respondents were divorced or widowed. Many doctors participated in this study, 55(71%), six registered nurses (8%). Medical lab scientists were 3 (4%), Cleaners 2(3%) Health attendants were 9(12%). Those tested for covid-19 were 26 (33%). while those that did not were 52 (67%). Table 2

Variables		Frequency N=78	Percentage (%)
Mean age (SD), Min-Max		36.19 (6.7), 24-53	
Highest educational qualification	no education	3	3.8
	Primary	4	5.1
	secondary school	6	7.7
	Tertiary	65	83
Marital status of the participants	Single	27	35
	Married	51	65
	Divorced	0	0
	Separated	0	0
	Widowed	0	0
The department to the participant belongs.	A and E	8	10
	medical wards	0	0
	surgical wards	0	0
	ICU	7	9
	isolation ward	6	7.7
	Admin	0	0
	Pediatrics wards	2	2.6
	O&G	9	12
	Others	46	59
Designation of the HCW	Medical doctor	55	71
	physician assistant	0	0
	registered nurse	6	7.7
	Phlebotomist	0	0
	MLS	3	3.8
	Nutritionist	0	0
	Admin	0	0
	Cleaner	2	2.6
Tested for COVID-19	Yes	26	33
	No	52	67

Table 2: Sociodemographic Characteristics of the Study Participants

Departments in which HCWs were exposed to a confirmed case of covid-19 are as shown in the table below.

		Where Did the Contact Occur					
			call duty	A&E	clinic	ward	others
Were you exposed to a confirmed case of a COVID-19 patient?	yes		10	15	1	14	26
	no	12	0	0	0	0	0
Did the patient have symptoms suggestive of COVID-19 at first contact?	yes		6	9	0	9	19
	no	9	4	6	1	5	10

Table 3: Exposure to a Confirmed Case of Covid-19

				Did you know what the risk assessment for PPE use is?		
		Frequency	percentages	yes	Frequency	Per cent
Were you adequately trained to protect yourself against SARS COV 2?				yes	17	23.1
	yes	37	47.436	no	61	76.9
	no	41	52.564	Total	78	100.0
If yes, what is it?						
					Frequency	
NO					61	
ABILITY TO TRIAGE THE PATIENT					1	
APPROPRIATE PPE BASED ON RISK					1	
APPROPRIATE USE OF PPE AND EVALUATION OF INFECTION					1	
ESTABLISH IF YOU NEED TO WEAR PPE					1	
IDENTIFYING AND TAKING PRECAUTION ON RISK					4	
KNOWING TYPE OF PPE TO BE USED					1	
MEASURES TAKEN WHILE USING PPE					1	
PROTECTIVE MEASURES					1	
RISK OF CONTACTING INFECTION WHEN EXPOSED TO A PT					1	
RISK OF EXPOSURE DURING REMOVING PPE					2	
USE OF PPE					2	
USING PPE TO PROTECT FROM INFECTION					1	
Total					78	

Table 4

Those that responded to the availability of facilities for hand hygiene were also included in the table. The majority of HCWs (73) did not have the premorbid condition. Those HCWS with hypertension were 2, hypertension and asthma were one, diabetes one, Asthma one. Those that adequately trained for SARS COV 2 were 37 (47%). Those that were not were 41 (53%). Those who knew what risk assessment was few 17 (23%) while those that did not were 61 (77%). Their view on what risk assessment is on the table below.

If Yes to Premorbid Conditions			
	yes	no	
Nil	0	73	
Hypertension	2	0	
Hypertension, asthma	1	0	
Diabetes	1	0	
Heart disease	0	0	
Renal disease	0	0	
Asthma	1	0	
Others	0	0	

Table 5: Premorbid Condition

3.1. Community Exposure

HCWS that have a history of staying in the same household with the confirmed patient were 47(60.3%) Those that did not were 31 (39.7%) Those with a history of travelling with a confirmed case of covid-19 were 24(30.8%). Those without were 54(69.2%). Table 6

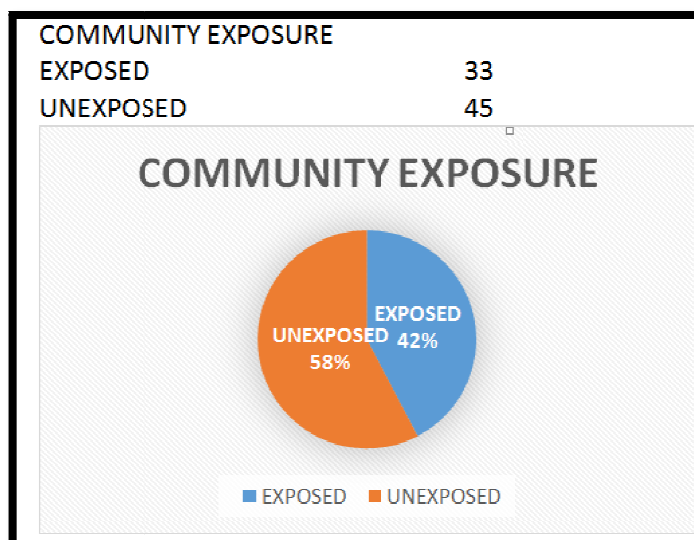


Figure 1

Community Exposure		Total	Percentage
Does the Healthcare Workers have a history of staying in the same household with a confirmed patient	Yes	47	60.3%
	No	31	39.7%
		78	100.0%
Does the Healthcare Workers have a history of travelling with the confirmed case	Yes	24	30.8%
	No	54	69.2%

Table 6

Does the Healthcare Workers have a history of staying in the same household with a confirmed patient		Cases		Control		TOTAL
		Total	(%)	Total	(%)	
	EXPOSED	16	61.5	28	53.8	44
	UNEXPOSED	10	38.5	24	46.2	34
	TOTAL	26		52		78
*ODD RATIO		1.4				
Those with covid-19 are 1.4 times as likely to have the exposure compared to those without covid-19.						
Does the HCW have a history of travelling with the confirmed case?		Cases		Control		TOTAL
		Total	(%)	Total	(%)	
	EXPOSED	6	23.1	17	32.7	23
	UNEXPOSED	20	76.9	35	67.3	55
	TOTAL	26		52		78
*ODD RATIO		0.6				
Those with covid-19 are 0.6 times as likely to have the exposure compared to those without covid-19.						

Table 7: Community Exposure to Covid-19 Case and Control

3.2. Occupational Exposure

Health care workers with low risk of exposure were 64.1%, while those with high risk were 35.9%. These are shown in the table below.

Occupational Exposure	
LOW RISK	64.1
HIGH RISK	35.9

Table 8

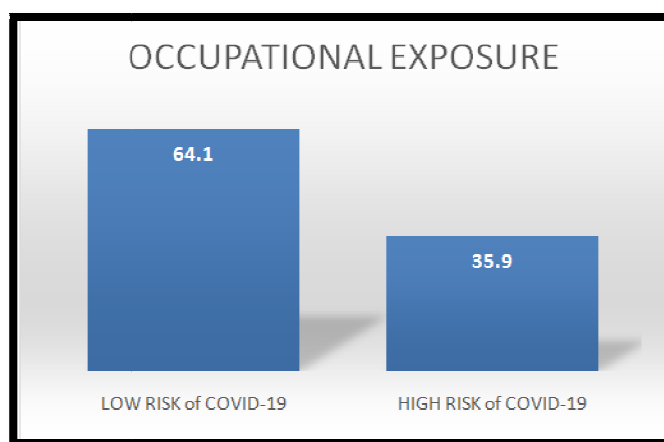


Figure 2

In Q4 of the WHO risk assessment, those that provided direct care to a confirmed covid-19 patient were 53 (67.90%) while those that did not were 23 (29.50%) and those that were not sure were 2 (2.60%). Those with face-to-face contact within one meter were 66 (84.60%), while those without contact were 10 (12.80%), and those that were not sure were 2 (2.60%). Those that were present during the aerosol-generating procedure performed on the patient were 27 (34.60%). Those not present were 42 (53.80%). Those that were not sure were 9 (11.60%). Out of the 27 HCWs present for resuscitation, 7 (8.90%) HCWs were present during cardiac resuscitation, 6 (7.70%) HCWs were both presents for collection of sputum and open airway suctioning, while others were 2 (2.6%). These are shown in the table below. The majority, 67 (85.9%) of HCWs, directly contact the environment where confirmed cases have cared. Those that did not were 11 (14.1%). Table 9.

Did you provide direct care to a confirmed covid-19 patient?		
	yes	53
	no	26
	unknown	2
Did you have face-to-face contact (within 1metre)		
	yes	66
	no	10
	unknow	2
Were you present when aerosol-generated procedures were performed on the patient?		
	yes	27
	no	42
	unknown	9
If yes, what type of procedure?		51
	Tracheal intubation	5
	Nebulizer treatment	1
	Open airway suctioning	6
	collection of sputum	6
	Tracheotomy	0
	Bronchoscopy	0
	cardiopulmonary resuscitation	7
	others	2
Did you have direct contact with the environment of the confirmed case?		
	yes	67
	no	11
	unknown	0
Did you have direct contact with the environment where the confirmed case has cared?		
	yes	67
	no	11
	unknown	0

Table 9: Health Care Workers Risk Assessment

The Q5 and Q 6 of the WHO risk assessment form are high risks and low risk of contracting covid-19. Health Care Workers involved in health care interaction at other facility were 14 (17.9%) home care 3 (3.8%), ambulance 3 (3.8%) those not involved and other health care facility were 52(66.7%). The above results were HCW activities performed on the covid-19 patient in health care facility under the WHO risk assessment and management of exposure of health care workers interacting with the covid-19 patient. Results on adherence to IPC procedure during health care interactions include; HCW who wear PPE during health care interaction with covid-19 patients were 64 (82.1%). Those who did not wear 7 (9%). Those who wear gloves as always recommended were 43 (55.1%), those who wear gloves most of the time were 18 (23.1%) those who occasionally wear gloves were 2 (2.6%). Those who use medical mask always as recommended were 45 (57.7%) most of the time were 15 (19.2%), occasionally 1 (1.3%) rarely 2 (2.6%). HCW who use disposable gown always as recommended were 17 (21.8%), most of the time 7 (9%) occasionally, 12 (15.4%) rarely 28 (35.9%). In adherence to IPC procedure during health care interactions always as recommended means over 95% of the

time, most of the time means 50% or more but not 100%, occasionally means 20% to under 50% and rarely means less than 20%.

Those HCW who removed and replaced PPE according to the protocol that is, when mask becomes wet, dispose of the wet PPE in the waste bin, perform hand hygiene always as recommended were 21 (26.9%), most of the time 30 (38.5%) occasionally 3(3.8%), rarely 11 (14.1%). Those who performed hand hygiene before and after touching covid-19 patient always as recommended were 42 (53.8%), most of the time 21 (26.9%), occasionally 1 (1.3%), rarely 1 (1.3%). Those that performed hand hygiene before aseptic procedure always as recommended 42 (53.8%), most of the time 16 (20.5%), occasionally 1 (1.3%) rarely 3 (3.8%). HCW who perform hand hygiene before and after touching body fluids always as recommended were 51 (65.4%) most of the time 8 (10.3%) rarely 2 (2.6%). Those who perform hand hygiene after touching the patients' surrounding always as recommended were 36 (46.2%), most of the time 26 (33.3%) occasionally 1. (1.3%) rarely 2 (2.6%). High surface decontamination at least three times daily, always as recommended were 20 (25.6%) most of the time 21 (26.9%) occasionally 18 (23.1%) rarely 6 (7.7%). The above section is adherence to IPC procedure during health care interaction to IPC measure when performing the aerosol-generating procedure, e.g. tracheal intubation, nebulizer treatment, HCW that wore PPEs during aerosol-generating procedures were 45 (57.4%) those that did not were 12 (15.4%) those that wear gloves always as recommended were 37 (47.4%) most of the time 7 (9.0%), rare 1(1.3%) those that use N95 mask equivalent respiration always as recommended were 19 (24.4%) most of the time 17 (21.8%) occasionally 3 (3.8%) rarely 5 (6.4%). Those that use face shield or goggles protective glasses always as recommended were 12 (15.4%), most of the time 13 (16.7%) occasionally 6 (7.7%) rarely 13 (16.7%). The use of disposable gowns always as recommended were 14 (17.9%), most of the time 11 (14.1%) occasionally 6 (7.7%) rarely 13 (16.7%). Those who used waterproof gown always as recommended were 9 (11.5%) most of the time, 9 (11.5%), occasionally 12 (15.4%) rarely 14 (17.9%). Those who removed and replaced the PPE according to protocol always as recommended were 19 (24.4%), most of the time 18 (23.1%), occasionally 5 (6.4%), rarely 3 (3.8%). Respondents who performed hand hygiene before and after touching body fluids procedure always as recommended 30 (38.5%), most of the time 12 (15.4%) occasionally 3 (3.8%), rarely 1(1.3%). HCW who performed hand hygiene before aseptic procedure always as recommended were 33 (42.3%) most of the time 12 (15.4%) occasionally 3 (3.8%) rarely 1 (1.3%). HCW who performed hand hygiene before aseptic procedure always as recommended were 33 (42.3%), most of the time 12 (15.4%) occasionally 1 (1.3%) rarely 1 (1.3%). HCW during aerosol generally procedures were high surface were decontaminated frequently, always as recommended were 14 (17.9%), most of the time 22 (28.2%), occasionally 9 (11.5%) rarely 3 (3.8%)TABLE10.

Q5 During a health care interaction with the covid patient, did you wear PPE?	Yes	70	always, as recommended	low risk	most of the time	occasionally	rarely	Total	High risk
	no	8							
If yes to single-use gloves			56	71.79 487	20	2	0	22	28.20513
If yes to use f a medical mask.			53	67.94 872	22	1	2	25	32.05128
If yes, for the face shield.			24	30.76 9	17	8	29	54	69.23077
If yes to use of disposable gown.			26	33.33 333	9	13	30	52	66.66667
Did you remove and replace PPE according to protocol?			27	34.61 538	35	5	11	51	65.38462
			51	65.38 462	25	1	1	27	34.61538
Did you perform hand hygiene before the aseptic procedure?			51	65.38 462	23	1	3	27	34.61538
Did you perform hand hygiene before and after the touching body fluids procedure?			64	82.05 128	12	0	2	14	17.94872
Did you perform hand hygiene after touching the patient's surroundings?			46	58.97 436	29	1	2	32	41.02564

Were high surfaces decontaminated frequently			28	35.89 744	26	18	6	50	64.10256
Q6 Did the HCW wear PPE during the aerosol-generating procedure	Yes	62							
	No	16							
	Single-use gloves		62	79.48 718	15	0	1	16	20.51282
	use of N95 or equivalent respirator		24	30.76 923	39	10	5	54	69.23077
	Use of face shield or goggles or protective glasses		33	42.30 769	25	6	14	45	57.69231
	Use of disposable gown		32	41.02 564	26	6	14	46	58.97436
	Use of waterproof gown		10	12.82 051	9	25	34	68	87.17949
Did you remove and replace your PPE according to protocol?		23	29.48 718	26	12	17	55	70.51282	
Did you perform hand hygiene before and after the touching body fluids procedure?		43	55.12 821	24	9	2	35	44.87179	
Did you perform hand hygiene before the aseptic procedure?		35	44.87 179	25	15	3	43	55.12821	
Did you perform hand hygiene after touching the patient's surroundings?		33	42.30 769	34	9	2	45	57.69231	
Were high surfaces decontaminated frequently		20	25.64 103	35	17	6	58	74.35897	

Table10
Section 7 Accident with Biological Material

Health Care Workers who had accident with body fluids or respiratory secretions were 2 (2.6%), those who did not were 74 (94.9%) out of the two HCWs that had accident with body fluids or respiratory secretions 1 (1.3%) had a splash of biological fluids/respiration secretions eye. The other had a splash of biological fluids respiration secretions to intact skin 1 (1.3%). TABLE11.

Did you have an accident with body fluids or respiratory secretions?		
	Frequency	Per cent
Yes	2	2.6
No	76	97.4
Total	78	100.0

Table11: Those That Had Accident with Body Fluid/Respiratory Secretion

The various units where exposure occurred were those that have direct care to a confirmed covid-19 patient were 53 (67.9%), those that did not were 21 (26.9%), and those that are not sure were 12 (2.6%) those that had face to face contact (within) with a confirmed covid-19 patient in a health care facility were 66 (84.6%), those that did not were 7 (9%) and those that were not sure are 2 (2.6%)

Those HCW present when any aerosol generated procedures were performed on the patient were 26 (33.3%), those not present were 41 (52.6%), those not sure were 9 (11.5%). Out of the 23 HCWs, present during an aerosol-generating procedure like tracheal incubation 5 (6.4%) cardiopulmonary resuscitation 7 (9.9%) collection of sputum 6 (7.7%) open airway suctioning 5 (6.4%) nebulizer treatment 1 (1.3%)

The majority, 66 (84.6%), had direct contact with the environment where confirmed covid-19 cases were cared for while 9 (11.5%), did not directly contact patient's environment in terms of bed linen, medical equipment, bathroom etc.

Questions 5 and 6 deals with high and low-risk group. During a health care interaction with the covid patient, was PPE worn by Health care workers. Those who wore single used gloves were 56(72%) low risk and high risk of 22(28%). Those who wore face mask always recommended were 53(68%), low risk while those with high risk were 25(32%). HCWs who continuously remove their face shield as recommended were 24(31%), low risk while the high risk was 54(69%). Those who consistently use disposable gowns were 26(33%) low risk, while those with high risk were 54(67%). Can see other parameters in the table below. For question 6, addressed adherence to IPC procedures to HCWs who did not respond 'yes to always as recommended' for Q6A-6F were categorized as a high- risk group. The same goes for 7A. Those HCWS who wore PPEs during aerosol-generating procedures were 62, while those that did not were 16. Those that wore single used gloves were 62(79%) low risk, while those with high risk were 16(21%). Those who wore N95 or equivalent respirator were 24(31% low risk while those that were high risk were (54%). Use of face shield, goggles or protective glasses were 33(41%) low-risk ad 46(59%) high risk. Those who consistently remove and replace PPE according to the protocol were 23(29%) low risk and 55(71%) high risk,HCWs who performed hand hygiene before and after touching covid-19 patients were 43 (55%) low risk and 35 (45%) high risk. Those that performed hand hygiene before and after any clean or aseptic procedure was performed were 35(45%) low risk, and 43(55%) high risk. Those that performed hand hygiene after touching covid-19 patient surroundings were 33(42%) low risk and 45 (58%) highrisk. Decontamination of high surfaces at least three times daily were 20(26%) low risk and 58(74%) high risk. Question 7 of WHO assessment.Those with biological material accidents were 2(2.6%) and 76(97.4%) without accident.

Comparing community exposure rate of positive HCWS to those negativecontrol. There were 16(61.5%) HCWs with a history of staying in the same household witha confirmed covid-19 case. Their control counterpart was 28(53.8%), while those that were unexposed were 10(38.5%). The control counterpart was 24(46.2%) TABLE 7. Hence, those with covid-19 are 1.4 times more likely to have exposure than those without covid-19. Positive HCWs with a history of exposure to travelling with confirmed covid-19 cases were 6(23.1%) The control HCWs were 17(32.7%). Positive HCWs unexposed were 20(76.9%) while the control counterpart was 35 (67.3%). Those positive HCWs with Covid-19 are 0.6 times likely to have exposure than those that are not. Question 6 of the WHO risk assessment also compared the positive cases to the control. The positive cases with high risk include, Use of N95 (73%) or equivalent, use of face shield or Goggles (54%), use of the disposable gown (54%), use of waterproof gown (88%). Removing and replacing PPE according to the protocol(85%) Performing hand hygiene before and after touching body fluids procedure(50%), Performing hand hygiene before aseptic procedures(62%). Performing hand hygiene after touching the patient's surroundings (77%).Frequent high surface decontamination(81%).Comparing the high risk above to that of the control are N95(67%) Face shield or goggles(60%), disposable gown (62%), Waterproof gown (87%), removing and replacing PPE according to the protocol(63%), hand hygiene before and after touching body fluid procedures(42%) low risk in the positive case was (13%). In comparison, that of control was (58%)Furthermore, High risk in the case when performing hand hygiene before the aseptic procedure (62%). At the same time, the control was (52%) High risk in the case when performing hand hygiene after touching the patient's surroundings was (77%) while control was (48%). High risk infrequent high surfaces decontamination (81%) while that of control was (52%).

Variables		Cases		Control		Total	Percent
		TOTAL	PERCENT	TOTAL	PERCENT		
During a health care interaction with the COVID patient, did you wear PPE?	low risk	24	31	46	59	70	90
	High risk	2	3	6	8	8	10
If yes to single-use gloves	low risk	18	23	38	49	56	72
	High risk	8	10	14	18	22	28
If yes to use of medical mask	low risk	15	19	38	49	53	68
	High risk	11	14	14	18	25	32
if yes for face shield or goggles	low risk	8	10	16	21	24	31
	High risk	18	23	36	46	54	69
If yes to use of disposable gown	low risk	8	10	18	23	26	33
	High risk	18	23	34	44	52	67
Did you remove and replace PPE according to protocol	low risk	10	13	16	21	26	33
	High risk	16	21	36	46	52	67
Did you perform hand	low risk	14	18	37	47	51	65

hygiene before and after touching the	High risk	12	15	15	19		27	35
Did you perform hand hygiene before the aseptic procedure	low risk	13	17	38	49		51	65
	High risk	13	17	14	18		27	35
Did you perform hand hygiene before and after the touching body fluids procedure?								0
	low risk	18	23	46	59		64	82
	High risk	8	10	6	8		14	18
Did you perform hand hygiene after touching the patient's surroundings	low risk	11	14	35	45		46	59
	High risk	15	19	17	22		32	41
Were high surfaces decontaminated frequently	low risk	9	12	19	24		28	36
	High risk	17	22	33	42		50	64

Table 12: Healthcare Workers with Low and High-Risk Exposure to Covid-19 Case and Control

3.3. Focal Group Discussion

The Focal Group Discussion was held at Federal Medical Centre Katsina. There were 6 Participants A doctor representing each treatment centre, the principal investigator, a hospital attendant, a nurse who was the timekeeper. The Discussion lasted 65minutes. Each representative was made to answer some questions. In GARSH, no IPC team or committee in the hospital. There was no training on IPC on Covid-19before being posted to the isolation unit. No PPEs were provided by the hospital, Patients were made to provide Hand gloves before they are being attended to. Health care workers had to demonstrate before they were provided with face mask by the management, No goggles or gowns were provided.

Hand washing facilities are available only on the wards, none in the clinics.PPEs such as mand gloves, facemask, goggles were not worn all the time; the representative from GARSH claimed to wash hands after and not before seeing patients. He also said he uses hand sanitizers after touching the patient's environment. He said he has never encountered any accident with confirmed covid-19 body fluid or respiratory secretions. He said the reason healthcare workers are coming down with the infection is a system failure. The 5000-naira hazard allowance being paid to workers across the board cannot buy hand gloves and face mask packets to talk of other PPEs. He also mentioned that the resuscitation equipment was not available; only two ventilators available in the whole of the hospital with no oxygen concentrator. The consultant made the junior Medical officers see patient making them vulnerable to Covid-19 infection.

Turai had an IPC committee; they were trained on IPC on Covid-19 by the Primary Health Care Agency and NCDC. But most doctors were not present during the training. He said PPEs were provided but not regularly. He also added that most of the PPEs were gotten from donations. He suggested that training and retraining of Health Care Workers would go a long way to curb infection among Health Care Workers.

FMC Katsina representative said there is a non-functional IPC team/Committee, he said no former training was given to those at the isolation centre, but they go by NCDC guidelines. PPEs were provided but not always. Hand washing facilities are available on both wards and clinics. He said HCWs are coming down with the infection because of improper training, carefree attitude and fire brigade approached. Suggestion for curbing covid-19 were same as above.

4. Discussion

The community exposure of health care workers in this study is 60.3%. The occupational exposure is 35.5%. Community exposure is high compared to a study done in Ghana^{xi}. This is expected since the sites are designated treatment centres for covid-19. This study recorded more community exposure than occupational exposure; the reverse is the case with the study done in Ghana and United States^{11,xii}. Hence, health care workers are at high risk of exposure to covid-19. Regular training on IPC protocols with a steady supply of PPEs is the way forward.

Adherence to IPC procedure during interaction with Covid-19 patient is low even though the management of Federal

Medical Centre Katsina and non-governmental organisations donations made efforts to make PPEs available, but some do not use it consistently. Can see this in the findings on the high-risk groups: Those that did not use disposable gown were 67%; those who did not remove their face shield as recommended 69%; Those who did not wear N95 or its equivalent during aerosol-generating procedure 54%; those who did not perform hand hygiene before and after any clean or aseptic procedure 55%; Infrequent decontamination of high surfaces 74%.The above findings require strict adherence to PPE use and infection control irrespective of whether the patient is Covid-19 positive or not. The management of Federal Medical Centre Katsina and non -governmental agencies should not relent in their effort on regular supplies of PPEs. Hence, it is imperative to reduce infection among healthcare workers. Health Care workers should endeavour to carry out the covid-19 test enabling one to know the actual number of those infected and prevent asymptomatic spread. Early covid-19 detection among healthcare workers (HCWs) is crucial for protecting patients and healthcare workers.

Strict Use of PPE must be stressed to healthcare workers in all settings maintaining sufficient PPEs supplies and ensuring that everyone is effectively trained in infection, prevention and control to avoid risking their health.

In the Focus group discussion held, most said, 'In the early pandemic PPEs were scarce, made some reuse PPE or forgo protection'. Hence, maintaining sufficient PPEs and ensuring that everyone is effectively trained in infection, prevention and control to avoid risking their health is the key.

Significant factors for covid-19 infection among HCWs are lack of understanding of covid-19 infection, inadequate Use and unavailability of PPEs, protection of HCWs by authorities should be prioritized through education and regular training, incentives, availability of PPEs and psychological support.

5. Conclusion and Recommendation

Those adequately trained for COVID were 37(47%), not up to 50%. Those that knew what risk assessment was were very few 17(23%) HCWs with community exposure were 60.3%. Those with occupational exposure were 35.9%. High-risk groups involved in this study were the removal of face mask 54%, Use of N95 or equivalent respirator 54%, removal of PPE according to protocol 71%, Hand hygiene after touching patients surrounding 58%. Decontamination of high surfaces 74%. Inadequately clean and sanitized surfaces compromised the disinfection of medical equipment. Hence, decontamination of high surfaces should be carried out at least three times a day. The health regulatory bodies should start with training and educating medical and supporting staff through compulsory online courses. Regular training on IPC protocols, constant supply of PPEs, monitoring HCWs on IPC practices and supervision, giving HCWs incentives as when due would go a long way in reducing the risk of covid-19 among HCWs.

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