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Prevalence and Pattern of COVID-19 among Healthcare Workers in Rivers State Nigeria

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Abstract

Introduction: The evaluation of COVID-19 prevalence among healthcare workers (HCW) within the general population of COVID-19 cases is an important epidemiologic variable. The objective of this study is to describe the prevalence and patterns of COVID-19 infection in HCWs amongst a group of patients receiving care for COVID-19 in Rivers state, Nigeria. **Methods:** This study was a prospective descriptive study of all consenting patients who received care through hospitals, designated for COVID-19 treatment in Rivers state either as in-patient or out-patient following a laboratory-confirmed diagnosis of COVID-19 based on a positive SARS-CoV-2 RT-PCR from April to September 2020. **Results:** A total number of 646 COVID-19 patients were enrolled over the study period with 98 (15.2%) HCWs in the patient population. The HCWs with COVID-19 consisted largely of Doctors 47 (47.9%), Nurses 30 (30.6%), and socio-sanitary and hygiene workers 10 (10.2%). There were 46 (46.9%) female HCWs, compared to Non-HCWs with 112 (21.1%), females, p = 0.000. Sixty-eight (69.4%) HCWs had a source of contact for infection established compared to Non-HCWs with an established source of contact in 181 (34.2%), p = 0.000. Eight (8.2%) HCWs had Severe disease compared to 52 (9.8%) Non-HCWs with severe disease, p = 0.670. The case fatality in HCWs was 1% compared to 1.9% in Non-HCWs, p = 0.554. **Conclusion:** The prevalence of COVID-19 among HCWs in the study location is high with clinical and clinical support staff particularly, doctors and nurses are at higher risk of COVID-19 infection. This calls for action to improve and prevent HCWs infections in hospital settings in addition to improving HCW infection prevention behaviour in the community. The intensification of risk communication, provision of protective equipment (PPE), and training on the appropriate use of PPE; in addition to routine surveillance for infection is recommended.

Keywords

SARS-CoV-2 Infection, COVID-19, Prevalence, Healthcare Workers, Nigeria

1. Introduction

The response to the COVID-19 pandemic as declared by the World Health Organisation (WHO) in March 2020 [1], elevated global cognizance of the role of healthcare workers as a critical resource for the world. This acknowledgement was accentuated as healthcare workers (HCWs) became frontline combatants across all pillars of the COVID-19 response with the attendant risk of infection. Healthcare worker infection, therefore, became an issue of concern in the early period of the pandemic response with documentation of alarming rates of HCW infections [2] [3]. A report from the WHO joint mission to China in February 2020 reported 2055 COVID-19 laboratory-confirmed cases of HCW healthcare infections in 476 hospitals across China [2]. Correspondingly Wang *et al.* [3], reported that 29% of patients with COVID-19 infection were HCWs from a cohort of 138 patients treated in a hospital in Wuhan. The study [3] also referred to the risk of widespread transmission in healthcare settings as evidenced by a super spreader patient who infected over 10 HCWs in the hospital. Similar observations regarding HCW infections were also noted in Spain as of 31st March 2020 with over 9400 HCWs consisting of approximately 15% of all confirmed cases infected with COVID-19 [4]. The WHO Africa region office also reported that over 10,000 HCWs had been infected with COVID-19 in Africa as of July 2020, with an average rate of 10% of infections in some key countries [5].

The evaluation of healthcare worker's prevalence among the general population of COVID-19 cases has therefore become an important variable in the epidemiologic analysis of the pandemic; with studies around the world documenting a range of 3% - 19% prevalence of HCWs among the populations infected with SARS-CoV-2 [6] [7] [8] [9]. Wu *et al.* [10] in a Chinese centre for disease control (CDC) report, documented that 3.8% of 44,672 cases were healthcare workers; while two studies [11] [12] from Italy reported that HCWs accounted for 9% [11] and 9.8% [12] of cases in March 2020. Elimian *et al.* [13] in descriptive epidemiology of COVID-19 in Nigeria, found that HCWs accounted for 9.3% of all positive cases. A hospital prevalence study from Qatar [6] reported a prevalence of 10.6% among tested HCWs; whereas the USA CDC [7] reported a 19% prevalence of COVID-19 in HCWs among a population of 49,370 people. In addition to the established higher risk of reporting a positive test for COVID-19 among frontline HCWs compared to the general population [14]; patterns of distinctions in disease demographics and epidemiology, clinical trends and outcomes have also been documented in comparisons of HCWs and the general population with COVID-19 [3] [7] [8] [10]. The evaluation of HCW infections and applicable epidemiologic patterns at subnational and national le-

vels is, therefore, an important research focus; as the consequence of HCWs infection is a depletion in the workforce available to confront the pandemic and increase risk of transmission among other HCWs and patients attending hospitals. These shortages in the health workforce result from self-isolation of health workers for periods of at least two weeks and the time lost to ill health thus imposing an increased workload on available staff. Besides, health workplace safety may also be compromised by the risk of hospital-acquired infections from healthcare workers to patients. The objective of this study is to describe the prevalence and patterns of COVID-19 infection in HCWs amongst a group of patients receiving care for COVID-19 through ambulatory and in-patient hospital services in Rivers state, Nigeria.

2. Methodology

2.1. Study Location

The study was conducted in Rivers State, one of Nigeria's 36 states located in south-south, Nigeria. The state ranks within the top 7 in the number of COVID-19 cases in the country as stated by the Nigerian Centre for disease control (NCDC) since June 2020 [15].

2.2. Study Design, and Population

This study was a prospective descriptive study of all consenting patients who received care through hospitals, designated for COVID-19 treatment in Rivers state either as in-patient or ambulatory (out-patient) following a laboratory-confirmed diagnosis of COVID-19 based on a positive SARS-CoV-2 RT-PCR after presentation with suggestive symptoms or contact tracing of other patients from April to September 2020. The patients were categorised based on their occupation into Healthcare workers and Non-Healthcare workers. The healthcare workers were classified based on the WHO and International Labour Organisation (ILO) International Standard Classification of occupations (ISCO) [16], and their roles in patient management and healthcare services into six groups. Health Professional (HP) Group 1—Medical and dental doctors; Health Professional (HP) Group 2—Nurses; Health and Health Associate Professional (H & HAP) Group 3—(Pharmacist; Laboratory scientist and technologist, clinical psychologist, social support services and medical records information); Health and Health Associate Professional (H & HAP) Group 4—(Water Sanitation & Hygiene (WASH)/Socio-sanitary/Hygienist, Health attendants, Respiratory and anaesthetic technicians); Health and Health Associate Professional (H & HAP) Group 5—(Public Health officers, epidemiology and disease surveillance officers) and Health Management and Health Support Personnel (HM & HSP) Group 6—(Administrative and support staff and hospital managers).

2.3. Data Collection

A data extraction form built on the open data kit (ODK) tool was used to collect

data that was subsequently exported to a Microsoft Excel spreadsheet. Data domains included socio-demography, epidemiology, symptomatology, comorbidity, and disease outcome. Disease severity was classified using Nigerian Centre for disease control National COVID-19 case management guideline parameters [17] as severe and non-severe, with severity defined presence of fever > 38˚C or suspected respiratory infection, plus one of respiratory rate > 30 breaths/min; severe respiratory distress; >SpO_2 ≤ 93% on room air & Presence of co-morbid conditions such as diabetes, asthma, hypertension in adults and cough or difficulty in breathing & at least one of the following central cyanosis or SpO_2 < 92%; severe respiratory distress e.g. grunting breathing, very severe chest in-drawing & signs of pneumonia in children. Disease outcome was classified into discharged and died.

2.4. Ethical Considerations

The Ethical approval was obtained from the Research Ethics Committee of the University of Port Harcourt Teaching Hospital, Rivers state before the commencement of the study. Confidentiality was maintained by the removal of patient identifiers from the dataset and ensuring that only researchers involved in this study had access to the extracted data.

2.5. Statistical Analysis

The data was exported from the Microsoft Excel spreadsheet into IBM Statistical Package for Social Sciences (SPSS) version 23 for the data analysis. The proportion of HCWs among the cohort and the distribution of HCWs by professional category was done using basic descriptive statistics and frequencies. The HCWs were then compared with all adult patients aged over 18 years in the cohort for patterns in epidemiologic and clinical variables using both descriptive and inferential analysis. An independent t-test was used for comparison of means for categorical variables. Qualitative variables were compared for proportions in the occurrence of socio-demographic, epidemiological, and clinical characteristics between HCWs and non HCWs using Pearson chi-square test with mantel Hensel correction with relative risk and odds ratio as appropriate. A two-tailed p-value less than 0.05 was considered statistically significant. The population size for the study was time-bound and dependent on the course of the pandemic. This accounts for limitations arising from the sample size.

3. Results

A total number of 646 patients were enrolled over the study period with 98 (15.2%) HCWs in the patient population.

The HCWs consisted largely of HP Group 1—Doctors 47 (47.9%), HP Group 2—Nurses 30 (30.6%), H & HAP Group 3—5 (5.1%), H & HAP Group 4—10 (10.2%), H & HAP Group 5—3 (3.1%), HM & SP Group 6—3 (3.03%). The distribution of HCWs is displayed in **Table 1** and **Figure 1**.

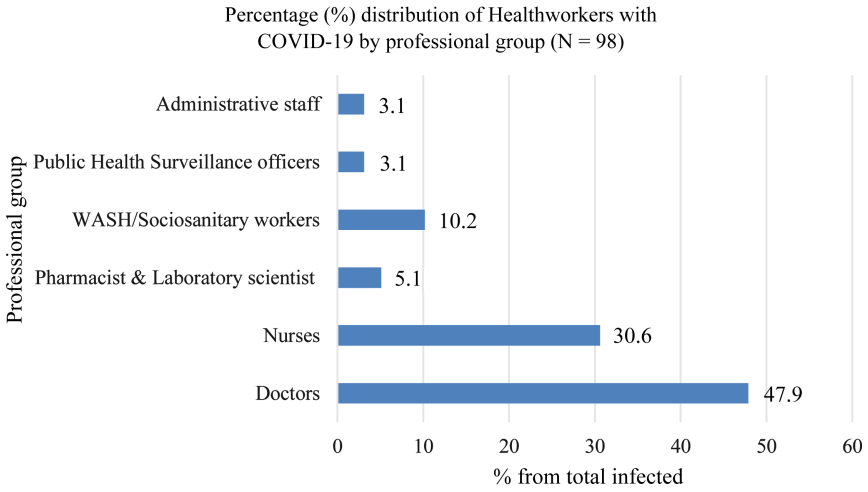

Figure 1. Distribution of health workers with COVID-19 by professional groups.

Table 1. Distribution of healthcare workers with COVID-19 by professional grouping.

Health Professional Group	Specific Profession	N	Group total	Percentage %
Health Professional Group 1	Doctors	47	47	47.9
Health Professional Group 2	Nurses	30	30	30.6
Health & Health Associate Professional Group 3	Pharmacist	1	5	5.1
	Laboratory Science/Technologist	4		
Health & Health Associate Professional Group 4	WASH/Sociosanitary & Environmental health officer	10	10	10.2
Health & Health Associate Professional Group 5	Public Health Surveillance officers	3	3	3.1
Health Management & Support Professional Group 6	Administrative staff	3	3	3.1
	Total		98	100%

Age: The mean age of 98 HCWs was 40.22 ± 11.17 compared to 530 patients ≥ 18 years with 39.89 ± 11.95, p-value = 0.798 (see Table 2).

The age group distribution of HCWs, with comparison to Non-HCWs, is as displayed in Table 2. The majority of the HCWs were in the 31 - 40 (40.8%) and 41 - 50 (23.5%) year age groups, there was no significant difference in comparison with non-healthcare workers p = 0.202, $\chi^2 = 9.777$ (see Table 2).

Gender: There were 52 (53.1%) male HCWs and 46 (46.9%) female HCWs, compared to Non HCWs with 418 (78.9%) males and 112 (21.1%), female proportion, p = 0.000, $\chi^2 = 29.903$.

The pattern of contact source, comorbidity, disease severity, and outcome variables are presented in Table 3. Contact source: 68 (69.4%) HCWs had a source of contact for infection established while a source of contact was unknown for 30 (30.6%) HCWs; compared to Non-HCWs with an established source of contact in 181 (34.2%) and 349 (65.8%) with the source of contact unknown, p = 0.000,

Table 2. Age group and gender distribution of healthcare workers compared with non-healthcare workers.

Variable	Healthcare Workers		Non-Healthcare Workers		χ^2	p value
Age Group	N	%	N	%		
18 - 30	17	17.3	124	23.4		
31 - 40	40	40.8	173	32.6	9.777	0.202
41 - 50	23	23.5	131	24.7		
51 - 60	9	9.2	77	14.5		
61 - 70	8	8.2	19	3.6		
>70	1	1.0	6	1.1		
Total	98	100	530	99.9		
Mean Age (Years)	40.22 ± 11.168		39.89 ± 11.949			0.798.
Gender	Male (%)	Female N (%)	Male N (%)	Female N (%)		
	53.1%	46.9%	78.9%	21.1%	29.903	0.000

Table 3. The pattern of comorbidity, disease severity, and outcome variables.

Variable	Healthcare workers N = 98		Non-Healthcare workers N = 530		χ^2	p value
	Yes (%)	No (%)	Yes (%)	No (%)		
Contact known	69.4	30.6	34.2	65.8	43.881	0.000
Comorbidity	33.7	66.3	33.6	66.4	0.554	0.758
Hypertension	20.4	79.2	25.7	74.3	1.531	0.465
Diabetes	10.2	89.8	7.74	92.3	1.072	0.585
Asthma	2.0	98.0	0.9	99.1	1.282	0.525
Heart disease	2.0	98.0	0.8	99.2	0.444	0.801
Kidney Disease	1.0	97.0	0.6	99.4	0.643	0.725
HIV/AID	0.0	100.0	0.4	99.6	0.737	0.692
COPD	0.0	100.0	0.4	99.6	2.554	0.466
Severe disease	8.2	91.8	9.8	91.2	0.670	0.802
Death	1.0	99.0	1.9	98.1	1.179	0.554

χ^2 = 43.881, odds ratio = 4.43, CI = 2.378 - 7.061. Sixty-one (62.2%) of the HCWs had their source of contact within the hospital while all the Non-HCWs had a source of contact for infection in the community.

Presence of comorbidity: Thirty three (33.7%) HWCs had at least one comorbidity present while 65 (66.3%) had none; compared to Non-HCWs with 178 (33.5%) who had a comorbidity and 352 (66.4%) with none, p = 0.758, χ^2 = 0.554.

Disease severity: 8 (8.2) HCWs had severe disease and 90 (91.8%) had non-severe disease compared to Non-HCWs with 52 (9.8%) with severe disease and 478 (91.2%) with non-severe disease, p = 0.670, χ^2 = 0.802.

Case fatality: One (1.0%), HCW died while 97 (99.0%) were discharged com-

pared to 10 (1.9%) who died and 520 (98.1%), who were discharged, p = 0.554, χ^2 = 1.179.

Comorbidities: The pattern of comorbidities is as displayed in Table 3. The leading comorbidities in HCWs were hypertension 20.4%, diabetes 10.2%, and asthma 2.0%. Hypertension 25.7% and diabetes 7.7% were also the leading comorbidities in non-healthcare workers. There were no significant differences in the proportions of comorbidity in both groups. The pattern of symptoms: The pattern of symptoms is shown in Table 4 and Figure 2. The leading symptoms

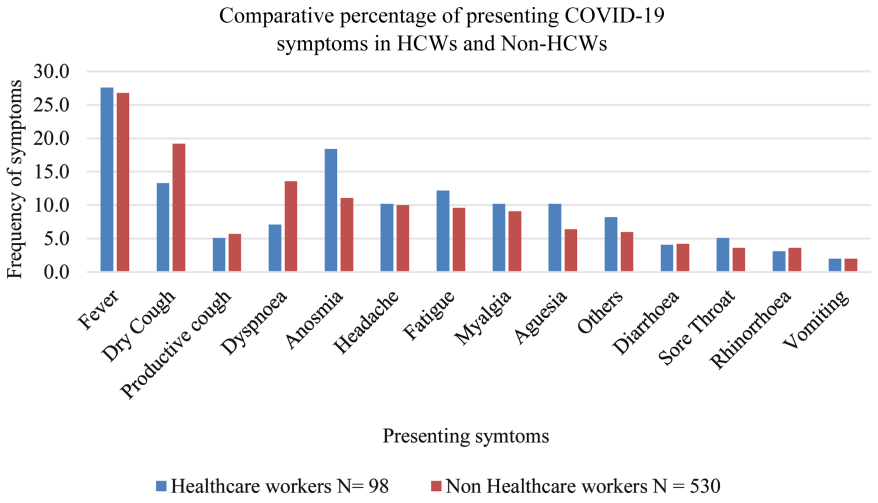

Figure 2. The pattern of presenting symptoms in patients with COVID-19.

Table 4. The pattern of symptoms among HCWs and Non-HCWs with COVID-19.

	Healthcare N = 98		Non Healthcare N = 530		χ^2	p value
	N	%	N	%		
Symptom						
Fever	27	27.6	142	26.8	0.403	0.818
Dry Cough	13	13.3	102	19.2	2.287	0.319
Productive cough	5	5.1	30	5.7	0.411	0.814
Dyspnoea	7	7.1	72	13.6	3.646	0.302
Anosmia	18	18.4	59	11.1	4.974	0.174
Headache	10	10.2	53	10.0	0.374	0.830
Fatigue	12	12.2	51	9.62	1.029	0.598
Myalgia	10	10.2	48	9.1	0.510	0.775
Aguesia	10	10.2	34	6.4	0.2239	0.326
Others	8	8.2	32	6.0	1.197	0.550
Diarrhoea	4	4.1	22	4.2	0.553	0.759
Sore Throat	5	5.1	19	3.6	1.083	0.582
Rhinorrhoea	3	3.1	19	3.6	0.616	0.863
Vomiting	2	2.0	10	2.0	0.564	0.754

in HCWs were fever (27.6%), anosmia (18.4%), dry cough (13.3%), fatigue (12.2%), headaches (10.2%), and myalgia (10.2%), and ageusia (10.2%). In Non-Healthcare workers, the leading symptoms were fever (26.79%), dry cough (19.2%), shortness of breath (13.6%), anosmia (11.1%), headache (10.0%), fatigue (9.6%), and myalgia (9.1%). There were no significant differences in the proportion of symptom patterns.

4. Discussion

Healthcare worker infection with SARS-CoV-2 has been a global source of concern since the onset of the pandemic with alarming prevalence rates of HCW infection. The prevalence of HCWs infection in this group of patients seen in hospitals from a Nigerian state was 15.2%. Though is it within the range of 3% - 19% reported globally [6] [7] [8] [9]; it is a source of concern as it is higher than the 9.3% prevalence reported by Elimian *et al.* [13], in a descriptive study of COVID-19 from all states in Nigeria. The understanding that Rivers state is one of the high burden states for COVID-19 infection may also explain the higher prevalence of HCWs infection above a National average value in this study. The prevalence of HCW infection in this study is similar to 15% reported in Spain [4] and lower than 19% from the USA [7], which were both within the early phases of the pandemic in March and April 2020 respectively. In further comparison with other studies, the prevalence of HCWs with COVID-19 in this study is above 2.8% and 2.5% observed by Shararidad *et al.* [18] and Giesen *et al.* [19] from Iran and Spain respectively among hospitalised patients. A systematic review of global studies [8] reported HCW infection prevalence of 3.9% consisting of an estimated 152,888 of 3,912,156 cases as of 8 may 2020; while Wu *et al.* [10] from China found a prevalence of 3.4%. Two other studies [11] [12], from Italy reported a prevalence of 9% and 9.8% respectively while a study in Qatar [6] found a prevalence of 10%. The prevalence of the above studies, is lower than the finding in this index study. It is therefore evident that HCWs contribute significantly to the burden of COVID-19 in the study location with prevalence rates above what is general observed from many other studies.

In the professional group of HCWs the most affected by COVID-19 in this study were doctors (47.9%), nurses (30.6%), and WASH/Environmental health, health attendants (10.2%). This shows that medical and clinical staff who have direct contact with patients and support staff who are in contact with the patient's environment are most at risk for infection. This pattern corresponds with the findings of Zheng *et al.* [20] in a study from the London teaching hospital which found that clinical staff groups had higher infection rates 7.3% compared to non-clinical staff with 2.8%, with medical and dental and nursing and midwifery as the professional groups with the highest rates of infections. A similar pattern was also observed by Sotgui *et al.* [21] at an Italian forefront hospital in a serologic prevalence study for SARS-CoV-2 with doctors (47.0%), Nurses (26.2%), and socio-sanitary workers (5.5%), having the highest prevalence of

SARS-CoV-2 infection. Other studies have also corroborated this pattern as shown in a systematic review of global studies [8] which had nurses (38.6%) and Doctors (31.3%) as the leading professional category in correspondence with the findings of this study. Lombardi *et al.* [22] in Italy also reported Doctors, Health technicians, Nurses, and Health assistants 10.5%, 9.4%, 8.4%, and 8% were the leading professional groups with SARS-CoV-2 infection. Fusco *et al.* [11] also reported a higher proportion of nurses (50%) and doctors (23%) in their cohort. Alajmi *et al.* [6] from a Qatar national surveillance study reported the highest infection rates in Nurses (33.2%) and non-clinical support staff with (31.3%) with physicians consisting 5% of infections. Maskari *et al.* [23] from Oman reported Nurses with 38% of infections while doctors and paramedics had 13% of infections each with administrative/support staff making up 36%. The pattern of reported by Alajmi [6] and Maskari [23] differs slightly from our pattern with nurses, non-clinical support, and paramedics having higher rates of infections compared to doctors. The variations may be due to a higher proportion of community-acquired infections over hospital-acquired infections documented in those studies. The summary of all studies still shows that clinical workers especially doctors and nurses and support staff with contact to patient environments have a higher risk of infection. Clinical staff are therefore at higher risk and require an emphasis on risk communication prevention messages, provision of PPEs, and surveillance for infection. There were no significant differences in the mean age and age group distribution profile of HCWs and non HCWs in this study, with the mean age of 40.22 years above the national average of or mean of 37.1 years explained by the exclusion of people under 18 in the comparisons. Similar age means and median and age group distribution have also been reported by other studies [8] [11] [21] [23].

There was a significant difference in the gender distribution between healthcare and non-healthcare workers in this study, with a higher female prevalence among healthcare workers compared to non-healthcare workers, this reflects the high preponderance of females in healthcare occupations in Nigeria especially nursing which accounted for over 30% of the HCWs and doctors. Other studies show a similar trend of female HCWs proportions above general population figures with Fusco *et al.* [11], Bandyopadhyay [8], Lombardi *et al.* [22], Maskari *et al.* [23] reporting proportions of 49%, 71.6%, 62.4%, and 64% respectively.

In this study, the majority of HCWs (69.4%) with COVID-19 had a source of contact established compared to non-healthcare workers with a predominantly unknown source of disease indicating higher levels of community transmission in Non-HCWs. Also, the majority of HCWs had their contacts within the hospital environment from patients and other healthcare workers. These findings correspond with that of Wang *et al.* [3] who reported a higher rate of hospital-associated transmission in HCW of 29% compared to 12.3% in hospitalized non-HCWs. This finding shows the need for better infection prevention and control practice and appropriate PPE use among HCWs in this environment to reduce transmission of SARS-CoV-2 among HCWs. There was no significant

difference in the presence of comorbidity, the proportion of disease severity, and case fatality in the study among HCWs and non HCWs. Hypertension and diabetes were the leading comorbidities both in HCWs and Non-HCWs. This observation is reassuring as HCWs do not have a higher risk of adverse outcomes compared to the general population. Also, the case fatality among HCWs reported in this study corresponds with global observations from a systematic review by Bandyopadhyay *et al.* [8] that reported a global case fatality among HCWs at 1 in 100 (1%). The pattern of hypertension and diabetes as the leading comorbid disease condition has also been reported by other studies [3] [23] [24]. Wang *et al.* [3] reported hypertension and diabetes as the leading comorbid disease conditions, while Maskari *et al.* [23] reported diabetes as the leading comorbid disease condition over hypertension. The range of comorbidity presence of 22.9% to 46.4% among HCWs reported by Wang *et al.* [3] and Maskari *et al.* [23] respectively is comparable to the 33.7% reported in this study.

The pattern of symptoms among the HCWs in this study was similar and did not differ significantly from non-HCWS, with fever, dry cough, fatigue, headaches, myalgia, anosmia, ageusia, and shortness of breath as the leading symptoms in line with the existing symptom pattern and other studies involving the general population [25] and HCWs [3] [6]. The presence of anosmia among HCWs as the second most common symptom in this study is a finding of interest as anosmia is predictive of less severe disease, reduced hospitalizations', and lower in-hospital mortality in COVID-19 patients [26] [27].

5. Conclusion

The study has shown that the prevalence of COVID-19 among HCWs in the study location is high and a cause of epidemiologic concern as HCWs contribute a significant burden of COVID-19 infections. This calls for action to improve and prevent HCWs infections in hospital settings in addition to improving HCW infection prevention behaviour in the community. Clinical and clinical support staff particularly doctors and nurses are at higher risk of COVID-19 infections and require intensification of risk communication, provision of protective equipment (PPE), and training on the appropriate use of PPE; in addition to routine surveillance for infection. There is no risk for the development of more severe disease and higher case fatality among HCWs compared to the general population.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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