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Prevalence of Post COVID-19 Condition among Healthcare Workers: Self-Reported Online Survey in Four African Countries, December 2021–January 2022

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Abstract: The impact of Post COVID-19 Condition (PCC) is ongoing despite the declaration that the 2019 COVID-19 pandemic has ended. In this study, we explore the prevalence of PCC among healthcare workers (HCWs) in four African Countries and its influence on their professional performance. This study was conducted as an online cross-sectional survey of healthcare workers from four African countries (Cameroon, Egypt, Nigeria, and Somalia) between the 20th of December 2021 to 12th of January 2022. We determined the prevalence of PCC based on the WHO case definition and assessed variables associated with a higher prevalence of PCC in these countries using univariable and multivariable logistic regression analyses. A total of 706 HCWs from four African countries were

included in this survey. Most of the HCWs were aged between 18–34 years (75.8%, n = 535). Our findings showed that 19.5% (n = 138) of the HCWs had tested positive for SARS-CoV-2. However, 8.4% (n = 59) were symptomatic for COVID-19 but tested negative or were never tested. Two-thirds of the HCWs (66.4%, n = 469) have received a COVID-19 vaccine and 80.6% (n = 378) of those vaccinated had been fully vaccinated. The self-reported awareness rate of PCC among the HCWs was 16.1% (n = 114/706) whereas the awareness rate of PCC among COVID-19-positive HCWs was 55.3% (n = 109/197). The prevalence of PCC among HCWs was 58.8% (n = 116). These changes include the self-reported symptoms of PCC which included headache (58.4%, n = 115), fatigue (58.8%, n = 116), and muscle pain (39.6%, n = 78). Similarly, 30% (n = 59) and 20.8% (n = 41) of the HCWs reported the loss of smell and loss of taste long after their COVID-19 infection, respectively. Some HCWs (42%, n = 83) believed that their work performance has been affected by their ongoing symptoms of PCC. There was no significant difference in the prevalence of PCC among the vaccinated and unvaccinated HCWs ($p > 0.05$). Of the socio-demographic variables, age (older HCWs between 45–54 years; OR:1.7; 95% CI: 1.06, 10.59; $p = 0.001$) and location (Egypt; OR:14.57; 95% CI: 2.62, 26.76; $p = 0.001$) were more likely to have experienced PCC than other age groups and countries respectively. The study revealed a low prevalence of PCC among the surveyed HCWs. In addition, it observed the need for adequate medical and psychological support to HCWs with PCC and improved mass advocacy campaigns on PCC.

Keywords: PCC; COVID-19; Long-COVID; Africa; HCWs

1. Introduction

The 2019 coronavirus disease (COVID-19) pandemic resulted in loss of lives as well as severe socio-economic implications. The disease, caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) mainly affects the respiratory system and has various clinical presentations, which vary from mild to severe, especially among elderly and immunocompromised patients [1,2]. The accelerated and efficient development, production, distribution, and acceptance of the COVID-19 vaccines have helped to curb the disease spread, reduce hospitalization rates, and reduce the severity of the disease, particularly among infected patients [3]. A combination of several factors such as non-pharmaceutical interventions, vaccines, political decisions, and the attitude of the populace, among other factors have resulted in the reduction of the SARS-CoV-2 transmission and accelerated the return of routine daily life worldwide. The reduced transmission led to the declaration that the pandemic was over on the 5 May 2023 [4].

Although the pandemic is over, several long-term effects of COVID-19 are still being studied. After infection with SARS-CoV-2, most of the ill patients return to their normal health status within days to a few weeks. However, some patients continue to suffer from ongoing, recurrent, or long-term health issues post-infection [5,6]. For instance, some patients were reported to experience a wide range of symptoms such as headache, fatigue, change in taste or smell, irregular menstruation, and mood changes among others, for months, post-infection [7,8].

In October 2021, the WHO announced that symptoms/signs that were previously termed long-term COVID-19, chronic COVID-19, or Post COVID-19 syndrome, should be identified as Post COVID-19 Condition (PCC) [6]. The WHO defined PCC as a history of probable or confirmed SARS-CoV-2 infection, usually 3 months from the onset of COVID-19, with symptoms lasting for at least 2 months that could not be explained by an alternative diagnosis [6]. Despite the identification of these COVID-19 sequelae as PCC by WHO, they lack clear classifications, and several things remain unclear [6]. For instance, the impact of vaccinations on the incidence of PCC requires further studies.

Given the insufficient information about its effects on individuals' health during the illness, or long after recovery, PCC may have a negative impact not only on the patient's health but also on their personal and professional life. For instance, PCC has been reported

in COVID-19 survivors regardless of their COVID-19 severity (mild or severe), presentation (acute, sub-acute, or chronic), and whether the patient was hospitalized or not [8,9]. Thus, the USA considered PCC a disability under the Americans with Disabilities Act (ADA) since July 2021 [4].

In Sub-Saharan Africa, Healthcare Workers (HCWs) represent some of the frontline staff that are crucial to the primary healthcare system. They are involved with clinical case management and routine immunization activities amongst other duties which include significant roles in improving COVID-19 vaccine uptake [10]. Several systematic reviews and meta-analysis studies have reported a high incidence of COVID-19 among HCWs [11–16]. For instance, Gomes-Ochoa et al. [17] reported that 11% (95% CI: 7−15) of HCWs tested positive for COVID-19. In addition, studies such as those of Štěpánek et al. [18] reported that 59.3% of HCWs reported persisting symptoms attributable to PCC. There is a paucity of reliable data about the COVID-19 pandemic and PCC in Africa.

The objective of this study was to assess the prevalence of COVID-19, the COVID-19 vaccination rate, as well as the awareness, symptoms, and prevalence of PCC among HCWs in four selected countries in Sub-Saharan Africa.

2. Materials and Methods

2.1. Ethical Clearance

The ethical clearance for this study was obtained from the Kwara State Ministry of Health, Ilorin, Nigeria with reference number MOH/KS/EHC/777/502 as well as the ethical review board of the Faculty of Human Medicine of the University of Zagazig, Egypt (Reference number: ZU-IRB #9241/2-1-2022). We obtained written informed consent from each respondent after brief information on the purpose of the study was provided to them. To participate in the study, a respondent must tick the consent box in the mobile application (ODK). Participation in this survey was voluntary and without prejudice, as participants could withdraw from the survey at any time.

2.2. Study Participants and Survey Methodology

This study presented the preliminary findings from a larger study that was conducted as a cross-sectional online survey of HCWs across Africa between the 20 December 2021 to 12 January 2022. HCWs include anyone who provides health services and advice based on formal training and experience. Hence, they included physicians, nurses, veterinarians, etc. The questionnaire was designed using Google Forms (Google incorporated) and administered via online social media platforms such as WhatsApp, Facebook, and E-mails. The sample size was calculated using the formula for cross-section surveys: $n = (Z1\text{-}\alpha/2)^2 P(1-P)/d^2$ where "n" is the calculated sample size for post-COVID condition, "Z1-α/2" is the degree of confidence (1.96), "P" is the expected prevalence of post-COVID condition, and d is the desired absolute precision (0.04). In this study, an expected prevalence of 50% was used. Therefore, n = 600. A contingency of 15% was added to the calculated sample size to address non-response. In this study, a minimum number of 690 respondents were recruited into the survey across African countries. Respondents from four African countries: Cameroon (Central), Egypt (North), Nigeria (West), and Somalia (East) were purposefully selected to participate in the survey. Our inclusion criteria were age (18 years and above) and occupation (healthcare worker). The questionnaire was also distributed among healthcare workers in other African countries. However, countries with less than 100 respondents were excluded from this preliminary analysis.

2.3. Study Variables

This study evaluated four self-reported variables among HCWs in each country. These were: (1). COVID-19 positivity rate, (2). COVID-19 full vaccination rate, (3). awareness of PCC, and (4). prevalence of PCC among HCWs. The COVID-19 positivity rate among HCWs was essential to understanding the prevalence of COVID-19 in HCWs and evaluating the occupational exposure of HCWs in these countries. The second study variable evaluated

the vaccination coverage of HCWs in these countries. Although HCWs were designated as priority recipients for the COVID-19 vaccination, acceptance of the vaccine is voluntary. Hence, our interest in the vaccination status of HCWs. The third variable evaluated the awareness of PCC (especially its symptoms and clinical presentation). This is crucial to the diagnosis of PCC among patients. The final study variable evaluated the prevalence of PCC among HCWs. Based on the WHO case definition, a respondent was classified as having PCC if the individual had a history of probable or confirmed SARS-CoV-2 infection, usually 3 months from the onset of COVID-19, with symptoms lasting for at least 2 months that could not be explained by an alternative diagnosis [6]. So, only respondents that fit the four criteria of the WHO case definition of PCC were regarded as having PCC.

2.4. Questionnaire Design

The awareness of PCC among HCWs was assessed using a semi-structured pre-validated questionnaire. The survey instrument was further validated by three independent academic examiners to ascertain the content and face validity of the adapted questionnaire as well as observe for any technical glitches. In addition, the reliability of the survey instrument was assessed using the Cronbach Alpha test (with a score of 0.72) based on 11 purposefully selected questions. Finally, the questionnaire was pre-tested among 10 HCWs from each of the four countries before the deployment of the final version for data collection. The results of the pre-test were not included in the final analysis.

The questionnaire was designed in three of the most common languages in Africa (Arabic, English, and French). The back-to-back translation was validated by two linguists to ensure that the intended meaning of each question was not lost. In each of the translations, the questionnaire was divided into 4 sections: (a). Socio-demographic information on HCWs; (b). history and course of COVID-19 infection; (c). Awareness of PCC among HCWs; (d). Impact on work performance. The form is available here: https://forms.gle/f6NUTDw5HjVZ2VjK9 (Accessed on 14 December 2021).

2.5. Data Analysis

The data obtained from this survey were analyzed using Statistical Package for Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). We conducted descriptive statistics and summarized the information as frequency and percentages. Chi-square analysis was used to test for association between the four key study variables (COVID-19 positivity rate, COVID-19 full vaccination rate, awareness of PCC, and the prevalence of PCC) in the four countries. Finally, the significant variables (p-value < 0.05) were entered into a logistic regression model (univariable and multivariable) to determine the association between the socio-demographic variables (age, gender, occupation, and their country of origin) and the outcome variable (prevalence of PCC in HCWs). The odds ratios generated from the multivariable logistic regression analysis were used for all the inferences in this study.

3. Results

3.1. Healthcare Worker Demographics

A total of 713 HCWs filled out the survey instrument out of which 99% (n = 706) gave consent and responded to the questionnaire (Table 1). The distribution from the four African countries was Egypt (n = 281), Nigeria (n = 210), Somalia (n = 111), and Cameroon (n = 104). Most of the HCWs were aged between 18–34 years (75.8%, n = 535). Of the respondents, nurses represented 36.3% (n = 256) and more female respondents were recruited (55.8%, n = 394). Some 60 respondents (8.5%) reported that they had known underlying disease conditions such as hypertension (n = 24/60), Diabetes mellitus (n = 18/60), Asthma (n = 16/60), and autoimmune diseases such as rheumatoid arthritis (n = 7/60).

Table 1. Demographics of HCWs recruited into this study (n = 706).

Variables	Number (%)
Nationality	
Cameroon	104 (14.7)
Egypt	281 (39.8)
Nigeria	210 (29.8)
Somalia	111 (15.7)
Occupation	
Dentist	38 (5.4)
Nurse	256 (36.3)
Physician	143 (20.3)
Pharmacist	42 (6.1)
Laboratory technician	74 (6.7)
Veterinarian	79 (11.2)
Others *	74 (6.7)
Age	
18–24	283 (40.1)
25–34	252 (35.7)
35–44	125 (17.7)
45–54	36 (5.1)
>55	10 (1.4)
Gender	
Female	394 (55.8)
Male	301 (42.6)
Prefer not to say	11 (1.6)
Do you have a known underlying disease?	
No	646 (91.5)
Yes	60 (8.5)

Others *: scientific officers, health information technologists, and clinical medical students who work or study in a health facility.

3.2. COVID-19 Infection among Healthcare Workers

Of the 706 HCWs included in this survey, 19.5% (n = 138/706) tested positive for SARS-CoV-2 by real-time polymerase chain reaction (RT-PCR), rapid diagnostic test (RDT), or reverse transcription loop-mediated isothermal amplification (RT-LAMP). In addition, 8.4% (n = 59/706) of the HCWs were probable COVID-19 cases. During their COVID-19 infection, 22.3% of them had moderate to severe symptoms and were admitted to a health facility (Table 2). Our findings showed that two-thirds of the HCWs (66.4%, n = 469) in these countries have received a COVID-19 vaccine and 80.6% (n = 378) of those vaccinated had received their second dose (fully vaccinated). A quarter of the HCWs (27.5%, n = 38) were tested less than a month before this survey.

The awareness rate of PCC among the general HCWs was 16.1% (n = 114/706) whereas the awareness rate of PCC among COVID-19-positive HCWs was 55.3% (n = 109/197). Based on the WHO case definition, more than half of the COVID-19-positive HCWs (58.8%, n = 116/197) were deemed to have PCC, and one-third (35.5%, n = 70/197) of them noticed changes in their health status due to the PCC. These changes include the symptoms of PCC which included headache (58.4%, n = 115), fatigue (58.8%, n = 116), and muscle pain (39.6%, n = 78). Similarly, 30% (n = 59) of the HCWs reported the loss of smell after their COVID-19 infection and 20.8% (n = 41) of the HCWs experienced the loss of taste long after their COVID-19 infection. Other less frequent COVID-19 symptoms experienced by HCWs in the 4 African countries included rash, pins and needles, and memory problems (Figure 1). Half of the HCWs (53.3%, n = 105) reported that their symptoms of PCC were mostly mild, and only 6.9% of them (n = 14) were admitted due to their PCC or its symptoms (Table 3).

Table 2. History of COVID-19 infection among healthcare workers recruited into this study.

Variables	Number (%)
1. Have you ever been diagnosed with COVID-19? (n = 706)	
No	568 (80.5)
Yes	138 (19.5)
2. Have you noticed the symptoms of COVID-19 which were not confirmed (probable cases)? (n = 568)	
No	509 (72)
Yes	59 (8.4)
3. When was your last COVID-19 test conducted? (n = 127)	
<1 month ago	38 (27.5)
2–3 months	13 (9.4)
3–6 Months	20 (14.5)
6–12 months	30 (21.7)
12–18 months	24 (17.4)
>18 months	2 (2.2)
4. Were you admitted to a health facility during your COVID-19 infection? (n = 197)	
No	153 (77.7)
Yes	44 (22.3)
5. Have you received any of the approved COVID-19 vaccines? (n = 706)	
No	237 (33.6)
Yes	469 (66.4)
6. Are you fully vaccinated against COVID-19? (n = 469)	
No	91 (19.4)
Yes	378 (80.6)

Table 3. Structure of PCC among HCWs in four African countries (n = 197).

Variable	Number (%)
1. Are you aware of the term "post-COVID-19 condition"? (n = 706)	
No	592 (83.9)
Yes	114 (16.1)
2. Have you noticed any changes in your health status after the COVID-19 infection? (n = 197)	
No	127 (64.5)
Yes	70 (35.5)
3. How would you describe the severity of your PCC? (n = 192)	
Mild/moderate	181 (94.3)
Severe	10 (5.2)
Very severe	1 (0.5)
4. Have you been admitted to a health facility due to the PCC? (n = 197)	
No	183 (93.1)
Yes	14 (6.9)
5. Have you received any treatment for your PCC? (n = 197)	
No	125 (63.4)
Yes	72 (36.6)

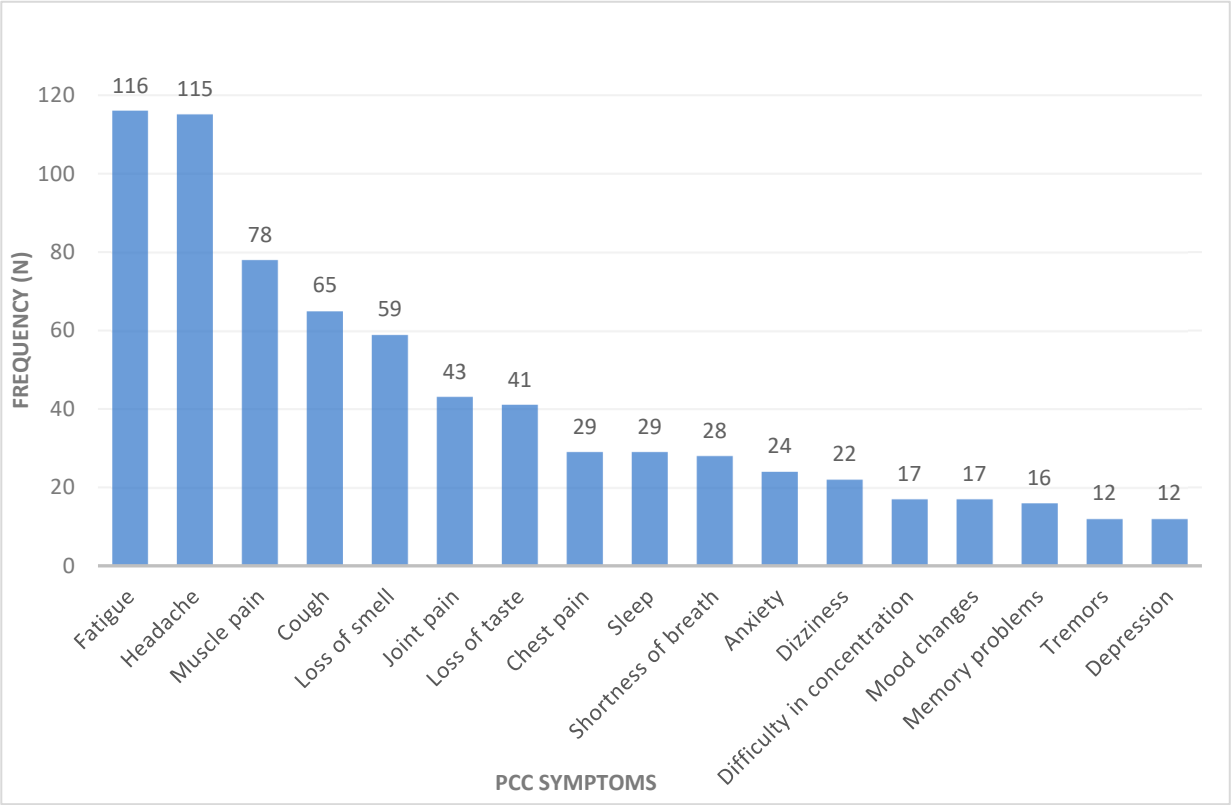

Figure 1. Frequency of PCC symptoms among COVID-19-positive healthcare workers from four African countries, 2022 (n = 197/706).

3.3. Work Performance

Only 29.7% (n = 58) of the HCWs who experienced COVID-19 and PCC described their work environment as more stressful. In addition, 42% (n = 83) of them believed that their performance at work has been affected by their PCC. Approximately half of the HCWs (49.3%, n = 97) got tired faster than usual whereas 16.2% of them (n = 32) got more forgetful after their COVID-19 infection (Table 4).

3.4. Post-COVID Condition among African Healthcare Workers

Across the four countries, there were statistically significant differences in the positivity rate of COVID-19 infection among HCWs, their vaccination rates, their awareness of PCC, and the prevalence of PCC among HCWs (Table S2). HCWs in Somalia tested more positive for COVID-19 than HCWs in other countries ($p < 0.05$). However, more HCWs in Nigeria (73.8%, n = 155) had received full COVID-19 vaccines than in the three other countries ($p < 0.05$). The highest awareness rate of PCC was in Somalia HCWs where 25.2% of them knew about PCC (Table S2). The prevalence of PCC among COVID-19-positive HCWs was 58.8% (n = 116). However, there were no significant differences in the prevalence of PCC among the vaccinated and un-vaccinated HCWs ($p > 0.05$).

Of the sociodemographic variables, only nationality significantly impacted the prevalence of PCC among HCWs in Africa. Hence, HCWs in Egypt were more likely (OR:14.57; 95% CI: 2.62, 60.76; $p = 0.001$) to have experienced PCC than HCWs in the three other countries (Table 5). This is further evident in the fact that 90.7% (n = 49) of the 54 Egyptian HCWs who tested positive for SARS-CoV-2, experienced PCC.

Table 4. Perception of COVID-19 infection and PCC on work performance among HCWs (n = 197).

	Variable	Number (%)
1.	How would you describe your work environment stress level after experiencing the PCC?	
	Less stressful	87 (44)
	The same environmental stress level	52 (26.3)
	More stressful	58 (29.7)
2.	Has your performance at work been affected by your PCC?	
	No	114 (58)
	Yes	83 (42)
3.	On a scale of 5, how severely has the COVID-19 pandemic affected your work as an HCW?	
	1	76 (38.8)
	2	43 (22)
	3	47 (24)
	4	23 (11.7)
	5	7 (3.5)
4.	How has the PCC affected your work performance?	
	I get tired faster now	97 (49.3)
	I feel less motivated	44 (22.3)
	I feel more stressed	49 (24.9)
	I have less tolerability	39 (19.8)
	I get more forgetful	32 (16.2)
5.	Have you received proper support from your workplace?	
	No	63 (43.5)
	Yes	82 (56.5)

Table 5. Logistic regression analysis of demographic variables that affected the prevalence of PCC among HCWs.

Outcome Variable	Variable	Baseline Category		OR (95% CI)	*p*-Value	OR (95% CI)	*p*-Value
			Univariable analysis			Multivariable analysis	
Prevalence of PCC among HCWs	Age (years)	18–24	25–34 35–44 45–54 >55	3.50 (2.17, 5.65) 2.27 (1.26, 4.09) 4.00 (1.78, 9.00) 6.1 (1.61, 22.81)	0.027	0.47 (0.08, 2.71) 0.86 (0.11, 6.52) 1.70 (1.01, 10.59) 0.34 (0.01, 6.01)	<0.001
	Admission due to COVID-19	No	Yes	1.14 (0.53, 2.47)	0.738	-	-
	Gender	Male	Female	0.89 (0.42, 1.86)	0.322	-	-
	Nationality	Cameroon	Egypt Nigeria Somalia	10.14 (3.00, 34.27) 3.28 (0.92,11.78) 0.78 (0.47, 1.31)	<0.01	14.57 (2.62, 26.76) 3.18 (0.51, 19.78) 0.82 (0.47, 1.48)	0.002
	Occupation	Physician	Nurse Pharmacist Technician Veterinarian Others	2.47 (0.87,6.95) 3.57 (0.94, 13.44) 1.91 (0.50, 7.23) 0.35 (0.06, 1.83) 0.59 (0.14, 2.56)	0.051	-	-

4. Discussion

Globally, HCWs play vital roles as frontline response personnel during the COVID-19 pandemic, especially in emergency responses, public education, and case management. This, however, exposes them to a higher risk of COVID-19. One of the problems associated with the COVID-19 infection is the persistence of symptoms which is generally referred to as "long COVID" or "PCC" [6]. Here, we present the first PCC survey that targeted HCWs across four African countries (Cameroon, Egypt, Nigeria, and Somalia).

Our findings showed that 19.5% of HCWs who participated in this study had confirmed the COVID-19 diagnostic test, while 8.4% had COVID-like symptoms and signs but without a confirmatory test. Therefore, the prevalence of SARS-CoV-2 infection among the HCWs was 27.9% (n = 197) in the aforementioned four African countries. The highest COVID-19 positivity rate was among Somali HCWs (52.1%).

Our results showed a higher prevalence rate than recorded by studies such as those of Galanis et al. [17] and Gómez-Ochoa et al. [18], where they observed the seroprevalence of SARS-CoV-2 in African HCWs around 8.2% and 7–11% in 2021 respectively. However, another study in the same year observed a wider range of prevalence (0–45.1%) of COVID-19 among HCWs in 11 African countries [19]. A recent meta-analysis reported that 10.1% of COVID-19 patients were healthcare workers [20]. The variability in the prevalence rate of COVID-19 among HCWs could be attributed to the sensitivities and specificities of the diagnostic tests used (self-reported vs. serosurveillance), the study design, the wave of the pandemic in each country, the period the samples were taken, and the country-specific contextual differences. For instance, Muller et al. [19] solely relied on rapid antibody diagnostic tests and their results differed between African countries, with 45.1% seroprevalence in Nigeria and 1.3% seropositive prevalence in Egypt by the end of 2021.

Our findings showed that among the 197 HCWs who suffered from COVID-19, 58.8% of them experienced PCC based on the clinical symptoms and the WHO clinical case definition. This PCC prevalence rate is in line with the reports of Osikomaiya et al. [21] who reported a prevalence of 40.9% for PCC among the general populace in Lagos, Nigeria in 2020. In the same vein, a systematic review of 57 studies with more than 250,000 participants by Groff et al. [22], reported a PCC prevalence of 54% among recovered COVID-19 patients in 2021. Also, Taquet et al. [23] reported that the prevalence of PCC in the USA was 57% during the first 6 months after a positive COVID-19 test in the year 2021.

In addition, Hyassat D, et al. [24] reported that 59.3% of the healthcare providers in Jordan reported more than one persisting COVID-19 symptom, and among them, 97.5%, 62.6%, and 40.9% reported more than one COVID-19 symptom at 1–3, 3–6 and 6–12 months, respectively, after the acute phase of the infection. This finding is in consonant with our findings. However, Menges et al. [25] reported a much lower PCC prevalence of 26% within 6 to 8 months in COVID-19-positive patients. The slightly higher prevalence of PCC in older health professionals (45–54 years old) than in other age groups could be attributed to the fact that older persons could have underlying conditions and they usually have more symptomatic COVID-19 than younger age groups [26].

Like other studies across the globe, the most reported symptoms of PCC in this study were fatigue, headache, malaise, headache, myalgia, cough, and loss of smell among other symptoms. These symptoms have been the most common among patients diagnosed with PCC across the globe. For instance, Montenegro et al. [27] and Iwu et al. [28] reported that fatigue, anosmia, headache, and dyspnoea have been the most common complaints among PCC patients. In addition, Osikomaiya et al. [23] observed that 12.8% of patients with PCC in Nigeria had persistent fatigability and another 12.8% had a headache after their discharge from the hospital. In the same vein, fatigue was the most reported symptom among Jordanian HCWs [24]. These results opined that most PCC manifestations were ongoing COVID-19 symptoms.

Our findings showed that a large proportion of the HCWs who participated in this study had no prior knowledge about PCC as only 16.6% of them were aware of PCC. For instance, Somali HCWs had the highest awareness rate (25.2%) than the other three

countries whilst HCWs from Cameroon had the least awareness rate of PCC as only 4.8% (n = 5/104) of them were aware of PCC or its symptoms. The differences in the awareness rate of PCC could be due to the differences in the health systems of each country, the HCW training schedule of each country, and the designation of the HCWs. However, the PCC awareness rate was high among COVID-19-positive HCWs as 55.3% of them were aware of PCC.

The COVID-19 vaccination rate was different in the four countries. Study participants from Cameroon had the lowest vaccination rate as only 17.3% of them were vaccinated. These low vaccination rates could be because Cameroon has the lowest national COVID-19 vaccination rates of the four countries (Table S1) [29]. Although our findings showed that HCWs from Nigeria had the highest vaccination rate, Egypt has the highest national COVID-19 vaccination rate with over 71.8 million vaccinations and 41.5% (42.34 million) of its populace fully vaccinated. These results were supported by a previous study in 34 African countries which showed that only 63% of their study participants were willing to accept the COVID-19 vaccine [30].

More longitudinal research is needed to evaluate the impact of vaccinations on the incidence of PCC. Our data showed that the vaccination status had no impact on the prevalence of PCC as there was no significant difference ($p > 0.05$) in the fully vaccinated, partially vaccinated, and un-vaccinated HCWs. This is contrary to the findings of several studies which reported that COVID-19 vaccines reduced the likelihood of PCC in COVID-19 patients [31]. Also, Al-Aly et al. [32] reported that COVID-19 vaccines reduced the likelihood of PCC in people who had been infected by only about 15% whereas Antonelli et al., reported that two doses of the COVID-19 vaccines halved the risk of PCC [33].

In the same vein, the category of the HCW (dentist, nurses, physicians, laboratory technicians, veterinarians, and others) was not associated with the prevalence of PCC in the four countries.

Besides the clinical manifestations of COVID-19, several studies have reported the psychological burden of the current pandemic on HCWs irrespective of their SARS-CoV-2 infection status [34–38]. While HCWs know that their profession poses a high infection risk, most of them were afraid to transmit the disease to their families [39]. Furthermore, other studies have observed anxiety, stress, exhaustion, and depression, with increasing rates of burnout among HCWs in Africa especially due to the insufficiency of personal protective equipment and the limited number of standardized care facilities in most African countries [39–41].

Similar to the findings of these studies, our findings showed that psychological symptoms were experienced by HCWs in the four African countries included in this study. For instance, 12.2%, 8.6%, and 6.1% of the HCWs had anxiety issues, mood changes, and depression respectively. This psychological burden could affect the perceived stress level in HCWs. Previously, Salazar et al. [42], Schwartz et al. [43], and Chew et al. [44] reported that the stress level at health facilities during the pandemic was considered more apparent than pre-pandemic era, with rising levels of burnout syndrome. Conversely, the majority of the HCWs felt the work environment had been either less stressful (44%) or no change in the work stress level (26.3%) during the pandemic compared to the pre-pandemic era, and only 29.7% of the HCWs felt higher stress level after the pandemic at their workplaces.

This general perception among the general HCWs was different from the PCC-affected HCWs, as 42% of the latter felt that because of their PCC, their work performance has been negatively affected. For instance, 49.3% of them got easily fatigued, while others were more stressed (24.9%), and lost their enthusiasm (22.3%). In an international study involving 56 countries, Davis et al. [45] reported that 45.2% of their study participants (n = 3762) required a reduced workload due to ongoing symptoms of PCC. In addition, Twycross, A. [46] opined that the current support scheme for healthcare professionals with PCC in the UK requires immediate review.

Despite the several challenges of each country's healthcare system, HCWs in this study opined that their respective work institutions provided their affected professionals with appropriate work support when they got back to work as reported by 56.5% of our HCWs that had PCC. Recently, several studies have discussed the importance of modifying the health services settings in Africa to deliver better care for COVID-19 patients and especially for healthcare workers in African countries [39,47–53]. On a general note, Politics often play a significant role in shaping healthcare systems, policies, and resource allocation [54]. Furthermore, the government's attitude towards healthcare could significantly affect the awareness of PCC, the vaccination rate, and the impact of PCC on work. Interestingly, several African countries are making remarkable strides in handling PCC in Africa [21]. These strides started with the recognition of PCC, its burdens, as well as its management and control. In addition, Egypt recently established the first clinic dedicated to PCC patients' care and treatment [55].

Study Limitations

This study has several limitations. Firstly, the sample size is small and the findings should not be generalized for each country. In addition, online, self-reported surveys could be biased and usually skewed toward the younger, urban population with access to the internet. In addition, since the prevalence of PCC was based on self-reports, there was a high likelihood of misclassification, misunderstanding of some questions, and overestimation of the prevalence of PCC, especially in the probable COVID-19 cases. Despite the limitations of our survey methodology (which makes it impossible to generalize for the HCWs in each country), we believe that this study will provide baseline information on PCC among HCWs in Africa.

5. Conclusions

This study presented the COVID-19 positivity rate, vaccination rate, awareness of PCC, and prevalence of PCC among HCWs in four African countries. The COVID-19 positivity rate was high in Nigeria and Somalia. Hence, improved IPC measures such as PPE as well as regular training should be instituted for HCWs in these countries. The very low PCC awareness in HCWs from Cameroon is worrying and the relevant health authorities in Cameroon should provide advocacy campaigns on PCC and its varying implications. Finally, HCWs from Egypt had the highest prevalence of PCC. Hence, adequate medical and psychological support should be provided.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/covid3110114/s1, Table S1: COVID-19 vaccination status in the four African countries as of 6th June 2023 [30]. Table S2: Association between the nationality of HCWs and their COVID-19 positivity, vaccination rate, and awareness of PCC.

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