Attitudes, and perceptions of COVID-19 vaccines and acceptance to receive COVID-19 vaccine among healthcare workers in Yaoundé, Cameroon

Tendongmo Kinsley Aka, Sylvester Ndeso Atanga, Seraphine Nkie Esemu, Lucy Mande Ayamba Ndip

Corresponding author: Lucy Mande Ayamba Ndip, Microbiology and Parasitology, Faculty of Science, University of Buea, Buea, Cameroon. lndip@yahoo.com

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Tendongmo Kinsley Aka[1], Sylvester Ndeso Atanga[1], Seraphine Nkie Esemu[2], Lucy Mande Ayamba Ndip[2,&]

[1]Department of Public Health and Hygiene, Faculty of Health Sciences, University of Buea, Buea, Cameroon, [2]Microbiology and Parasitology, Faculty of Science, University of Buea, Buea, Cameroon

[&]**Corresponding author**

Lucy Mande Ayamba Ndip, Microbiology and Parasitology, Faculty of Science, University of Buea, Buea, Cameroon

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Abstract

Introduction: great efforts were being made to stop the spread and impact of the coronavirus pandemic through vaccines. Cameroon began vaccinating Healthcare Workers (HCWs) against Coronavirus disease 2019 (COVID-19) vaccines on March, 2021. However, willingness to be vaccinated highly depends on factors other than vaccine availability. This study sought to measure the acceptance rate and related factors for COVID-19 vaccination among HCWs in Yaoundé, Cameroon. *Methods:* a cross-sectional study was conducted with 510 HCWs in Yaoundé, Cameroon. Data were collected, reviewed, entered into Excel 2016, and exported to the SPSS version 25.0 for analysis. The dependent variable was acceptance to be vaccinated for COVID-19, and the independent variables included sociodemographic factors, attitudes, and perceptions toward COVID-19 vaccines. A binary logistic regression model was used to determine associations between vaccination acceptance and independent variables. From bivariate analysis, variables with p-values < 0.25 were retained for multivariate analysis. Multivariate analysis shows that variables with Adjusted Odds Ratio (AOR) and p-values <0.05 at 95% CI are factors significantly associated with vaccine refusal among HCWs. *Results:* overall, the percentage of HCWs with sufficient attitudes and perceptions toward COVID-19 vaccines was 45.5% and 52.8%, respectively. Almost 68.4% of HCWs accepted to be vaccinated, but 31.6% were against it. Negative attitudes (AOR: 4,411; 95% CI [2.324 - 8.372] for COVID-19 vaccine were significantly associated with vaccine acceptance. Nearly half (39.8%) of HCWs said the vaccines could exacerbate existing conditions. *Conclusion:* willingness to be vaccinated was relatively high among HCWs. Negative attitudes toward COVID-19 vaccines were significantly associated with vaccination acceptance.

Introduction

Over 5.8 million people have died worldwide since World Health Organization (WHO) announced the coronavirus disease 2019 (COVID-19) pandemic [1], including over 1915 persons in Cameroon [2]. In Africa, particularly Cameroon, COVID-19 infection rates are declining. Private and public institutions/agencies have made a record-breaking global effort to create vaccines against the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). As the pandemic progressed, the world observed the emergence of a new variant [3]. The SARS-CoV-2 strains that have been characterized globally have been given the names Alpha (B.1.1.7 in the United Kingdom in September 2020), Beta (B.1.351 in South Africa, May 2020), Gamma (P.1 in Brazil, November 2020), Delta (B.1. 617.2 in India, October 2020), and the most recent Omicron (B.1.1.529 in many countries in the world) [3]. The global strategy has made vaccine distribution and development a top priority. The COVID-19 vaccination (COVAX) program, supported by the World Health Organization (WHO) and other international organizations, aims to send 600 million vaccine doses to Africa, enough to immunize at least 20% of the continent's population. By April 2021, 18 million doses, or 2% of all vaccine doses administered globally, had been disseminated throughout 41 African countries [4]. As part of the global effort to combat the COVID-19 pandemic, the COVID-19 vaccine was being distributed in various nations; Cameroon joined the COVAX facility in April 2020. The COVAX facility is the Access to COVID-19 Tools (ACT) vaccine pillar accelerator, pursuing equitable and innovative access to diagnostics vaccination and treatment [5]. By March 23, 2023, there were zero vaccinations in clinical testing in Cameroon, just like in all nations where clinical trials have been conducted [6].

As Cameroon qualified for the COVAX facility's advance market commitment 92 funding mechanism [7], the Chinese government sent

200,000 tablets of Sinopharm to the Prime Minister of Cameroon on April 11, 2021. On April 17, it received 391,200 doses of the 1,200,000 doses of Covishield vaccines that were anticipated. Four vaccines against SARS-CoV-2 have been approved by the Cameroonian health authorities, represented by the National Immunization Technical Advisory Groups (NITAG) and the Scientific Advice for Public Health Emergencies. These vaccines include the JNJ-78436735 (Johnson and Johnson), the AZD1222 (Oxford-Astra Zeneca), the BBIBP-CorV (Sinopharm), and more recently the BNT162b2 (Pfizer-BioNTech) [7]. Healthcare workers, security employees, persons over 50, and those with comorbidities were listed in the responses as the top priority target populations for COVID-19 immunization according to vaccination statistics. Sinopharm, Johnson and Johnson, AstraZeneca, and Pfizer SARS-CoV-2 vaccines work effectively against severe SARS-CoV-2 in 73%, 86%, 94%, and 95% of cases, respectively [8]. Three rounds of the national vaccination campaign were held to increase vaccination coverage to reach the target of at least 60% of the population being immunized. Forty-three thousand six hundred fifty-one individuals received at least one dose of the vaccine between April 12 and May 12, 2021. The target population for the COVID-19 vaccination has already received doses from 43,651 and 1,061, respectively, representing 5.4% and less than 1% of the population [9]. As of 18th November 2022, around 5% of the eligible population had received vaccinations, putting the nation far behind the worldwide goal of obtaining 70% vaccination coverage by the end of the year. The Johnson and Johnson vaccine was the most often requested vaccine, followed by the Oxford-Astra Zeneca vaccine, accounting for 48.24% and 38.49% of all delivered vaccine doses [9]. Representatives are working to increase population coverage and close vaccine equality disparities. During a five-day mission, representatives from the WHO, UNICEF, GAVI, USAID, and Africa CDC came together to convince senior government officials, religious leaders, and civil society organizations of the need

to support the Ministry of Public Health's COVID-19 vaccine campaign [10]. During a high-level COVID-19 vaccine delivery partnership (CoVDP) mission in Yaoundé, Cameroon, on November 14th to 18th, 2022, representatives and staff from WHO, UNICEF, USAID, and Africa Centers for Disease Control (CDC) met to discuss strategies for accelerating COVID-19 vaccinations in the nation [10].

A further barrier to vaccination uptake in African countries, including Cameroon, may be a preference for conventional/traditional treatments. This is in addition to the poor availability of COVID-19 vaccines and resistance to receiving the vaccine. Despite not meeting safety and efficacy standards, traditional drugs have been utilized in Tanzania and Madagascar to treat COVID-19 ([11]. It can be challenging to convince people in many countries to receive the COVID-19 vaccine [12]. The general population's approval of COVID-19 immunization was best in Vietnam (98%), India (91%), China (91%), Denmark (87%), and South Korea (87%), while it was lowest in Serbia (38%), Croatia (41%), France (44%), Lebanon (44%), and Paraguay (51%). According to reports from all over the world, HCWs have high rates of hesitancy essential to easing the effects of the epidemic through their work in giving immunizations and establishing an excellent example for prevention, which is crucial to reducing the consequences of the epidemic.

A review of 35 studies found that vaccination resistance rates varied from 4.3% to 72% globally [13]. Vaccine's efficacy, safety, and possible adverse effects were significant issues facing medical practitioners. Higher socioeconomic status, direct patient contact, feeling of COVID-19 risk and fear, and having received an influenza vaccination in the past were all associated with higher vaccine uptake [13]. HCWs who refuse COVID-19 immunization may increase the risk of viral transmission to their patients and society and be less likely to advise their patients and community to acquire the vaccine [13]. There is no

evidence to support Cameroonian health personnel's attitudes, viewpoints, and perceptions regarding COVID-19 vaccination in Cameroon. In this study, healthcare worker's vaccination acceptance rates for the COVID-19 virus are evaluated along with the participant's attitudes and perceptions about the COVID-19 vaccine and its related causes in Yaoundé, Cameroon. The objective of this study aimed to determine the acceptance rate of COVID-19 vaccination and associated factors among HCWs in Yaoundé, Cameroon. The hypothesis is that there is a significant difference between the attitudes and perceptions of the acceptance of COVID-19 vaccines among healthcare workers in Yaoundé, Cameroon.

Methods

Study design and study location

A cross-sectional study was conducted in Yaoundé, Centre Region, Cameroon. Yaoundé is the capital of Cameroon, which spans seven hills. It is in the central part of the country (Figure 1). The city covers an area of 180 km² and had a total population of 2,766 million in 2015. The city is 726 m (2,382 ft) [14]. Yaoundé was selected for this study because it has a significant health department and a Ministry of Health.

Population of origin, inclusion, and exclusion criteria

The healthcare workers selected for this study were from 19 healthcare centres, district hospitals, private hospitals and clinics in the Yaoundé III and VI sub-division of Mfoundi Division (Figure 2). All HCWs at selected medical facilities formed the study population. These include selected hospitals and healthcare centers: University Teaching Hospital Yaoundé (CHU), National Rehabilitation Center of Persons with Disabilities, Efoulan District Hospital, Centre Médicale d'Administration de Mendong (CMA), Centre de Santé Saint Jacky, Entre Mario, Centre de Santé Le Progress, Saint Joseph Health Center Comino, Lycée d'Etoug-Ebe,

Centre de Santé Main Benie, Centre de Santé St Justine d'Ahala, INIESAT Health Centre, Centre de Santé La Guérison, Centre de Santé Le Confort, Doh's Medical Health Center, Unicare Health Center, Centre de Santé NGOMDA, Solidarity Health Center Mendong, Mathilda Health Center Mendong, Amaka Mother and Child Health Center Mendong, Galilee Health Center. The survey included all healthcare workers enrolled at selected healthcare facilities at the time of the survey. The payslip-based sampling procedure (interval calculation) does not consider absentees (sick leave, annual leave, maternity leave). Interns and volunteers working at the health facilities were all included in this study.

Quantitative data collection

Sampling technique and determining sample size

The single population proportion formula was used to determine a total of 510 study participants while considering the following presumptions: n = is the minimum sample size required, $Z\alpha/2$ is the standard normal variable at (1-α)% confidence level (α is 0.05 with 95% CI, $Z\alpha/2$ = 1.96), where: P is an estimate of the attitude toward the COVID-19 vaccination (50%) and d is the error margin (5%). Based on these assumptions, 384 individuals were estimated using the formula [15]:

$$n = \frac{(z_{a/2})^2 * p(1-p)}{d^2}$$

To reduce mistakes caused by the risk of non-compliance, an additional 30% of the sample size contingency was applied, resulting in a final sample size of 510.

Sampling techniques

Nineteen healthcare facilities were chosen randomly to offer study participants, comprising five government hospitals, seven private hospitals and clinics, and eight health centers. A proportional allocation of study participants was

made, based on their number, for the selected healthcare facilities, regardless of their occupation. Then, study participants were chosen through an organized random selection process. The first participants were chosen via a straightforward lottery system. Public health officials, nurses, midwives, pharmacists, laboratory technicians, porters, medical doctors (including interns), administrative employees, cleaners, laundry workers, and guards (auxiliary staff) were all represented in the study.

Measurement of outcomes and explanatory factors

The sociodemographic characteristics, attitudes, and perceptions were the independent variables, and the dependent variable was the acceptance to get the COVID-19 vaccination. To determine the two outcome variables of attitude (positive or negative), and perception (good or poor), we took the mean score of responses to nine questions about perceptions and eight questions regarding attitudes. A score of 0 was awarded for a negative attitude and poor perception, while a score of 1 was given for a positive attitude and an acceptable perception. Scores above the median demonstrated a positive mindset and acute awareness. The acceptance to get the COVID-19 vaccine will also be associated with sociodemographic, attitude, and perception characteristics as independent variables.

Data collection and quality assurance

Data for this study was collected for a period of eight months, between October 2022 to May, 2023. Data was gathered utilizing structured questionnaires modified from pertinent research/literature. Selected professionals were asked to complete a self-administered questionnaire to provide the data. Five nurses with bachelor's degrees and one laboratory technician with a master's degree were employed as data collectors and supervisors. The lead investigator spent a day training both data collectors and supervisors on the study's goals, the

questionnaire's content, ethical concerns, and data collection techniques to ensure accurate data collection. Before gathering actual data, we pre-tested the questionnaire with 5% of the sample size of HCWs in the nearby town of Mbankomo and made the required changes to the questionnaire. By enlisting professionals to review the material, we were able to determine the validity of this questionnaire as well. The experts either concurred or disagreed that the test was a legitimate measure of the topic being measured based on the validity of the questionnaire. This means that they assessed whether each measured item matched a specific idea domain of the research topic. The data collectors and supervisors reviewed the acquired data every week. The Cronbach alpha test was used to evaluate the questionnaire's reliability, and the results for the attitude, and perception questions were 0.73, and 0.71, respectively, indicating that the questionnaire was reliable. By hiring experts to evaluate the questionnaire's content using face validity, we were able to determine the validity of this questionnaire as well. The experts agreed that the test was a reliable indicator of how well understood a concept was measured. This means they assessed whether each measured item matched a specific idea domain in our research.

Data management and statistical analysis

The collected data was examined, entered into Excel 2016, and exported to SPSS Version 25.0 for data cleansing and analysis. Calculated descriptive statistics included frequency distribution (n) and proportions (%). We performed a logistic regression analysis with the acceptance of vaccination (planning to get vaccinated) as the dependent variable and sociodemographic, attitudes, and perceptions as the independent factors. After performing a bivariate logistic regression analysis (Crude Odds Ratio (COR) at 95% CI), variables with a p-value of less than 0.25 were kept for multivariate logistic regression analysis. Variables with significant p-values from the multinomial logistic regression analysis independently associated with acceptance to be

vaccinated were those with a p-value of less than 0.05 and an Adjusted Odds Ratio (AOR) at the 95% confidence interval. The Hosmer-Lemeshow test was used to determine the model's goodness of fit, with a P-value of 0.675, which was higher than 0.05, indicating the model was fit. Multi-collinearity between independent variables was also checked using the Variance Inflation Factor (VIF) coefficient of the model, which gave a value of less than 10, with a maximum VIF value of 5.689 reported from our model indicating the absence of multi-collinearity between independent.

Results

Socio-demographic characteristics of respondents of the study participant HCWs

The response rate was 100%. The mean age of the respondents was 31 years (standard deviation [SD] = ± 8.385); 271 were male (53.1%), and 239 were female (46.9%). The study participants included 44(8.6%) medical doctors, 140(27.5%) laboratory technicians, 210(41.2%) nurses and midwives, 40(7.8%) pharmacists, 51(10%) public health officers and environmental health officers, and 25(4.9%) non-medical auxiliary staff. The majority were university degree holders 310(60.8%), 412(80.8%) did not have health insurance, and more than one-third, 388(76.1%), had received training or orientation about COVID-19 vaccination. The majority, 435(85.3%) of respondents, had no chronic condition, while 75(14.7%) had one or more chronic conditions. Four hundred and ten (80.4%) have worked for less than ten years, and only 100(19.6%) have worked for ten years or more. Three hundred and one (56.3%) of the HCWs had family members who once had COVID-19, while 334 (65.5%) live in a household of less than five. Four hundred and sixty-nine (92%) of the study participants have been tested for COVID-19, and out of the 469 tested, 190 (40.5%) were positive for COVID-19 (Table 1).

HCWs attitudes towards COVID-19 vaccines

The mean score of attitudes was 0.7031, with a standard deviation of 0.14744. The overall positive attitude rate about the COVID-19 vaccine was 45.5% with 95 % CI (41.2% - 49.8%). Of those who had a positive attitude towards the COVID-19 vaccine, 179 (77.2%) have been vaccinated. About 55.7% (127) males and 45.3% (105), females had a positive attitude while 51.8% (144) of males and 48.2% (134) of females had a negative attitude towards COVID-19 vaccines. Eleven (4.7%) medical doctors, 63 (27.2%) laboratory technicians, 107 (46.1%) nurses and midwives, 25 (10.8%) pharmacists, 10 (4.3%) public health workers and 16 (6.9%) non-medical-auxiliary staff had a positive attitude towards the COVID-19 vaccine. Of those with a chronic disease, 49 (21.1%) had a positive attitude towards COVID-19 vaccines. One hundred and sixty-eight (72.4%) of university degree holders, 51 (22%) diploma holders, 11 (4.7%) secondary and 2 (0.9%) of those with primary school had good attitudes about COVID-19 and its vaccines, 37 (15.9%), 68 (29.2%) and 127 (54.7%) HCWs who grew up in rural, semi-urban and urban areas, respectively, had a good perception of the COVID-19 vaccines. Four hundred and twenty-four (83.1%) of the HCWs were confident that the Ministry of Public Health could control COVID-19 in Cameroon, but 301 (59%) expressed a general mistrust/uncertainty about the effectiveness of COVID-19 vaccines. Two hundred and ninety-six (58%) of HCWs feared COVID-19. Out of those who feared COVID-19, 109 (36.8%) and 107 (36.1%) of HCWs say COVID-19 can result in severe allergic reactions and infertility, respectively. Four hundred and forty-three (86.9%) responded that HCWs should get priority COVID-19 vaccination. Three hundred forty-nine (68.4%) of HCWs were planning to get vaccinated, and 161 (31.6%) refused to be vaccinated for COVID-19. About 83.1% of HCWs are confident that the MPH can control COVID-19 in Cameroon. Fifty-nine percent (59%) have general mistrust about COVID-19 vaccines. Of the 58% of HCWs who fear COVID-19 vaccines, 36.8%

and 36.1% of HCWs said COVID-19 can lead to severe allergic reactions and infertility, respectively (Table 2).

Perceptions of HCWs towards COVID-19 and COVID-19 vaccines in Yaoundé

The mean score of perceptions was 0.7736, with a standard deviation of 0.32935. The overall rate of good perception about the COVID-19 vaccine was 52.8% with 95% CI (48.5 - 57.2%). Of those with a good perception of the COVID-19 vaccine, only 190 (70.6%) have been vaccinated. Nearly half, 150(55.8%) of the male and 119(44.2%) of the female HCWs had a good perception, whereas 121(50.4%) of the males and 119 (49.6%) of the females had a poor perception of COVID-19 vaccines. Fourteen 14 (5.2%) doctors, 81 (30.1%) laboratory technicians, 119(44.2%) nurses and midwives, 21 (7.8%) pharmacists, and 21 (7.8%) public health workers and 13 (4.8%) non-medical auxiliary staff had a good perception about COVID-19 vaccines. One hundred eighty-two (67.7%) of the Orthodox Christians, 64(23.8%) of the Protestants, and 86 (21%) Muslims had a good perception of COVID-19 vaccines. One hundred and seventy (63.2%) of university degree holders, 86 (32%) diploma holders, 9 (3.3%) secondary and 4 (1.5%) of those with primary school had good perception about COVID-19 and its vaccines. Fifty-seven (21.2%), 78 (29%) and 134 (49.8%) HCWs who grew up in rural, semi-urban and urban areas, respectively, had a good perception of the COVID-19 vaccines. Of those with a chronic disease, 49 (18.2%) had good perceptions. Similarly, nearly half, 203 (39.8%) of the HCWs thought that vaccines could worsen any pre-existing medical conditions. On the other hand, 281 (55.1%) of the respondents thought it may be impossible to reduce the incidence of COVID-19 without vaccination. Four hundred and fifty-seven (89.6%) responded that they were at high risk of becoming infected, and 418 (82%) HCWs think vaccination is a good idea. In comparison, 282(55.3%) of the HCW's family and friends considered COVID-19 vaccination as a good idea, and 201(39.4%) didn't consider it a good idea. Two hundred and thirty

(45.1%) think they could get infected through vaccination. Three hundred and ninety-four (77.3%) believed you could get proper medical care if you contract COVID-19. One hundred and fifty-three (30%) said vaccine development was improperly carried out (Table 4). Four hundred and fifty-seven (89.6%) of the HCWs considered themselves at high risk of contracting COVID-19, and 10.4% thought they could get infected with COVID-19 through vaccination. Of these, 119 (51.7%) in the 20-30 age group, 72 (31.3%) aged 31-40, 14 (6.1%) aged 41-50 and 25 (10.9%) in the 51-60 age group linked vaccines to COVID-19 infection. About educational level, 14 (6.5%) HCWs with secondary education and below (grades 12 and below), 47(20.4%) with diplomas, and 168(73%) with university degrees associated vaccines with infection. Among the different occupational categories, 7 (3%) medical doctors, 54 (23.5%) medical laboratory technicians, 129 (56.1%) nurses and midwives, 15 (6,5%) pharmacists, 6 (2.6%) public health officers, 19 (8.3%) non-medical auxiliary staff believed that they could get infected with COVID-19 through vaccination (Table 3).

Overall attitudes and perceptions of COVID-19 and COVID-19 vaccine and proportion of acceptance to be vaccinated for COVID-19 among HCWs in Yaoundé

Nearly half percent (45.5%), 95% CI (41.2% - 49.8%) of HCW had a positive attitude towards COVID-19 and COVID-19 vaccines, and 52.8%, 95% CI (48.59% - 57.2%) had good perception. One hundred and sixty-one (31.6%, 95% CI [27.6%-35.7%]) refused to be vaccinated for COVID-19, and 349 (68.4%, 95% CI [64.3% - 72.4%]) said they had been vaccinated for COVID-19 (Table 4).

Binary logistics regression

Factors associated with refusal to be vaccinated from bivariate analysis

Bivariate analysis identified the following factors with P<0.25 with Crude Odd Ratio (COR) as factors

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associated with the acceptance to be vaccinated: age, religion, education status, profession, where you grew up, years of work, you have health insurance, has anyone in your family, friends, or colleagues had COVID-19, were you positive for COVID-19, smoking status, how many times have you received training and orientation on COVID-19 vaccination? Negative attitude, and poor perceptions. One hundred and sixty-one (31.6%, 95% CI [27.6 % - 35.7%]) refused to be vaccinated for COVID-19, and 349 (68.4%, 95% CI [64.3% - 72.4%]) said they had been vaccinated (Table 5, Table 5 suite).

Multivariate logistic regression analysis: factors associated with refusal to be vaccinated

In multivariable analysis, acceptance to be vaccinated for the COVID-19 vaccine was significantly associated with a negative attitude (Adjusted Odd Ratio (AOR): 4.411; 95% CI [2.324-8.372]) with a regression coefficient of 1.484 and poor perception (AOR: 0.941; 95% CI [0.551-0.1737]) with a regression coefficient of -0.22. HCWs who had negative attitudes about COVID-19 vaccines were 4.411 times more likely to refused been vaccinated compared to those who had positive attitudes towards COVID-19 vaccines. Furthermore, HCWs who had a poor perception of COVID-19 vaccines were 0.941 times more likely to refuse to be vaccinated compared to those who had a good perception of COVID-19 vaccines. However, HCWs with years worked in healthcare of less than ten years (AOR: 2,811; 95% CI [1.523-3.742]) were significantly associated with refusal to be vaccinated for COVID-19 vaccine compared to other HCWs who worked more than ten years. Also, most HCWs of age between 20-50 years, without health insurance, have been nurses and midwives, grew up in rural and semi-rural areas, have attended training only once, have members of families or friends with COVID-19 and those with poor perceptions of HCWS to COVID-19 vaccines refused to be vaccinated. Still, this association was not statistically significant (Table 6).

Discussion

Ongoing efforts are being made to end the COVID-19 pandemic. Various COVID-19 vaccines have been distributed in many countries, including Cameroon. The sound perception, and favourable attitude rates of the HCWs about COVID-19 vaccines were 52.8%, and 45.5%, respectively. In our study, 68.4% of the HCWs have been vaccinated, and 31,6% refused to do so. A similar vaccine acceptance rate was reported by a study in Iraq (61.7%) [16] and a study in Ethiopia, which reported a 64% acceptance rate [17], which was higher than in two studies in the USA, where more than half of all HCWs were undecided and delayed the decision to be vaccinated [18]. Low acceptance rates were also reported among healthcare workers in the Democratic Republic of Congo (27.7%), Egypt (21%), Nepal (38.3%) and Ghana (39.3%) [19]. Studies in Nigeria reported intended vaccine uptake rates of 50.2% [20]. Low rates were due to earlier study dates (when prospects of the vaccine rollout were uncertain), HCWs limited knowledge about vaccines, lack of trust in government management capacity, and concerns about vaccine safety. Some of the highest vaccine acceptance rates (above 80%) were reported from South and Southeast Asia, where HCWs were willing to be vaccinated because they perceived the pandemic to be severe, considered the vaccines to be safe, experienced few financial constraints and little stigmatization of being vaccinated, and trusted the health authorities [21]. Studies in China and Vietnam reported intended vaccine uptakes of 76.63% [22] and 76.10%, respectively [23], slightly higher than ours. These high rates were associated with good knowledge regarding the severity of COVID-19, HCWs' trust in the vaccines, and earlier study dates than in our study.

In this study, high rates of not intending to be vaccinated were associated with negative attitudes and low perception of the COVID-19 vaccine despite poor perception not being statistically significant. Our study also showed that

HCWs of age between 20 and 50 years, without health insurance, have been nurses and midwives, grew up in rural and semi-rural areas, have attended training only once, and have a member of families or friends who had COVID-19 were not willing to be vaccinated. Still, this association between being a nurse and a midwife was not significantly associated with acceptance to be vaccinated for COVID-19, similar to a study in Ethiopia at Debre Tabor Hospital. In contrast to our findings, a study in India found vaccine acceptance to be highest among nurses [24]. However, Medical doctors and public health workers had higher acceptance rates, similar to a study in Debre Tabor Hospital in northern Ethiopia, nurses had the lowest acceptance rates [24]. Our findings corroborate a study from the Democratic Republic of the Congo that reported a positive attitude towards COVID-19 vaccines, significantly associated with the willingness to receive a vaccine [25]. A study among HCWs of an inner-city hospital in New York [25] reported similar results. A study in India indicated that having a family member or friend infected with COVID-19 was positively associated with the likelihood of vaccine acceptance [26]. A community-based study in Wolaita Zone, Ethiopia, showed that family members and friends tested for COVID-19 were significantly associated with accepting the COVID-19 vaccine [27]. In our study, having COVID-19-infected family members, colleagues, or friends was significantly associated with increased vaccine uptake intention only in the multivariate analysis but not in the bivariate logistic model. In addition, as indicated in Table 4, 39.4% and 11.6% of the HCWs do not think their family members and colleagues, respectively, see vaccination as a good idea. Meanwhile, from our study, 45.1% of the HCWs associated vaccines with possible COVID-19 infections, and 39.8 % thought vaccines could worsen any pre-existing medical conditions. Twenty-one percent (21%) of HCWs still do not believe that getting vaccinated is an excellent way to protect their friends and families.

This raises serious concerns since it suggests that HCWs are both uninformed and unconvinced about the safety of COVID-19 vaccinations. Although the cause of this widespread misunderstanding is unknown, Cameroonian public health organizations may need to step up their efforts to enlighten HCWs about the security of these vaccines. Study limitations, including bias, may have impacted the outcome of our study. HCWs may have overreported positive attitudes and impressions and anticipated vaccine uptake due to social desirability bias, which occurs when respondents answer questions in a way that others would see favorably. Furthermore, due to the study's methodology, causal conclusions cannot be taken from it.

Conclusion

Healthcare professionals in Yaoundé, Cameroon, showed a moderately high level of readiness to receive the COVID-19 vaccine. The most important reasons for refusing immunizations were negative attitudes of HCWs concerning COVID-19 vaccines. HCWs are tasked with administering vaccines to the population and are among the first to get vaccines. Thus, it is imperative that critical aspects of their decision-making process, such as information and attitudes regarding vaccine safety, are addressed as soon as possible. Our findings may assist health administrators and planners in creating pertinent interventions encouraging Cameroonian healthcare workers to receive vaccines during the pandemic. The high percentage of HCWs who believed that immunizations could exacerbate any existing medical issues or lead to COVID-19, in particular, is highly troubling because it appears that HCWs are both uninformed and unconvinced about the safety of immunizations. The Ministry of Public Health and other Cameroonian public health organizations must address these problems immediately. Raising attitudes and perceptions of COVID-19 vaccines may be possible by working on behavioral change, communication, and social mobilization using culturally appropriate methods.

This would increase the rate of COVID-19 immunization. We also recommend studies in urban and rural communities to investigate the religious conspiracy about COVID-19 vaccines that may increase the vaccination rate of COVID-19.

What is known about this topic

- *COVID-19 pandemic in Cameroon;*
- *COVID-19 vaccines and vaccination campaigns in Yaoundé.*

What this study adds

- *Factors influencing the attitudes of healthcare workers toward COVID-19 vaccines in Yaoundé Cameroon;*
- *Factors influencing the perceptions of healthcare workers towards COVID-19 vaccines in Yaoundé Cameroon.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Data curation, formal analysis, investigation, conceptualization, methodology, project administration, resources, software, writing an original draft, writing a review, and editing was done by Tendongmo Kinsley Aka. Supervision, validation visualization, project administration, and editing done by Lucy Mande Ayamba Ndip, Sylvester Ndeso Atanga and Seraphine Nkie Esemu.

Acknowledgments

Tables and figures

Table 1: sociodemographic characteristics of HCWs in Yaoundé, Cameroon

Table 2: attitudes of HCWs towards COVID-19 and COVID-19 vaccines in Yaoundé

Table 3: perceptions of HCWs towards COVID-19 and COVID-19 vaccines in Yaoundé

Table 4: overall attitudes and perceptions of HCWs towards COVID-19 and COVID-19 vaccines in Yaoundé

Table 5: bivariate analysis of acceptance to get vaccinated with independent variables

Table 5 suite: bivariate analysis of acceptance to get vaccinated with independent variables

Table 6: multivariate analysis

Figure 1: Mfoundi division, Yaoundé and all the seven subdivisions

Figure 2: selected municipalities in Mfoundi division

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Table 1: sociodemographic characteristics of HCWs in Yaoundé, Cameroon

Socio-demographic characteristics of HCWs in Yaoundé		Count	Column N %	95.0 % Lower CL for Column N %	95.0 % Upper CL for Column N %
Sex	Male	271	53.1	48.8	57.4
	Female	239	46.9	42.6	51.2
Age in Years	20-30	220	43.1	38.9	47.5
	31-40	120	23.5	20.0	27.4
	41-50	100	19.6	16.3	23.2
	51-60	70	13.7	10.9	16.9
Education Status	Primary	5	1.0	0.4	2.1
	Secondary	15	2.9	1.7	4.7
	Diploma	180	35.3	31.2	39.5
	University degree	310	60.8	56.5	65.0
Profession	Medical Doctor	44	8.6	6.4	11.3
	Laboratory Technician	140	27.5	23.7	31.4
	Nurse and Midwives	210	41.2	37.0	45.5
	Pharmacists	40	7.8	5.7	10.4
	Public Health Officer	51	10.0	7.6	12.8
	Nonmedical Auxiliary Staff	25	4.9	3.3	7.0
Religion	Orthodox Christian	340	66.7	62.5	70.7
	Protestants	130	25.5	21.9	29.4
	Muslim	40	7.8	5.7	10.4
Marital Status	Single	179	35.1	31.0	39.3
	Married	290	56.9	52.5	61.1
	Divorce	41	8.0	5.9	10.6
Where do you grow up	Rural	111	21.8	18.3	25.5
	Semi-urban	133	26.1	22.4	30.0
	Urban	266	52.2	47.8	56.5
Household sizes	<5	334	65.5	61.3	69.5
	>5	176	34.5	30.5	38.7
Years worked in a healthcare facility	<10	410	80.4	76.8	83.7
	>10	100	19.6	16.3	23.2
Do you have health insurance	No	359	70.4	66.3	74.2
	Yes	151	29.6	25.8	33.7
Has anyone in your family or friends had Covid-19	No	209	41.0	36.8	45.3
	Yes	301	59.0	54.7	63.2
Have you been tested for Covid-19?	No	41	8.0	5.9	10.6
	Yes	469	92.0	89.4	94.1
If yes, were you positive?	No	279	59.5	55.0	63.9
	Yes	190	40.5	36.1	45.0
Do you have any chronic disease?	No	435	85.3	82.0	88.2
	Yes	75	14.7	11.8	18.0
Smoking status	Never smoked	399	78.2	74.5	81.7
	Current smoker	29	5.7	3.9	8.0
	Ex-smoker	82	16.1	13.1	19.5
Have you received training or orientation about COVID-19 vaccination?	No	122	23.9	20.4	27.8
	Yes	388	76.1	72.2	79.6
How many times have you received training/orientation?	once	140	36.0	31.3	40.8
	more than once	249	64.0	59.2	68.7

Table 2: attitudes of healthcare workers towards COVID-19 and COVID-19 vaccines in Yaoundé					
HCWs' attitudes towards COVID-19 and COVID-19 vaccines		**Count**	**Column N %**	**95.0 % Lower CL for Column N %**	**95.0 % Upper CL for Column N %**
Are you confident that the Ministry of Health can control Covid-19 in Cameroon?	No	86	16.9	13.8	20.3
	Yes	424	83.1	79.7	86.2
	I don't know	0	0.0		-
Do you have general mistrust/uncertainty about the COVID-19 vaccine's effectiveness?	No	209	41.0	36.8	45.3
	Yes	301	59.0	54.7	63.2
	I don't know	0	0.0	-	
Do you fear Covid-19 vaccines?	No	214	42.0	37.7	46.3
	Yes	296	58.0	53.7	62.3
	I don't know	0	0.0	-	.
Reasons for fearing Covid-19 vaccines	Infertility	107	36.1	30.8	41.7
	Severe allergic reactions	109	36.8	31.5	42.4
	Unknown long-term effects	80	27.0	22.2	32.3
Have you been vaccinated for Covid-19?	No	161	31.6	27.6	35.7
	Yes	349	68.4	64.	72.4
Do you refuse vaccination because only Allah/God can prevent Covid-19?	No	469	92.0	89.4	94.1
	Yes	41	8.0	5.9	10.6
	I don't know	0	0.0	-	-
What alternative preventive measures did you use to prevent Covid-19?	Traditional medicine	142	27.9	24.1	31.9
	Prayers	55	10.8	8.3	13.7
	Physical exercise	312	61.3	57.0	65.5
Should people with chronic and severe diseases get priority for Covid-19 vaccination?	No	0	0.0		
	Yes	449	88.0	85.0	90.6
	I don't know	61	12.0	9.4	15.0
Should HCWs get priority COVID-19 vaccination?	No	67	13.1	10.4	16.3
	Yes	443	86.9	83.7	89.6
	I don't know	0	0.0		
Should all HCWs be vaccinated to protect the public?	No	199	39.0	34.9	43.3
	Yes	311	61.0	56.7	65.1
	I don't know	0	0.0		
To protect the public, HCWs should follow government guidelines about vaccines	Disagree	19	3.7	2.3	5.6
	Agree	491	96.3	94.4	97.7
	I don't know	0	0.0		

Table 3: perceptions of HCWs towards COVID-19 and COVID-19 vaccines in Yaoundé

Perceptions of HCWs about COVID-19 and COVID-19 vaccines		Count	Column N %	95.0 % Lower CL	95.0 % Upper CL
Do you think you are at high risk of contracting COVID-19?	No	38	7.5	5.4	10.0
	Yes	457	89.6	86.7	92.0
	I don't know	15	2.9	1.7	4.7
Do you think that you could get infected with COVID-19 through vaccination??	No	254	49.8	45.5	54.1
	Yes	230	45.1	40.8	49.4
	I don't know	26	5.1	3.4	7.3
Is it possible to control and reduce the incidence of COVID-19 without vaccination?	No	281	55.1	50.8	59.4
	Yes	150	29.4	25.6	33.5
	I don't know	79	15.5	12.5	18.8
Do most of my colleagues think that getting vaccinated is a good idea?	No	59	11.6	9.0	14.6
	Yes	418	82.0	78.4	85.1
	I don't know	33	6.5	4.6	8.9
Is getting yourself vaccinated an excellent way to protect your family and others against infection?	No	107	21.0	17.6	24.7
	Yes	350	68.6	64.5	72.5
	I don't know	53	10.4	8.0	13.3
My family and friends think that getting vaccinated is a good idea.	No	201	39.4	35.2	43.7
	Yes	282	55.3	51.0	59.6
	I don't know	27	5.3	3.6	7.5
Do you think that COVID-19 vaccine can worsen any health condition you have?	No	217	42.5	38.3	46.9
	Yes	203	39.8	35.6	44.1
	I don't know	90	17.6	14.5	21.1
Do you believe you can get proper medical care if you contract COVID-19?	No	124	24.3	20.7	28.2
	Yes	352	69.0	64.9	72.9
	I don't know	34	6.7	4.7	9.1
Do you think the development of COVID-19 vaccines was adequately carried out to make them safe?	No	153	30.0	26.1	34.1
	Yes	357	70.0	65.9	73.9

Table 4: overall attitudes and perceptions of healthcare workers towards COVID-19 and COVID-19 vaccines in Yaoundé

Variable		Count	Column N %	95.0 % Lower CL for Column N %	95.0 % Upper CL for Column N %	Mean	Std Deviation
Overall Attitude of HCWs to COVID-19 and COVID-19 vaccines	Negative	278	54.5	50.2	58.8	0.7031	0.14744
	Positive	232	45.5	41.2	49.8		
Overall Perception of HCWs to COVID-19 and COVID-19 Vaccine	Poor	240	47.2	42.8	51.5	0.7736	0.32935
	Good	269	52.8	48.5	57.2		
Have you been vaccinated for COVID-19?	No	161	31.6	27.6	35.7		
	Yes	349	68.4	64.3	72.4		

Table 5: bivariate analysis of acceptance to get vaccinated with independent variables

Have you been vaccinated for COVID-19?a	B	Sig.	Exp(B)	95 % C.I.for EXP(B) Lower	Upper
Sex (1) Male Female	-0.555 Ref	0.190	0.574	.250	1.316
Age in Years 20-30		0.001			
31-40	6.817	0.001	3.239	2.509	4.651
41-50	7.836	0.001	3.966	2.193	6.439
51-60	1.885	0.181	6.588	0.417	8.184
Education Status Primary		0.139			
Secondary	2.577	0.356	5.151	0.056	7.199
Diploma	-1.555	0.569	0.211	0.001	44.325
University degree	.113	0.877	1.119	0.267	4.685
Profession Medical Doctor		0.590			
Lab Technician	2.003	0.159	7.409	0.455	10.661
Nurses and Midwives	2.760	0.214	2.798	0.204	4.475
Pharmacist	1.533	0.465	4.630	0.076	6.377
Public health workers	1.086	0.541	1.963	0.091	2.501
Non-Medical Auxillary staff	1.648	0.340	2.196	0.176	3.167
Religion Christian Muslim	-1.018	0.123	0.361	0.099	1.318
Marital Status Single		0.324			
Married	-1.274	0.569	0.280	0.022	3.523
Divorce	-1.285	0.289	0.277	0.026	2.967
Where do you grow up Rural		0.125			
Semi-Urban	1.930	0.047	3.723	1.037	8.087
Urban	0.732	0.241	2.080	0.611	7.085
Household sizes <5 >5	-1.023	0.261	0.360	0.060	2.140
Years I have worked in a healthcare facility. Ten or Less >10	-7.989	0.001	0.001	0.001	0.018
Do you have health insurance? No Yes	-0.915	0.099	0.400	0.135	1.189
Has anyone in your family or friends had Covid-19 No Yes	-0.597	0.188	0.551	0.227	1.339

Table 5 suite: bivariate analysis of acceptance to get vaccinated with independent variables					
Have you been vaccinated for COVID-19?a	**B**	**Sig.**	**Exp(B)**	**95 % C.I. for EXP(B)**	
				Lower	**Upper**
Have you been tested for COVID-19? Yes No	2.053	0.900	3.642	0.001	
If Yes, were you Positive? Yes No	-0.867	0.172	0.420	0.121	1.459
Do you have any chronic disease? Yes No	0.738	0.418	4.093	0.301	1.495
Smoking status Current smoker		0.050			
Ex-smoker	1.675	0.016	0.187	0.048	0.731
Non-smoker	-0.764	0.479	0.466	0.056	3.863
Have you received training or orientation about COVID-19 vaccination? Yes No	2.309	0.999	0.388	0.000	
How many times have you received training/orientation? Once More than once	1.741	0.055	2.705	0.962	3.836
Overall Attitude of HCWs to COVID-19 and COVID-19 vaccines Negative Positive	1.411	0.001	0.244	0.123	0.482
Overall Perception of HCWs to COVID-19 and COVID-19 Vaccine Poor Good	-0.092	0.765	0.912	0.499	1.667

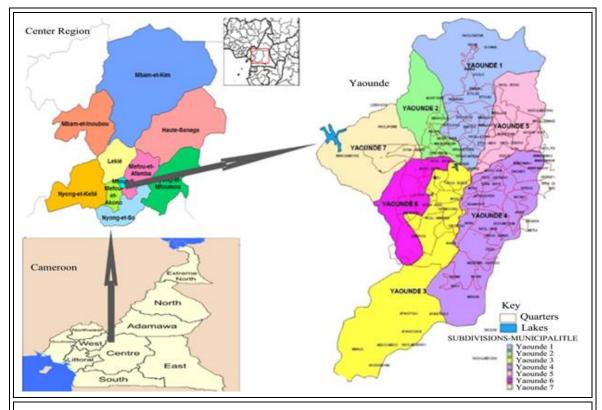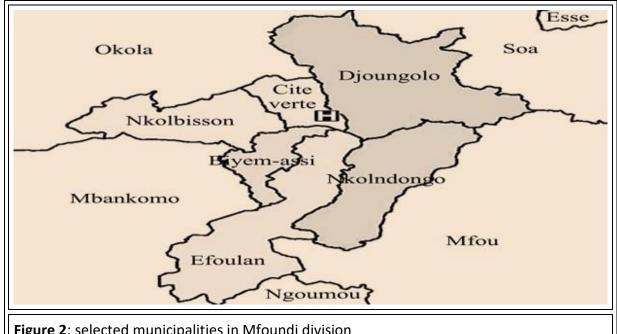| Table 6: multivariate analysis								
Parameter estimates								
Have you been vaccinated for COVID-19?a	**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95 % Confidence Interval for Exp(B)**	
							Lower Bound	**Upper Bound**
Intercept	-2.440	1.202	4.123	1	0.042			
[Age in Years=0]	-4.508	1.298	2.056	1	0.001	0.011	0.001	0.140
[Age in Years=1]	-4.886	1.552	9.905	1	0.002	0.008	0.001	0.158
[Age in Years=2]	-0.420	1.060	0.157	1	0.692	0.657	0.082	2.243
[Age in Years=3]	0b	.	.	0	.	.	.	.
[Education Status=1]	1.457	2.107	0.478	1	0.489	2.292	0.069	2.700
[Education Status=2]	3.827	2.265	2.854	1	0.091	1.928	0.542	3.216
[Education Status=3]	-0.655	0.626	1.093	1	0.296	0.520	0.152	1.773
[Education Status=4]	0b	.	.	0	.	.	.	.
[Profession=1]	0.681	0.863	0.623	1	0.430	0.506	0.093	2.746
[Profession=2]	0.224	1.386	0.026	1	0.872	1.251	0.083	1.934
[Profession=3]	-0.594	1.485	0.160	1	0.689	1.811	0.099	1.256
[Profession=4]	1.131	1.112	1.034	1	0.309	1.099	0.350	2.422
[Profession=5]	0.042	1.118	0.001	1	0.970	1.043	0.117	2.339
[Profession=6]	0b	.	.	0	.	.	.	.
[Religion=1]	1.121	0.609	3.396	1	0.065	0.069	0.931	1.116
[Religion=2]	0b	.	.	0	.	.	.	.
[Where do you grow up=0]	-1.498	1.050	2.035	1	0.154	0.224	0.029	1.751
[Where do you grow up=1]	-0.605	0.606	0.997	1	0.318	0.546	0.167	1.790
[Where do you grow up=2]	0b	.	.	0	.	.	.	.
[Years worked in healthcare facility=0]	2.693	1.444	15.551	1	0.001	2.811	1.523	3.7426
[Years worked in healthcare facility=1]	0b	.	.	0	.	.	.	.
[Do you have health insurance=0]	-0.948	0.518	3.352	1	0.067	0.387	0.140	1.069
[Do you have health insurance=1]	0b	.	.	0	.	.	.	.
[Has anyone in your family or friends had COVID-19=0]	-0.848	0.409	4.298	1	0.038	0.428	0.192	.955
[Has anyone in your family or friends had COVID-19=1]	0b	.	.	0	.	.	.	.
[How many times have you received training/orientation?=1]	-1.183	0.632	3.499	1	0.061	0.306	0.089	1.058
[How many times have you received training/orientation?=2]	0b	.	.	0	.	.	.	.
[If Yes, Where you Positive?=0]	-0.491	0.490	1.002	1	0.317	0.612	0.234	1.600
[If Yes, Where you Positive?=1]	0b	.	.	0	.	.	.	.
[Smoking status=0]	0.860	0.571	2.270	1	0.132	2.364	0.772	7.241
[Smoking status=1]	0.217	1.001	0.047	1	0.828	1.242	0.175	8.830
[Smoking status=2]	0b	.	.	0	.	.	.	.
[Overall Attitude of HCWs to COVID-19 and COVID-19 vaccines=1.00]	1.484	0.327	0.609	1	0.000	4.411	2.324	8.372
[Overall Attitude of HCWs to COVID-19 and COVID-19 vaccines=2.00]	0b	.	.	0	.	.	.	.
[Overall Perception of HCWs to Covid-19 and COVID-19 Vaccine=1.00]	-0.022	0.293	0.006	1	0.941	0.978	0.551	1.737
[Overall Perception of HCWs to COVID-19 and COVID-19 Vaccine=2.00]	0b	.	.	0	.	.	.	.

Figure 1: Mfoundi division, Yaoundé and all the seven subdivisions

Figure 2: selected municipalities in Mfoundi division

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