

# Determinants of Knowledge, Attitudes, and Practices of Frontline Health Care Givers During the First Wave of Covid-19 in Africa: a Multi-centers Online Cross-sectional

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# Abstract

**Background:** During its first wave in sub-Saharan Africa, there was insufficient understanding of the new pandemic of coronavirus disease 2019 (COVID-19) among frontline health care professionals that has led to a misidentification, and mistreatment of affected patients, with a potential risks of contacting and spreading the disease. This study was carried out to determine the knowledge, attitude, and practices (KAP) of frontline health care givers (HCGs) towards COVID-19 in Africa and their related factors.

**Methods:** This was a multi-centers online cross-sectional study conducted over a 3-months study-period using a google survey link among front lines African HCGs in the COVID-19 response units within 28 African countries. Bivariate and Multivariate logistic regression were used to assess the associations between co-variates. Statistical significance was set at  $p \leq 0.05$  and 95% confidence interval.

**Results:** There a total of 518 out of 588 approached HCGs participated in the study from 28 African countries. Overall, 496 (96%) had bad practice score, and 405 (78%) had positive attitude regarding COVID-19. The related factors of KAP towards COVID-19 identified were the lack of self- esteem and self-confidence in the management of COVID-19 (aOR: - 0.17, 95% CI=-0.766 to -4.33,  $p >0.05$ ), Ignorance (aOR: 1.55, 95% CI=1.003 to 2.402,  $p <0.048$ ), lack of knowledge updates on COVID-19 (aOR: 1.81, 95% CI=1.105 to 2.951,  $p <0.018$ ).

**Conclusions:** Majority of the frontline HCG has an overall good knowledge and attitude towards the disease across the African continents regardless of their level of study. However, the KAP is influenced negatively by the lack of self-esteem, self- confidence, ignorance, and insufficiency of frequent update of COVID-19 information. Promoting psychological support in addition to regular trainings could help to enhance the KAP of frontline HCG in African region.

## Introduction

The emergence of Corona virus disease 2019 (COVID-19) in China and its exponential transmission to more than 219 countries around the world, including fifty-two countries in Africa, present a delicate situation for low-resource countries. This current pandemic has immeasurable health, economic, and social consequences that are shaking the entire planet (1-6).

During its first wave, while millions of people worldwide stay at home to minimize the transmission of the COVID-19, the majority of health care givers (HCGs) remained at the forefront of the response to this pandemic. They go to clinics and hospitals, exposing themselves to a high risk of COVID-19. In addition to exposure to the pathogen, high hours of work, psychological distress, tiredness, overwork, stigma, social and physical abuse are additional burdens that affecting HCGs (7). A recent study published by Hakan E. et al., found that 300,000 HCGs from thirty-seven countries had been infected with COVID-19. In addition to the high number of infections, over 2,500 of HCGs have already lost their lives around the world as of August 15th. Of the thirty-seven countries surveyed, the United States had the highest number of coronavirus infections among HCGs with 114,500 infections (PLEASE reference and ADD a DATE of

this report). Mexico followed with a reported 78,200 infections while France and Italy had 30,000 and 29,000 coronavirus infections respectively. While the United States had the highest number of infections, the rate of infections adjusted for the population size was highest in Mexico, Italy, and France.

Among all thirty-seven countries, the median rate of death from COVID-19 in HCGs was 0.05 per 100,000 individuals. Mexico experienced the highest number of deaths due to COVID-19, with the loss of 1,162 HCGs. The United States followed with 574 HCGs deaths. In Italy, 304 healthcare workers died from COVID-19 and in Iran there were 164 COVID-19 deaths among doctors, nurses, and other medical staff. In Spain, more than 7,400 health professionals have been infected, or 26% of all those infected in the country. (2, 6-8).

As of the third of October 2020, over 34,904,254 million cases and 1,034,382 deaths have been reported globally (2,96 %). America is the most affected with over 50% of cases and 60% of deaths reported in this region. The United States of America with 7,556,613 cases of COVID-19 and 213,578 deaths, constitutes currently the most infected country in the World. The African region was the least affected with 1,504,015 cases, 36,288 deaths, and 1,218,821 recoveries but an overall decrease in the number of cases and deaths across the region has been reported by 11% in the last 40 days. Despite the overall decrease of cases in the region, Uganda reported an intensive community transmission in capital Kampala and an increase of over 300% of cases; and similarly, an overall increase in the number of cases has been reported in Namibia and Nigeria in term of 55% and 19% respectively (9, 10). Despite the infrastructure and equipment limitations of the African health care system, COVID-19 seems to be contained and under control. Several hypotheses have been reported; this could be explained by more than 60% of the population in Africa are under the age of 25. Authorities revealed some contributing factors to African coping better such as low travel and outdoor living, expertise in epidemic control from tackling other outbreaks, and cross-immunity from other coronaviruses (10, 11).

Despite governmental efforts to mobilize HCGs to support the health systems, most of those health professionals were not sufficiently educated about the adequate precautionary measures of this novel disease, and were at a high risk of contracting the disease, and also of spreading the virus to uninfected patients who seek an assessment (6, 7, 12). There is a paucity of literature on Knowledge, Attitude, and Practice (KAP) of African HCGs towards the COVID-19 pandemic. However, a study among HCGs in Henan, China revealed that over 80% of HCGs had sufficient knowledge of COVID-19 and correct practices regarding COVID-19. (13). In Uganda, a study done at Mulago and Kirundu Hospitals reported 69% of HCWs had good knowledge, 21% had a positive attitude, and 74% had good practices towards COVID-19 (14). Several studies reported that, age, news media, holding a diploma or were significantly associated with good Practice and Knowledge towards COVID-19 (8, 14, 15). There is a paucity of evidence of the current KAP towards COVID-19 in sub-Saharan Africa, despite several WHO materials, up-to-date, and governments' guidelines. Understanding frontline HCGs' KAP and possible risk factors help to improve the safety of both the HCGs and the general population. This study aimed to assess the KAP of the frontline HCGs towards COVID-19 during the first wave of the pandemic, and also to identify their related factors to the sub-Saharan African countries.

## Methods

**Study design, setting, and participants:** It was a cross-sectional descriptive study using an online structured questionnaires (both French or English version), and sent to the frontline HCGs in several African countries where there was an increasing number of COVID-19 cases and reported deaths between April 2020 and July 2020; In most of those countries, there was a lockdown measure during the same period to control the spread of infections (9, 16-18). The approached frontline HCGs were either nurses, midwives, or doctors in any level of years of practice in any of those African hospitals where COVID-19 patients are screened or managed.

**Study instrument, variables and data collection:** The online Google Form link was sent via emails, or social media platforms (Whatsapp, Twitter, and Facebook).

Standardized and pre-tested screening tools and adjusted pre-validated questionnaire were used to obtain information on the study variables. Twenty-eight variables from the Question and Answer about COVID-19 in the webpage of WHO and other previous studies (14, 19-22) were assessed and adapted during our interview. A pilot study was carried out by 11 HCWs from Benin, Ghana, Malawi and Niger, and adjustment were made based on their opinions relating to the feasibility of the questionnaire, and the final questionnaire was determined by the authors accordingly. The final questionnaire had five sections. The first section comprised demographic characteristics of the participants. The second section included 14 questions regarding the knowledge of COVID-19; knowledge was assessed through two points scale, and each incorrect response weighed 0 point and 1 for correct responses (the lower the points, the less knowledgeable is the HCG).

The third section evaluated the attitude, including 5 questions in a Likert scale of agreement as used for assessing the participants' answers from Olum and Goni et al. (14, 21). The responses were: strongly disagree, disagree, neutral, agree and strongly agree; each weighing 1–5 respectively. The fourth section included 5 questions regarding the practices of COVID-19. The responses were; always, occasional, never, and neutral each weighing 3, 2, and 1 point respectively for a good practice.

The last section estimated the determinants regarding COVID-19, and included 4 questions in which the participants' answers were assessed through 3 points Likert scale of agreement. The responses were: disagreement, occasional, neutral, agreement and each weighing 3, 2, and 1 point respectively for a good answer. Some questions were reversed to eliminate biases of giving a single similar response in all the items (14, 22, 23).

As part of the data collection process, the most active email of each participant was collected to identify duplicate responses. To optimize the participants' responses to our survey, continuous reminders were given to them through the same way they were contacted (email or social media platforms).

**Statistical analysis:** Fully completed questionnaires were extracted from Google Forms and exported to a Microsoft Excel 2016 for cleaning and coding. The cleaned data was exported to STATA version 16 and

GraphPad 8.3 for analyses (14, 21).

Statistical analysis used SPSS 16.0 for encoding, statistical processing and data analysis. The means and standard deviations described the characteristics of the sample, while the frequencies and proportions described levels of KAP and determinants. The hypothesis tests were the Pearson correlation coefficient  $r$  for the covariance while the difference in means was tested by ANOVA (24). To determine the best determinants of KAPs toward COVID-19 specifically among frontline African HCGs, logistic regression was applied to the different significant odds ratios as a multivariate model.

Ethical considerations: The protocol has been cleared by the Integrated Multidisciplinary Research Center Ethics committee (IMRCEC) of Adventist University of Lukanga (Campus Wallace, Lukanga, D.R. Congo) (Protocol Number.02/2020), and All participants provided an informed consent, and their anonymity were guaranteed.

## Results

Socio-demographic characteristics of the HCGs: Of the twenty-eight countries surveyed, 518 (88.1%) responded over the 588 frontline HCGs approached. The top four countries surveyed were as follows: DRC 254 (48%), Uganda 60 (12%), Algeria 57 (11%) and Ghana 37 (7%). 363 (70%) of the participants were aged from 18 and 40. Two hundred and ninety (56%) were male. Two hundred ninety-eight (58%) were practicing medical doctors, and 332 (64%) had at least a bachelor's degree. Four hundred fourteen (80%) were Christians.

Knowledge of HCGs regarding COVID-19: A total of 335 (65%) of participants revealed that official websites and media of the International Health Organization were the main source of information for COVID-19, followed by Newspapers and News 157 (30%), and Social media 118 (23%). According to their best knowledge, throat irritation, cough, respiratory disorder, and fever are been reported to be the major symptoms of COVID-19 respectively 86%, 65%, 59% and 52% respectively (Table 1). Also, very old age of > 75 years old (88%), patients with comorbidities (82%) and obese (47%) are recognized as main categories of patients who are at risk of developing severe forms of COVID-19 in African region. Four hundred seventy-two (91%) participants are convinced that COVID -19 spreads through the droplets emitted by the respiratory tract of infected people. Four hundred thirty-four (84%) of frontline HCGs believed that wearing surgical masks can prevent someone from getting COVID-19 versus 307 (59%) thought that wearing a home-made mask (masks with clothing) prevent against COVID-19. 427 (82%) disagreed that children and older adults do not need to take protective measures against COVID-19. About 91% of participants reported that people should avoid frequenting public places such as parking lots, churches, schools or universities, markets, and avoiding public and public transportation in order to prevent contracting COVID-19 infection. About 90% of frontline HCGs are convinced that isolation and treatment of patients infected with COVID-19 virus are the safe ways to reduce the spread of this virus. About 90% of participants agreed that persons who have been in contact with patients infected with COVID-19 should immediately

be isolated and quarantined in an appropriate place. Table 2 summarizes the knowledge of HCGs regarding COVID-19.

Attitude of the HCGs towards COVID-19: Overall, 405 (78%) of frontline HCGs had positive attitude toward Covid-19.

Practice of the HCGs about COVID-19: Overall, 496 (96%) had bad practices.

Factors related to HCGs' KAP: Only 129 (25%) of frontline African HCGs reported to be able to manage COVID-19 disease with self-esteem and self-confidence. Half of participants declared that they have many other more important patients than those with COVID-19 which could be interpreted as negligence towards COVID-19 cases. About 58% of participants revealed that COVID is not a politicized disease made by researchers. About 47% of frontline HCGs recognize that have insufficient training which could affect their KAP regarding COVID-19 versus 382 (74%) of participants declared that they have never been updated on COVID-19 trends/ new features (Table 3). The related factors of KAP towards COVID-19 identified were the lack of self- esteem and self-confidence in the management of COVID-19 (aOR: - 0.17, 95% CI=-0.766 to -4.33, p >0.05), Ignorance (aOR: 1.55, 95% CI=1.003 to 2.402, p <0.048), lack of updating (aOR: 1.81, 95% CI=1.105 to 2.951, p <0.018).

Association of knowledge score and socio-demographics, attitude and practice: Country/Place of work, qualification, education level, attitude, gender, and marital status were significantly associated with knowledge of frontline HCGs toward COVID-19 with p <0.05 (Table 4). The Ghana's frontline HCGs scored the highest mean of knowledge 16.1±4.0. The men's mean knowledge score was 13.9± 2.8. Doctors' mean knowledge was 14.4±2.5. Holding a master or PhD had a knowledge mean score of 14.9±2.6. The mean of knowledge score of married participants was 13.9±3.0. The mean of knowledge score of having a positive attitude was 14.2±2.4. At multivariate analysis, the factors positively associated with knowledge were practicing in "Uganda" (aOR: 1.1, 95% CI=0.39 to 1.87, p <0.003), Ghana (aOR: 3, 95% CI=2.03 to 3.94, p <0.000) and holding a Masters, and a PhD degrees (aOR: 1.1, 95%CI= 0.27 to 1.91, p <0.010), and having a positive attitude (aOR: 2, 95% CI=0.27 to 1.91, p =0.000). The factors negatively associated with knowledge include practicing in "Algeria" (aOR: 0.9, 95% CI=1.74 to 0.02, p <0.045), being a "Nurse" (aOR: 0.6, 95% CI=1.18 to 0.09, p=0.023), and lacking of the "good practice" (aOR: 1.9, 95% CI=3.04 to 0.7, p=0.002) (Table 4). Ignorance of COVID-19 as a politicized disease was found to be determinant factor of knowledge of COVID-19 in multivariate linear regression (Table 5).

Association of attitude, socio-demographics and knowledge score: Overall, 405 (78%) participants had positive attitude toward Covid-19. Country/place of work, gender, qualification, education level, religious domination, knowledge and marital status were significantly associated with attitude of African frontline HCGs about COVID-19 with p <0.05. The factors positively associated with Attitude of frontline HCGs toward COVID-19 in Africa: "Married" (aOR: 1.7, 95% CI=1.04 to 2.78, p <0.034), and "Christian" (aOR: 2.8, 95%CI= 1.37 to 5.81, p <0.005), "Knowledge" (aOR: 1.4, 95%CI= 1.25 to 1.56, p = 0.000) (Table 6). Again, ignorance towards COVID-19 as a politicized disease, and lack of updated information of COVID-19

trends have been found to be significant factors for the attitude of HCGs towards COVID-19 management during its first wave (Table 7).

Association of practice, socio-demographics and knowledge score: Overall, 496 (96%) of frontline HCGs had bad practices toward COVID-19. Country/Place of work, age, and religious denomination were significantly associated with Practice of frontline HCGs toward COVID-19 with  $p < 0.05$  (For more details see Table 8). The factors positively associated with practices of frontline HCGs toward COVID-19 in Africa: "Ghana" (aOR: 81.9, 95% CI=14.78 to 453.87,  $p = 0.000$ ), 41 years and above (aOR: 4.1, 95% CI=1.37 to 12.57,  $p < 0.013$ ), and "Knowledge" 0.8 (0.69 - 0.99) (aOR: 0.8, 95% CI=0.69 to 0.99,  $p < 0.040$ ) (Tables 8). Self-esteem, self-confidence, negligence, ignorance, and lack of update have been found to be significant factors associated with bad practice of frontline HCGs of COVID-19 (Table 9).

## Discussion

Among 518 frontline African HCGs leaving in 28 countries who agreed and returned the questionnaire between April and July 2020, we noted that 78% of participants had positive attitude towards COVID-19. This finding is in agreement with a study conducted in Pakistan which reported a high positive attitude among HCGs about COVID-19 (15). This result is higher than the findings reported in Uganda and Ethiopia in term of 21% and 65.7% respectively (8, 14, 25). This finding could be explained by a positive attitude regarding COVID-19 among frontline HCGs might result to a good knowledge. This statement is confirmed by a multivariate positive logistic regression found between attitude and knowledge in this study. The above finding of positive attitude among African frontline HCGs is corroborated with the findings of Bhagavathula et al. who revealed that 78% of HCGs, had positive attitude about COVID-19 (26). Interestingly, the factors positively associated with Attitude of frontline HCGs towards COVID-19 in Africa were marital status, religious denomination, good knowledge about COVID-19 ( $p < 0.05$ ). In contrast, attitude did not differ significantly ( $P > 0.05$ ) with country, age, gender, qualification, education level, and practice. These results are similar with other surveys (15, 22).

In contrast, the survey found that 96% of participants had bad practices regarding COVID-19. This finding has revealed a practice gap among African HCGs and could explain the major barriers to infection control in African region. A possible explanation of this finding is that a poor practice is negatively associate with knowledge and vice-versa. This is shown by a negative logistic regression found between knowledge and practice in this survey.

Multivariate logistic regression showed that the factors positively associated with knowledge were practicing in Uganda, Ghana, holding a Masters, graduation and PhD degrees, and having a positive attitude regarding COVID-19. Among frontline African HCGs, the factors negatively associated with knowledge include practicing in Algeria, being a Nurse, and having a bad practice. The factors positively associated with attitude of frontline HCGs towards COVID-19 in Africa: being Married, and Christian, having knowledge toward COVID-19. The factors positively associated with Practices of frontline HCGs

toward COVID-19 in Africa: practicing in Ghana, being aged from 41 years and above and having knowledge toward COVID-19.

Our results could inform policy makers on the practice of African frontline HCGs towards SARS-CoV-2 infections. Our findings by providing a more precise assessment of the magnitude of bad practice among frontline HCGs, offer an additional knowledge which could explain the insufficient understanding of the disease among frontline HCGs, and can lead to misidentification and mistreatment of affected patients. This would cause rapid spread of the disease, nosocomial contamination and exposing the lives of several patients (1). In addition, this misunderstanding would contribute to the spread of the virus to uninfected patients who seek an assessment. (6, 7, 12). Frontline HCGs are directly exposed to SARS-CoV-2 infections. The risk of acquiring COVID-19 is higher among HCGs compared to the general population (27).

A good knowledge about COVID is correlated with having a higher educational status because of increased opportunity to access to local and international information, mini-round, seminar, lectures, research, conference and knowledge. 335 (65%) of participants revealed that official websites and media of the International Health Organization were the main source of information for COVID-19, followed by Newspapers 157 (30%), and Social media 118 (23%). These results are different with other studies which reported that the majority of frontline HCGs use social media to seek information about COVID-19 (14, 15, 22, 26). This study revealed that holding Masters or PhD degree is positively associated with better knowledge. Previous studies supported this finding (20, 26).

Throat irritation, cough, respiratory disorder, and fever are the major symptoms of COVID-19 in terms of 86%, 65%, 59% and 52% respectively. Very old patients (88%), patients with comorbidities (82%) and obese (47%) are recognized as main categories of patients who are at risk of developing severe forms of COVID-19 in African region. 472 (91%) participants are convinced that COVID-19 spreads through the droplets emitted by the respiratory tract of infected people. 434 (84%) of frontline HCGs believed that wearing surgical masks can prevent someone from getting COVID-19 versus 307 (59%) thought that wearing a home-made mask (masks with clothing) prevent against COVID-19. 427 (82%) disagreed that children and older adults do not need to take protective measures against COVID-19. 470 (91%) of participants reported that people should avoid frequenting public places such as parking lots, churches, schools or universities, markets, and avoiding public and public transportation in order to prevent contracting COVID-19 infection. 464 (90%) of frontline HCGs are convinced that isolation and treatment of patients infected with COVID-19 virus are the safe ways to reduce the spread of this virus. 464 (90%) of participants are agreed that persons who have been in contact with patients infected with COVID-19 should immediately be isolated and quarantined in an appropriate place. In general, this observation period is 14 days. These findings are consistent with previous studies which shown the knowledge of frontline HCGs towards the transmission, the typical and atypical COVID-19 symptoms, signs and preventive measures and management of COVID-19 (28-31).

Interestingly, Ghana's frontline HCGs scored the highest mean of knowledge  $16.1 \pm 4$ . This finding corroborates with previous studies (32-34).

Only 129 (25%) of frontline African HCGs reported to be able to manage with self-esteem and self-confidence COVID-19 disease. This finding confirmed the practice's gap among African frontline HCGs. Half of participants declared that they have many other more important patients than those with COVID-19 which could be interpreted as negligence or fear towards COVID-19 cases. The psychological impact of COVID-19 among frontline HCGs is well documented by the previous findings in terms of anxious regarding their safety and psychological distress (35, 36). 302 (58%) of participants revealed that COVID is not a politicized disease made by researchers. 242 (47%) of frontline HCGs recognize that have insufficient training which could affect their KAP regarding COVID-19 versus 382 (74%) of participants declared have been updated on COVID-19 trends/ new features. These findings corroborated with previous 20 studies from Australia, Central and North America, Asia and Africa. The frontline HCGs reported a lack of training about COVID-19 itself and about how to use personal protection equipment (37).

Limitation of the study: Ideally, 54 African countries were approached and 28 (53, 38%) were responded. As the area of study was bigger and financial constraint, we didn't find adequate sample size to include in our study which could help us to assess better knowledge, attitude and practices of African frontline HCGs. Then, the study assessed knowledge and attitude and practice, it may not necessarily reflect the actual attitude, practice and that people comply with. The best way to assess practice could be by daily observation of African frontline HCGs. Despite these limitations, our findings provide valuable information about African frontline HCGs' KAP regarding COVID-19.

## Conclusions

Majority of the frontline HCG has an overall good knowledge and attitude towards the disease across the African continents regardless of their level of study. However, the overall KAP are influenced negatively by the lack of self-esteem, self-confidence, ignorance, and insufficiency of frequent update of COVID-19 information. Promoting psychological support and additional update of the trends of the disease as well as regular trainings could help to enhance the KAP of frontline HCG in African region.

## Abbreviations

aOR: adjusted odds ratio;

COVID-19: Coronavirus disease 19;

DRC: Democratic Republic of the Congo;

KAP: Knowledge, Attitudes, Practices. HCG: Health caregiver.

# Declarations

Competing interests:

The authors declare no competing interest.

Ethics approval and consent to participate: Before collecting data, Ethical approval has been cleared by the Integrated Multidisciplinary Research Center Ethics committee (IMRCEC) of Adventist University of Lukanga. (Campus Wallace, Lukanga, DR Congo). (Protocol Number.02/2020). The study was conducted according to the Declaration of Helsinki and all participants signed a written informed consent.

Consent for Publication: not applicable.

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Authors' contributions:

LKK conceived and designed the study and wrote the first draft of the manuscript. ESB, ZMS, DKM, BMK, SKN, FKS, MMV, LMK, AKK, YALT, BMV, undertook the data collection, LMK did the statistical analysis. LKK, HML, BMK, AKN, FK, LMK. ESB, FK, TTK did the manuscript correction, critical review of the final manuscript and SR and LKK did the supervision of the work.

All authors contributed in intellectual content and approved the final manuscript. All authors have read and agreed to the final manuscript.

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Availability of data and materials:

All data generated or analyzed during this study are included in this published article.

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## Tables

**Table 1: Knowledge questions on main symptoms and risk factors**

<b>Variable</b>	<b>YES -Answer (%)</b>
Main symptoms of COVID-19	
Fever	268 (52)
Headache	184 (36)
Myalgia (muscle pain)	38 (7)
Respiratory disorder	306 (59)
Throat irritation	448 (86)
Runny nose	108 (21)
Sneezing	117 (23)
Diarrhea	160 (31)
Cough	337 (65)
Confusion	21 (4)
Asymptomatic	8 (2)

**Table 2: Knowledge questions on risk factors and prevention of COVID-19**

<b>Variable</b>	<b>N (%)</b>
Sample Size	518 (100)
Not every patient with COVID-19 will necessarily develop severe forms of the disease:	
Obese	242 (47)
Very old (>70 years)	455 (88)
Wealthy	10 (2)
Of Asian, European or American origin	162 (31)
With comorbidities	427 (82)
Pregnant	39 (8)
None	8 (2)
There is currently no effective and curative treatment for COVID-19, but early symptomatic treatment can help most patients regain their health	
False	56 (11)
True	429 (83)
Don't Know	33 (6)
No one with COVID-19 can transmit the disease when the fever is not present	
False	347 (67)
True	112 (22)
Don't Know	59 (11)
COVID -19 spreads through the droplets emitted by the respiratory tract of infected people	
False	24 (5)

Variable	N (%)
True	472 (91)
Don't Know	22 (4)
Wearing surgical masks can prevent someone from getting COVID-19: 1 viral infection	
False	42 (8)
True	434 (84)
Don't Know	42 (8)
To prevent contracting COVID-19 infection, people should avoid frequenting public places such as parking lots, churches, schools or universities, markets, and avoiding public and public transportation	
False	20 (4)
True	470 (91)
Don't Know	28 (5)
Isolation and treatment of patients infected with COVID-19 virus are the safe ways to reduce the spread of this virus	
False	27 (5)
True	464 (90)
Don't Know	27 (5)

**Table 3: Some determinants of the KAP: Factors related to Health Care Workers**

<b>Variable</b>	<b>Frequency %</b>
Sample Size	518 (100)
Self-esteem and self-confidence in the management of COVID-19: I am unable to manage COVID-19 disease	
Okay	82 (16)
Neutral	133 (26)
Disagree	129 (25)
Not sure	174 (34)
Negligence: I have many other more important patients than those with COVID-19	
Okay	28 (5)
Neutral	193 (37)
Disagree	260 (50)
Not sure	37 (7)
Ignorance: COVID is a politicized disease made by researchers	
Okay	40 (8)
Neutral	144 (28)
Disagree	302 (58)
Not sure	32 (6)
Insufficient training: I had never been trained and capacity on the COVID-19	
Okay	25 (5)
Neutral	164 (32)
Disagree	242 (47)
Not sure	87 (17)
I've never been updated on COVID-19 trends/ new features	
Okay	70 (14)
Neutral	51 (10)
Disagree	382 (74)
Not sure	15 (3)

**Table 4: Association of knowledge score and socio-demographics-attitude and practice**

Variable	COVID-19 knowledge score			Multivariate linear regression		
	Mean (SD)	N (%)	p	$\beta$	ACoef (95%CI)	p
All	13.6 (3.0)	518(100)			518	
Country/Place of work						
DRC	13.4 (2.7)	251 (48)	0.001	Ref	Ref	
Uganda	15.0 (3.0)	60 (12)		0.12	1.1 (0.39 - 1.87)	0.003
Algeria	12.3 (3.0)	57 (11)		-0.09	-0.9 (-1.74 - -0.02)	0.045
Ghana	16.1 (4.0)	37 (7)		0.26	3 (2.03 - 3.94)	0.000
Other	13.4 (2.5)	113 (22)		-0.06	-0.4 (-1.05 - 0.2)	0.186
Age group in years						
18 to 40	13.6 (3.0)	363 (70)	0.955	Ref	Ref	
41 and above	13.6 (2.8)	155 (30)		0.05	0.3 (-0.16 - 0.82)	0.189
Sex						
Male	13.9 (2.8)	290 (56)	0.018	Ref	Ref	
Female	13.3 (3.1)	228 (44)		-0.03	-0.2 (-0.64 - 0.29)	0.463
Qualification						
Doctor	14.4 (2.5)	298 (58)	0.001	Ref	Ref	
Nurse	12.9 (2.2)	154 (30)		-0.10	-0.6 (-1.18 - -0.09)	0.023
Other	11.9 (4.9)	66 (13)		-0.22	-2 (-2.74 - -1.24)	0.000
Education level						
Certificate/Diploma	12.4 (3.3)	81 (16)	0.001	Ref	Ref	
Bachelor/First degree	13.5 (2.8)	332 (64)		0.04	0.3 (-0.41 - 0.94)	0.442
Master/Graduate/PhD	14.9 (2.6)	105 (20)		0.15	1.1 (0.27 - 1.91)	0.010
Marital status						
Living single	13.3 (2.9)	248 (48)	0.017	Ref	Ref	
Married	13.9 (3.0)	270 (52)		0.06	0.4 (-0.1 - 0.81)	0.122
Religious denomination						
Non-Christian	13.2 (2.9)	104 (20)	0.127	Ref	Ref	
Christian	13.7 (3.0)	414 (80)		-0.04	-0.3 (-0.98 - 0.35)	0.354

Attitude						
Negative	11.6 (3.8)	113 (22)	0.001	Ref	Ref	0.000
Positive	14.2 (2.4)	405 (78)		0.28	2 (1.44 - 2.54)	
Practice						
Bad	13.7 (3.0)	496 (96)	0.083	Ref	Ref	
Good	12.5 (2.3)	22 (4)		-0.13	-1.9 (-3.04 - -0.7)	0.002

**Table 5: Relationship of knowledge score and determinant factors**

Variable	Knowledge score			Multivariate Linear Regression		
	N	Mean (SD)	p	$\beta$	Coef. (95%CI)	p
Total	518	13.6 (3.0)				
Self-esteem and self-confidence in the management of COVID-19: I am unable to manage COVID-19 disease			0.900			0.586
False	389	13.6 (3.2)		Ref	Ref	
True	129	13.6 (2.0)		-0.02	-0.17 (-0.766 - 0.433)	
Negligence: I have many other more important patients than those with COVID-19			0.006			0.059
False	258	13.3 (3.4)		Ref	Ref	
True	260	14.0 (2.4)		0.09	0.51 (-0.019 - 1.042)	
Ignorance: COVID is a politicized disease made by researchers			0.130			0.495
False	216	13.4 (3.9)		Ref	Ref	
True	302	13.8 (2.0)		0.03	0.18 (-0.347 - 0.716)	
Insufficient training: I had never been trained and capacitated on the COVID-19			0.027			0.183
False	276	13.3 (3.3)		Ref	Ref	
True	242	13.9 (2.5)		0.06	0.36 (-0.17 - 0.885)	
I've never been updated on COVID-19 trends/new features			0.007			0.086
False	136	13.0 (4.5)		Ref	Ref	
True	382	13.8 (2.2)		0.08	0.55 (-0.077	

**Table 6: Association of attitude, socio-demographics and knowledge score**

Variable	COVID-19 Attitude score				Multivariate logistic regression		
	All (%)	+Att (%)	-Att(%)	p	ACoef. (95%CI)	AOR (95%CI)	p
Sample Size	518 (100)	405 (78)	113 (22)		518		
Country/Place of work							
DRC	251 (48)	190 (47)	61 (54)	0.001	Ref	1	
Uganda	60 (12)	54 (13)	6 (5)		1 (-0.02 - 1.97)	2.7 (0.98 - 7.19)	0.054
Algeria	57 (11)	34 (8)	23 (20)		0.6 (-0.31 - 1.49)	1.8 (0.74 - 4.43)	0.196
Ghana	37 (7)	34 (8)	3 (3)		1.2 (-0.29 - 2.69)	3.3 (0.75 - 14.79)	0.114
Other	113 (22)	93 (23)	20 (18)		1.1 (0.32 - 1.79)	2.9 (1.38 - 5.99)	0.005
Age group in years							
18 to 40	363 (70)	288 (71)	75 (66)	0.331	Ref	1	
41 and above	155 (30)	117 (29)	38 (34)		-0.3 (-0.81 - 0.23)	0.7 (0.45 - 1.26)	0.274
Sex							
Male	290 (56)	240 (59)	50 (44)	0.004	Ref	1 (0 - 0)	
Female	228 (44)	165 (41)	63 (56)		-0.3 (-0.81 - 0.19)	0.7 (0.45 - 1.21)	0.227
Qualification							
Doctor	298 (58)	251 (62)	47 (42)	0.001	Ref	1	
Nurse	154 (30)	105 (26)	49 (43)		-0.3 (-0.9 - 0.25)	0.7 (0.41 - 1.28)	0.268
Other	66 (13)	49 (12)	17 (15)		0.4 (-0.5 - 1.33)	1.5 (0.6 - 3.78)	0.378
Education level							
Certificate/Diploma	81 (16)	57 (14)	24 (21)	0.014	Ref	1	
Bachelor/First degree	332	256	76		0.2 (-0.48 -	1.3 (0.62 -	0.528

	(64)	(63)	(67)		0.93)	2.53)	
Master/Graduate/PhD	105 (20)	92 (23)	13 (12)		0.3 (-0.63 - 1.26)	1.4 (0.53 - 3.52)	0.517
Marital status							
Living single	248 (48)	183 (45)	65 (58)	0.020	Ref	1	
Married	270 (52)	222 (55)	48 (42)		0.5 (0.04 - 1.02)	1.7 (1.04 - 2.78)	0.034
Religious denomination							
Non-Christian	104 (20)	70 (17)	34 (30)	0.003	Ref	1	
Christian	414 (80)	335 (83)	79 (70)		1 (0.31 - 1.76)	2.8 (1.37 - 5.81)	0.005
Practice							
Bad	496 (96)	388 (96)	108 (96)	0.916			
Good	22 (4)	17 (4)	5 (4)		Ref	1	
Knowledge score	13.6 (3.0)	14.2 (2.4)	11.6 (3.8)	0.001	0.2 (-1.1 - 1.59)	1.3 (0.33 - 4.89)	0.720

**Table 7: Association of attitude and determinant factors**

Variable	Bivariate analysis: Attitude score			Multivariate logistic regression		
	Total (%)	Positive (%)	Negative (%)	p	AOR (95%CI)	p
Sample size	518 (100)	405 (100)	113 (100)	-		
Self-esteem and self-confidence in the management of COVID-19: I am unable to manage COVID-19 disease				0.779		0.678
False	389 (75.1)	303 (74.8)	86 (76.1)		Ref :1	
True	129 (24.9)	102 (25.2)	27 (23.9)		0.9 (0.542 - 1.49)	
Negligence: I have many other more important patients than those with COVID-19				0.429		0.851
False	258 (49.8)	198 (48.9)	60 (53.1)		Ref: 1	
True	260 (50.2)	207 (51.1)	53 (46.9)		0.96 (0.615 - 1.495)	
Ignorance: COVID is a politicized disease made by researchers				0.010		0.048
False	216 (41.7)	157 (38.8)	59 (52.2)		Ref: 1	
True	302 (58.3)	248 (61.2)	54 (47.8)		1.55 (1.003 - 2.402)	
Insufficient training: I had never been trained and capacity on the COVID-19				0.307		0.842
False	276 (53.3)	211 (52.1)	65 (57.5)		Ref: 1	
True	242 (46.7)	194 (47.9)	48 (42.5)		1.05 (0.672 - 1.629)	
I've never been updated on COVID-19 trends/ new features				0.003		0.018
False	136 (26.3)	94 (23.2)	42 (37.2)		Ref: 1	
True	382	311	71		1.81	

(73.7) (76.8) (62.8)

(1.105 -  
2.951)

**Table 8: Association of practice and socio-demographics and knowledge score**

Variable	Practice score			p	Multivariate logistic regression		
	All (%)	Good (%)	Bad (%)		ACoef. (95%CI)	AOR (95%CI)	p
Sample Size	518 (100)	22 (4)	496 (96)		518		
Country/Place of work							
DRC	251 (48)	3 (14)	248 (50)	0.001	Ref	1	
Uganda	60 (12)	1 (5)	59 (12)		1.1 (-1.32 - 3.58)	3.1 (0.27 - 35.75)	0.365
Algeria	57 (11)	3 (14)	54 (11)		1.1 (-0.85 - 3.14)	3.2 (0.43 - 23.22)	0.259
Ghana	37 (7)	11 (50)	26 (5)		4.4 (2.69 - 6.12)	81.9 (14.78 - 453.87)	0.000
Other	113 (22)	4 (18)	109 (22)		1.2 (-0.57 - 2.87)	3.2 (0.57 - 17.7)	0.190
Age group in years							
18 to 40	363 (70)	11 (50)	352 (71)	0.036	Ref	1	
41 and above	155 (30)	11 (50)	144 (29)		1.4 (0.29 - 2.53)	4.1 (1.34 - 12.57)	0.013
Sex							
Male	290 (56)	10 (45)	280 (56)	0.309	Ref	1	
Female	228 (44)	12 (55)	216 (44)		-0.4 (-1.56 - 0.7)	0.7 (0.21 - 2.02)	0.458
Qualification							
Doctor	298 (58)	7 (32)	291 (59)	0.025	Ref	1	
Nurse	154 (30)	9 (41)	145 (29)		0.7 (-0.54 - 1.97)	2 (0.58 - 7.14)	0.263
Other	66 (13)	6 (27)	60 (12)		0.6 (-1.13 - 2.3)	1.8 (0.32 - 10.01)	0.501
Education level							
Certificate/Diploma	81 (16)	4 (18)	77 (16)	0.172	Ref	1	
Bachelor/First degree	332	17	315		0.6 (-0.84 -	1.9 (0.43 -	0.396

	(64)	(77)	(64)		2.13)	8.41)	
Master/Graduate/PhD	105 (20)	1 (5)	104 (21)		-0.9 (-3.45 - 1.65)	0.4 (0.03 - 5.21)	0.489
Marital status							
Living single	248 (48)	14 (64)	234 (47)	0.130	Ref	1	
Married	270 (52)	8 (36)	262 (53)		-0.8 (-1.91 - 0.38)	0.5 (0.15 - 1.47)	0.193
Religious denomination							
Non-Christian	104 (20)	8 (36)	96 (19)	0.051	Ref	1	
Christian	414 (80)	14 (64)	400 (81)		-0.6 (-1.86 - 0.68)	0.6 (0.16 - 1.98)	0.363
Attitude							
Negative	113 (22)	5 (23)	108 (22)	0.916			
Positive	405 (78)	17 (77)	388 (78)		Ref	1	
Knowledge score	13.6 (3.0)	12.5 (2.3)	13.7 (3.0)	0.083	0.7 (-0.78 - 2.15)	2 (0.46 - 8.61)	0.359

**Table 9: Association of practice and determinant factors**

Variable	Bivariate analysis Practice score			Multivariate logistic regression		
	Total (%)	Good (%)	Bad (%)	p	AOR (95%CI)	p
Sample size	518 (100)	22 (100)	496 (100)			
Self-esteem and self-confidence in the management of COVID-19: I am unable to manage COVID-19 disease				0.809		0.411
False	389 (75.1)	17 (77.3)	372 (75)		Ref: 1	
True	129 (24.9)	5 (22.7)	124 (25)		1.6 (0.523 - 4.886)	
Negligence: I have many other more important patients than those with COVID-19				0.028		0.320
False	258 (49.8)	16 (72.7)	242 (48.8)		Ref: 1	
True	260 (50.2)	6 (27.3)	254 (51.2)		0.6 (0.22 - 1.64)	
Ignorance: COVID is a politicized disease made by researchers				0.420		0.630
False	216 (41.7)	11 (50)	205 (41.3)		Ref: 1	
True	302 (58.3)	11 (50)	291 (58.7)		1.25 (0.502 - 3.12)	
Insufficient training: I had never been trained and capacitated on the COVID-19				0.001		0.032
False	276 (53.3)	19 (86.4)	257 (51.8)		Ref: 1	
True	242 (46.7)	3 (13.6)	239 (48.2)		0.25 (0.071 - 0.885)	
I've never been updated on COVID-19 trends/ new features				0.001		0.001
False	136 (26.3)	15 (68.2)	121 (24.4)		Ref: 1	
True	382	7	375		0.18	

(73.7) (31.8) (75.6)

(0.065 -  
0.511)