Knowledge, preparedness, and attitude towards COVID-19 among health profession students in Sub-Saharan Africa: A cross-sectional survey

Priscia Olabisi Adejumo¹, Faith Nawagi², Ifeoluwapo Oluwafunke Kolawole³*, Mamudo Rafik Ismail⁴, Abdon W. Mukalay⁵, Rose C. Nabiye⁶, Abigail Kazembe⁷, Iyanuoluwa Oreofe Ojo⁸, Adebayo Adejumo⁹, Jean B. Nachenga⁰, Fatima Suleman¹¹, Nelson K. Sewankambo¹², Funmilayo A. Okanlawon¹³, Emilia Virginia Noornahomed¹⁴,¹⁵,¹⁶

¹ Department of Nursing, Faculty of Clinical Sciences, University of Ibadan, Nigeria
² Ph.D. scholar - Makerere University College of Health sciences Uganda, Global Partnership Development Rep- Africa: ECFMG/FAIMER
³ Department of Nursing, Faculty of Clinical Sciences, College of Medicine, University of Ibadan, Nigeria
⁴ Associate Professor, Surgical Pathologist Head Pathology Department, Faculty of Medicine, Eduardo Mondlane University (UEM) Avenue Salvador Allende n°702, P.O. Box 257 Maputo, Mozambique
⁵ University of Luhumabashi, Faculty of Medicine & School of Public Health, Clinical Epidemiology and Tropical Disease Unit, Nr 111, Cliniques Universitaires de Luhumabashi, Democratic Republic of the Congo
⁶ Makerere University, Kampala
⁷ Faculty of Midwifery, Neonatal and Reproductive Health Studies, Kasamu College of Nursing, University of Malawi
⁸ Department of Nursing, Faculty of Clinical Sciences, University of Ibadan, Nigeria
⁹ Department of Psychology, Faculty of Social Sciences, University of Ibadan, Nigeria
¹⁰ Infectious diseases and Microbiology, Department of Epidemiology and Center for Global Health, University of Pittsburg, Graduate School of Public Health
¹¹ Pharmacetical Sciences, School of Health Sciences, University of KwaZulu-Nata, Durban, South Africa
¹² LLD Makerere University School of Medicine, Uganda
¹³ Department of Nursing, Faculty of Clinical Sciences, University of Ibadan, Nigeria
¹⁴ Department of Microbiology, Parasitology Laboratory, Faculty of Medicine, Eduardo Mondlane University, Maputo, Mozambique
¹⁵ Department of Medicine, Infectious Diseases Division, University of California, San Diego, USA
¹⁶ Mozambique Institute for Health Education and Research, Maputo, Mozambique

A B S T R A C T

Objective: We assessed the knowledge, preparedness, and attitude of health profession students towards COVID-19 outbreak in Sub-Saharan Africa.

Methods: This cross-sectional study used convenience sampling to recruit participants from institutions under African Forum for Research and Education in Health (AFREhealth). The survey was developed in QuestionPro software covering the participants’ socio-demographic characteristics, knowledge, attitude, and preparedness towards the COVID-19 outbreak. Data were analysed and the association between variables was tested.

Results: The mean age of the 336 students was 25±75 (±7±88) years. Most (99±7%) knew the cause of COVID-19 which could be transmitted via droplets (97±3%). Several participants vowed to adhere to preventive measures (92±3%) and claimed their curriculum equipped them with skills addressing infectious disease outbreaks (63±5%). Nursing students were better prepared than other students (p=0±001). Students from West African regions were more prepared (p=0±001) and aware they could contract COVID-19 if they cared for infected persons (p=0±001).

Conclusion: Students are knowledgeable about COVID-19, adequately prepared to handle epidemics, have a positive attitude towards infection prevention, and their training institutions and government have taken adequate measures to address the COVID-19 outbreak.

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* Corresponding author. Ifeoluwapo Oluwafunke Kolawole (RN, MSc), Department of Nursing, Faculty of Clinical Sciences, College of Medicine, University of Ibadan, Nigeria. +2349024983591.
E-mail address: ifeololarin2014@gmail.com (I.O. Kolawole).

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Research in Context

Evidence before this study

We searched Google, WHO websites, PubMed and Google Scholar between May and June, 2020 for studies on COVID-19 knowledge, attitude and level of preparedness among health profession students. We used the search terms: “COVID-19 OR coronavirus”, “medical students OR health professions' students”, “preparedness OR readiness”, “knowledge OR awareness”. We did not find any such cross-sectional studies. Most studies related to COVID-19 treatment among healthcare professionals, infection prevention and control, clinical trials of medications for COVID-19 treatment and breaking the chains of COVID-19 spread. Results from the studies showed that there were misconceptions about the origin, the cause and the treatment of the infection; specifically, there was no definite treatment modality for COVID-19 as of the time the study was conducted, but there existed controversies on the origin and the drug of choice for its treatment. Globally, there were preventive measures to curb its spread, such as border and airport closures, school closures, lockdown and curfew, mandatory hand hygiene and face-masking among others. Notably, these studies were only causes and preventive strategies.

Added value of this study

Our study focused on the students’ perspectives on the COVID-19 pandemic; to our knowledge, this is the first study to evaluate health profession students' level of preparedness for the COVID-19 pandemic in Sub-Saharan Africa. This study provides empirical evidence of individual, institution, and governmental levels of preparedness towards future pandemics in Africa. Our findings indicate that the students had good knowledge of the cause, mode of transmission, and preventive measures against COVID-19. However, only the nursing students reported that their curriculum was adequately structured to prepare them towards prevention of infectious diseases including COVID-19.

Implications of the available evidence

The available evidence thus indicates that the efforts to achieve an adequate level of preparedness against future pandemics should focus more on enriching the health professions’ curriculums, instituting inter-professional education for health profession students, and addressing the implications of government and institutional policies as regards the control of COVID-19 spread by engaging the students to strengthen the health profession workforce.

INTRODUCTION

COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2, a novel virus, whose true origin remains unknown but is postulated to have originated in a large animal and seafood market in Hubei Province, China (World Health Organization, 2020a). It eventually became a major global health concern because of its pathogenicity and widespread distribution (Hosain, 2021). It is transmitted through direct contact from infected hands into the moist facial mucosal surfaces or by the inhalation of respiratory droplets produced by infected persons when they sneeze and cough (WHO, 2020b; Ong, Tan, Chia et al., 2020). The virus lodges within the respiratory system and has a mean incubation period of 5–6 days (range, 1–14 days) (WHO, 2020c).

As of 25 March 2021, the number of confirmed coronavirus disease 2019 (COVID-19) cases in Africa was 4,181,204, including 11,450 deaths (Woldomet, 2021). South Africa had the highest number of confirmed cases (1,540,009, including 52,372 deaths), followed by Morocco (492,842 confirmed cases, including 8,786 deaths), and Egypt (197,350 confirmed cases, including 11,720 deaths) (Woldomet, 2021). Various preventive and control measures as prescribed by the World Health Organization (WHO) as well as vaccination strategies have been implemented in several African countries (Africa, Center for Disease Control, 2021a). With the spread of COVID-19 across the world, health professionals have had to prepare for the challenges associated with this emerging, rapidly evolving situation. They also need to ensure speedy isolation, infection prevention and control among COVID-19 patients, healthcare professionals, and others who are susceptible to nosocomial transmission. Higher education institutions should also step up to the challenge of addressing any gaps in the knowledge and preparedness of upcoming health professionals (Phua, Weng, Ling et al. 2020).

Globally, there appear to be misconceptions about COVID-19 among certain groups of people, amounting to poor knowledge (Mekonnen, Azagew, Wubneh et al. 2020). However, the virus is highly infectious and the fatality rate is high among some populations (WHO, 2020d). Consequently, medical staff and clinical students often have to work under psychological pressure when attending to COVID-19 patients (Khanal, Devkota, Dahal et al. 2020). Currently, scientists predict that COVID-19 is here to stay even as key measures to control it through vaccination and therapies are being put in place (Bell, Hansen, Kiragga et al. 2020). Thus, the current and future healthcare workers have a key role to play in addressing the situation. Therefore, adequate and correct knowledge regarding COVID-19 along with the preparedness and attitude of health profession students are important in order to succeed in the fight against the pandemic. Considering an empirical inquiry into these factors would be beneficial, we aimed to assess them with respect to the COVID-19 outbreak in Sub-Saharan Africa.

METHODS

Study design

This was an online descriptive cross-sectional study conducted between November 2020 and February 2021 among undergraduate and postgraduate health professions students in their clinical years of training at institutions connected with the African Forum for Research and Education in Health (AFREhealth).

Study setting

AFREhealth is an interdisciplinary health professional group partnering with ministries of health, training institutions, and other stakeholders to improve the quality of healthcare research, education and practice in Africa (The African Forum for Research and Education in Health (AFREHealth), 2020). It comprises members from all the geographic and linguistic regions of Africa, namely Anglophone, Francophone, Lusophone, and Arabophone (AFREHealth, 2020). Membership is open to African and external stakeholders committed to an Africa with strong, self-sustaining, and robust health systems. AFREHealth is currently headquartered in Kumasi, Ghana at the Kwame Nkrumah University of Science and Technology.

Participants

Participants were recruited using the convenience sampling method through the permission and support of the AFREHealth focal persons in their institutions. Students who were easily accessible online were included. All the institutions training health profession students in Africa were targeted for this study but those that are not affiliated with AFREHealth were excluded. The study group comprised undergraduates and postgraduates in their clinical years of study from 16 countries. Using the Kish and Leslie formula (1965), 2023 a minimum sample size of 360 participants was proposed to be recruited at a level of significance equal to or less than 0.05. The sample size was adequately generated to
estimate the process parameters. With G*Power 3.1 software (Heinrich-Heine-Universität Düsseldorf, Germany) 16 the appropriateness of the sample size was determined and an effect size of 0.60, an alpha of 0.05 and 0.80 power was ensured.

Procedures

Data were collected from 362 students out of which 336 completed responses were considered for reporting of findings and analysis. Responses were collected from 16 health institutions in the Anglophone, Francophone, and Lusophone regions using the questionnaire prepared by the study team. It elicited information about the participants’ socio-demographic characteristics, knowledge about COVID-19, level of preparedness in handling the pandemic, and the participants’ attitude towards it. The questionnaire was composed in English, translated to French and Portuguese, and responses in these languages were translated back to English. A reliability test of the questionnaire was run and a calculated Cronbach alpha value of 0.718 was considered acceptable. The self-administered questionnaire was uploaded to QuestionPro (QuestionPro Inc., 9450 SW Gemini Dr #62790, Beaverton; www.questionpro.com) that limits participation to once. Advertisements with the survey link were sent biweekly to the AFREhealth mailing list for 4 months. The AFREhealth Institutions’ personnel were encouraged to circulate the survey questionnaires among the students’ mailing lists.

Statistical analysis

The collected data were downloaded and exported to IBM SPSS Statistics for Windows, version 21 (IBM Corp., Armonk, N.Y., USA) for cleaning, coding, and analysis. Descriptive statistics including mean, median, standard deviation, and inter-quartile range were determined for continuous variables. Frequency distributions and percentages were calculated for categorical variables. Bivariate analysis, chi-square test, and Fischer’s test were performed to establish an association between the socio-demographic characteristics and the responses related to knowledge, preparedness, and attitude. A p value of 0.05 was used to report statistical significance at a power of 80%.

Approval to collect data was obtained from the ethical committees of the participating institutions. Permission was also obtained from the school heads and written informed consent was obtained from individual participants. Details of the study were stated in the consent forms in English, French, and Portuguese. There was no identifier attached to the survey. Data were only accessible to the study team through a password. The study protocol was approved by the Research and Ethics Boards of the University of Ibadan (Nigeria) with IRB number UI/EC/20/0305, the Makerere University (Uganda) with IRB number UHLSREC/L50/01/07/2020, the Eduardo Mondlane University (Mozambique) with IRB number CIBS FM&HCM/P074/2020, and the University of Lubumbashi (Democratic Republic of Congo) with IRB number UNILU/CEM/014/2020.

RESULTS

Table 1 shows the socio-demographic characteristics of the study subjects. Students from 16 African countries of the Western, Central, Eastern, and Southern regions of Africa were included. More than a quarter (33.4%) of the students were from Nigeria, while Benin and Botswana had the least representation (0.3%). Of the 336 study participants, 50.3% were men and 49.7% were women. The mean age of the respondents was 25±7.8 years with majority (88.7%) of them at the undergraduate level of training. The majority of the students were studying medicine (33.4%), followed by those studying physiotherapy (32.4%). About two-thirds of them (63.7%) were from Anglophone countries, 15.2% from Francophone countries, while 21.1% were from Portuguese-speaking countries. Only a few (11.3%) were postgraduate students, while 88.7% were undergraduate students.

Almost all the students (99.7%) knew that COVID-19 was caused by a virus and that disease transmission occurs through droplets after sneezing (97.3%) or close contact with an infected person (97.0%). Very few students (28.3%) knew that the incubation period for the disease is 1–14 days. Most of the students (99.1%) reported that washing hands with soap and clean water is key to disease prevention. They also recognised that polymerase chain reaction tests are highly effective in the diagnosis of COVID-19 (88.7%) (Table 2).

Further, a majority of the students reported that they would not consider changing their profession (91.7%) as a result of COVID-19 and would adhere to the preventive measures (92.3%). They also emphasised the need for leadership to ensure total transparency regarding the facts of disease (92.6%). They also indicated that COVID-19 does not have any association with stigmatization (75.3%). A majority of the students considered COVID-19 real and not a mere myth (86.3%) and more than three-quarters of the students (71.1%) considered themselves psychologically competent to volunteer as caregivers at COVID-19 isolation centres (Table 3).

More than half (55.1%) of the students reported that the training curriculum covered the requisite information on infectious diseases and their prevention (63.6%), and believed their clinical experience rendered them competent in managing COVID-19 cases (62.4%). Above half the number of students (55.2%) considered that school closures
Table 2
Knowledge level of COVID-19 among health professions students.

| Characteristics                                                                 | Fr (N) | (%)  |
|---------------------------------------------------------------------------------|--------|------|
| The cause of coronavirus is                                                      |        |      |
| Virus                                                                           | 335    | 99.7 |
| Parasite                                                                       | 1      | 0.3  |
| Patients with coronavirus present with severe acute respiratory illness Yes        | 328    | 97.6 |
| No                                                                              | 8      | 2.4  |
| The disease is transmitted through Droplets after sneezing No                     | 9      | 2.7  |
| Yes                                                                             | 327    | 97.3 |
| Touching and shaking hands with an infected person No                             | 50     | 14.9 |
| Yes                                                                             | 286    | 85.1 |
| The use of objects used by an infected person No                                 | 86     | 25.6 |
| Yes                                                                             | 250    | 74.4 |
| People with coronavirus may be most contagious at what point? 1-2 days            |        |      |
| First 7 days of illness                                                          | 146    | 43.4 |
| 14-21 days                                                                      | 136    | 40.5 |
| Tracking down contacts of people with COVID-19 should include                    |        |      |
| Only the people encountered soon after symptoms                                  | 100    | 29.8 |
| People encountered several days before the symptoms                              | 214    | 63.7 |
| Only the people in the office and homes of the infected                          | 22     | 6.5  |
| After how many days can an infected person who is cured of COVID-19 communicate with the general population immediately | 43     | 12.8 |
| 2-5 days                                                                        | 16     | 4.8  |
| After 14 days                                                                    | 41     | 12.2 |
| After 14 days following a negative test result                                   | 236    | 70.2 |
| People with comorbidity (Diabetes, cancer, and other chronic illnesses,) are more likely to be severely infected |        |      |
| No                                                                              | 20     | 5.9  |
| Yes                                                                             | 316    | 94.1 |
| The incubation period for COVID-19 virus is 14-28 days                           |        |      |
| No                                                                              | 95     | 28.3 |
| Yes                                                                             | 241    | 71.7 |
| Fever, cough, and difficulty in breathing are hallmark symptoms of COVID-19      |        |      |
| No                                                                              | 6      | 98.2 |
| Yes                                                                             | 330    | 1.8  |
| COVID-19 can spread through close contact with infected persons                  |        |      |
| No                                                                              | 10     | 3.0  |
| Yes                                                                             | 326    | 97.0 |
| Washing hands with soap and water for at least 20 seconds can help in the prevention of transmission of COVID-19 disease |        |      |
| No                                                                              | 3      | 0.9  |
| Yes                                                                             | 333    | 99.1 |
| Polymerase chain reaction (PCR) can be used to diagnose COVID-19                 |        |      |
| No                                                                              | 38     | 11.3 |
| Yes                                                                             | 298    | 88.7 |
| Special caution must be taken by a person with symptoms of COVID-19 in your region |        |      |
| No                                                                              | 2      | 99.4 |
| Yes                                                                             | 334    | 0.6  |
| COVID-19 can be fatal                                                           |        |      |
| No                                                                              | 5      | 1.5  |
| Yes                                                                             | 331    | 98.5 |
| Which of the following is the drug of choice in COVID-19 treatment               |        |      |
| Hydroxychloroquine or chloroquine                                               | 61     | 18.1 |
| Azithromycin and Favipiravir                                                     | 13     | 3.9  |
| Remdesivir and Interferon                                                       | 11     | 3.3  |
| No definitive approved treatment                                                 | 251    | 74.7 |
were a barrier to their preparedness in dealing with the pandemic, although many of them reported that their training continued through virtual classes during the lockdown (56•1%) (Table 4).

Almost all the students reported that their home country governments had made efforts towards the promotion of COVID-19 preventive measures (Table 5) and that health professionals received training for COVID-19 management (91•9%).

Table 6 shows there was no statistical association between socio-demographic characteristics and knowledge on COVID-19 except for their profession.

Nevertheless, there was a statistical relationship between the preparedness of students and the different professions’ training curriculums in institutions located in West Africa (Table 7).

Further, the relationship between the attitude of the students towards COVID-19 and the location of the various institutions in West Africa was statistically significant (Table 8). The remaining variables showed no statistical significance.

Moreover, there was no statistically significant relationship between the level of government preparedness and the various socio-demographic characteristics (Table 9).

**DISCUSSION**

We investigated the knowledge, preparedness, and attitude towards COVID-19 among health profession students in Sub-Saharan Africa. The findings revealed that the participants were aware that a virus causes COVID-19, which corroborates with studies conducted in China and Ethiopia (Angelo, Alemaayehu and Dacho, 2020; Peng, Pei, Zheng et al. 2020), where 97•3% and 74•8% of the study participants identified a virus as the cause of the disease, respectively. This is possibly due to increased awareness resulting from intensive coverage through media and other communication channels and the global impact of the disease. Moreover, being health profession students could have influenced their knowledge.

The majority of the participants also knew the infection could be transmitted through close contact with an infected person. The number of students in our study who possessed this knowledge was higher than those who participated in studies from Indonesia (78•99%) and Palestine (78•5%) (Saefi, Fauzi, Kristiana et al. 2020). This could be cause our study subjects were at advanced levels of clinical study, that is, students in their clinical years are those expected to have practical exposures and direct contact with patients.

However, we found that most of our study participants were not aware about the incubation period for COVID-19 which is contradictory to the findings reported in a study conducted among Ethiopian university students (Angelo, Alemaayehu and Dacho, 2020). Having good knowledge about when the infection could become contagious is crucial in planning appropriate preventive and control measures against the spread of COVID-19.

Furthermore, the sequential bivariate analysis indicated that nursing profession students and those in West African training institutions were significantly more knowledgeable about COVID-19. This could be

### Table 3
Participants’ attitude towards COVID-19.

| Statements                                                                 | Agree n (%) | Disagree n (%) |
|---------------------------------------------------------------------------|-------------|----------------|
| The long isolation period and social distancing associated with COVID-19 | 159 (47.3)  | 177 (52.7)     |
| displeases me                                                             |             |                |
| I feel I can contract COVID-19 if I care for patients who have COVID-19   | 217 (64.6)  | 119 (35.4)     |
| disease.                                                                  |             |                |
| I feel like changing my profession because of the experiences I had       | 28 (8.3)    | 308 (91.7)     |
| witnessed during the COVID-19 pandemic                                    |             |                |
| Attending to COVID-19 patients at isolation centers could be stressful    | 246 (73.2)  | 90 (26.8)      |
| with the reports received so far                                           |             |                |
| The fear of death constrains me to avoid contracting COVID-19             | 204 (60.7)  | 132 (39.3)     |
| My loved ones will panic if I decide to participate in the care of people | 230 (68.5)  | 106 (31.5)     |
| infected with COVID-19                                                    |             |                |
| Watching people dying of COVID-19 could be scary                          | 281 (83.6)  | 55 (16.4)      |
|                                                                           |             |                |
| I am sufficiently psychologically competent to volunteer as a caregiver   | 239 (71.1)  | 96 (28.9)      |
| at COVID-19 isolation centers                                            |             |                |
| Lessons from the COVID-19 pandemic compel me to be more cautious to       | 310 (92.3)  | 26 (7.7)       |
| attend patients that tested positive for coronaviruses                    |             |                |
| Repetitive hand-washing, wearing of face masks, and use of personal      | 118 (35.1)  | 218 (64.9)     |
| protective equipment in caring for COVID-19 patients is not               |             |                |
| convenient.                                                               |             |                |
| There is no big deal with COVID-19, people should not feel threatened     | 65 (19.3)   | 271 (80.7)     |
| by it.                                                                    |             |                |
| Although there is no known treatment for COVID-19 yet, I am confident    | 208 (61.9)  | 128 (38.1)     |
| that current management techniques are enough to curtail the virus.      |             |                |
| Disruption of social life and economic stagnation characterize the       | 293 (87.2)  | 43 (12.8)      |
| COVID-19 pandemic, hence are potentially mentally stressful.             |             |                |
| I do not feel compelled to adhere strictly to precautions related to     | 72 (21.4)   | 264 (78.6)     |
| COVID-19 infection because others in my community may not be              |             |                |
| compliant also.                                                           |             |                |
| Unlike other conditions such as mental illness, COVID-19 do not have      | 83 (24.7)   | 253 (75.3)     |
| any associated stigma.                                                    |             |                |
| I will self-isolate if I perceive that I have possible COVID-19           | 312 (92.9)  | 24 (7.1)       |
| symptoms                                                                  |             |                |
| I consider most COVID-19 campaigns as mere myths                         | 46 (13.7)   | 290 (86.3)     |
|                                                                      |             |                |
| Authorities (and others) should communicate the risks surrounding         | 311 (92.6)  | 25 (7.4)       |
| COVID-19 to the public as faithfully as possible                          |             |                |
| I will prefer to manage any of my family members who are infected at     | 131 (39.0)  | 205 (61.0)     |
| home to avoid stigmatization and unnecessary panic                        |             |                |

### Table 4
Participants’ training institutional preparedness during the COVID-19 outbreak

| Statements                                                                 | Yes, n, % | No, n, % |
|---------------------------------------------------------------------------|-----------|---------|
| My school curriculum covers almost all I need to know about infectious   | 213 (63.6)| 122 (36.4)|
| diseases and their prevention                                             |           |         |
| Infection prevention related courses are taught as a general course in    | 258 (66.4)| 106 (31.6)|
| my institution                                                            |           |         |
| The curriculum we use in my institution only exposes us to specific       | 213 (63.6)| 122 (36.4)|
| infection prevention and control based in my discipline                   |           |         |
| The extent of the curriculum content covered could translate to my       | 270 (80.6)| 65 (19.4) |
| competence in the use of personal protective equipment                    |           |         |
| I do not support our being sent home from school during the COVID-19      | 130 (38.8)| 205 (61.2)|
| pandemic,                                                                  |           |         |
| With the closure of schools, I feel students should be retained to learn  | 257 (76.7)| 78 (23.3) |
| from the clinical experiences on how COVID-19 is being managed,           |           |         |
| The closure of my school is a barrier to students' preparedness for      | 185 (55.2)| 150 (44.8)|
| COVID-19                                                                  |           |         |
| I have been able to assume virtual classes during this lockdown           | 188 (56.1)| 147 (43.9) |
| My clinical exposures have prepared me to build competence in the        | 209 (62.4)| 126 (37.6)|
| management of pandemic conditions like COVID-19                          |           |         |

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attributed to the large number of nurses in the healthcare workforce at the frontline during the COVID-19 pandemic and even other previous health emergencies (New York State Nurses Association, 2020). However, while the significant association between knowledge of COVID-19 and the students of West African institutions on account of their training curriculum was noted in this study, it is important to understand that there was an equal distribution of responses with the majority being from West Africa. Additionally, this significant association could be linked to the 2014 West Africa Ebola outbreak (CDC, 2020), which led to an emphasis on infectious disease training at various institutions.

On exploring the attitude of health profession students, it was found that many of them believed that they could contract COVID-19 if they cared for infected patients. This finding is similar to those of studies conducted in Pakistan and United Arab Emirates (Salmanu, Mustafa, Asì, et al. 2020; Hassan and Soliman, 2021), and could be attributed to the participants’ knowledge of viral infections, their severity, associated morbidities, and mortality that they gained during training.

The respondents believed that repetitive handwashing, wearing face masks, and use of personal protective equipment (PPE) when caring for COVID-19 patients are vital for preventing the spread of infection. This

Table 5
COVID-19 preparedness of the government

| n=336 | Yes (%) | No (%) |
|-------|---------|--------|
| Government trained health professionals on COVID-19 during the outbreak, | 308 (91.9) | 27 (8.1) |
| Placement of soap and water in public places | 324 (96.7) | 11 (3.3) |
| Provision of appropriate facemasks | 291 (86.9) | 44 (13.1) |
| Health promotional campaign on prevention of coronavirus, | 324 (96.7) | 11 (3.3) |
| Provision of hand sanitizers | 289 (86.3) | 46 (13.7) |
| Avoidance of large social gatherings, | 324 (96.7) | 11 (3.3) |
| Disallowing citizens from going to the grocery store/market or pharmacy, | 158 (47.2) | 177(52.8) |
| Disallowing citizens from going out to bars/pubs/drinking joints, | 300 (89.5) | 35(10.5) |
| Disallowing citizens from going to restaurants or eating joints, | 254 (75.8) | 81 (24.2) |
| Disallowing citizens from attending social/religious gatherings (large and small), | 254 (75.8) | 81 (24.2) |
| Avoidance of opening the mail or delivered goods, | 128 (38.2) | 207 (61.8) |
| Disallowing citizens from any non-essential travel, | 313 (93.4) | 22(6.6) |
| Avoidance of play dates (letting children play with other children) | 265 (79.1) | 70 (20.9) |
| Avoidance of using public transportation | 193 (57.6) | 142(42.4) |
| Exercising outside alone or with people, you live with only | 262 (78.2) | 73 (21.8) |
| Staying/working at home rather than going to work or school | 307 (91.6) | 28(8.4) |
| Self-quarantining if you are returning from an international/ local trip | 307 (91.6) | 28 (8.4) |
| Self-quarantining if you have or believe you have the virus | 306 (91.3) | 29 (8.7) |
| People engage in panic buying as a natural response of risk-averse individuals to a threat of future unavailability or lack of access (e.g. due to isolation) in my country | 243 (72.5) | 92 (27.5) |
| It is believed that specific social groups (e.g. politicians, public figures, the rich, celebrities, etc.) advocating for COVID-19 control might face discrimination | 180 (53.7) | 155 (46.3) |

Table 6
Bivariate analysis for socio-demographic characteristics of respondents and knowledge on COVID-19

| n=336 | People with point | coronavirus infections | may be most | contagious at | which |
|-------|-------------------|------------------------|--------------|---------------|-------|
| Region | 1-2 days | First 7 days | 14-21 days | P value |
| East Africa | 13 (24.1) | 34 (23.3) | 35 (25.7) | 0.117* |
| Southern Africa | 21 (38.9) | 46 (31.5) | 29 (21.3) | 0.477* |
| West Africa | 20 (37.0) | 66 (45.2) | 72 (53.0) | |
| Gender | Male | 28 (51.8) | 68 (46.6) | 73 (53.7) | 0.007* |
| Female | 26 (48.2) | 78 (53.4) | 63 (46.3) | |
| Professional | Medicine | 19 (35.2) | 59 (40.4) | 34 (25.0) | |
| Physiotherapy | 11 (20.4) | 44 (30.1) | 54 (39.9) | |
| Pharmacy | 1 (1.9) | 4 (2.7) | 5 (3.7) | |
| Nursing | 10 (18.5) | 14 (9.6) | 19 (14.0) | |
| Medical | 6 (11.1) | 1 (0.7) | 6 (4.4) | |
| Laboratory | Science | 1 (1.8) | 1 (0.7) | 0 (0.0) | |
| Dentistry | 6 (11.1) | 23 (15.8) | 18 (13.2) | |
| Age category | < 23 | 29 (53.7) | 74 (50.7) | 78 (57.4) | |
| > 23 | 25 (46.3) | 72 (49.3) | 58 (42.7) | 0.532* |
| Education level | Undergraduate | 50 (92.9) | 130 (89.0) | 118 (86.8) | |
| Postgraduate | 4 (7.4) | 16 (11.0) | 18 (13.2) | 0.558** |

*chi-square test **Fisher’s exact test p-value p-value <0.05 for statistical significance.
finding is similar to what researchers found in the UAE and is also in agreement with the WHO recommendations (Hassan and Soliman, 2021; WHO, 2020e). The commitment of the students to preventive strategies could be because of their previous clinical experiences and theoretical knowledge of infection prevention and control. Therefore, continued reinforcement of effective training at various institutions should be encouraged. The participants also disagreed that persons infected with COVID-19 could face stigmatisation. This finding is in contrast with anecdotal evidence regarding the stigma associated with COVID-19 that could prevent people from reporting their illness (Bruns, Kranguljac and Bruns, 2020). Thus, a variety of holistic measures have been introduced to address stigma and the various myths associated with the disease (Nachea, Seydi, and Zumla, 2020; Mehtar, Preiser, Lakhe et al. 2020; Ayoub, Chemaltelly, Seedat et al. 2020; Nachea, et al. 2020).

Despite knowing that they could eventually be infected by COVID-19, the students did not consider leaving their profession. This could be attributed to acculturation and the mentorship support at various training institutions coupled with the infectious disease training in Africa. Furthermore, the students likely possess the vocation and maturity for the career they have chosen.

Participants also reported that the institutional training curriculum covered almost all they needed to know about infectious diseases and their prevention. It also prepared them to be competent in the use of PPE. Further, their clinical experience contributed to their ability in managing COVID-19 cases. These findings are similar to those of a study conducted in northern Thailand where a good level of preparedness was found among certain groups of the population (Srichan, Apidechakul, Tamornpark et al. 2020). Although this is very promising, it is important

| Region          | My curriculum prepares me, yes | My curriculum prepares me, no | P-value |
|-----------------|--------------------------------|--------------------------------|---------|
| East Africa     | 57 (26.8)                      | 25 (20.5)                      |         |
| Southern Africa | 72 (33.8)                      | 23 (18.8)                      |         |
| West Africa     | 84 (39.4)                      | 74 (60.7)                      | 0.001*  |

| Gender          | My curriculum prepares me, yes | My curriculum prepares me, no | P-value |
|-----------------|--------------------------------|--------------------------------|---------|
| Male            | 113 (53.1)                     | 56 (45.9)                      |         |
| Female          | 100 (46.9)                     | 66 (54.1)                      | 0.208   |

| Professional    | My curriculum prepares me, yes | My curriculum prepares me, no | P-value |
|-----------------|--------------------------------|--------------------------------|---------|
| Medicine        | 74 (34.7)                      | 38 (31.2)                      |         |
| Physiotherapy   | 52 (24.4)                      | 57 (46.7)                      |         |
| Pharmacy        | 4 (1.9)                        | 5 (4.1)                        |         |
| Nursing         | 30 (14.1)                      | 13 (10.7)                      | 0.001*  |
| Medical laboratory | 12 (5.6)                   | 1 (0.8)                        |         |
| Dentistry       | 2 (0.9)                        | 0 (0.0)                        |         |
| Others          | 39 (18.3)                      | 8 (6.6)                        |         |

| Age category    | My curriculum prepares me, yes | My curriculum prepares me, no | P-value |
|-----------------|--------------------------------|--------------------------------|---------|
| < = 23          | 112 (52.6)                     | 69 (56.6)                      |         |
| >23             | 101 (47.4)                     | 53 (43.4)                      | 0.482   |

| Education level| My curriculum prepares me, yes | My curriculum prepares me, no | P-value |
|----------------|--------------------------------|--------------------------------|---------|
| Undergraduate  | 187 (87.8)                     | 111 (91.0)                     |         |
| Postgraduate   | 26 (12.2)                      | 11 (9.0)                       | 0.370   |

*Based on the chi-square test. <0.05 for statistical significance

**Based on Fisher’s exact test <0.05 for statistical significance.

Table 8

Bivariate analysis for socio-demographic characteristics of respondents and attitude on COVID-19

| Region          | I feel I can contract COVID if I Care for patients, yes | I feel I can contract COVID if I Care for patients, no | P-value |
|-----------------|--------------------------------------------------------|--------------------------------------------------------|---------|
| East Africa     | 58 (26.7)                                               | 24 (20.3)                                               |         |
| Southern Africa | 44 (92.0)                                               | 51 (43.2)                                               |         |
| West Africa     | 115 (53.0)                                              | 43 (36.4)                                               | 0.001*  |

| Gender          | I feel I can contract COVID if I Care for patients, yes | I feel I can contract COVID if I Care for patients, no | P-value |
|-----------------|--------------------------------------------------------|--------------------------------------------------------|---------|
| Male            | 107 (49.3)                                              | 62 (52.5)                                               |         |
| Female          | 118 (50.7)                                              | 56 (47.5)                                               | 0.572   |

| Professional    | I feel I can contract COVID if I Care for patients, yes | I feel I can contract COVID if I Care for patients, no | P-value |
|-----------------|--------------------------------------------------------|--------------------------------------------------------|---------|
| Medicine        | 66 (30.4)                                              | 46 (39.0)                                               |         |
| Physiotherapy   | 82 (37.8)                                              | 27 (22.9)                                               |         |
| Pharmacy        | 6(2.8)                                                 | 3 (2.5)                                                 |         |
| Nursing         | 27 (12.4)                                              | 16 (13.6)                                               | 0.126   |
| Medical laboratory | 8 (3.7)                                              | 5 (4.2)                                                 |         |
| Dentistry       | 2(0.9)                                                 | 0 (0.0)                                                 |         |
| Others          | 26 (12.0)                                              | 21 (17.8)                                               |         |

| Age category    | I feel I can contract COVID if I Care for patients, yes | I feel I can contract COVID if I Care for patients, no | P-value |
|-----------------|--------------------------------------------------------|--------------------------------------------------------|---------|
| < = 23          | 125 (57.6)                                              | 56 (47.5)                                               |         |
| >23             | 92 (42.4)                                               | 62(52.5)                                                | 0.075   |

* Based on chi-square test p<0.05 for statistical significance.
Table 9
Bivariate analysis for socio-demographic characteristics of the respondents and government preparedness on COVID-19

| Region       | Health promotion campaign on prevention of coronavirus, yes | Health promotion campaign on prevention of coronavirus, no |
|--------------|-----------------------------------------------------------|-----------------------------------------------------------|
| East Africa  | 79 (24.4)                                                 | 3 (27.7)                                                 |
| Southern Africa | 91 (28.1)                                             | 4 (36.6)                                                 |
| West Africa  | 154 (47.5)                                                | 4 (36.6)                                                 |

**Gender**

|                |                                                      |                                                           |
|----------------|-------------------------------------------------------|-----------------------------------------------------------|
| Male           | 165 (50.9)                                             | 4 (36.4)                                                 |
| Female         | 159 (49.1)                                             | 7 (63.6)                                                 |

**Professional**

|                |                                                      |                                                           |
|----------------|-------------------------------------------------------|-----------------------------------------------------------|
| Medicine       | 108 (33.3)                                             | 4 (36.4)                                                 |
| Physiotherapy  | 107 (33.0)                                             | 2 (18.2)                                                 |
| Pharmacy       | 9 (2.8)                                                | 0 (0.0)                                                  |
| Nursing        | 42 (13.0)                                              | 1 (9.1)                                                  |
| Medical laboratory | 12 (3.7)                                      | 1 (9.1)                                                  |
| Science        |                                                       |                                                           |
| Dentistry      | 2 (0.6)                                                | 0 (0.0)                                                  |
| Others         | 44 (13.6)                                              | 3 (27.3)                                                 |

**Age category**

|                  |                                                      |                                                           |
|------------------|-------------------------------------------------------|-----------------------------------------------------------|
| <= 23            | 174 (53.7)                                             | 7 (63.6)                                                 |
| >23              | 150 (46.3)                                             | 4 (36.4)                                                 |

* based on Fisher’s each test <0.05 statistically significant.

to note that self-assessment can overrate people’s judgements partly because they are unaware of their lack of knowledge. However, adequate training is expected to suitably prepare students in all areas of infection prevention, control, and management.

This study revealed that the participants’ home governments had made efforts in promoting COVID-19 preventive measures by providing training to health professionals on COVID-19 management, endorsing health promotion campaigns, promoting the use of face masks and maintaining physical distance in public places, and encouraging the use of soap and water for washing hands. This is in line with the findings of a study conducted in Uganda (Kapata, Ihhekweazu, Ntoumi et al. 2020). Furthermore, Africa is one of the continents that has faced various health emergencies and epidemics previously; therefore, it is better prepared to take action and prioritise preventive measures (Kapata, Ihkekweazu, Ntoumi et al. 2020; Africa CDC, 2020b). Health profession students in Africa demonstrated good knowledge and a positive attitude towards the COVID-19 outbreak. However, despite the participants’ claims that their institution training and government protocols prepared them for infection prevention and control, it is still important that necessary measures be put in place by the government, institutions, and individuals to ensure that the preventive protocols are strictly adhered to, especially with the emergence of the new wave of the pandemic in which the disease manifests differently in separate individuals. Such measures should also include adequate vaccination strategies and improve existing care protocols.

Our study has some limitations. The data obtained in this study were unevenly distributed. We received more responses from some regions than others and only focused on sub-Saharan Africa since northern Africa is often considered to be part of the Eastern Mediterranean region. This is the result of an online approach of data collection coupled with a non-probability sampling method. Furthermore, the institutional membership of AFReHealth is still very limited in Northern Africa. However, dichotomisation of data was done to enhance the power and reporting of results and more variables were considered to establish knowledge. Future studies should aim at all health profession institutions across Africa without restrictions. The training curricula should also be assessed for the extent to which they prepare the future healthcare professionals for a pandemic. The training should also lay more emphasis on emergency preparedness, infection, prevention and control, personal protective equipment, oxygen administration, and interpretation of laboratory results.

Finally, given that vaccination is a key factor in controlling the pandemic, it is important that the understanding of students regarding vaccinations against COVID-19 be established in a detailed manner because they are the future health workforce who will largely contribute to COVID-19 vaccination advancement and implementation. Students have acknowledged the extent of national/government preparedness towards pandemics, which should also be upheld by various training institutions even at the individual level. Also, the Government and higher health institutions might improve teaching of Covid-19 and infectious disease. Students must know how to cope with dangerous pathologies. Future qualitative and quantitative research is recommended in light of our findings.

**Conflict of Interest**

We declare no competing interests

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**Ethical Approval statement**

The study protocol was approved by the Research and Ethics Boards of the University of Ibadan (Nigeria) with IRB number UI/EC/20/0305, the Makerere University (Uganda) with IRB number: UNHLSREC/L50/01/07/2020, the Eduardo Mondlane University (Mozambique) with IRB number: CIBS FM8HCM/P074/2020, and the University of Lubumbashi (Democratic Republic of Congo) with IRB number: UNILU/CEM/014/2020.

**DATA SHARING**

The anonymized underlying dataset for this paper will be made available upon reasonable request. Data requests should be made to the corresponding author, Ifeoluwapo O. Kolawole

**CONTRIBUTORS**

PA, IK, FA, IO, conceived and designed the study, PA, IK, IO, FN, drafted the protocol, PA, IK, FN, MI, RN, AK, and AM contributed and directed the implementation, oversaw data management, IK and FN did the statistical analysis and interpretation, and PA, IK, FN, MI, RN, AK, and AM wrote the manuscript. PA, IK, FN, MI, RN, AK, and AM contributed to the study design and the final version of the protocol, and
implementation. All authors delivered the interventions, supervised and monitored the household survey interviews, contributed to data management, read, and approved the final manuscript. All the authors have accessed and verified all data in the study. All authors had full access to all the data in the study and had final responsibility for the decision to submit it for publication.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jiregi.2021.10.010.

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