

## Review Article

# Knowledge and Adherence to COVID-19 Preventive Measures: A Continental Review

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### Abstract

**Background:** The burden of the novel coronavirus disease (COVID-19) has been on the rise since it was first reported in December 2019. COVID-19 has devastated global economy, public health, social interaction, and has claimed millions of lives globally within a few months. Due to the severe effect of some of the instituted guidelines on citizens and the economy, some of the policies in place to curtail the spread were receded. Hence, the present review aims to assess existing literature on the knowledge and adherence of Africans toward the COVID-19 preventive measures.

**Methods:** Studies focused on Africans' knowledge and adherence to COVID-19 preventive measures were selected using Google Scholar, Scopus, and PubMed databases. Preprints that have not been peer-reviewed, reviews, and non-COVID-19 studies were excluded.

**Results:** All selected studies showed a satisfactory knowledge of respondents about COVID-19 but poor level of adherence to the preventive measures. Good knowledge and satisfactory level of adherence was common mostly among the clinical health workers, highly educated, and those with higher professional qualification, while poor knowledge and poor practice was observed mostly among rural dwellers, people of poor educational background, and those unable to read and write.

**Conclusion:** This review identified a relatively good knowledge about COVID-19 from all the studies, however, the level of adherence to preventive measures was poor. We recommend that the populace adhere to the laid guidelines to ensure the spread of the virus is curbed while also enhancing the eradication of the pandemic.

**Keywords:** COVID-19, adherence, knowledge, preventive measures, Africa

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## 1. Introduction

The rampaging novel coronavirus disease (COVID-19) has become prevalent. The highly pathogenic severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes COVID-19, has spread globally, claiming over a million lives within a few

months of its outbreak [1, 2]. Coronaviruses are members of a large family of respiratory viruses, which cause mild to severe disease symptoms; ranging from common cold to severe respiratory illnesses [3]. SARS-CoV-2 is related to SARS-CoV and Middle East Respiratory Syndrome (MERS-CoV) epidemics [4]. In humans, SARS-CoV-2 is transmitted through droplets, respiratory secretion, and direct contact with infected patients or surfaces [5].

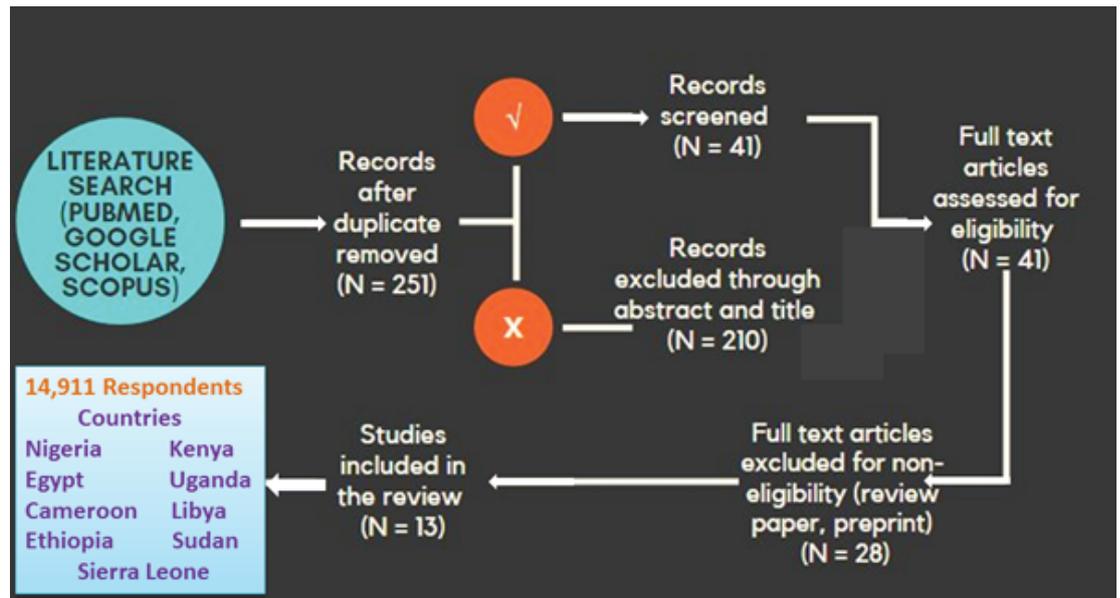
The World Health Organization (WHO) on March 11, 2020 declared COVID-19 a pandemic [6]. COVID-19 outbreak in Africa was predicted to be very lethal due to the prevalence of poor healthcare structure, lifestyle factors, poverty, and immunocompromised population (due to malaria, hepatitis virus, HIV/AIDS, etc.) in most African countries [7, 8]. High mortality due to COVID-19 has been reported in the elderly and those with compromised immune system associated with chronic diseases [9]. Although Africa was eventually hit by the pandemic with index cases reported in Egypt [10] and Nigeria [11], surprisingly, the continent boasts of 84% recovery rate, which at this stage of the pandemic is higher than Oceania (70%), North America (61%), and Europe (48%) [2, 12].

The ongoing vaccination with COVID-19 vaccines is a step in the right direction. However, a large percentage of the human population is still not being reached, especially those in low- and mid-income countries. Hence, with the increasing daily COVID-19 human-to-human transmission, it is necessary to curtail the spread by instituting preventive and public health measures. The knowledge, attitude, and adherence of every individual toward COVID-19 preventive guidelines are very germane to curtail the spread of the disease. The general knowledge, attitude, and practice help justify the need to determine the effectiveness of the measures put in place to control the spread of this disease [13]. This review article aims to review the knowledge and adherence to the COVID-19 preventive measures in African population.

## 2. Materials and Methods

### 2.1. Literature search

A literature search was conducted in December 2020 on Google Scholar, Scopus, and PubMed using the following keywords: “COVID-19,” “knowledge,” “adherence,” “preventive measures,” restricting the search only to Africa (being a continental review). Preprints that have not been peer-reviewed, non-COVID-19-related studies, and review articles were excluded (Figure 1).



**Figure 1:** Flow chart illustrating the inclusion and exclusion criteria of the review.

## 2.2. Studies on knowledge and adherence to COVID-19 preventive measures

The selected articles on knowledge and adherence to COVID-19 preventive measures used for this review used questionnaires as research instruments with the number of respondents ranging from 141 to 3712 for a total of 14,911. The respondents consisted of correctional officers, healthcare workers, and chronic disease patients, residents of a conflict-affected area, urban slum dwellers, and sample populations from Nigeria, Egypt, Cameroon, Kenya, Uganda, Sudan, Sierra Leone, Libya, and Ethiopia.

## 2.3. Knowledge about COVID-19

Table 1 presents 13 selected articles on the knowledge about COVID-19 among healthcare workers and correctional officers in Nigeria, hospital staff in Libya, residents in a conflict-affected area in Cameroon, chronic disease patients in Ethiopia, and sample populations from Egypt, Sudan, Sierra Leone, Kenya, and Uganda. All reviewed articles reported satisfactory levels of respondents' knowledge about COVID-19.

A study [14] on 446 healthcare workers including clinical and nonclinical staff in North-Central Nigeria showed that the clinical staff (doctors =  $18.86 \pm 2.56$ ; nurses =  $18.96 \pm 1.92$ ; pharmacists =  $18.6 \pm 2.34$ ; physiotherapist/lab scientist =  $18.66 \pm 2.42$ ) had a higher knowledge about COVID-19 compared to nonmedical staff (admin/accountant =  $18.41 \pm 2.41$ ; transport/works =  $17.83 \pm 2.4$ ). The healthcare workers' knowledge about

COVID-19 was significantly associated with their different job cadre with  $F$  value = 3.691;  $P = 0.001$ . Furthermore, 79.9% of the 318 Libyan healthcare workers studied had satisfactory knowledge about COVID-19 [15]. Their major sources of information about COVID-19 were health practitioners (33.3%), social media platforms (30.2%), and journal articles (29.2%).

In Kenya, among 353 respondents sampled, most (83.97%) had very good knowledge about COVID-19 [16]. Social media platforms serve as a major source of information for 55% of the respondents. Despite this, only half (50%) of the respondents have trust in the news and information on social media about the pandemic. Among the 404 chronic disease patients (mean age  $56.5 \pm 13.5$  years) in northwest Ethiopia, only few (33.9%) had a good knowledge of COVID-19 [17]. Respondents' age, illiteracy (unable to read and write), rural dwellers, and low monthly income were factors associated with poor knowledge of COVID-19. This calls for concern as most severe COVID-19 cases are seen in infected patients with comorbidities. Hence, more drastic measures are needed to sensitize the high-risk individuals about the novel COVID-19.

In a study of 3712 Egyptians, most (70.2%) had high satisfactory knowledge of COVID-19 [18]. High educational level was associated with good knowledge. This corroborates with another study in Nigeria where there was a significantly higher knowledge level among 141 correctional officers sampled with higher educational qualifications [19]. In a binational study, Egyptians were reported to be 1.8 times (95% CI: 0.43–0.74;  $P < 0.001$ ) more likely to have more satisfactory knowledge about COVID-19 than Nigerians [20]. This disparity might be a result of public health literacy and the specific and peculiar measures implemented in both countries in curbing the spread of the pandemic. Of the 362 respondents (mean age  $33.5 \pm 10.4$  years) sampled in Uganda [21], 264 (93.9%) had good knowledge about COVID-19. Television (77.4%) and social media (73.2%) were the major sources of information and there was no difference in respondents' sociodemographic with respect to their knowledge about COVID-19.

Among the 545 respondents (mean age  $30.03 \pm 11.2$  years) sampled in conflict-affected areas in southwest Cameroon [22], only 21.9% had very good knowledge about COVID-19, while others had intermediate (43.8%), poor (34.4%), and no knowledge (11.92%). The respondents live in an anglophone crisis-affected area; hence, the knowledge gap observed might be a result of poor health literacy and adjustment to normal communal living. Those with no knowledge of COVID-19 (11.92%) were not included in the analysis. In line with earlier reports [21, 23], television (64.2%) and social media (38.8%) were also respondents' major sources of information about the pandemic and

there was no association between respondents' sociodemographic and their knowledge about COVID-19.

Out of the 2336 respondents in Sudan, the majority (84.7%) had a good level of knowledge. Age ( $\leq 17$  years), education (primary or lower school), low-income earner, and those who reside outside Khartoum were related to lower COVID-19 knowledge score [24]. A good knowledge level was also reported among 1253 respondents in Sierra Leone [25], 589 respondents from north-central Nigeria [23] and a study of 1006 respondents from Cameroon [13] with most (84.19%) having a high knowledge score.

In all, a high proportion of the targeted populace in Nigeria, Kenya, Ethiopia, Uganda, Sudan, south-west Cameroon, Sierra-Leone, Libya, and Egypt had a good and satisfactory knowledge of COVID-19. The knowledge of COVID-19 is mainly acquired through health practitioners, social media and Internet, which have proven to be a chosen tool to adapt to the physical constraint measure of prevention during the pandemic outbreak as especially among the young adults where social media is the source of disseminating information and communication. In contrast to this, the level of trust in social media is low amongst the respondents in Kenya [16]. In a similar study on Indian citizens, Roy *et al.* [27] noted that the citizens considered social media as a threat to their state of mind, often causing them to worry about receiving updates on COVID-19.

The level of education, literacy, gender, educational background, and age of the respondents are major contributory factors to increased knowledge about COVID-19 [20]. However, in the south-west Cameroon, no association has been noted between respondent's sociodemographic factors and knowledge about COVID-19. The different studies reviewed have also shown a low level of knowledge in Sudan and south Cameroon which is partly associated with the age difference, illiteracy, low income, and respondent's residence [17, 28]. Poor knowledge, health illiteracy, poverty, poor health infrastructure, as well as distrust in Government's intervention can serve as major obstacles to the global effort against COVID-19.

## 2.4. Adherence to COVID-19 preventive measures

An increased adherence to the health regulations laid down by the WHO would drastically reduce the COVID-19 burden. Table 2 represents articles on adherence and practice of COVID-19 preventive measures conducted in Africa. The study on 446 healthcare workers in Jos, Nigeria [14] showed that clinical healthcare workers had higher satisfactory practice scores (9.01 out of 12) compared to nonclinical healthcare workers (with an average score of 6.59). This gap could be attributed to their need for

more precaution due to their relative closeness to patients and knowledge discrepancies when compared to nonclinical healthcare workers. In another study of 318 Libyan healthcare workers [15], 39.6% took vitamins and supplements and majority (69.5%) ate healthy food to avoid infection. Although most participants wash their hands with soap, use alcohol-based hand rub, maintain social distancing, and avoid touching the face with unwashed hands, their practice of wearing masks was poor. As frontline workers and with a very low availability of COVID-19 vaccines in Africa, it is pertinent for healthcare workers to strictly adhere to the precautionary measures.

Among the 353 Kenyans [16], the level of adherence is poor as about half (50%) had visited a crowded place. Although most (91%) wear face masks, 83% apply hand sanitizers and 67% maintain social distancing in public places. Majority (60%) indicated that other people do not adhere to the preventive measures. This could be deleterious due to the observed high human–human transmission of the virus. Among the 141 correctional officers in Nigeria [19], 87.9% regularly washed their hands with soap and water, 84.4% wore face masks when outside, 83% maintained a safe distance from others, and 58.9% distanced from crowded places. Knowledge and practice showed a statistically significant, moderate, positive correlation ( $r = 0.375$ ,  $P < 0.001$ ).

A study on 3712 Egyptians showed good knowledge but poor adherence to COVID-19 preventive measures. Poor practice was found associated with young age (OR = 2.41, 95% CI: 1.94–2.98), unemployment (OR = 4.95, 95% CI: 4.07–6.02), and low educational level [18]. In a binational study of Nigerians and Egyptians [20], most residents (96%) recognized the important role of maintaining social distancing and self-isolation; but very few (36%) adhered to all preventive guidelines.

Among the studied Ugandans, less than half (48.3%) of the 362 respondents adhered to practicing the instituted preventive guidelines [21]. The respondents who had the highest level of adherence had up to secondary school education (71.4%), were >45 years of age (61.2%), self-employed (57.3%), female (56%), and are Anglicans (53%). Poor adherence observed was also found among Cameroonians living in a conflict-affected area [22], where although most participants identified the importance of face mask (93.5%) and hand sanitizers (88.8%), only 21.7% and 32.9% of them had purchased them for use, respectively. This is in contrast with another report on Cameroonians, where all 1006 respondents used face masks, 94.5% washed hands and/or used hand sanitizers, and 83.8% observed social distancing [13]. This disparity can be a result of the direct consequences of conflict on inhabitant's health and social lifestyle.

In a study of 404 chronic disease patients in Ethiopia [17], the adherence level was also not satisfactory as only 105 (25.9%) had a good practice of the preventive measures.

More so, only 224 (55.2%) disinfect frequently touched surfaces, 154 (38.1%) refrained from overcrowded places, 148 (36.6%) used face masks in public places, and 121 (29.9%) practiced social distancing. This calls for concern as COVID-19 has been reported to be severe in patients with comorbidities [7].

To adhere to the lockdown policy and social distancing rule, most of the studies utilized web-based surveys, which serve as a major limitation to the studies due to the low Internet penetration rate in most African countries. This likewise skewed the respondents toward young people and highly educated individuals or professionals who are the major Internet users. The present review shows that a good number of the population although having a good knowledge of the disease outbreak failed to adhere strictly to the COVID-19 preventive measures. A high number of healthcare providers have a good practice of the measure of prevention while others do not. This is the case with Libyan healthcare workers where only very few (<30 %) wear face masks and/or gloves as part of preventive measures against COVID-19 infection [15]. This calls for concern as healthcare workers are at the forefront of combatting the pandemic. This is in contrast to 353 Kenyans [16], who also had low level of adherence but a good practice of wearing facemask. The associated myths, misinformation circulated on social media, health illiteracy, distrust in government's policies, and low mortality due to COVID-19 in most African countries could have contributed to the poor adherence to the preventive measures.

## **2.5. Relevance of assessing knowledge and adherence to COVID-19 preventive measures**

The present review showed the discrepancies between the studies that reported on the level of knowledge and adherence toward instituted guidelines against COVID-19, as discussed above. All 13 studies on knowledge showed a satisfactory knowledge of respondents about COVID-19. It is a bit worrisome that despite a relatively good knowledge, the level of adherence to the preventive measures was poor. Educational level (up to tertiary), being a clinical healthcare worker, and a very good knowledge of COVID-19 were found to influence satisfactory adherence. Increasing awareness and sensitizing the populace through health education would go a long way in mitigating the spread of COVID-19. Most participants of the selected studies used in this review identified social media, Internet, TV, and health practitioners as the major sources of information [16, 21, 23]. These channels should be leveraged on to enhance adherence to COVID-19 preventive measures.

TABLE 1: Selected studies on knowledge of African's about COVID-19.

S/N	Author	Study site	Participants	No. of participants	Knowledge score	Knowledge result
1	Shehu	Jos, Nigeria	Health workers	446	Doctors (18.86 ± 2.56) Nurses (18.96 ± 1.92) Pharmacists (18.6 ± 2.34) Nurse Aide or Pharm Tech (17.18 ± 2.28) Admin/accountant (18.41 ± 2.41) Physiotherapist/lab scientist (18.66 ± 2.42) Transport/works (17.83 ± 2.4) Attendants/radiographers (18.48 ± 2.3) Good knowledge – 83.97%	There was satisfactory knowledge with a significant difference between the cadres of healthcare workers
2	Muriuki	Kenya		353	Good knowledge – 83.97%	There is a good knowledge level about COVID-19 which changes with respondents' sociodemographic factors.
3	Okoro	Enugu, Nigeria	Correctional officers	141	Satisfactory knowledge – 77.36%	There was a significantly higher knowledge level among officers with higher educational qualifications.
4	Kasemy	Egypt		3712	Satisfactory knowledge – 70.2%	Unsatisfactory knowledge was associated with low education [OR = 1.97, 95% CI: 1.51–2.56] and rural residency (OR = 1.2, 95% CI: 1.05–1.41).
5	Okello	Uganda		362	Good knowledge – 264 (93.9%)	Females were more knowledgeable about COVID-19 than males (AOR, 1.01; 95% CI, 0.95–1.07).
6	Nicholas	South-west Cameroon	Residents in conflict affected area	545	Correct knowledge – 21.9% Intermediate knowledge – 43.8% Poor knowledge – 34.4% No knowledge – 11.93%	There was no association between sociodemographic characteristics and respondents' level of knowledge.
7	Hweissa	Libya	Healthcare workers	318	Sufficient knowledge – 79.9%	The knowledge scores observed were significantly associated with respondents' age difference.
8	Mousa	Khartoum, Sudan	Citizens	2336	Correct knowledge – 84.7%	The knowledge score varied considerably among respondents' marital status, gender, age groups, occupation, educational levels, and residential places.
9	Sengeh	Sierra Leone	Citizens	1253	NA	Knowledge gap differs between respondents' gender, educational levels, regions, and age.
10	Akalu	Ethiopia	Chronic disease patients	404	Satisfactory knowledge – 33.9%	Age (AOR = 1.05, [95% CI {1.01–1.08}], educational status of "can't read and write" (AOR = 7.1, 95% CI [1.58–31.93]), rural dweller (AOR = 19.0, 95% CI [6.87–52.66]), and monthly income earner (AOR = 0.8, 95% CI [0.79–0.89]) were significantly associated with poor knowledge.
11	Reuben	North-central Nigeria	Residents	589	Good knowledge – 99.5%	Though with a high knowledge score, only few (29%) would accept COVID-19 vaccines when available.
12	Ngwe-wondo	Cameroon	Residents	1006	High knowledge score – 847 (84.19%)	Age (>20 years) was associated with a high satisfactory knowledge of COVID 19.
13	Hager et al.	Nigeria and Egypt	Citizens	1437	Satisfactory knowledge – 61.6%	Respondents' age (18–39 years), educational level (college/bachelors), and educational background-influenced knowledge level.

TABLE 2: Selected studies on adherence of Africans to COVID-19 preventive measures.

Author	Study location	Participants	Adherence score	Adherence result
Shehu	Jos, Nigeria	Health workers	Doctors (9.49 ± 2.65) Nurses (8.74 ± 2.72) Pharmacists (8.40 ± 2.75) Nurse Aide or PharmTech (8.43 ± 2.90) Admin/accountant (7.70 ± 3.02) Physiotherapist/lab scientist (8.41 ± 2.00) Transport/works (6.95 ± 2.92) Attendants/radiographers (8.06 ± 3.09)	Adherence was good with clinical health workers, while non-clinical health workers had average scores.
Muriuki	Kenya		NA	Majority of respondents fail to adhere to the COVID-19 preventive measures.
Okoro	Enugu, Nigeria	Correctional officers	NA	There was a significant moderate, positive correlation between knowledge and practice.
Kasemy	Egypt		Good practice – 49.2%	Poor practice of preventive measures was associated with young age (OR = 2.41, 95% CI: 1.94–2.98), low education (OR = 1.19, 95% CI: 1.03–1.37), and unemployed (OR = 4.95, 95% CI: 4.07–6.02).
Okello	Uganda		Good practice – 175 (48.3%)	Compared to males, females were more adherent to the preventive measures (aPR, 1.23; 95% CI, 1.01–1.53).
Nicholas	South-west Cameroon		NA	Although most participants knew about the use of face mask (93.5%) and hand sanitizers (88.8%), only 21.7% and 32.9% had purchased them for use, respectively.
Hweissa	Libya	Healthcare workers	Physician – 8.36 (7.99 ± 8.74) Pharmacist – 7.99 (7.70 ± 8.27) Dentist – 8.75 (8.19 ± 9.30) Technician – 7.70 (7.03 ± 8.36) Nurse – 8.50 (6.44 ± 10.5)	Females, older respondents, and dentists had higher practice scores compared to other healthcare workers.
Moussa	Khartoum, Sudan	Citizens	NA	Despite the preventive measures, some of the respondents had visited crowded areas (30.1%) and most (50.7%) had not worn masks in public places.

TABLE 2: Continued.

Author	Study location	Participants	Adherence score	Adherence result
Sengeh	Sierra Leone	Citizens	NA	Having a satisfactory knowledge was associated with higher odds of washing hands with soap (medium knowledge: AOR 2.1, 95% CI 1.0–4.4; high knowledge: AOR 4.6, 95% CI 2.1–10.2), and avoiding crowded places (medium knowledge: AOR 2.0, 95% CI 1.1–3.6; high knowledge: AOR 2.3, 95% CI 1.2–4.3).
Akalu	Ethiopia	Chronic disease patients	Satisfactory adherence level – 52.7%	Being unmarried (AOR = 3.9, 95% CI [1.47–10.58]), cannot read and write (AOR = 2.7, 95% CI [1.03–7.29]), can read and write (AOR = 3.5, 95% CI [1.48–8.38]), rural dweller (AOR = 2.7, 95% CI [1.09–6.70]), income of <7252 Ethiopian birr (AOR = 2.3, 95% CI [1.20–4.15]), and poor knowledge (AOR = 8.6, 95% CI [3.81–19.45]) were significantly associated with poor adherence to preventive measures.
Reuben	North-central Nigeria	Residents	Satisfactory adherence level – 79.5%	Most respondents practice social distancing/self-isolation (92.7%), improved personal hygiene (96.4%), and use face mask in public places (82.3%).
Ngewondo	Cameroon	Residents	Satisfactory adherence level – 60.8%	Women had lower adherence level scores compared to men (OR = 0.72; 95% CI 0.56–0.92)
Hager <i>et al.</i>	Nigeria and Egypt	Citizens	Adhered to all preventive measures – 36%	68.9% had satisfactory attitude toward the preventive measures.

Some other factors that could account for the variations in the knowledge and adherence to the preventive measures to COVID-19 include poor healthcare structure, social welfare of individuals as many did not have access to basic needs of life (especially those living in a conflict-affected area) and had to strive daily in making ends meet, economic capacity of various countries in the continent to access medication, funds for emergency interventions varied and perhaps was an inclusion factor to the discuss. Political factors which include system of government, policy like lock down and closing of borders as well as bilateral agreement with countries making waves in the containment of the virus likewise paved the way for some. As stipulated by the reviewed reports, culture/tradition and habits, negligence, poor health literacy, poverty, and conspiracy theories about COVID-19 might have contributed immensely to the low level of adherence to the preventive measures.

### 3. Results

The ongoing COVID-19 pandemic comes with excruciating psychological, financial, social and public health challenges. The selected 13 studies on knowledge and practice reviewed showed a satisfactory knowledge, a positive attitude, and a relatively poor adherence to the COVID-19 preventive measures. Good knowledge and satisfactory level of adherence was common mostly among the clinical healthcare workers, highly educated, and those with higher professional qualification, while poor knowledge, negative attitude, and poor practice was observed mostly among the rural dwellers, people of poor educational background, and those unable to read and write. This poor practice and negative attitude occurs due to ignorance, negligence, and the inability to read and write.

### 4. Conclusion

There is a need for improvement in maintaining a good practice of the preventive measures. A better and simplified way of passing the information to the rural dwellers and those in war-torn communities needs to be encouraged which will in turn create more awareness alongside reducing the spread of the virus.

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## Ethical Considerations

Not applicable.

## Competing Interests

The authors declare no competing interests.

## Availability of Data and Material

All data used are available in public repositories and are adequately cited.

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## References

- [1] WHO. (n.d). *WHO coronavirus disease (COVID-19) dashboard*. Retrieved from: <https://covid19.who.int/>
- [2] Worldometer. (Live). Coronavirus update: 79,057,857 cases and 1,737,767 deaths from COVID-19 virus pandemic. Retrieved from: <https://www.worldometers.info/coronavirus/>
- [3] Wang, D., Hu, B., Hu, C., et al. (2020). Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*, vol. 323, no. 11, pp. 1061–1069.
- [4] Shanmugaraj, B., Siri wattananon, K., Wangkanont, K., et al. (2020). Perspectives on monoclonal antibody therapy as potential therapeutic intervention for Coronavirus disease-19

- (COVID-19). *Asian Pacific Journal of Allergy and Immunology*, vol. 38, no. 1, pp. 10–18.
- [5] Luo, L., Liu, D., Liao, X., et al. (2020). Modes of contact and risk of transmission in COVID-19 among close contacts. medRxiv.
- [6] Infogripe, P., Abertos, P. D., Saúde, M., et al. (2020). Virtual press conference on COVID-19 – 11 March 2020. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, vol. 20, no. 1, pp. 98–99. Retrieved from: <https://doi.org/10.1016/j.tmaid.2020.101607><https://doi.org/10.1016/j.ijesu.2020.02.034><https://onlinelibrary.wiley.com/doi/abs/10.1111/cjag.12228><https://doi.org/10.1016/j.ssci.2020.104773><https://doi.org/10.1016/j.jinf.2020.04.011>
- [7] Omotoso, O. E. (2020). Contributory role of SARS-CoV-2 genomic variations and life expectancy in COVID-19 transmission and low fatality rate in Africa. *Egyptian Journal of Medical Human Genetics*, vol. 21, no. 72, pp. 1–6.
- [8] World Poverty Clock. (2020). Retrieved from: <https://worldpoverty.io/headline>
- [9] Mueller, A. L., McNamara, M. S., and Sinclair, D. A. Why does COVID-19 disproportionately affect older people? *Aging*, vol. 12, no. 10, pp. 9959–9981.
- [10] WHO. (2020). *COVID-19 cases top 10 000 in Africa*. WHO: Regional Office for Africa.
- [11] Releiwed. (2020). First case of coronavirus in Nigeria. Retrieved from: [https://reliefweb.int/report/nigeria/first-case-coronavirus-disease-confirmed-nigeria?gclid=Cj0KCQjw1dGJBhD4ARIsANb6OdkyvDyrCtIVOXAI9zcgMLxD-Ja3fASNn2FvyCdOPjYu2rE2cbUPMxAaAk9qEALw\\_wcB](https://reliefweb.int/report/nigeria/first-case-coronavirus-disease-confirmed-nigeria?gclid=Cj0KCQjw1dGJBhD4ARIsANb6OdkyvDyrCtIVOXAI9zcgMLxD-Ja3fASNn2FvyCdOPjYu2rE2cbUPMxAaAk9qEALw_wcB)
- [12] Africa CDC. (2020). *Coronavirus disease 2019 (COVID-19)*. Retrieved from: <https://africacdc.org/covid-19/>
- [13] Ngwewondo, A., Nkengazong, L., Ambe, L. A., et al. Knowledge, attitudes, practices of/towards COVID 19 preventive measures and symptoms: a cross-sectional study during the exponential rise of the outbreak in Cameroon. *PLOS Neglected Tropical Diseases*, vol. 14, no. 9, pp. 1–15.
- [14] Shehu, M., Shehu, H., Izang, A. B., et al. (2020). Coronavirus disease (COVID-19) pandemic: analysis of the knowledge, attitude and practice among healthcare facilities in Jos, Nigeria. *Journal of Advances in Medicine and Medical Research*, vol. 32, no. 19, pp. 74–85.
- [15] Hweissa, N. A. B., Shawesh, F. A., Krema, S. O., et al. (2020). Knowledge , attitude and practice (KAP) for preventing the coronavirus (COVID19) pandemic among libyan health care workers. *Libyan Journal of Medical Sciences*, vol. 4, pp. 109–114.

- [16] Muriuki, W., Muriithi, B., Duncan, K., et al. (2020). Assessing knowledge, attitude and practices (KAP) towards COVID-19: a cross-sectional study in Kenya. *Global Journal of Medical Research*, vol. 20, no. 10.
- [17] Akalu, Y., Ayelign, B., and Molla, M. D. (2020). Knowledge, attitude and practice towards covid-19 among chronic disease patients at Addis Zemen Hospital, Northwest Ethiopia. *Infection and Drug Resistance*, vol. 13, pp. 1949–1960.
- [18] Kasemy, Z. A., Bahbah, W. A., Zewain, S. K., et al. (2020). Knowledge, attitude and practice toward COVID-19 among Egyptians. *Journal of Epidemiology and Global Health*, vol. 10, no. 4, pp. 378–385.
- [19] Okoro, J., Ekeroku, A., Nweze, B., et al. (2020). Attitude and preventive practices towards COVID-19 disease and the impact of awareness training on knowledge of the disease among correctional officers. *Emerald Open Research*, vol. 2, p. 51.
- [20] Hager, E., Odetokun, I. A., Bolarinwa, O., et al. (2020). Knowledge, attitude, and perceptions towards the 2019 coronavirus pandemic: a bi-national survey in Africa. *PLoS One*, vol. 15, pp. 1–13.
- [21] Okello, G., Izudi, J., Teguzirigwa, S., et al. (2020). Findings of a cross-sectional survey on knowledge, attitudes, and practices about COVID-19 in Uganda: implications for public health prevention and control measures. *BioMed Research International*, vol. 2020, article 5917378.
- [22] Nicholas, T., Mandaah, F. V., Esemu, S. N., et al. (2020). COVID-19 knowledge, attitudes and practices in a conflict affected area of the southwest region of Cameroon. *Pan African Medical Journal*, vol. 35, no. 2, pp. 1–8.
- [23] Reuben, C. R., Danladi, M., Saleh, A. D., et al. (2020). Knowledge, attitudes and practices towards COVID-19: an epidemiological survey in north-central Nigeria. *Journal of Community Health* [Epub ahead of print].
- [24] Altayb Mousa, K. N. A., Saad, M. M. Y., and Tayseer Bashir Abdelghafor, M. (2020). Knowledge, attitudes, and practices surrounding COVID-19 among Sudan citizens during the pandemic: an online cross-sectional study. *Sudan Journal of Medical Sciences*, vol. 15, pp. 32–45.
- [25] Sengeh, P., Jalloh, M. B., Webber, N., et al. (2020). Community knowledge, perceptions and practices around COVID-19 in Sierra Leone: a nationwide, cross-sectional survey. *BMJ Open*, vol. 10, no. e040328, pp. 1–8.
- [26] Abdelhafiz, A. S., Mohammed, Z., Ibrahim, M. E., et al. (2020). Knowledge, perceptions, and attitude of egyptians towards the novel coronavirus disease (COVID-19). *Journal of Community Health*, vol. 45, no. 5, pp. 881–890.

- [27] Roy, D., Tripathy, S., Kar, S. K., et al. (2020). Study of knowledge, attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19 pandemic. *Asian Journal of Psychiatry*, vol. 51, 102083.
- [28] Reuben, R. C., Danladi, M. M. A., Saleh, D. A., et al. (2020). Knowledge, attitudes and practices towards COVID-19: an epidemiological survey in north-central Nigeria. *Journal of Community Health*, vol. 46, pp. 457–470.