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The gaps and strengths towards effective infection prevention and control on a background of knowledge attitude and perception on COVID-19 among undergraduate students in Southeastern Nigeria: a multicentre online cross-sectional survey

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Abstract

The advent of the Coronavirus Disease (COVID-19) pandemic posed a serious health burden locally and globally as it altered people's daily activities due to restrictive preventive measures instituted by countries and health authorities to curb its spread like wildfire. The undergraduate population remains at the epicentre for the spread and curbing of COVID-19. This study assessed the knowledge, attitude, and perception of COVID-19 among undergraduate students in Southeastern Nigeria. The gaps and strengths achieved towards effective infection prevention and control in the eastern states were assessed. This was a cross-sectional online population-based survey conducted among undergraduate students attending Universities in 5 states (Abia, Anambra, Ebonyi, Enugu, and Imo), located in Southeastern Nigeria from June 29 to July 20, 2020. A structured pre-tested questionnaire was designed for the Google survey tool (Google Forms), and the generated link was shared with students online. From a total of 1,012 respondents from Universities in Southeastern Nigeria, 560 (55%) were females and 452 (45%) were males. The overall mean age of the respondents was 21.63±0.65years. The age distribution did not vary considerably across states (t=-0.007, p=0.995>0.05). The majority (93.8%) of the respondents were Igbos, Yorubas, and Hausas accounting for 2.6% and 0.4% respectively while 3.3% did not identify their ethnic group. Christians (96.0%) were dominant compared to Islam (2.7%) while traditionalists and other non-captured worshippers accounted for 0.5% and 0.8% respectively. Most of the respondents were in second and fourth years in the university. The variation across the states was statistically significant (=112.01, p=0.000<0.05). The respondents identified that their main source of information concerning COVID-19 was social media (26.9%). The level of knowledge was highest among people in Anambra state (78.0%); followed by those in Enugu state (74.3%), Abia state (72.2%), in Imo state (70.8%), and lastly, Ebonyi state (65.4%). The participants' attitudes about COVID-19 safety practices were on average moderately positive (49.2%) with the best result in Imo state (60.5%), followed by Abia state (55.3%), Ebonyi state (52.4%), Enugu state (42.9%) and lastly Anambra state (35.1%). In summary, the respondents' general perception of the realness, infectiveness, and source was positive (>50.0%) in all the Southeastern states. The knowledge, attitude, and perception of COVID-19 among undergraduate students in Southeastern states, of Nigeria were appreciable but a lot has to be done in terms of enhanced public health education, positive behavioural changes as

well as proactive preventive measures to curb the progress of the COVID-19 pandemic.

Introduction

Coronavirus Disease (COVID-19) remains an emerging and re-emerging respiratory disease that is caused by Coronavirus 2 and is similar to Severe Acute Respiratory Syndrome (SARS-CoV-2) which ravaged the entire world and was considered a global public health burden of continental concern that threatened the world health security.[1] Initially it was named Novel Coronavirus 2019 (2019-nCoV). On February 12, 2020, the International Committee on Taxonomy of Viruses re-named it SARS-CoV-2.[2] Later the same day, the World Health Organization (WHO) officially named the disease caused by SARS-CoV-2 Coronavirus Disease 2019 (COVID-19).[3] SARS-CoV-2 belongs to the family of Ribonucleic Acid (RNA) viruses called *Coronaviridae,* with infections ranging from the common cold, to more severe diseases, such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV).[4] COVID-19 was first reported in Wuhan City, Hubei Province, China, on December 30, 2019.[5] The spread continued to escalate, overwhelming the health systems of most countries, leading to catastrophic effects. WHO declared the outbreak a global pandemic on March 11, 2020.[1,6] The first case of COVID-19 in Nigeria was on February 27, 2020, involving an Italian citizen who worked in Nigeria and returned from Milan, Italy.[7,8] As of December 10, 2020, Nigeria had a total of 71,344 cases with 1190 deaths, although it is possible that the actual number of cases was higher due to limited testing capacities, un-willingness of the masses to run the test, and many who were asymptomatic cases.[9] The pandemic destabilized the socio-economy, public health, and health systems, especially in developing countries. COVID-19 has a high transmission rate, and a good number of asymptomatic carriers were responsible for transmitting the infection. There was an eruption of the second wave of the infection in many countries globally.[10] The most severe recorded pandemic in history was the Spanish flu that occurred in 1918, where most of the fatalities in the pandemic occurred during the second wave.[11] Effective vaccines and antiviral drugs were developed and effective therapeutic solutions were ultimately approved.[12] At present, few WHO-approved vaccines against COVID-19 and many other vaccines were subjected to clinical trials.[12,13] We hope that these vaccines will continue to be accessible and affordable to low-income countries like Nigeria. Nigeria is the largest and most densely populated country in Africa.[14]

In view of the availability of a few authorized vaccines, it is important to strictly adhere to all the behavioural measures against COVID-19 in order not to have a high morbidity and mortality rate, especially in the future in case of a resurgence due to antigenic variation. Therefore, protecting the citizens from new infections and health care institutions from using up capacities became extremely necessary for all countries.[15] The lack of knowledge remains a good amplifier of outbreaks, so adequate public knowledge is important in combating the spread of infection in pandemic situations.[16] Undergraduate students form a major part of the general population[17] and can play a crucial role in mitigating and educating others on behavioural measures to curb the spread. This study assessed the knowledge, attitude, and perception of COVID-19 among undergraduate students in Southeastern Nigeria. This will help to identify the gaps and strengthen the efforts made to halt or limit the spread of the infection across the country.

Materials and Methods

Sample design and population

This was a cross-sectional online population-based survey conducted among undergraduate students attending universities in 5 states (Abia, Anambra, Ebonyi, Enugu, and Imo), located in Southeastern Nigeria. The survey was conducted from June 29 to July 20, 2020. A structured pre-tested questionnaire was designed for the Google Survey tool (Google Forms), and the generated link was shared with students online (e-mails, Facebook, WhatsApp, Instagram, and Twitter). The responses of 1012 undergraduate students; Abia (76), Anambra (377), Enugu (415), Imo (81), and Ebonyi (63) were analysed. Their responses were anonymous and the institutions where the respondents were studying were not identified by name.

Sample size calculation

The sample size of this study was calculated using the online Raosoft sample size calculator[18] designed specifically for population surveys. Based on an estimated population of 112,591, an anticipated response of 50%, a confidence level of 95%, and a 5% margin of error, the required sample size would be at least 383.

Statistical analysis

Statistical analysis was carried out using the statistical software SPSS (Statistical Package for Social Sciences), version 25.0. Descriptive and inferential statistics were used, and the statistical significance level was set at a p-value <0.05

Analytical tool used

Data were analysed using SPSS for Windows (version 25.0). Specifically, statistical tools used include descriptive statistics such as simple percentages, mean, standard deviation, and inferential Chi-Square test of association, student's t-test, and Kendall's W test of agreement at a 5% significance level. The percentages (or proportions) were used on the discrete data series while mean and standard deviations estimates were used on continuous data series in the study. Chi-Square test of association was used to determine the variations (or otherwise) in the discrete data series across the states; the t-test was applied in cases of continuous dataset comparison, while Kendall's W test of concordance was employed in ascertaining the level of agreement in perception of the respondents in the Southeast states.

Results

From Supplementary Table 1, out of a total of 1012 respondents from Universities in Southeastern Nigeria, there were comparatively more females 560 (55%) than males 452 (45%). The variation by location was statistically insignificant (=4.786, p=0.310>0.05). While 48.0% of respondents were within the age group of 15-20 years, 38.2% were within the age group 21-25 years, 9.1% were within 26-30 years, 2.8% were within 31-35 years, 0.7% within 36-40 years and 1.2% was within 41-45 years. The mean age of the respondents in Enugu was 21.75±0.62 years, 21.44±0.35 years in Anambra, 21.31±0.32 years in Imo, 22.67±0.31 years in Ebonyi and 20.97±0.42 years in Abia state. The overall mean age of the respondents was 21.63±0.65 years. The age distribution did not vary considerably across states (t=-0.007, p=0.995>0.05).

Based on religion, Christians (96.0%) were dominant compared to Islam (2.7%) while traditionalists and other un-captured worshippers accounted for 0.5% and 0.8% respectively. Specifically, the traditionalists were from Anambra state. The variations across the Southeast states were statistically significant (=44.211, p=0.000<0.05).

The majority (93.8%) of the respondents were Igbos, Yorubas, and Hausas accounting for 2.6% and 0.4% respectively while 3.3% did not identify their ethnic group. Based on comparative result, there were significant variations in ethnicity statistics of the respondents (=47.420, p=0.000<0.05). The Igbos were higher, followed by Yorubas and lastly Hausas.

Also, 94.9% of the total respondents were single while only 5.1% were married. This was expected as the respondents were mainly students who were mostly unmarried. The location of the respondents revealed that 41.0% were in Enugu, 37.3% were in Anambra, 8.0% were in Imo, 6.2% were in Ebonyi, while 7.5% were in Abia state. The variation across the states was statistically significant (=25.001, p=0.000<0.05).

Distribution of level of study of the respondents revealed that the majority were in the second year (32.3%), followed by the fourth year (26.2%), while the third year, first year, sixth year, and fifth year accounted for 15.0%, 13.5%, 7.4%, and 5.5% respectively. Most of the respondents were in their second and fourth years in the university. The variation across the states was statistically significant (=112.01, p=0.000<0.05).

Supplementary Table 2 showed that the main source of information concerning COVID-19 was social media (26.9%) followed by WHO (1.8%), and television (1.6%). In terms of combined sources of information, about 9.8% sourced their information concerning COVID-19 from social media, WHO, and television; 6.0% got their information from social media, television, and family/friends. Thirteen percent source their information concerning COVID-19 from a combination of social media and television, while about 6.6% regardless of the location source their information from social media, WHO, television, radio, printed media, and family/friends. Other combinations can be categorized as secondary/rare sources.

The social media information sources include Facebook (F), Whatsapp (W), Twitter (T), Instagram (I), Messenger (M), and others (Supplementary Table 3). According to respondents, the leading source of social media information about COVID-19 was WhatsApp (14.9%). This was followed by Facebook (8.3%), and Twitter (7.0%). The last was Messenger (0.1%). However, by interaction, Whatsapp, Facebook, Twitter, and Instagram were the major sources through which information about COVID-19 was obtained in the area. Only about 1.8% of the total respondents got their information from other social media sources.

Knowledge of COVID-19

From the survey result (Supplementary Table 4), the origin of COVID-19 was China as supported by about 97.1% of the study participants. Only about 2.1% stated that COVID-19 originated in the United States, and the remaining 0.8% were not sure of the origin of this deadly pandemic. Also, the prime causative agent of COVID-19 was a virus (93.9%). Only 6.1% of the participants were of the view that COVID-19 was caused by bacteria.

From the statistics of the route of transmission (Supplementary Table 4), the major route according to Enugu residents was droplet inhalation (5.9%), followed by contact with contaminated surfaces (5.8%) and aerosol inhalation (1.7%), and lastly faeco-oral (0.2%). Based on the opinions of Anambra respondents, the prime route of transmission of the causative agent coronavirus was contact with contaminated surfaces (7.7%). This was followed by droplet inhalation (3.3%) and aerosol inhalation (1.1%); the least is faeco-oral (0.5%). The ratings of causative agents by Imo residents were similar to those in Anambra only that the Imo residents did not succumb to faeco-oral route being one of the routes of transmission of COVID-19 in the area. For those residing in the Ebonyi state, the major route of transmission of the causative agent was contact with contaminated surfaces (0.7%), followed by droplet inhalation (0.4%) and faeco-oral (0.3%) and lastly aerosol inhalation (0.2%). For those in Abia state, faeco-oral was not a route of transmission of COVID-19; meanwhile, every other rating flow with those in Anambra and Imo states. Generally, the major route of transmission of the causative agent of COVID-19 in Southeast Nigeria was contact with contaminated surfaces (17.4%), followed by droplet inhalation (11.6%) and aerosol inhalation (3.7%). The least being faeco-oral (1.0%).

Consequently, as shown in Supplementary Table 4, the incubation period of the agent causing the COVID-19 pandemic ranges from 2 to 42 days. However, this was often 2-14 days (87.7%) and sometimes 2-7 days (2.9%). This was generally agreed by the respondents in different states of the study area. Meanwhile, 7.0% are unsure of the exact period of incubation of the agent causing the pandemic. More so, the key symptoms of COVID-19 are sneezing, coughing, fever, and difficulty in breathing (28.9%). This was generally accepted by residents in various states across Southeast Nigeria. In summary, therefore, the overall level of knowledge of COVID-19 among the respondents was high (72.1%). State-wise, the level of knowledge was highest among people in Anambra state (78.0%); followed by those in Enugu state (74.3%), those in Abia state (72.2%), those in Imo state (70.8%), and lastly, by those in Ebonyi state (65.4%).

Perceptions about Covid-19 pandemic

The respondents' perceptions about the pandemic were categorized into: main view, preventive measures, and effectiveness of the preventive measures. The opinion poll results are as shown in Supplementary Tables 5, 6, and 7.

From Supplementary Table 5, it was highly accepted (78.3%) that the COVID-19 pandemic was real with about 12.6% who disagreed. Also, as shown in the table, about 9.1% of the total respondents stated that maybe, the pandemic was real. State-wise, 33.4% of the respondents from Enugu agreed that the pandemic was real, 31.0% from Anambra agreed, while from Imo, Ebonyi, and Abia states, about 4.9%, 4.0%, and 4.9% respectively submit that the pandemic was real. However, it can be inferred that the pandemic was real in Southeast Nigeria. The Kendall's W test of concordance (with Kendall's W stat. =0.613, p-value =0.009<0.05) confirmed that there was a high level of agreement in the opinions of the respondents from the respective states.

Interestingly 51.8% agreed that they could get infected by COVID-19 while 31.9% disagreed with that. The remaining 16.0% stated that maybe, they could get infected by the virus. Kendall's test result (with test statistic =0.582, p=0.015<0.05) showed that the respondents' opinions about whether they could get infected by the virus were similar across the states. Looking at the source of this pandemic, about 27.6% submitted that it came from the virology research laboratory, while 22.8% agreed that it came from wild animals like bats and pangolins. Apart from the virology research laboratory and wild animals like bats and pangolins, many (18.0%) said they were unsure of the source, while the remaining 31.6% were distributed among other sources as highlighted in this study.

Assessing the respondents' opinions by states, Kendall's W stat. =0.486, p=0.035<0.05; which revealed a significant correlation in the level of agreement among the people from different states in Southeast Nigeria. In summary, the respondents' general perception of the realness, infectiveness, and source was positive (*i.e.*, >50.0%) in all the Southeast states.

The preventive measures for COVID-19 include wearing a facemask, washing hands frequently with soap and water, use of hand sanitizers, avoiding crowded places, restriction of movement, social/physical distancing, isolation of infected persons, self-isolation if having COVID-19 symptoms, eating garlic, eating bitter cola, bathing with salt water, inhalation of steam, taking alcohol, amongst others. However, the survey results as shown in Supplementary Table 6, align that the essential preventive measures for COVID-19 include wearing a facemask, washing hands frequently with soap and water, use of hand sanitizers, avoiding crowded places, restriction of movement, social/physical distancing, isolation of infected persons, and self-isolation if having COVID-19 symptoms (40.7%). Particularly, about 0.2% respectively agreed that wearing a facemask alone, avoiding crowded places, and isolation of infected persons can help to prevent COVID-19. Also, 0.7% agreed that frequent washing of hands with soap and water alone can help to curb the pandemic, and 0.6% submitted that the use of hand sanitizer alone and social/physical distancing can help prevent contracting the disease. More so, wearing a facemask and use of hand sanitizer is supported by only about 7.6% of the total respondents to be an effective measure for the COVID-19 pandemic. Generally, the respondents' perception of the preventive measures for COVID-19 was low (<50.0%) across the states.

As shown in Supplementary Table 7, wearing a facemask was effective (58.6%) in the area, especially in Enugu and Anambra state. Frequent washing of hands with soap and water was very effective (55.2%), especially in the Enugu and Anambra states, use of hand sanitizers and practice of social distancing were also effective in the area; but still, management of the pandemic was not confirmed to be effective in the area as only 49.6% could nod in support of effectiveness of management of the pandemic in Nigeria. 50.4% opines that the management is not effective.

However, a total of 50.3% agreed that Nigeria can defeat COVID-19 as against 49.7% who disagreed. About 77.9% support that people who recover from COVID-19 will face stigmatization, while only 22.0% disagree. It was agreed by the respondents that as of then, there was no suitable vaccine for COVID-19 (56.3%), while about 26.1% said they were not sure if the vaccine was available or not. In furtherance, a total of 48.9% welcomed being vaccinated if an effective vaccine was available; 29.1% said they didn't need the vaccine while 22.0% agreed that maybe, they would be vaccinated if an effective vaccine was manufactured. In conclusion, therefore, the respondents' view on the effectiveness of available preventive measures for COVID-19 was positive (>50.0%) across the states; an indication that with the suggested preventive measures, including vaccination, COVID-19 can be defeated in the area.

As shown in Supplementary Table 8 above, the participants' attitude about COVID-19 safety practices was moderately positive (49.2%) with the best result in Imo state (60.5%), followed by Abia state (55.3%), Ebonyi state (52.4%), Enugu state (42.9%) and lastly Anambra state (35.1%).

Supplementary Table 9 shows how COVID-19 in Southeast Nigeria was treated. Evidently, there was no confirmed treatment for COVID-19 in Southeast Nigeria. According to the respondents' opinion, if there could be any treatment for COVID-19 in the area, it should be by use of hydroxychloroquine (8.7%). Other respondents chose several treatment options for COVID-19 in Southeast Nigeria.

Supplementary Table 10 above presents statistics of agencies that are involved in tackling COVID-19 in Southeast Nigeria. From the result, the key agencies in charge of COVID-19 in southeast Nigeria were the Nigeria Centre for Disease Control (NCDC) 29.2%, WHO 2.9%, and the Ministry of Health.

Discussion

This multicentre online study evaluated the knowledge, attitude, and perception of COVID-19 among undergraduate students in Southeastern Nigeria as they played a crucial role in the spread and curbing of the pandemic. Students form a very important and influential population group both for their peers and families and their perspective is crucial to evaluate current KAP toward COVID-19 to provide recommendations for improvements in this area.[19]

The demographic characteristics of respondents in this study as shown in Supplementary Table 1 compared favourably with studies by Hatabu *et al*.[15] and Adam *et al*.[19] but at variance with the findings of studies by Omosefe *et al*.,[20] Faishal *et al.*,[21] Peng *et al.*,[22] Saefi *et al.*[23] respectively. The observed difference in demographic characteristics of these studies could be attributed to difference in culture, geographical location, and religious belief.

The source of information about COVID-19 for the respondents in this study was mainly through social media and internet as opposed to other sources of information. This was in tandem with the findings of Hayder *et al*.[19] in the United Arab Emirates and Faisal *et al*.[21] in Pakistan, Omosefe *et al*.[20] in South –Western Nigeria but at variance with that of Saefi *et al*.[23] in Indonesia. The high figure recorded in this study could be attributed to the fact that most of the student respondents were young, and had their mobile devices with internet availability most of the time [24] and mostly resident in areas with internet availability.[22,24] A drawback to this trend was that a good number of students who relied on social media may have become victims of misinformation and fabricated knowledge from unreliable sources. The university needs to concentrate efforts on directing students to credible social media platform pages.[19]

Our finding in this study that the majority of our respondents were moderately knowledgeable about COVID-19 though with content disparity in different states, aligns with the findings of Omosefe *et al.*,[20] Hatabu *et al.*,[15] Faisal *et al.* in Pakistan,[21] Peng *et al.* in China,[22] and different studies in Bangladesh by Kumar *et al.*,[25] a later study by Rahman *et al*.[26] but at variance with similar studies by Adam *et al.* in Saudi Arabia,[19] and an earlier study by Rahman *et al.*[27] in Bangladesh that recorded lower values. The improved value in knowledge recorded by a later study the same year by Rahman *et al.* in Bangladesh[26] has shown that the knowledge level might improve over the period.

The respondents' attitude score towards COVID-19 was averagely positive; a level in concordance with the findings of studies in South-western Nigeria,[20] Pakistan,[21] Bangladesh,[26,27] higher than lower values obtained by the Saudi Arabian study[19] but at variance with higher figures recorded by studies in China[28] and Italy.[29]

The general respondents' perception of preventive measures for COVID-19 across the southeastern states was low (<50%). Perception of the reality, source of infection, nature of the

causative agent, and source were averagely positive (>50%). The University through robust educational interventions if enshrined in their curriculum will improve awareness and develop behavioural measures that could build up the attitude level of the undergraduates and populace.[29,30] The COVID-19 pandemic was a completely new experience for many countries, and it required new knowledge, attitudes, and practices for many cultures and societies. Social distancing was very uncommon, and compliance was very poor, regular hand washing, alcohol-based hand rub, wearing of face mask, and adequate cough etiquette should be practiced. Awareness of the COVID-19 pandemic has become an urgent issue with authentic information.[29] The media can contribute to reaching these people with authentic knowledge; it can also increase their confidence level and confirm the required practices to prevent COVID-19 infection, particularly with the use of vaccination which must be encouraged among the populace to achieve herd immunity.

Conclusions

The knowledge, attitude, and perception of COVID-19 among undergraduate students in Eastern states of Nigeria was appreciable but a lot has to be done in terms of greater educational interventions to be enshrined in our academic curriculum. This will improve public awareness and develop appropriate informed behavioural changes to curb the spread of COVID-19.

They act as a means of positive wind of change through sharing the gained knowledge, and attitudes, and implementing the required practices of behavioural change towards COVID-19 including the encouragement of mass vaccination that will lead to societal herd immunity.

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Online supplementary material.

Supplementary Table 1. Socio-demographic characteristics of the respondents by location.
Supplementary Table 2. Sources of information concerning the COVID-19 pandemic.
Supplementary Table 3. Social media information source for COVID-19.
Supplementary Table 4. Knowledge of the COVID-19 pandemic.
Supplementary Table 5. Respondents' perception about COVID-19.
Supplementary Table 6. Respondents' perception of preventive measures for COVID-19.
Supplementary Table 7. Effectiveness of the preventive measures of COVID-19.
Supplementary Table 8. Respondents' attitude about COVID-19 safety practices.
Supplementary Table 9. Treatment of COVID-19 in Southeast Nigeria.
Supplementary Table 10. Agencies that are involved in tackling COVID-19 in Southeast Nigeria.