Original Article

Putative factors influencing knowledge and behavioural practices of health science undergraduate students towards COVID-19 infection ahead of re-opening universities in Ghana

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Background: The coronavirus disease 2019 (COVID-19) virus is a global pandemic affecting daily activities and delaying the reopening of several institutions such as universities. As a result, precautionary and preventive measures are being implemented to curtail the spread of the virus. However, knowledge and compliance measures are essential for adequate preparedness to reopen the universities amidst the pandemic.

Methods: This cross-sectional study evaluated knowledge, attitudes, and practices (KAP) along with factors influencing Health Science undergraduate students toward the COVID-19 infection pandemic in Ghana. A total of 606 students provided information regarding KAP of COVID-19 infection using an online questionnaire designed via Google forms.

Results: Majority of the students 'mostly' obtained information on COVID-19 infection from social media (69.4%) followed by Television/radio/newspaper (60.4%). Majority of the students' population had adequate knowledge (92.7%), showed a good attitude (90.9%) and positive cues (90.8%) towards COVID-19 infection. Students that more often obtained information about COVID-19 infection from the news media were 2.86 and 4.01 increased odds of having a positive attitude and good practices towards COVID-19 infection, respectively. Those who obtained information from social media were significantly more likely to have adequate knowledge [OR=2.32 (1.10–7.19] but non-significantly less likely to have good practices [OR=0.57 (0.22–1.51)]. Male students had 0.53 decreased odds of having adequate knowledge of COVID-19 infection compared with female students. When compared with the sixth year students, students in the first year [OR =0.25 (95% CI: 0.10–0.62)] and second year [OR =0.33 (95% CI: 0.14–0.81)] were significantly less

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knowledgeable about COVID-19 infection. Students from urban settings were significantly associated with higher positive attitude towards COVID-19 infection [OR =2.04 (1.29–3.23)].

Conclusions: Increasing public health education on COVID-19 infection would increase knowledge and awareness, and create an opportunity for compliance with precautionary measures, thereby ensuring continuity of university education amidst the pandemic.

Keywords: Putative factors; knowledge; attitude; practices; coronavirus disease 2019 (COVID-19) infection

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Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by a novel coronavirus called severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) (1). This virus belongs to the larger family of ribonucleic acid (RNA) viruses that cause mild-to-severe respiratory infections; from a common cold to more serious disease, such as middle east respiratory syndrome (MERS-CoV) and severe acute respiratory syndrome (SARS-CoV) (2). So far, the identified symptoms of COVID-19 infection are fever, dry cough, fatigue, myalgia, shortness of breath, and dyspnoea (3,4). Moreover, COVID-19 infection related compilations including neurological manifestations (cerebrovascular accident, Guillian barre syndrome, acute transverse myelitis, acute encephalitis and hyposmia) (5), cardiovascular involvement (myocardial injury, myocarditis, acute myocardial infarction, heart failure, dysrhythmias, and venous thromboembolic events) (6), respiratory and renal disorders, have been reported (7).

The escalating impact of COVID-19 infection is felt in both developed and developing countries. In Ghana, there are 41,212 cases of COVID-19 and out of this number, 3,661 cases are active, 38,727 have recovered whereas 215 have died (last updated on 23rd June 2020) at 481 cases per 1 million people). These worrying statistics position Ghana as one of the worst affected in the African continent, just after Nigeria [46,140], Egypt [95,314] and South Africa [559,859] (8-10). The cause of alarm in Ghana and most African countries are how to create a sweep spot between complacency and anxiety, as well as reasonable disgust.

The prevalence of COVID-19 has necessitated the need for public awareness, preventive measures, and planning. In doing so, several drastic measures have been introduced. These include restriction of public transport, social distancing, closure of public spaces and schools, management of communities, isolation and caring for infected people and suspected cases. Although these efforts limited the spread, the impact was not significant. Thus, on March 30, 2020, the government of Ghana directed a lockdown of two cities; Kumasi and Accra, the two major cities in Ghana and citizens were required to just stay at home to avoid contact with others. The Government also directed the compulsory wearing of masks. On April 20, 2020, Ghana became the first African country to lift its COVID-19 infection lockdown, and now implementing strategies to restore education (9). This situation is same for several other countries, which has negatively impacted on education but highlight the significance of E-learning as an option for similar situations in the future.

The details on the COVID-19 are still evolving, and the common transmission by close contact may not be the only mode of transmission. Despite the national measures in combating the outbreak, new cases are being detected at a higher rate. Public behaviour towards preventive measures are influenced by knowledge and attitudes toward diseases (11,12). Thus, by assessing the knowledge of the public on COVID-19 infection, deeper insights into existing public perception and practices can be gained. Especially in efforts to return to school, assessing students' knowledge is important in identifying gaps, strengthen the ongoing preventive efforts, and other attributes that may influence healthy practices and responsive behaviour.

Medical students have played key roles during this pandemic which also informs the potential efforts of other health science students. For example, medical students at the Johns Hopkins University School of Medicine have founded a social media platform that provides daily updates on COVID-19 infections, to help combat online misinformation (13). Also, health science students are adept at many clinical roles which their temporal services may

help improve patient care especially in the moments, where personnel crises have plagued most health care systems (14). Thus, while health science students are potential opportunities to prevent workforce shortages and benefits to COVID-19 patients, they also serve as the immediate health personnel icons in colleges for non-medical students to help fight the spread of COVID-19 infection. Prospectively, health science students may be an option for key roles in mass testing, public education and monitoring, when school re-opens.

Thus, assessing their KAP is important to highlights gaps ahead of school reopening, and their preparedness towards national calls in joining frontline rescue for COVID-19 infection. Moreover, it provides important insight about the preparedness of the students to fit in the plans of the University, as workforce for COVID-19 infection, even as Universities are in preparation to re-open for the 2021 academic year. We present the following article in accordance with the SURGE reporting checklist (available at http://dx.doi.org/10.21037/jphe-20-89).

Methods

Study design/setting

This descriptive cross-sectional study was conducted among CHS students of KNUST, Kumasi, Ghana from May 1, 2020, to May 30, 2020. Geographically, the University Campus is located in Kumasi, Ashanti Region of Ghana on longitude and latitude 6º 41' 5.67" N, 01º 34'13.87" W. It represents an important Centre for the training of scientist and technologies not only for Ghana but also for other African countries as well as the other part of the world. It currently has a total student's population of 55,590. The map of KNUST is shown in Figure S1. The CHS in KNUST comprises the Faculties of Allied Health Sciences, Pharmacy and Pharmaceutical Sciences, School of Medicine and Dentistry and School of Veterinary Medicine. It has close affiliations with the Kumasi Centre for Collaborative Research (KCCR) in Tropical Medicine, the Komfo Anokye Teaching hospital and the University's hospital, which happens to be core centres for COVID-19 mass testing and treatment.

Sample size and sampling technique

To ensure a higher external validity and generalizability of the study, the study gathered data from as many respondents as possible. The KNUST CHS has a total student population of 3,536 (approximately 1,200 medical, 320 dentistry, 923 pharmacy, 420 nursing/midwifery, 280 medical laboratory, 182 sports and exercise science, 91 veterinary medicine and 120 Medical imaging, students). Therefore, the recommended sample size needed to achieve the study objectives and enough statistical power was 359 students, using a margin of error of ±5%, a confidence level of 95%, and a 50% response distribution. To ensure a proportional distribution of the sample by Specialty, the total health students' population was stratified into specialty and the expected sample from each was calculated using the formular below

$$ni = n\frac{Total\ number\ in\ each\ specialty}{Estimated\ number\ of\ Total\ students} \quad [1]$$

Thus, we expected 128, 34, 98, 45, 29, 10 and 13, responses from medical, dentistry, pharmacy, nursing/midwifery, medical laboratory, veterinary medicine and medical imaging students, respectively.

Due to the social distancing measures, restricted movement and lockdowns, a self-reported questionnaire was designed using Google Forms and a link to the survey was distributed to respondents, via class media platforms. Students were informed about the background and objectives of the study on the first page of the Google Forms. All CHS students in KNUST that agreed to participate in the study were instructed to complete the questionnaire once. Informed consent was obtained from students on the first page of the questionnaire before proceeding with the questionnaire.

Measurement instrument

The questionnaire consisted of four sections that were carefully appraised to ensure clarity and objective achievements. The questionnaire was designed based on previously published articles (15-17) and carefully translated into plain language to ensure the meaning of the content in context. The first section was designed to collect data on socio-demographics, which includes age, gender, the programme of study, education level, region, and place of residence. The second section consisted of 17-items that assessed participants' awareness and knowledge and sources of knowledge of COVID-19 infection. This section was designed to test respondents' knowledge on (I) the structure, and transmission mechanism of the virus, (II) sources of information on COVID-19 infection (4-point

Likert-scale), (III) signs/symptoms and complications, and (IV) risk reduction protocols (True/False questions). The third section consisted of 14-items that assessed the perceived confidence towards COVID-19 infection and willingness to adhere to preventive protocols (3 points Likert-scale). The scale has a Cronbach's Alpha of 0.651 and an inter-item correlation coefficient of 0.532. The final section consisted of 5-items that assessed cues to adherence, preventive practices, and tolerance towards COVID-19 infection. This scale has Cronbach's Alpha of 0.560 and an inter-item correlation of 2.44.

Outcome measures/dependent variables

Knowledge items were based on choosing the most appropriate response. Additional true or false questions were also included. Incorrect or uncertain (don't know) responses were given a score of zero, and correct answers were assigned a score of one. The total score for knowledge ranged from zero to fifteen, with high scores indicating better knowledge of COVID-19 infection. The section on attitudes was calculated by averaging respondents' answers. The total scores on attitudes ranged from 14 to 42, with high scores indicating positive attitudes. Regarding items on practices towards COVID-19 infection, a score of one was given to answers that reflected positive cues, and a score of zero was given for answers that reflected negative or bad cues. Median was used to determine the cut-off point for each section of KAP; equal to or more than 12 out of 15 were considered as adequate knowledge, equal to or more than 38 out of 42 were considered as favourable attitude, and equal to or more than 12 out of 15 were considered as positive cues (Figure S2).

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Ethical approval was obtained from the Committee on Human Research, Publications and Ethics (CHRPE), School of Medicine and Dentistry, Kwame Nkrumah University of Science & Technology (CHRPE/AP/288/20).

Statistical analysis

Descriptive statistics was used to summarise responses into frequency tables. Univariate and multivariable regression analyses were used to make inferences of the data. One-way analysis of variance (ANOVA) and t-tests were used, where appropriate, to assess differences in mean values for KAP scores within three and two categorical variables, respectively. KAP scores were divided into percentiles (25th, 50th, and 75th) and ordinal regression analysis was used to model demographic factors associated with KAP. To test the hypothesis that the sources of information on COVI-19 influences KAP of health science students, a multivariate logistic regression analysis was used. The P value of ≤ 0.05 was set as the significance level of the study. All analysis was computed using SPSS version 25.

Results

A total of 606 students completed the questionnaire and the results of socio-demographic data summarised in *Table 1*. Female students constituted more than half of the study sample 329/606 (54.3%). Majority 374/606 (61.7%) of the respondents were between the age group 21–25 years. Students who study Medicine, 316/606 (52.2%) were the most presented group, whereas those who study Veterinary Medicine and Medical Imaging were least represented 14/606 (2.3%). Respondents from the urban areas were the most 520/606 (85.8%).

Table 2 shows the sources of information on COVID-19 infection among the respondents. The greater frequency of the respondents either more often or mostly obtained information on COVID-19 infection from the News/Media and social media. However, most of the respondents least or sometimes obtained information on COVID-19 infection from Official government websites and/or close relatives.

Majority of the students' population had adequate knowledge (92.7%), showed a good attitude (90.9%) and positive cues to COVID infection preventive practices (90.8%) (*Figure 1*).

The correct-response rate on knowledge questions ranged from 57.6–99.8%. A significantly high percentage of 257/606 (42.4%) of the respondents could not correctly identify the transmission mechanism of the Novel Coronavirus. Also, 163/606 (36.9%) could not correctly identify a measure to reduce the risk of the novel coronavirus. Moreover, 181/606 (29.9%) could not correctly identify the incubation period of the novel coronavirus (Table S1).

Regarding attitude towards COVID-19 infection, the correct-response rate ranged from 42.7–91.3%. Majority 542/606 (89.4%) of the respondents indicated that they are scared of human-person transmission of COVID-19 virus but are rational and can self-protect themselves.

Table 1 Descriptive summary of demographic data

Variable	Response/category	Frequency (n=606)	Percentage (%)
Sex	Male	329	54.3
	Female	277	45.7
Age (years)	15–20	187	30.9
	21–25	374	61.7
	26–30	45	7.4
Programme of study	Medicine	316	52.2
	Dentistry	51	8.4
	Pharmacy	80	13.2
	Physician assistant	42	6.9
	Med. Lab. Tech	68	11.2
	Nursing/midwifery	35	5.8
	Veterinary medicine and medical imaging	14	2.3
Year of study	1st	123	20.3
	2nd	89	14.7
	3rd	68	11.2
	4th	186	30.7
	5th	68	11.2
	6th	72	11.9
Place of residence	Rural	86	14.2
	Urban	520	85.8

Med. Lab. Tech, medical laboratory technology; Others, veterinary medicine and medical imaging.

About 81/606 (13%) of the respondents indicated that they are too scared to endure any more of such a public health emergency. Majority 557/606 (91.9%) of the respondents thinks the COVID-19 pandemic has significantly impacted their studies. However significantly 29.5% were doubtful if the pandemic would be successfully controlled. Also, 192/606 (31.7%) were not so confident about Ghana winning the battle against COVID-19 infection. Also, a significant percentage (39.1% and 57.3%) of the respondents were either uncertain or not willing to accept COVID-19 vaccine if available or attend a COVID-19 infection public lecture if organized (Table S2).

Regarding practices towards COVID-19 infection, most of the respondents were positive about showing kindness to infected persons (46.4% indicated they will shore more kindness and 47.2% indicated they will meet them just like before). Generally, the positive response rate to practices towards COVID-19 infection ranged from 46.4–93.1% (Table S3).

Table 3 shows the association between information sources and KAP towards COVID-19 infection. Students who obtained information more often from the news media were 2.86 and 4.01 times more likely to have a positive attitude and good practices towards COVID-19 infection. Students who mostly obtained information from social media platforms were significantly more likely to have adequate knowledge [OR =2.32 (1.10–7.19], but non-significantly less likely to have good practices [0.57 (0.22–1.51)]. Also, students who acquired information of COVID-19 infection from official government sites were significantly associated with a higher likelihood of adequate knowledge [OR =2.58 (1.10–6.18)] and positive attitude [OR =2.70 (1.21–5.99)]. Students that mostly obtained information of COVID-19 infection from official

Table 2 Sources of information about COVID-19 infection

Variable	Response/category	Frequency (N=606)	Percentage (%)	Rank
News, Media (Television, Radio, newspapers etc..,)	Least	66	10.9	4th
	Sometimes	126	20.8	3rd
	More often	233	30.5	1st
	Most	181	29.9	2nd
Social media (Facebook, Twitter, WhatsApp, YouTube, Instagram, Snap chat…)	Least	71	11.7	4th
	Sometimes	114	18.8	3rd
	More often	222	36.6	1st
	Most	199	32.8	2nd
Official government websites (MOH, GHS, WHO, CDC)	Least	164	27.1	2nd
	Sometimes	172	28.4	1st
	More often	162	26.7	3rd
	Most	108	17.8	4th
Family member, colleague, or friend	Least	222	36.6	2nd
	Sometimes	237	39.1	1st
	More often	111	18.3	3rd
	Most	36	5.9	4th

MOH, Ministry of Health; WHO, World Health Organization; CDC, Centre for Disease Control; GHS, Ghana Health Service.

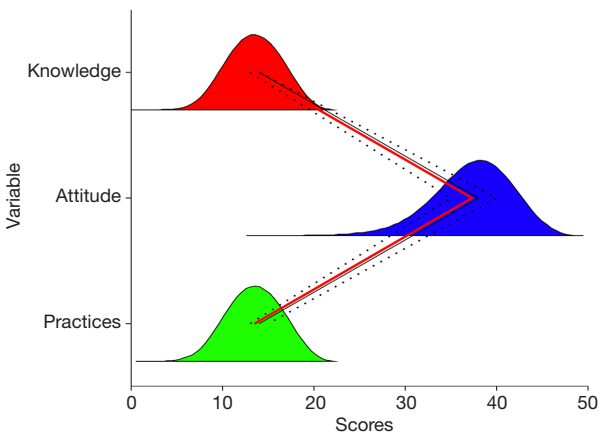

Figure 1 Density plots showing the distribution of knowledge, attitudes, and practices (KAP) scores of the respondents.

government sites recorded increased odds of adequate knowledge [OR =2.05 (0.81–5.17)] and good practices [OR =1.39 (0.58–3.31)], but it was not statistically significant. On the other hand, a statistically significant higher likelihood to develop positive attitude was observed [OR =2.63 (1.10–6.30)] (*Table 3*).

Table 4 shows the association between socio-demographic characteristics and KAP among the students in an ordinal regression analysis model. Male students were 0.53 times less likely to have adequate knowledge of COVID-19 infection compared with female students (P<0.01). Also compared to students in Veterinary medicine and medical imaging, medicine [OR =7.73 (2.19–27.22)], dentistry [OR =5.64 (1.48–21.48)], Med-Lab Tech [OR =4.94 (1.26–19.31)] and Nursing/Midwifery [OR =8.08 (2.04–32.07)] students were significantly more likely to have adequate knowledge on COVID-19 infection (P<0.05). Moreover, compared with the 6th year students, the 1st year students [OR =0.25 (0.10–0.62)] and the 2nd year student [OR =0.33 (0.14–0.81)] were significantly less knowledgeable of COVID-19 infection. Students from the urban settings compared with those from the rural settings were 2.04 times more likely to show a positive attitude towards COVID-19 infection. Also, students aged between 15–20 years compared with students between 26–30 years, physician assistant students compared with Veterinary medicine and medical imaging students; and students in the 5th year compared with those in the

Table 3 Logistic regression analysis of the association of KAP with information sources on COVID-19 among respondents

Sources of information	OR (95% CI)		
	Adequate knowledge	Positive attitude	Good practices
News media			
Least	1	1	1
Sometimes	1.16 (0.38–3.55)	1.64 (0.69–3.93)	0.87 (0.37–2.05)
More often	1.40 (0.50–03.95)	2.86 (1.22–6.71)*	4.01 (1.51–10.60)**
Most	0.87 (0.31–2.44)	2.28 (0.96–5.41)	1.85 (0.77–4.43)
Social media			
Least	1	1	1
Sometimes	2.12 (0.79–5.66)	2.42 (0.93–6.29)	1.11 (0.34–3.55)
More often	2.32 (0.94–5.77)	3.50 (1.40–8.72)*	0.99 (0.35–2.78)
Most	2.32 (1.10–7.19)*	1.41 (0.64–3.14)	0.57 (0.22–1.51)
Official government websites			
Least	1	1	1
Sometimes	1.99 (0.87–4.55)	1.94 (0.92–4.06)	1.41 (0.66–3.02)
More often	2.58 (1.10–6.18)*	2.70 (1.21–5.99)*	1.36 (0.62–2.56)
Most	2.05 (0.81–5.17)	2.63 (1.10–6.30)*	1.39 (0.58–3.31)
Close relatives			
Least	1	1	1
Sometimes	1.05 (0.51–2.16)	0.95 (0.50–1.83)	1.89 (0.93–3.84)
More often	0.81 (0.34–1.94)	1.15 (0.49–2.69)	0.99 (0.47–2.11)
Most	1.17 (0.24–5.64)	1.06 (0.28–4.03)	0.62 (0.22–1.76)

*P<0.05, **P<0.01. OR, odds ratios.

6th year; were significantly less likely to have a positive attitude towards COVID-19 infection.

Discussion

Since the World Health Organization (WHO) first announced the COVID-19 pandemic, the KAP about the infection has been growing rapidly and so does the tidal wave of misinformation. Most of the COVID-19 infections in affected countries are defined by the gravity of the illness, the severity of its spread and the fatality rate. However, the complete clinical picture of the infection is still emerging and the common transmission by close contact may not be the only means of the transmission. To date, there has been limited published data on KAP toward COVID-19 infection, and from the Ghanaian perspective, this is the first instance where such a study is carried out.

For the most part, assessing KAP towards COVID-19 infection among students is important in identifying gaps, strengthening ongoing preventive efforts, and identifying attributes that may influence practices and responsive behaviour due to the efforts to restore formal education. Therefore, this study provided insights into the KAP towards COVID-19 infection among College of Health science students in a Ghanaian population.

The study revealed that the greater frequency of the respondents either more often or mostly obtained information on COVID-19 infection from the News/Media and social media. However, more of the students least or sometimes obtained information on COVID-19 infection from official government websites and/or close relatives. Importantly, we modelled that students that mostly obtain

Table 4 Ordinal regression analysis of the association between socio-demographic variables and KAP

Sources of information	OR (95% CI)		
	Adequate knowledge	Good attitude	Positive cues
Gender			
Male	0.53 (0.37–0.74)**	0.91 (0.66–1.26)	0.71 (0.50–1.00)
Female	1	1	1
Age (range)			
15–20	1.01 (0.41–2.48)	0.38 (0.16–0.91)*	0.49 (0.20–1.23)
21–25	0.82 (0.40–1.70)	0.70 (0.35–1.43)	0.69 (0.33–1.46)
26–30	1	1	1
Programme of study			
Medicine	7.73 (2.19–27.22)*	0.34 (0.11–1.07)	0.46 (0.14–1.45)
Dentistry	5.64 (1.48–21.48)*	0.31 (0.09–1.05)	0.46 (0.13–1.60)
Pharmacy	3.36 (0.88–12.76)	0.31 (0.09–0.06)	0.32 (0.09–1.11)
Physician assistant	2.62 (0.65–10.56)	0.27 (0.07–0.97)*	0.91 (0.25–3.34)
Med. Lab. Tech	4.94 (1.26–19.31)*	0.46 (0.13–1.64)	0.47 (0.13–1.69)
Nursing/midwifery	8.08 (2.04–32.07) *	0.45 (0.12–1.58)	0.37 (0.10–1.34)
Others	1	1	1
Year of studies			
1st	0.25 (0.10–0.62)*	1.47 (0.63–3.45)	1.12 (0.46–2.74)
2nd	0.33 (0.14–0.81)*	1.25 (0.53–2.92)	1.08 (0.44–2.65)
3rd	0.69 (0.28–1.75)	0.55 (0.23–1.33)	1.46 (0.57–3.73)
4th	0.76 (0.39–1.46)	0.71 (0.38–1.33)	0.96 (0.49–1.88)
5th	1.22 (0.59–2.49)	0.31 (0.15–0.62)**	0.80 (0.38–1.67)
6th	1	1	1
Residence			
Urban	1.34 (0.83–2.14)	2.04 (1.29–3.23)**	1.22 (0.75–1.96)
Rural	1	1	1

*P<0.05, **P<0.01. OR, odds ratios.

information via the news media were more likely to have good attitudes and positive cues to preventive practices. This positive association was not observed among students who mostly seek COVID-19 infection information from the social media, official government sites and close-relatives. This indicates that the news media serves as an important platform for presenting facts about COVID-19 infection that is meant to make them aware of the surroundings, people, and COVID-19 infection's events. Thus, it will be appropriate for countries, especially where the pandemic is hard, to keep their students (health science students) updated on emerging public health and medical emergencies via the news media platforms. It also informs the need to properly teach and guide students about the proper sources of information during uncertain times.

A higher KAP score on COVID-19 infection was obtained with an overall correct rate between 90% and 93%. Nonetheless, the overall KAP scores ranged widely (4–15 for knowledge; 20–42 for attitudes and 8–15 for practices). Accordingly, 7.3%, 9.1% and 9.2% of the

student's population had poor knowledge, poor attitude, and negative cues to COVID-19 preventable practices. Compared with females, male students were less likely to have adequate knowledge, good attitudes, and positive cues towards COVID-19. Also, the 1st and 2nd year students compared with the 6th year students had inadequate knowledge of COV1D-19. Another finding in the present study was from the urban areas were more likely to present with adequate knowledge, good attitudes, and positive cures towards COVID-19 preventive practices. This variation in levels of KAP may be reflective of the current COVID-19 infection information landscape in Ghana and public response to this information, especially the students' population. Our findings, therefore, present some key information that may influence Higher Education councils on the decision about restoring the education system.

First, for the reason of not delaying the graduation of final year students and enabling new health workers as interns to join the COVID-19 workforce, it may be appropriate to consider final year students in medical and allied health professionals. This can encompass a pre-graduation health training including virtual reality. Fortunately, final year health students have a historical role in past pandemic epidemic in Denmark (18,19) and have also demonstrated their innovative role in this current COVID-19 pandemic (13). Second, it may be appropriate to use school media platforms to encourage students, especially males to follow COVID-19 updates, especially on the news media. It will also be useful if students are directed on the right sources of COVID-19 information. Although, there are no solid reason why gender, residence and level of education inequalities in knowledge and attitudes were observed in this study, it will appropriate to enhance COVID-19 information coverage via reachable platforms. This may be appropriate to facilitate their perceptions of aptitude. In line with several other published reports (20-22), this study has demonstrated a higher level of KAP towards COVID-19 among CHS students.

Although a majority of the students are significantly affected by the pandemic and are hopeful that the pandemic ends soon for school to resume, 31.3% and 29.5% of the students were uncertain whether COVID-19 can be successfully controlled. This could be attributed to the fact that although drastic measures are being taken by the Ghanaian government in mitigating the spread of the virus yet cases are been reported exponentially (8).

Furthermore, only 38.8% of the students indicate they will be willing to take a vaccine against COVID 19 if it were available. Moreover, 57.7% also were uncertain if they would attend an organised public lecture on COVID-19. These attitudes may be anticipatory to the infectious nature of the pandemic, unavailability of vaccines at the moment and existing media misinformation about COVID-19 vaccines (23-25).

The present study explored the willingness of the students to accept national calls when called join frontline rescue team for COVID-19. It was surprising that about 30% were not certain and 7% were not willing because of the perceived severity of the pandemic. Therefore, providing an educational and experiential opportunity for students would help facilitate and motivate perceptions of competency. Accordingly, a COVID-19 training course could be an added course, especially for final year students, while the education sector decides to resume schooling. More importantly, considering the level of knowledge and attitudes in addition to the education background of health science students in relation to related studies (22), they can be considered as part of the Education's Ministry and Government strategic plans to resume schooling. This will be beneficial in areas of community awareness about the seriousness of the pandemic, monitoring and promoting community adherence to preventive protocols and even in testing and treatment (for final year students preferably).

Conclusion and recommendation

In conclusion, Health Science students showed an expected level of knowledge, attitude, and practices towards COVID-19 infection. The results highlight the importance of consistent messaging from health authorities and the government via school media platforms, especially to inform health science students on public health and emerging emergencies Also, it highlights the need for tailored health education programs to improve levels of knowledge, attitudes, and practices of a college of health science students. These includes Web-Based COVID-19 workshops that specifically tackles issues on coping strategies during pandemics (uncertain times in medical education) and innovative strategies as a medical student during such times.

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Footnote

Reporting Checklist: The authors have completed the SURGE reporting checklist. Available at http://dx.doi.org/10.21037/jphe-20-89

Data Sharing Statement: Available at http://dx.doi.org/10.21037/jphe-20-89

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Data Availability: Datasets used and/or analysed during the current study has been deposited at Open Science Framework (https://osf.io/6jy3b/).

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jphe-20-89). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Ethical approval was obtained from the Committee on Human Research, Publications and Ethics (CHRPE), School of Medicine and Dentistry, Kwame Nkrumah University of Science & Technology (CHRPE/AP/288/20). All CHS students in KNUST that agreed to participate in the study were instructed to complete the questionnaire once. Informed consent was obtained from students on the first page of the questionnaire before proceeding with the questionnaire.

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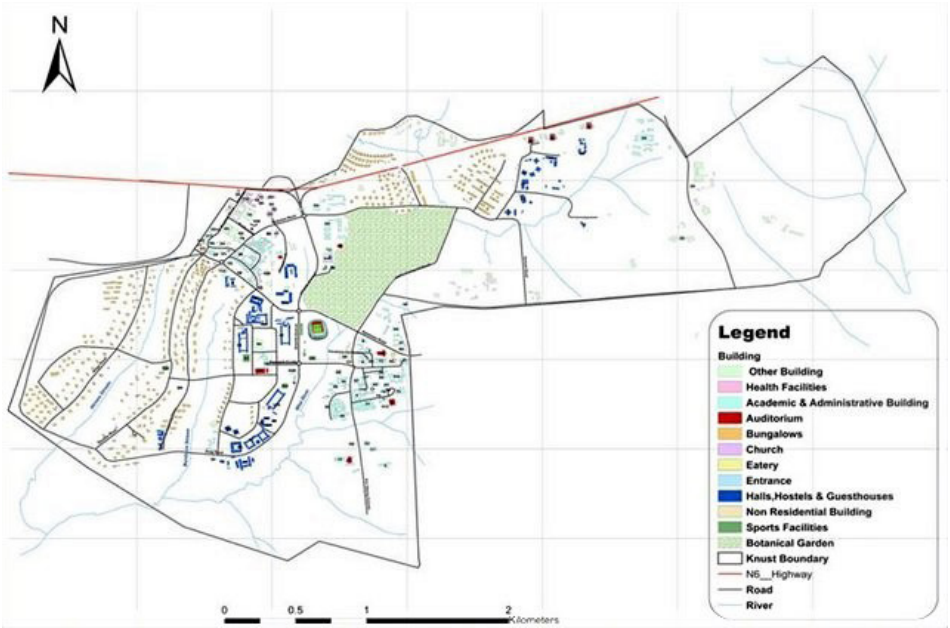

Figure S1 MAP of KNUST campus. Adopted from Awelia *et al.* (25).

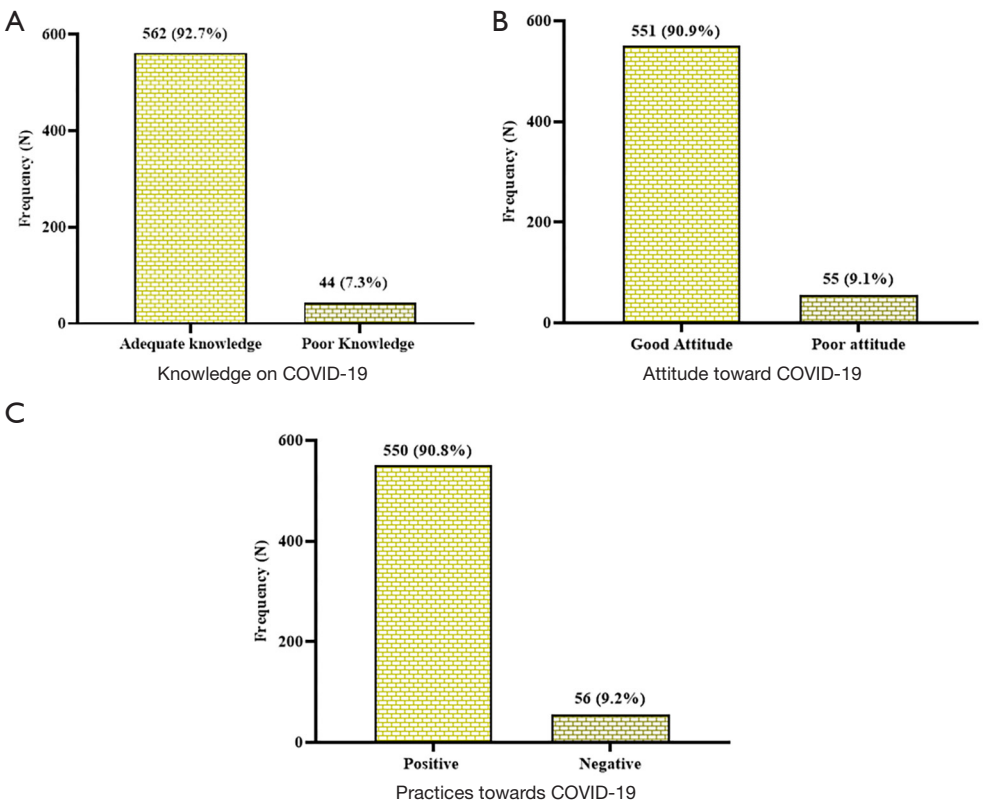

Figure S2 KAP level among the respondents, (A) level of knowledge on COVID-19; (B) attitude towards COVID-19; (C) cues to COVID-19 infection preventive practices.

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Table S1 Summary of responses to knowledge on COVID-19 questions (N= 606)

Question	Correct response	Incorrect response
What type of infectious disease is COVID-19?	605 (99.8%)	1 (0.2)
The incubation period of the Novel coronavirus	425 (70.1%)	181 (29.9%)
Suppose zoonotic origin of COVID-19	583 (96.2%)	23 (3.8)
Transmission mechanism of the Novel Coronavirus	349 (57.6%)	257 42.4)
Complications of Novel Coronavirus	598 (98.7%)	8 (1.3%)
Treatment of Novel coronavirus	563 (92.9%)	43 (5.1%)
How to reduce the risk of transmission?	443 (73.1%)	163 (36.9%)
It is believed that symptoms of the novel coronavirus may appear in as few as 2 days or as long as 14 after exposure	554 (91.4%)	52 (8.6%)
If anyone get the novel coronavirus, there is no possibility of survival	546 (90.1%)	60 (9.9%)
If anyone had a flu shot, a vaccinated against the novel coronavirus is sufficient	591 (97.5%)	15 (2.5%)
Even in areas experiencing outbreaks, meat products can be safely consumed if these items are cooked thoroughly and properly handled during food preparation	535 (88.3%)	71 (21.7%)
If anyone has a fever, cough and difficulty breathing seek medical care early and share previous travel history with the health care providers	599 (98.8%)	7 (1.2%)
If anyone work in a "wet market" it is recommended to disinfect the equipment and working area at least once a day	559 (92.2%)	47 (7.8%)
As per WHO guidelines for the novel coronavirus, you only need to wash your hands when they are visibly dirty	589 (97.2%)	17 (2.8%)

Data is presented as frequency and corresponding percentages.

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Table S2 Summary of responses to Attitude towards COVID-19 questions

Question	Response	Score	N (%)
Are you scared by human-person transmission of Covid-19?	Yes, but I am rational and I can protect myself	1	542 (89.4)
	I don't care, I feel the same	0	42 (6.9)
	I don't know	0	22 (3.6)
Do you hope the outbreak stops fast so you can return to school soon?	Yes	1	480 (79.2)
	I don't care	0	45 (7.4)
	No, I want to stay home as long as possible	0	81 (13.4)
Do you think you will be more capable to endurance such public health emergency?	Yes, I am more educated and thus more capable	1	438 (72.3)
	I will be the same	0	91 (15.0)
	No, I am too sacred to stand it anymore	0	77 (12.7)
Do you think this outbreak has impacted your study?	Yes, it has	1	557 (91.9)
	No, I am self-disciplined and my studies was not affected at home	0	49 (8.1)
Do you agree that COVID-19 will finally be successfully controlled?	Yes, I certainly agree	1	406 (67.0)
	I neither agree nor disagree	0	179 (29.5)
	No, I disagree	0	21 (3.5)
Do you have confidence that Ghana can win the battle against the COVID-19 virus?	Yes, I do believe we can win	1	393 (64.9)
	I'm not so confident about this	0	192 (31.7)
	No, I don't think we can	0	21 (3.5)
When I meet my friends and colleagues, I will always greet them with a handshake or a hug	Agree	0	61 (10.1)
	Neither Agree nor disagree	0	110 (18.2)
	Disagree	1	435 (71.8)
If there is an available lab test for detection of the virus, I am willing to do it	Agree	1	465 (76.7)
	Neither Agree nor disagree	0	84 (13.9)
	Disagree	0	57 (9.4)
If there is an available vaccine for the virus, I am willing to get it	Agree	1	375 (61.9)
	Neither Agree nor disagree	0	150 (24.8)
	Disagree	0	81 (13.4)
I usually follow the updates about the spread of the virus in my country	Agree	1	490 (80.9)
	Neither Agree nor disagree	0	87 (14.4)
	Disagree	0	29 (4.8)
I usually follow the updates about the spread of the virus worldwide	Agree	1	366 (60.4)
	Neither Agree nor disagree	0	171 (28.2)
	Disagree	0	69 (11.4)
If a lecture about the virus is organized near me, I will attend it	Agree	1	259 (42.7)
	Neither Agree nor disagree	0	199 (32.8)
	Disagree	0	148 (24.4)
If flyers or brochures that include information about the disease are distributed, I will read them and follow the instructions mentioned in them	Agree	1	513 (84.7)
	Neither Agree nor disagree	0	66 (10.9)
	Disagree	0	27 (4.5)
If protective measures and equipment are available at an affordable price, I will buy them	Agree	1	553 (91.3)
	Neither Agree nor disagree	0	36 (5.9)
	Disagree	0	17 (2.8)

Data is presented as frequency and corresponding percentages.

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Table S3 Summary of responses to preventive practices towards COVID-19 questions

Question	Response	Score	N (%)
What would you do if you have fever and dry cough?	I will analyze the situation rationally. Stay home for observation and quarantine or go to the hospital for treatment	1	543 (89.6)
	I would like to go to the hospital, but with the fear of possible contact with an infected person	0	60 (9.9)
	I fell panic and wouldn't know what to do	0	3 (0.5)
If the country needs you, are you willing to help the frontline rescue?	Yes. A country's trouble is everyone's responsibility	1	382 (63.0)
	I am not sure and need suggestions from the family	0	184 (30.4)
	No! It is too dangerous	0	40 (6.6)
What would you do if you had close contact with a confirmed cases?	Proactively report to the community and stay in quarantine as required	1	564 (93.1)
	I will do nothing	0	13 (2.2)
	I fell panic and wouldn't know what to do	0	29 (4.8)
What would you do if someone cured from Covid-19 wanted to meet you?	I will meet them and show more kindness	1	281 (46.4)
	I will meet them just like before	0	286 (47.2)
	I will find an excuse to keep away from them	0	39 (6.4)
What will be your top priority when the epidemic stops?	I will go back to school and restart normal study	1	458 (75.6)
	Same as before	0	121 (20.0)
	The outbreak is too scary. I need to enjoy my life as much as possible	0	27 (4.4)

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Table S4 Comparison of knowledge scores by student's characteristics

Variable	Knowledge		Attitude		Practices	
	Mean ±SD	P-value	Mean ±SD	P-value	Mean ±SD	P-value
Sex		0.008		0.007		0.188
Male	13.26±1.38		36.87±3.62		13.39±1.36	
Female	13.55±1.34		37.64±3.37		13.54±1.44	
Age (years)		0.001		0.174		0.180
15-20	13.12±1.32		37.01±3.75		13.39±1.50	
21-25	13.52±1.37		37.33±3.39		13.48±1.36	
26-30	13.78±1.31		38.33±3.30		13.82±1.35	
Programme of Study		<0.0001		0.273		0.158
Medicine	13.72±1.13		37.20±3.39		13.39±1.43	
Dentistry	13.37±1.23		36.67±4.17		13.33±1.55	
Pharmacy	13.29±1.16		36.99±3.19		13.46±1.50	
Physician Assistant	12.38±1.91*		37.45±3.42		13.55±1.37	
Med. Lab. Tech	13.37±1.42		38.01±3.38		13.60±1.28	
Nursing/Midwifery	13.26±1.04		37.43±4.33		13.83±0.99	
Others	11.14±2.38*		38.64±2.74		14.29±0.91	
Level of education		<0.0001		0.218		0.002
100 level students	12.85±1.55*		37.19±3.68		13.67±1.38	
200 level students	13.03±1.64		36.99±4.11		13.51±1.46	
300 level students	13.49±1.22		38.06±3.03		13.28±1.41	
400 level students	13.61±1.15		37.37±3.03		13.45±1.40	
500 level students	13.82±1.20		36.60±3.76		12.94±1.44*	
600 level students	13.90±1.00		37.51±3.61		13.85±1.20	
Place of residence		0.948		0.188		0.002
Rural	13.41±1.68		37.74±3.54		13.87±1.26	
Urban	13.42±1.31		37.21±3.49		13.41±1.42	

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