

Unsatisfactory COVID-19-Related Knowledge, Attitudes and Practices among Undergraduate University Students in Uganda: An Online Cross-Sectional Survey

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Abstract

Background: This study examined the COVID-19-related knowledge, attitude and practices among undergraduate students in Uganda. **Methods:** An online cross-sectional survey was conducted from 12th-19th June 2020 among undergraduate students using a standard questionnaire designed using Google Forms sent via WhatsApp Messenger. The data were analyzed using SPSS. Pearson's Chi-square test was used to test the differences and odds ratios with their 95% confidence intervals were used for quantifying the association between independent and dependent variables. $p < 0.05$ was considered significant. A cut-off score of $\geq 80\%$ was used to denote sufficient knowledge, positive attitude, and good practices. **Results:** Of the 161 respondents, 102 (63.4%) were males with a mean age of 24.2 (5.0) years. The majority 121 (75.2%) were pursuing health-related programs and overall, 110 (68.3%) had sufficient knowledge while 76 (47.2%) had a positive attitude and good practice each. Knowledge and attitude were significantly associated with health-related programs (AOR 4.78, 95% CI 2.06 - 11.07; $p < 0.001$) and (AOR 3.18, 95% CI 1.33 - 7.62; $p = 0.010$) respectively. The practice was associated with the male gender (AOR 2.37, 95% CI 1.19 - 4.73; $p = 0.014$). The most commonly cited sources of COVID-19 information were news media 147 (91.3%), Ministry of Health 134 (83.2%), and social media 125 (77.6%). The ministry of health was considered the most trustworthy source 139 (86.3%) and social media the least 21 (13.0%). **Conclusions:** COVID-19-related knowledge, attitude and practices among undergraduates in Uganda were low

overall. Therefore, concerted efforts to provide tailored health education and behaviour change communication are needed.

Keywords

Knowledge, Attitude, Practice, COVID-19, Undergraduate Students

1. Introduction

The Coronavirus Diseases of 2019 (COVID-19) was declared a pandemic by the World Health Organization (WHO) on 11 March 2020 and by 29 June 2020, a landmark 10 million confirmed cases and nearly 500,000 deaths of COVID-19 globally were reported by the WHO [1]. To date (as of 30th March 2021), there were an estimated 126,372,442 global confirmed cases, at least 3,061,438 of the cases and 77,446 deaths were in African countries [1]. Uganda recorded its first case of COVID-19 on 21 March 2020 and as of 31 March 2021, the country had 40,767 confirmed cases and 335 reported deaths [1].

COVID-19 is a highly infectious disease believed to spread through respiratory aerosol generated through coughing and sneezing by an infected person [2] [3]. Evidence also suggests that a proportion of asymptomatic and mildly ill COVID-19 cases do also spread the disease [4]. However, the mode of transmission, just as its pathophysiology is still cloudy. The main clinical symptoms of COVID-19 include fever, dry cough, fatigue/myalgia, and difficulty in breathing. Other symptoms are sore throat, diarrhoea, loss of taste or smell, and arthralgia [5] [6] [7] [8]. About 20% of patients can develop severe disease characterized by acute respiratory distress syndrome (ARDS) requiring oxygen therapy and about 5% will require intensive care unit treatment including mechanical ventilation [9].

To date, there is no proven antiviral treatment or vaccine against SARS-CoV-2, the virus responsible for the current COVID-19 pandemic [8]. Containment of the pandemic, therefore, centres primarily on strong and strict infection control measures arising from the knowledge of the mechanisms of its transmission, to minimize the spread of the infection within the population [10] [11] [12]. The primary preventive measures are largely behavioural and include regular hand washing, social distancing, respiratory hygiene [11] [12], and use of face masks in public, compliance with which is largely dependent on the change in behaviour which is shaped by one's knowledge about the disease and their attitude [6] [8]. While there has been a breakthrough in vaccine development, with several vaccine candidates currently under emergency use in different parts of the world, the global impact is yet to be realized. Uganda launched the COVID-19 vaccination using the Astra-Zeneca vaccine on the 10th of March 2021, targeting mainly frontline healthcare workers, the elderly and persons with preexisting health conditions associated with increased risk of COVID-19 morbidity and

mortality. Vaccine uptake has generally remained low with only approximately 180,969 having been vaccinated as of 10th April 2021—a month since its launch, and the country is yet to realize any meaningful impact of the vaccine.

University students are among the most exposed to a wide range of information, including social media where misinformation abounds, and yet are not among the current targets of the COVID-19 vaccination drive. This has the potential of clouding their understanding of the current COVID-19 pandemic [13], with dire consequences. To date, there is a paucity of data on knowledge, attitude, and practices related to the current COVID-19 pandemic among undergraduate students undertaking various study programs in Sub Saharan Africa, Uganda inclusive. This study, therefore, aimed to assess the COVID-19-related knowledge, attitude, and practices among undergraduate university students in Uganda to recognize socio-demographic factors which can be useful in sanctioning behaviour change.

2. Materials and Methods

2.1. Study Design

This was an online cross-sectional survey conducted from 12th-19th June 2020, to determine the knowledge, attitude, and practices related to COVID-19 among the respondents.

2.2. Study Setting

The study was conducted at three Universities in the northern region of Uganda, namely; Lira, Gulu and Muni Universities. The northern region comprises three sub-regions with distinct indigenous populations and is located approximately 360 - 600 km from Kampala, Uganda's capital city.

2.3. Study Population

The study targeted students undertaking various undergraduate programs at different years of studies at the three universities.

2.4. Sample Size Determination

The sample size was estimated at 285 using the single population proportion formula [14] based on an average previous estimate of good knowledge related to COVID-19 of 79.9% [15], with a marginal error of 5%, a standard normal value corresponding to 95% certainty, and a non-response rate of 15%.

2.5. Study Instrument

A precoded structured questionnaire was used to collect quantitative data, developed with questions adapted from previous peer-reviewed KAP surveys [6] [16] [17] and the national COVID-19 Diagnosis and Treatment Protocol [18]. The questionnaire consisted of four parts: 1) Socio-demographic characteristics, 2) Knowledge questions, 3) Attitude-based questions, and 4) Practice questions.

2.6. Sampling Procedure and Data Collection

Because the country was in a lockdown with all learning institutions, including the universities, closed, we opted for an online platform using WhatsApp Messenger (Facebook, Inc., California, USA) to enroll potential participants. We employed a convenient sampling method and identified all the existing WhatsApp groups of the undergraduate students in the three universities. The Google Form link to the questionnaire was sent via WhatsApp Messenger (Facebook, Inc., California, USA) to identified students' WhatsApp groups.

3. Study Variables

3.1. Independent Variables

The independent variables included respondents' age; gender; year of study; institution, academic program, previous qualifications, residence, and source of information.

3.2. Dependent Variables

Respondents' COVID-19-related knowledge, attitude and practices formed the dependent variables.

The knowledge domain was assessed using a 15-item question, aimed at assessing the general knowledge about the cause, transmission, clinical presentation, risk factors and prevention of COVID-19 answered largely on a true or false basis with an additional option of "I don't know" for those who are uncertain. Each correct response weighed 1 point and 0 points for incorrect or uncertain responses, giving a maximum score of 15 and a minimum score of 0. The higher the points scored, the more knowledgeable the student.

The attitude domain was assessed using a 10-item question, each based on a 5 Likert scale with responses of strongly disagree, disagree, not sure, agree, and strongly agree. A score of 1 was assigned for a response reflecting a positive attitude and 0 for a response reflecting a negative attitude or neutral response, giving a maximum score of 10 and a minimum score of 0.

The practice of COVID-19 prevention was assessed using a 7-item question to assess the actual uptake of, and adherence to, the primary preventive measures for COVID-19. Each item was based on a response of "always", "sometimes" and "never" or as specified. A weight of 1 was given for a response reflecting good practice and 0 for a response reflecting poor practice, giving a maximum score of 7 and a minimum score of 0.

Students' KAP levels will be defined as "good"/"sufficient" or "poor"/"insufficient" based on cut off points adapted from that used in previous KAP studies [17] [19]. For knowledge assessment, scores of 80% and above will be regarded as sufficient knowledge, while those below 80% will be taken to reflect insufficient knowledge. For attitude, scores of 80% and above will be regarded as reflecting a good attitude, while scores below 80% will be regarded as a poor attitude. For practice, students with scores of $\geq 80\%$ will be categorized as having good pre-

ventive practice, while those with scores <80% will be considered as having poor preventive practice [20].

3.3. Data Management and Statistical Analysis

The completed questionnaires were extracted from Google Forms into Microsoft Excel 2010 and the data was exported to Statistical Package for Social Sciences (SPSS) software package (SPSS for Windows, Version 16.0. Chicago, SPSS Inc.) for analysis. Descriptive statistics were calculated for demographic characteristics and responses to given KAP questions, and summarized as frequencies (percentages) for categorical variables and mean (standard deviation) or median (interquartile range) for continuous variables. A cut-off of 80% was used to categorize sufficient knowledge, positive attitude and good practice. Pearson's Chi-square test was used to test the differences between socio-demographic characteristics with regards to KAP, and multivariate logistic regression analysis was used to determine the association between the socio-demographic variables and KAP. Variables with p-value < 0.3 on bivariate analysis were entered into the multivariate model. The adjusted odds ratios (AOR) and their 95% confidence intervals (CIs) were used to quantify the associations between socio-demographic variables and KAP. $p < 0.05$ was considered for statistical significance.

3.4. Ethics Approval Considerations

The study was approved by the Lacor Hospital Institutional Research and Ethics Committee [approval number LHIREC 0165/05/2020]. Online informed consent was made accessible to the respondents and informed consent was obtained before participating in the study. The questionnaire was designed to be anonymous and respondents were informed that all information provided would be anonymous and confidential.

4. Results

4.1. Socio-Demographic Characteristics of the Respondents

A total of 162 participants completed the online survey questionnaire, giving a response rate of 57%. After validating the data, 1 respondent was excluded and a final sample of 161 was analyzed. The age range was 19 - 56 years, median (IQR) 23 (22 - 24) years and mean 24.2 (SD 5.0) years. Up to 75.2% (121/161) were pursuing health-related programs while 40 (24.8%) were pursuing non-health-related programs. The main sources of information about COVID-19 were News media 147 (91.3%), Ministry of health sites 134 (83.2%) and social media 125 (77.6%). The trust in these sources varied widely, with the ministry of health sources being rated as the most trustworthy by 136 (86.3%) of the respondents, while only 21 (13.0%) of the respondents rated social media as a trustworthy source of COVID-19 information (**Table 1**).

Table 1. Demographic characteristics of the respondents.

Variable	Frequency	Percentage
Gender		
Male	102	63.4
Female	59	36.6
Age (years)		
Mean (SD)	24.2 (5.0)	
19 - 23	102	63.4
≥24	59	36.6
Institution		
Lira University	66	41.0
Gulu University	51	31.7
Muni University	44	27.3
Study program		
Health-related Course	121	75.2
Non-health-related Course	40	24.8
Year of study		
1 st year	18	11.2
2 nd year	34	21.1
3 rd year	57	35.4
4 th year	39	24.2
5 th year	13	8.1
Previous qualifications		
Yes	25	15.5
No	136	84.5
Type of the previous qualification		
Certificate	3	1.9
Diploma	22	13.7
None	136	84.4
Residence during lockdown		
Rural	69	42.9
Urban	92	57.1
Source of information on COVID-19		
International health organizations	104	64.6
Ministry of Health sites	134	83.2
TVs, Radios & Newspapers	147	91.3
Social Media	125	77.6
Others	6	3.7
The most trusted source of information		
International health organizations	95	59.0
Ministry of Health	139	86.3
TVs, Radios & Newspapers	74	46.0
Social Media	21	13.0
Others	10	6.2

4.2. Respondents' COVID-19-Related Knowledge

The total knowledge score to the 15-item knowledge questions ranged from 40%

(6/15) to 100% (15/15). Nearly all, 156 (96.9%) were aware that COVID-19 is a viral infectious disease, while all 161 (100%) were familiar with the main mode of transmission. The majority were able to identify fever 157 (97.5%), shortness of breath 146 (90.7%) and cough 146 (90.7%) as the main clinical symptoms of COVID-19, though only 60 (37.3%) were aware of myalgia as one of the main symptoms. **Table 2** summarizes the knowledge levels on various aspects of COVID-19.

The mean knowledge score was 12.0 (SD 1.5) with an overall knowledge score of 68.3%, indicating a low knowledge of COVID-19 (**Table 3**). When correlated against the baseline socio-demographic characteristics of the respondents, there was a statistically significant difference in knowledge levels on COVID-19 between students undertaking health-related programs and those undertaking non-health-related programs on bivariate analysis (χ^2 16.4; $p < 0.001$). Likewise, there was a statistically significant difference in knowledge levels with regards to the use of the ministry of health as the main source of information about COVID-19 (χ^2 6.10; $p = 0.014$). There was no statistically significant difference in knowledge levels for the rest of the socio-demographic characteristics on the bivariate analysis (**Table 3**).

On multivariate analysis, the study program was the only factor that significantly influenced the level of COVID-19-related knowledge among the respondents. Students pursuing health-related programs were more likely to have sufficient knowledge about COVID-19 than those pursuing non-health-related programs (AOR 4.78, 95% CI 2.06 - 11.07; $p < 0.001$). Respondents' age, year of study, previous qualifications, and source of information did not significantly influence knowledge levels (**Table 3**).

4.3. Respondents' Attitude towards COVID-19

Notably, 28 (17.4%) of the respondents believed that being a black race confers less risk of COVID-19 infection and only 56 (34.8%) were confident that Uganda is in a good position to contain the infection. Likewise, only 66 (41.0%) were confident that the school environment was enabling in preventing the spread of COVID-19. The majority 153 (95.0%) of the students believed the pandemic has impacted on their study, while 138 (85.7%) were willing to help in the frontline rescue if needed (**Table 4**).

The overall positive towards COVID-19 was 47.2% (76/161)—indicating that the attitude among the undergraduate students was generally negative (**Table 5**). There was a statistically significant difference in attitude between students undertaking health-related programs and those undertaking non-health-related programs (χ^2 4.62; $p = 0.032$). There was also no statistically significant difference in attitude with regards to the rest of the socio-demographic characteristics on bivariate analysis (**Table 5**).

On multivariate analysis, students undertaking health-related programs were more likely to have a positive attitude towards COVID-19 than those pursuing

Table 2. Knowledge of the undergraduate students about COVID-19.

Knowledge question	Correct response N (%)
K1 _ What type of infectious disease is COVID-19?	156 (96.9)
K2 _ What is the main transmission route of COVID-19?	161 (100)
K3 _ How long is the COVID-19 incubation period?	150 (93.2)
K4 _ Who is susceptible to COVID-19?	100 (62.1)
K5 _ Persons with COVID-19 cannot infect others if they do not have signs and symptoms of COVID-19 like fever, cough, etc.	143 (88.8)
K6 _ Eating or getting into contact with wild animals would result in infection with the coronavirus	67 (41.6)
K7 _ What are the main clinical symptoms of COVID-19? (overall)	52 (32.3)
Fever	157 (97.5)
Shortness of breath	146 (90.7)
Cough	146 (90.7)
Myalgia	60 (37.3)
K8 _ Other clinical symptoms of COVID-19	46 (28.6)
K9 _ Those at risk of severe disease include the elderly, those with pre-existing chronic illnesses, and children <1 year.	126 (78.3)
K10 _ There is no treatment for COVID-19 but early symptomatic & supportive treatment can help most patients recover from the infection.	158 (98.1)
K11 _ Wearing general medical masks can prevent one from COVID-19	144 (89.4)
K12 _ Children and young adults do not need to take measures to prevent the infection by the COVID-19 because they are at low risk.	146 (90.7)
K13 _ To prevent the infection by COVID-19, individuals should avoid going to crowded places	158 (98.1)
K14 _ Isolation and treatment of people who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus.	161 (100)
K15 _ People who have contact with someone infected with the COVID-19 virus should be immediately isolated for 14 days.	159 (98.8)

other programs (AOR 3.18, 95% CI 1.33 - 7.62; $p = 0.010$). Likewise, second-year students, regardless of the study program, were significantly more likely to have a positive attitude towards COVID-19 than first-year students (AOR 5.75 (95% CI 1.41 - 23.55; $p = 0.015$), and so were the third-year students (AOR 7.26, 95% CI 1.92 - 27.45; $p = 0.004$), fourth-year students (AOR 9.20, 95% CI 2.9 - 38.73; $p = 0.002$) and fifth-year students (AOR 7.19, 95% CI 1.29 - 40.03; $p = 0.024$) (Table 5).

4.4. COVID-19 Prevention Practices among the Respondents

In responding to questions assessing observance of the COVID-19 preventive practices, only 77 (44.7%) had avoided a crowded place in the period preceding the study and just over half, 88 (54.7%) had worn a mask when leaving home. When asked about what they would do if they had a fever and dry cough, the

Table 3. Socio-demographic characteristics associated with knowledge on COVID-19 among the undergraduate university students.

Characteristic	Mean score	Bivariate		χ^2	P-value	Multivariate	
		Sufficient Knowledge N (%)	Insufficient knowledge N (%)			AOR (95% CI)	P-value
Overall Score	12.0 ± 1.5	110 (68.3)	51 (31.7)	NA	-	-	-
Gender							
Male	12.0 ± 1.4	70 (63.7)	32 (62.7)	0.01	0.913	-	-
Female	11.8 ± 1.5	40 (36.4)	19 (37.3)				
Age (years)							
19 - 23	11.9 ± 1.3	66 (60.0)	36 (70.6)	1.68	0.195	0.68 (0.23 - 2.03)	0.492
≥24	12.0 ± 1.7	44 (40.0)	15 (29.4)			1.0	
Institution							
Lira University	12.0 ± 1.6	46 (41.8)	20 (39.2)	1.19	0.553	-	-
Gulu University	11.9 ± 1.4	32 (29.1)	19 (37.3)				
Muni University	11.9 ± 1.3	32 (29.1)	12 (23.5)				
Study program							
Health-related	12.2 ± 1.4	93 (84.5)	28 (54.9)	16.4	<0.001*	4.78 (2.06 - 11.07)	<0.001*
Non-health-related	11.2 ± 1.5	17 (15.5)	23 (45.1)			1.0	
Year of study							
1 st year	11.6 ± 1.4	10 (9.1)	8 (15.7)	5.46	0.243	1.0	
2 nd year	12.0 ± 1.4	20 (18.2)	14 (27.5)			1.09 (0.31 - 3.89)	0.890
3 rd year	11.8 ± 1.5	39 (18.2)	18 (35.3)			0.66 (0.20 - 2.19)	0.499
4 th year	12.2 ± 1.5	31 (28.2)	8 (15.7)			0.49 (0.11 - 2.20)	0.350
5 th year	12.2 ± 1.5	10 (9.1)	3 (5.9)			0.70 (0.10 - 4.79)	0.719
Prev. qualification							
Yes	12.6 ± 1.4	21 (19.1)	4 (7.8)	3.36	0.067	3.12 (0.74 - 13.13)	0.122
No	11.9 ± 1.4	89 (80.9)	47 (92.2)			1.0	
Residence							
Rural	12.3 ± 1.5	48 (43.6)	21 (41.2)	0.09	0.769	-	-
Urban	11.8 ± 1.4	62 (56.4)	30 (58.8)				
Information source							
International	12.3 ± 1.3	74 (67.3)	30 (58.8)	1.09	0.297	0.87 (0.35 - 2.15)	0.766
Ministry of Health	12.1 ± 1.3	97 (88.3)	37 (72.5)	6.10	0.014*	2.65 (0.89 - 7.86)	0.079
TVs, Radios, etc	12.0 ± 1.4	100 (90.9)	47 (92.2)	0.07	0.794		
Social Media	11.9 ± 1.4	85 (77.3)	40 (78.4)	0.03	0.870		
Others	12.0 ± 1.5	5 (4.5)	1 (2.0)	0.65	0.421		

NA = Not applicable; Prev. qualification = Previous qualification; AOR = Adjusted Odds Ratio; *p-value significant.

majority, 159 (98.8%) would self-quarantine or go to the hospital for treatment, while 2 (1.2%) would hide or go to a clinic or buy some medicine and self-medicate. Participants' responses to the other COVID-19 preventive practices are as summarized in **Table 6**.

Overall, only 76 (47.2%) of the respondents demonstrated good COVID-19 prevention practices (**Table 7**). There was a statistically significant difference in COVID-19 prevention practices by gender on bivariate analysis (χ^2 5.49; p =

Table 4. Respondents' response concerning attitude towards COVID-19.

Attitude question	Response*				
	SD N (%)	D N (%)	NS N (%)	A N (%)	SA N (%)
A1 _ Being of black race makes one less prone to infection with the COVID-19 virus.	70 (43.5)	41 (25.5)	22 (13.7)	19 (11.8)	9 (5.6)
A2 _ Wearing a well-fitting face mask is effective in preventing COVID-19.	10 (6.2)	8 (5.0)	4 (2.5)	80 (49.7)	59 (36.6)
A3 _ Using a hand wash can prevent you from getting COVID-19.	7 (3.4)	3 (1.9)	1 (0.6)	93 (57.8)	57 (35.4)
A4 _ Uganda is in a good position to contain COVID-19.	22 (13.7)	54 (33.5)	29 (18.0)	44 (27.3)	12 (7.5)
A5 _ Are you scared by the person-person transmission of COVID-19?	2 (1.2)	17 (10.6)	2 (1.2)	88 (54.7)	52 (32.3)
A6 _ Do you hope the outbreak stops fast so you can return to school soon?	14 (8.7)	9 (5.6)	16 (9.9)	33 (20.5)	89 (55.3)
A7 _ Do you think you will be more capable of the endurance of such a public health emergency?	7 (4.3)	21 (13.0)	32 (19.9)	68 (42.2)	33 (20.5)
A8 _ Do you think this outbreak has impacted your study?	5 (3.1)	1 (0.6)	2 (1.2)	17 (10.6)	136 (84.5)
A9 _ Are you confident in the school environment in preventing the spread of COVID-19?	38 (23.6)	35 (21.7)	22 (13.7)	47 (29.2)	19 (11.8)
A10 _ If the country needs you, are you willing to help the frontline rescue?	6 (3.7)	5 (3.1)	12 (7.5)	57 (35.4)	81 (50.3)

*SD = Strongly Disagree; D = Disagree; NS = Not Sure; A = Agree; SA = Strongly Agree.

0.019), but not the other socio-demographic characteristics (**Table 7**). On multivariate analysis, gender remained the only socio-demographic characteristic that independently influenced practice, where male students were significantly more likely to exhibit good preventive practices than their female counterparts (AOR 2.37, 95% CI 1.19 - 4.73; $p = 0.014$) (**Table 7**).

5. Discussion

The current COVID-19 pandemic has had devastating global effects on all spheres of human life since first reported in Wuhan, China, in December 2019 and subsequently declared a pandemic by WHO in March 2020. In the absence of proven vaccine or treatment, strong and strict infection control measures to prevent its spread are crucial, compliance to which is influenced by individuals' knowledge, attitude, and practices. To date, there has been limited published data on KAP among university students in Sub Saharan Africa (SSA) and to the best of our knowledge; this is the first study in investigating COVID-19-related KAP among university students undertaking programs beyond the medical field. The study assessed COVID-19-related KAP among students in three public universities in Uganda to recognize socio-demographic factors which can be useful in sanctioning behaviour change.

5.1. COVID-19-Related Knowledge

Overall, 68.3% of the students had sufficient COVID-19-related knowledge, a level much lower than that reported among medical students in Uganda (90%) [21], Iran (87%) [22], China (82.34%) [16] and Pakistan (79.9%) [15]. However, the knowledge level among undergraduate students in our study is higher than 10.5% and 37.5% reported among students in Bangladesh [23] and Saudi Arabia [24] respectively. This could be attributed to the difference in the study populations

Table 5. Socio-demographic characteristics associated with Attitude towards COVID-19 among the undergraduate university students.

Characteristic	Mean score	Bivariate				Multivariate	
		Positive Attitude N (%)	Negative Attitude N (%)	χ^2	P-value	AOR (95% CI)	P-value
Overall Score	7.3 ± 1.7	76 (47.2)	85 (52.8)	NA	-	-	-
Gender							
Male	7.4 ± 1.8	51 (67.1)	51 (60.0)	0.87	0.350	-	-
Female	7.1 ± 1.5	25 (32.9)	34 (40.0)				
Age (years)							
19-23	7.5 ± 1.5	51 (67.1)	51 (60.0)	0.87	0.350	-	-
≥24	7.1 ± 1.9	25 (32.9)	34 (40.0)				
Institution							
Lira University	7.4 ± 1.7	35 (46.1)	31 (36.5)	2.20	0.334	-	-
Gulu University	7.4 ± 1.8	24 (31.6)	27 (31.8)				
Muni University	7.1 ± 1.4	17 (22.4)	27 (31.8)				
Study program							
Health-related	7.1 ± 1.6	63 (82.9)	58 (68.2)	4.62	0.032*	3.18 (1.33 - 7.62)	0.010*
Non-health-related	6.6 ± 1.8	13 (17.1)	27 (31.8)			1.0	
Year of study							
1 st year	7.9 ± 2.1	14 (18.4)	4 (4.7)	8.65	0.070	1.0	
2 nd year	7.3 ± 1.4	16 (21.1)	18 (21.2)			5.75 (1.41 - 23.55)	0.015*
3 rd year	7.1 ± 1.7	23 (30.3)	34 (40.0)			7.26 (1.92 - 27.45)	0.004*
4 th year	7.1 ± 1.6	16 (21.1)	23 (27.1)			9.20 (2.19 - 38.73)	0.002*
5 th year	7.6 ± 1.4	7 (9.2)	6 (7.1)			7.19 (1.29 - 40.03)	0.024*
Prev. qualification							
Yes	7.2 ± 1.9	13 (17.1)	12 (14.1)	0.27	0.601	-	-
No	7.3 ± 1.6	63 (82.9)	73 (85.9)				
Residence							
Rural	7.3 ± 1.6	30 (39.5)	39 (45.9)	0.67	0.412	-	-
Urban	7.4 ± 1.7	46 (60.5)	46 (54.1)				
Information source							
International	7.5 ± 1.5	54 (71.1)	50 (58.8)	2.62	0.105	1.28 (0.58 - 2.79)	0.540
Ministry of Health	7.4 ± 1.6	67 (88.2)	67 (78.8)	2.51	0.114	2.00 (0.71 - 5.68)	0.192
TVs, Radios, etc	7.4 ± 1.6	71 (93.4)	76 (89.4)	0.81	0.367		
Social Media	7.3 ± 1.7	59 (77.6)	66 (77.6)	0.00	0.998		
Others	8.0 ± 1.1	4 (5.3)	2 (2.4)	0.95	0.330		

NA = Not applicable; Prev. qualification = Previous qualification; AOR = Adjusted Odds Ratio, *p-value significant.

Table 6. Participants' response to practice questions concerning COVID-19 preventive measures.

Practice question	Response		
	Always N (%)	Sometimes N (%)	Never N (%)
P1 _ In recent days, have you gone to any crowded place?	11 (6.8)	78 (48.4)	71(44.7)
P2 _ In recent days, have you worn a mask when leaving home?	88 (54.7)	54 (33.5)	19 (11.8)
P3 _ In recent days, have you refrained from shaking hands?	116 (72.0)	36 (22.4)	9 (5.6)
P4 _ In recent days, have you washed your hands at all times and before and after touching anything?	91 (56.5)	70 (43.5)	0 (0.0)
	Right action	Wrong action	Unsure
P5 _ What would you do if you had close contact with a confirmed case of COVID-19?	156 (96.9)	5 (3.1)	0 (0.0)
P6 _ What would you do if you had a fever and dry cough?	159 (98.8)	2 (1.2)	0 (0.0)
P7 _ What would you do if a colleague or your classmate who cured of COVID-19 wanted to meet you or is to attend class with you?	145 (90.1)	5 (3.1)	11 (6.8)

Table 7. Socio-demographic characteristics associated with COVID-19 prevention practice among the undergraduate university students.

Characteristic	Mean score	Bivariate				Multivariate	
		Good Practice N (%)	Poor Practice N (%)	χ^2	P-value	AOR (95% CI)	P-value
Overall Score	5.1 ± 1.3	76 (47.2)	85 (52.8)	NA			
Gender							
Male	5.0 ± 1.4	41 (53.9)	61 (71.8)	5.49	0.019*	2.37 (1.19 - 4.73)	0.014*
Female	5.5 ± 1.1	35 (46.1)	24 (28.2)			1.0	
Age (years)							
19 - 23	5.2 ± 1.3	52 (68.1)	50 (58.8)	1.59	0.207	0.72 (0.37 - 1.41)	0.338
≥24	5.0 ± 1.5	24 (31.6)	35 (41.2)			1.0	
Institution							
Lira University	5.3 ± 1.4	32 (42.1)	34 (40.0)	1.24	0.538	-	-
Gulu University	5.0 ± 1.4	21 (27.6)	30 (35.3)				
Muni University	5.1 ± 1.3	23 (30.3)	21 (24.7)				
Study program							
Health-related	5.1 ± 1.5	58 (76.3)	63 (74.1)	1.10	0.747	-	-
Non-health-related	5.3 ± 1.1	18 (23.7)	22 (25.9)				
Year of study							
1 st year	5.6 ± 1.3	10 (13.2)	8 (9.4)	1.21	0.876	-	-
2 nd year	5.1 ± 1.2	17 (22.4)	17 (20.0)				
3 rd year	5.2 ± 1.4	27 (35.5)	30 (35.3)				
4 th year	5.0 ± 1.2	16 (21.1)	23 (27.1)				
5 th year	4.0 ± 2.0	6 (7.9)	7 (8.2)				
Prev. qualification							
Yes	5.3 ± 1.3	13 (17.1)	12 (14.1)	0.27	0.601	-	-
No	5.1 ± 1.4	63 (82.9)	73 (85.9)				
Residence							
Rural	5.1 ± 1.4	31 (40.8)	38 (44.7)	0.25	0.616	-	-
Urban	5.2 ± 1.3	35 (59.2)	47 (55.3)				
Information source							
International	5.3 ± 1.3	53 (69.7)	51 (60.0)	1.66	0.197	0.52 (0.26 - 1.05)	0.067
Ministry of Health	5.1 ± 1.4	65 (85.5)	69 (81.2)	0.54	0.461		
TVs, Radios, etc	5.1 ± 1.4	69 (90.8)	78 (91.8)	0.05	0.826		
Social Media	5.2 ± 1.3	60 (78.9)	65 (76.5)	0.14	0.707		
Others	5.3 ± 0.8	3 (3.9)	3 (3.5)	0.02	0.889		

NA = Not applicable; Prev. qualification = Previous qualification; AOR = Adjusted Odds Ratio, *p-value significant.

and the parameters used in assessing knowledge. For instance, unlike the other studies, the current study assessed knowledge among a mixed group of students across various non-medical disciplines based on a more diverse criterion on a 15-item question.

In this study, COVID-19-related knowledge was significantly associated with

the study program pursued, being significantly higher among students undertaking health-related programs than their counterparts. This finding is consistent with that reported in other studies [15] [16] [24] and has been attributed to the training of these students in clinical medicine and public health, as well as their sense of duty and responsibility as a candidate medical professional [25]. Contrary to findings from other pieces of literature [15] [26], age, education, institution, year of study, and source of information did not significantly influence the level of knowledge about COVID-19 among undergraduate university students in the current study.

The study found a high level of knowledge regarding COVID-19 aetiology, its main route of transmission, the incubation period and the groups at high risk. This finding is similar to that reported among undergraduate students in Pakistan [15] and Saudi Arabia [24]. This is important because knowledge of the aetiology, transmissibility of, and susceptibility to, the disease is considered as the first step of individuals education and behaviour change communication in adopting the preventive measures that limit its spread [27]. In the same breath, the knowledge that asymptomatic persons of COVID-19 can still transmit the infection to others was high among the respondents. This finding is critical in shaping behaviour change to observe the preventive measures in all situations since the available body of evidence indicates that mild or asymptomatic COVID-19 cases may spread the disease [4]. Furthermore, the current finding reveals that while only 32.3% of participants were aware of all the main symptoms of COVID-19, awareness of the individual symptoms of fever, cough, and shortness of breath as the top main symptoms of COVID-19 were generally high. However, only 37.3% knew that myalgia was one of the symptoms of the disease. This finding resonates with that reported in other studies [15] [21] [28] where knowledge of myalgia as one of the main symptoms of COVID-19 was limited. Given that COVID-19 is largely a respiratory disease, this finding may thus not be surprising, since the triad of fever, cough and shortness of breath is a common clinical presentation of respiratory tract infections usually experienced by many in Uganda.

The most cited sources of information on COVID-19 were the national ministry of health; the news media like TV, radios and newspapers, and social media. Reliance on messages through official government sources through TV, radio and official websites which are usually censored has previously been reported in Uganda [21] and remains a widely used source of information in other settings [28]. The reliance on social media as found in the current study is not unexpected since it has become a widely popular source of information among many population groups [8] [15] [21] [27] owing to its ease of accessibility and cost-effectiveness. However, the spread of misinformation through social media remains of great concern [8] [29], a situation which, as asserted by Shu *et al.* (2017), can have devastating effects on society [30]. Importantly, while many students in the current study used social media for COVID-19 information, only

13% trusted its worthiness. This is reassuring as it means that those engaged with these channels may scrutinize the information presented to them. Nonetheless, social media continues to play a vital role in educating the public about COVID-19 [24].

5.2. Attitude Related to COVID-19

This study reveals a generally negative attitude related to COVID-19 among the undergraduate students, only 47.2% had a positive attitude overall. The attitude was significantly influenced by the study program and the year of study. Students undertaking health-related programs were three times as likely to have a positive attitude towards COVID-19 as those pursuing non-health-related programs. Similarly, students in their second year of study onwards, regardless of the program being undertaken were significantly more likely to have a positive attitude towards COVID-19 than the first-year students. This finding bodes well with that conducted among purely medical students [21]. Unlike the report by other authors [5] [16], there was no statistically significant difference in attitude score by gender among the undergraduate students in the current study.

When asked about the ability of the country to contain the current COVID-19 pandemic, the majority of the respondents held a pessimistic attitude: only 34.8% had confidence that Uganda can win the battle against COVID-19, while only 41.0% were confident that the school environment was enabling in preventing the spread of COVID-19. This finding mirrors that from previous studies in Pakistan [15] and Uganda [17] where a large number of respondents did not believe in the ability of the government to combat the COVID-19 epidemic but contrasts with findings from China, Saudi Arabia and Nepal [5] [6] [26]. This is rather surprising given the government's prompt response in taking stringent control and precautionary measures against COVID-19 but is in tandem with the assertion that people tend to express negative emotions, such as anxiety and panic, during a pandemic that could affect their attitude [31]. The pessimistic attitude could have also been informed by the ongoing rise in the number of cases in the country, the general lack of trust in the national health system, and the information gap between the population and the government. There is thus a need for authorities in government and the health ministry to instil confidence in the common man, in general, using all the available channels.

5.3. Practices Related to COVID-19 Prevention

Overall, only 42.7% of the respondents in the current study demonstrated good practice towards COVID-19 prevention. Male students were twice as likely to exhibit good preventive practices as females. This finding contrasts with that on Middle East Respiratory Syndrome Coronavirus (MERS-CoV) among the Saudis population where males were significantly less likely than females to take safety precautions and prevention [27]. On the other hand, a report by Ping and colleagues (2020) showed no statistically significant difference in preventive prac-

tices between groups by gender [16]. The finding of positive practice among the male gender has, however, previously been reported [32] and is of significance in that generally, men and late adolescents are more likely to engage in risk-taking behaviour [33] [34] as was evidenced in China where male gender was significantly associated with the practice of defying the principle of social distancing [6].

SARS-CoV-2 is a highly infectious agent just like most viral infections and has been documented to be highly contagious among people in close proximity [35]. However, while close to three-quarters (72%) of the respondents had refrained from shaking hands in the period preceding the study, more than half either frequently or occasionally associated with a crowded environment—defying the recommended social distancing measures. Likewise, up to 45.3% of the respondents either inconsistently or never wore a face mask when leaving home for public places, while 43.5% inconsistently washed their hands before and after touching anything. This is concerning and comes on the backdrop when the national ministry of health has produced a guide on COVID-19 to provide residents with facts and precautionary messages. It, however, calls for more concerted effort in intensifying education and behaviour change communication to the population, especially in as far as dissemination of the available information, education and communication (IEC) materials are concerned. This approach is supported by evidence from a Saudi's study where the provision of education and outreach materials to increase public understating of the disease and influence behavioural change was associated with high rates of adoption of good and safe practices towards COVID-19 [26].

The majority of the respondents in the current study would self-quarantine or go to the hospital for treatment if they had a fever and dry cough, while 1.2% would hide or rather go to a clinic or buy some medicine and self-medicate. Similarly, the majority of the undergraduate students would proactively report to the authority and stay in quarantine as required if they had close contact with a confirmed case of COVID-19, though 3.1% would rather keep the information to themselves. Concerning what they would do if a colleague or one of their classmates who got cured of COVID-19 wanted to meet them or were to attend class with them, the majority of the respondents would meet or attend class with their classmates and show them more kindness, while 3.1% would rather find an excuse to keep away from such a colleague or classmate. While these findings are largely reassuring, the wrong actions that would be demonstrated by the minority cannot be ignored, especially when it causes stigmatization, since this would hinder other students from coming forward.

6. Limitations of the Study

The convenience sampling technique used in this study could have introduced sampling bias which, together with the relatively small sample size, could limit the representativeness of the study findings.

7. Conclusion

Overall, the current findings suggest an unsatisfactory COVID-19-related KAP among undergraduate students. Although the government has taken major steps to create public awareness through various channels to limit the spread of the disease, there is a need for more educational program and behaviour change communication, tailored to target undergraduate students, especially in the non-health-related disciplines.

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Conflicts of Interest

No competing interests were disclosed.

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Availability of Data and Materials

All data underlying the results are available as part of the article and no additional source data are required.

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