

The Knowledge and Attitude of Precautionary Measurements for COVID-19 Pandemic Among College Students: A Cross-Sectional Study in Jeddah City, Saudi Arabia

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Abstract

Introduction and Research Problem: Since SARS-CoV-2 virus spread, 190 countries have reported over 84 million confirmed cases. Many countries took certain precautionary measurements. The balance between maintaining the educational process and protecting the lives of millions at risk remains a debate and whether to maintain public attendance or promote virtual learning.

The goal of this study is to evaluate the knowledge and attitude of college students in Jeddah, Saudi Arabia, towards COVID-19 precautionary measurements in both public and private spaces.

Materials and Methods: A cross-sectional study for an epidemiological investigation in compliance to STROBE criteria and based in King Abdulaziz University, was conducted during the period of June 2021 looking at percentage of compliance to different precautionary measurements by college students and an analysis of their behavior. A total number of 606 college students were selected on random sampling technique from both genders in 12 different universities. Microsoft software was used with a 95% confidence level and a 5% error margin. Data input and statistical analysis were done by Excel and SPSS.

Summary of Results: 51.32% of the participants were males while 48.68% were females. Mean participants' age was 21.01 ± 2.828 . Participants were grouped according to their age into, $21 >$ group and $21 \leq$ group. Groups participated according to their enrolled universities where students enrolled at King Abdulaziz University contributed the most to the questionnaire.

Conclusion and Recommendations: Measuring the knowledge and attitude of college students is essential to understand the virus' social course among this population. Findings were encouraging in terms of their knowledge and attitude. However, periodic training is required based on the previous experience. Social media proved to be a main source in obtaining information. Almost all institutions eventually applied a hybrid model of online/in person classes. This study also bridges the current gap in local research related to the acceptability of the COVID-19 vaccine among university students.

Though the sample has been collected from all major universities in Jeddah, sample sizes from different universities varied. Moreover, the study focuses on the knowledge of the population in the recent days of the pandemic (June 2021) and therefore might not be generalizable outside the domain of the defined population and scope of the present study.

Keywords: coronavirus, SARS-CoV-2, attitude, knowledge, students, precautionary measurements, Saudi Arabia

Introduction

In late December 2019, a report of the novel coronavirus (2019-nCoV)-infected pneumonia (NCIP) was reported among 138 hospitalized patients in Wuhan, China (1). The World Health Organization (WHO) on March 11, 2020, declared the coronavirus disease 2019 (COVID-19) outbreak a global pandemic. On the same day, it was announced that there were now over 118,000 confirmed cases distributed among 114 countries worldwide (2). Since the initial spread of the SARS-CoV-2 virus that causes COVID-19 and as of week 2021-16, the world hit a record of 147,443,848 confirmed cases (3). As of the fourth week of 2021, it was reported that that virus has spread in over 222 countries and territories (4). As the disease spread among millions around the world it is also now evident that individuals with fever or chills, dry cough, shortness of breath or difficulty breathing, new loss of taste or smell and nausea or vomiting are most likely to be diagnosed with COVID-19. This put a burden and a challenge to government bodies worldwide to maintain certain measurements to protect the public and especially towards groups at risk. According to the WHO, risk groups in our communities which include adults over the age of 60, as well as those with health issues including lung or heart disease, diabetes, or immune system disorders (5) are highly exposed as the virus spreads relatively easy and can be acquired through direct, indirect, or close contact with infected people via contaminated secretions, which include saliva, respiratory secretions, or their respiratory droplets, which can be emitted when an infected person coughs, sneezes, speaks, or sings. (6-7). As this study handles the knowledge and attitude of college students towards COVID-19 precautionary measurements; their commitment is essential and can impact the community as a whole with both close contact transmission and household transmission representing two of the most common modes of transmission. The more we know about the virus, its variants, severity and mode of transmission; the more challenges we, as people and governments, confront. Governments that handle economic, health and social issues are now required to maintain the balance of normal social routine and healthcare services. Countries that provide free or universal health care systems are exposed to increased challenges to maintain these charge-free health services to their population. The Kingdom of Saudi Arabia is an example of a country which provides a national healthcare system as well as free health care services through a number of government agencies that handle the ongoing pandemic in a proactive manner which led to the announcement of multiple precautionary measurements nationwide. As early as February 27, 2020, Saudi authorities halted entry for Umrah in Makkah and tourism from coronavirus-hit states. On March 4, 2020, Saudi authorities suspended Umrah for both nationals and residents over coronavirus concerns and as of March 8, 2020 school attendance was suspended and all schools were closed from physical attendance until further notice due to rising concern and confirmed cases of coronavirus disease 2019 (8). Ever since March 8 of the same year and until the midterm break which starts on the two first weeks

of 2021, school, college and public educational institutions remained closed and were guided to use distant learning methods. Although there isn't a reliable source on the total number of college and university students in the Kingdom of Saudi Arabia; the General Authority for Statistics released a summary in 2015 stating there are over 1.9 million enrolled college students nationwide (9). With this massive number of college students, it was critical to maintain certain social precautionary measurements that ranged from school closure, social distancing in public spaces, temporary episodes of curfew and mandatory face masks, all to maintain the balance of resuming the educational process and to not overwhelm healthcare facilities. In September 2021, in-person attendance was announced publicly and officially for students aged 12 years and older followed by in-person attendance for students younger than 12 years old on October 30th, 2021 and on October 15th of the same year, the Saudi Minister of Interior announced reducing the restrictions in public precautionary measurements which include removing the mandatory wearing of face masks and social distancing instructions in open areas starting from October the 17th, 2021 (10). According to the WHO, the transmission of SARS-CoV-2 virus (which causes coronavirus disease 2019) in schools remains one of the most concerning questions. In early 2020, few outbreaks were reported in schools worldwide. In most infections or COVID-19 cases reported in children, the infection was acquired at home and at higher rates in high schools than primary and elementary schools. In places where attendance is still partially held as in many colleges in Saudi Arabia, it is highly recommended to maintain personal hygiene, to continue cleaning and disinfecting the surrounding environment and maintain social distancing in all areas. In view of this, we decided to measure the overall adherence and especially the knowledge and attitude of college students enrolled in universities and colleges based in Jeddah towards these precautionary measurements for COVID-19 as it is vital to control the spread of the virus.

Methodology

Study design and samples:

STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines were used in this epidemiological cross-sectional study. A total number of 606 currently enrolled college students selected on random sampling technique basis, both males and females, in 12 different universities and colleges all located in Jeddah city responded to an online questionnaire and consent to provide their data by a non-probability convenience sampling method in June 2021. A total of 606 participants met the inclusion criteria and gave their consent to participate. The data were collected online, by a questionnaire containing 19 questions using Google form which was electronically distributed to college students in both Arabic and English languages. The questionnaire was randomly distributed to students studying in a university/college in Jeddah, Saudi Arabia. The developed questionnaire for this research consisted of four parts: The first part included consent to use the data provided by

the participants. The second part was targeted to collect both personal and demographic variables which included age, gender and current college/university of enrollment. The third part consisted of a mix of 6 close-ended and checklist type multiple-choice questions that assessed the participants' general knowledge of the pandemic which included route of transmission, WHO's recommendations, most common symptoms, participation's in educational courses, how important is the community education in the participant's opinion and assessing their knowledge on approaching COVID-19 after acquiring its symptoms or signs. The fourth part consisted of a mix of 8 close-ended and checklist type multiple-choice questions that assessed the participants' attitude towards the COVID-19 precautionary measures in both public and private spaces. The questions in this part assessed the frequency of leaving their houses, what they carry upon leaving their houses, how often do they maintain social distancing, their behavior towards maintaining face masks and nose covers, other general precautionary measurements, their social behavior with their friends and family, their compliance to new-tech services launched by public authorities and their vaccine adherence. Questions with Yes/No options were coded 1 for Yes and 0 for No. In every question there was a Yes/No/Sometimes options. The Sometimes option was coded 0 as we were focusing on full adherence to the knowledge and attitude. Raosoft® software was used to compute the sample size, which was based on a 95% confidence level and a 5% margin of error. The survey received 606 responses, which was sufficient to form a broad conclusion on college students' understanding and views of COVID-19 precautionary measurements. The questionnaire was written in English initially, then translated into Arabic by the first author and all co-authors who were fluent in both Arabic and English, ensuring that the translation was accurate and comprehensive. One of the co-authors, a public health specialist, reviewed the questionnaire and agreed that it was clear and relevant. Before being distributed, the questionnaire was evaluated on a group of university students to verify that it was clear. Finally, the target demographic received both an English and an Arabic version of the questionnaire simultaneously.

Eligibility criteria

Included candidates were selected according to the following criteria:

- College students
- Enrolled in colleges based in Jeddah, Saudi Arabia

Candidates excluded from the survey:

- Academics and university/college employees not enrolled in a learning program/course
- Students attending universities/colleges outside of Jeddah city

Statistical analysis:

The collective knowledge assessment questions (Q1-Q6) were assembled and given responders a score of 1 when answering every correct option which were as following; for Q1, a score of 1 was given to participants who only chose all three options. In Q2, a score of 1 was given to participants

who only chose every option beside the "to use antipyretic when you have a fever" and "the consumption of orange juice rich in Vitamin C" as it was specified to choose the answers according to the WHO guidelines which included all options except for those two options. In Q3, a score of 1 was given to participants who only chose "fever", "cough" and "fatigue" together. From Q4-Q6, a score of 1 was given to participants who answered "Yes". The optimum score is 6/6. The comparison included the gender i.e. male and female, different age i.e. 21 years and older and 20 years and younger, students enrolled in King Abdulaziz University (KAU) and other universities, students enrolled in King Abdulaziz University (KAU) and King Saud bin Abdulaziz University for Health Sciences (KSAUHS), University of Jeddah (UJ) and King Saud bin Abdulaziz University for Health Sciences (KSAUHS). Afterward, a descriptive analysis was performed to describe the students included in the sample based on demographic variables. For categorical variables, frequencies and percentages were calculated. For continuous variables, the mean and standard error were calculated. For inferential statistics, a multiple-linear regression analysis was constructed to model the linear relationship between different independent variables and the outcome (dependent) variable of knowledge and attitude total score. This analysis predicted the total score of knowledge and attitude from; age, gender, and universities groups. Other models were also constructed to determine the predictors of the three different knowledge and attitude constructs (Age, Gender, and University [KAU and others]). The level of significance was set at P-value ≤ 0.05 . A Shapiro-Wilk test of normality was done for the sum of questions Q1-Q6 to collect the knowledge score and Q9-Q14 to collect the attitude score. In regards to Q12, we stated a specific and important statement which was (I don't wear a mask when I meet friends or family who don't live at the same house with me) and asked participants to choose "True" if they agree, "False" if otherwise or "Sometimes" if the statement was partially applicable. Furthermore, we explored the relationship between the sum of these questions (continuous dependent variable) and age, gender, universities (independent variables). Microsoft Excel 2016 was used for data entry, and statistical analysis was performed using IBM® SPSS® Statistics version 21 (IBM® Corp., Armonk, NY, USA).

Results

A total number of 606 college students in Jeddah participated and completed the distributed questionnaire (Table 1). 100% of the participants consented to use the provided data for research purposes. Of these, 51.32% (n = 311) were males and 48.68% (n = 295) were females. The mean age of the participants was found to be 21.01 ± 2.828 . The participants were grouped according to their age into, 21 > group (n= 274) and 21 \leq group (n= 332). Groups participated according to their enrolled colleges and universities where students enrolled at King Abdulaziz University contributed the most in participating in the questionnaire (Table 1). The location distribution in the city of Jeddah for the universities and colleges in the targeted population were divided into north, south, east and center (Figure 1).

Table 1. The distribution of participants according to their characteristics.

Demographic characteristics	Participants n (%)
Gender	
Male	311 (51.32)
Female	295 (48.68)
Age in years	
17	2 (0.33)
18	41 (6.77)
19	104 (17.16)
20	127 (20.96)
21	156 (25.74)
22	98 (16.17)
23	23 (3.80)
24	18 (2.97)
25	14 (2.31)
26	7 (1.16)
27	3 (0.50)
28	2 (0.33)
29	3 (0.50)
30	2 (0.33)
31	1 (0.17)
32	2 (0.33)
44	1 (0.17)
46	1 (0.17)
54	1 (0.17)
Current university/college of enrollment	
King Abdulaziz University	342 (56.44)
University of Jeddah	119 (19.64)
King Saud bin Abdulaziz University for Health Sciences	104 (17.16)
Batterjee Medical College	11 (1.82)
Ibn Sina National College for Medical Studies	7 (1.16)
University of Business and Technology	7 (1.16)
Effat University	5 (0.83)
Arab Open University	4 (0.66)
Jeddah College of Technology	4 (0.66)
Dar Al-Hekma University	2 (0.33)
Alfaisal University	1 (0.17)
University/college location (Jeddah city, Figure 1)	
North	18 (2.98)
South	357 (58.93)
East	108 (17.82)
Center	123 (20.30)

Figure 1. Courtesy of Wikimedia Commons. Map of Jeddah, KSA with universities/colleges approximate location distribution.

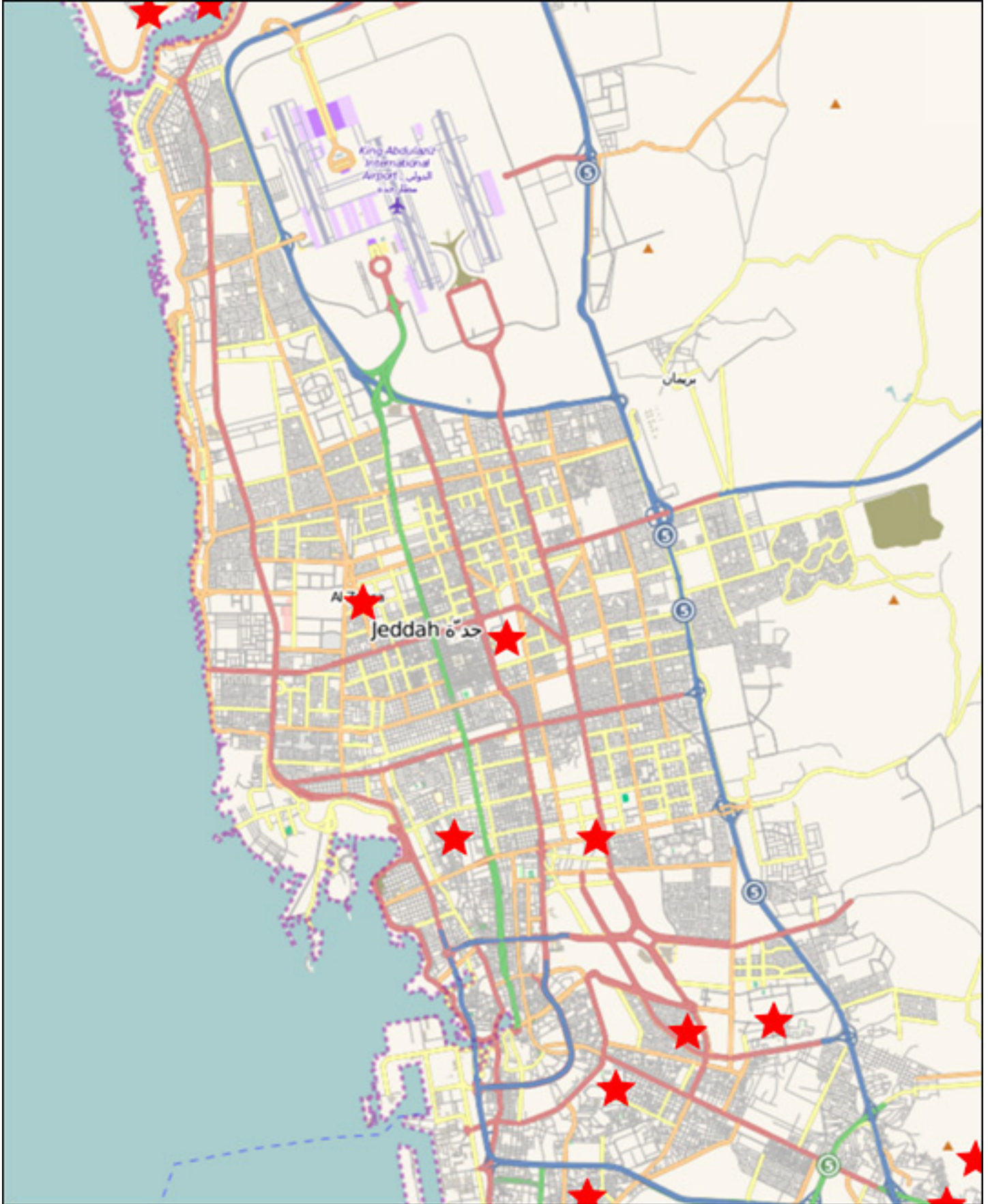


Table 2. Responses to questions assessing the knowledge of Jeddah college students to recommended precautionary measurements in the COVID-19 pandemic.

Knowledge variables	Choices	Total number of responses n (%)
Q1. Choose the ways you think COVID-19 virus is spread by - select all applicable	Through inhaling the virus directly	519 (85.64)
	Through the touch of the virus on contaminated surfaces	515 (84.98)
	Through handshake of an infected individual	519 (85.64)
Q2. According to the World Health Organization (WHO) what are the necessary precautions you should follow to prevent you from getting the virus? - select all applicable	Wash your hands regularly with soap and water	563 (92.90)
	Maintain social distancing	578 (95.40)
	Avoid touching the face	500 (82.51)
	To use antipyretic when you have a fever	140 (23.10)
	The consumption of orange juice rich in Vitamin C	205 (33.83)
	Cover your mouth and nose when coughing or sneezing	561 (92.57)
	Stay home if you feel unwell	527 (86.96)
Q3. What are the COVID-19 most common symptoms? - select all applicable	Fever	583 (96.20)
	Cough	479 (79.04)
	Fatigue	280 (46.20)
	Episodes of Syncope	25 (4.13)
Q4. Did you attend any educational courses on COVID-19?	Yes	205 (33.83)
	No	401 (66.17)
Q5. Do you believe it is important to educate the public on COVID-19?	Yes	577 (95.21)
	No	29 (4.79)
Q6. Do you know what to do if you have signs or symptoms of COVID-19?	Yes	592 (97.69)
	No	14 (2.31)

In response to Q1 (Table 2) (Choose the ways you think COVID-19 virus is spread by - select all applicable) in the knowledge assessment section, The majority of the respondents had an overall knowledge and understanding of the transmission of SARS-CoV2 by choosing the answers of: direct inhaling of the virus, touching contaminated surfaces and hand shaking infected individuals with a percentage of 85.64%, 84.98% and 85.64% respectively. However, 15% of respondents chose only a single or double choice, meaning a lack of full understanding of the entire transmission mode even among the educated population of currently enrolled university/college students. In Q2 which directly assessed the participants knowledge of the WHO's guidelines on necessary precautions an individual should follow to avoid the viral infection, a mass majority (92.90%) were aware of the recommendation of constant hand hygiene using soap and water. Moreover, an even bigger majority (95.40%) chose the answer of maintaining social distancing to avoid the viral infection. Although 95.40% were knowledgeable of the importance of social distancing and it was the third highest answered question in the entire knowledge assessment

section; only 68.32% of respondents to Q9 were practicing this knowledge when asked "Do you maintain social distancing outside your house?" and 30.03% practiced it sometimes. In Q2, a lower percentage (82.51%) chose the answer of avoiding face touching leaving a percentage of (17.49%) possibly unaware of the possibilities of hands-face transmission route. Around a quarter of respondents (23.27%) believed that the WHO guidelines' include using antipyretic to control fever. One third of respondents (33.83%) had another misconception by thinking that drinking orange juice rich in percentage dropped to 79.04% for cough and 46.20% for fatigue. The previous mentioned symptoms are indeed part of the U.S. CDC's table for most common symptoms. The fourth choice which was "episodes of syncope" was chosen by approximately 25 persons (4.13%) but it is not part of the US CDC's table of common symptoms. For Q4 we asked if participants had attended any educational courses on COVID-19 and it was found that only 205 participants (33.83%) took an educational course of any form but with a majority of 401 participants (66.17%) not taking any educational courses on COVID-19. When linking this finding to Q6 we can find that most of the community

might “think” that they know about COVID-19 but without a scientific background. In Q6 we asked if participants knew what to do if they acquired signs or symptoms of COVID-19. 592 respondents (97.69%) claim that they knew what to do while 66.17% of respondents never took any educational courses. The same question (Q4) can be linked to Q5 where 95.21% of respondents believe it is important to educate the public on COVID-19 but with only 33.83% of respondents actually taking educational courses.

In Table 3 the results are expressed and a comparison of the total knowledge score according to the different demographic characteristics is included. Total knowledge score was significantly higher in students with age groups ≤ 20 years versus students with age groups ≥ 21 years ($P < 0.000$), in students in KSAUH than students in KAU ($P = 0.003$) and in students in UJ than students in KSAUH ($P < 0.000$).

Table 3. Data were expressed as mean +/- standard deviation. Significance was made using Mann Whitney test as data not normally distributed.		
Characteristics	Total knowledge score	Significance
Gender		$P = 0.004$
Female (n= 295)	3.53±1.186	
Male (n= 311)	3.80±1.161	
Age group		$P = 0.000$
≤ 20 years (n= 274)	3.41±1.079	
≥ 21 years (n= 322)	3.88±1.217	
King Abdulaziz University (KAU) and other universities' respondents		$P = 0.677$
KAU (n= 342)	3.65±1.184	
Other universities (n= 264)	3.69±1.177	
King Abdulaziz University (KAU) and King Saud bin Abdulaziz University for Health Sciences (KSAUH) respondents		$P = 0.003$
KAU (n= 342)	3.65±1.184	
KSAUH (n= 104)	4.06±1.261	
University of Jeddah (UJ) and King Saud bin Abdulaziz University for Health Sciences (KSAUH) respondents		$P = 0.000$
UJ (n= 119)	3.45±0.945	
KSAUHS (n= 104)	4.06±1.261	
King Abdulaziz University (KAU) and University of Jeddah (UJ) respondents		$P = 0.060$
KAU (n= 342)	3.65±1.184	
UJ (n= 119)	3.45±0.945	

Table 4. Responses to questions assessing the attitude of Jeddah college students towards precautionary measurements in the COVID-19 pandemic.

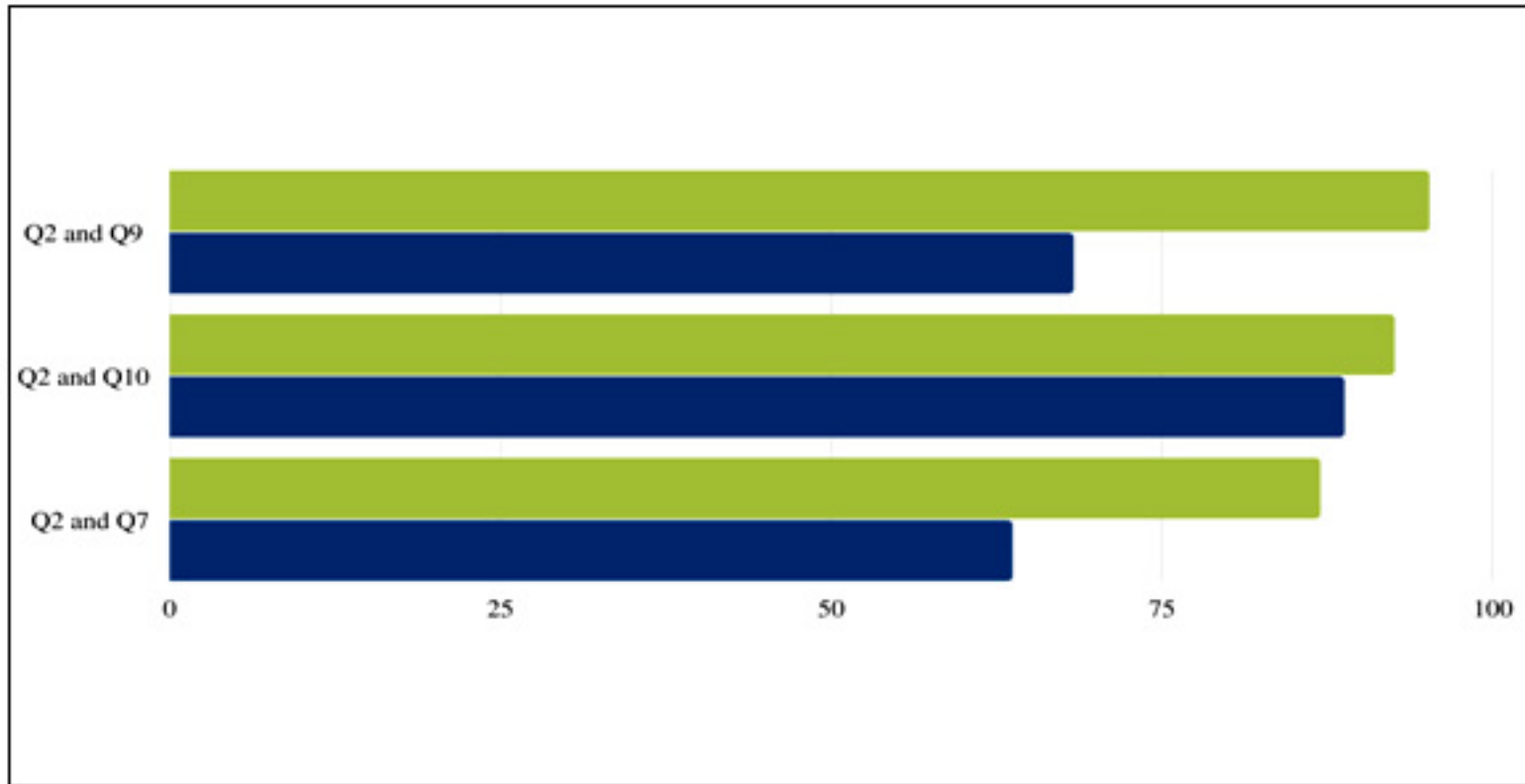
Attitude evaluation	Choices	Total number of responses n (%)
Q7. How many times do you currently leave your house?	More than once a day	179 (29.54)
	Once a day	207 (34.16)
	Weekly basis	182 (30.03)
	Monthly basis	32 (5.28)
	I don't leave my house at all	6 (0.99)
Q8. Choose what you currently carry whenever you leave your house - select all applicable	Face mask	598 (98.68)
	Hand gloves	30 (4.95)
	Sanitizer	410 (67.66)
	Wet Wipes	119 (19.64)
Q9. Do you maintain social distancing outside your house?	Yes	414 (68.32)
	No	10 (1.65)
	Sometimes	182 (30.03)
Q10. Do you maintain face mask covering both nose and mouth at all time?	Yes	538 (88.78)
	No	9 (1.49)
	Sometimes	59 (9.74)
Q11. Do you take any precautionary measurements inside your house?	Yes	136 (22.44)
	No	290 (47.85)
	Sometimes	180 (29.70)
Q12. I don't wear a mask when I meet friends or family who don't live at the same house with me	True	349 (57.59)
	False	90 (14.85)
	Sometimes	167 (27.56)
Q13. I downloaded all mobile applications launched by the Ministry of Health in regards to COVID-19 precautions	Yes	504 (83.17)
	No	102 (16.83)
Q14. I'm now willing to take COVID-19 vaccine	True	552 (91.09)
	False	54 (8.91)
Q15. In case you chose "False" as your answer to the previous question, please mention your reasons		48 (7.92)*

*out of the 54 participants who answered the question of "I'm now willing to take COVID-19 vaccine" with "False", 48 participants answered the question of "In case you chose "False" as your answer to the previous question, please mention your reasons" which showed a compliance rate of 88.89%. Answers included (but not only) the following; "Lies", "not comfortable with taking the vaccine", "fearing the long term side effects which have not been clinically proven", "Pregnant and I fear the side effects", "I implement precautionary measurements" and "Because it is not mandatory".

In response to precautionary measurements imposed to minimize viral spread, participants were asked to self-report behavior (Table 4). In Q8 we asked participants on what they carry when they leave their house. Other positive practices including using a hand sanitizer and wet wipes were found among 67.66% and 19.64% respectively. In Q11 (Do you take any precautionary measurements inside your house?) 47.85% of the participants do not take any forms of precautionary measurements inside their houses and a percentage of 52.14% either constantly or occasionally take certain preventive measurements. Results were 57.59%, 14.85%, and 27.56% to Q12 choices respectively. In Q13, a response rate of 83.17% downloaded every application launched by the Ministry of Health during the COVID-19

pandemic and 16.83% either downloaded some of these applications or have not downloaded any application at all. Finally, Q14 and Q15 assessed the respondents' attitude towards the vaccine where of 91.09% of respondents stated that they are willing now to take the vaccine and only 8.91% stating otherwise.

Figure 2. Relationship between knowledge- and practice-based questions.



In Table 5 the results are expressed and a comparison of the total attitude score according to the different demographic characteristics is included. Total attitude score was significantly higher in females versus males ($P < 0.0001$), in students with age groups ≤ 20 years versus students with age groups ≥ 21 years ($P < 0.0001$), in students in other universities than students in KAU ($P = 0.003$).

After controlling confounding factors in multiple-linear regression analyses, Table 6 displays the predictors of the knowledge and attitude assessment, and its three constructs (Age, Gender & University). Regarding the knowledge assessment, ($B = 0.1515$, 95% CI: 0.001, 0.017) were the Age predictors, ($B = 0.129$, 95% CI: -0.014, 0.077) were the Gender predictors, ($B = -0.021$, 95% CI: -0.014, 0.011) were the University predictors. Regarding the attitude assessment, ($B = -0.040$, 95% CI: -0.134, -0.024) were the Age predictors, ($B = -0.034$, 95% CI: -0.169, -0.172) were the Gender predictors, ($B = 0.001$, 95% CI: -0.065, 0.050) were the University predictors. Finally, regarding the knowledge and attitude assessment, ($B = 0.111$, 95% CI: -0.133, -0.007) were the Age predictors, ($B = 0.094$, 95% CI: -0.183, -0.095) were the Gender predictors, ($B = 0.020$, 95% CI: -0.079, 0.062) were the University predictors.

Table 5. Comparison of total attitude score according to different demographic characteristics. Data were expressed as mean \pm standard deviation. Significance was made using Mann Whitney test as data are not normally distributed.

Characteristics	Total attitude score	Significance
Gender		$P < 0.0001$
Female (n=295)	3.37 \pm 1.92	
Male (n=311)	2.73 \pm 1.94	
Age group		$P < 0.0001$
≤ 20 years (n=274)	3.39 \pm 1.88	
≥ 21 years (n=322)	2.75 \pm 1.96	
King Abdulaziz University (KAU) and other universities' respondents		$P = 0.003$
KAU (n=342)	2.86 \pm 1.95	
Other universities (n=264)	3.27 \pm 1.94	
King Abdulaziz University (KAU) and King Saud bin Abdulaziz University for Health Sciences (KSAUH) respondents		$P = 0.081$
KAU (n=342)	2.86 \pm 1.95	
KSAUH (n=104)	3.18 \pm 1.99	
University of Jeddah (UJ) and King Saud bin Abdulaziz University for Health Sciences (KSAUH) respondents		$P = 0.321$
UJ (n=119)	3.47 \pm 1.84	
KSAUHS (n=104)	3.18 \pm 1.99	
Respondents who attended any educational courses on COVID-19?		$P = 0.581$
No (n=401)	3.04 \pm 1.89	
Yes (n=205)	3.04 \pm 2.07	

Table 6. Responses to questions assessing the knowledge and attitude assessment of Jeddah college students towards precautionary measurements in the COVID-19 pandemic.

Construct	Knowledge assessment		Attitude assessment		Total knowledge and attitude assessment	
	B (significance)	95% CI	B (significance)	95% CI	B (significance)	95% CI
Age	0.1515 (P=0.219)	0.001-0.017	-0.040 (P=0.428)	-0.134- -0.024	0.111 (P=0.647)	-0.133- -0.007
Gender	0.129 (P=0.268)	-0.014-0.077	-0.034 (P=0.163)	-0.169- -0.172	0.094 (P=0.431)	-0.183- -0.095
University (KAU and others)	-0.021 (P=0.244)	-0.014-0.011	0.001 (P=0.459)	-0.065-0.050	0.020 (P=0.704)	-0.079-0.062

Discussion

Saudi Arabia is the second largest country in the Arab world with a population exceeding 34 million and with a majority of people between 15-64 years. Casting a shadow over the college student's knowledge and attitude in the middle of this pandemic is essential to understand the social and community course and behavior of this pandemic. Saudi Arabia as a country has taken multiple restrictive measurements which included travel ban to China (11), mandatory social distancing, face masking and multiple precautions based on the available knowledge. This study which was the first study to assess the knowledge and practice of college students in Jeddah revealed curious findings. In Q2, the question and choices were based on the WHO guidelines and recommendations in the pandemic and multiple other esteemed health institutions worldwide including Harvard Medical School recommendations. Choices included common recommendations for maintaining a distance of at least six feet between an individual and others alongside other preventive measures (12). In the same question, a percentage of (23.27%) had the misconception that using antipyretic to control fever is part of WHO guidelines. Although this might be true in some cases and some physicians might advise patients to self-medicate for COVID-19 fever in this approach; this is not a recommendation in the WHO guidelines and there isn't any current evidence which supports routine antipyretic administration to treat fever in acute respiratory infections and COVID-19 (13). One intriguing finding was in respect to Q3 where 96.20% of responders showed positive knowledge that fever is a common symptom of COVID-19 but this percentage dropped to 79.04% for cough and 46.20% for fatigue meaning there is a partial lack of clear knowledge of the symptoms for SARS-CoV2 infections for about 17.16% and 50% of respondents. In Q4, 205 respondents resembling a total percentage of 33.83% took an educational course on COVID-19 in contrast to the other 401 respondents who constituted a majority of 66.17%. When linking this finding to Q6 where we asked if participants knew what to do when acquiring a symptom of COVID-19; 592 respondents (97.69%) claim that they knew what to do while 66.17% of respondents never took any educational courses. This linkage suggests that with the increasing trend of COVID-19 campaign especially on social media platforms and private gatherings; many misunderstood concepts might be acquired and used as scientific knowledge. This finding is enhanced by [Al-Hanawi et al, 2020] (14) results where a question regarding the participants' sources of knowledge signify that most students sought and received their knowledge from social media rather than newspaper or television. When linking Q4 with Q5 where 95.21% of Q5 responders believed that it is important to educate the public on COVID-19 but only 33.83% of respondents actually took an educational course. These findings suggest that respondents believe in the importance of spreading knowledge about COVID-19 but with a smaller portion of them actually taking the initiative to do so. This might suggest a lack of access to educational courses or

further social causes that requires further analysis and observation. This next section which includes questions from Q7-Q15 mainly aimed at assessing the individual behavior towards certain precautionary measurements focusing on social distancing, masks and hygiene, and other daily routine practices. Some of these practices were already discussed and linked to the knowledge. In Q8, we found that 4.95% wear hand gloves though they are not mandatory requirements in many guidelines as for face masks. This practice is even claimed that it gives a false sense of security where the virus might adhere to the gloves and eventually touch the face or phone. Consequently, hand gloves should be worn whenever instructed depending on your place and occupation. We further assessed different demographic characteristics based on their answers on questions from Q9-Q14 which assessed the population adherence to maintaining social distancing outside their houses. We also assessed their adherence to face covering outside their house which has proven to be one of the most protective approaches to decrease the spread of the respiratory transmitted disease. This question is important since we specifically asked about covering both the nose and mouth where we can notice a large portion of people wearing mask only covering one of those two organs. Another question directly asked if they maintain any precautionary measurements inside their houses since it was one of the major risk factors for spreading the disease in Saudi Arabia. We requested participants to directly answer if they wear a mask or otherwise when meeting a friend or a family member who does not live in the same house as them, hence they are not fully aware of the other person's behavior and how well they maintain precautionary measurements with strangers and in the public space. Since we targeted a younger population with higher chances of using smartphones and social media we asked if they have downloaded the mobile applications created by the Ministry of Health as part of their efforts to control the spread of the disease. This gives a hint of the practice of the population even for non-compulsory measurements such as downloading these apps. Finally we included a question which directly asked about their willingness to take the vaccine. These combined questions are collectively required to maximize our outcomes in controlling this disease. This is consistent with the WHO recommendation labeled "Do it all!" (15) which recommended that mask wearing should be part of a wider and more comprehensive approach which includes physical distancing, avoiding crowds, closed and close-contact settings, good ventilation, cleaning hands, covering sneezes and coughs, and more. In the Saudi government's efforts to maintain the spread of the disease and control the pandemic, the Saudi Ministry of Health launched a series of initiatives and public procedures including the use of modern technologies and phone applications for various reasons (e.g. case detection, health status, vaccine and PCR appointments and etc...). In Q8, the attitude of 98.68% showed a high commitment level to public instructions and carrying a face mask whenever they leave their houses. This shows a positive correlation not only with local public instructions but with esteemed international health organizations and institutions which

recommend mask wearing to reduce the spread of COVID-19. In Q12, results were 57.59%, 14.85%, and 27.56% respectively which suggested that half of the sample population do not take a simple yet effective procedure of mask wearing with people that they do not know who they meet and how far did they implement preventive measurements on themselves. In Q13 we assessed the sample's attitude towards these applications and asked if they had downloaded every mobile application launched by the Ministry of Health during the COVID-19 pandemic. A high response rate (83.17%) showed compliance to downloading every application launched by the Ministry of Health during the COVID-19 pandemic and a smaller fraction (16.83%) either downloaded some of these applications or have not downloaded any application at all. In the last two questions which addressed the participants' tendency towards receiving the vaccine, around 91.09% were positive to do so with 8.91% stating otherwise. We followed up with the 8.91% to inquire about their reasons in Q15 and received a response rate of 88.89% (among the 8.91%) stating different reasons. When conducting the association analysis it was found based on the P-value there was a very significant relationship among male and female participants when assessing their attitude to questions Q9-Q14. The relationship was also significant between the age group of 20 years old and younger and 21 years old and older participants as well as when comparing participants enrolled at King Abdulaziz University with students from the other universities and colleges (Figure 3). In the last question within the questionnaire, it was found that around 91.09% of the targeted population were willing to take the COVID-19 vaccine. In contrast to [Alduwayghiri and Khan, 2021] (16) findings where in regards to the acceptance and attitude of the 31-45 year old population, concluded a negative attitude towards receiving the vaccinations, mostly due to the participants' fear of the vaccine's side effects making it the most chosen reason to reject being vaccinated. This comparison reveals that a younger population (university/college) might have a more positive response towards vaccination. This finding can be strongly supported by the findings of [Almalki et al, 2021] (17) research where he assessed the acceptability of the COVID-19 vaccine and its determinants among university students in Saudi Arabia and it was concluded that 90.4% of participants who were not vaccinated stated they would receive the vaccine. More than three-quarters of the participants declared their trust in the COVID-19 vaccines used in Saudi Arabia. The primary factor for the participants' trust in the COVID-19 vaccine used in Saudi Arabia was their confidence in the government and the healthcare system. However, upon comparing the results with a similar population in a different country, we find an overall low intent to get COVID-19 vaccines (34.9%) by university students in Jordan as investigated by [Sallam et al, 2021] (18). In the same study, it was found that college students enrolled in health faculties tended to have a higher acceptance rate (43.5%) compared to their peers in Scientific or Humanities Schools (23.6%). This can be related to their higher knowledge about the disease (19). Finally, when conducting a multiple-linear regression analysis

(Table 6) to display the predictors of the knowledge and attitude assessment and its three constructs, a statistical significant outcome was undetected. This can be explained by the similar level of knowledge and attitude across the sample population (college students) regardless of their age, gender or enrolled university. However, this can also be explained by the positive approach in which the local authorities have taken by making public instruction (attitude) and information (knowledge) accessible to the entire population regardless of the different sociodemographic variables. This finding, disregarding that it lacks significance statistically, when interpreted, can be reassuring that the included sample obtained a decent level of knowledge and a compliance towards the precautionary measurements.

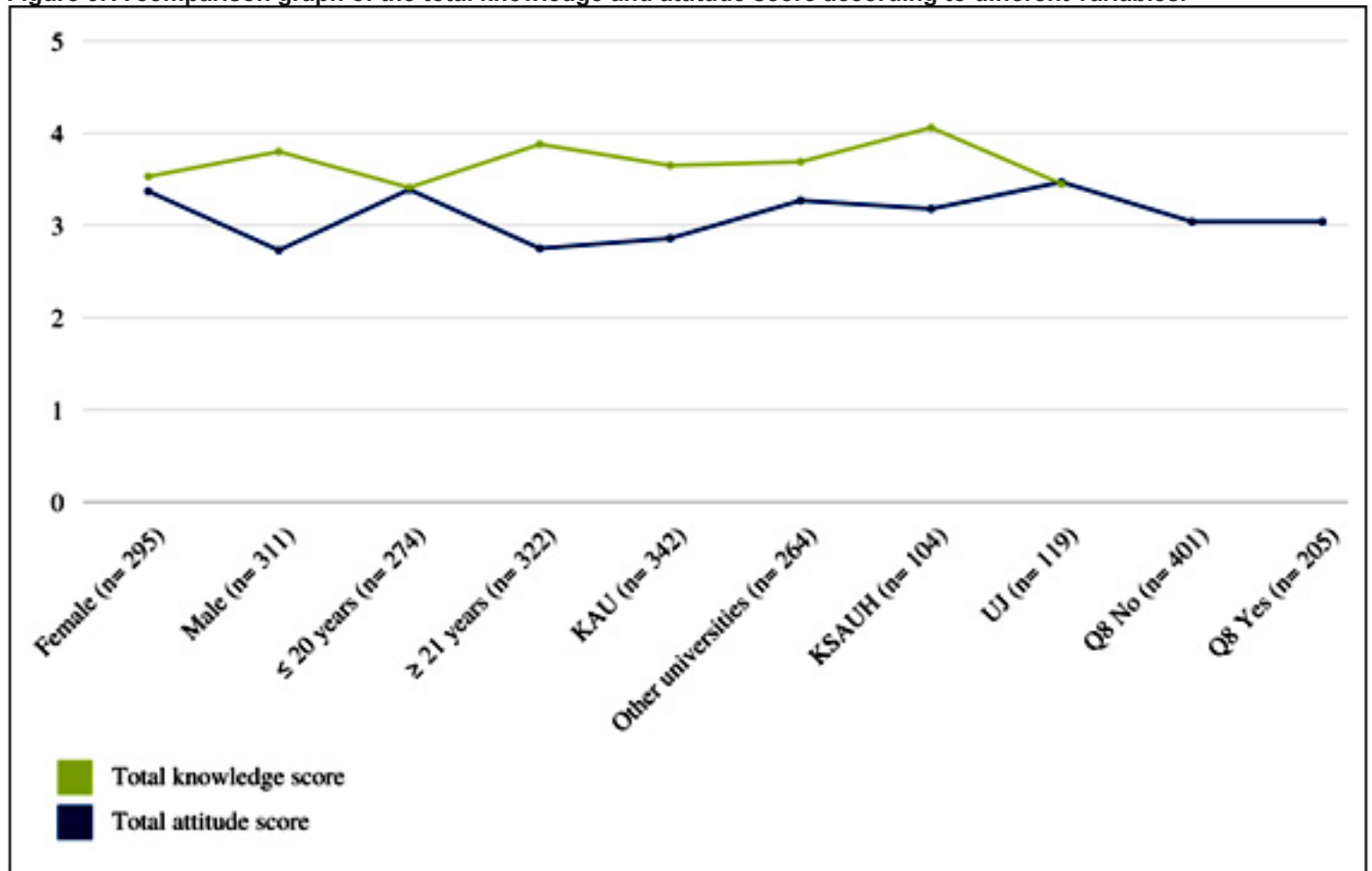
Limitations of this study:

Despite the fact that the sample was drawn from all of the city's main colleges, sample sizes at each differed, which might be a drawback of the current study. Furthermore, because the study solely focuses on general public knowledge in the early days of the pandemic (June 2021), it may not be generalizable outside the specific demographic and scope of the current study. Furthermore, maintaining good hand hygiene is a socially acceptable habit. As a result, in a self-reported research, respondents may over-report hand-washing routines, resulting in exaggerated results. Non-obtrusive monitoring studies may produce more impartial data and provide a more accurate portrayal of actual participant behavior. However, in the midst of the epidemic, such a method of data collecting proved to be ill-advised. With a greater grasp of the disease, more in-depth knowledge assessment and analysis is necessary.

Conclusion

In this study, although the findings were encouraging in terms of college student's knowledge and attitude towards the COVID-19 pandemic, however, periodic and sufficient training to effectively cope with such diseases in the future is required based on the lessons obtained from the previous approaches. Social media has proven to be a main source for a majority of college students and the younger generation when it comes to obtaining information and knowledge, and hence, efforts to increase community awareness about the pandemic will be more effective if social media platforms are incorporated into the strategy for distributing information and educating the public. Furthermore, in this research we managed to demonstrate a strong association between male and female attitudes and practices during the pandemic as well as in different age groups and in students attending different universities and colleges. The association found that college students have a favorable attitude toward precautionary measures and vaccinations. This is likely owing to the fact that university students are a more educated and higher awareness group of the society, with a more positive attitude. As a result, students may play a key role in fostering a positive public sphere. The outcomes of this study will aid researchers and government agencies

Figure 3. A comparison graph of the total knowledge and attitude score according to different variables.



in comprehending the existing scenario, particularly since Saudi colleges seek to implement in-person education beginning in 2022. During the prior period of the pandemic, almost all educational institutions used remote education, which later evolved into a hybrid approach of online/in-person attendance. This study will also bridge the current gap in local literature related to the COVID-19 vaccine's acceptance among university students.

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Ethical approval:

Ethical approval for the study protocol, questions and consent statement was granted by the Faculty of Medicine Ethics Committee at King Abdulaziz University with the reference number (317-21). Individuals willing to participate in this survey and consent to use the data provided for research purposes were needed to click the "Yes" button and only then would be directed to the questionnaire. This research was also registered at the Public Health Authority, Public Health Analytics and Research with registration number (202106171)

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