Original Article

Assessment Of The Knowledge, Attitude And Preventive Measures Of Medical Students Towards COVID-19

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Abstract

Introduction: Ever since COVID-19 became a pandemic much responsibility has been put on healthcare providers, and since medical students are future healthcare workers, it is necessary to study their response and perceptions on the current pandemic. This study's objective is to evaluate the knowledge, attitude, and preventive practices (KAP) of medical students in King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) Riyadh branch towards COVID-19.

Methods: This cross-sectional study was conducted from 26th of August 2021 to 15th of February 2022 using an online questionnaire. The questionnaire was composed of 34 questions: 7 on demographics, 13 on knowledge about COVID-19, 5 on attitude towards COVID-19, and 9 on preventive behaviors against COVID-19. This study included all undergraduate medical students of KSAU-HS, Riyadh branch. The sample size was calculated to be 370.

Results: In this study, the 378 participants who responded were mostly males (51.06%), and more than half (56.51%) were in their basic years. The percentage of stream I students was 89.95%. The average correct response rate of knowledge questions was 81.40%. Most of the participants adopted positive behaviors over the course of the pandemic. In addition, 55.29% had high adherence to precautionary practices. When comparing the variables, clinical year students had higher knowledge, but basic year students had better preventive measures. Furthermore, stream II students exhibited better knowledge.

Conclusion: Overall, medical students had excellent knowledge levels, adequate positive attitude, and high adherence to preventive measures. Although clinical year students showed high knowledge their lower performance in preventive behaviors should be investigated.

Keywords: COVID-19; Knowledge; Attitude; Preventive measures; Medical students

Introduction

The awareness of a disease is invariably important in assessing the public's perception and the effectiveness of awareness campaigns provided by the community. Without the dissemination of proper information, the public will rely on other unofficial sources which promote false information, leading to worse outcomes. The employment of awareness campaigns along with the compliance of the public with the preventive measures, should limit the contagion of any infectious agent. Furthermore, exploring the public's attitude and perception on disease outbreaks is invaluable to measure awareness of the right protocols to apply and to determine the possible negative behaviors caused by false

information [1]. In today's context, the novel COVID-19 displayed the lack of preparedness of many countries in facing this pandemic possibly due to the lack of knowledge of what preventive measures should be applied.

On January 2020, COVID-19 epidemic has been declared as a public health emergency of international concern, according to World Health Organization (WHO). COVID-19 or Coronavirus Disease is a respiratory syndrome caused by an agent named SARS-CoV-2. The etiological agent is a member of coronavirus family which is known to be enterically and respiratory pathological [2]. Bats are suggested to be the natural host of SARS-CoV-2 which has transmitted to humans by an unknown intermediate host [3]. Unlike SARS-CoV and MERS-CoV, SARS-CoV-2 can spread among communities very rapidly but fortunately with mild severity in most cases [4]. The clinical manifestation of COVID-19 varies between different patients. Patients with mild infection may present with flu-like symptoms, such as cough, fever, and shortness of breath or may be asymptomatic. Others show pneumonia, hypoxemia, and acute respiratory distress syndrome (ARDS) in moderate to severe cases [2,4]. According to WHO, there have been more than 410 million confirmed cases and 5 million deaths reported by Feb 2022 [11].

In Saudi Arabia, a study was conducted between 3 March and 7 June 2020, the total number of confirmed cases with COVID-19 increased from one to 101,914, showing an average of 1039 new cases per day. Although there was an increase in daily cases, it had stabilized after two months after the beginning of the pandemic showing a recovery rate of 71.4%. Compared to other demographic groups, COVID-19 cases were more frequent among adults, and males were more affected than females [5]. Ever since the beginning of Covid-19 in Saudi Arabia, awareness campaigns have been initiated by Ministry of Health (MOH) in order to inform the general public about the means of transmission and the importance of curfew. MOH has also implemented firm measures to control the spread of the virus, including regulating outdoor activities, suspending schools, and reducing social interactions. However, it seemed that the more immediate need at this point was to understand the mode of transmission amongst humans. In order to limit the pandemic spread, more focus on public awareness needs to be implemented [6].

Besides vaccination or treatment against COVID-19, one way to control the infection from spreading among the community is to increase the general perception and enhance the public attitude [7]. To measure awareness, several studies were conducted towards public awareness and perception in the COVID-19 pandemic. One of these studies was conducted in Egypt that resulted in good overall knowledge and positive behavior among Egyptians. The majority of participants relied on social media platforms for acquiring knowledge, which may lead to misinformation. Three-quarters of participants were assured of the mask benefits, however; only 35% were willing to use it as a protective precaution. On the other hand, most of participants were willing to stay at home if they contacted a confirmed case to prevent further spread [7]. In a study conducted in Riyadh, the majority of participants had high overall knowledge about the infectious disease and its mode of transmission and the symptoms related to COVID-19. Regarding their attitude, about 90% of participants encouraged behaviors that promoted hindrance concerning COVID-19 spread. In brief, the study displayed a high level of awareness and positive attitude among Riyadh citizens [6]. Despite the numerous studies aimed at the public, only a few were towards medical students. The fact that today's medical students will be the future providers of health care, therefore justifies the necessity to evaluate student's general perception, knowledge, and attitude in regards the current pandemic [8]. A study conducted in Jordan showed more than 80% of medical students in Jordan followed the public health guidelines in controlling the spread of COVID-19. This reflects the high level of awareness expected of medical students [1].

Due to importance of assessing medical students' behavior during the global situation in Saudi Arabia, the study aims to assess the knowledge, attitude, and preventive measures (KAP) of medical students in King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) Riyadh branch towards COVID-19 pandemic.

Material and Methods

This cross-sectional study was conducted on medical students in KSAU-HS to assess the knowledge, attitude, and preventive measures of medical students towards the COVID-19 pandemic. KSAU-HS is a governmental university specialized in health sciences. KSAU-HS is accredited by the Ministry of Education in the Kingdom of Saudi Arabia for its various programs for undergraduate and postgraduate degrees. The main goal of the university is to provide high quality educational services by attracting the best students.

The target population was those who are undergraduate medical students from KSAU-HS and only from Riyadh branch. Based on an estimated population of 1000, population proportion of 50%, 5% margin of error, a confidence level of 95%, the sample size was determined to be 370. Convenient-sampling technique was used for collecting the sample.

This study was conducted using an online questionnaire, which was obtained from two pre-validated questionnaires [10,12], in the English language from 26th of August 2021 to 15th of February 2022. The sample includes all undergraduate male and female medical students of King Saud bin Abdulaziz University for Health Sciences Riyadh branch. To be specific, the sample included medical students from batches 14,15,16, 17, 18, and 19. Approval of the Institutional Review Board (IRB) from King Abdullah International Medical Research Center (KAIMRC) IRB SP21R/248/08.

Measures

The questionnaire comprised of four elements which includes, demographic data, multiple choice questions on knowledge, five statements to assess their attitude, and preventive measures statements about COVID-19.

Demographics

The first part of the questionnaire was about the student's demographic characteristics such as gender, age, batch, stream, college year, GPA, and student level. Stream defines if the student holds a bachelor's degree. Stream I are students currently studying for their bachelors, and stream II are students that already have their bachelors related to science, applied medical sciences, pharmacy and are currently undergoing bachelor's degree in medicine. Regarding student level, students are divided into three groups based on their year of study in Medicine: Pre-med students (1st year), Basic year students (2nd – 3rd years), and Clinical year students (4th –5th years).

Knowledge of COVID-19

Based on previous study [10], the degree of knowledge about COVID such as causes, signs and symptoms, mode of transmission, prevention, and management was assessed using 13 questions of which a total of 26 points can be gained. The participant had an option to answer "True, False or Don't Know. The correct answer was recorded as 2. The incorrect answer is 0. An answer with "Don't Know" was recorded as 1. The total score was converted into a percentile. A score of <50% (<13Pts) was labeled as low, 50%-75% (13-19Pts) as average and >75% (>19Pts) as excellent.

Attitude of COVID-19

To assess the attitude of participants toward COVID 19, Five Point-Likert scale (strongly agree=5 to strongly disagree=1) statements obtained from a previous study were used [10]. The total score ranges from 5 to 25. The students were then put into groups depending on their score. Scores between 1 to 11 were labeled as negative attitude, 12 and 18 as neutral attitude, and 19 to 25 as Positive attitude.

Preventive Measures of COVID-19

Researchers utilized a questionnaire used by previous study to help evaluating students' practices [12]. A number of 9 closed-ended (Yes or No) items were asked to assess the students' preventive measures about COVID 19. Out of the nine items, there were five items were about reducing the use of public places in daily life, one item about preventive behavior during coughing, two items about intensive hand washing and surface disinfection and the last item about talking with people nearby about prevention. Participants were assigned one point for each item if they answered "Yes" and 0 points if they answered "No". The total score ranged from 0 to 9; 0 to 6 was designated as low performance and 7 to 9 as High performance.

Data analysis

Researchers utilized the statistical program SAS (version 9.4) to analyze data. Researchers used Chi-square test for association between categorical variables when appropriate and Wilcoxon Two-sample test as well as Kruskal-Wallis test for continuous variables. For categorical variables, data was presented as frequency and percentage. For

continuous variables, data was presented as (n, mean, standard deviation). The p-value < 0.05 were considered statistically significant for all tests applied

Results

A total number of 378 students responded to the questionnaire. The mean age of the participants was 20.86. Of the participants, 51.06% were males, while 48.94% were females. Based on the student level, 30.69% were in their Pre-med years, 56.61% were in their basic years, and only 12.7% were in their clinical years. The distribution of students based on college year is shown in **Table 1.** Stream I students made up the majority of the participants (89.95%), while stream II students (holders of bachelor's degree in other scientific fields) were only 10.05%.

Table 1. Major Demographic Variables and their associate statistics

Variables	Characteristics	Number	Percentage
Gender	Male	193	51.06
	Female	185	48.94
Stream	I	340	89.95
	II	38	10.05
Student Level	Pre-Med	116	30.69
	Basic	214	56.61
	Clinical	48	12.70
College Year	2	115	30.42
	3	72	19.05
	4	144	38.10
	5	28	7.41
	6	19	5.03

As shown in **table 2,** the average correct answers regarding COVID-19 knowledge-related questions were 81.40% and 5.37% for the don't know answers. The highest correct response rate (96.83%) pertained to the question **'Which of the following best describes characteristics of COVID-19?'**, while the lowest (48.41%) pertained to the question **'A suspected case can only be ruled out'.** Overall, 86.5% of the participants achieved an excellent score, 9.52% an average score, and 3.97% a low score.

Table 2. COVID-19 Knowledge-related Statistics

Questions	Incorrect	Correct	Don't Know
The source of COVID-19 infection is?	65 (17.20%)	269 (71.16%)	44 (11.64%)
Transmission mainly occurs through?	27 (7.14%)	349 (92.33%)	2 (0.53%)
Who are generally susceptible to infection?	153 (40.48%)	219 (57.94%)	6 (1.59%)
Which of the following best describes characteristics of COVID-19?	9 (2.38%)	366 (96.83%)	3 (0.79%)
What are the best ways to prevent infection of COVID-19?	13 (3.44%)	359 (94.97%)	6 (1.59%)
Which of the following can spread the infection?	19 (5.03%)	353 (93.39%)	6 (1.59%)
Which of the following is the correct incubation time of the disease?	27 (7.14%)	333 (88.10%)	18 (4.76%)
Which of the following are the main symptoms of COVID-19?	17 (4.50%)	354 (93.65%)	7 (1.85%)
What best describe the prognosis of patients of COVID-19?	19 (5.03%)	345 (91.27%)	14 (3.70%)
A suspected case can only be ruled out:	157 (41.53%)	183 (48.41%)	38 (10.05%)
How should Suspected and confirmed patients be treated by?	15 (3.97%)	357 (94.44%)	6 (1.59%)
If patient develops fever during the outbreak, which of the following is the best choice?	53 (14.02%)	301 (79.63%)	24 (6.35%)
Which of the following can inactivate the COVID-19 virus?	76 (20.11%)	212 (56.08%)	90 (23.81%)
Total	13.23%	81.40%	5.37%

On average, 61% had a positive attitude (strongly agree and agree) during the COVID-19 pandemic. Furthermore, 37.30% had a neutral attitude, while only 1.32% had a negative attitude (disagree and strongly disagree). In this section, answering with "Strongly agree" and "agree" will be considered positive attitude. The average statements with positive attitudes is 64.4%. The highest positive attitude (87.83%) was related to the statement **"I am willing to cooperate with the relevant departments to take prevention and control measures"**, whereas the lowest

positive attitude (51.86%) was from the statement **"It is believed that the outbreak will soon be contained"** Further information is listed in **table 3**

Table 3. COVID-19 Attitude-related Items and their Statistics

Items	Strongly Agree (%)	Agree (%)	Not sure (%)	Disagree (%)	Strongly Disagree (%)
I pay close attention to the development of the epidemic situation	78 (20.63)	119 (31.48)	108 (28.57)	55 (14.55)	18 (4.76)
I think I am playing an important role in controlling the epidemic	103 (27.25)	106 (28.04)	100 (26.46)	43 (11.38)	26 (6.88)
I fear infection for myself and my family	188 (49.74)	95 (25.13)	57 (15.08)	24 (6.35)	14 (3.70)
It is believed that the outbreak will soon be contained	98 (25.93)	98 (25.93)	121 (32.01)	44 (11.64)	17 (4.50)
I am willing to cooperate with the relevant departments to take prevention and control measures	246 (65.08)	86 (22.75)	36 (9.52)	7 (1.85)	3 (0.79)
Total	37.73%	26.67%	22.33%	9.15%	4.13%
Items	**Strongly Agree (%)**	**Agree (%)**	**Not sure (%)**	**Disagree (%)**	**Strongly Disagree (%)**
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I think I am playing an important role in controlling the epidemic	103 (27.25)	106 (28.04)	100 (26.46)	43 (11.38)	26 (6.88)
I fear infection for myself and my family	188 (49.74)	95 (25.13)	57 (15.08)	24 (6.35)	14 (3.70)
It is believed that the outbreak will soon be contained	98 (25.93)	98 (25.93)	121 (32.01)	44 (11.64)	17 (4.50)
I am willing to cooperate with the relevant departments to take prevention and control measures	246 (65.08)	86 (22.75)	36 (9.52)	7 (1.85)	3 (0.79)
Total	37.73%	26.67%	22.33%	9.15%	4.13%

Regarding preventive behaviors, **table 4** shows that the average of statements answered 'Yes' is 79.84%. In addition, 55.29% of the participants had high performance, while the remaining 44.71% had low performance in preventive

behaviors. The lowest "Yes" answered statement (64.29%) pertained to 'I reduced the use of closed spaces, such as library, theatre and cinema'. On the contrary, the highest "Yes" answered (94.71%) pertained to the statement 'I avoided coughing around people as much as possible'.

Table 4. COVID-19 Preventive measures and their Statistics

Statements	Yes (%)
I cancelled or postponed meetings with friends, eating-out and sport events.	274 (65.34)
I reduced the use of public transportation.	296 (78.31)
I went shopping less frequently.	298 (78.84)
I reduced the use of closed spaces, such as library, theatre and cinema.	243 (64.29)
I avoided coughing around people as much as possible.	358 (94.71)
I avoided places where a large number of people gathered.	323 (85.45)
I increased the frequency of cleaning and disinfecting items that can be easily touched with hands (i.e. door handles and surfaces).	289 (76.46)
I washed the hands more often than usual.	330 (87.30)
I discussed, with my family and friends about COVID-19 preventions.	332 (87.83)
Total	79.84%

According to **Table 5,** when comparing male and female with **KAP**, there was no significant difference at level of $p<0.05$. However, there was a significant difference in the association of knowledge with student level and preventive measures at level of $p<0.05$. The mean score for knowledge is greatest among clinical year students (22.83) and least among pre-

med students (21.09). Students' knowledge levels are arranged in a descending order (Clinical years > Basic Years > Pre-Med Years). Regarding preventive measures, the highest mean score was achieved by basic year students (7.54), while pre-med students had the lowest mean score (6.71). The difference between the streams was significant in knowledge score at level of $p<0.05$. Generally, stream II students had a higher score (22.61).

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Table 5. Association of Knowledge, Attitude, and Preventive Measures with Major Demographics, using Mann-Whitney and Kruskal-Wallis Tests

Items		N (%)	Knowledge (Mean ± SD)	P-value	Attitude (Mean ± SD)	P-value	Preventive Measures (Mean ± SD)	P-Value
Gender	**Male**	193 (51.06)	21.53 ± 3.87	0.1966	19.05 ± 3.31	0.1869	6.95 ± 2.22	0.0888
	Female	185 (48.94)	22.21 ± 2.87		19.43 ± 3.31		7.43 ± 1.78	
Student Level	**Pre-Med Years**	116 (30.69)	21.09 ± 3.78	0.0015*	19.28 ± 3.03	0.9855	6.71 ± 2.15	0.0001*
	Basic Years	214 (56.61)	22.07 ± 3.30		19.21 ± 3.41		7.54 ± 1.90	
	Clinical Years	48 (12.70)	22.83 ± 2.71		19.23 ± 3.56		6.77 ± 2.02	
Stream	**I**	340 (89.95)	21.78 ± 3.40	0.0289*	19.20 ± 3.26	0.2928	7.14 ± 2.07	0.4505
	II	38 (10.05)	22.61 ± 3.65		19.55 ± 3.78		7.55 ± 1.57	

Number; SD, Standard Deviation; *Significant at level $p<0.05$
Mann-Whitney Test was used in analyzing 'Gender' and 'Stream' values
Kruskal-Wallis Test was used in analyzing 'Student level' values

Discussion

Since the emergence of COVID-19 and its transition into a pandemic state, there have been numerous studies focused on the general population conception and attitude towards this novel virus. Due to the nature of its transmissibility, the virus yields a substantial risk of spreading amongst communities. Healthcare workers (HCW), especially medical students, are even at a higher risk of contracting as well as transmitting the infectious agent. Because medical students are in contact with patients in healthcare facilities, it is necessary to assess their knowledge on the salient characteristics of the SARS-CoV-2 along with their attitude and preventive measures (KAP) adopted throughout the course of the pandemic.

Many studies were published globally, including Saudi Arabia, which investigated HCW's knowledge and behaviors regarding COVID-19. However, this study specifically targeted students at college of medicine from King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), Riyadh branch.

In this study, the results showed that most of the participants had a higher level of knowledge than that of similar studies [13, 14, 15, 16], but a lower level of knowledge compared to a study conducted in Iran [9]. As expected, our findings indicated a higher level of knowledge compared to a previous study about MERS [17]. Further analysis illustrated that there is a significant difference between knowledge score and student level. Medical students from clinical years had the highest score compared to basic years which is similar to a previous study [15]. This finding can be explained by the fact that clinical year students are more experienced in Medicine, and they perform clinical rotations at the hospital. Of note, stream II exhibited a greater level of knowledge when compared to stream I students. This is easily attributed to their double major, most of whom had a previous bachelor's degree in science. The knowledge section presented a correct response rate of 81.40%. The question with the lowest correct answer rate was "A suspected case can only be ruled out". This is worth mentioning because it may reflect the lack of student attention to the guidelines. To overcome this issue, it is recommended to raise awareness campaigns that emphasize the importance of adherence to guidelines.

Regarding participants' attitude, this research demonstrated an acceptable positive attitude towards COVID-19, yet this is substantially lower than the findings of a study conducted on the public of China [10], and several other studies conducted on HCWs [18, 19, 20]. Only half of the medical students paid close attention to the course of the development of COVID-19. Likely because it has been more than two years since the first registered case of COVID-

19, we believe some medical students had lost their interest. Interestingly, more than half (55.29%) considered that they are playing an essential role in controlling the pandemic. To improve the rate, it is advised to educate medical students about their responsibilities as HCWs. Additionally, as it is not unusual of medical students, they displayed a high willingness to cooperate with the designated authorities to adopt prevention and control measures. Lastly, the majority of the students expressed concern about infection for themselves and their families which signifies the high level of knowledge they have related to the harmful health consequences of the agent. There is no significant difference between participants' variables and attitudes.

Concerning participants' preventive behaviors, more than half of the participants (55.29%) displayed high performance while the rest (44.71%) had low performance. When comparing our results, it was lower than previous studies [9, 14, 15]. The majority of participants answered "Yes" to the following statements 'I avoided coughing around people as much as possible' and 'I washed the hands more often the usual', 94.71% and 87.30% respectively. This is largely due to the level of knowledge medical students have regarding the nature of the virus and its contagion. Furthermore, the enormous number of people who adopted these statements "I avoided places where a large number of people gathered" and "I reduced the public transportation" is indicative of their awareness as well as the extensive endeavors of the Ministry of Health (MOH). Thanks to the MOH's intervention, the general awareness of preventive behaviors had been positively influenced, which contributed to limiting the spread of the virus. As a result, normal activities resumed early and cautiously. This is demonstrated by the fact that fewer of the participants canceled entertainment events and reduced visiting closed spaces compared to the rest of the preventive practices as shown in Table 4. According to our results, basic year students had better practices as opposed to clinical year students.

The study limitations can be summarized in several points. First of which, the data collection process started on August 2021, which was more than a year following the quarantine. Since then, the policies have changed, including guidelines and precautionary measures. Another limitation is the unequal distribution between clinical and preclinical students, mostly because clinical year students were difficult to contact with. The imbalance is also present amongst the two streams, and it is a byproduct of the low number of stream II students. Additionally, the data collected was from one faculty of one university in one of three branches. Therefore, the result cannot be representative.

In conclusion, clinical year students exhibited the highest level of knowledge, while basic year students showed the highest performance in precautionary practices. Stream II was higher in knowledge than stream I students. Overall, medical students from KSAU-HS displayed a high level of knowledge, a satisfactory positive attitude, and high performance in preventive measures.

Ethical Consideration

The research was approved by KAIMRC (King Abdullah International Medical Research Center). All the participants were given an informed consent form along with the questionnaire. They were informed that their participation in the study was voluntary, and they were free to withdraw anytime. No compensation or benefit were given to the participants. No information related to personal identification of the participants was taken. All the data collected was kept confidential and only the research team had access to it. Anonymity of the participants was kept throughout the study and afterwards in dissemination as well.

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