ORIGINAL RESEARCH

Evaluation of the Knowledge, Attitudes, and Resulting Behavior Changes in Response to COVID-19 Among Students at the College of Applied Medical Sciences (CAMS), Jazan University, Saudi Arabia

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Background: The emergence of COVID-19 posed a threat to millions of lives worldwide. The pandemic impacts extended to affect people's psychological well-being, resulting in significant behavioural change. This study was designed to assess the knowledge regarding COVID-19 precautions among the College of Applied Medical Science students at Jazan University and to evaluate the general, psychosocial, and behavioral changes due to COVID-19.

Methods: This is an observational study targeting 630 undergraduate students randomly selected during January 2020, using stratified random sampling. Data were collected using an online questionnaire. Linear regression models were used to evaluate the predictors of three outcome measures: knowledge, attitudes, and practice scores.

Results: Knowledge of COVID-19 revealed that the students with correct answers ranged from 48.9 to 95%. Furthermore, significant gender differences are found regarding shortness of breath, fatigue, persistent chest discomfort, headache, and malaise ($p < 0.05$). Knowledge scores differed significantly across gender and academic level ($p < 0.05$) and so does attitude scores ($p < 0.05$). No significant difference was observed between practice scores according to socio-demographic background ($p > 0.05$). The linear regression model showed that females had significantly higher knowledge, attitudes, and practice scores ($p < 0.05$) as well as those within the 21–23 age group and above ($p < 0.05$). Students residing in urban and semi-urban places had significantly higher scores for knowledge, attitudes, and practice ($p < 0.05$).

Conclusion: The results demonstrated moderate knowledge about COVID-19 among study participants, with significant differences between the responses of males and females and among the urban and rural populations. Outcomes suggest the need for interventions to bridge students' knowledge about COVID-19 and practice gaps. Students were concerned about basic life amenities and the inability to provide for their dear ones regarding behavioral changes.

Keywords: COVID-19, health and safety, public health

Introduction

The Coronavirus 2019 (COVID-19), a new unprecedented strain caused severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that was initially reported in Wuhan, China (December 2019), spread rapidly around the world. Many

patients started to develop pneumonia of unknown etiology.[1] COVID-19 effects the respiratory system, while the symptoms range from mild clinical manifestations to numerous fatal complications, including severe bilateral pneumonia, Acute Respiratory Distress Syndrome (ARDS), and septic shock, eventually resulting in multi-organ failure.[3,4] In March 2020, the WHO declared COVID-19 as a global pandemic.[5,6]

The WHO stressed awareness as a preventive measure to protect against COVID-19 to slow down the spread of COVID-19. Moreover, recent research suggested that practicing preventive measures at an individual level is an effective tool in halting the spread of infection.[7,8] Social distancing, staying at home, wearing a mask, were strictly enforced by the governments in many countries for the prevention of the epidemic.[9]

Huge efforts and research were conducted on the clinical manifestations, pathophysiology, diagnosis, and treatment of COVID-19. However, few research explained the behavioral changes and psychological impact among the affected population.[10–13] Several studies have been conducted in Saudi Arabia to assess the knowledge, attitude, and practices among various strata of the Saudi population and in different regions of KSA, but only few studies dealt with the issue of behavioral changes.[14,15]

In this context, we will establish evidence-based information to contribute at addressing this gap and establish a foundation for interventions. Additionally, this study intends to furnish baseline data by studying two major concepts: knowledge and attitudes that lead to specific behaviors (practices). Hence, the aim was to examine the impact of knowledge and attitudes on behavioral change, including the demographic characteristics of the study population. Subsequently, we employed two predictors of the predisposing constructs in the PRECEDE model[16] as an investigative step to represent factors that illustrate the behaviors of Jazan University students in this study towards the COVID-19. In addition, the PROCEED model generates objectives and criteria for evaluation. However, we have not restricted ourselves to a specific theory or a conceptual framework. Nevertheless, the conceptual plan is a simplified multi-disciplinary model that combines knowledge, attitudes, and behaviors to serve the purpose of the investigation.

The aim of our study was to assess the overall knowledge regarding COVID-19 precautions in a section of a young educated population and to understand the general, psychosocial, and behavioral changes in the young population with regard to the new way of life due to COVID-19.

Materials and Methods

Study Design, Population and Setting

Observational cross-sectional study was conducted among students at the College of Applied Medical Science, Jazan University. The main inclusion criteria were being regular students in the college and registered for the academic year 2019/2020, and age above 18 years. The College of Applied Medical Science has six programs: Medical Laboratory technology, Clinical Nutrition, Diagnostic Radiology, Physical Therapy, Respiratory therapy, and emergency medical services. Four programs had male and female students, except for respiratory therapy and emergency medical services programs, which only enrolled male students.

Sample Procedure

We used the equation of the cross-sectional survey, which is given by the following formula

$$n = \frac{Z^2 \pi (1-\pi)}{d^2}$$

The parameters of the formula including n: the initial sample size; π:is an anticipated population proportion. Z: is the standardized variable that corresponds to 95% confidence level; d: the desired marginal error. Since there is no estimate of the prevalence of knowledge/precautionary behavior among study participants at Jazan University, it is safer to set a prevalence of 50%. Based on the values $\pi = 0.5$, d, the desired marginal error = 0.04, and z = 1.96, the initial sample size will be 600 participants. The sample size was increased by 5% to account for non-response, providing a final sample size of 630 students. Stratified random sampling was used to select the study participants. The College was divided into six strata according to different specializations. Probability proportional-to-size sampling (PPS) was used to determine

the number of participants in different strata. In the final stage, systematic randomization was used to select the study units.

Data Collection and Study Tool

Data were collected using a web-based questionnaire. A survey link was distributed to the selected students. This self-administered questionnaire comprised four sections, with the first section collecting sociodemographic information, while the second section assessed COVID-19 related knowledge (n = 10), with the response (yes and no). The third section involved attitudes questions a Likert scale type question (n = 10). The final section contains the practice questions (n = 10) with the responses (never, sometimes and always). The Internal consistency of the three main domains of the questionnaire were as follows; Knowledge (Cronbach's alpha: 0.699), Attitude and Practice reliability (Cronbach's alpha= 0.837 and.0927), respectively.

Data Analysis

Data analysis was conducted using Statistical Package for the Social Sciences (SPSS version 24). The analysis involved descriptive and inferential statistics. Simple tabulation, frequencies, and chi-squared tests were used to test the association between different variables. A Shapiro–Wilk test of normality showed that the Knowledge, Attitude and Practice scores were not normally distributed ($p < 0.05$), so we used the quartiles and interquartile range to summarize the data. Kruskal–Wallis and Mann–Whitney U-tests were used to compare the groups. The students' knowledge, attitudes, and practices were quantified into scores. The total knowledge score was assessed by assigning a score of 10 to each correctly answered item. The same was applied for assessing students' practices, as correct practices were given a score of 10. The total score for attitudes was calculated by assigning 10 points to positive attitudes. Linear regression models were used to evaluate the predictors of three outcome measures: knowledge, attitudes, and practice scores. A p value less than 0.05 will be used to indicate statistically significant results.

Ethical Considerations

Ethical clearance was obtained from the Jazan Research Ethics Committee (reference number: REC42/1/024). All study participants read, understood and signed the study consent. All information was kept confidential and not accessed except for scientific research purposes. Helsinki declaration and Saudi Bioethics were the Ethical guidelines for this study.

Results

The KAPs scores according to sociodemographic characteristics were calculated for the students of College of Applied Medical Sciences, Jazan University and Jazan, as shown in Table 1. The total number of respondents was 54% male and 46% female, with significant differences in their KAP score. The majority of participants were 21–23 years of age. The students were from academic levels 3 to 8 (18 to 24 years old), although most respondents were from level 4. Around (41.6%) of the respondents lived in semi-urban villages within the Jizan region, which consists of a group of small semi-urban villages. Most respondents were unmarried (90.7%), and most lived with their families (91.8%). Knowledge scores differed significantly according to sex and academic level ($p < 0.05$). Additionally, there were significant differences according to attitude scores and academic level ($p < 0.05$). No significant difference was found between practice scores according to different socio-demographic backgrounds ($p > 0.05$ for all).

Furthermore, the questionnaire involved information regarding the students' knowledge regarding COVID-19 symptoms (Table 2). The general knowledge of COVID-19 showed that the proportion of students with correct answers ranged from 43.3 to 95%. There was no significant difference between males and females, except for views on the treatment of coronavirus from home remedies ($p < 0.05$). 85.8 Of the males were in favor of home remedies, whereas 65.9% of females were believed to be home remedies (Table 2).

The respondents' attitudes towards being infected with COVID-19 are also assessed in Table 3. Some answers to the questions, such as what they would do if they think that they had symptoms of the coronavirus, had significant differences between males and females in their following responses: See Table 3.

Table 1 Distribution of KAP Scores According to Some Selected Socio-Demographic Characteristics (N=546)

Variables	N	%	Knowledge Score			Attitude Score			Practice Score		
			Median	IQR (Q1–Q3)	p-value*	Median	IQR (Q1–Q3)	p-value*	Median	IQR (Q1–Q3)	p-value*
Gender					<0.001			0.193[#]			0.263[#]
Male	295	54.0	80	70–90		65	50–90		80	70–90	
Female	251	46.0	90	80–90		75	55–90		80	70–90	
Age Groups					0.087			0.039			0.209
18–20 years	160	29.3	90	80–90		70	50–90		80	70–100	
21–23 years	322	59.0	80	80–90		70	50–85		80	70–90	
Over 23 years	64	11.7	80	80–90		85	65–100		80	70–90	
Academic Level					0.008			0.042			0.147
1st	5	0.9	95	90–100		85	70–95		95	90–100	
2nd	2	0.4	75	60–90		8	5–10		70	60–80	
3rd	78	14.4	90	80–100		70	50–90		90	80–90	
4th	110	20.3	80	70–90		60	45–90		80	70–90	
5th	68	12.5	80	70–80		65	55–85		80	70–90	
6th	102	18.8	90	80–90		78	55–90		80	70–90	
7th	81	14.9	80	80–90		75	50–85		80	70–90	
8th	96	17.7	80	80–90		75	55–95		80	70–90	
Residence					0.083			0.195			0.442
Rural	151	27.7	80	80–90		75	55–90		80	70–90	
Semi-Urban	221	40.6	80	80–90		65	50–85		80	70–90	
Urban	173	31.7	80	70–90		75	55–90		80	70–90	
Marital Status					0.099[#]			0.091[#]			0.106[#]
Single	495	90.7	80	80–90		70	50–90		80	70–90	
Married	51	9.3	80	80–90		85	53–100		90	75–100	
Mode of Living					0.284[#]			0.292[#]			0.552[#]
With family	501	91.8	80	80–90		70	50–90		80	70–90	
Student's housing	45	8.2	80	75–90		70	60–93		80	70–90	

Notes: *P-value based on Kruskal–Wallis. [#]P-value based on Mann–Whitney U.

Table 4 shows practice related to COVID-19 prevention among study participants. Large proportion always adhered to the good practice except for wearing gloves when going out of the home (42.3%) said never. With regards to not gathering with more than 5 people (45.4%) said sometimes. Table 4 demonstrates the percentage of people who never adhered to the practices related to COVID-19 prevention which showed majority of people did not prefer to wear gloves while going outside while only a very minority of people preferred to go outside without wearing a mask.

We assessed the extent of the issues faced by the respondents during the COVID-19 shutdown and social distancing (Table 5). There are significant differences between male and female participants in some issues, such as loss of income, loss of job, and inability to attend religious rituals or religious events. Unable to get enough food, medications, and

Table 2 General Knowledge About COVID-19 Among Study Participants (N=546)

Statement	Proportion with Correct Answers			p-value*
	Total N%	Male N%	Female N%	
Coronavirus began in China	517(95.6)	280(95.9)	237(95.2)	0.689
Pets can get and spread coronavirus	305(57.3)	158(55.4)	147(59.5)	0.343
Coronavirus can be cured with home remedies	409(76.6)	247(85.8)	162(65.9)	<0.001
Most people who get coronavirus will have relatively mild flu-like symptoms	378(70.3)	199(68.4)	179(72.5)	0.302
There is currently no cure for coronavirus	296(55.0)	155(53.3)	141(57.1)	0.375
Coronavirus was developed in a lab	258(48.9)	144(51.1)	114(46.3)	0.279
Most people infected by COVID-19 will die	332(62.3)	184(64.3)	148(59.9)	0.249
Hot weather help in reducing COVID-19 cases	229(43.3)	115(40.5)	114(46.5)	0.162

Note: *P value based on Chi Square test.

Table 3 Student's Attitudes Towards Being Infected with COVID-19

What Would You Do if You Think You Have Symptoms of the Coronavirus?	Proportion with Agree Answers			p-value*
	Total N%	Male N%	Female N%	
Stay at home, rest, and monitor symptoms	453(85.3)	232(80.8)	221(90.6)	0.002
Call a hotline for guidance	415(78.6)	228(79.4)	187(77.6)	0.606
Call a health care provider to get an appointment	473(89.8)	259(90.6)	214(88.8)	0.506
Go to the emergency room	247(48.1)	146(52.5)	101(43.0)	0.031
Find a coronavirus test	428(81.1)	243(84.4)	185(77.1)	0.033
Quarantine myself from other family members	525(98.1)	281(96.6)	244(100.0)	0.003
Stay away from work and public places	516(96.3)	279(95.9)	237(96.7)	0.601
Wear a face mask in the house	502(94.7)	274(94.5)	228(95.0)	0.791
Not share dishes, utensils, towels, or bedding with other members of the family	521(97.0)	279(95.9)	242(98.4)	0.090
Sleep alone	518(97.4)	281(97.6)	237(97.1)	0.753
Clean all high touch surfaces	386(73.5)	211(74.0)	175(72.9)	0.772

Note: *P value based on Chi Square test.

supplies in the house, difficulty in accessing the healthcare system, domestic violence, crowding in the house, and anxiety and stress of family members.

Table 6 shows Linear Regression Analysis of factors associated with knowledge, attitude, and practice scores among study participants. The result found that females were significant predictor of increased knowledge attitudes and practice scores (p < 0.05 for all). Those within age group of (21–23) years, and those over the age of 23 years are associated with higher knowledge, attitude, and practice scores (p < 0.05 for all). Also, students who reside in urban and semi-urban areas were also significant predictors associated with increased scores of knowledge attitudes and practice (p < 0.05 for all).

Table 4 Practices Related to COVID-19 Prevention Among Study Participants (N=546)

Statements	Never	Sometimes	Always
Washing hands for 20 seconds after touching possibly contaminated objects and surfaces	5.2	38.9	55.9
Avoiding public transport	11.3	25.9	62.8
Cleaning frequently touched surfaces at home and work	12.0	38.0	50.0
Avoiding physical contact with people (eg, no hugs and handshaking)	9.2	36.4	54.4
Cleaning frequently groceries and delivery with an alcohol-based cleaner	23.7	35.6	40.7
Avoiding events and meetings with a large number of people	11.7	35.5	52.8
Staying at home as much as possible	13.0	37.5	49.5
Wearing a mask when going out	5.6	11.1	83.3
Wearing gloves when out of the home	42.3	32.1	25.6
Not gathering with more than 5 people	19.1	45.4	35.5
Coughing and sneezing into sleeve	15.5	29.0	55.5
Avoiding people who are sick	6.3	16.4	77.3
Avoiding touching face (eyes, nose, mouth) with hands	6.3	16.4	77.3

Note: Figures indicates percentage of the study participants.

Table 5 Student's Experiences During COVID-19 Shutdown and Social Distancing

What Issues Have You Faced During This Period of Shutdown and Social Distancing?	Proportion That Answered Yes			p-value*
	Total N%	Male N%	Female N%	
Not able to visit or support older relatives and friends	448(83.9)	245(84.2)	203(83.5)	0.838
Concern about the health of immediate family members	491(91.9)	265(90.4)	226(93.8)	0.159
Loss of income	197(37.5)	127(44.6)	70(29.0)	<0.001
Loss of job	134(25.4)	91(31.5)	43(18.1)	<0.001
Inability to attend religious rituals or religious events.	366(70.1)	210(74.2)	156(65.3)	0.026
Unable to get enough food, medications, and supplies in the house	180(34.2)	114(39.6)	66(27.7)	0.004
Delays in education	227(42.9)	131(45.0)	96(40.3)	0.279
Boredom	405(76.4)	230(79.0)	175(73.2)	0.117
Loneliness	351(66.4)	198(68.3)	153(64.0)	0.302
Difficulty in accessing the health care system	221(42.3)	144(50.2)	77(32.6)	<0.001
Conflicts and arguments in the house	180(34.2)	102(35.5)	78(32.6)	0.485
Domestic violence	67(12.9)	49(17.3)	18(7.6)	0.001
Crowding in the house	175(33.7)	114(40.7)	61(25.5)	<0.001
Anxiety and stress of family members	211(40.6)	126(45.0)	85(35.4)	0.027

Note: *P values based on Chi Squared test.

Table 6 Linear Regression Analysis of Factors Associated with Knowledge, Attitude, and Practice Scores Among Study Participants

Variable	Knowledge Scores			Attitude Scores			Practice Scores		
	Coef	SE Coef	p-value	Coef	SE Coef	p-value	Coef	SE Coef	p-value
Gender									
Male (Ref)									
Female	24.74	2.35	<0.001	21.22	2.47	<0.001	21.00	2.63	<0.001
Age groups									
18–20 years (Ref)									
21–23 years	12.94	3.16	<0.001	16.05	3.23	<0.001	12.14	3.53	0.001
More than 23 years	13.43	5.34	0.012	14.34	5.61	0.011	16.46	6.04	0.007
Academic Level									
3rd (Ref)									
1st	49.3	11.9	<0.001	48.1	12.8	<0.001	46.0	15.6	0.003
2nd	58.8	17.9	0.001	53.9	19.3	0.005	−5.9	21.4	0.782
4th	50.23	3.29	<0.001	49.25	3.36	<0.001	41.96	3.68	<0.001
5th	39.31	4.43	<0.001	39.20	4.61	<0.001	31.82	5.01	<0.001
6th	44.46	3.85	<0.001	39.20	4.01	<0.001	35.78	4.38	<0.001
7th	44.88	4.49	<0.001	41.90	4.79	<0.001	39.05	5.09	<0.001
8th	39.65	4.63	<0.001	35.20	5.02	<0.001	38.27	5.29	<0.001
Residence									
Rural (Ref)									
Semi-Urban	24.93	2.65	<0.001	23.84	2.81	<0.001	16.03	3.00	<0.001
Urban	23.96	2.78	<0.001	27.04	2.94	<0.001	22.64	3.19	<0.001
Marital Status									
Single (Ref)									
Married	7.57	4.38	0.085	11.04	4.67	0.018	5.86	5.07	0.249
Mode of Living									
Living with family (Ref)									
Student's housing	−5.80	4.79	0.226	−7.15	4.89	0.144	−3.43	5.36	0.523

Abbreviations: Coef, Regression coefficient; SE Coef, Standard error of the coefficient; ref, reference category.

Discussion

This cross-sectional survey sheds the lights into students' KAP towards COVID-19 from various programs at the College of Applied Medical Sciences, Jazan University, KSA. The level of awareness of about COVID-19 and the willingness to carry out appropriate practices were discussed.

The results of this study documented somewhat higher willingness to carry out appropriate practices to prevent COVID-19, this pattern is similar to study conducted by Alhajjaj et al, 2020 in KSA, where majority of participants

supported protective measures taken for COVID-19 prevention.[17] Our KAP survey results go along with other KAP surveys in other countries, which showed that our group of people were knowledgeable about COVID-19 in the early stages of the outbreak.[18–21] For example, Abdel Wahed et al concluded that the grossly knowledge level of Health care workers (HCWs) was by and large high, especially among physicians. A more positive attitude was detected among allied health professionals than among physicians. Risk sensitivity was high among HCWs. The causes of increased risk insight need to be considered by the government and the Egyptian Ministry of Health.[22] According to Limbu et al their healthcare workers have analogously better knowledge regarding COVID-19. Pertinent practice correlates with better knowledge, and a positive attitude towards COVID-19 infection is observed with growing age. Hence, training on protection and protective course of action for having a positive attitude among healthcare workers is necessary to fight against COVID-19.[23]

The online survey respondents were both male (54%) and female (46%), young (18–23 years), and in rural, semi-urban, and urban settings. It is generally believed that men are more revealed to information technology and public information in the KSA. Erroneous information spreads as rumors among women's groups, without being critically appraised or discussed. However, our study depicted a slightly higher score for knowledge and attitude in females than in males. The reason may be an equal level of education in the participants, as opposed to the surveys conducted with the general public, where females are relatively less educated.[24]

There were a significant number of participants who preferred home remedies, particularly females, which is probably due to the acuteness and severity of the illness as well as the unavailability of a definitive scientific cure. The public should be made aware of the latest developments regarding the treatment of COVID-19 and should be taught about red flags when seeking medical help and to stop home remedies, which can be supported by the following reports. Rabbani et al concluded that evidence-based and context-specific likelihood communication and community engagement, and a social and etiquette change communication strategy against COVID-19 should be developed in Bangladesh, targeting different socioeconomic groups.[25] There was a remarkable effect of gender and academic level on the knowledge scores of the participants.[17] The other part of questionnaire was composed of questions based on knowledge of the symptoms of COVID-19. Both male and female participants showed good knowledge of most symptoms.[26] The knowledge of some of the symptoms was significantly higher in females than male participants as shortness of breath, fatigue, persistent pain or pressure in the chest, headaches, and body aches. Similar results were found in other studies conducted in other regions of Saudi Arabia.[27]

In this study, it was apparent that the students were concerned about self-safety regarding the seriousness of the coronavirus COVID-19. The majority mentioned that covid-19 was very serious for them (70.1%), followed by their families (65.5%) and community (65.3%). About 32.1% of participants mentioned that it is a serious disease in the Jazan region, 28.6% stated that it is serious for the community, and 28.3% stated that it is a serious disease for the world.

In terms of practices and behavioral changes, a majority of participants in the study were concerned about loss of income, loss of employment, inability to attend religious rituals or religious events, inability to get enough food, medications, and supplies in the house, difficulty in accessing the healthcare system, domestic violence, crowding in the house, and anxiety and stress of family members. Although the anxiety scores of each individual were not tested in the study, most participants were concerned about basic life amenities and the inability to provide them to their dear ones. There were anxieties related to social isolation, which led to increased stress levels among families. Further studies are needed to quantify stress levels among the population and their short- and long-term adverse effects.

Strengths and Limitations

This study has some limitations, first the population selected in the study was one college students, which does not represent the general population as a whole. Further studies are needed to represent other population groups in society. The other limitation of the study is the online survey, which has got its own disadvantages, including the inability to connect with students from remote areas, response bias, and survey fatigue. Despite these limitations, the current research adds new information to the existing literature regarding the knowledge of COVID-19 precautions and the understanding

of the general behavioral changes in the young population with regard to COVID-19. These findings may be useful to policymakers and healthcare administrators in developing intervention programs.

Conclusions

In conclusion, our results showed that the participants had moderate knowledge, which was reflected in their behavior change with positive attitude, awareness, and precautionary measures. It was also found that females have a slightly higher score for knowledge and attitude than males which is in contrast to the general public. Most of the participants in the study were concerned about the major basic issues of concerning life during the pandemic. The study outcome suggests the need for interventions to bridge students' knowledge and practice gaps.

Acknowledgments

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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