

ORIGINAL ARTICLE

A VIRAL CRISIS: KNOWLEDGE, ATTITUDE AND PRACTICES OF UNDERGRADUATE MEDICAL STUDENTS OF THE TWIN CITIES OF PAKISTAN TOWARDS COVID-19

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Background: A novel coronavirus strain, SARS-CoV-2, was identified in December 2019, causing a disease known as coronavirus disease 2019 (COVID-19). WHO declared the COVID-19 emergency as a pandemic in March 2020. Following nationwide lockdowns, it becomes pertinent that the self-quarantined medical students are able to dispense necessary knowledge regarding appropriate prevention practices related to the disease to their respective families and communities, therefore playing a positive role in sharing the economic load of the health system already overburdened by the increasing number of COVID-19 patients. This study aims to investigate the knowledge, attitudes and practices (KAP) of undergraduate medical students of the Twin Cities of Pakistan toward COVID-19, with regards to their observance of precautionary measures against the disease. **Methods:** Online data in this descriptive cross-sectional study was collected through self-developed questionnaires from 267 undergraduate medical students of twin cities, by convenient sampling. **Results:** High level of knowledge (72.7%) regarding Covid-19 infection among undergraduate medical students was consistent with their practices (70.8%) but not with their satisfactory attitude ($p < 0.01$). Being female than male and students of private medical colleges showed more satisfactory attitude ($p < 0.05$) and knowledge ($p < 0.01$) towards Covid-19 infection respectively, while practices were more among the students of public sector medical college ($p < 0.05$). **Conclusion:** The Knowledge of the students was satisfactory and consistent with their practices but not with their Satisfactory attitude, indicating a need to improve upon the prevailing attitude regarding infectious diseases such as Covid-19 and their prevention.

Keywords: Covid-19 Pandemic; Medical Students; Knowledge, Attitude and Practices; Pakistan; Prevention

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INTRODUCTION

In the latter half of December 2019, a novel coronavirus strain, named SARS-CoV-2, was identified.¹ The disease caused by this novel strain was assigned the name coronavirus disease 2019 (COVID-19) by the World Health Organization on 11 February 2020; first reported in Wuhan city, in the Hubei Province of China, in December 2019.^{2,3}

Patients with COVID-19 clinically present with a flu-like respiratory illness characterized by fever, dry cough and dyspnoea. Upon imaging, bilateral patchy infiltrates in the lungs are observed.^{1,3,4} Previously seen coronavirus strains that were pathogenic to humans followed a similar pattern of emergence and infectivity to SARS-CoV-2, in that they were both transmitted among humans via respiratory droplets, and originated in animals before moving into their human hosts; SARS-CoV was transmitted from civet cats to humans, MERS-CoV from Arabian camels to humans and the Novel Coronavirus from bats to humans.^{3,5} Although the mortality rate of the disease caused by SARS-CoV-2

so far happens to be lower than the mortality rates of the diseases caused by the previous SARS-CoV and MERS-CoV epidemics, COVID-19 is highly contagious and it is due to this reason that it has travelled around the world rapidly, causing epidemics in more than 200 countries, compelling the WHO to declare the COVID-19 emergency as a pandemic on the 11th of March 2020.^{1,4} According to WHO's Situation Report number 189, that was released on 27 July 2020, 16 114 449 COVID-19 cases have been reported with a total death count of 646 641 worldwide.⁶ The situation however is rapidly evolving, and changes may yet be seen in morbidity and mortality rates as the pandemic progresses.

The pandemic began its course in Pakistan on 26th February 2020, with the index case being a student from Karachi who tested positive for COVID-19 after returning from Iran.⁷ The very next case was reported in the federal capital, Islamabad as the month of February 2020 closed off with fresh COVID-19 cases in the Twin cities (Islamabad and Rawalpindi). As the disease flourished, all educational institutions including schools, colleges,

universities and Madrassas were ordered to be closed on the 13th of March 2020 followed shortly by a nationwide lockdown that was imposed on 23rd March 2020.⁷ As of 28 July 2020, 274289 cases of COVID-19 have been confirmed in Pakistan, according to the Government of Pakistan's COVID-19 Health Advisory Platform website, of which 27,421 are active cases and 241,026 patients have recovered from the disease. The total death toll in Pakistan currently is 5,842.⁸

A survey-based study conducted on the 10th of April 2020, aimed at evaluating general awareness regarding COVID-19 among 1132 Pakistani professionals reported positive findings with above 50% of the participants showing a high level of awareness and knowledge about the pandemic.⁹ However, a survey conducted by Inter University Consortium for Promotion of Social Sciences (IUCPSS) and published in The News (a popular national newspaper) on the 30th of April 2020 stated that 22.1% of the people out of the 1776 surveyed were not practicing social distancing or other precautionary measures properly.¹⁰ Even more alarming is a more recent survey conducted by Ipsos Pakistan, published by Associated Press of Pakistan (APP) on the 15th of May 2020, which showed that the compliance of Pakistani people to the COVID-19 precautionary standard operating procedures (SOPs) is on the decline with only 50% of the 1000 people surveyed showing concern about the disease spreading.¹¹

Prevention outweighs cure in reducing not only the morbidity but also the economic burden that the Country and its health infrastructure faces in testing times. Awareness campaigns regarding the reasons for the spread of COVID-19 and appropriate preventive measures are one way of educating the public in order to control the spread. However, gaps in this strategy can emerge in the form of limited availability of online health information resources and other media through which these campaigns can be run. This impediment leads to poor knowledge, attitudes and preventive practices mainly among the illiterate, rural and older portions of the population.⁷

As health professionals in the hospitals are already overburdened² catering for the management and treatment of the ever-increasing number of COVID-19 patients, self-quarantined medical students have the potential of becoming focal points for dispensing relevant information to their families and communities. For this feat to be possible, it is necessary to ensure that the medical students themselves have sufficient knowledge regarding Covid-19 and are themselves practicing the preventive measures efficiently. It is for this

reason, primarily, that this study aims to investigate the knowledge, attitudes and practices (KAP) of undergraduate medical students of the Twin Cities of Pakistan towards COVID-19. The results of our study are likely to help inform the health authorities about the current compliance of undergraduate medical students towards practicing precautionary measures and hence, help them formulate policies related to proper teaching and training of medical students so they become an important part of the health task force and play their role alongside the health authorities in combating the threat of the pandemic.

MATERIAL AND METHODS

A descriptive cross-sectional study was conducted from May till July to assess the Knowledge, Attitude and Practices about COVID-19 among undergraduate medical students of four private and one public sector medical colleges in twin cities of Pakistan.

The sample size was calculated using equation of estimating a population proportion with specified absolute precision from WHO sample size software. At 95% confidence level, 6% required absolute precision and 50% anticipated population proportion, the calculated sample size came out to be 267. We kept the anticipated population proportion 50% to get the maximum sample size.

The participants have been recruited in the study by non-probability convenience sampling.

Medical students of 4th year and Final year from various medical colleges were asked to participate in the study, as these students have acquainted with basic subjects of medicine and can influentially be brought a behaviour change in the community by convincing them in more promising style.

Those students who did not respond to questionnaires within ten days or who had sent incomplete questionnaires were excluded from the study.

Permission to conduct the study was taken from the Institutional Review Board of Fazaia Medical College (IRB-FMC) and written informed consent was taken from each participant prior to data collection.

A questionnaire in English was prepared after thorough literature search, comprising four components as; demographic, Knowledge, attitude and practices toward COVID-19. Important or difficult terminologies had been described in glossary¹²⁻¹⁴, which was a part of the questionnaire.

Questionnaire was uploaded on Google Forms (an online survey administration application) and its link had been shared with our target population on their respective social media groups. It was self-administered by students and took average of ten minutes for completion.

The pilot study was conducted on 10% of total sample size that is on 27 students, who were not the part of actual study results. The internal consistency among the questions of knowledge, attitude and practice were dual checked by three senior Professors from the faculty of FMC and by calculating alpha. The questions related to knowledge and practice had Cronbach's alpha of 0.71 and 0.69 respectively.

Data was entered and analysed by using SPSS version 23.0. Mean and standard deviation were computed for continuous variables like age and total scores of Knowledge, attitude and practices, while proportions have been computed for categorical variables and results have been presented in the form of figures and tables. Results of each composite variables of knowledge, attitude and practices have been cross tabulated with demographic variables and with each other and chi square test was applied to see the association between them. p -value <0.05 was considered as significant. It contained close ended questions of multiple choice and true/false types with only single correct answer. Each correct answer of knowledge regarding covid-19 is scored as "1", while either incorrect answer or don't know has been scored as "0". Mean score with standard deviation has been calculated. The knowledge has been categorized "Satisfactory if scored $\geq 75\%$ " and "Unsatisfactory if scored $<75\%$ ".

Attitude related questions were such designed that answer "Agree = 1" while either "Neither agree nor disagree" or "Disagree" assigned "0" marks. A composite dichotomous variable of attitude has been generated, in which the persons who scored $\geq 75\%$ were labelled with "Satisfactory attitude" and those with $<75\%$ as "Unsatisfactory attitude".

Questions related to practices of the participants were also close ended, and kept dichotomous based on "all or none" principal, because we perceived that incorrect practice of health task force (even one time) can expose the community to Covid-19 infection and they should have very clear concepts of what they should and must do in reality. Each answer showing the correct practice got "1" mark and "0" to that of incorrect practice. Considering the percentages of overall score regarding the questions of practices, a new variable has been constructed having two

options on the basis of which persons who scored $\geq 75\%$ are labelled with "Satisfactory practice" and those with $<75\%$ as "Unsatisfactory practice".

Conflict of interest: There is no conflict of interest among the researchers and the result of present research has not been influenced and/or funded by any organization.

RESULTS

A total of 296 students participated in the online survey, 27 of which were conducted a pilot study on while two were excluded due to incomplete questionnaire, leaving the final sample size to 267 students. The mean age of the participants was 22.5 ± 1.0 years. Total 183 of the 267 participants (68.5%) were female. The students of five medical colleges from twin cities participated in the study; one is public sector while the others were private medical colleges. Majority of the responses were recorded from students of private medical colleges (85.4%). Majority of the students that responded, 186 (69.7%), were in their Fourth Year of medical education as shown in Table-1.

Majority of the students (83.5%) were aware that the causative agent for COVID-19 is SARS-CoV-2 and even a greater number (97.4%) were aware of the most common clinical finding in COVID-19 patients. All of the students (100%) were aware of the route of transmission of the virus. An overwhelming majority of students showed accurate knowledge about incubation period of the virus as well as diagnostics and preventive measures related to COVID-19, however, only 47.2% students were able to correctly identify that 'Isolation' is applicable only to individuals who have been infected with SARS-CoV-2.

More than 90% of the students showed correct knowledge regarding the transmission of the virus through contact and the effectiveness of standard measures employed to prevent the spread such as proper hand washing using soap and water, use of hand sanitizers and social distancing, with $>95\%$ of the participants exhibiting awareness regarding the importance of avoiding social occasions and public places to control spread. Knowledge regarding the importance of isolation, asymptomatic carriers, at risk population and availability of treatment options was also quite sound. The results of the knowledge survey are given in Table-2.

As shown in Table 3.a., 91.8% of the participating students agreed to COVID-19 being a serious disease and a greater than 90% of the students show a positive attitude towards government-imposed lockdowns, use of facemasks and social distancing guidelines. Only 66.3% of the students

agree that COVID-19 is not a stigma. Total 73.4% of the participants showed readiness to join the healthcare workforce during the pandemic if need be.

Results for this survey show overall good practices adopted by the students in order to prevent contracting and spreading COVID-19, as can be seen in Table-3.b. More than 90% of the participants replied in the affirmative when asked about whether they wash their hands with soap and water and whether their frequency of hand washing has increased owing to the outbreak. Although 21.7% of the participants disclosed that they do not wash their hands for at least 20 seconds, a very high percentage (>85%) of the participants exhibited good preventive practices such as wearing a mask while going out, following proper sneezing and coughing etiquettes and avoiding social contact. It is advisable however for the students to save the helpline number in their phone's contact lists in case any emergency arises. Unnecessary travel must also be curtailed as 32.2% of the students confessed to have made unnecessary travels outside home in the current conditions.

Mean score of KAP was 18.28±1.35, 6.80±1.13 and 10.97±1.17 respectively. More than 70 of the participants showed satisfactory knowledge and practices but the attitude towards COVID-19 infection was bit less (63.7%) as shown in Table-4.

When cross tabulated, it was observed that more students from private medical college had satisfactory knowledge while larger proportion of participants from public sector medical colleges had satisfactory practices toward COVID-19 pandemic and these differences found statistically significant ($p<0.05$). Statistically significant difference of satisfactory attitude toward COVID-19 pandemic was noticed among females than males ($p<0.05$) as shown in Table-5.

Table-6 shows the association of knowledge with attitude and practices toward COVID-19 pandemic. Highly significant difference ($p<0.01$) in attitude of the participants was observed when compared with knowledge toward COVID-19 infection but the association of practice with knowledge was not significant.

Table-1: Demographic characteristics of the participants

Variable	Categories	Number (%)
Age in Years (Mean±SD)		(22±1.0)
Gender	Male	84 (31.5)
	Female	183 (68.5)
Institution of Participants	Public Sector Medical College	39 (14.6)
	Private Medical Colleges	228 (85.4)
Level of Undergraduate Medical Education	4 th Year MBBS	186 (69.7)
	Final Year MBBS	81 (30.3)

Table-2: Knowledge of the medical students regarding Covid-19 pandemic

Variables regarding knowledge	Responses of Students	
	Correct N (%)	Incorrect N (%)
Causative agent of COVID-19 infection	223 (83.5)	44 (16.4)
Most commonly reported clinical finding in patients with COVID-19	260 (97.4)	7 (2.6)
Most common triad of symptoms to suspect COVID-19 infection	197 (73.8)	70 (26.2)
Route and mode of transmission of Coronavirus	267 (100)	0 (0)
Estimated incubation period of COVID-19	235 (88)	32 (12)
Best possible preventive measures used to protect the individual from getting infection	249 (93.3)	18 (6.7)
"Isolation" is applicable to whom	126 (47.2)	140 (52.4)
Commonly used diagnostic test for COVID-19	237 (88.8)	30 (11.2)
What would you do if someone you know develops the symptoms of COVID-19?	196 (73.4)	71 (26.6)
Transmission by of novel Corona virus through mosquito bites.	211 (79)	56 (21)
Transmission by touching contaminated surfaces	250 (93.6)	17 (6.4)
Prevention of spread through practicing proper hand-washing.	262 (98.1)	5 (1.9)
Using an alcohol based sanitizer to clean hands, in the unavailability of soap and water,	260 (97.4)	7 (2.6)
COVID-19 can be prevented by practicing social distancing.	264 (98.9)	3 (1.1)
COVID-19 infection can be prevented by avoiding crowded places and unnecessary travel	267 (100)	0 (0)
Isolation and treatment of people who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus.	265 (99.3)	2 (0.7)
COVID-19 positive persons with only minor symptoms can be isolated at home	260 (97.4)	7 (2.6)
Contacts of infected COVID-19 persons should be quarantined immediately, and should be tested if they begin to show symptoms.	265 (99.3)	2 (0.7)
Individuals with COVID-19 can transmit the virus to others even when they do not have fever.	262 (98.1)	5 (1.9)
Patients with underlying chronic diseases are at a higher risk of developing the severe form of COVID-19	261 (97.8)	6 (2.2)
To this date, there is no available vaccine against COVID-19 virus	258 (96.6)	9 (3.4)
Taking Antibiotics will not help against COVID-19.	194 (72.7)	73 (27.3)

Table-3: Attitude and practices of the medical students toward Covid-19

Questions related to attitude and practices regarding Covid-19	Responses of the Students	
	Correct N (%)	Incorrect N (%)
a. Attitude of the Medical Students toward Covid-19 Pandemic		
Do you think the lockdown and social distancing guidelines are useful tools towards curbing the spread of COVID-19?	248 (92.9)	19 (7.1)
Do you like to follow regular updates (four times a week or more) regarding COVID-19 and its spread in Pakistan? (Newspapers/Television/Social Media)?	218 (81.6)	49 (18.3)
Do you believe COVID-19 is a serious disease?	245 (91.8)	22 (8.2)
Do you believe it is important to use face masks as a prevention strategy?	261 (97.8)	6 (2.2)
Do you believe it is important to maintain social distancing from friends and distant family members during this outbreak?	263 (98.5)	4 (1.5)
Do you think COVID-19 is NOT a stigma?	177 (66.3)	90 (33.7)
If you or someone you know tested positive for COVID-19, would you be willing to disclose this information to the community?	204 (76.4)	63 (23.6)
Would you be willing to join the healthcare workforce, if the need arises during this outbreak?	196 (73.4)	71 (26.6)
b. Practices of the Participants regarding COVID-19 Pandemic		
Do you always wash your hands with soap and water, if you come into contact with an outside person, or with a surface that may be contaminated?	258 (96.6)	9 (3.4)
Has the outbreak of the COVID-19 made you increase the frequency of washing your hands?	255 (95.5)	12 (12.4)
Do you always wash your hands for at least 20 seconds or more during this outbreak?	209 (78.3)	58 (21.7)
Do you wear a mask every time you leave the house?	249 (93.3)	18 (6.7)
Do you avoid shaking hands with people you may meet during this outbreak?	256 (95.9)	11 (4.1)
Do you avoid hugging people you may meet during this outbreak?	259 (97)	8 (3)
Have you written down or stored in your phone any helpline number to contact, in case you suspect that you or someone you know may have COVID-19?	98 (36.7)	169 (63.3)
Do you follow proper respiratory etiquette every time you cough or sneeze?	239 (89.5)	28 (10.5)
Have you left your home for any unnecessary travel or outing during the COVID-19 outbreak?	181 (67.8)	86 (32.2)
Have you discussed with your family and friends, what they should do if they get exposed to a case of COVID-19?	238 (89.1)	29 (10.9)
What would you do if you started developing symptoms of COVID-19?	262 (98.1)	5 (1.9)
What would you do if you had close contact with confirmed cases of COVID-19?	260 (97.4)	7 (2.6)
What would you do if a friend, who is not following social distancing guidelines, wanted to meet you during this outbreak?	257 (96.3)	10 (3.7)

Table-4: Overall knowledge, attitude and practices toward COVID-19 pandemic

Variables	Satisfactory N (%)	Unsatisfactory N (%)	Mean±(SD)
Knowledge	194 (72.7)	73 (27.3)	18.28±1.35
Attitude	170 (63.7)	97 (36.3)	6.80±1.13
Practices	189 (70.8)	78 (29.2)	10.97±1.17

Table-5: Association of knowledge, attitude & practices toward Covid-19 Pandemic with demographic characteristics

Demographic Characteristics	Knowledge Score			Attitude Score			Practices Score		
	≥75% ^a N (%)	<75% ^b N (%)	p-value	≥75% ^a N (%)	<75% ^b N (%)	p-value	≥75% ^a N (%)	<75% ^b N (%)	p-value
Gender									
Male	56 (67.5)	27 (32.5)	0.22	45 (54.2)	38 (45.8)	0.04*	59 (71.1)	24 (28.9)	0.97
Female	136 (74.7)	46 (25.3)		123 (67.6)	59 (32.4)		129(70.9)	53 (29.1)	
Institution									
Private	174 (76.3)	54 (23.7)	0.00**	146 (64)	82 (36)	0.77	156(68.4)	72 (31.6)	0.04*
Public	20 (51.3)	19 (48.7)		24 (61.5)	15 (38.5)		33 (84.6)	6 (15.4)	
Level of MBBS									
4 th Year	131 (70.8)	54 (29.2)	0.24	115 (62.2)	70 (37.8)	0.49	137(74.1)	48 (25.9)	0.10
Final Year	63 (77.8)	18 (22.2)		54 (66.7)	27 (33.3)		52 (64.2)	29 (35.8)	

("a" represents Satisfactory KAP, "b" represents Unsatisfactory KAP); *p-value <0.05 (significant), **p-value <0.01 (highly significant)

Table-6: Association of knowledge with attitude and practices toward COVID-19 pandemic

	Knowledge regarding COVID-19 Pandemic		
	Satisfactory	Unsatisfactory	p-value
Attitude			
Satisfactory	135 (69.6)	35 (47.9)	0.001**
Unsatisfactory	59 (30.4)	38 (52.1)	
Practices			
Satisfactory	139 (71.6)	50 (68.5)	0.61
Unsatisfactory	55 (28.4)	23 (31.5)	

*p-value <0.05, **p-value <0.01

DISCUSSION

Emerging at the tail-end of 2019 from China, the novel coronavirus has rapidly engulfed the entire world in 2020 and brought around a transformation in almost every field, globally. Not only the general population, but even the healthcare workers have had trouble protecting themselves from the gravid effects of COVID-19 infection. Rapid spread of this infection in the general population has not only highlighted the need for more Health Care workers (HCWs) in a severely understaffed healthcare system, but the spread of the infection in HCWs has actually rendered a dearth in available healthcare personnel, rather than allowing HCWs to meet the increased demands of pandemic. The present study was conducted to assess the existing Knowledge, attitude and practices regarding COVID-19 Pandemic of undergraduate medical students of twin cities, keeping in mind that the evidence presented by this study can be used by the concerned authorities in order to design a training program for undergraduate medical students, and to ultimately be able to utilize them as a health task force if/when such a need may arise.

From the data collected, it was observed that more than 80% of students have correct knowledge regarding the causative agent and incubation period of the novel coronavirus/ COVID-19. A study in Iran³ showed almost the same result (85.4%) regarding incubation period, but it was a much lower number (55%) in another study conducted in Lahore, Pakistan.⁷ The reason for this might be the inclusion of non-medical students (32%) and staff in the study based in Lahore. More than 90% of students in our study distinguished the modes and route of transmission, and also identified the correct ways (proper hand washing, use of alcohol-based sanitizer, social distancing and avoidance of crowded places) to prevent the infections. Acquaintance with the use of personal protective equipment was much higher (93.3%) in our study than those conducted in Jordan (68%) and Mumbai (79%), possibly due to inclusion of exclusively medical students in our study.^{4,5} A study conducted in Mumbai showed markedly less proportion of knowledge with regards to the causative agent (22.6%), modes of transmission through respiratory droplets (62%) and use of personal protective equipment (79%)⁵ than present study. This could be an influence caused by inclusion of staff members and a more divergent age group. Almost all (99.3%) respondents agreed that contacts of COVID-19 positive persons should be quarantined and be tested when symptoms arise. These findings were more or less similar to a study conducted in India¹, while noticeably higher than the results of the study in Iran (73.8%).³ These variances might be due to four-month time difference between the two studies leading to a greater

clarity of concepts in our study. The knowledge about common triad of symptoms to suspect COVID-19 infection in our study (73%) was much less than Iran (90%)³, participants serving in hospitals of Iran, being exposed to COVID-19 cases daily could be the possible reason behind this difference, while all the respondents of our study were medical students, and were at home due to lockdown and closure of universities. Knowledge pertinent to increased risk of infection/ COVID-19 disease in patients with chronic diseases (97.8%), and unavailability of vaccine against COVID-19 till the time of data collection (96.6%) was remarkably higher in our study than reported by another study (71.9%, 66.6% respectively) from Pakistan⁷, which might be due to the differences of knowledge in administrative staff and rural population (16%) of this study, than in purely medical students. Only 47% of participants correctly identified those who should be isolated. The COVID-19 infection cannot be spread via mosquito bite was correctly judged by 79% of respondents, while even fewer (73%) were cognizant of the fact that calling the Government provided COVID-19 helpline number was the correct first action, in case they happen to know of an infected individual.

We found that 72.7% of participants had satisfactory knowledge about COVID-19 infection overall, which is far better than another similar study (50%) conducted in Pakistan⁷, despite the fact that its cut-off value for good knowledge (71% or 10/14 correct responses) was lower than in our study (75%). A greater participation of females, as well as the respondents being exclusively medical students in our study might provide an insight towards this difference. This fact is supported by the study of Jordan having same proportions of female participants showing almost the same level of knowledge regarding different variables as in our study.⁴ A study conducted in Saudi Arabia is also showing the same proportions of good and excellent knowledge among the participants however a comparison with our study results would be inappropriate, as they did not mention the cut-off values.¹⁵

When cross tabulated with demographic variables, the overall knowledge showed no significant statistical difference in relation to gender and level of education, but a statistically significant difference was found between participants of public and private sector medical colleges ($p < 0.05$). This finding supported the results of a study conducted in Karachi on intellectual wellness awareness among medical students.¹⁶ Majority of Participants of the study (>90%) showed a positive attitude towards COVID-19 guidelines, the role of face masks in prevention, and the importance social distancing from family and friends for the control of COVID-19 infection. The proportion of participants following regular updates on COVID-19 infection were

similar to the study of Jordan and India^{2,4}, however the proportion considering COVID-19 as a stigma was much higher in our study (33.7%) as compared to Jordan (5.4%). Medical students who were willing to join health task force were 73.4%, totally in contrast with the study conducted in India.² Positive attitude of our medical students should be appreciated and utilized by the health department in overcoming the shortage of doctors for the control COVID-19 epidemic and in future cases that would require such intervention.

Despite a high proportion of students with satisfactory knowledge (72.7%) about COVID-19 infection, the proportion of satisfactory attitude was relatively low (63.7%) among them ($p<0.05$). These results were supported by another study in Pakistan⁷ and contradicted by the study carried out in Saudi Arabia¹⁵, in which there was no such difference among proportion of knowledge and attitude. A study in China also showed the protective effect of knowledge towards negative attitude (OR=0.75, $p<0.001$), but nothing can be said with indemnity, due to the difference in questionnaire and measurement scale.¹⁷

The positive attitude was observed to be higher in female students than in their male counterparts, and this difference was statistically significant ($p<0.05$) and supported by similar study ($p<0.001$) in Lahore, Pakistan.⁷

Results showed that proportions of students having satisfactory knowledge (72.7%) were almost consistent with satisfactory practices (70.8%) against COVID-19 pandemic. Overall, the following of preventive practices in our study were slightly lower to the students of Bangladesh (almost 80%) but higher than the study conducted in Lahore (36.5%). Differences in the assessment scale might be behind these variances. A statistically significant difference was noticed in satisfactory practices against COVID-19 pandemic between private and public sector medical students ($p<0.05$) with a higher proportion in undergraduates of private colleges.

Practices of medical students of Islamabad regarding frequent hand washing, and not visiting crowded places were almost matched with residents of Malaysia and university students of Bangladesh.^{18,19} The practices of wearing face masks in our participants (93.3%) were similar to the residents of China¹⁷, while having a large difference with that of study in Malaysia (51.2%) and Bangladesh (53.8%), attributed to the inclusion of general residents and non-medical students respectively.^{18,19} Our study showed similar results as the study conducted on the university students in China²⁰ regarding preventive practices while developing similar symptoms as in COVID-19 infection, and upon coming into contact with COVID-19 confirmed cases.

CONCLUSION

High level of knowledge (72.7%) regarding COVID-19 pandemic among medical undergraduate students of Islamabad were consistent with their practices (70.8%) but not with their satisfactory attitude (63.7%) and this difference is statistically significant ($p<0.01$). Being female than male and students of private medical colleges showed more satisfactory attitude ($p<0.05$) and knowledge ($p<0.01$) towards COVID-19 infection respectively, while practices were more among the students of public sector medical college than private medical colleges ($p<0.05$).

Limitations:

Due to non-probability sampling, generalization of results can be an issue, even though we have included the undergraduate students of multiple medical colleges of twin cities. Furthermore, the results of KAP surveys cannot be compared exactly with other studies due to differences in questions and techniques of analysis.

Recommendations:

It is appropriate to say that senior medical students (as soon-to-be physicians) are held at a higher regard in the general population with respect to their medical knowledge, and their attitudes towards infections and diseases. Their practices can influence perceptions of those around them. It would also be prudent to believe that a nonchalant attitude, or a disregard for recommended preventive practices from such individuals can lead to people in their surroundings to become lax regarding those very same practices. While the knowledge, attitude and practices of our medical students are almost compatible with similar studies in other countries but can be optimized with little efforts. In light of the results of our study, we would recommend the following:

1. A primary protocol regarding COVID-19 be determined and disseminated to undergraduate medical students, which would serve as a step-by-step guide to the correct measures which should be taken by healthcare workers, medical students, and the general population, should they encounter such a situation in the future.

This will improve the national response to COVID-19 pandemic.

2. Workshops be carried out during undergraduate medical education, which inculcate the importance of prevention in situations such as the COVID-19 pandemic, and improve upon the prevailing attitude by highlighting the importance of medical students as health-related role-models to their communities; thus providing medical students with a social incentive to improve their practices and subsequently uplift the attitudes and practices of their respective communities. There is a pressing need for

such workshops to be carried out in all colleges, especially public sector colleges/universities with regards to the results of our study.

3. As a follow up to the Covid-19 pandemic, lectures and workshops should be arranged to improve preventive practices and adherence to these practices among medical students, to prevent a second wave of COVID-19 pandemic and potential future diseases.

4. On the other hand, further such studies with probability sampling are required to endorse or refute our results.

AUTHORS' CONTRIBUTION

AB: Principal author, conceived the idea, participated in methodology designing, data collection & analysis, drawing inferences and discussion write up. AFK; Second author, participated in literature search, proposal writing, data collection & compiling. SAAN: Second author, participated in literature search, questionnaire development, data collection and manuscript write up. LSH: Second author, participated in literature search, introduction writing, data collection & analysis. RK: Third author, contributed in research designing and proof reading.

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