Knowledge, Attitude and Practices related to COVID-19 among Medical Students in Pakistan: A Web-Based Survey

Running Title: *Medical Students' Knowledge about COVID-19*

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Abstract

In the times of the COVID-19 pandemic, it is necessary for the medical students to have knowledge about the features of the disease, how the disease is transmitted, and protective measures to contain the COVID-19. This study was conducted to evaluate knowledge, attitude, and practices related to COVID-19 in Pakistani medical students. We conducted a web-based survey from March 29 to May 10, 2020, utilizing an online platform. Medical students from 1st to 5th professional years in medical colleges across the country were requested to participate. The questionnaire consisting of 31 items were circulated online using different social media channels to collect the required information. Proportions for categorical variables were tested using the Chi-square test or Fisher's exact tests. A total of 344 medical students responded, and their overall knowledge about COVID-19 was 88.86 %. Nearly 31.0% of participants were involved in awareness projects regarding COVID-19 in the community and 84.6% of participants were willing to volunteer in healthcare crises. The percentage of the medical students who opted lockdown/curfew to be a better solution for curbing disease transmission was 94.2% while 95.9% of them believed social distancing can prevent the transmission. The average rate of practicing correct preventive measures among the respondents was 93.25%. The study showed sufficient knowledge, the crucial practice of preventive measures regarding COVID-19, and unveiled a profoundly assertive attitude of the medical students of Pakistan toward the current health crises. More regular awareness and educational programs for medical students related to the COVID-19 can boost and update their current knowledge.

Keywords: COVID-19, Knowledge, Attitude, Practice, Medical students, Pakistan

1. Introduction

In December 2019, a cluster of patients presenting with respiratory symptoms of unknown etiology were being identified in Wuhan city of Hubei province, China [1,2]. On 7th January 2020, the causative agent was identified to be a novel Coronavirus by the Chinese health authority. The World Health Organization (WHO) named the disease caused by this virus as coronavirus disease 2019 (COVID-19) while the Coronavirus Study Group (CSG) of the International Committee on Taxonomy of Viruses named the novel coronavirus as Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in February 2020 [1, 2, 3]. In Pakistan, the first 2 cases of COVID-19 were confirmed on 26th February 2020 in Karachi and Islamabad. An increasing number of cases have been reported since then in all the four provinces and the Capital of Pakistan.

The virus is transmitted via respiratory droplets of infected symptomatic as well as asymptomatic individuals. The virus also remains viable in favorable atmospheric conditions on the surfaces for several days and can also be transmitted by touching these contaminated surfaces and then touching the nose, eyes, or face [4, 5]. The genomic analysis of SARS-CoV-2 has shown similarities with previously identified coronavirus strains of SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV) [1, 6].

The clinical symptoms of COVID-19 include fever, cough, myalgia, headache, fatigue, and difficulty breathing and range from mild to severe presentation. The laboratory features are non-specific comprising leukopenia, thrombocytopenia, raised erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) and, elevated liver enzymes. The imaging of patients with COVID-

19 has shown a wide range of possible findings on chest X-rays and Computed Tomography (CT) scans including ground-glass opacities, consolidation and infiltrates while, molecular tests on the respiratory tract samples lead to a specific diagnosis [4, 7, 8].

Medical professionals are always at high risk of contracting infectious diseases and even asymptomatic individuals can transmit the source of infection [9], therefore, adequate knowledge and aggressive practical measures can limit the transmission rate. Medical students are vulnerable to COVID-19 since they can be among the first individuals contracted by those with the disease. Good knowledge and practicing measures among this population are necessary especially in countries like Pakistan where they can play a role in educating the general community. Our survey aims at assessing these parameters and the attitude of medical students of Pakistan toward the recent health crises.

2. Materials and Methods

Study design and setting

An online web-based study was intended to collect the required information from medical students across the country using a Google form platform respecting the preventive measures like social distancing and restrictive movements implemented by the government.

Sample Size

A sample size of 344 (M=80 and F=264) was calculated by using online Raosoft sample size calculator with a 95% confidence interval, 50% response distribution, and a 6% margin of error. The inclusion criteria is that the person should be a medical student enrolled in the medical colleges in the Pakistan. Exclusion criteria is Outside Pakistan Medical Student or Resident/ House Physician in Pakistan.

3. Data collection and sampling

The self-reported questionnaire was prepared in the English language after detail literature search, and the data was collected by using convenient sampling method through online Google document. The data was collected from March 29 to May 10, 2020, and the sample size of 344 participants was achieved in this period. The target population was the medical students currently enrolled in the medical colleges and universities of Pakistan. The questionnaire was circulated online to accomplish the required information with enlisted eligibility criteria (e.g Inform consent, being medical student and being Pakistani) which can hardly take 10 minutes to filled. Social media such as Facebook, WhatsApp and Gmail was used and shared in various medical students groups for this purpose. The participants were requested to follow the link and affirm their willingness to participate in the voluntary survey.

The questionnaire consisted upon four sections- the background characteristics, knowledge regarding COVID-19, attitude toward the recent pandemic and practice of protective measures. Background characteristics included gender, religion, and year of medical school and place of residence. The knowledge regarding COVID-19 was evaluated via 13 items-based section. The included items inquired about the basic information about COVID-19, the infectious agent causing the disease, its mode of transmission and incubation period. Four more items inquired about the symptoms, management, vaccination, and the methods to reduce the transmission rate. For the assessment of the attitude regarding the COVID -19, the section included 8 items. These combined

an inquiry about medical students' perception regarding the role of human behaviors in the emergence of the recent pandemic, the role of social media, religious leaders, seminars and workshops in raising awareness about the COVID-19. This section also queried about the volunteer work in raising awareness about COVID-19 and their willingness to work in the recent health care crises. To measure the level of practice of the standard precautionary measures, we included a 6 items-based section which interrogated about the daily practices of the medical students including the frequency and technique of handwashing, social distancing, and handshaking. We also inquired about whether they encourage their fellows and family to follow the same customs. After complication of initial questionnaire, draft was sent to 3 senior public health researchers. Final questionnaire was drafted after expert consensus and suggestion. Pilot study was done on 30 samples to check for validity of questionnaire where Cronbach alpha of knowledge, attitude and practice was 0.731. Reliability of total sample was 0.704.

As medical students are the key part of the health system, they should have a clear knowledge about the pandemic, the proper attitude which should be played correctly with the practice of correct guidelines.

4. Ethical consideration

Ethical consideration was taken according to Helsinki declaration and Consent was taken from each participant before the starting of the questionnaire. The consent is taken in digital format. As majority of the students enroll in undergraduate medical studies after 18 years of age so no special consent was prepared for under 18. A generalized consent was being prepared. The ethical review committee waived ethics approval for our study.

Statistical analysis

Descriptive statistics (frequency and percentage) of each variable was analyzed and proportions for categorical variable were tested using Chi square test or Fischers exact tests. P-value at 0.05 was set as significant for statistical tests. SPSS version 21 was used for data analysis.

5. Results

A total of 344 participants were included in the final analysis. Of the total, 264 (76.7%) were females and the males were 80 (23.3%). In all, majority 135 (39.2%) were final year students, 91(26.5%) from fourth year, 4(15.7%) from third year, 53(15.4%) from second year and 11(3.2%) from first year participated in this survey with majority of the students residing in Punjab province 184(53.5%). (Table 1)

-Insert Table 1 here-

Firstly, students were asked about the acronym of COVID-19. To this statement 270 (78.4%) students responded correctly that it means Coronavirus disease 2019. Further, difference between COVID-19 and nCoV was asked to which 74 (21.5%) of the participants answered correctly. Medical Students were then asked about the origin of nCoV that is Wuhan, China and 338 (98.3%) participants responded correctly. Questions regarding mode of transmission, which is respiratory

droplet secured 339 (98.5%) correct responses, and incubation period that is 2-14 days is correctly marked by 324 (94.2%). Regarding the common (fever and cough) and uncommon (diarrhea) sign and symptoms, 323 (93.9%) and 268 (77.9%) correctly marked correspondingly. Furthermore, 303 (88.1%) students affirmed the seriousness of disease in older patients and information regarding mortality, 332 (96.5%) students responded that not every individual infected by COVID-19 will die. Regarding the treatment of the COVID-19 students were asked about any specific antiviral drug to which 293 (85.2%) students recorded their response as 'not available'. (Table 2)

-Insert Table 2 here-

Knowledge items were cross tabulated with professional year of study as shown in Table 3. There was no significant association difference among year of study observed except 3 questions such as Q7) Is diarrhea an uncommon symptom of COVID-19? ($p=0.003$), Q9) Is there any specific antiviral medication to treat COVID-19? ($p=0.004$), and Q11) Will every patient infected by nCoV die? ($p=0.019$).

-Insert Table 3 here-

To assess the attitude of students in response to COVID-19, a total of 8 questions were asked. Regarding question of the participation of students in any awareness program of COVID-19, 105 (30.5%) students confirmed their participation in the relevant awareness campaign. Out of 344 students, 291 (84.6%) answered the question and showed willingness to volunteer in case of current health crisis. When students were asked about role of various factors in spreading awareness of COVID-19, 290 (84.3%) of them named social media, 302 (87.8%) named the role of Islamic scholars and 240 (69.8%) students opted the role of seminars. The information about prevention of COVID-19 by social distancing ($N= 330$), lockdown/curfew ($N=324$) is also recorded. (Table 4)

-Insert Table 4 here-

Practices were assessed using 6 questions pertaining to all the precautionary measures taken in daily life. When students were questioned regarding practices, 334 (97.1%) answered that they practice hand washing, 286 (83.1%) answered that they do hand washing for 20 seconds, 239 (69.4%) answered that they are practicing social distancing, 330 (96%) answered that they avoid hand shaking while 342 (99.4%) said that they are spreading awareness among friends and family regarding preventive measures (Table 5)

-Insert Table 5 here-

6. Discussion

The current pandemic created a chaos across the globe and mounted fear and anxiety in general public and the healthcare professionals (HCPs) including medical students. The core parameters

such as knowledge, attitude and practices that need to be assessed were considered in this basic study. A study revealed insufficient basic knowledge about COVID-19 among HCPs including medical students in Pakistan [10]. Of the total 344, students of fourth and final year made more than half of the participants, while only 11 first year students participated in the survey (3.2%). The vast difference could be due to less exposure of fresh new first years to the popular social forums which are used by their seniors, on which the survey was circulated or it could be due to the lack of communication between the first years and their seniors.

According to the World Health Organization (WHO), COVID-19 is an infectious disease which is caused by a new virus called the coronavirus [11]. Mode of spread is through respiratory droplets. Majority of the people infected with the COVID-19 virus experience mild to moderate respiratory illness and will recover without requiring special treatment. Older people and those with underlying chronic medical problems like cardiovascular disease, diabetes, chronic respiratory disease, hypertension and cancer are more prone to develop serious illness [11-16]. In our study more than half (78.5%) of the students knew what COVID-19 and nCoV really meant and more than 90% knew about its origin, mode of transmission and incubation period which was considerably higher than in the previously conducted study [10]. Majority of the students were aware of the possibility of the coronavirus causing a more severe disease in older adults while a few (37) were not sure. More than 90% of the participants were also aware of the unavailability of a vaccine to prevent COVID-19 and that every person infected with coronavirus does not die. This may be due to the rigorous awareness programs and campaigns occurring globally and in Pakistan [17]. Moreover, there is a notable role of media through broadcasting of any new development regarding the pandemic on the social networks and other forms of media. This is consistent with the study conducted by Rubin et.al [18].

The most common symptoms include fever, dry cough and tiredness with less common symptoms being sore throat, aches and pains, diarrhea, headache etc. [11]. The question “Is diarrhea an uncommon symptom of COVID-19?” yielded the results with 77.9% of the participants classifying it as an uncommon symptom for the disease. Significant data indicates that there is a close association with year of study of medical students to the level of knowledge in this case. Majority of the students of 2nd, 3rd, 4th and final year agreed with diarrhea being an uncommon symptom while many 1st year students did not. A probable explanation for this could be that senior students are more updated on the epidemiology, transmission dynamics and clinical presentations of the disease, both common and uncommon through regular reading of research papers. Contrary to this, students in first year of medical school are deficient in the knowledge of pathophysiology of the diseases and are also unable to understand the health research in the field of medicine due to their lack of advanced knowledge [19]. They only know about the common symptoms like fever, cough and sore throat which they get to know through awareness programs and information circling through social media.

While majority of the students of different years of study were aware that there is no anti-viral medication currently available to treat COVID-19, however, out of the students who were of the view that an anti-viral drug is available, majority were from 1st year. We can assume that many of the junior students who think a drug is available, have heard about the recent trials done with hydroxychloroquine and azithromycin [20] which was also given wide media attention [21]. It could be possible that those students must have mistaken these drugs to be anti-viral medication just because they showed some efficacy in a few patients in clinical trials. Moreover, new researches keep on appearing showing different drugs to be working in some COVID-19 patients

[22]. With continuous reports of different countries using different anti-viral drugs like favipiravir, remdesivir etc. people assume that a drug is now available, when in reality many trials still need to be conducted to see which drug is actually effective [23].

With so much uncertainty regarding the outcomes of the pandemic at hand, it is essential to know the attitude and practices of current medical students towards COVID-19. We asked a series of questions to assess these two aspects. Majority of the population were of the view that there is a role of human behavior in the emergence of COVID-19. This is not astonishing, given that when the disease was still considered an epidemic in China, reports started arising that the virus spread due to consumption of bat soup by the Chinese [24]. These reports acted as a fuel for racism and hate crimes against Asians, particularly Chinese, with the virus even being labelled as a “Chinese virus” [25]. What many people did not know that researches were already underway to find out the origin of the new coronavirus and it led to bats [26]. These findings in no way implied that the spread was due to human behavior. This is where social media comes in. Most of the students agreed that social media is playing an important role in the pandemic. Spread of proper information through different media outlets has been shown to create more awareness during swine flu outbreak as reported by Rubin et al. [18]. On the contrary, spread of wrong information can have devastating effects and it is therefore crucial that whatever is being circulated on these forums is fact checked by experts. People who were less aware and spent more time on news to get information about COVID-19 were at a high risk of developing anxiety and depression [27]. The situation of Covid-19 has been well monitored in Pakistan as it has managed to focus on other epidemics by flattening the curve of Covid-19. Hence to keep the curve flattened, all preventive measures should be taken care of by the general public so the economy and the basic infrastructure of the country can thrive. [28]

Khola Noreen et al. [29] study also addressed the similar study, and both of our study results are more or less similar with respect to knowledge, attitude and practice. In our study we have addressed the questions in much more detailed formed and the statistical analysis is done based on each question individually.

Most of the participants agreed that religious leaders could play an important role in raising awareness about COVID-19 because Pakistan is an Islamic country and “Imams” and the religious scholars are very respected and revered here. They also agreed that a lockdown will prevent a nationwide spread because it will help people follow along the lines of “social distancing”. Interestingly 30.2% of the participants did not believe that seminars could help raise awareness among medical students. One of the reasons could be that in the age we are today, people are more likely to know more through social networks than seminars. Another possible reason is that arranging seminars completely goes against the idea of social distancing. This is in accordance with our findings as 330 (95.9%) students agreed with social distancing necessary to prevent transmission of the disease. Regarding involvement in the awareness campaigns, 30.5% of the participants were already part of various campaigns when the research was being conducted and 84.6% of the students agreed to volunteer if a health-care crisis arises. This was very uplifting as it showed that the future healthcare workforce of Pakistan had a fighting spirit, a positive attitude toward this pandemic and the empathy needed during such trying times.

Regarding practices adopted by medical students to prevent the spread of the disease, majority of the participants were following the guidelines given by WHO which included frequent washing of hands, practicing social distancing and avoiding handshakes. When inquired if they encouraged

these preventive measures among their family and friends, 99.4% of the students said yes. This shows that the medical students of Pakistan are practicing the proper preventive measures and also encouraging others to practice them which is imperative during this crisis as these are our only defense against the coronavirus for now.

Our study had a few limitations. Firstly, it was based on a questionnaire which was distributed online through different social networks. This led to unequal representation of students of various years of study which lead to minimal data collection from first year medical students. Secondly, the study was conducted at a specific point in time which gives us an idea of the knowledge, attitude and practices of students only during that time period. Thirdly, any recent change in the level of knowledge and attitude regarding the pandemic, in light of the changing global situation, could not be assessed. Finally, our sample was small. As the sample is small so its tough to generalize the data with Chi Square/Fisher. In this study, we have tried to show the scenario of knowledge, attitude and practice among the medical students and in the majority of cases students gave impressive results irrespective to year of medical study.

7. Conclusions

In conclusion, the medical students in Pakistan had the awareness they should possess during this crisis. They had a positive attitude towards this disease and practiced and preached the necessary preventive measures. Although a majority of the students had the correct knowledge and attitude regarding COVID-19 and also followed the recommended practices, for those few who do not possess the same level of knowledge and attitude need to be made aware. Conventionally, seminars and conferences are the way to go but with the current social distancing guidelines we would have to adapt ourselves. Online webinars should be conducted with proper student participation to make it more interactive and also dispel off any misconceptions they have. Furthermore, with ongoing researches and new information being available about COVID-19, we need to encourage students to be updated on new studies through subscriptions to various journals.

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9. Conflict of interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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None to declare.

11. Ethical Approval:

Institutional Ethical Review Committee, Faisalabad Medical University, Faisalabad, IRB0006912 (OHRP, USA), F.No.48-ERC/2020-21/PHRC/FMU/17

12. Author contributions

I.U and H.R.K conceived the idea; L.H, I.M, N.A, M.A, I.A and H.R.K collected the data; I.U analysed and interpreted the data; L.H, I.M, N.A, M.A, I.A, H.R.K and M.J.T did write up of the manuscript; and finally DM, SA, I.U and M.J.T reviewed the manuscript for intellectual content critically. All authors approved the final version of manuscript.

References

- [1] Guo YR, Cao QD, Hong ZS, Tan YY, Chen SD, Jin HJ, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. *Mil Med Res.* 2020 Mar 13;7(1):11. doi: 10.1186/s40779-020-00240-0.
- [2] Coronaviridae Study Group of the International Committee on Taxonomy of Viruses. The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol.* 2020 Apr;5(4):536-544. doi: 10.1038/s41564-020-0695-Z.
- [3] Gorbalenya AE, Baker SC, Baric R, Groot RJ, Drosten C, Gulyaeva AA, et al. Severe acute respiratory syndrome-related coronavirus: The species and its viruses—a statement of the Coronavirus Study Group.
- [4] Singhal T. A Review of Coronavirus Disease-2019 (COVID-19). *Indian J Pediatr.* 2020 Apr;87(4):281-286. doi: 10.1007/s12098-020-03263-6.
- [5] Shereen MA, Khan S, Kazmi A, Bashir N, Siddique R. COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. *J Adv Res.* 2020 Mar 16;24:91-98. doi: 10.1016/j.jare.2020.03.005.
- [6] Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int J Surg.* 2020 Apr;76:71-76. doi: 10.1016/j.ijssu.2020.02.034.
- [7] Rodriguez-Morales AJ, Cardona-Ospina JA, Gutiérrez-Ocampo E, Villamizar-Peña R, Holguin-Rivera Y, Escalera-Antezana JP, et al.; Latin American Network of Coronavirus Disease 2019-COVID-19 Research (LANCOVID-19). Electronic address: <https://www.lancovid.org>. Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis. *Travel Med Infect Dis.* 2020 Mar-Apr;34:101623. doi: 10.1016/j.tmaid.2020.101623.
- [8] Li LQ, Huang T, Wang YQ, Wang ZP, Liang Y, Huang TB, et al. COVID-19 patients' clinical characteristics, discharge rate, and fatality rate of meta-analysis. *J Med Virol.* 2020 Jun;92(6):577-583. doi: 10.1002/jmv.25757.
- [9] Chang D, Xu H, Rebaza A, Sharma L, Dela Cruz CS. Protecting health-care workers from subclinical coronavirus infection. *Lancet Respir Med.* 2020 Mar;8(3):e13. doi: 10.1016/S2213-2600(20)30066-7.
- [10] Khan S, Khan M, Maqsood K, Hussain T, Noor-Ul-Huda, Zeeshan M. Is Pakistan prepared for the COVID-19 epidemic? A questionnaire-based survey. *J Med Virol.* 2020 Jul;92(7):824-832. doi: 10.1002/jmv.25814.
- [11] WHO. Coronavirus disease (COVID-19) – World Health Organization. (2020). Retrieved 6 July 2020, from <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>

- [12] Hussain A, Ali I, Hassan Z. People with Diabetes Mellitus: Soft target for COVID-19 infection. *Pak J Med Sci.* 2020 May;36(COVID19-S4):S3-S5. doi: 10.12669/pjms.36.COVID19-S4.2629.
- [13] Singh AK, Gupta R, Ghosh A, Misra A. Diabetes in COVID-19: Prevalence, pathophysiology, prognosis and practical considerations. *Diabetes Metab Syndr.* 2020 Jul-Aug;14(4):303-310. doi: 10.1016/j.dsx.2020.04.004.
- [14] Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA.* 2020 Mar 17;323(11):1061-1069. doi: 10.1001/jama.2020.
- [15] Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, et al. Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: a systematic review and meta-analysis. *Int J Infect Dis.* 2020 May;94:91-95. doi: 10.1016/j.ijid.2020.03.017.
- [16] Al-Quteimat OM, Amer AM. The Impact of the COVID-19 Pandemic on Cancer Patients. *Am J Clin Oncol.* 2020 Jun;43(6):452-455. doi: 10.1097/COC.0000000000000712.
- [17] Government of Pakistan. COVID-19 Situation. Available from <http://covid.gov.pk/>. Accessed 6 July 2020.
- [18] Rubin GJ, Amlôt R, Page L, Wessely S. Public perceptions, anxiety, and behaviour change in relation to the swine flu outbreak: cross sectional telephone survey. *BMJ.* 2009 Jul 2;339:b2651. doi: 10.1136/bmj.b2651.
- [19] Khan H, Khawaja MR, Waheed A, Rauf MA, Fatmi Z. Knowledge and attitudes about health research amongst a group of Pakistani medical students. *BMC Med Educ.* 2006 Nov 2;6:54. doi: 10.1186/1472-6920-6-54.
- [20] Gautret P, Lagier JC, Parola P, Hoang VT, Meddeb L, Mailhe M, et al. Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial. *Int J Antimicrob Agents.* 2020 Jul;56(1):105949. doi: 10.1016/j.ijantimicag.2020.105949.
- [21] The Guardian. Hydroxychloroquine And Coronavirus: A Guide To The Scientific Studies So Far. Available at <https://www.theguardian.com/world/2020/apr/22/hydroxychloroquine-coronavirus-scientific-studies-research>. Accessed 6 July 2020.
- [22] Amici C, Di Caro A, Ciucci A, Chiappa L, Castilletti C, Martella V, et al. Indomethacin has a potent antiviral activity against SARS coronavirus. *Antivir Ther.* 2006;11(8):1021-30.
- [23] The Jakarta Post. Which Drugs Are Effective For COVID-19? Available at <https://www.thejakartapost.com/academia/2020/05/05/which-drugs-are-effective-for-covid-19.html>. Accessed 6 July 2020.
- [24] BBC News. China Coronavirus: Misinformation Spreads Online. Available at <https://www.bbc.com/news/blogs-trending-51271037>. Accessed 6 July 2020.
- [25] AlJazeera. Anti-Asian hate continues to spread online amid COVID-19 pandemic. Available at <https://www.aljazeera.com/news/2020/04/anti-asian-hate-continues-spread-online-covid-19-pandemic-200405063015286.html>. Accessed 6 July 2020,

[26] Alanagreh L, Alzoughool F, Atoum M. The Human Coronavirus Disease COVID-19: Its Origin, Characteristics, and Insights into Potential Drugs and Its Mechanisms. *Pathogens*. 2020 Apr 29;9(5):331. doi: 10.3390/pathogens9050331.

[27] Muhammad Alfareed Zafar S, Junaid Tahir M, Malik M, Irfan Malik M, Kamal Akhtar F, Ghazala R. Awareness, anxiety, and depression in healthcare professionals, medical students, and general population of Pakistan during COVID-19 Pandemic: A cross sectional online survey. *Med J Islam Repub Iran*. 2020(6 Oct);34:131. <https://doi.org/10.34171/mjiri.34.131>

[28] Ahmad S, Babar MS, Ahmadi A, Essar MY, Khawaja UA, Lucero-Prisno DE. Polio Amidst COVID-19 in Pakistan: What are the Efforts Being Made and Challenges at Hand? *Am J Trop Med Hyg*. 2020 Dec 2. doi: 10.4269/ajtmh.20-1438. Epub ahead of print. PMID: 33269673.

[29] Noreen K, Rubab ZE, Umar M, Rehman R, Baig M, Baig F. Knowledge, attitudes, and practices against the growing threat of COVID-19 among medical students of Pakistan. *PloS one*. 2020 Dec 11;15(12):e0243696.

Tables

Table-1: Characteristics of medical students

Characteristics		N (%)
Gender	Male	80(23.3)
	Female	264 (76.7)
Year of study	1 st year	11 (3.2)
	2 nd year	53 (15.4)
	3 rd year	54 (15.7)
	4 th year	91 (26.5)
	5 th year	135 (39.2)
Place of residence	Punjab	184 (53.5)
	Sindh	66 (19.2)
	Khyber Pakhtunkhwa	13 (3.8)
	Baluchistan	60 (17.4)
	Islamabad	8 (2.3)
	Azad Jammu and Kashmir	13 (3.8)

Table-2: Knowledge toward COVID-19

	Answer, N (%)		
	Correct	Incorrect	Uncertain
Meaning of COVID-19?	270 (78.5)	74 (21.5)	-
Difference between COVID-19 and nCoV?	74 (21.5)	270 (78.5)	-
nCoV originated from?	338 (98.3)	6 (1.7)	-
Mode of transmission of nCoV?	339 (98.5)	5 (1.5)	-
Incubation period of nCoV infection?	324 (94.2)	20 (5.8)	-
Most common symptoms of COVID-19?	323 (93.9)	21 (6.1)	-
Diarrhea an uncommon symptom of COVID-19?	268 (77.9)	76 (22.1)	-
nCoV causes more serious disease in older people?	303 (88.1)	4 (1.2)	37 (10.8)
Any specific antiviral medication to treat COVID-19?	293 (85.2)	13 (3.8)	38 (11.0)
Any vaccine available to prevent COVID-19?	319 (92.7)	07 (2.0)	18 (5.2)
Will every patient infected by nCoV die?	332 (96.5)	06 (1.7)	06 (1.7)
Current medical management of a patient with COVID-19?	296 (86)	48 (14)	
We can stop/reduce the transmission of COVID-19?	342 (99.4)	2 (0.6)	

Table 03: Association of year of study with knowledge

		Year of study N(%)					
Question	Responses	1st (N=11)	2nd (N=53)	3rd (N=54)	4th (N=91)	5th (N=135)	P value
Meaning of COVID-19?							
	Correct	8 (72.7)	41 (77.4)	41 (75.9)	74 (81.3)	106 (78.5)	0.925
	Incorrect	3 (2.73)	12 (22.6)	13 (24.1)	17 (18.7)	29 (21.5)	
Difference between COVID-19 and nCoV?							
	Correct	3 (2.73)	12 (22.6)	13 (24.1)	17 (18.7)	29 (21.5)	0.925
	Incorrect	8 (72.7)	41 (77.4)	41 (75.9)	74 (81.3)	106 (78.5)	
Origin of nCoV							
	Correct	11 (100.0)	51 (96.2)	52 (96.3)	91 (100.0)	133 (98.5)	0.227
	Incorrect	0 (0.0)	2 (3.8)	2 (3.7)	0 (0.0)	2 (1.5)	
Mode of transmission							
	Correct	10 (90.9)	52 (98.1)	53 (98.1)	91 (100.0)	133 (98.5)	0.145
	Incorrect	1 (9.1)	1 (1.9)	1 (1.9)	0 (0.0)	2 (1.5)	
Incubation period							
?	Correct	10 (90.9)	50 (94.3)	46 (85.2)	88 (96.7)	130 (96.3)	0.43
	Incorrect	1 (9.1)	3 (5.7)	8 (14.8)	3 (3.3)	5 (3.7)	
Most common symptoms							
	Correct	9 (81.8)	51 (96.2)	49 (90.7)	85 (93.4)	129 (95.6)	0.258

	Incorrect	2 (18.2)	2 (3.8)	5 (9.3)	6 (6.6)	6 (4.4)	
Diarrhea an uncommon symptom							
	Correct	6 (54.5)	38 (71.7)	36 (66.7)	81 (89.0)	107 (79.3)	0.003*
	Incorrect	5 (45.5)	15 (28.3)	18 (33.3)	10 (11.0)	28 (20.7)	
nCoV causes more serious disease in older people?							
	Correct	9 (81.8)	45 (84.9)	42 (77.8)	84 (92.3)	123 (91.1)	0.57
	Incorrect	0 (0.0)	0 (0.0)	3 (5.6)	0 (0.0)	1 (0.7)	
	Uncertain	2 (18.2)	8 (15.1)	9 (16.7)	7 (7.7)	11 (8.1)	
Any specific antiviral medication to treat COVID-19?							
	Correct	1 (9.1)	2 (3.8)	0 (0.0)	3 (3.3)	7 (5.2)	0.004*
	Incorrect	6 (54.5)	48 (90.6)	48 (88.9)	71 (78.0)	120 (88.9)	
	Uncertain	4 (36.4)	3 (5.7)	6 (11.1)	17 (18.7)	8 (5.9)	
Any vaccine available to prevent COVID-19?							
	Correct	1 (9.1)	1 (1.9)	0 (0.0)	4 (4.4)	1 (0.7)	0.338
	Incorrect	10 (90.9)	50 (94.3)	50 (92.6)	82 (90.1)	127 (94.1)	
	Uncertain	0 (0.0)	2 (3.8)	4 (7.4)	5 (5.5)	7 (5.2)	
Will every patient infected by nCoV die?							
	Correct	1 (9.1)	0 (0.0)	1 (1.9)	2 (2.2)	2 (1.5)	0.019*
	Incorrect	9 (81.8)	50 (94.3)	53 (98.1)	87 (95.6)	133 (98.5)	
	Uncertain	1 (9.1)	3 (5.7)	0 (0.0)	2 (2.2)	0 (0.0)	

**p* value is less than 0.1

Table 04: Attitude of student toward COVID-19

Variables	N (%)		
	Yes	No	May be
Do you think there is a role of Human behavior in the emergence of COVID-19?	285 (82.8)	16 (4.7)	43 (12.5)
Is social media playing an important role in recent COVID-19 pandemic?	290 (84.3)	18 (5.2)	36 (10.5)
Can religious leaders play a role in raising awareness in COVID-19 pandemic?	302 (87.8)	14 (4.1)	28 (8.1)
Arranging seminars and workshops regarding COVID-19 will increase the knowledge about the disease among the medical students.	240 (69.8)	104 (30.2)	-
Is lockdown or curfew a better solution for reducing the transmission of COVID-19?	324 (94.2)	20 (5.8)	-
Are you currently involved in an awareness project regarding COVID-19?	105 (30.5)	239 (69.5)	-
In case of health care crises, would you volunteer to work for the patients of COVID-19?	291 (84.6)	53 (15.4)	-
Does social distancing and avoiding handshakes prevent the transmission of COVID-19?	330 (95.9)	04 (1.2)	10 (2.9)

Table-05: Practices of students

Questions	Yes, N (%)	No, N (%)
Do you wash your hands frequently?	334 (97.1)	10 (2.9)
Do you wash your hands for 20 seconds?	286 (83.1)	58 (16.9)
Do you practice social distancing?	239 (98.5)	05 (1.5)
Do you avoid handshaking?	330 (95.9)	14 (4.1)
Do you encourage your family and friends to take preventive measures?	342 (99.4)	02 (0.6)