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The relationship between health-related quality of life of students at Tehran University of Medical Sciences and their knowledge, attitudes, and practices regarding COVID-19 in 2020

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Abstract:

BACKGROUND: Present study attempts to investigate health-related quality of life (HRQoL) and its relation with knowledge, attitudes, and practices (KAP) of students of Tehran University of Medical Sciences (TUMS) during this pandemic.

MATERIALS AND METHODS: In this cross-sectional study which was conducted between 23 may to 21 June 2020, 470 students in different levels of TUMS were included to the study randomly. participants completed validate, designed online questionnaire which assessed KAP towards coronavirus disease 2019 (COVID-19) and HRQoL. All statistical tests were applied, including Chi-square and Fisher's exact test, Partial correlation, analysis of variance, multiple linear regression, multiple binary and multinomial logistic regression models ($P < 0.05$) and were performed in SPSS 16, R 4.0.2, and GraphPad Prism 6.0 softwares.

RESULTS: A total of 470 students were included in the study. The overall correct answer rate of the COVID-19 knowledge questionnaire was 74.43% and total score of the HRQoL was 72.50 (14.85). 61.7% of the students were agreed that COVID-19 will finally be successfully controlled, 44.3% had confidence that Iran can win the battle against the COVID-19, and 92.6% agreed that Quarantine will reduce the prevalence of COVID-19. Most of them adhered to health protocols and about a relation between HRQoL and knowledge we have a weak positive and unsignificant correlation between them (r = 0.05, $P = 0.27$).

CONCLUSIONS: TUMS students showed expected levels of knowledge, proper attitudes, and preemptive practices regarding COVID-19, whereas COVID-19 outbreak substantially affected the physical and mental health but, the students were in a way better physical health rather than mental. Therefore, motivational planning and other related intervention to improve mental health can be noticeable.

Keywords:

Attitude, COVID-19, health, knowledge, quality of life

Introduction

In December 2019, an unidentified case of pneumonia was reported in Wuhan City, Hubei Province, China, which was very similar to viral pneumonia. This recently-detected virus was later named coronavirus disease 2019 (COVID-19) by

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the World Health Organization (WHO).[1,2] The virus has spread rapidly around the world as of 9:33 a. m. CET, January 10, 2021, there have been more than 88.1 million confirmed cases of COVID-19, including more than 1.9 million deaths reported to the WHO. Moreover, in Iran, more than 1.2 million people have been infected with this disease and almost 56 thousand of them have died until 10 January 2021.[3] COVID-19 has clinical symptoms such as cough, fever, shortness of breath, fatigue, and loss of smell and taste, and also the resultant emotional and mental disorders.[4,5] In this delicate situation many universities around the world have canceled physical classes to prevent the spread of the COVID-19 infection. Furthermore, the students' long stay at home would lead to the short and long-term adverse consequences for their physical and mental health.[6-8] Previous studies have demonstrated that COVID-19 affected the health and quality of life (QoL) of the students and resulted in some students' problems such as depression and anxiety. Previous research suggested that the mental and physical health of students should be monitored during epidemics due to their vital importance.[9-11] Due to the influence of knowledge about COVID-19 on the students' perceptions and health-related QoL (HRQoL) concerning their past experiences and beliefs, the status of knowledge, attitudes, and practices (KAP) of students becomes crucially important.[12]

To the best of researchers' knowledge just one study has assessed only related knowledge, preventive behaviors, and risk perceptions of students concerning COVID-19 in Iran but not the HRQoL and its relation with KAP.[13] Because of the probable effects of universities closure and the COVID-19 pandemic on the physical and mental health of students, this study was the first attempt to investigate HRQoL (mental and physical status) and its relation with KAP of students of Tehran University of Medical Sciences (TUMS) during COVID-19 pandemic. However, not enough researches focused on exploring the KAP towards COVID-19 among the medical students.[12,14,15] Therefore, the results of this study can show the effectiveness of the efforts of relevant agencies (WHO and Ministry of Health and Medical Education) and additionally determine the gap for relevant interventions by demonstrating the status of KAP, mental and physical health.

Materials and Methods

Study design and setting

This cross-sectional study was conducted in TUMS from May 23 to June 21, 2020, to investigate TUMS students' KAP of COVID-19 and its relation with HRQoL.

Study participants and sampling

The sample size calculated through using Cochran's formula was 372 with a confidence level of 95% and 5% margin of error. Due to the TUMS closure and prevention recommendations caused by the outbreak, data was gathered using a designed online questionnaire through Telegram channels, WhatsApp, and the TUMS website.

Inclusion and exclusion criteria in this study: Students entered into the study with personal consent and only TUMS students who had completed the electronic questionnaire were eligible for participation, without any age or gender restriction and finally we checked the students ID of all participants, and others were excluded from the study.

Measures

The online questionnaire consisted of three sections: Demographic data, KAP of COVID-19 and HRQoL. The demographic section included gender, marital status, age, region (village or city), history of COVID-19 infection, place of residency (dormitory or others), and academic degree (undergraduate or postgraduate).

Concerning the COVID-19 guidelines and announcement issued by WHO, the Ministry of Health and Medical Education of Iran, and a similar study conducted in China by Zhong 2020,[16,17] a COVID-19 KAP questionnaire was developed by the authors of the current study.

The KAP questionnaire had 21 questions including 14 knowledge, 3 attitude, and 4 practice items. Knowledge questions had three response options of true, false, and I don't know, in which the true answer was assigned 1 score and the false and I don't know answer were assigned 0 point. With regard to the reliability of the modified version of Zhong's knowledge questions, the Cronbach's alpha coefficient was 0.82 in our sample, indicating an acceptable level of internal consistency.[16,18]

SF-36 is a standardized and validated HRQoL questionnaire which was constructed to survey health status in the Medical Outcomes Study. It involved 36 questions with eight distinct health status concepts (physical functioning [PF], role-physical [RP], role-emotional [RE], vitality [VT], mental health [MH], social functioning [SF], bodily pain [BP] and general health [GH]) in order to assess HRQoL. Eight of the SF-36 scales contributed, with different degrees, to the physical component summary (PCS) and the mental component summary (MCS). PF, RP, BP and GH, contribute more significantly to the PCS, whereas VT, SF, RE, and MH, contribute more significantly to MCS,[19,20] to be precise.

Statistical analysis

We used mean ± standard deviation and frequency (percentage) indices to describe quantitative and qualitative variables, respectively. The univariate correlation of KAP regarding COVID-19 and HRQoL

with demographic characteristics was analyzed using independent *t*-test, one-way analysis of variance, and Chi-square test or Fisher's exact test. Furthermore, multiple linear regression analysis was used to identify adjusted association of the demographic variables as independent variables and Knowledge, HRQoL, PCS, and MCS scores as the dependent variables. Partial correlation coefficients were used to assess the relationship between each of the subscales and knowledge score. Likewise, multiple binary and multinomial logistic regression models were used to identify factors associated with practices (a binary dependent variable) and attitudes (a nominal qualitative dependent variable with more than two levels), respectively. Odds ratios and their 95% confidence intervals were used to quantify the associations between the variables and KAP. Statistical analysis was performed in SPSS ver. 16 (IBM, Chicago, IL, USA) and the logistic package (for penalized binary logistic regression) in R software (version 4.0.2, R Foundation for Statistical Computing, Vienna, Austria). GraphPad Prism software (version 6.0, GraphPad, San Diego, CA, USA) was also used to draw the graphs. The level of significance selected for the statistical tests was 0.05.

Ethical considerations

The first page of the online questionnaire was related to the consent form which had to be approved before starting and detailed information about the study; therefore, all students were informed of the study's goals and procedures. The study was conducted in accordance with the World Medical Association's Helsinki Declaration for Human Studies and was approved at the ethics committee of TUMS (Approval ID: IR.TUMS.VCR.REC.1399.237).

Results

The online questionnaire was viewed 984 times, but only 499 (response rate: 64%) viewers completed it, and the average response time was 9 min and 46 s. About 94% of these questionnaires were completed by mobile device, 4% by personal computer, 2% by tablet phone, and the distribution networks included Telegram (41%), WhatsApp (2%), and others (57%). Among 499 respondents, only 470 included to the study because 29 of them were not the TUMS students. The mean age of students was 24.2 ± 6.84 years old (range: 17–60 years). With regard to gender, 287 of the participants (61.3%) were women and the rest of them were men. The overall correct answer rate of the COVID-19 knowledge questionnaire was 74.43% and total score of the COVID-19 knowledge and HRQoL were 10.42 (1.74) and 72.50 (14.85), respectively. Table 1 shows the COVID-19 knowledge and HRQoL scores based on the level of demographic characteristics.

HRQoL and knowledge scores showed no significant difference across demographic characteristics, but history of COVID-19 was associated with HRQoL [Table 2].

Concerning the attitudes, 61.7% of the students were agreed that COVID-19 will finally be successfully controlled (A1), 44.3% had confidence that Iran can win the battle against the COVID-19 (A2), and 92.6% agreed that quarantine will reduce the prevalence of COVID-19 (A3). The adjusted association between attitudes and demographic characteristics, knowledge, and HRQoL using multi-nominal logistic regression model are shown in Table 3 and unadjusted association is summarized in Supplementary Table S1.

The results of four questions about practices showed that 60.9% of the students did not go to crowded places in recent days (P1), 78.1% of them wore masks when leaving their houses (P2), 93.8% washed their hands when they returned home (P3) and 92.1% of the students avoided touching their eyes, their mouths and noses as far as possible (P4). The adjusted associations between practices and demographic characteristics, knowledge, and HRQoL conducted using multiple binary logistic regression are reported in Table 4 and unadjusted correlation is summarized in Supplementary Table S2.

The results showed a weak, positive, and insignificant correlation between HRQoL and knowledge (r = 0.05, P = 0.27). The results of subscales of the SF-36, showed that the mean scores of PCS and MCS were 78.21 (15.85) and 61.12 (20.89), respectively. The relationships between knowledge and two dimensions of HRQoL (PCS and MCS) regarding the students' demographic characteristics are reported in the supplementary Table S3. Besides, the descriptive statistics and partial correlation coefficients between each of the subscales and knowledge (whilst controlling for the effect of the others) are shown in Figure 1.

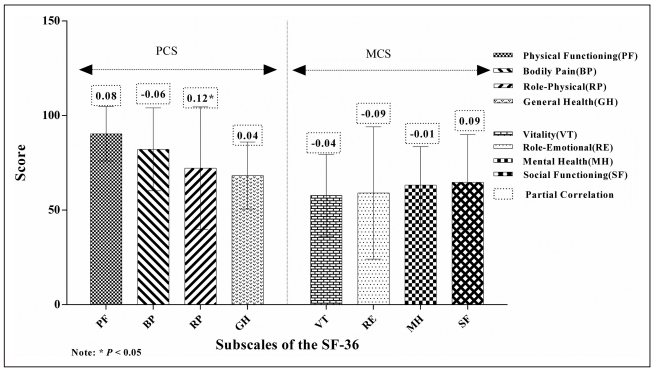

Figure 1: Result of descriptive statistics of the Subscales of the SF-36, and their relation to knowledge

Table 1: Baseline demographic characteristics of students in relation to coronavirus disease-2019 knowledge and health-related Quality of Life

Variables	*n* (%)	Knowledge score	*P*	HRQoL score	*P*
Gender					
Male	181 (38.7)	10.22±1.96	0.072	72.99±14.77	0.523
Female	287 (61.3)	10.53±1.58		72.09±14.92	
Age					
<22	208 (44.5)	10.25±1.71	0.063	73.91±13.89	0.062
≥22	259 (55.5)	10.55±1.76		71.33±15.53	
Marital status					
Married	78 (16.7)	10.44±1.66	0.928	68.48±16.41	0.008
Single	389 (83.3)	10.42±1.76		73.33±14.37	
Academic degree					
Undergraduate	309 (67.8)	10.38±1.72	0.418	72.79±15.26	0.64
Postgraduate	147 (32.2)	10.52±1.79		72.09±14.04	
Region					
Village	14 (3)	10.43±1.16	0.984	70.58±11.25	0.623
City	456 (97)	10.42±1.76		72.56±14.95	
Residence places					
Others	261 (57.4)	10.44±1.70	0.714	71.91±15.11	0.285
Dormitory	194 (42.6)	10.38±1.79		73.41±14.39	
History of COVID-19					
No	449 (95.5)	10.39±1.75	0.09	73.24±14.44	<0.001
Yes	21 (4.5)	11.05±1.43		56.75±15.11	

COVID-19=Coronavirus disease-2019, HRQoL=Health-related Quality of Life

Table 2: Results of multiple linear regression on factors associated with coronavirus disease-2019 knowledge and health-related Quality of Life

Variable		Coefficient	SE	*P*	95% CI (lower–upper)
Independent	Dependent				
Gender (male versus female)	Knowledge	−0.32	0.17	0.06	−0.66–0.02
	HRQoL	0.06	1.43	0.97	−2.76–2.88
Age	Knowledge	0.002	0.17	0.91	−0.031–0.04
	HRQoL	−0.16	0.14	0.25	−0.44–0.12
Marital status (married versus single)	Knowledge	−0.06	0.29	0.83	−0.64–0.51
	HRQoL	−2.32	2.41	0.34	−7.06–2.42
Academic degree (postgraduate versus undergraduate)	Knowledge	0.12	0.12	0.51	−0.25–0.49
	HRQoL	−0.26	1.54	0.87	−3.29–2.77
Region (city versus village)	Knowledge	−0.19	0.49	0.69	−1.16–0.77
	HRQoL	2.86	4.04	0.48	−5.09–10.81
Residence places (dormitory versus others)	Knowledge	−0.11	0.18	0.53	−0.47–0.24
	HRQoL	0.89	1.497	0.55	−2.05–3.83
History of COVID-19 (yes versus no)	Knowledge	0.71	0.43	0.09	−0.13–1.54
	HRQoL	−15.98	3.51	<0.001	−22.88–−9.09

SE=Standard error, COVID-19=Coronavirus disease-2019, HRQoL=Health-related Quality of Life, CI=Copnfidence interval

Discussion

Due to the widespread prevalence of COVID-19, the subsequent quarantine and closure of universities, students' physical and mental health has been exposed to danger. On the other hand, having enough knowledge, optimistic attitude and cautious practice about this disease could have a great impact on its prevention. Therefore, this study aimed to the investigation of such issues. According to the literature, this study was the first to investigate the impact of COVID-19 on HRQoL and its relationship with KAP among TUMS Students in 2020. The majority of the students scored more than 10 points, indicating their knowledgeability while only 0.6% showed limited (score <4 points) knowledge about COVID-19. Concerning HRQoL, about half of the students had an acceptable level of HRQoL (score more than 75) while 5.5% of them had very low level of HRQoL (score <45). The students had a relatively optimistic attitude towards COVID-19 pandemic: Most believed that social distancing (quarantine) would reduce the prevalence of COVID-19, 61.7% believed that COVID-19 would finally be successfully controlled and 44.3% believed that Iran could definitely win the

Table 3: Multi-nominal logistic regression analysis of factors associated with attitudes

Variables		No versus yes			I don't know versus yes		
	A*	OR	95% CI	*P*	OR	95% CI	*P*
Gender (male versus female)	A1	0.97	0.59-1.61	0.91	0.41	0.22-0.75	0.004
	A2	0.76	0.48-1.21	0.25	0.53	0.32-0 0.89	0.02
	A3	1.65	0.66-4.13	0.28	0.77	0.19-3.16	0.72
Age	A1	1.004	0.95-1.06	0.89	1.02	0.97-1.08	0.37
	A2	1.01	0.96-1.06	0.75	1.02	0.97-1.07	0.53
	A3	0.85	0.72-1.00	0.052	1.03	0.92-1.16	0.58
Marital status (married versus single)	A1	1.05	0.46-2.40	0.91	0.65	0.26-1.62	0.35
	A2	1.10	0.49-2.36	0.86	0.88	0.37-2.06	0.76
	A3				**		
Academic degree (postgraduate versus undergraduate)	A1	0.85	0.49-1.47	0.56	1.33	0.75-2.38	0.33
	A2	1.44	0.87-2.36	0.15	1.29	0.75-2.23	0.36
	A3	0.84	0.28-2.52	0.76	0.65	0.15-2.87	0.57
Region (city versus village)	A1	1.79	0.37-8.87	0.47	0.89	0.17-4.51	0.88
	A2				*		
	A3				**		
Residence places (dormitory versus others)	A1	0.86	0.51-1.45	0.57	0.71	0.39-1.27	0.25
	A2	1.03	0.64-1.65	0.92	0.80	0.48-1.36	0.42
	A3	1.28	0.51-3.16	0.60	5.4	1.09-27.29	0.04
History of COVID-19 (yes versus no)	A1	1.28	0.31-5.23	0.73	6.65	1.95-22.68	0.002
	A2	4.77	0.98-23.18	0.053	5.52	1.04-29.27	0.045
	A3				*		
Knowledge score	A1	0.98	0.86-1.13	0.81	0.95	0.81-1.12	0.54
	A2	0.93	0.81-1.06	0.25	0.91	0.79-1.05	0.19
	A3	0.70	0.56-0.88	0.003	0.52	0.37-0.71	<0.001
HRQoL score	A1	0.96	0.95-0.98	<0.001	0.98	0.96-1.00	0.08
	A2	0.97	0.95-0.98	<0.001	0.99	0.97-1.01	0.15
	A3	0.97	0.94-0.99	0.03	0.98	0.94-1.02	0.29

*Attitude, **Estimates do not converge because we have an empty cell. A1=Do you agree that COVID-19 will finally be successfully controlled?, A2=Do you have confidence that Iran can win the battle against the COVID-19?, A3=Do you agree that social distancing (quarantine) will reduce the prevalence of COVID-19?. COVID-19=Coronavirus disease-2019, HRQoL=Health-related Quality of Life, OR=Odds ratio, CI=Confidence interval

Table 4: Results of multiple binary logistic regression analysis on factors associated with practices of coronavirus disease-2019

Variables	Practices, OR (95% CI) yes versus no			
	P1	P2	P3	P4
Gender (male versus female)	1.74 (1.16-2.6)**	0.44 (0.28-0.71)**	0.50 (0.22-1.12)	0.62 (0.28-1.34)
Marital status (married versus single)	0.91 (0.45-1.81)	2.04 (0.76-5.49)	2.82 (0.63-17.84)	4.03 (0.86-26.94)
Region (city versus village)	1.4 (0.43-4.4)	0.96 (0.28-3.38)	4.37 (0.95-16.99)	0.23 (0.002-1.99)
History of COVID-19 (yes versus no)	0.6 (0.21-1.72)	0.82 (0.26-2.62)	0.52 (0.13-2.94)	0.33 (0.1-1.24)*
Residence places (dormitory versus others)	1.1 (0.72-1.67)	0.66 (0.41-1.08)	1.1 (0.47-2.57)	0.41 (0.19-0.91)*
Academic degree (postgraduate versus undergraduate)	1.13 (0.73-1.75)	1.57 (0.91-2.69)	1.69 (0.69-4.68)	3.86 (1.49-12.03)**
Age	1.00 (0.96-1.04)	1.00 (0.95-1.06)	0.97 (0.90-1.05)	0.95 (0.89-1.03)
Knowledge score	0.97 (0.86-1.1)	1.09 (0.96-1.24)	1.28 (1.05-1.56)*	1.18 (0.99-1.44)
HRQoL score	0.99 (0.97-1)	1.01 (0.99-1.03)	1.02 (0.99-1.05)	1.05 (1.02-1.07)***

*P<0.05, **P<0.01, ***P<0.001. P1=Have you gone to any crowded place, in recent days?, P2=Have you worn a mask when leaving home, in recent days?, P3=In recent days, when you return home, have you washed your hands (for at least 20 s with soap and water) and disinfected your devices before entering into home?, P4=In recent days, do you avoid touching your eyes, mouth and nose as much as possible when leaving home?. COVID-19=Coronavirus disease-2019, HRQoL=Health-related Quality of Life, OR=Odds ratio, CI=Confidence interval

battle against the COVID-19. Although the results of the current study were consistent with the findings of some previous studies,[13,16,21] the measure values of previous research were much higher. For instance, in Zhong's study, the mean score of COVID-19 knowledge was 10.8 and the overall correct answer rate of COVID-19 knowledge questionnaire was 90% while in the current study these measures were 10.4 and 74.43%, respectively. Moreover, Zhong's study showed the better function of participants in the areas of "had not visited any

crowded place" and "wore masks when going out" than the present study, which could be the probable reason of China successfulness in controlling the COVID-19 pandemic. In addition, this study evaluated other aspects of precautionary practices such as "avoid touching eyes, mouth and nose as far as possible when they leave home" and "washing hands when they return home" which are not mentioned in Zhang's study.[16] Furthermore, this study unlike similar previous studies made use of a wider sample size (including different provinces of the country) and longer period of completion time.[13,16,22] Also, to identify factors associated with attitudes, instead of fitting two independent binary logistic regression models with a same reference category, this study used the multinomial logistic regression to predict the probability of category membership on given several independent variables. The used analysis approach was more powerful than previous approaches because it provided lower standard error than the separate binary logistic models.

The results expressed that knowledge score did not show any significant difference across gender, age, marital status, academic degree, region, place of residency, and history of COVID-19, which was similar to Zhong's study.[16] However, HRQoL scores differed significantly only across history of COVID-19 and Marital status. To be exact, HRQoL of single students was higher than married students in MCS and PCS, which could be due to the economic problems and health-related concerns of families. It is worth noting that the married students less likely went to crowded places and more likely followed hygienic protocols such as masking, hand washing, and avoiding touching the face than the single students.

The students with a history of COVID-19 were more likely to choose "I don't know" rather than "yes" to the item of "eventually COVID-19 will be controlled and Iran can win the battle against the COVID-19", which could be due to the psychological burden of experiencing COVID-19 infection. To put differently, the history of COVID-19 infection reduced the HRQoL scores (MCS and PCS). Also, the more knowledge about COVID-19 the students acquired, the more PCS promotion they gained; however, their MSC did not considerably increase. The reason behind the relative stability of the MCS scores may be due to effect of the critical COVID-19 pandemic on the students' mental health. In addition, the students with a history of COVID-19 less often went to the crowded places; however, they have less adhered to health prohibitive protocols (P1-P4), especially regarding avoiding touching the face when leaving home, which could be a factor in the growth of prevalence of the disease.

Those students living in the dormitory were more likely to say "I don't know" than "yes" to the item of "Belief of quarantine is effective in preventing COVID-19;" however, they had better attitudes towards A1 and A2. Moreover, they wore less masks when they went out, which could be due to the less rigorous and voluntary measures at the time of the study.

It is worth mentioning that male students less likely opted to say "I don't know" than "yes" to the item of "eventually COVID-19 will be controlled and Iran can win the battle against the COVID-19" and they were more likely (74%) to go to crowded place. Whereas a vast majority of the students held an optimistic attitude towards the effectiveness of quarantine but men were less agreed to quarantine than women and men were more likely to go to crowded places. Although the male students more likely believed that COVID-19 would finally be successfully controlled, they less frequently adhered to health protocols than women, especially wearing a mask when leaving home.

As mentioned in the previous parts, the student's practice and attitude were at an appropriate level during the study time, which is consistent with Khasawneh and Zhong's study.[15,16] Therefore, timely, proportional, and accurate reports and guidelines issued by WHO and Ministry of Health and Medical Education of Iran play an important role in tackling the COVID-19 pandemic.

The findings suggested that HRQoL and knowledge might have an influence on attitudes and practices since the students with higher knowledge score were more likely to wash their hands when they returned home and also those students with higher HRQoL score were more likely to avoid touching eyes, mouth and nose as far as possible when they were outside. Besides, the students with higher knowledge score were less likely to say "I don't know" and "No" than "yes" to the item of "Belief of quarantine is in reduction of the prevalence of COVID-19". Also, the students with higher HRQoL score were less likely to say "I don't know" than "yes" to the two items of "eventually COVID-19 will be controlled, Iran can win the battle against the COVID-19" and "quarantine is effective in reduction of the prevalence of COVID-19". The negative attitude of the students towards Iran's success in overcoming COVID-19 could be due to the fact that Iran is a developing country and also dealing with an unfavorable economic situation due to imposed sanctions.

Regarding the students' PCS and MCS in this study, which was measured by the SF-36 questionnaire, the students were in a way better physical rather than mental condition because their scores in PCS were higher than their scores in MCS. Although there was no significant correlation between HRQoL and knowledge, there was a significant positive correlation between

PCS and knowledge. Therefore, it could be implied that knowledge was a prerequisite to a decent high QoL in which the increase in knowledge score resulted in the increases in PCS score. The results suggested that the COVID-19 outbreak radically affected the physical and mental health of the TUMS students, which is line with some studies that suggested the need for measures to strengthen the physical and mental health during the epidemic.[23-26]

Limitations and recommendation

Regarding the limitations, first, the sample included those medical students who had access to the internet. Second, this study used the Sf-36 questionnaire to assess HRQoL which was not a specialized questionnaire of the pandemic condition like COVID-19 so future research needs to be aimed at developing a COVID-19-specialized questionnaire for HRQoL assessment. Third, various dimensions of physical and mental health such as depression and stress that could affect the QoL were not investigated in this study. Therefore, future longitudinal studies are needed to analyze the long-term impact of COVID-19 pandemic on the health state and QoL of TUMS students to reach a conclusion on the causative relationships among the involved variables.

We recommend that improving the quality of educational programs for students during this pandemic can reduce students' mental stress and assist those for effective learning.

Conclusions

Overall, the TUMS students showed expected levels of knowledge, appropriate attitudes, and precautionary practices regarding COVID-19. Whereas no significant evidence observed between HRQoL and knowledge and a significant positive correlation was detected between PCS and knowledge. In other words, an increase in the knowledge score resulted in an increase in the PCS score, which somehow indicated the effectiveness of knowledge in the QoL. Furthermore, the results suggested that the COVID-19 outbreak substantially affected the physical and mental health of medical students. Additionally, it was indicated that those students with higher HRQoL and knowledge scores had relatively better attitudes and preventive practices regarding COVID-19. It is worthwhile noting that the precautionary practices of the Iranian medical students have been lower than other countries, which was a reason behind the growth of COVID-19 prevalence in Iran. This issue emphasizes the fact that COVID-19 announcement and prohibitive education in Iran require necessary further modifications. These results could be used by the researchers as a scientific basis for future research in this area. Moreover, this study proves useful for the Ministry of Health and Medical Education of Iran in proposing the right policy measures.

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Conflicts of interest

There are no conflicts of interest.

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Table S1: The students' coronavirus disease-2019-related attitudes regarding demographic characteristics, knowledge, and health-related Quality of Life

Characteristics	Attitudes, n (%), mean±SD											
	A1				A2				A3			
	Yes	No	I don't know	*P*	Yes	No	I don't know	*P*	Yes	No	I don't know	*P*
Gender												
Male	121 (66.9)	41 (22.7)	19 (10.5)	0.006	90 (49.7)	58 (32)	33 (18.2)	0.056	163 (90.1)	13 (7.2)	5 (2.8)	0.171
Female	168 (58.5)	56 (19.5)	63 (22)		117 (40.8)	92 (32.1)	78 (27.2)		271 (94.4)	10 (3.5)	6 (2.1)	
Marital status												
Married	46 (59)	17 (21.8)	15 (19.2)	0.858	30 (38.5)	28 (35.9)	20 (25.6)	0.54	76 (97.4)	1 (1.3)	1 (1.3)	0.258
Single	242 (62.2)	80 (20.6)	67 (17.2)		176 (45.2)	122 (31.4)	91 (23.4)		357 (91.8)	22 (5.7)	10 (2.6)	
Age (years)												
<22	130 (62.5)	45 (21.6)	33 (15.9)	0.674	101 (48.6)	60 (28.8)	47 (22.6)	0.207	186 (89.4)	17 (8.2)	5 (2.4)	0.029
≥22	158 (61)	52 (20.1)	49 (18.9)		105 (40.5)	90 (34.7)	64 (24.7)		246 (95)	7 (2.7)	6 (2.3)	
Region												
Village	10 (71.4)	2 (14.3)	2 (14.3)	0.926	10 (71.4)	3 (21.4)	1 (7.1)	0.133	13 (92.9)	0	1 (7.1)	0.402
City	280 (61.4)	96 (21.1)	80 (17.5)		198 (43.4)	148 (32.5)	110 (24.1)		422 (92.5)	24 (5.3)	10 (2.2)	
History of COVID-19												
No	283 (63)	94 (20.9)	72 (16)	0.002	205 (47.7)	139 (31)	105 (23.4)	0.011	416 (92.7)	23 (5.1)	10 (2.2)	0.452
Yes	7 (33.3)	4 (19)	10 (47.6)		3 (14.3)	12 (57.1)	6 (28.6)		19 (90.5)	1 (4.8)	1 (4.8)	
Residence place												
Others	151 (57.9)	58 (22.2)	52 (19.9)	0.133	110 (42.1)	83 (31.8)	68 (26.1)	0.303	246 (94.3)	12 (4.6)	3 (1.1)	0.088
Dormitory	129 (66.5)	38 (19.6)	27 (13.9)		92 (47.4)	63 (32.5)	39 (20.1)		174 (89.7)	12 (6.2)	8 (4.1)	
Academic degree												
Undergraduate	192 (62.1)	70 (22.7)	47 (15.2)	0.327	146 (47.2)	94 (30.4)	69 (22.3)	0.231	284 (91.9)	18 (5.8)	7 (2.3)	0.525
Postgraduate	89 (60.5)	28 (19)	30 (20.4)		57 (38.8)	53 (36.1)	37 (25.2)		138 (93.9)	5 (3.4)	4 (2.7)	
Knowledge score	10.24 (1.68)	10.32 (1.93)	10.4 (1.73)	0.78	10.53 (1.62)	10.28 (1.84)	10.41 (1.83)	0.40	10.54 (1.61)	9.38 (2.41)	7.82 (2.27)	<0.001
HRQoL score	74.86 (13.71)	67.68 (17.09)	69.93 (14.17)	<0.001	75.52 (13.21)	68.44 (16.74)	72.36 (13.76)	<0.001	72.95 (14.48)	67.99 (18.11)	64.68 (19.05)	0.059

COVID-19=Coronavirus disease-2019, SD=Standard deviation, HRQoL=Health-related Quality of Life

Table S2: The students' coronavirus disease-2019-related practices of regarding demographic characteristics, knowledge, and health-related Quality of Life

Characteristics	Practices, *n* (%), mean±SD											
	P1			P2			P3			P4		
	Yes	No	*P*	Yes	No	*P*	Yes	No	*P*	Yes	No	*P*
Gender												
Male	85 (47)	96 (53)	0.005	123 (68)	58 (32)	<0.001	163 (90.1)	18 (9.9)	0.008	162 (89.5)	19 (10.5)	0.099
Female	97 (33.8)	190 (66.2)		242 (84.3)	45 (15.7)		276 (96.2)	11 (3.8)		269 (93.7)	18 (6.3)	
Marital status												
Married	31 (39.7)	47 (60.3)	0.946	70 (89.7)	8 (10.3)	0.006	76 (97.4)	2 (2.6)	0.199	75 (96.2)	3 (3.8)	0.144
Single	153 (39.3)	236 (60.7)		294 (75.6)	95 (24.4)		362 (93.1)	27 (6.9)		355 (91.3)	34 (8.7)	
Age (years)												
<22	75 (36.1)	133 (63.9)	0.185	153 (73.6)	55 (26.4)	0.04	194 (93.3)	14 (6.7)	0.68	186 (89.4)	22 (10.6)	0.06
≥22	109 (42.1)	150 (57.9)		211 (81.5)	48 (18.5)		244 (94.2)	15 (5.8)		244 (94.2)	15 (5.8)	
Region												
Village	5 (35.7)	9 (67.3)	0.79	10 (71.4)	4 (28.6)	0.52	11 (78.6)	3 (26)	0.49	14 (100)	0 (0)	0.62
City	179 (39.3)	277 (60.7)		357 (78.3)	99 (21.7)		430 (94.3)	26 (5.7)		419 (91.9)	37 (8.1)	
History of COVID-19												
No	177 (39.4)	272 (60.6)	0.58	351 (78.2)	98 (21.8)	0.79	422 (94)	27 (6)	0.38	418 (93.1)	31 (6.9)	0.004
Yes	7 (33.3)	14 (66.7)		16 (76.2)	5 (23.8)		19 (90.5)	2 (9.5)		15 (71.4)	6 (28.6)	
Residence places												
Others	97 (37.2)	164 (62.8)	0.44	213 (81.6)	48 (18.4)	0.023	246 (94.3)	15 (5.7)	0.53	245 (93.9)	16 (6.1)	0.102
Dormitory	79 (40.7)	115 (59.3)		141 (72.7)	53 (27.3)		180 (92.8)	14 (7.2)		174 (89.7)	20 (10.3)	
Academic degree												
Undergraduate	117 (37.9)	192 (62.1)	0.55	233 (75.4)	76 (24.6)	0.07	287 (92.9)	22 (7.1)	0.21	279 (90.3)	30 (9.7)	0.04
Postgraduate	60 (40.8)	87 (59.2)		122 (83)	25 (17)		141 (95.9)	6 (4.1)		141 (95.9)	6 (4.1)	
Knowledge score	10.33 (1.94)	10.48 (1.59)	0.40	10.51 (1.63)	10.10 (2.1)	0.033	10.47 (1.66)	9.59 (2.61)	0.08	10.47 (1.67)	9.81 (2.36)	0.103
HRQoL score	71.12 (14.05)	73.33 (15.31)	0.13	72.80 (14.87)	71.43 (14.79)	0.41	72.95 (14.67)	65.63 (16.06)	0.01	73.52 (14.05)	60.54 (18.53)	<0.001

COVID-19=Coronavirus disease-2019, SD=Standard deviation, HRQoL=Health-related Quality of Life

Table S3: The results of multiple linear regression on factors associated with physical and mental component summary

Variable		Coefficient	SE	*P*	95% CI (lower-upper)
Independent	Dependent				
Gender (male versus female)	PCS	−0.38	1.50	0.80	−3.33-2.58
	MCS	−0.14	2.06	0.95	−4.19-3.91
Age	PCS	−0.23	0.15	0.11	−0.52-0.06
	MCS	0.19	0.20	0.34	−0.20-0.59
Marital status (married versus single)	PCS	−3.26	2.52	0.19	−8.21-1.69
	MCS	−1.69	3.45	0.63	−8.47-5.09
Academic degree (postgraduate versus undergraduate)	PCS	−0.06	1.61	0.97	−3.23-3.10
	MCS	−2.56	2.21	0.25	−6.89-1.78
Region (city versus village)	PCS	3.35	4.22	0.43	−4.96-11.65
	MCS	5.01	5.79	0.39	−6.37-16.39
Residence places (dormitory versus others)	PCS	0.97	1.56	0.53	−2.10-4.05
	MCS	2.39	2.14	0.26	−1.82-6.61
History of COVID-19 (yes versus no)	PCS	−20.49	3.68	<0.001	−27.72-−13.27
	MCS	−17.81	5.04	<0.001	−27.71-−7.90
Knowledge score	PCS	1.03	0.42	0.01	0.21-1.84
	MCS	0.44	0.57	0.44	−0.67-1.56

SE=Standard error, CI=Confidence interval, PCS=Physical component summary, MCS=Mental component summary, COVID-19=Coronavirus disease-2019