Knowledge, Risk Perception, and Preventive Behaviors Related to COVID-19 Pandemic Among Undergraduate Medical Students in Egypt

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Abstract

With the deteriorating situation during the COVID-19 pandemic, healthcare workers and medical students posted in wards are also supposed to be at risk of getting infected. This study aimed to evaluate knowledge, risk perception, and preventive behaviors related to the COVID-19 pandemic among undergraduate medical students in Egypt. This is a cross-sectional observational study using an anonymous online questionnaire. The survey was conducted through a link shared on social networking sites. Data were collected from 19 June 2020 to 26 June 2020. The medical students of Suez Canal University fulfilled the inclusion criteria and agreed to participate in the study were included by using convenience and snowball sampling technique (283 students). The total related knowledge score was 80.9%. The majority (83%) feel that coronavirus infection is a life-threatening illness. About 86.9% of the students perceived a COVID-19-infected person as a serious threat to society. However, three-quarters of the students (76.3%) perceived risk of infection with COVID-19 during ward rotations. About 92% of the students are practicing preventive behaviors. Female senior students have higher percentages in regard to related knowledge and practicing preventive behaviors. Students who received education about Covid-19 and students perceived higher risk of infection were more adherent to preventive measures. There is a moderate correlation between related knowledge and practicing preventive behaviors. Medical students have good knowledge, practice preventive behaviors, and perceive risk of being infected. The direction to raise knowledge and awareness will enhance practicing preventive behaviors to control the disease.

Keywords COVID-19 · Egypt · Knowledge · Preventive behaviors · Risk perception

Introduction

In the past two decades, many countries faced challenges of major infectious disease epidemics including SARS-CoV-1, swine flu (H1N1), Middle East respiratory syndrome coronavirus (MERS-CoV), avian influenza (H7N9), ebolavirus, and the recent worldwide SARS-CoV-2 pandemic [1].

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Epidemic outbreaks are the main cause of increasing fatality rates and morbidity [2] and may obligate communities to introduce restrictive public health protective measures like isolation, mass quarantine, and community containment interventions in order to prevent transmissions and save people [3].

The novel coronavirus disease 2019 (COVID-19) has been recognized as one of the most critical pandemics and disastrous diseases that happened in human history, with many fatalities and morbidities globally that happened daily since its arise in December 2019 and are still occurring these days in June 2020 [4]. On 5 June 2020, WHO reported that confirmed COVID-19 cases have exceeded 6.6 million globally, with over 391,000 fatalities and more than 2.87 million recoveries [5].

COVID-19 is different from its previous ancestor in that it is highly transmissible and contagious, where it is rated to be 2 times more so than that of seasonal influenza [6]. The virus spread mainly from human to human via respiratory droplets of saliva or discharge from the nose of an infected person and

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direct contact which led to this immense number of infected people [7].

During a pandemic, healthcare organizations are supposed to have a main role, where healthcare professionals are at extreme risk of exposure and getting infected [8]. During the outbreak of SARS, they underwent a lot of anxiety and bother that may be related to the overstressed and fragile healthcare system [9, 10].

With the deteriorating situation during the COVID-19 pandemic, healthcare workers and medical students posted in wards are also supposed to be at risk of getting infected [11].

Medical universities all over the world have rapidly developed new strategies to establish innovative experiences for students who were suspended from their clinical rotations [12].

Moreover, many universities across the world rapidly take a decision to develop new strategies and to shift many of their educational activities from face-to-face mode to an online one using a lot of applications such as Twitter, Facebook, Cisco Webex, and Zoom [13].

In Egypt, by the beginning of April 2020, there were over 800 confirmed cases, with more than 50 fatalities, and a rapid tendency towards an increase [14]. Over about 1 month, the number of confirmed cases increased enormously to reach 31,115 cases on 5 June 2020, with about 1166 fatality cases, a jump that can cause anxiety and fear in the community [15].

Recently, there are ongoing research studies on COVID-19, and as a new disease, many facts continue to change rapidly. In parallel to this, many myths and fake news spread in the general public, and with the extensive use of social media, they highly pervade causing more stress, fear, confusion, and anxiety among individuals [16].

Medical students are the first persons who may have close contact with the infected people. Different research studies on medical students during different pandemics have stated that they experienced high levels of psychological stress and anxiety, which may lead to undesirable effects on their education and overall psychological well-being [17, 18].

Most of the recent emerged multiple studies related to COVID-19 have focused on topics such as epidemiology, genetic characteristics of the virus, and its clinical consequences; however, there is a scarcity of information on the COVID-19 pandemic-related knowledge, preventive behaviors, and risk perception among undergraduate medical students in Egypt [19, 20].

Therefore, this present study aimed to evaluate knowledge, risk perception, and preventive behaviors related to the COVID-19 pandemic among undergraduate medical students in Egypt, particularly with its expansion in Egypt and other countries of the world and the uncertainty surrounding it.

Subjects and Methods

Study Design and Population

This is a cross-sectional observational study to evaluate knowledge, risk perception, and preventive behaviors related to the COVID-19 pandemic among undergraduate medical students in Egypt by using an anonymous online questionnaire. The survey was conducted through a link shared on social networking sites. The study was conducted from 19 June 2020 to 26 June 2020. The medical students of Suez Canal University fulfilled the inclusion criteria and agreed to participate in the study and were included by using convenience and snowball sampling technique. The sample size of 283 was calculated using www.openepi.com keeping an anticipated frequency of 75.8%, in view of a study done in Pakistan [11] which estimated that 75.8% of participants felt at risk of contracting COVID-19 infection at the university, while the confidence interval was 95% and absolute precision 5%.

Inclusion and Exclusion Criteria

Medical students in the faculty of medicine of both sexes, who agreed to participate in the study, were included. Those who are less than 18 years old as they are not willing to give consent and other universities were excluded.

Study Tools

The semi-structured questionnaire consisted of four parts:

1. *Socio-demographic characteristics*: age, gender, study year, living partners, smoking status, illicit drug use, and presence of chronic diseases
2. *Students knowledge and risk perception about COVID-19 pandemic*: (1) perception of the students to their physical and mental state, whether they perceive COVID-19 as a life-threatening illness or not and as a serious threat to society or not; who are susceptible individuals to COVID-19 infection; and their risk perception of getting infected. The sources of information they use about the COVID-19 pandemic are items previously validated and reliable [21]. (2) The level of related knowledge about COVID-19 using previously validated and reliable 15 items based on a framework from previous studies about MERS [22, 23] and COVID-19 [24, 25]. These items include COVID-19 basic science and its etiology, symptoms and incubation period, diagnosis, transmission, public prevention, medical professionals' specific prevention, treatment, and referring suspicious cases. A correct answer will have 1 point, and an incorrect answer or "I don't know" will have 0 points. The total score was converted

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into a percentile. A score $\geq 75\%$ will be designated as high, 50–75% as moderate, and $\leq 50\%$ as a low level of knowledge.

3. *Self-reported preventive behaviors*: include previously validated and reliable 9 items used in previous studies [22, 24]. Practices such as reducing the use of public places in daily life, preventive behavior during coughing, intensive handwashing, surface disinfection, and talking with people about prevention. Choices are "yes" or "no." One point was assigned for each appropriate behavior and 0 points for inappropriate behaviors. The total score ranged from 0 to 9 and then converted to a percentile.

Validation and Pilot Study

The questionnaire was face validated by three expert opinions with no major modifications. A pilot study was carried out on 20 students before the study to assess the feasibility and reliability of the questionnaire, with acceptable Cronbach's α of 0.7.

Data Collection

Data were collected through an online semi-structured questionnaire using Google forms with a consent form included with it. Consent was obtained from the vice-dean of the faculty to send forms to groups of the faculty students. The link to the questionnaire was sent through WhatsApp groups and faculty students' Facebook groups. The participants were encouraged to roll out the survey to more colleagues as they could. On receiving and clicking the link, the participants were directed to the information about the study and informed consent. After they accept to take the survey, they will fill up the demographic details. Then, a set of several questions appear consecutively, in which the participants answer.

4. *Outcome variables*: knowledge and risk perception related to the COVID-19 pandemic and self-reported preventive behaviors.

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS V20.0). The normal distribution of the continuous data was checked using the Shapiro-Wilk test. Descriptive statistics data were expressed by mean and standard deviation and median and interquartile range. Frequencies and percentages were calculated and tabulated. Inferential statistics data were analyzed using the Mann-Whitney U test and Spearman's correlation. A P value of < 0.05 was considered statistically significant.

Research Ethics

The ethics committee of the Faculty of Medicine, Suez Canal University, approved the study (research no. 4207). Informed consent was obtained from all participants included in the study.

Results

The study included 283 medical students of Suez Canal University, and about two-thirds of the sample (173, 61.1%) were females. Age ranged between 18 and 25 years old with a mean of 20.1 years. The majority of participants were in academic years (first, second, or third) (217, 76.7%). Most of the students are living currently with their families (251, 88.7%). Only 24 (9.5%) suffer from a chronic condition (Table 1).

Table 2 shows the level of knowledge related to the COVID-19 pandemic. About 94.7% of the students know that COVID-19 is a respiratory infection caused by a new species of the coronavirus family. The majority (95.1%) recognized that the first case of COVID-19 was diagnosed in Wuhan, China. Most of them (79.2%) correctly answered the origin of COVID-19 is not clear. The majority (83.7%) recognized the symptoms of COVID-19, while 91.5% realized the incubation period of the infection. About 84.1% recognize the diagnostic test, and 94.3% know the method of transmission, while 95.1% know the circumstances of infection transmission. About preventive methods, 92.2% know the importance of handwashing and hygiene, while 89.4% know the importance of masks, and also 87.6% recognized preventing close contacts. About 78.8% of students accepted that society should wear masks, while only 43.1% accepted wearing an N95 mask during intubation and resuscitation. About half of them (49.5%) know that antiviral drugs do not treat the disease. The majority (80.2%) accepted the referral of suspected cases to the near center. The average total of all related knowledge was 80.9%.

Table 1 Socio-demographic characteristics of the sample ($n = 283$)

Variable		N	$\%$
Gender	Male	110	38.9
	Female	173	61.1
Age	Mean ± SD (range)	20.1 ± 1.8 (18–25)	
Faculty year	Academic	217	76.7
	Clinical	66	23.3
Living currently	In student accommodation	14	4.9
	With family	251	88.7
	Alone	18	6.4
Chronic disease	Yes	24	9.5

Table 2   Knowledge related to the COVID-19 pandemic among medical students ($n = 283$)

Items (true or false)	Correct answer (range 0–100)
COVID-19 is a respiratory infection caused by a new species of the coronavirus family. (T)	94.7%
The first case of COVID-19 was diagnosed in Wuhan, China. (T)	95.1%
The origin of COVID-19 is not clear, but it seems that it has been transmitted to humans by seafood, snakes, or bats. (T)	79.2%
Its common symptoms are fever, cough, and shortness of breath, but nausea and diarrhea were reported rarely. (T)	83.7%
Its incubation period is up to 14 days with a mean of 5 days. (T)	91.5%
It can be diagnosed by a PCR test on samples collected from nasopharyngeal and oropharyngeal discharge or from sputum and bronchial washing. (T)	84.1%
It is transmitted through respiratory droplets such as cough and sneeze. (T)	94.3%
It is transmitted through close contacts with an infected case (especially in the family, crowded places, and health centers). (T)	95.1%
The disease can be prevented through handwashing and personal hygiene. (T)	92.2%
A medical mask is useful to prevent the spread of respiratory droplets during coughing. (T)	89.4%
The disease can be prevented through no close contacts such as handshakes or kissing, not attending meetings, and frequent hand disinfection. (T)	87.6%
All people in society should wear masks. (T)	78.8%
Only during intubation, suction, bronchoscopy, and cardiopulmonary resuscitation, you have to wear an N95 mask. (T)	43.1%
The disease can be treated by usual antiviral drugs. (F)	49.5%
If symptoms appear within 14 days from direct contact with a suspected case, the person should inquire at a nearby public health center. (T)	80.2%
Total	80.92%

About two-thirds of the students (189, 66.8%) feel good physically, while 202 (71.4%) feel mentally good. The majority (235, 83%) feel that coronavirus infection is a life-threatening illness, while 163 (57.6%) agreed that the novel coronavirus is categorized as the deadliest of its entire species. A COVID-19-infected person was perceived as a serious threat to society in 246 students (86.9%). However, three-quarters of the students (216, 76.3%) perceived risk of being infected with COVID-19 during ward rotations, and only one-third (96, 33.9%) perceived risk of COVID-19 from being a medical student in general. Only 28 (9.9%) are currently in contact with a COVID-19 suspected case. The majority have a high level of related knowledge (208, 73.5%). Concerning susceptible persons for infection, 215 (76%) of the students chose healthcare workers, while 186 (65.7%) chose infected family members and 125 (44.2%) chose recent travelers from affected countries. About two-thirds of the sample (194, 68.6%) received education about COVID-19, mostly from visiting the WHO website (187, 66.1%) (Table 3).

Table 4 shows that about 92% of the students practice preventive behaviors towards COVID-19.

Females have higher percentages in regard to related knowledge and practicing preventive behaviors ($P < 0.001$). Students who received education to COVID-19 have higher knowledge but not significant, and more in practicing preventive measures ($P = 0.04$). Students in clinical years have higher knowledge and practice preventive behaviors more than students in academic years. Furthermore, perceived risk is related to practicing preventive measures ($P = 0.014$) (Table 5).

Table 6 shows a significant moderate correlation between related knowledge and practicing preventive behaviors ($r = 0.309$ and $P < 0.001$).

Discussion

The present study was designed to investigate the level of related knowledge, preventive behaviors, and concerns of the undergraduate medical students regarding the COVID-19 pandemic. To the best of our knowledge, this study is the first to discuss such aspects among medical students in Egypt.

Since the cases and fatalities in Egypt are still rising, especially among the healthcare workers, our hypothesis was that medical students concerned with the pandemic are affected more than others in the general population.

Our study revealed that the average of correct answers of the students to the COVID-19-related knowledge was 80.92%, where 73.5% of the students have high levels of knowledge. This result is close to that mentioned by Yakar et al. [26] in his study among Turkish medical students, as the average of correct answers of the participants was 78.3%; however, this percentage is slightly lower than that found among medical students in Mumbai which was about 74% [27].

Table 3 General perception and knowledge related to the COVID-19 pandemic among medical students (*n* = 283)

Variable		Count	%
Feel physically	Good state	189	66.8
	Poor state	94	33.2
Feel mentally	Good state	202	71.4
	Poor state	81	28.6
Feel that coronavirus infection is a life-threatening illness	Yes	235	83.0
Novel coronavirus categorized as the deadliest of its entire species	Yes	163	57.6
COVID-19-infected person a serious threat to society	Yes	246	86.9
Risk of getting infected with COVID-19 during ward rotations	Yes	216	76.3
Perceived risk for COVID-19 as a medical student	Yes	96	33.9
Currently in contact with a suspected COVID-19 patient	Yes	28	9.9
Level of knowledge	Low	11	3.9
	Moderate	64	22.6
	High	208	73.5
Individuals susceptible to acquiring COVID-19 infection			
Healthcare workers		215	76.0
Person with any infected family member		186	65.7
Recent traveler from affected countries		125	44.2
Received education about COVID-19	Yes	194	68.6
Sources of information			
Visiting the Egyptian Health Ministry website		93	32.9
Visiting the World Health Organization website		187	66.1
Searching or reading a scientific paper about COVID-19 on any scientific database		137	48.4
Visiting the websites of any of the professional medical associations (infectious disease specialists, public health specialists, etc.)		86	30.4
Hospital announcement, social media, or YouTube		168	59.4

It is worth mentioning that the lowest scores of knowledge appertained to the 2 items "During intubation, suction, bronchoscopy, and cardiopulmonary resuscitation, you have to wear an N95 mask (T)" and "The disease can be treated by usual antiviral drugs (F)" (43.1% and 49.5%, respectively). According to the CDC recommendation, the N95 respirator is preferred over a face mask when performing or subjected to aerosol-generating procedures [28]. Hence, medical students who will graduate in the near future should receive more courses about self-protection and the right management related to the COVID-19.

On the other hand, about 95% of the students have good knowledge about the transmission of the disease through respiratory droplets and from infected persons to others. This result is in similarity to that found among the Ugandan medical students (99%) [29] but is more than that reported by the

Table 4 Practicing preventive behaviors among medical students (*n* = 283)

Items (yes or no)	Yes (%)
I canceled or postponed meetings with friends, eating out, and sports events.	88.7
I reduced the use of public transportation.	93.6
I went shopping less frequently.	92.9
I reduced the use of closed spaces, such as the library, theaters, and cinema.	96.1
I avoided coughing around people as much as possible.	95.8
I avoided places where a large number of people are gathered.	95.4
I increased the frequency of cleaning and disinfecting items that can be easily touched with hands (i.e., door handles and surfaces).	88.3
I washed the hands more often than usual.	90.5
I discussed COVID-19 prevention with my family and friends.	86.2
Total	92

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Table 5 Related knowledge and practicing preventive measures according to socio-demographic characteristics and risk perception

Variable		Related knowledge Range (0–100) Median (IQR)	Mean ranks	U test P value	Preventive measures Range (0–100) Median (IQR)	Mean ranks	U test P value
Gender	Male	80.0 (73.3–86.7)	121	7191	100 (77.8–100)	121	7231
	Female	86.7 (80–93.3)	155	< 0.001*	100 (88.9–100)	155	< 0.001*
Received education about COVID-19	No	86.7 (73.3–86.7)	136	8084	100 (88.9–100)	129	75,030
	Yes	86.7 (80.0–88.3)	145	0.38	100 (88.9–100)	148	0.04*
Faculty year	Academic	80.0 (73.3–86.7)	128	4034	100 (88.9–100)	135	5627
	Clinical	86.7 (86.7–93.3)	189	< 0.001*	100 (100–100)	165	0.002*
Perceived risk	No	80.0 (73.3–86.7)	138	8209	100 (88.9–100)	135	7620
	Yes	86.7 (73.3–93.3)	150	0.23	100 (88.9–100)	156	0.014*
Contact with a suspected case	No	86.7 (73.3–86.7)	143	0.55	100 (88.9–100)	141	0.30
	Yes	80.0 (73.3–86.7)	133		100 (88.9–100)	155	

Mann-Whitney test

*Statistically significant ($P < 0.05$)

Pakistani students, where 70% of the participants only believed that airborne droplets are the main cause of transmission [11].

Our study showed that merely 33.2% of the participants reported feelings of poor physical state, and about 29% felt mentally poor. This result is in congruence with a previous Egyptian study which revealed that those who are in the medical field reported lower psychological impact than other populations [30]. However, it is in opposition to that found by Aker and Mıdık [21] in Turkey, where more than half of the students reported feelings of poor mental state.

Regarding the students' risk perception, 83% of the students reported that they felt that coronavirus infection is a life-threatening illness, and more than half of them considered it the deadliest of its entire species. This is in conformity with that mentioned in the literature where COVID-19 is recognized as one of the most catastrophic diseases with many fatalities and morbidities globally that are still occurring ceaselessly on a daily basis [4]. It also found that 86.9% of the students asserted that persons infected with COVID-19 are a serious threat to society. Similarly, 88% of the Pakistani students studied by Ahmed et al. [11] confirmed the same answer.

Table 6 Correlation between related knowledge and practicing preventive measures

Preventive behaviors	Related knowledge
r	0.309
P value	< 0.001**

Spearman's correlation

*Statistically significant ($P < 0.05$)

In the same context, 76.3% were concerned about the risk of getting infected with COVID-19 during ward rotations, and almost the same percentage deemed that healthcare workers are the most susceptible to acquire COVID-19 infection. These results are congruent to that found among medical students in previous studies in Iran, Pakistan, and Jordan [11, 24, 31], where they all have the same apprehension. This matter is needed to be taken seriously, as during the MERS crisis, Abolfotouh et al. [32] reported that 7.1% of the healthcare workers changed their careers due to their worries.

Our study revealed that while 69% of the students had received some sort of education about COVID-19, nearly 2/3 of them obtain their information about the disease through visiting the World Health Organization (WHO) website, and more than half of them obtain it using social media or YouTube channels. These results are in accordance with that found among the Turkish students [21], where the WHO website was the most prevailing source of information, and alike the Egyptian students, more than 50% of them use social media as a usual source, a result that was reported also by other studies [21, 33, 34]. These findings should raise the concern of the governments on how to make use of these sources in a dynamic way to send targeted messages to this age group.

Unexpectedly, the Health Ministry website was one of the least sources to be reported for seeking information in our study (only 32.9% of the participants), as well as in other studies conducted in Turkey and Jordan [21, 31]. This finding should stand upon the root causes of this mistrust issue regarding the sources obtained from the national official bodies.

Our study displayed that 92% of the participants were practicing preventive behaviors, with high scores in most of the items; however, there is a lower score particularly to cleaning and disinfecting items (88.3%). This result is in line with that found among Iranian students, where about 94% were stacked

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to preventive measures, and surprisingly they reported the lowest score in disinfecting items with almost the same score (85.6%) [24].

On the other hand, on comparing the Egyptian students with their Ugandan peers in some behaviors, it was found that they scored lower percentages in regard to avoiding crowded places (95.4% vs. 99%), yet they have much better practices regarding keeping social distances and coughing around people (95.8% vs. 61%) [29].

In our study, we found that the level of female knowledge is significantly higher than that of male's ($P < 0.001$). However, contrary to our study, Yakar et al. [26] reported that the knowledge score of the Turkish males was significantly higher ($P = 0.033$). Furthermore, other studies among students in Iran and Mumbai found that there was no significant relationship between sex and knowledge [24, 27], a finding that makes the data among all these studies irreconcilable. It was also found that senior students in the clinical years had a higher level of knowledge than their counterparts in academic ones ($P < 0.001$), a finding that is similar to that in former studies [26, 29].

Another finding of this study was that those who received education about COVID-19 and those with higher risk perception had significantly higher preventive attitudes ($P = 0.04$ and $P = 0.014$, respectively). This finding coincides with the study of Olum et al. [29] in regard to the received education and contradicts that of Taghrir et al. [24] where no significant differences were found between students who experienced previous education and those who did not.

In addition, it was revealed that both females and senior students had also significantly better preventive practices ($P < 0.001$ and $P = 0.002$, respectively). Moreover, on studying the association between knowledge and preventive behaviors, it was found that there was a positive significant correlation between them ($P < 0.001$). Likewise, preceding studies mentioned that as the level of knowledge increases, favorable practices increase as well [26, 27, 35]; accordingly, it is reasonable to find such findings in our study among females and students in clinical years.

Limitations of the Study

The study participants were from one faculty, so we cannot generalize results for all medical students. It included more students in academic years than in senior clinical years.

Conclusion

COVID-19 pandemic-related knowledge and practicing preventive measures among Egyptian students are very good. However, there are some defects as the lowest scores of

knowledge were appertained to the 2 items "During intubation, suction, bronchoscopy, and cardiopulmonary resuscitation, you have to wear an N95 mask" and "The disease can be treated by usual antiviral drugs." Also, national official sites were not the most sourced sites of information to the medical students unlike the WHO website and social media. Females and senior clinical students have more knowledge and practice preventive behaviors more. Finally, related knowledge is related to practicing preventive measures, so we should raise knowledge and awareness for preventing the disease.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in the study were following the ethical standards of the institutional research committee of the Faculty of Medicine, Suez Canal University (research no. 4207), and the 1964 Helsinki declaration and its later amendments.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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