Journal of High Institute of Public Health 2021;51(1):25-32.

Original Article

COVID-19 Knowledge, Risk Perception, and Precautionary Behavior among Medical Students in Egypt

Rasha S. Hussein, Ayat F. Manzour, Maha M. Wahdan ¥

Department of Community, Environmental and Occupational Medicine, Faculty of Medicine, Ain Shams University, Egypt

Abstract

Background: During clinical training, medical students may have close contact with COVID-19-infected patients. Lack of proper knowledge about COVID-19 dynamics and prevention makes them more liable to infection.

Objective: To evaluate the level of awareness, precautionary behavior, and risk perception regarding COVID-19 and identify the factors motivating and hindering medical students to take preventive measures.

Methods: A cross-sectional research study was conducted using an online questionnaire of medical students at Ain Shams University, Cairo, Egypt between June 1 and June 30, 2020. The questionnaire design was based on a literature review mainly on the domains of the standard risk perception questionnaire.

Results: A total of 351 medical students (mean age of 21 ± 2 years) completed the questionnaire. Over 94% had a high level of knowledge, 96.9% scored at high level of practicing precautionary behavior, and 86.1% had a high level of risk perception. Precautionary behavior practices had significant negative correlation with the knowledge scores associated with COVID-19 and a significant positive correlation with risk perception score. There was a significant association between the precautionary behavior performance and risk perception levels (odds ratio = 4.14).

Conclusion: Most medical students showed a high degree of COVID-19-related awareness, precautionary behavior, and perception of risk.

Recommendations: There were students who did not practice or that showed a low risk perception as well as reported hindering factors for not practicing precautionary behaviors. Therefore, intensification of health education sessions to support adherence to precautionary measures is still required.

Keywords: COVID-19, knowledge, practice, risk perception, medical students

Available on line at:
jhiphalexu.journals.ekb.eg

Print ISSN: 2357-0601
Online ISSN: 2357-061X

¥*Correspondence*:
Email:
Drmaha_wahdan@med.asu.edu.eg

Suggested Citations: Hussein RS, Manzour AF, Wahdan MM. COVID-19 knowledge, risk perception, and precautionary behavior among medical students in Egypt. JHIPH. 2021;51(1):25-32.

INTRODUCTION

The main goal of public health as well as infection prevention and control is the prevention of infectious disease transmission in population and healthcare settings.[1] Significant global attention has recently been drawn to emerging infectious diseases outbreaks caused by respiratory viruses, specifically, severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), pandemic influenza A and H1N1, and, finally, to the latest novel coronavirus (COVID-19) pandemic.[2]

Health professionals have always been at risk for infectious diseases. Knowing that even asymptomatic individuals are likely to spread COVID-19, the risk level increases when the infected person is a healthcare worker.[3] Medical students will have direct interaction with affected individuals. In this population, a lack of appropriate relevant knowledge will lead them to overestimate the situation, increase their level of stress and anxiety, and interrupt their medical decisions.[4]

The detection of causative agents, the production of infectivity, vaccinations and treatment, as well as contact tracing, isolation, and screening are all essential for controlling emerging infectious diseases. Many of these measures are partially focused on individual actions and how people at risk comply with behavioral guidelines.[5] Compliance with precautionary behavior among at-risk

populations is often the only way to avoid further spread of the disease.[6]

Risk perception is critical for precautionary steps. Precautionary practices should be based on the correct knowledge and skills to facilitate and enable successful risk management of emerging infectious disease epidemics when treatment is not yet feasible.[7]

Few studies on the knowledge and risky behavioral responses to infectious disease epidemics have been conducted.[4,8] Medical students are considered health messengers within the community. Their attitude makes a great difference in infection prevention. Therefore, the current study aims to evaluate the level of awareness, precautionary behavior, and risk perception relevant to COVID-19 and identify the factors motivating and hindering medical students to take preventive measures.

METHODS

Study design and population

A cross-sectional survey was conducted of Egyptian medical students at Ain Shams University, Cairo, Egypt. The sample size was determined using the sample size estimation software PASS11, with 95% confidence intervals (CIs) and a 5% margin of error. After reviewing the results of a previous relevant study[8] that showed an average of 86.96% correct answers of COVID-19 knowledge and an average of 94.2% preventive behavior. Based on these data and using the least prevalence, which was the percentage of correct answers of knowledge related to COVID-19 (86.96% ± 5%), the required sample size was determined to be at least 175 medical students.[9] By the end of the data collection time schedule, the collected sample consisted of 351 medical students.

Data collection tools:

- A validated, organized, self-administered, anonymous online questionnaire (Google form) was used to collect data via a social media network (WhatsApp). Participants were recruited from June 1 to June 30, 2020. The questionnaire design primarily focused on the main domains of the standard questionnaire for risk perception.[10] In the event of an infectious disease outbreak, this tool offers a standard questionnaire that can be used to test awareness and risk perception. The awareness of disease etiology and dynamics, perception of disease severity, perception of disease vulnerability, perceived self-efficacy of preventive approaches, and motivating/hindering factors for the practice of preventive approaches are the main domains of the questionnaire. The questionnaire consisted of five sections as follows:
- Section 1: Demographic information (e.g., age, sex and academic year).
- Section 2: Level of COVID-19–related knowledge: Knowledge was evaluated using 15 items based on available information about the disease etiology and dynamics at World Health Organization (WHO)[11] and Centers for Disease Control (CDC)[12] studies and fact sheets in addition to results from other previous studies.[4] A correct response was awarded 1 point and an incorrect answer or "I don't know" was scored 0 points. The overall score was converted into a percentage. Scores of > 75%, 50% to 75%, and <50% were rated as high, moderate, and low levels of knowledge, respectively. Reliability was checked using Cronbach's α; the result was 0.68.
- Section 3: Practicing preventive behavior: This section consisted of 8 items based on recommended preventive behavior by the WHO and CDC,[11,12] for example, preventive behavior during coughing, handwashing, and surface disinfection. Choices were "yes, always," "yes, sometimes," or "no" and 2 points were awarded to the participant for "yes, always," 1 point for "yes, sometimes," and 0 points for "no." The overall score ranged from 0 to 16 and was converted to a percentage. A score of 75% was designated as high and < 75% as low results. Item validation has been developed by experts. Reliability (Cronbach's α = 0.72) was checked.
- Section 4: Perception of seriousness, susceptibility, and self-efficacy of COVID-19: Five items were used to assess the seriousness perception, susceptibility, and self-efficacy of COVID-19 among participants based on previous studies.[4,10] The answers were given a score using a 4-point Likert-type scale (1 = strongly disagree, 4 = strongly agree). The cumulative total score varied from 5 to 20. The total score was converted into a percentage. Scores of > 75%, 50% to 75%, and < 50% were categorized as high, moderate, and low levels of seriousness perception, respectively. Item validation was developed by experts. Reliability (Cronbach's α = 0.6) was checked.
- Section 5: Motivating/hindering factors to perform preventive measures: According to a previous study,[10] 8 items were used to evaluate the motivating factors for using preventive measures, and 10 items were used to evaluate the hindering factors for not using preventive measures among the participants. The choices were "yes" or "no."

Ethical considerations:

This study was approved by the research ethics committee at the faculty of medicine, Ain Shams University (Approval number: FMASU R 31/2020). The study conformed to the international ethics guidelines and that of Declaration of Helsinki (2013). The students' completion of the questionnaire was considered authorization to participate in the analysis. Data confidentiality has been preserved through questionnaire anonymity.

Statistical analysis

Revision, coding, and computer data entry were done, and then analysis was conducted using SPSS software package version 25 (SPSS, Inc., Chicago, IL, USA). Mean, standard deviation, and range values were used to describe

the quantitative data. Numbers and percentages were used to present the qualitative data. Significance was considered at $p < 0.05$.

Total scores for COVID-19 knowledge, precautionary behavior, and perception of seriousness, susceptibility, and self-efficacy were computed. The Kolmogorov–Smirnov test was used to evaluate the normality of the distribution of the quantitative data, which included age and the three scores. Age was normally distributed, but none of the three scores followed a normal distribution, so the median and interquartile range was used to describe the total scores. Score percentages were used among the studied participants to identify their levels of awareness, precautionary actions, and perception of severity, vulnerability, and self-efficacy relevant to COVID-19. The Spearman rank test was used to examine the correlations between scores. The independent student t test and chi-squared test were used to study the association between the participants' precautionary behavior and other factors, including age, sex, academic year, presence of previous awareness about COVID-19, level of knowledge relevant to COVID-19, and level of risk perception. In addition, odds ratios and 95% confidence intervals (CIs) were calculated. Binary logistic regression was performed with the following predictor variables: age, gender, students' academic year, previous knowledge about COVID-19, COVID-19 knowledge score, and risk perception score to measure its impact on exhibiting precautionary behavior (i.e., low and high performance) among our sample.

RESULTS

Three hundred and fifty-one undergraduate medical students from all academic years participated in our study (mean age, 21.0 ± 2.0 years; 121 [34.5%] males, 230 [65.5%] females). Most participants (338 [96.3%]) had previous knowledge related to COVID-19. The mass media was the most reported source of information (90.6%), followed by healthcare workers (33.3%), friends and relatives (32.2%), and last, academic studies (26.2%). Slightly more than 3% reported the WHO, the CDC, and others as knowledge source (Table 1).

Table 1: Students' demographic data and previous information about COVID-19

Students' demographic characteristics		Medical students (n = 351)	
		No.	%
Age: Mean ± SD (range)		21.0 ± 2.0 (18.0–24.0)	
Sex	Male	121	34.5
	Female	230	65.5
Academic year of education	First year	44	12.5
	Second year	68	19.5
	Third year	59	16.8
	Fourth year	132	37.6
	Fifth year	24	6.8
	Last year	24	6.8
Previous information about COVID-19			
Previous information about COVID-19	No	13	3.7
	Yes	338	96.3
Source of information about COVID-19 *	Mass media	317	90.3
	Healthcare workers	117	33.3
	Friends and relatives	113	32.3
	Academic study	92	26.2
	Other sources**	12	3.4

*Categories of this variable are not mutually exclusive.
** Other sources include attending online educational courses and searching through different scientific websites as the CDC, the WHO, and Up-to-date.

Nearly all participants (94.3%) scored a high level of knowledge regarding COVID-19. The lowest reported knowledge level was approximately two items: "The origin of COVID-19 is unclear, but it appears that wild desert life has transmitted it to humans" and "It can be diagnosed by the CBC when lymphocytosis is found" (29.9% and 50.7%, respectively) (Table 2).

The self-reported performance of precautionary behavior by the studied group is presented in Table 3. Most of our study group (96.9%) had a high performance level of precautionary actions, while only 3.1% had a low level. The lowest precautionary activity recorded (52.4%) was "I increased the frequency of cleaning and disinfecting objects that can be easily touched with hands (i.e., door handles and surfaces)," followed by "I speak to my family and friends about COVID-19 prevention" (60.4 %), and "I cancelled or postponed friends' meetings, dining out, and sporting activities" (61.8%).

The COVID-19 risk perception level was rated as high, moderate, and low in 83.2%, 15.9%, and 0.9% of the participants, respectively. Approximately half of our participants reported strong agreement about the seriousness of COVID-19, and more than half strongly believed that social distancing and wearing facial masks are effective measures in COVID-19 prevention (Table 4).

Table 2: Medical students' knowledge about the clinical picture, transmission, and prevention of COVID-19

Knowledge statements about clinical picture, transmission, and prevention of COVID-19	Medical students (n = 351)	
	Correct answer	
	No.	%
1. COVID-19 is a respiratory infection caused by a new category of coronavirus species. *(the correct answer: Yes)*	338	96.3
2. The first case of COVID-19 was identified in Wuhan, China. *(the correct answer: Yes)*	343	97.7
3. The origin of COVID-19 is unclear, but it appears that wild desert life has transmitted it to humans. *(the correct answer: No)*	105	29.9*
4. Common symptoms of COVID-19 include fever, cough, and shortness of breath, but nausea and diarrhea have rarely been reported.*(the correct answer: Yes)*	316	90.0
5. The COVID-19 incubation period is up to 14 days, with an average of 5 days. *(the correct answer: Yes)*	321	91.5
6. It can be diagnosed by the CBC when lymphocytosis is found. *(the correct answer: No)*	178	50.7*
7. It can be diagnosed by PCR test on samples collected from nasopharyngeal and oropharyngeal discharge or from sputum and airways washing fluids. *(the correct answer: Yes)*	321	91.5
8. COVID-19 infection spreads by respiratory droplets, such as cough and sneezing.*(the correct answer: Yes)*	350	99.7
9. Infection with COVID-19 is transmitted via close contact with a confirmed case (particularly in families, crowded places, and health centers). *(the correct answer: Yes)*	344	98.0
10. Handwashing and personal hygiene are not useful measures to prevent COVID-19. *(the correct answer: No)*	337	96.0
11. A surgical mask is effective for prevention of respiratory droplets spread during coughing. *(the correct answer: Yes)*	337	96.0
12. A helpful measure to prevent COVID-19 is avoiding close touches, such as handshakes or hugging, not attending meetings, and regular hand disinfection. *(the correct answer: Yes)*	347	98.9
13. For certain individuals, COVID-19 can be fatal, as older age group and people with current health problems are more at risk of severe complications. *(the correct answer: Yes)*	349	99.4
14. The disease can be treated by usual antiviral drugs. *(the correct answer: No)*	250	71.2
15. There is a vaccine against COVID-19. *(the correct answer: No)* **	333	94.9
Total knowledge score percentage *median (IQR)*:	86.66 (6.67)	
Students' knowledge about COVID-19 level:		
- High knowledge level *No.* (%)	331 (94.3)	
- Average knowledge level *No.* (%)	19 (5.4)	
- Low knowledge level *No.* (%)	1 (0.3)	

* Items with lowest correct answers percentages ** data was collected before vaccine invention

Table 3: Students' practicing precautionary behavior toward COVID-19

Statements about practicing precautionary behavior toward COVID-19	Medical students (n = 351)					
	No		Sometimes		Always	
	No.	%	No.	%	No.	%
1. I cancelled or postponed friends' meetings, dining out, and sporting activities.	12	3.4	122	34.8	217	61.8*
2. I minimized my use of public transportation.	13	3.7	31	8.8	307	87.5
3. I went shopping less frequently.	17	4.9	71	20.2	263	74.9
4. I've significantly reduced the usage of closed spaces, including libraries, malls, etc.	5	1.4	24	6.9	322	91.7
5. I use a tissue or my elbow during cough/sneeze.	14	4.0	71	20.2	266	75.8
6. I increased the frequency of cleaning and disinfecting objects that can be easily touched with hands (i.e., door handles and surfaces).	35	10.0	132	37.6	184	52.4*
7. I washed my hands more often than usual.	19	5.4	73	20.8	259	73.8
8. I speak to my family and friends about COVID-19 prevention.	23	6.6	116	33.0	212	60.4*
Total score percentage of practicing precautionary behavior toward COVID-19 *Median (IQR)* 100 (0)						
Students' practicing precautionary behavior toward COVID-19:						
- Low performance of precautionary behavior *No.* (%)				11 (3.1)		
- High performance of precautionary behavior *No.* (%)				340 (96.9)		

* Items with lowest performance of precautionary behavior.

Students' motivating/hindering factors that affected the performance of preventive measures against COVID-19 are listed in Table 5. The highest motivating factor was "I feel responsible for my health," followed by "COVID-19 can be serious" and "I don't want to transfer COVID-19 to people around me" (98.9%, 98.6%, and 98.6%, respectively). Conversely, the highest hindering factor (47.0%) was "I feel that very little knowledge about preventive measures is given," followed by "I believe that preventive measures will not be carried out by people in my environment" (43.3%).

Table 4: Students' perception of the seriousness, susceptibility, and self-efficacy of COVID-19

Statements about the perception of the seriousness, susceptibility, and self-efficacy of COVID-19	Medical students (n = 351)							
	Strongly disagree		Disagree		Agree		Strongly agree	
	No.	%	No.	%	No.	%	No.	%
1. COVID-19 is a serious disease.	10	2.8	18	5.1	148	42.2	175	49.9
2. I am worried to be infected by COVID-19.	11	3.1	34	9.7	187	53.3	119	33.9
3. I can get infected more easily than others with COVID-19.	33	9.4	181	51.7	104	29.7	32	9.1
4. I think that social distancing helps to prevent COVID-19?	6	1.7	3	0.9	103	29.3	239	68.1
5. I think that wearing masks help in preventing COVID-19?	5	1.4	9	2.6	157	44.7	180	51.3
Total score percentage of perception of the seriousness, susceptibility, and self-efficacy of COVID-19								
Median (IQR) 80(10)								
Students' perception of the seriousness, susceptibility, and self-efficacy of COVID-19								
- High perceived risk level *No.* (%)					292 (83.2)			
- Moderate perceived risk level *No.* (%)					56 (15.9)			
- Low perceived risk level *No.* (%)					3 (0.9)			

Table 5: Students' motivating/hindering factors affecting carrying out preventive measures against COVID-19

Statements about the motivating/hindering factors affecting carrying out preventive measures against COVID-19	Medical students (n = 351)	
	Yes	
	No.	%
Motivating factors		
- COVID-19 can be fatal.	346	98.6*
- I feel responsible for my health.	347	98.9*
- I believe that I am at risk of contracting COVID-19.	258	73.5
- I don't want to transmit COVID-19 to individuals around me.	346	98.6*
- I am sure that the preventive measures are helpful.	332	94.6
- The authorities recommend it, so I will do it.	284	80.9
- If I do not apply these measures, I may regret it later.	331	94.3
- I think that other people in my environment will also apply these measures.	203	57.8
Hindering factors		
- I never get sick.	28	8.0
- COVID-19 is not fatal.	14	4.0
- I don't consider it essential.	14	4.0
- I'm not concerned about my health.	30	8.5
- I do not believe that I am at risk of contracting COVID-19.	44	12.5
- I do not think I can transmit the virus to anyone.	29	8.3
- I doubt whether preventive efforts are helpful.	55	15.7
- Preventive actions require too much effort and time.	109	31.1
- I believe that preventive measures will not be carried out by people in my environment.	152	43.3*
- I feel that very little knowledge about preventive measures is given.	165	47.0*

* Items with the highest percentages.

A weak significant positive correlation between students' risk perception and their precautionary behavior regarding COVID-19 infection and a significant weak negative correlation regarding their COVID-19-related knowledge are shown in Table 6.

Regarding the factors affecting students' performance of precautionary behavior toward COVID-19, the results indicate that age, sex, academic year, and degree of COVID-19-related knowledge were not significantly associated with participants' performance of precautionary behavior, whereas participants who had previous information about COVID-19 and those with a high-level risk perception had a significant association with the performance of precautionary behavior ($p < 0.01$; Table 7).

The logistic regression model showed that the risk perception score was the only predictor variable that had a statistically significant association with the performance of precautionary behavior by our study group (Table 8).

Table 6: Correlation between COVID-19 knowledge score, risk perception score, and precautionary behavior practicing score among the studied medical students (N = 351)

Variables	COVID-19 knowledge score	Risk perception score
Risk perception score	−0.017	1
Precautionary behavior practicing score	−0.122**	0.127**

** $p < 0.05$; computed by Spearman's rho rank correlation test.

Table 7: Factors affecting students' performance of precautionary behavior toward COVID-19

	Performance level among medical students (n =351)				*p*	Crude OR (95% CI)
	Low performance		High performance			
	No.	%	*No.*	%		
Age *(Mean ± SD)*	21.33 ± 1.5		21.11 ± 1.5		0.83#	--
Sex						
Female (n = 230)	7	3.0	223	97.0	0.89†	1.08 (0.31–3.79)
Male (n = 212)	4	1.9	117	98.1		
Academic year of education						
Academic years (n = 171) (1st to 3rd year)	4	2.3	167	97.7	0.69†	0.592 (0.17–2.05)
Clinical years (n = 180) (4th to 6th year)	7	3.9	173	96.1		
Previous information about COVID-19						
No (n = 13)	2	15.4	11	84.6	0.01* †	6.65 (1.28–34.46)
Yes (n = 338)	9	2.7	329	97.3		
Knowledge level						
Mild to moderate (n = 20)	1	5.0	19	95.0	0.622†	1.68 (0.21–13.89)
High (n = 331)	10	3.0	321	97.0		
Risk perception level						
Mild to moderate (n = 59)	5	8.5	54	91.5	0.01* †	4.14 (1.28–34.46)
High (n = 292)	6	2.1	286	97.9		

(†) The χ^2 test was used for all, except for the (#) independent t test,* $p < 0.05$.

Table 8: Binary logistic regression for the factors associated with students' performance of precautionary behavior toward COVID-19

Predictors	β	*p* value	AOR	95% C.I.	
				Lower	Upper
Age	0.143	0.651	1.154	0.622	2.141
Gender Female *vs*. Male	-0.122	0.856	0.885	0.236	3.313
Academic year of education Academic years vs. Clinical years	0.801	0.437	2.228	0.296	16.795
Previous information about COVID-19 No *vs*. yes	-1.458	0.108	0.233	0.039	1.374
Risk perception Score	0.347	0.003*	1.415	1.123	1.784
COVID-19 knowledge score	-0.208	0.478	0.812	0.457	1.443

* $p < 0.05$.

DISCUSSION

The COVID-19 pandemic is threatening the general population as well as healthcare workers all over the world. COVID-19 knowledge remains limited to its status as a novel virus. Vaccination and effective antiviral therapies are currently under trial. Until now, we could only prevent human-to-human transmission by implementing infection control measures.[3]

Medical students showed a high level of knowledge. The majority of the participants (96.9%) had a good performance level of precautionary behavior. Over 85% had a high level of risk perception. The two most important hindering factors were not feeling that enough information was provided on the pandemic and not trusting that people would perform preventive measures. The participants' performance was affected significantly by their degree of risk perception.

Regarding the sources of COVID-19 infection knowledge, only 26.2% and 3.4% of the respondents reported academic and other educational sources, respectively. The mass media, including television, the radio, and the Internet, were the highest reported sources of knowledge. This agrees with the study by Olaimat et al. in Jordan among university students. Like our results, only 24.2% of the subjects cited scientific sources of knowledge, whereas the highest reported sources were the Internet and the mass media.[13]

The present study shows that the majority of students (94.3%) scored a high knowledge level, which disagrees with the study by Olaimat et al., who found that 56.5% scored a high level when their knowledge was tested. This difference may be due to different study populations; their study included students from all university faculties whereas ours included only medical students. Medical students would know academic basics that apply to all viruses, including COVID-19. Our results are aligned with those of Baseer et al.[14] in Saudi Arabia, who found a high level of MERS-related knowledge among dentists during the 2016 coronavirus outbreak.

Regarding knowledge questions, two items on which participants scored the least are worth mentioning: "The origin of COVID-19 is not clear, but it seems that it has been transmitted to humans by wild desert life" (29.9%) and "It can be diagnosed by the CBC when lymphocytosis is found" (50.7%). This ambiguity necessitates the inclusion of COVID-19 study in medical school curricula.

The highest scores were for questions related to the mode of transmission and virus fatality: "COVID infection spreads by respiratory droplets, such as cough and sneeze," "Infection with COVID-19 is transmitted via close contact with a confirmed case (particularly in families, crowded places and health centers)," and "For certain individuals, COVID-19 can be fatal, as older age group and people with current health problems are more at risk of severe complications." This agrees with the findings of Taghrir et al.[4] as both study populations were of medical students.

High performance of preventive behavior was found in the majority of the study participants (96.9%). This result is similar to those of Bashirian et al.[15] in Iran, who found desirable behavior in 73.1% of the hospital staff evaluated. Three items in our results were alarmingly low: "I cancelled or postponed friends' meetings, dining out, and sporting activities" and I increased the frequency of cleaning and disinfecting objects that can be easily touched with hands (i.e., door handles and surfaces)," in 61.8% and 51.4% of respondents, respectively. These results disagreed with those of Olapegba et al.[16] in Nigeria, who explored similar items but found more strict preventive behavior among their study population such as "I changed my way of living because of coronavirus" in 76.8% and "I'd like to wash my hands or sanitize them after hand-shaking" in 81%. This discrepancy may be because they performed a country-wide survey with a different sociodemographic distribution (e.g., a wider age range). The third item in our results, "I speak to my family and friends about COVID-19 prevention" was found in only 60.4% of the participants, which is considered unsatisfactory as medical students should consider health education regarding a current pandemic in their surrounding community.

High risk perception was found in 86.1% of the participants, which is similar to the results found by Dryhurst et al.,[17] who analyzed data about risk perception regarding COVID-19 throughout 10 European countries. It was found that risk perception varied among the 10 studied countries (4.78 and 5.45) on a 7-point scale, which was fairly high according to their evaluation. This result also agrees with that of Bashirian et al.,[15] who found a desirable level of perceived threat of infection among healthcare workers.

A significant positive correlation between students' risk perception and their precautionary behavior was detected. This significant relationship was confirmed using binary logistic regression. This result agrees with that of Iorfa et al.,[18] who found that risk perception significantly predicted precautionary behavior. Conversely, a significant but weak negative correlation was found between knowledge and precautionary behavior. Although this result may seem paradoxical; it was previously found in more than one study.[8,19,20] This can be explained by the fact that the more technical information people know, the more secure they feel, which reduces their precautionary behavior.[19] This also implies that despite their good knowledge level, risk perception is the most important variable that could be the basis for reliable precautionary behavior, and it could possibly be a means of preventing newly coming waves of the COVID-19 pandemic.

Regarding motivating and hindering factors, the majority of the study participants agreed that there is a lack

of trust in other people efficiently performing preventive measures. These worries of medical students in our research may be explained by the high percentage of health illiteracy among the Egyptian population as shown by Almaleh et al.[21] Therefore, the study participants exhibited a lack of trust in other people.

CONCLUSION AND RECOMMENDATIONS

The study participants exhibited a high knowledge level. The majority of the participants (96.9%) had a high performance level of precautionary behavior. More than 85% had a high level of risk perception. The two most important hindering factors were not feeling that enough information was provided about the pandemic and not trusting that people would perform preventive measures. The participants' performance was significantly correlated with their degree of risk perception. Including COVID-19 education in medical curricula of microbiology, public health, and internal medicine is therefore highly recommended. We also recommend massive public information campaigns to prevent or at least mitigate other potential waves of the pandemic. Adopting preventive measures on a university campus encourages the students to adopt preventive behavior.

Limitations of the study

The study was conducted with only volunteer participants; namely, medical students attending Ain Shams University who filled out the online questionnaire. Thus, there is no generalizability of the results for all medical students at Ain Shams University or all medical students at other universities. Therefore, further studies should be conducted involving medical students from different universities.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

FUNDING

No funding sources

REFERENCES

1. Trock SC, Burke SA, Cox NJ. Development of framework for assessing influenza virus pandemic risk. Emerg Infect Dis. 2015; 21 (8):1372-78.
2. Barratt R, Shaban RZ, Gilbert GL. Clinician perceptions of respiratory infection risk; a rationale for research into mask use in routine practice. Infect Dis Health. 2019; 24(3):169-76.
3. Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. Int J Antimicrob Agents. 2020; 55(3):105924. doi: 10.1016/j.ijantimicag.2020.105924.
4. Kim JS, Choi JS. Middle East respiratory syndrome–related knowledge, preventive behaviours and risk perception among nursing students during outbreak. J Clin Nurs. 2016; 25(17-18): 2542-9.
5. Brug J, Aro AR, Richardus JH. Risk perceptions and behaviour: Towards pandemic control of emerging infectious diseases. Int J Behav Med. 2009; 16 (3). https://doi.org/10.1007/s12529-008-9000-x.
6. Smith RD. Responding to global infectious disease outbreaks: Lessons from SARS on the role of risk perception, communication, and management. Soc Sci Med. 2006; 63:3113–23.
7. Leppin A, Aro AR. Risk perception related to SARS and avian influenza: theoretical foundations of current behavioral research. Int J Behav Med. 2009; 6(1):7-29.
8. Taghrir MH, Borazjani R, Shiraly R. COVID-19 and Iranian medical students: A survey on their related-knowledge, preventive behaviors and risk perception. Arch Iran Med. 2020; 23(4):249-54.
9. Fleiss, J. L., Levin, B., Paik, M.C. Statistical methods for rates and proportions. Third Edition. New York: John Wiley & Sons; 2003.
10. ECOM. Standard questionnaire on risk perception of an infectious disease outbreak. 2015. Available from: http://ecomeu.info/wp-content/uploads/2015/11/Standard-questionnaire-risk-perception-ECOM-november-2015.pdf. Accessed at: 22/7/2020.
11. World health organization (WHO). Coronavirus disease (COVID-19) pandemic. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019. Accessed at: 10/07/2020
12. Centers of Disease Control and Prevention (CDC). Get the facts about Coronavirus. Available from: https://www.cdc.gov/coronavirus/2019-ncov/index.html. Accessed at: 10/07/2020
13. Olaimat AN, Aolymat I, Shahbaz HM, Holley RA. Knowledge and information sources about COVID-19 among university students in Jordan: A cross-sectional study. Public Health. 2020; 8:254. doi: 10.3389/fpubh.2020.00254.
14. Baseer MA, Ansari SH, Al-Shamrani SS, Alakras AR, Mahrous R, Alenazi AM. Awareness of droplet and airborne isolation precautions among dental health professionals during the outbreak of corona virus infection in Riyadh city, Saudi Arabia. J Clin Exp Dent. 2016; 8(4): e379-87. http://www.medicinaoral.com/odo/volumenes/v8i4/jcedv8i4p379.pdf.
15. Bashirian S, Jenabi E, Khazaei S, Barati M, Karimi-Shahanjarini A, Zareian S et al. Factors associated with preventive behaviours of COVID-19 among hospital staff in Iran in 2020: An application of the protection motivation theory. Journal of Hospital Infection. 2020; 105(3): 430-3.
16. Olapegba P, Iorfa S, Kolawolea S, Oguntayoa R, Gandi J, Ottu I et al. Survey data of COVID-19-related knowledge, risk perceptions and precautionary behavior among Nigerians. Data in Brief. 2020; 30: 105685.
17. Dryhurst S, Schneider C, Kerr J, Freeman A, Recchia G, Van der Bles AM, et al. Risk perceptions of COVID-19 around the world, Journal of Risk Research. 2020. DOI: 10.1080/13669877.2020.1758193.
18. Iorfa S, Ottu IF, Oguntayo R, Ayandele O, Kolawole S, Gandi J, et al. COVID-19 knowledge, risk perception and precautionary behaviour among Nigerians: A moderated mediation approach, medrxiv, [Preprint], Posted May 26, 2020. https://doi.org/10.1101/2020.05.20.20104786
19. Evirgen O , Savas N , Motor VK , Onlen Y , Yengil E. An evaluation of knowledge, attitudes, and behaviors of employees of a university hospital in an H1N1 influenza pandemic. J Infect Dev Ctries 2014; 8(5):561-9.
20. Iliyasu G, Dayyab FM, Habib ZG, Tiamiyu AB, Abubakar S, Mijinyawa MS, et al. Knowledge and practices of infection control among healthcare workers in a tertiary referral center in North-Western Nigeria. Ann Afr Med. 2016 Jan-Mar; 15(1): 34–40.
21. Almaleh Y, Farhata H, Abdelhafez H. Assessment of health literacy among outpatient clinics attendees at Ain Shams university hospitals, Egypt: A cross-sectional study. Public Health. 2017; 151: 137-45.