

# Medical students' knowledge of the disease, frequency of depression, anxiety, stress symptoms, and related factors in the COVID-19 pandemic: A web-based questionnaire

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**Submitted:** 22.04.2022

**Accepted:** 23.09.2022

## ABSTRACT

**Objective:** In this study, it was aimed to determine the level of knowledge of medical students about coronavirus disease 2019 (COVID-19), to investigate the frequency of depression, anxiety, stress symptoms and related factors.

**Materials and Methods:** The study is a cross-sectional study conducted with 904 volunteer medical students. Data were collected with an online questionnaire, including sociodemographic characteristics, knowledge about COVID-19, the Depression, Anxiety, and Stress Scale.

**Results:** Mean age was 21.3±2.2 years, and 54% of them (n=488) were female. Fifty five percent (n=497) thought that their level of knowledge about COVID-19 was sufficient, and 94.6% (n=846) were concerned about the disruption of their education. Their knowledge level was found to be 15.09±2.43 points out of 23 points. The depression, anxiety and stress symptoms were found in 64.9%, 70.4% and 34.1% of participants, respectively. The risk of anxiety (OR=0.51, 95%CI=0.94, p=0.020) and depression (OR=0.95, 95%CI=1.15, p=0.025) were higher in women. Those with a high fear of transmitting the COVID-19 infection to their relatives had higher symptoms of depression, anxiety, and stress. (p<0.001).

**Conclusion:** Medical students have a good knowledge level of COVID-19. However, they experience high levels of anxiety, stress and depression symptoms; and concerned about the disruption of their education.

**Keywords:** Medical student, COVID-19, Pandemic, Depression, Stress, Anxiety

## 1. INTRODUCTION

The novel coronavirus was described in China at the end of 2019, and the disease was named as coronavirus disease 2019 (COVID-19). The virus spread worldwide in few months and became a pandemic [1].

The COVID-19 pandemic has affected all areas in life. Life has been regulated according to the prevention of COVID-19 transmission. Variety of restrictions and rules were applied, leading to many changes in social life. Adaptation to the new life was different from person to person. Not only social life but also economic situations were affected negatively, and many people lost their jobs [2].

Restrictions, social distance and isolation, fear of disease, and stigma affected the mental health of people during this period. Anxiety and depression increased in both previously healthy persons and patients [3,4].

Healthcare workers (HCW) are the first-line group in defense against the COVID-19. Despite this life-threatening infectious disease, HCWs continued their services in all branches. Many healthcare professionals isolated themselves from their families by staying in a different home to prevent the spread of the disease. Face-to-face training has been transferred to digital

\* This study was presented as an oral presentation at the 9th Turkey EKMUD International Scientific Platform (20-23 May 2021, Antalya, Turkey) and was published in the proceedings booklet (23 June 2021, Vol.10).

**How to cite this article:** Tanriverdi, Cinar E, Bayraktar M, Sincan S, et al. Medical students' knowledge of the disease, frequency of depression, anxiety, stress symptoms, and related factors in the COVID-19 pandemic: A web-based questionnaire. *Marmara Med J* 2023; 36(1):140-148. doi: 10.5472/marumj.1244747

platforms. This situation caused disruption in the education of professions that require skills and practice, such as medicine.

Medical students have been affected by all aspects of this pandemic, both as members of the public and as future doctors. They were concerned not only about the changes associated with life and education but also because of their professional role in public health. Since they saw the difficulties of their future profession, they may started to question their medical school preferences.

The uncertainty of the end of the pandemic, the transition to the unfamiliar distance education model, the interruption of the education, the inability to carry out practical and bedside learning, or the concerns about exam type uncertainties have created another stress and anxiety situations in students.

In this study, we aimed to investigate the knowledge levels of medical students about COVID-19 and to research depression, anxiety, stress frequencies and related factors.

## 2. MATERIALS and METHODS

A cross-sectional study was conducted at the Atatürk University, Faculty of Medicine. The study protocol was approved by the Turkish Ministry of Health Scientific Research Platform and the Ethics Committee of Clinical Researches, Faculty of Medicine, Atatürk University (IRB number B.30.2.ATA.0.01.00/264, Date 28.05.2020). The study was carried out in accordance with the principles of the Helsinki Declaration. Informed consent of the participants was obtained.

### Setting and Participants

The eligible population of the research consisted of 1592 medical students who were 1-5<sup>th</sup> semester students at the Faculty of Medicine of Atatürk University, at the time of the study. The students were informed about the purpose of the study via e-mail. Of the students, 645 could not be reached, or they did not accept participation, and 43 were excluded due to insufficient or unreliable data. Complete data of 904 participants were included and analyzed. Thus, 60.7% of the population has been reached out. Inclusion criteria for the study were determined as studying at the Faculty of Medicine of Atatürk University, being a volunteer for participation, not having a psychiatric disease, and not using medication. Those with a previous diagnosis of psychiatric disease and/or drug use, alcohol and substance abuse were excluded from the study.

### Data collection

Data were collected via an online questionnaire. The survey link was shared with all students via e-mail on 2 June 2020. Participation in the study was on a voluntary basis. The online consent of the students was obtained by having them type "I agree to participate in the study" button in the first section of the online survey. Students who did not give consent could not allowed to answer the questions. Data collection was terminated on 10 June 2020. Data collection tool consisted three parts: (1)

Sociodemographic features, (2) Knowledge about COVID-19, and (3) Depression, Anxiety and Stress Scale (DASS-21).

### The Knowledge Score

In the knowledge level evaluations, a literature-based form which was prepared by the researchers was used. A total of 23 questions were asked, such as the ways of transmission of COVID-19, ways of protection, personal protective equipment, isolation recommendations, hygiene measures, and lung findings of COVID-19. The options were given as "true", "false", and "I don't know". Correct answers were coded as 1, and incorrect or 'I don't know' responses as 0. The knowledge level of the students who knew more than 60% of the questions was evaluated as 'adequate'.

### Depression Anxiety Stress Scales Short Form – DASS-21

DASS-21 is a scale firstly developed by Lovibond PF and Lovibond SH in 1995 as 42 items and later converted into a short form by reducing the items. There are 21 items on this short form, and it is answered according to last week's perceptions. There are three sub-dimensions showing depression, anxiety, and stress in the scale answered according to a 4-point Likert system. The score that can be obtained from each item is between 0 and 3. The lowest score that can be obtained from each sub-dimension is 0, and the highest score is 21 [5]. The Turkish adaptation of the scale were performed by Sarıçam et al. (2018), and the Cronbach's alpha coefficients for the anxiety, depression, and stress sub-domains were 0.84, 0.87, and 0.85, respectively [6]. The cut-off scores of the of the scale are given below.

The total depression subscale score was identified as normal (0-4 points), mild depression (5-6 points), moderate depression (7-10 points), severe depression (11-13 points), or extremely severe depression (14 and above). The total anxiety subscale score was defined as normal (0-3 points), mild anxiety (4-5 points), moderate anxiety (6-7 points), severe anxiety (8-9 points), and extremely severe anxiety (10 and above). The total stress subscale score was described as normal (0-7 points), mild stress (8-9 points), moderate stress (10-12 points), severe stress (13-16 points), and extremely severe stress (17 and above). Cut-off scores of <sup>3</sup> 5, <sup>3</sup>4 and <sup>3</sup>8 represent a positive screen of depression, anxiety and stress, respectively [6].

### Statistical Analysis

Data were analyzed using the SPSS 20.0 software (SPSS Inc., Chicago, IL, USA), and presented as mean, standard deviation, median, minimum, maximum, percentage, and number. The normal distribution of continuous variables was evaluated with the Shapiro-Wilk test and the Kolmogorov Smirnov test. Categorical variables were compared with the Pearson Chi-square test, the Chi-square Yates test, the Fisher's Exact test, or the Fisher-Freeman-Halton test, depending on the expected values. The relationship between the quantitative variables was analyzed by using Pearson correlation analysis for normal distributions and Spearman correlation analysis for non-normal distributions. In multivariate analysis,

predictive risk factors between groups were examined using the logistic regression analysis, which included possible risk factors identified in univariate analyzes. Logistic regression model results were presented with 95% confidence intervals of  $B \pm S.E.$ , and OR. A p-value of  $<0.05$  was considered statistically significant.

### 3. RESULTS

#### Participants

The study included 904 medical students. The mean age of the students was  $21.3 \pm 2.2$  years, and 488 (54%) were females. Sociodemographic variables of the students are given in Table I.

Of the students, 283 (31%) read the COVID-19 information guide published by the Ministry of Health of the Republic of Turkish, and 497 (55%) thought that their level of knowledge was sufficient. During the pandemic, 851 (94.1%) of them had increased screen time, 716 (79.2%) had concerns about the interruption of their education, 448 (49.5%) were concerned about their own transmission of COVID-19, and 727 (80.4%) were concerned about their family being infected with COVID-19. Two students individually (0.2%) and 152 relatives of them (16.8%) had COVID-19. Responses to the questions about COVID-19 are presented in Table II.

**Table I.** Sociodemographic characteristics of the participants

Variable (n=904)	n	%
Sex		
Female	488	54
Male	416	46
Grade		
1 <sup>st</sup> year	150	16
2 <sup>nd</sup> year	324	35.8
3 <sup>rd</sup> year	211	23.3
4 <sup>th</sup> year	136	15
5 <sup>th</sup> year	83	9.2
Nationality		
Turkish	863	95.5
Other	41	4.5
Place of accommodation		
Family house	856	94.7
Student house with friends	29	3.2
Student house alone	9	1.0
Dormitory	10	1.1
Smoking		
Never	671	74.2
Active smoker	93	10.3
Ex-smoker, quit during the pandemic	48	5.3
Ex-smoker, quit before the pandemic	71	9.93
Tried quitting in the pandemic but could not	21	2.3

**Table II.** The responses to questions about COVID-19

	n	%	
Have you read the COVID-19 guideline?	Yes	283	31.3
	No	191	21.1
	I have read part of it	221	24.4
	I browsed but did not read	209	23.1
How would you describe your level of knowledge about COVID-19?	Low	85	9.4
	Moderate	322	35.6
	Sufficient	497	55.0
Has your daily screen time increased during the pandemic?	Yes	851	94.1
	No	53	5.9
How much time do you spend on news about COVID-19? (hour/day)	I never follow the news	26	2.9
	Less than 1 hour	614	67.9
	1-3 hours	227	25.1
	3-5 hours	29	3.2
	5-7 hours	5	.6
What is your level of anxiety about the interruption of your education?	None	58	6.4
	Very low	40	4.4
	Low	90	10.0
	Moderate	292	32.3
	Severe	230	25.4
	Extremely severe	194	21.5
What is your level of anxiety about contracting yourself with COVID-19?	None	69	7.6
	Very low	167	18.5
	Low	220	24.3
	Moderate	286	31.6
	Severe	117	12.9
	Extremely severe	45	5
What is your level of anxiety about the transmission of COVID-19 to your acquaintances?	None	16	1.8
	Very low	64	7.1
	Low	94	10.7
	Moderate	341	37.7
	Severe	245	27.1
	Extremely severe	141	15.6
Have you had COVID-19? <sup>†</sup>	Yes	2	0.2
	No	902	99.8
Has anyone close to you had COVID-19? <sup>†</sup>	Yes	152	16.8
	No	752	83.2

<sup>†</sup> Results in the third month of the pandemic; n=904

#### The Knowledge Scores

Responses to the knowledge questions are presented in Table III. The mean knowledge scores were  $15.0951 \pm 2.43$ . Their knowledge level was found to be 65%. The most known information was that social isolation was the most effective way to prevent transmission, and the least known was that patients with COVID-19 should use heparin for thrombosis prophylaxis. Disease stigmatization was assessed by the question “The virus is also called the Chinese virus,” which was marked as ‘true’ by 54.2% of the students.

**Table III.** Responses to knowledge questions

Knowledge questions	True n (%)	False n (%)	Do not know n (%)
Washing hands with soap and water for at least 20 seconds kills the coronavirus. (T)	746 (82.5)	112 (12.4)	46 (5.1)
The novel coronavirus is an enveloped DNA virus. (F)	395 (43.7)	304 (33.6)	205 (22.7)
The virus is also called the Chinese virus. (F)	490 (54.2)	300 (33.2)	114 (12.6)
The incubation period is between 2-14 days. (T)	847 (96.7)	16 (1.8)	14 (1.5)
The COVID-19 agent is also called SARS-CoV-2. (T)	590 (65.3)	123 (13.6)	191 (21.1)
COVID-19 is mainly transmitted by droplet and contact. (T)	859 (95)	31 (3.4)	14 (1.5)
The first case was seen in China on 31 December 2019. (T)	558 (61.7)	120 (13.3)	226 (25)
Asymptomatic people are not contagious. (F)	12 (1.3)	785 (86.8)	107 (11.8)
Surfaces such as door handles, faucets, and sinks should be cleaned with disinfectant or diluted bleach. (F)	875 (96.8)	11 (1.2)	18 (2)
Social isolation is the most effective method to prevent the transmission of the virus. (T)	889 (98.3)	6 (0.7)	9 (1.0)
A negative COVID-19 test does not exclude the infection. (T)	787 (87.1)	49 (5.4)	68 (7.5)
Patients who have recovered from the infection and are discharged enter the home follow-up period. (T)	658 (72.8)	100 (11.1)	146 (16.2)
COVID-19 patients monitored at home should use separate toilets and bathrooms if possible. (T)	849 (93.9)	13 (1.4)	42 (4.6)
Patients monitored at home should also apply isolation at home and stay in a separate room if possible. (T)	889 (98.3)	3 (0.3)	12 (1.3)
Patients under 50 without any additional disease and with mild clinical symptoms can be monitored at home. (T)	728 (80.5)	63 (7)	113 (12.5)
70% alcohol can be used to clean surfaces that are thought to be contaminated. (T)	635 (70.2)	104 (11.5)	135 (18.3)
1/100 diluted bleach is used on surfaces contaminated with patient excreta. (T)	339 (37.5)	76 (8.4)	489 (54.1)
All individuals with COVID-19 must be hospitalized and treated. (F)	108 (11.9)	692 (76.5)	104 (11.5)
Bilateral ground-glass opacities in the lungs are typical for COVID-19. (T)	459 (50.8)	49 (5.4)	396 (43.8)
Magnetic resonance (MR) is preferred as the imaging method of the lungs in COVID-19 patients. (F)	98 (10.8)	160 (17.7)	646 (71.5)
Heparin is administered to patients with COVID-19 for thrombosis prophylaxis. (T)	129 (14.3)	140 (15.5)	635 (70.2)
Bilateral diffuse infiltrates in the lungs are typical in the disease. (T)	684 (75.7)	17 (1.9)	203 (22.5)
Even if the test result is negative, treatment should be started for clinically positive patients. (T)	633 (70)	55 (6.1)	216 (23.9)

**Table IV.** Prevalence of depression, anxiety, and stress symptoms as to the DASS-21 subscales

DASS subscales	(n)	(%)
<b>Stress</b>		
Normal	596	65.9
Mild	102	11.3
Moderate	113	12.5
Severe	68	7.5
Extremely severe	25	2.8
<b>Anxiety</b>		
Normal	268	29.6
Mild	176	19.5
Moderate	156	17.3
Severe	108	11.9
Extremely severe	196	21.7
<b>Depression</b>		
Normal	317	35.1
Mild	178	19.7
Moderate	255	28.2
Severe	98	10.8
Extremely severe	56	6.2

**Prevalence of Depression, Anxiety, and Stress Symptoms**

Of the students, 64.9% (n=587) had depression, 70.4% (n=636) anxiety, and 34.1% (n=308) stress symptoms (Table IV).

Depression was severe or extremely severe in 17% (n=154), anxiety in 33.6% (n=304), and stress in 10.3% (n=93) of the participants. Depression, anxiety, and stress subgroups are presented in Table IV.

**Evaluation of DASS and knowledge scores by sex and study period**

Women's anxiety (6.68±4.38 vs. 5.65±4.24, p=0.001) and depression scores (6.80±4.17 vs. 5.96±4.09, p=0.002, respectively) were significantly higher than men's scores. There was no significant difference between the sex regarding stress scores (p=0.16) (Figure 1).

**Table V.** Comparison of DASS subgroups according to various variables

		Stress group				p	Anxiety group				p	Depression group				p
		Normal		Stressful			Normal		Anxiety			Normal		Depression		
		n	%	n	%		n	%	n	%		n	%	n	%	
Sex (n=596)	Male	284	47.7	132	42.9	0.17	145	54.1	271	42.6	0.00	167	52.7	249	42.4	0.00
	Female	312	52.3	176	57.1		123	45.9	365	57.4		150	47.3	338	57.6	
Study period (n=596)	Preclinic	458	76.8	227	73.7	0.29	210	78.4	475	74.7	0.23	240	75.7	445	75.8	0.97
	Clinic	138	23.2	81	26.3		58	21.6	161	25.3		77	24.3	142	24.2	
Instruction (n=596)	Turkish	500	83.9	252	81.8	0.42	226	84.3	526	82.7	0.55	270	85.2	482	82.1	0.24
	English	96	16.1	56	18.2		42	15.7	110	17.3		47	14.8	105	17.9	
Nationality (n=596)	Turkish	562	94.3	301	97.7	0.01	249	92.9	614	96.5	0.01	294	92.7	569	96.9	0.00
	Other	34	5.7	7	2.3		19	7.1	22	3.5		23	7.3	18	3.1	
Had COVID-19 (n=596)	Yes	1	0.2	1	0.3	1	1	0.4	1	0.2	0.50	1	0.3	1	0.2	1
	No	595	99.8	307	99.7		267	99.6	635	99.8		316	99.7	586	99.8	
Smoking (n=596)	Current smoker	54	9.1	39	12.7	0.00	27	10.1	66	10.4	0.50	34	10.7	59	10.1	0.56
	Never smoked	464	77.9	207	67.2		207	77.2	464	73.0		236	74.4	435	74.1	
	Quit during the pandemic	27	4.5	21	6.8		14	5.2	34	5.3		19	6.0	29	4.9	
	Quit before the pandemic	42	7.0	29	9.4		16	6.0	55	8.6		24	7.6	47	8.0	
	Tried quitting in the pandemic, but couldn't	9	1.5	12	3.9		4	1.5	17	2.7		4	1.3	17	2.9	
[Level of fear about your relatives (mother, father, sibling, close relative) being infected with COVID-19] (n=596)	None	12	2.0	4	1.3	<0.001	9	3.4	7	1.1	<0.001	9	2.8	7	1.2	<0.001
	Very little	49	8.2	15	4.9		25	9.3	39	6.1		33	10.4	31	5.3	
	Little	64	10.7	33	10.7		33	12.3	64	10.1		35	11.0	62	10.6	
	Moderate	244	40.9	97	31.5		127	47.4	214	33.6		136	42.9	205	34.9	
	Severe	156	26.2	89	28.9		54	20.1	191	30.0		73	23.0	172	29.3	
	Very severe	71	11.9	70	22.7		20	7.5	121	19.0		31	9.8	110	18.7	
[Level of fear about getting infected with COVID-19] (n=596)	None	49	8.2	20	6.5	0.00	29	10.8	40	6.3	<0.001	33	10.4	36	6.1	0.02
	Very little	118	19.8	49	15.9		58	21.6	109	17.1		63	19.9	104	17.7	
	Little	135	22.7	85	27.6		73	27.2	147	23.1		81	25.6	139	23.7	
	Moderate	204	34.2	82	26.6		81	30.2	205	32.2		99	31.2	187	31.9	
	Extreme	69	11.6	48	15.6		21	7.8	96	15.1		31	9.8	86	14.7	
	Very severe	21	3.5	24	7.8		6	2.2	39	6.1		10	3.2	35	6.0	
Time spent a day on news about COVID-19 (n=596)	Never follows the news	19	3.2	7	2.3	0.05	12	4.5	14	2.2	0.14	11	3.5	15	2.6	0.54
	Less than 1 hour	422	70.8	192	62.3		190	70.9	424	66.7		222	70.0	392	66.8	
	1-3 hours	134	22.5	93	30.2		58	21.6	169	26.6		74	23.3	153	26.1	
	5-7 hours	16	2.7	13	4.2		6	2.2	23	3.6		7	2.2	22	3.7	
	≥7 hours	5	0.8	3	1.0		2	0.7	6	0.9		3	.9	5	.9	
Perceived COVID-19 knowledge (n=596)	Very little	56	9.4	29	9.4	0.27	29	10.8	56	8.8	0.41	35	11.0	50	8.5	0.34
	Moderate	223	37.4	99	32.1		88	32.8	234	36.8		116	36.6	206	35.1	
	Adequate	317	53.2	180	58.4		151	56.3	346	54.4		166	52.4	331	56.4	
	Very good	0	0	0	0		0	0	0	0		0	0.0	0	0.0	
Perceived anxiety of interruption of education (n=596)	None	41	6,9%	17	5,5%	<0,001	27	10,1%	31	4,9%	<0,001	33	10,4%	25	4,3%	<0,001
	Very little	28	4,7%	12	3,9%		16	6,0%	24	3,8%		17	5,4%	23	3,9%	
	Little	66	11,1%	24	7,8%		31	11,6%	59	9,3%		37	11,7%	53	9,0%	
	Moderate	219	36,7%	73	23,7%		94	35,1%	198	31,1%		119	37,5%	173	29,5%	
	Extreme	152	25,5%	78	25,3%		64	23,9%	166	26,1%		74	23,3%	156	26,6%	
	Very severe	90	15,1%	104	33,8%		36	13,4%	158	24,8%		37	11,7%	157	26,7%	

**Table VI.** Stress, anxiety, and depression odds ratios (OR) by selected demographic characteristics

Variables B±SE		Stress			Anxiety			Depression		
		B±SE	OR (OR-95 CI)	p	B±SE	OR (OR-95 CI)	p	B±SE	OR (OR-95 CI)	P
	Age	0.06 ± 0.04	1.06 (0.97-1.17)	0.142	0.05 ± 0.05	1.05 (0.94-1.17)	0.323	0.04 ± 0.04	1.05 (0.95-1.15)	0.316
	Sex M	-0.14 ± 0.14	0.86 (0.65-1.16)	0.342	-0.35 ± 0.15	0.7 (0.51-0.94)	0.020	-0.32 ± 0.14	0.72 (0.54-0.96)	0.025
Study year	1 <sup>st</sup> grade			0.170			0.614			0.631
	2 <sup>nd</sup> grade	0.53 ± 0.36	1.7 (0.83-3.47)	0.143	-0.12 ± 0.38	0.88 (0.41-1.85)	0.739	0.28 ± 0.35	1.32 (0.66-2.65)	0.425
	3 <sup>rd</sup> grade	0.41 ± 0.31	1.51 (0.81-2.81)	0.185	0.11 ± 0.33	1.12 (0.58-2.15)	0.720	0.4 ± 0.3	1.5 (0.82-2.72)	0.183
	4 <sup>th</sup> grade	0.2 ± 0.31	1.22 (0.66-2.25)	0.519	-0.12 ± 0.32	0.88 (0.47-1.65)	0.699	0.27 ± 0.29	1.31 (0.73-2.35)	0.356
	5 <sup>th</sup> grade	0.64 ± 0.31	1.91 (1.03-3.53)	0.037	0.19 ± 0.32	1.21 (0.63-2.31)	0.555	0.42 ± 0.3	1.53 (0.84-2.77)	0.159
Nationality	Turkish	1.13 ± 0.44	3.11 (1.3-7.44)	0.010	0.74 ± 0.35	2.11 (1.05-4.23)	0.034	0.92 ± 0.34	2.53 (1.28-4.98)	0.007
Level of fear about relatives being infected with COVID-19	None			0.032			0.001			0.021
	Very little	-0.82 ± 0.69	0.44 (0.11-1.7)	0.235	-1.49 ± 0.65	0.22 (0.06-0.8)	0.022	-1.07 ± 0.63	0.34 (0.09-1.19)	0.091
	Little	-1.07 ± 0.39	0.34 (0.15-0.74)	0.006	-0.98 ± 0.41	0.37 (0.16-0.84)	0.018	-1.15 ± 0.38	0.31 (0.14-0.67)	0.002
	Moderate	-0.68 ± 0.32	0.5 (0.27-0.95)	0.034	-0.83 ± 0.37	0.43 (0.2-0.9)	0.025	-0.56 ± 0.34	0.56 (0.28-1.11)	0.098
	Severe	-0.79 ± 0.24	0.45 (0.28-0.73)	0.001	-1.15 ± 0.31	0.31 (0.17-0.58)	0.000	-0.81 ± 0.27	0.44 (0.25-0.75)	0.003
	Very severe	-0.54 ± 0.23	0.57 (0.36-0.92)	0.022	-0.5 ± 0.31	0.6 (0.32-1.11)	0.108	-0.44 ± 0.27	0.63 (0.37-1.09)	0.102
Level about getting infected with COVID-19	None			0.297			0.581			0.934
	Very little	-0.32 ± 0.48	0.72 (0.27-1.87)	0.501	-0.6 ± 0.59	0.54 (0.16-1.75)	0.308	-0.32 ± 0.52	0.72 (0.25-2)	0.533
	Little	-0.38 ± 0.41	0.67 (0.3-1.52)	0.347	-0.41 ± 0.54	0.65 (0.22-1.9)	0.440	-0.06 ± 0.46	0.93 (0.37-2.32)	0.882
	Moderate	-0.07 ± 0.39	0.92 (0.43-1.99)	0.846	-0.48 ± 0.52	0.61 (0.21-1.73)	0.358	-0.2 ± 0.44	0.81 (0.33-1.95)	0.643
	Severe	-0.52 ± 0.37	0.59 (0.28-1.24)	0.168	-0.19 ± 0.52	0.82 (0.29-2.29)	0.710	-0.08 ± 0.43	0.92 (0.38-2.18)	0.851
	Very severe	-0.21 ± 0.38	0.8 (0.37-1.72)	0.575	-0.06 ± 0.54	0.94 (0.32-2.71)	0.909	0 ± 0.45	0.99 (0.41-2.42)	0.994
	Constant	-2.52 ± 1.33	0.07	0.057	0.37 ± 1.49	1.45	0.801	-0.61 ± 1.37	0.54	0.655

Data were regrouped according to stress, anxiety, and depression scores (normal/stressed; normal/depressed, normal/anxious).

There was no difference between depression, anxiety, and stress scores of preclinical and clinical term students ( $p=0.22$ ,  $p=0.40$ , and  $p=0.33$ , respectively). Knowledge scores of; women compared to men ( $15.37\pm 2.25$  vs.  $14.76\pm 2.59$ ,  $p<0.001$ ), clinical students compared to preclinical students ( $15.60\pm 2.19$  vs.  $14.93\pm 2.49$ ,  $p<0.001$ ) (Figure 2), and students who read the COVID-19 scientific guideline compared to those who did not ( $15.48\pm 2.41$  vs.  $14.58\pm 2.61$ ;  $p<0.001$ ) were significantly higher.

There was no correlation between the knowledge scores and the stress, anxiety, and depression scores ( $p=0.49$ ,  $p=0.29$ , and  $p=0.47$ , respectively). Anxiety, stress, and depression rates were all higher in those who had a fear of their relatives getting infected with COVID-19 than those who did not. Comparisons

of DASS subgroups according to various variables are presented in Table V.

#### **Probability of stress, anxiety, and depression by demographics**

A regression model was created with the dependent variables with and without stress, anxiety, and depression, and the independent variables of age, sex, class, program, nationality, fear of COVID-19 contagion to relatives, and self. While class, nationality, and fear of contracting COVID-19 to relatives were effective on stress ( $p<0.05$  for all); sex, nationality, and fear of contracting COVID-19 to relatives were effective on anxiety and depression ( $p<0.05$  for all) (Table VI).

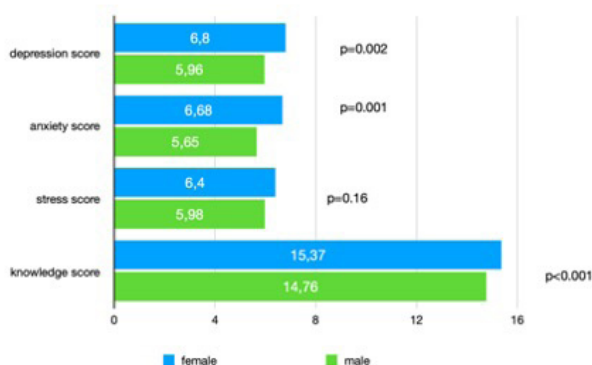


Figure 1. Evaluation of DASS and knowledge scores by sex

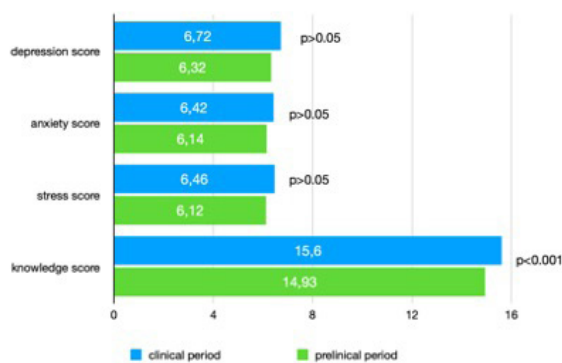


Figure 2. Evaluation of DASS and knowledge scores by period

#### 4. DISCUSSION

The present study has two main results. First, around two-thirds of medical students had sufficient knowledge about COVID-19. However, only half thought they had enough knowledge. Second, approximately one in two students experienced moderate-to-severe depression and anxiety symptoms, and one in five students experienced moderate-to-severe stress symptoms at the third month of the pandemic.

The implementation of disease-related preventive measures by a large part of the general population is critical to contain the spread of epidemics. In this context, increasing the knowledge of individuals on disease-related issues will facilitate their adaptation to preventive measures. Additionally, it is known among medical students that learning and developing knowledge about a new infectious disease will help improve students' perception of disease and preventive behaviors. As a generation of future healthcare professionals, the positive knowledge, attitudes, and behaviors of medical students in the context of a pandemic not only guide to communication and mitigation

strategies during the event but can also provide information to prepare for the future pandemic.

In our study, 65% of all participants had sufficient knowledge of the main clinical symptoms, transmission, and prevention associated with COVID-19. This level of knowledge is lower than that demonstrated among medical students in Iran (86.96%) [7] and in Uganda (91%) [8]. A recent study conducted on medical students in Turkey has also described a higher level of knowledge on COVID-19 (78.3%) [9]. Our findings also show that the level of knowledge of clinical-term students is higher than preclinical students, which is consistent with earlier studies [9]. While, most of the participants in our study were preclinical students, previous investigations included more clinical students than preclinical ones. This methodological difference may lead to a lower level of knowledge among medical students in the current study.

In females, higher levels of knowledge were observed, which contrasts with the previously mentioned studies. However, some other studies report no significant relationship between knowledge level and sex [7,10,11]. There are contradictory reports regarding the relationship between sex and knowledge [9]. This inconsistency between studies can be attributed to socio-cultural differences and the tools used.

In the current study, the low participation rate of 4th and 5th grade students and the fact that interns were not included in the study may have affected the results. However, in terms of the knowledge about COVID-19, medical students commonly scored highest in the items related to the transmission route of the virus and preventive behaviors. Our findings are supported by similar studies in the literature [7,8]. In our research, the lowest-scoring items were related to the treatment of COVID-19 and the imaging method used. As mentioned earlier, more than half of our participants were preclinical students; internship students were not included in our study. Therefore, it is not surprising that preclinical students had less or no contact with patients and did not have experience of working in risky and patient-contact environments, such as emergency and intensive work. Therefore, they had less knowledge of these items.

The transformation of COVID-19 into a pandemic that started from China and spread to the world has caused a stigma against China in some individuals. To evaluate the students' attitudes towards stigmatization, the proposition "The virus is also called the Chinese Virus" was included among the information questions. It was observed that more than half of the students marked this proposition as 'true'. Although we asked to evaluate stigma, this conclusion should be approached with caution as this statement does not necessarily measure stigma. The World Health Organization announced that the virus was named SARS-CoV2, and the disease of this novel coronavirus as COVID-19, to prevent such stigma at the beginning of the pandemic [12] and our study was not long after the onset of the pandemic, which means there was still confusion about the nomenclature in minds.

The current study shows high rates of depression, anxiety, and stress symptoms among medical students (64.9%, 70.4%, and

34.1%, respectively). This finding is supported by several studies showing the negative psychological effects of the COVID-19 outbreak on medical students in many other countries. For example, a study from Brazil reported moderate-severe depressive symptoms in 64.41% of medical students [13]. Another study assessing the psychological impacts of COVID-19 in medical students in the United States demonstrated self-reported anxiety in 66.1% of participants [14]. Similarly, the result from a study by Kumar et al., who reported 38.9% of stress among students during the pandemic, is in line with our findings [15]. As expected, the prevalence of psychological distress in medical students during the COVID-19 pandemic was higher than those reported before the outbreak [16]. In a study from Turkey using the DASS scale before the epidemic, 27.1%, 47.1%, and 27% of medical students suffered from depression, anxiety, and stress, respectively [17]. Current research shows higher depression, anxiety, and stress levels in medical students compared to before the pandemic [18,19]. In previous studies, depression and anxiety symptoms were also significantly higher in students in their basic academic years (years 1–3) than those in clinical years (years 4–6) [20,21]. Similarly, a literature review reported that female and first-year medical students are at a higher risk of depression [22]. Another finding of the study was that depressive and anxiety symptoms were significantly higher among students worried about transmitting the virus to family members. This finding contradicts an earlier study that showed students who were worried about transmitting the virus to family members, which found no statistically significant difference compared to students who were not worried [23]. Another finding of the study was that students with the worry about transmitting the virus to the family members are at a higher risk of anxiety, depression, and stress, which complies with a previous study conducted in the general population [24]. However, contrary to these, one study did not find any significant relationship between the risk of suffering from depressive and anxiety symptoms and the worry about transmitting the virus to family members in medical students [23,25].

This study shows that medical students are psychologically affected by the pandemic. They are more concerned about infecting their relatives with the disease than being infected themselves and experience high levels of depression, anxiety, and stress symptoms.

### Limitations

The study has some limitations. First of all, it is a cross-sectional study conducted with 1<sup>st</sup> – 5<sup>th</sup> year students of a single medical school. Thus, the results cannot be generalized to all medical students. The measurement tool used is a self-assessment instrument and is based on students' self-evaluations. Due to the pandemic, students could not be interviewed face-to-face, and data were collected online. The fact that students, who did not have a device or internet connection or did not use social media, could not be reached and therefore may have impacted the results. Finally, since the study was conducted in the third month of the pandemic, it should be noted that the findings are preliminary and may have changed over time.

### Conclusion

In this study, medical students' psychological status at the beginning of the pandemic was evaluated, and high levels of depression, anxiety, and stress were revealed. On one hand, students were concerned about the COVID-19 contamination of themselves and their relatives, and on the other hand, about the interruption of their education. Their anxiety levels about their relatives who get sick were higher than their own. While female sex is a risk factor for depression and anxiety, those who had a fear of contracting COVID-19 to their relatives, and those who were concerned about the interruption of their education had significantly higher depression, anxiety, and stress levels.

Students' knowledge rate for COVID-19 was found to be good (65%) even though it was just the beginning of the pandemic. Women's knowledge scores were significantly higher than men's, and knowledge scores of clinical students were significantly higher than preclinical students.

### Compliance with Ethical Standards

**Ethical Approval:** The study protocol was approved by the Turkish Ministry of Health Scientific Research Platform and the Ethics Committee of Clinical Researches, Faculty of Medicine, Atatürk University (IRB number B.30.2.ATA.0.01.00/264, Date 28.05.2020). The study was carried out in accordance with the principles of the Helsinki Declaration. Informed consent of the participants was obtained.

**Financial Support:** This manuscript did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Conflict of Interest:** The authors have stated explicitly that there are no conflicts of interest in connection with this manuscript.

**Authors' contributions:** ECT, MS and ZO: Design, YÇ, MŞ and ZO: Supervision, ECT, MB and SS: Resources, materials and collection and/or processing, KK: Analysis and/or interpretation, ECT: Writing the article, ECT, MB, SS, YC and ZO: Critical review. All authors approved the final manuscript.

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