

Decreased psychiatric symptomatology after the onset of COVID-19 pandemic: A longitudinal college mental health study from Turkey

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Research Article

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Abstract

Objective

COVID-19 pandemic brought significant challenges for college students. This study aimed to investigate changes in psychiatric symptomatology among them compared to the pre-pandemic period alongside their determinants.

Methods

Data were collected before and three months after the onset of the pandemic from 168 students who had applied to a college mental health center. Psychiatric symptomatology was assessed by Patient Health Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder-7 (GAD-7), and Adult Attention Deficit Hyperactivity Disorder Self-Report Scale (ASRS). Possible vulnerability factors were screened by a survey on COVID-19-related health and social isolation status, Fear of COVID-19 Scale, Social Media Use Disorder Scale (SMDS), Distress Thermometer, Scoff Eating Questionnaire, and International Physical Activity Questionnaire Short-Form (IPAQ).

Results

PHQ-9, GAD-7 and ASRS scores significantly declined in the follow up. Even though the screen time increased, SMDS scores significantly declined. SMDS had a direct effect on PHQ-9 and ASRS levels, in addition to an indirect effect through Stress Thermometer. Higher SMDS scores predicted higher anxious and depressive symptomatology in repeated assessments. Fear of COVID-19 scores had a direct effect on GAD-7 scores only.

Conclusion

This study suggested that stress level and psychiatric symptomatology of the students decreased significantly in the early phases of the pandemic. Level of social media use disorder should be taken into account while following college students with mental health symptoms.

1. Introduction

The world is going through a global pandemic of COVID-19, which is causing significant consequences on healthcare systems and public health. Studies have reported that the spatial distancing, self-isolation, quarantine, social and economic discord and misinformation (particularly on social media) are among the major contributing factors towards unusual sadness, fear, frustration, feelings of helplessness, loneliness, and nervousness^{1,2}. A recent systematic review concluded that COVID-19 pandemic is associated with highly significant levels of psychological distress which meets the threshold for depression, anxiety disorders and post-traumatic stress disorder in many cases³. College students is an emerging focus among vulnerable groups for the psychiatric impact of the pandemic. They are in an age of emerging adulthood (18–25 years of age) which is a second transition period of life after adolescence when well-being can easily become unstable especially during extraordinary circumstances⁴. Worldwide data collected before the pandemic suggest that about 20% of college students experience at least one diagnosable mental disorder⁵. The closure of university campuses with COVID-19 pandemic brought significant challenges to college students' daily routines. Prolonged social isolation, quick change in educational environment⁶, the fear of getting infected and not being able to meet their families for an unknown duration⁷, anxiety about potential impact of the pandemic on their studies and future job market opportunities⁸ are leading risk factors according to early studies. In addition, lifestyle and health behavior changes such as eating and drinking habits, sleep quality, physical activity, smart phone and social media use may also have an impact on students' mental health⁹. While social media may cause rapid spread of false information and rumors that create panic and confusion in the public, it can also play a positive role in information exchange in times of crisis such as covid-19¹⁰. College students who had to stay at home during the pandemic used social media to learn and communicate which increased the duration and frequency of social media use. Since the symptoms of problematic social media use are spending too much time and preoccupation; excessive use of social media can easily turn into problematic use¹¹. Although some studies reported a positive influence of social media use on mental health, problematic social media use has been linked to poor psychological well-being and symptoms of depression, and anxiety^{12,13}. A study from China during covid-19 pandemic showed that problematic social media use among university students predicted their levels of anxiety¹⁴.

A large number of cross-sectional studies reported varying degrees of increased acute stress, anxiety and depressive symptoms in college students. For example, a nation-wide survey of college students in China have found increased rates of acute stress, depressive and anxiety symptoms which were 34.9%, 21.1% and 11.0%, respectively¹⁵. Another survey from the USA reported that nearly half of the students showed a moderate-to-severe level of depression and nearly 40% of students showed a moderate-to-severe level of anxiety¹⁶.

However, cross-sectional studies neither explain how students' mental health has changed compared to pre-pandemic nor identify the predictors of this change. A few prospective studies have been published so far reporting mixed results on the change of psychiatric symptomatology in college student population^{8,17-19}. There is a need for studies investigating the effects of the COVID-19 pandemic on the mental health of university students and its related factors such as lifestyle changes and social media use. Thus, we aimed to investigate the changes in psychiatric symptomatology of the students compared to pre-pandemic period and the determinants of this change in relation to COVID-19 exposure, social isolation status, lifestyle and health behavior changes as well as stress levels and social media use disorder.

2. Methods

2.1. Study Setting

Turkey, with more than 15 million cases, is among the top 10 countries in the world where COVID-19 has spread the most, as of June 2022. The first COVID-19 positive case in Turkey was announced on March 11, 2020 and by 1 April it was confirmed that COVID-19 had spread all over the country. On March 16, 2020 face-to-face education has been suspended in all universities. From the beginning of April 2020, some additional regulations have been made by Turkish government such as restriction of intercity travel, the closure of shopping centers, cinemas, restaurants, sports centers and lockdown for people under the age of 20. By the end of March 2020, all Koc University campuses were evacuated and transition to online education was completed.

This study was conducted in Koc University Psychological Counselling and Psychotherapy Center which is a comprehensive mental health center that provides various clinical services including individual psychotherapy, psychiatric consultation and psychiatric treatment. The center accepts applications by email all year round.

2.2. Study Cohort

This study was approved by the Koc University Institutional Review Board and all procedures were in accordance with the Declaration of Helsinki. All participants provided an online informed consent before participating in the study.

Our target population was college students who already had psychiatric problems before the pandemic. The accessible population was the college students who applied to our college mental health center during pre-pandemic period. We invited the whole accessible population to the study, 330 students who applied to Koc University Psychological Counselling and Psychotherapy Center between September 2019 and March 2020 and completed the pre-evaluation scales. So the sampling method was convenient sampling. The characteristics of study sample ($n = 168$) are given in the results section. Follow-up data has been recruited between June 11- June 22, 2020. The timeline of pre-pandemic assessment, onset of COVID-19 in Turkey, the academic calendar of the university and data recruitment dates are presented in Fig. 1.

2.3. Evaluation Scales

Both pre-pandemic and follow-up survey applied online. Students are sent an online Qualtrics survey link, and they fill the survey as self-report. Each online survey includes attention questions to increase the reliability of the data collected. Pre-pandemic survey included 3 parts:

- i) A survey on demographic and health behavior data which collects information about demographic variables, education-related data, body weight, living conditions, sleep habits.
- ii) Measurements of psychiatric symptomatology and psychosocial functioning included Patient Health Questionnaire-9²⁰, Generalized Anxiety Disorder-7²¹, Adult Attention Deficit Hyperactivity Disorder (ADHD) Self-Report Scale (ASRS-v1.1)²² and World Health Organization Disability Assessment Chart (2010).
- iii) Measurements related to risk factors which included Distress Thermometer²³, Social Media Use Disorder Scale-9²⁴ (A 9 item five point Likert type scale which uses diagnostic criteria determined for Internet Gaming Disorder in DSM-V and higher scores indicate bigger problem with social media use), the SCOFF Questionnaire²⁵, and the International Physical Activity Survey (International Consensus Group)²⁶.
In addition to the 3 sections above, the follow-up survey included a fourth part:
- iv) COVID-19 Fear Scale (A 7 item five point Likert type scale questioning anxious thoughts and physical symptoms related to anxiety, higher scores indicate a greater level of anxiety) and a survey questioning the health problems and social isolation status associated with COVID-19. We also questioned whether they received psychotherapy or psychiatric treatment (from our center or external source) between pre-pandemic and follow-up assessments. Psychotherapy was defined as having had a minimum of 4 psychotherapy sessions and psychiatric treatment was defined as having had a regular pharmacotherapy regimen for at least 3 months.

Except The Fear of COVID-19 scale, the Turkish versions of all scales²⁷⁻³³ were used in the study.

2.4. Statistical Analysis

Descriptive statistics for continuous variables (mean, standard deviation, minimum, median, maximum) and distributions of gender and COVID-19 related measures have been calculated. Prepandemic and follow-up measurements for continuous variables were compared with the paired samples t test, and the non-parametric alternative Wilcoxon signed rank test was used for dependent variables that were not normally distributed. Due to multiple comparisons of various variables, we used a corrected p value. Since the number of tests was 8 in our study, p value lower than 0.006 has been accepted significantly for this analysis. Distributions of categorical variables in pre-pandemic and follow-up assessments were compared by McNemar test.

To determine which factors affected the decrease in psychiatric symptomatology, we specified two intercept-only models to define the predictor variables for each outcome variable (PHQ-9, GAD-7 and ASRS), in a linear mixed effect model where the outcome variable was regressed on a random effect variable for participants, and all other variables were defined as fixed factors, using Jamovi Version 1.1.9.0. All other analysis has been conducted using IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp. Program.

To test the interaction between Fear of COVID-19 Scale, Stress Thermometer, SMDS and psychiatric outcome (PHQ-9, GAD-7 and ASRS) scores, we conducted mediation analysis with model 4 under PROCESS macro version v3.5, developed by Hayes for SPSS. In the mediation models, fear of COVID-19 score and SMDS scores were defined as X and psychiatric outcome (PHQ-9, GAD-7 and ASRS) scores were defined as Y, whereas stress thermometer scores were defined

as the mediators. For this analysis, only participants' scores that were complete for all scales ($n = 151$) in the second assessment were put in the model, as this analysis required cross sectional data. The mediation analysis is performed by the bootstrapping method with 5,000 samples and bias-corrected 95% confidence intervals (CI) to estimate the significance of the indirect and direct effects.

3. Results

3.1. Demographic variables, health behavior, and COVID-19 related status of the participants

A total number of 330 students were asked to participate and 168 of them participated in the study. So, the response rate was 50.9%. There were no differences in stress levels, PHQ-9, GAD-7, ASRS scores and psychosocial functioning between responders and non-responders ($p > 0.05$).

21% of the applicants ($n = 168$) were referred by university counselling service or academic staff without a formal diagnosis, the rest stated that they heard about our center through the university web-site, orientation training and from peers. The most common reasons for application in pre-pandemic period were: 60% depressive and anxious symptoms, 30% difficulty in fulfilling academic responsibilities, 32% difficulties in social relationships, 24% psychosomatic symptoms, 18% romantic relationship problems, 16% family problems, 16% obsessive-compulsive symptoms.

120 (71.4%) of the participants were female. The mean age of the participants was 21.7 ± 2.52 . Body weight of the participants was similar compared to pre-pandemic (64.96 ± 13.45 vs 65.18 ± 14.05 , $p = 0.56$). The number of days of alcohol use decreased significantly ($p < 0.001$). Screen time increased significantly ($p < 0.001$) such as the frequency of screen time of 7 hours or more per day was 13.2% before the pandemic, while this rate was found 38.6% during the pandemic period. 77 of the participants (45.8%) received a psychotherapy or psychiatric management in between the two assessments. The average number of days between pre-pandemic and follow-up assessments was 190.66 (min 94-max 275). The rate of living with parents increased significantly from 4.8–38% ($p < 0.001$). The details of these data can be found in Supplementary Table S1)

The mean score of fear of COVID-19 scale was 17.23 ± 5.43 . 81. Of the participants, 13% stated that they did not experience any symptoms related to COVID-19, while 18.9% of participants experienced some possible COVID-19 related symptoms. 44.9% of participants isolated themselves that they did not expose themselves to anyone other than housemates. 83.7% of the students were accompanied by their families during the lockdown, the rest were either alone (3.7%) or with their friends (12.6%) (Supplementary Table S2).

3.2. Change in psychiatric symptomatology during the pandemic

Students reported significantly decreased stress (stress thermometer), depression (PHQ-9) and anxiety (GAD-7), in addition to social media use disorder (SMDS) scores when compared to pre-pandemic period ($p < 0.001$). Physical activity levels (IPAQ), eating related symptoms (SCOFF) and general functionality (WHODAS) did not differ between pre-pandemic and follow-up assessments ($p > 0.01$). Table 1 shows the pre-pandemic and follow-up (pandemic) assessment results. GAD-7, PHQ-9 and ASRS scores did not differ between those who received psychotherapy or psychiatric treatment and those who did not ($p > 0.05$).

Table 1
Comparison of pre-pandemic and follow-up psychiatric assessments

Scale	Pre-Pandemic Assessment	Follow-up Assessment	p value
PHQ-9 (n = 149)	13.47 ± 5.40	11.17 ± 5.36	< 0.0001
GAD-7 (n = 149)	10.95 ± 5.39	8.31 ± 4.97	< 0.0001
Stress Thermometer (n = 154)	64.29 ± 22.47	52.19 ± 25.24	< 0.001
SMDS (n = 138)	23.21 ± 8.09	18.12 ± 5.72	< 0.0001
ASRS (n = 146)	34.16 ± 11.22	31.68 ± 11.75	0.003
WHODAS (n = 145)	15.76 ± 7.92	14.06 ± 8.65	0.018
SCOFF (n = 150)	1.04 ± 1.16	1.24 ± 1.26	0.02
IPAQ (n = 168)	1769.67 ± 1757.8	1679.73 ± 1521.20	0.59
Note: p value lower than 0.006 has been considered significant due to multiple comparison			

3.3. Determinants of improvement in psychiatric symptomatology

To determine which factors affected the decrease in psychiatric symptomatology, we specified two intercept-only models to define the predictor variables for each outcome variable (PHQ-9, GAD-7 and ASRS), in a mixed effect model where the outcome variable was regressed on a random effect variable for participants, and all other variables were defined as fixed factors, using JAMOVI package. In the first model, the health behaviors that significantly changed during pandemic were included: living with parents (as a factor), screen time and the number of days of alcohol use in the last month (as covariates). In the second model, stress thermometer and SMDS were used added to the model as covariates. The results of the linear mixed effects model analysis are presented in Table 2. Both higher stress thermometer scores and SMDS scores predicted higher PHQ-9, higher GAD-7 and higher ASRS scores in the mixed effect regression model, where pre-pandemic and follow-up scores were used (Table 2). Living with parents and alcohol use were significant predictors of both PHQ-9 and GAD-7, however their effects were found insignificant in the second model where stress thermometer and SMDS scores were included as covariates.

Table 2
Mixed effect regression of changed variables on PHQ-9, GAD-7 and ASRS scores

	PHQ-9			GAD-7						ASRS					
	Block 1			Block 2			Block 1			Block 2			Block 1		
	B	95% CI	p	B	95% CI	p	B	95% CI	p	B	95% CI	p	B	95% CI	p
Intercept	11.86	11 to 12.7	< 0.001	12.25	11.53 to 12.97	< 0.001	9.3	8.45 to 10.14	< 0.001	9.67	9 to 10.34	< 0.001	33.1	31.2 to 35	< 0.0
Living with parents	-1	-1.73 to -0.22	0.01	-0.26	-0.92 to 0.38	0.42	-0.71	-1.5 to 0.06	0.072	-0.03	-0.67 to 0.61	0.92	-0.13	-1.5 to 1.3	0.8
Screen Time	-0.15	-0.97 to 0.67	0.71	-0.21	-0.9 to 0.47	0.54	-0.47	-1.3 to 0.35	0.27	-0.6	-1.27 to 0.08	0.09	0.51	-1.04 to 2.05	0.5
Alcohol use	0.52	0.10 to 0.94	0.015	0.25	-0.1 to 0.60	0.16	0.44	0.02 to 0.85	0.04	0.14	-0.2 to 0.48	0.42	0.93	0.12 to 1.74	0.0
Stress thermometer				0.1	0.078 to 0.12	< 0.001				0.11	0.09 to 0.13	< 0.001			
SMDS				0.15	0.08 to 0.23	< 0.001				0.11	0.04 to 0.19	0.003			
Random parts															
AIC	1623.62			1533.3			1621			1524			1948		
R2 marginal	0.053			0.33			0.04			0.36			0.0175		
R2 conditional	0.45			0.58			0.36			0.52			0.67		
Number of observations	266			266			266			266			263		
Groups	133			133			133			133			133		
ICC	0.42			0.37			0.33			0.25			0.62		

3.4. Relationship of fear of COVID-19 with current psychiatric status

Fear of COVID-19 scores significantly correlated with Stress Thermometer, anxiety (GAD-7), depression (PHQ-9), ASRS and psychosocial functioning (WHODAS) scores (Table 3). A multivariate linear regression analysis was carried out to investigate the predictors of current Stress Thermometer scores by putting Fear of COVID-19, PHQ-9 and GAD-7 scores in the model. This analysis revealed that the model explained 40.6% of the variance and that the model was a significant predictor of Stress Thermometer scores [(F (3,150) = 33.56, p < 0.001]. While PHQ-9 (B = 1.03, p = 0.009) and GAD-7 (B = 2.25, p < 0.001) significantly predicted Stress Thermometer scores, Fear of COVID-19 scores (B = 0.39, p = 0.215) did not. Correlations of all follow-up psychiatric assessments are presented in Table 3.

Table 3
Correlations of follow-up (pandemic) psychiatric assessments

	FEAR OF COVID-19	PHQ-9	GAD-7	Stress Thermometer	SMDS	ASRS	WHODAS
FEAR OF COVID-19	1	0.215**	0.299**	0.277**	0.238**	0.213**	0.355**
PHQ-9	0.215**	1	0.651**	0.525**	0.337**	0.570**	0.525**
GAD-7	0.299**	0.651**	1	0.610**	0.202*	0.434**	0.366**
Stress Thermometer	0.277**	0.525**	0.610**	1	0.202*	0.285**	0.359**
SMDS	0.238**	0.337**	0.202*	0.202*	1	0.377**	0.386**
ASRS	0.213**	0.570**	0.434**	0.285**	0.377**	1	0.440**
WHODAS	0.355**	0.525**	0.366**	0.359**	0.386**	0.440**	1
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

3.5. Mediation of PHQ-9, GAD-7 and ASRS scores by stress thermometer, fear of COVID-19 and SMDS scores

We have predicted that the Stress Thermometer scores had a mediator effect on GAD-7 and PHQ-9 scores. SMDS and Fear of COVID-19 seemed to have both direct and indirect effects on GAD-7 and PHQ-9 scores via Stress Thermometer scores. When SMDS (X), PHQ-9 (Y) and Stress Thermometer (M) scores were put in the model, both indirect effect through increasing Stress Thermometer scores (B:0.098, CI: 0.038 – 0.029) and direct effect of SMDS scores (B:0.21, CI: 0.086–0.33, $p = 0.011$) in PHQ-9 level was significant. Higher SMDS scores lead to higher PHQ-9 scores. When Fear of COVID-19 (X), PHQ-9 (Y) and Stress Thermometer (M) were put in the model, the indirect effect through increasing stress thermometer scores (B:0.133, CI: 0.045–0.23) was significant, whereas direct effect of effect fear of COVID-19 on PHQ-9 levels (B:0.083, CI: -0.06-0.23, $p = 0.25$) was insignificant.

When SMDS (X), GAD-7 (Y) and stress thermometer (M) scores were put in the model, the indirect effect through increasing stress thermometer scores (B:0.112, CI: 0.034-0.20) was significant, whereas direct effect of SMDS on GAD-7 levels (B:0.057, CI: -0.053-0.16, $p = 0.30$) was insignificant. When fear of COVID-19 (X), GAD-7 (Y) and stress thermometer (M) were put in the model, both indirect effect through increasing stress thermometer scores (B:0.14, CI: 0.044–0.23) and direct effect of fear of COVID-19 scores (B:0.21, CI: 0.016–0.26, $p = 0.026$) in GAD-7 level was significant.

When SMDS (X), ASRS (Y) and stress thermometer (M) scores were put in the model, both indirect effect through increasing stress thermometer scores (B:0.094, CI: 0.01–0.22) and direct effect of SMDS scores (B:0.67, CI: 0.36–0.98, $p < 0.0001$) in PHQ-9 level was significant. When Fear of COVID-19 (X), ASRS (Y) and stress thermometer (M) scores were put in the model, the indirect effect through increasing stress thermometer scores (B:0.14, CI: 0.027–0.31) was significant, whereas direct effect of effect fear of COVID-19 on ASRS levels (B:0.33, CI: -0.03-0.68, $p = 0.07$) was insignificant. For all of the reported statistics, B scores represent the direction and magnitude of the effect.

4. Discussion

This study investigated the change in depressive, anxiety and attention deficit symptoms of college students who had previously applied to a university mental health center before the onset of COVID-19 in Turkey. Compared to the pre-pandemic period, students were found to have decreased symptoms of depression, anxiety, and attention deficit. Since high levels of stress, anxiety and depression in college population is a frequent finding in the literature, a modest decrease in symptomatology after the onset of COVID-19 pandemic is a valuable finding. Decrease in stress levels and symptoms of social media use disorder were the predictors of this change, which is also another novel finding of our study. Although the screen time increased during pandemic, the level of social media use disorder decreased. The levels of depression and attention deficit are affected by social media use disorder both directly and indirectly through stress level. The level of anxiety is affected by fear of COVID-19 both directly and indirectly through stress level. So, stress thermometer was mediating the relationship between i) social media use disorder and depression scores, ii) social media use disorder and attention deficit scores, iii) fear of COVID-19 and anxiety scores.

At the time of the recruitment for the study, the campus had been closed for about three months and the Turkish government had further implemented a number of social distancing measures. Despite many regulations restricting social life, the decrease in psychiatric symptomatology was an unexpected finding. Majority of studies reported increased mental health problems and a large scale nation-wide survey from China reported that massive media exposure and prior mental health problems are associated with increased risk of college mental health problems in the early phase of the pandemic¹⁵. Only few studies such as a study from USA conducted with Hispanic adolescents have reported decreased mental health problems, similar to our results¹⁹. Despite all its drastic effects, some individual stressors related to academic life such as rigid study time tables or social stressors such Fear of Missing Out (FoMO) and competitive environment may be reduced at the time of crisis³⁴ and these factors might be related to decreased stress levels in the early phase of pandemic.

It is expected that the closure of the campus will result in disconnection from friends and romantic partners, thus creating risks of loneliness and isolation. However, in our sample, the majority of the students were living with their families or friends during lockdown which possibly minimized the negative effects of isolation. Even though the frequency of alcohol use and living with parents predicted the psychiatric symptoms in the first regression model, their effects became insignificant when SMDS and stress thermometer were added in the model. The reunion of the students, who stayed in the dormitories during the pre-pandemic period, with their families may have been beneficial in terms of social support and meeting basic needs. On the other hand, the fact that young adults may be asymptomatic carriers, might have increased the students' anxiety about transmission of COVID-19 to their elderly family members³⁵. Eventually, going back to the family house may increase social support and decrease household responsibilities but this protective effect might have been mixed with the stress of infecting the family members and possible adverse effects of the negative environment in some families. Of course, not every family is supportive, some families may have restrictive attitudes. There may also be concerns about covering online classes due to the lack of proper internet access and distraction due to a crowded family environment. A cross-sectional study from USA reported that over 40% of the students were worried about their families who were more vulnerable and nearly half of them mentioned that their home is a distractive environment³⁶. Therefore, increased stress due to the pandemic can only to some extent be compensated by returning to the family home. The insignificant effect of living with family on mental health in this study might be a result of its mixed negative and positive effects.

According to mixed effect regression analysis, decrease in stress and social media use disorder compared to pre-pandemic period, were found significant predictors of decrease in anxiety, depression and attention deficit symptoms. A mediator analysis revealed that stress thermometer had a mediator effect on the relationship between SMDS and PHQ-9 as well as between SMDS and ASRS but not on SMDS and GAD-7. Thus, decrease in problematic social media use yielded a decrease in depressive and attention deficit symptoms by both directly and indirectly by decreasing the stress levels. This finding is in line with previous studies which reported that, internet and smart phone addiction increased the depression levels during pandemic^{37,38}. Although there are several studies showing a mediator effect of addictive social media use on anxiety^{14,39}, social media disorder did not mediate the relationship between the decrease in stress levels and anxiety scores in this study. It can be predicted that the use of social media will increase in a period when physical interaction is restricted. In our sample, the decrease in the SMDS score despite the increase in screen time can be explained by a possible change in perception of social media use.

Social media use behavior may have been somewhat normalized during the pandemic, and the possibility of perceiving intense use as pathological may have decreased. Moreover, increased screen time may be due to the time spent for online education, instead of the time spent on social media.

Compared to traditional media, social media has played a multitude of positive roles in information exchange during the COVID-19 crisis, including disseminating health-related recommendations, enabling connectivity and psychological first aid⁴⁰ showing public attitudes, experience, and perception of the disease as well as sentiment to the government⁴¹. So, when more people use social media to seek and share health information, social media usage can provide an informational, emotional and social support⁴². A Chinese study which reported similar rewarding effect of social media use concluded that, social media usage helped manage stressors and health risks and it can be predicted by the informational, emotional, and peer support they received from the shared health information⁴³. A recent study showed the dual impact of social media on mental health: using social media for reduced loneliness and entertainment was associated with poorer mental health, and using social media for personal contact and relationship maintenance was associated with better mental health⁴⁴.

According to the mediator analysis, not the SMDS but the fear of COVID-19 mediated the relationship between stress thermometer and GAD-7 scores. Thus, low levels of COVID-19 fear yielded a decrease in anxiety both directly and indirectly by reducing the stress levels. This finding can be easily explained by a high correlation between fear of COVID-19 and general anxiety levels, which is supported by our correlation analysis. Studies that measured the levels of COVID-19 fear often report that it is a determinant of participants' anxiety levels^{45,46}.

Except for problematic social media use, we could not show any effect of other measured vulnerability factors on stress level. There are variables that were not assessed in this study and are still thought to be possible determinants of the reduction in stress levels. These may include elimination of peer pressure and attendance obligation as well as moving away from academic competition. Despite high levels of uncertainty at the beginning of the pandemic period, worries of a fatal infection and restricted social life; factors such as the elimination of physical participation in classes, update of grading system at Koc University in the form of pass fail under pandemic conditions, elimination of the negative consequences of peer interaction may have made students perceive less stress compared to the active school period. Actions taken by professors, such as reducing course loads, open book exams and other allowances on grading requirements, could also have contributed to alleviating or reducing stress. For students receiving counselling services on campus no access to those services could lead to exacerbation of psychiatric symptoms. So, prompt telecommunication with students and warranting the continuation of mental health services as tele-mental health services can prevent increase of anxiety.

This study has several limitations. First, observational research design does not allow us to make causal claims. Students tend to apply when their symptoms are most intense so the decrease in psychopathology may not be only related to the changing conditions during pandemic but also certain interventions before pandemic. In fact, some symptoms might decrease over time. Although symptoms are likely to subside in some way prior to the pandemic, it has been hypothesized that a significant mental health-threatening stressor, such as a global pandemic, may be a triggering factor in a population with a prior history of psychiatric problems. Since the response rate was 50% and varied by gender and psychopathology severity, the attrition bias can not be excluded. We ran additional analysis to compare the baseline characteristics of respondents and non-respondents and did not find significant differences in terms of pre-pandemic psychiatric symptom scales between them. Second, the scales, used to measure dependent variables, are not diagnostic and are used for screening purposes. Third, relative small sample sizes, sex imbalance and the timing of study (study was conducted 3 months after the lockdown) limits the generalizability of our results. Because the pandemic is still unfolding, social isolation and economic impacts may have worsened over the past 1 year period of time. Moreover, the time period between the first and the last evaluation was not constant among participants. All the analyses were done based on mean score that subgroup analysis could not be performed due to the small sample size. Last, not all stress factors such as social support and online education conditions could be measured.

This study has several strengths such as longitudinal design, development of regression models to measure the effect of risk factors. Besides, there were no difference among responders and non-responders in terms of psychiatric measurements and the study was carried out in a well-planned timeframe according to academic calendar, out of exam period but before the final grades are submitted that academic concerns were still on going. There could be a relieving effect of termination of final exams, however, since the grades have not been announced yet, we can not say the academic stress is over during recruitment.

Consequently, despite fear, uncertainty and restrictions in the early stages of the pandemic, it may be possible to reduce stress and protect mental health with some interventions. These include providing mental health services as online promptly and making adaptive arrangements for online education and grading system such as switching to the pass/fail system and encouraging the use of social media for communication and cooperation.

Declarations

Conflicts interests

The author(s) declare no competing interests.

Availability of Data and Material

Data is available upon request.

Author Contributions

Conceptualization: HYE, AED, VS, Data curation; DK, HYE, Formal analysis; AED, HYE, OE, ZK, DK, Methodology; HYE, AED, VS, Project administration; HYE, AED, DK, Software; HYE, Supervision; VS, Visualization; ZK, OE, AED, HYE. Roles/Writing - original draft; AED, NKC, HYE, Writing - review & editing: All authors

References

1. Ahorsu, D. K., Lin, C. Y. & Pakpour, A. H. The Association Between Health Status and Insomnia, Mental Health, and Preventive Behaviors: The Mediating Role of Fear of COVID-19. *Gerontol Geriatr Med* **6**, 2333721420966081, doi:10.1177/2333721420966081 (2020).
2. Sakib, N. *et al.* Depression and suicidality among Bangladeshi students: Subject selection reasons and learning environment as potential risk factors. *Perspect Psychiatr Care*, doi:10.1111/ppc.12670 (2020).
3. Xiong, J. *et al.* Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *J Affect Disord* **277**, 55–64, doi:10.1016/j.jad.2020.08.001 (2020).
4. Meo, S. A. *et al.* Novel coronavirus 2019-nCoV: prevalence, biological and clinical characteristics comparison with SARS-CoV and MERS-CoV. *Eur Rev Med Pharmacol Sci* **24**, 2012–2019, doi:10.26355/eurev_202002_20379 (2020).
5. Auerbach, R. P. *et al.* Mental disorders among college students in the World Health Organization World Mental Health Surveys. *Psychol Med* **46**, 2955–2970, doi:10.1017/S0033291716001665 (2016).
6. Khattar, A., Jain, P. R. & Quadri, S. M. K. Effects of the Disastrous Pandemic COVID 19 on Learning Styles, Activities and Mental Health of Young Indian Students - A Machine Learning Approach. *Proceedings of the International Conference on Intelligent Computing and Control Systems (Iciccs 2020)*, 1190–1195 (2020).
7. Zhai, Y. & Du, X. Mental health care for international Chinese students affected by the COVID-19 outbreak. *Lancet Psychiatry* **7**, e22, doi:10.1016/S2215-0366(20)30089-4 (2020).
8. Elmer, T., Mepham, K. & Stadtfeld, C. Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. *PLoS One* **15**, e0236337, doi:10.1371/journal.pone.0236337 (2020).
9. Ingram, J., Maciejewski, G. & Hand, C. J. Changes in Diet, Sleep, and Physical Activity Are Associated With Differences in Negative Mood During COVID-19 Lockdown. *Front Psychol* **11**, 588604, doi:10.3389/fpsyg.2020.588604 (2020).
10. Garfin, D. R., Silver, R. C. & Holman, E. A. The novel coronavirus (COVID-2019) outbreak: Amplification of public health consequences by media exposure. *Health Psychol* **39**, 355–357, doi:10.1037/hea0000875 (2020).
11. Andreassen, C. S., Torsheim, T., Brunborg, G. S. & Pallesen, S. Development of a Facebook Addiction Scale. *Psychol Rep* **110**, 501–517, doi:10.2466/02.09.18.PR0.110.2.501-517 (2012).
12. Elhai, J. D., Dvorak, R. D., Levine, J. C. & Hall, B. J. Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. *J Affect Disord* **207**, 251–259, doi:10.1016/j.jad.2016.08.030 (2017).
13. Hu, X., Tang, C. & Wang, D. Social Media Support and Funding Assistance for Psychological Injuries in Social Work. *Front Public Health* **10**, 796769, doi:10.3389/fpubh.2022.796769 (2022).
14. Jiang, Y. Problematic Social Media Usage and Anxiety Among University Students During the COVID-19 Pandemic: The Mediating Role of Psychological Capital and the Moderating Role of Academic Burnout. *Front Psychol* **12**, 612007, doi:10.3389/fpsyg.2021.612007 (2021).
15. Ma, Z. *et al.* Mental health problems and correlates among 746 217 college students during the coronavirus disease 2019 outbreak in China. *Epidemiol Psychiatr Sci* **29**, e181, doi:10.1017/S2045796020000931 (2020).
16. Wang, X. *et al.* Investigating Mental Health of US College Students During the COVID-19 Pandemic: Cross-Sectional Survey Study. *J Med Internet Res* **22**, e22817, doi:10.2196/22817 (2020).
17. Cellini, N., Canale, N., Mioni, G. & Costa, S. Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in Italy. *J Sleep Res* **29**, e13074, doi:10.1111/jsr.13074 (2020).
18. Meda, N. *et al.* Students' mental health problems before, during, and after COVID-19 lockdown in Italy. *J Psychiatr Res* **134**, 69–77, doi:10.1016/j.jpsychires.2020.12.045 (2021).
19. Penner, F., Ortiz, J. H. & Sharp, C. Change in Youth Mental Health During the COVID-19 Pandemic in a Majority Hispanic/Latinx US Sample. *J Am Acad Child Adolesc Psychiatry*, doi:10.1016/j.jaac.2020.12.027 (2020).
20. Kroenke, K., Spitzer, R. L. & Williams, J. B. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* **16**, 606–613, doi:10.1046/j.1525-1497.2001.016009606.x (2001).
21. Spitzer, R. L., Kroenke, K., Williams, J. B. & Lowe, B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med* **166**, 1092–1097, doi:10.1001/archinte.166.10.1092 (2006).
22. Kessler, R. C. *et al.* The World Health Organization adult ADHD self-report scale (ASRS): a short screening scale for use in the general population. *Psychological Medicine* **35**, 245–256, doi:10.1017/S0033291704002892 (2005).
23. Roth, A. J. *et al.* Rapid screening for psychologic distress in men with prostate carcinoma: a pilot study. *Cancer* **82**, 1904–1908, doi:10.1002/(sici)1097-0142(19980515)82:10<1904::aid-cnrc13>3.0.co;2-x (1998).
24. Van den Eijnden, R., Lemmens, J. & Valkenburg, P. The Social Media Disorder Scale: Validity and Psychometric Properties. *J Behav Addict* **5**, 13–13 (2016).
25. Morgan, J. F., Reid, F. & Lacey, J. H. The SCOFF questionnaire: assessment of a new screening tool for eating disorders. *Brit Med J* **319**, 1467–1468, doi:DOI 10.1136/bmj.319.7223.1467 (1999).
26. Craig, C. L. *et al.* International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sport Exer* **35**, 1381–1395, doi:10.1249/01.Mss.0000078924.61453.Fb (2003).
27. Sari, Y. E. *et al.* Turkish reliability of the patient health questionnaire-9. *Biomed Res-India* **27**, S460-S462 (2016).

28. Konkan, R., Senormanci, O., Guclu, O., Aydin, E. & Sungur, M. Z. Validity and Reliability Study for the Turkish Adaptation of the Generalized Anxiety Disorder-7 (GAD-7) Scale. *Noropsikiyatri Ars* **50**, 53–58, doi:10.4274/npa.y6308 (2013).
29. Dogan, S., Oncu, B., Varol-Saracoglu, G. & Kucukgoncu, S. Validity and reliability of the Turkish version of the Adult ADHD Self-Report Scale (ASRS-v1.1). *Anadolu Psikiyatr De* **10**, 77–87 (2009).
30. Aslan Kunt, D. & Dereboy, F. [Validity and Reliability of the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) in Turkish Psychiatry Patients and Healthy Controls]. *Turk Psikiyatri Derg* **29**, 248–257 (2018).
31. Ozalp, E., Cankurtaran, E. S., Soygur, H., Geyik, P. O. & Jacobsen, P. B. Screening for psychological distress in Turkish cancer patients. *Psychooncology* **16**, 304–311, doi:10.1002/pon.1059 (2007).
32. Saricam, H. & Adam Karduz, F. F. The Adaptation of the Social Media Disorder Scale to Turkish Culture: Validity and Reliability Study. *J Meas Eval Educ Psy* **9**, 116–135, doi:10.21031/epod.335607 (2018).
33. Aydemir, O., Koksall, B., Yalin Sapmaz, S. & Yuceyar, H. Reliability and validity of Turkish form of SCOFF Eating Disorders Scale. *Anadolu Psikiyatr De* **16**, 31–35, doi:10.5455/apd.174219 (2015).
34. Przybylski, A. K., Murayama, K., DeHaan, C. R. & Gladwell, V. Motivational, emotional, and behavioral correlates of fear of missing out. *Comput Hum Behav* **29**, 1841–1848, doi:10.1016/j.chb.2013.02.014 (2013).
35. Pan, H. M. A Glimpse of University Students' Family Life Amidst the COVID-19 Virus. *J Loss Trauma* **25**, 594–597, doi:10.1080/15325024.2020.1750194 (2020).
36. Son, C., Hegde, S., Smith, A., Wang, X. & Sasangohar, F. Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study. *J Med Internet Res* **22**, e21279, doi:10.2196/21279 (2020).
37. Dong, H., Yang, F., Lu, X. & Hao, W. Internet Addiction and Related Psychological Factors Among Children and Adolescents in China During the Coronavirus Disease 2019 (COVID-19) Epidemic. *Front Psychiatry* **11**, 00751, doi:10.3389/fpsy.2020.00751 (2020).
38. Duan, L. *et al.* An investigation of mental health status of children and adolescents in china during the outbreak of COVID-19. *J Affect Disord* **275**, 112–118, doi:10.1016/j.jad.2020.06.029 (2020).
39. Zhao, N. & Zhou, G. COVID-19 Stress and Addictive Social Media Use (SMU): Mediating Role of Active Use and Social Media Flow. *Front Psychiatry* **12**, 635546, doi:10.3389/fpsy.2021.635546 (2021).
40. Merchant, R. M. & Lurie, N. Social Media and Emergency Preparedness in Response to Novel Coronavirus. *JAMA* **323**, 2011–2012, doi:10.1001/jama.2020.4469 (2020).
41. Zhu, Y., Fu, K. W., Grepin, K. A., Liang, H. & Fung, I. C. Limited Early Warnings and Public Attention to Coronavirus Disease 2019 in China, January-February, 2020: A Longitudinal Cohort of Randomly Sampled Weibo Users. *Disaster Med Public Health Prep* **14**, e24-e27, doi:10.1017/dmp.2020.68 (2020).
42. Yibai, L. & Xuequn, W. Seeking Health Information on Social Media: A Perspective of Trust, Self-Determination, and Social Support. *Journal of Organizational & End User Computing* **30**, 1–22 (2018).
43. Zhong, B., Huang, Y. & Liu, Q. Mental health toll from the coronavirus: Social media usage reveals Wuhan residents' depression and secondary trauma in the COVID-19 outbreak. *Comput Human Behav* **114**, 106524, doi:10.1016/j.chb.2020.106524 (2021).
44. Thygesen, H. *et al.* Social Media Use and Its Associations With Mental Health 9 Months After the COVID-19 Outbreak: A Cross-National Study. *Front Public Health* **9**, 752004, doi:10.3389/fpubh.2021.752004 (2021).
45. Perz, C. A., Lang, B. A. & Harrington, R. Validation of the Fear of COVID-19 Scale in a US College Sample. *Int J Ment Health Addict*, 1–11, doi:10.1007/s11469-020-00356-3 (2020).
46. Skoda, E. M. *et al.* Psychological burden of healthcare professionals in Germany during the acute phase of the COVID-19 pandemic: differences and similarities in the international context. *J Public Health (Oxf)* **42**, 688–695, doi:10.1093/pubmed/fdaa124 (2020).

Supplementary Tables

Supplementary Tables S1-S2 are not available with this version.

Figures

Image not available with this version

Figure 1

Timeline of study methodology in relation to COVID-19 pandemic related regulations