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Original article

Risk Factors of Psychological Disorders After the COVID-19 Outbreak: The Mediating Role of Social Support and Emotional Intelligence

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Article history: Received March 20, 2021; Accepted July 12, 2021

Keywords: COVID-19; Psychological disorders; Emotional intelligence; Social support



 See Related Editorial on p.683

A B S T R A C T

Purpose: The present study examined the risk factors of psychological disorders after COVID-19 outbreak and tested the possible mediating role of social support and emotional intelligence on the relationship between COVID-19 pandemic exposure and psychological disorders.

Methods: We conducted an online survey from May 25, 2020 until June 10, 2020 among Chinese university students who had been quarantined at home due to the COVID-19 pandemic. Social support was assessed using the Social Support Rating Scale. Self-perceived emotional competency was measured using a Chinese version of the self-report Wong Law Emotional Intelligence Scale. The 10-item Kessler Psychological Distress Scale was used to assess nonspecific symptoms of psychological disorders.

Results: A total of 6,027 college students participated in the survey, of whom 2,732 (45.3%) reported mental health issues. Men and people in a relationship showed higher frequencies of psychological disorders. Social support and emotional intelligence were both negatively associated with psychological disorders. Stepwise linear regression revealed that the most important predictors of psychological disorders were self-emotion appraisal, family relationships, and showing panic about COVID-19 on the social media. Path analysis suggested that the association between pandemic exposure and psychological disorders was partially mediated by emotional intelligence, but not by social support.

Conclusions: Emotional intelligence may mediate the relationship between COVID-19 pandemic exposure and psychological disorders. Psychological interventions fostering emotional intelligence and social support should be implemented among university students to reduce the psychological harm caused by the COVID-19 pandemic

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IMPLICATIONS AND CONTRIBUTION

College students have reported particularly high levels of mental health issues during the COVID-19 pandemic, particularly young men and people in relationships. Emotional intelligence appears to mediate the relationship between pandemic exposure and psychological disorders.

Conflicts of interest: The authors have no conflicts of interest to declare.

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In late December 2019, an outbreak of COVID-19 was reported in China and was later found to be caused by severe acute respiratory syndrome coronavirus 2. Because of its high infectivity, this virus spreads rapidly around the world and infected an enormous number of people. The Chinese government locked

Table 1
Sociodemographic and mental health characteristics of the study participants (n = 6,027)

	n	%	Mean	SD
Gender				
Man	2,509	41.6		
Woman	3,518	58.4		
University year				
1st	2,029	33.7		
2nd	1,369	22.7		
3rd	1,731	28.7		
4th	898	14.9		
Romantic relationship				
Single	4,569	75.8		
In a local relationship	710	11.8		
In a long-distance relationship	738	12.2		
Married	5	0.1		
Divorced/separated	5	0.1		
Relationship with family				
Very good	2,443	40.5		
Good	2,423	40.2		
Not bad	1,026	17.0		
Bad	109	1.8		
Very bad	26	0.4		
Monthly household income (RMB) ^a				
20,000	139	2.3		
15,000–19,999	103	1.7		
10,000–14,999	521	8.6		
5,000–9,999	2,079	34.5		
0–4,999	3,185	52.8		
Showing panic about COVID-19 on social media				
No	5,487	91.0		
Yes	540	9.0		
Opinion about media reports about the pandemic				
Not interested	141	2.3		
General	287	4.8		
Detailed	893	14.8		
Very detailed	2,120	35.2		
Should be more detailed	2,586	42.9		
Worried about getting infected myself				
Not worried	1,836	30.5		
Slightly worried	2,388	39.6		
Moderately worried	1,343	22.3		
Very worried	460	7.6		
Worried about family getting infected				
Not worried	1,289	21.4		
Slightly worried	1,498	24.9		
Moderately worry	2,076	34.4		
Very worried	1,164	19.3		
Cohabitants nervous about COVID-19				
Never	2,477	41.1		
A few days	3,221	53.4		
More than half the time	274	4.5		
Almost every day	55	0.9		
Objective support score			9.8	2.6
1–6	607	10.1		
7–13	4,908	81.4		
14–20	512	8.5		
Subjective support score			22.7	4.5
1–15	336	5.6		
16–25	3,967	65.8		
25–32	1,724	28.6		
Use of support score			7.6	1.7
1–4	152	2.5		
5–8	4,156	69.0		
9–12	1,719	28.5		
SSRS score			40.1	7.1
1–29	381	6.3		
30–49	5,072	84.1		
50–64	574	9.5		
Self-emotion appraisal score			21.4	3.8
1–14	219	3.6		
15–21	2,687	44.6		

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Table 1
Continued

	n	%	Mean	SD
22–28	3,121	51.8		
Regulation of emotion score			19.2	4.4
1–14	797	13.2		
15–21	3,430	56.9		
22–28	1,800	29.9		
Use of emotion score			19.7	4.2
1–14	588	9.8		
15–21	3,396	56.3		
22–28	2,043	33.9		
Others-emotion appraisal score			20.6	4.1
1–14	352	5.8		
15–21	3,185	52.8		
22–28	2,490	41.3		
WLEIS score			80.9	13.5
1–56	193	3.2		
57–84	3,530	58.6		
84–112	2,304	38.2		
K10 score			21.4	8.2
10–15 (Good)	1,777	29.5		
16–21 (Normal)	1,518	25.2		
22–29 (Poor)	1,361	22.6		
30–50 (Terrible)	1,371	22.7		

K10 = 10-item Kessler Psychological Distress Scale; RMB = renminbi; SD = standard deviation; SSRS = Social Support Rating Scale; WLEIS = Wong Law Emotional Intelligence Scale.

^a 1 RMB = approximately .155 USD.

down the city center of Wuhan, the epicenter of the pandemic. Daily supplies and medical resources were supported by other provinces. People were asked to refrain from going outdoors as much as possible. The schools delayed the beginning of term and students studied online.

In the initial stage of the COVID-19 epidemic, a study found that about one third of respondents reported moderate-to-severe anxiety among the general population in China, and student status was associated with a greater psychological impact of the outbreak [1]. Subsequently, abundant studies conducted in China reported that the pandemic situation was associated with increased depression and fear in the general Chinese population [2–5]. In particular, about two fifths of Chinese university students have experienced anxiety symptoms [6]. In addition, some important problems need to be considered after the pandemic, such as gender inequality, intensification of poverty, and family well-being, which can help us to be better prepared for future pandemics [7]. To protect the psychological health of university students, governments should implement appropriate mental interventions to reduce the psychological harm caused by the COVID-19 pandemic.

Social support is positively related to people’s mental health. Depression symptoms are lower in individuals who report higher social support than in those with lower social support [8]. In addition, a study of Chinese adolescents found that levels of social support negatively correlated with the severity of depression and anxiety symptoms [9]. Thus, social support mediates the effect of stress on psychological disorders among university students [10]. These findings highlight the need to research the impact of social support on the mental health of this vulnerable population.

Emotional intelligence may help protect against depression [11]. A higher level of emotional intelligence has been linked to lower stress and, consequently, lower risk of associated depression [12]. A study showed a negative correlation between emotional intelligence and perceived stress as a predictor of

psychological disorders [13]. These studies illustrate the importance of emotional intelligence for protecting the mental health of university students. This information may be helpful for implementing more effective psychological interventions in this group.

Although many existing studies have researched the possible factors influencing adolescents' mental health under COVID-19, several research gaps exist in the literature on this area. First, as many studies only focused on risk factors affecting adolescents' mental health under COVID-19, the research on possible protective factors is limited. Second, few studies simultaneously considered the mediating effect of the following two psychological factors, social support and emotional intelligence, in one path analysis. There is an urgent need to explore the mediating impacts of these two factors on psychological disorders. Third, many existing studies conducted in China used translated Western measures of social support in their studies. Western measures may not capture the related phenomena under Chinese cultures [14]. Using scales mainly designed for Chinese people is more rigorous. Finally, for small samples of some existing studies, the employment of a larger sample would enhance the generalizability of the findings.

Concerning the above research gaps, in the present study, we aimed to identify risk factors of psychological disorders and assess social support and emotional intelligence ability to predict such disorders among university students. Based on previous studies, we also proposed the following hypotheses.

Hypothesis 1. Social support would serve as a mediator between the association of pandemic exposure and psychological disorders.

Hypothesis 2. Emotional intelligence would serve as a mediator between the association of pandemic exposure and psychological disorders.

Methods

Survey participants and procedure

A cross-sectional study was performed from May 25, 2020 until June 10, 2020 when university students from a major Chinese University (Chengdu, China) returned to campus after being quarantined at home from the mid-January 2020 to late May. A convenience sample of 40–70 students from 30 classes in each of the 4 university years, amounting to 8,000 students, was invited to participate in the survey. The selection of participants adheres to the principle of voluntary participation. The Questionnaire Star was used to collect data online using an anonymous questionnaire. The questionnaire was distributed to the WeChat group which comprised all selected students. Of the 8,000 students, 6,079 completed the survey, corresponding to a response rate of 75.9%. The protocol was approved by the Ethical Committee of the Chengdu Normal University.

Measures

Data on sociodemographic characteristics, including gender, university year, romantic relationship, relationship with family, and monthly household income, were collected from each participant. Social support, emotional intelligence, and psychological disorders were measured as outlined in the following subsections.

Social support. Social Support Rating Scale (SSRS) was used to assess social support. SSRS comprises 10 items, which measure 3

subscales of social support: 3 items assess objective support; 4 items assess subjective support; and 3 items assess use of social support. Objective support refers to visible and practical support from society; subjective support refers to the individual emotional experience of being respected, supported, and understood in the community; and use of support refers to the degree to which the respondent makes use of social support [15]. In this study, scores of 1–29 were taken to indicate a low level of social support, 30–49 intermediate level, and 50–66 high level. SSRS was considered reliable and easily understandable by Chinese respondents [16]. In the present study, the measure showed good internal consistency (Cronbach $\alpha = .79$).

Emotional intelligence. Self-perceived emotional competency was measured using a Chinese version of the Wong Law Emotional Intelligence Scale, which shows good psychometric properties [17]. The scale consists of four dimensions: self-emotion appraisal, others' emotion appraisal, regulation of emotions, and use of emotions. This self-report instrument is based on Mayer and Salovey's definition of emotional intelligence and consists of 16 items [18]. Each item is answered on a seven-point Likert scale that ranges from 1 = strongly disagree to 7 = strongly agree. In this study, scores of 0–56 were defined as low emotional intelligence, 57–84 as intermediate, and 85–112 as high. The measure has good internal consistency (Cronbach $\alpha = .94$) in this sample.

Psychological disorders. The 10-item Kessler Psychological Distress Scale (K10) was used to assess nonspecific psychological disorders. This survey contains items measuring symptoms of anxiety and depression during the preceding 4 weeks [19]. Scores range between 10 and 50, and higher scores indicate higher distress. In this study, scores of 10–15 were taken to indicate probably normal mental health, 16–21 indicate mild mental disorder, 22–29 indicate moderate mental disorder, and 30–50 indicate severe mental disorder. We opted for the K10 because of its brevity, ease of use by lay interviewers, and reliability in identifying common mental disorders [20]. The Chinese version has 10 items rated on a 5-point scale from 1 (never felt) to 5 (feel all the time). In this study, Cronbach's alpha coefficient was high (Cronbach $\alpha = .96$), which showed good internal consistency.

Pandemic exposure. Pandemic exposure refers to the exposure to the COVID-19 epidemic situation. It was assessed using a 5-item self-report scale, which evaluates the features of the respondents and their cohabitants of the COVID-19 epidemic situation. Each participant was asked the following: (1) whether they showed panic about COVID-19 on social media (no/yes); (2) their opinions on media reports about the pandemic (not interested/general/detailed/very detailed/should be more detailed); (3) how much are they worried about getting infected themselves (not worried/slightly worried/moderately worried/very worried); (4) how much are they worried about family getting infected (not worried/slightly worried/moderately worried/very worried); and (5) how long are their cohabitants nervous about COVID-19 (never/a few days/more than half the time/almost every day).

Statistical analysis

First, descriptive statistics was determined. Next, one-way analysis of variance or independent-samples *t*-test was used to

Table 2
The one-way ANOVA analysis or *t*-test, means and standard deviations for categorical variables (n = 6,027)

	Psychological disorders	F/t	p-value	Objective support	F/t	p-value	Subjective support	F/t	p-value	Use of support	F/t	p-value	Social support	F/t	p-value	Emotional intelligence	F/t	p-value
Gender		40.20	<.001		.765	.444		6.355	<.001		-8.313	<.001		2.22	.026		3.187	<.001
Man	22.17 (8.72)			9.82 (1.876)			23.16 (4.661)			7.41 (1.876)			40.39 (7.652)			81.59 (14.848)		
Woman	20.81 (7.828)			9.76 (2.382)			22.41 (4.323)			7.8 (1.631)			39.97 (6.603)			80.43 (12.339)		
University year		2.30	.075		.609	.609		2.066	.102		1.585	.191		1.161	.323		.125	.945
1st	21.3 (8.118)			9.74 (2.567)			22.55 (4.412)			7.69 (1.725)			39.99 (6.937)			81.05 (13.485)		
2nd	20.97 (8.401)			9.79 (2.683)			22.9 (4.519)			7.63 (1.809)			40.33 (7.08)			80.78 (14.219)		
3rd	21.73 (8.38)			9.78 (2.635)			22.71 (4.554)			7.57 (1.726)			40.05 (7.145)			80.87 (13.07)		
4th	21.47 (7.957)			9.89 (2.734)			22.87 (4.434)			7.65 (1.742)			40.41 (7.148)			80.88 (12.905)		
Romantic relationship		4.75	<.001		47.681	<.001		91.93	<.001		3.23	.012		80.82	<.001		3.25	.011
Married	23.4 (8.414)			10.6 (5.899)			26.6 (4.45)			6.2 (1.643)			43.4 (6.731)			80.97 (14.035)		
In a local relationship	21.56 (8.534)			10.7 (2.789)			24.8 (4.337)			7.82 (1.817)			42.59 (6.747)			82.09 (13.721)		
In a long-distance relationship	22.39 (8.506)			10.49 (2.68)			24.43 (4.383)			7.67 (1.705)								
Divorced/separated	29 (5.831)			7.8 (3.493)			21 (3.937)			8 (3.082)			36.8 (8.228)			81.8 (8.319)		
Single	21.17 (8.135)			9.53 (2.548)			22.12 (4.35)			7.6 (1.74)			39.26 (6.856)			80.73 (13.297)		
Relationship with family		93.92	<.001		92.453	<.001		256.378	<.001		55.814	<.001		249.413	<.001		46.432	<.001
Very good	19.63 (8.283)			10.33 (2.692)			24.42 (4.186)			7.96 (1.839)			42.71 (6.722)			83.54 (14.078)		
Good	21.4 (7.819)			9.77 (2.444)			22.36 (4.173)			7.55 (1.642)			39.68 (6.493)			79.87 (12.309)		
Not bad	24.63 (7.674)			8.84 (2.512)			20.22 (3.982)			7.23 (1.597)			36.29 (6.24)			77.69 (13.078)		
Bad	26.7 (8.153)			7.79 (2.55)			17.91 (4.25)			6.63 (1.665)			32.33 (6.64)			76.92 (14.902)		
Very bad	31.5 (8.439)			6.12 (2.688)			15.73 (3.329)			5.58 (1.362)			27.42 (5.155)			75.46 (17.333)		
Monthly household income (RMB) ^a		5.09	<.001		4.727	<.001		6.441	<.001		1.38	.238		6.9	<.001		11.187	<.001
20,000	21.06 (8.246)			9.97 (2.646)			23.76 (4.227)			7.64 (1.96)			41.37 (6.679)			84.17 (16.36)		
15,000–19,999	20.27 (7.832)			10.26 (2.977)			23.74 (4.219)			7.83 (1.687)			41.83 (6.843)			84.45 (15.535)		
10,000–14,999	20.71 (8.453)			10.13 (2.699)			23.31 (4.535)			7.78 (1.795)			41.22 (7.269)			83.45 (13.583)		
5,000–9,999	20.94 (7.908)			9.82 (2.533)			22.71 (4.352)			7.62 (1.721)			40.15 (6.834)			81.06 (13.152)		
0–4,999	21.81 (8.403)			9.68 (2.678)			22.56 (4.56)			7.62 (1.749)			39.86 (7.169)			80.15 (13.326)		
Showing panic about COVID-19 on social media		2.71	<.001		3.199	<.001		5.151	<.001		1.973	.049		4.954	<.001		4.902	<.001
No	20.94 (8.124)			9.82 (2.638)			22.82 (4.472)			7.65 (1.752)			40.29 (7.052)			81.18 (13.429)		
Yes	25.81 (8.081)			9.44 (2.625)			21.78 (4.48)			7.49 (1.694)			38.71 (7.005)			78.21 (13.392)		
Opinions about media reports about the pandemic		8.77	<.001		18.794	<.001		18.448	<.001		12.451	<.001		25.412	<.001		13.961	<.001
Not interested	23.64 (9.886)			8.26 (3.206)			20.83 (5.521)			6.92 (2.125)			36.01 (9.138)			79.21 (17.168)		
General	22.82 (8.924)			9.06 (2.983)			21.63 (4.901)			7.17 (1.941)			37.87 (7.865)			76.69 (15.605)		
Detailed	20.76 (7.954)			9.82 (2.514)			22.59 (4.474)			7.6 (1.664)			40.01 (6.941)			80.5 (12.826)		
Very detailed	20.99 (7.79)			9.83 (2.474)			22.51 (4.275)			7.67 (1.677)			40.01 (6.647)			80.33 (12.736)		
Should be more detailed	21.62 (8.468)			9.9 (2.699)			23.17 (4.48)			7.71 (1.772)			40.78 (7.079)			82.09 (13.612)		
Worried about getting infected myself		7.90	<.001		1.89	.129		10.849	<.001		.993	.395		3.341	.018		13.894	<.001
Not worried	20.72 (8.811)			9.69 (2.882)			23.15 (4.71)			7.58 (1.894)			40.42 (7.625)			82.55 (14.662)		
Slightly worried	20.9 (7.737)			9.78 (2.514)			22.44 (4.272)			7.66 (1.645)			39.88 (6.644)			80.46 (12.435)		
Moderately worried	22.08 (7.65)			9.87 (2.454)			22.52 (4.348)			7.63 (1.656)			40.03 (6.726)			79.8 (12.709)		
Very worried	24.37 (9.207)			9.94 (2.761)			23.11 (4.845)			7.7 (1.91)			40.76 (7.7)			79.97 (14.946)		
Worried about family getting infected		30.53	<.001		.998	.393		12.833	<.001		.861	.46		3.443	.016		15.829	<.001
Not worried	20.39 (8.89)			9.69 (2.933)			23.35 (4.787)			7.63 (1.911)			40.67 (7.786)			82.94 (15.099)		
Slightly worried	20.39 (7.915)			9.79 (2.555)			22.6 (4.298)			7.69 (1.653)			40.08 (6.696)			81.17 (12.569)		
Moderately worry	21.52 (7.656)			9.85 (2.482)			22.39 (4.301)			7.63 (1.65)			39.87 (6.665)			79.74 (12.49)		
Very worried	23.45 (8.5)			9.77 (2.669)			22.78 (4.611)			7.58 (1.845)			40.13 (7.337)			80.43 (14)		

(continued on next page)

Table 2
Continued

	Psychological disorders	F/t	p-value	Objective support	F/t	p-value	Subjective support	F/t	p-value	Use of support	F/t	p-value	Social support	F/t	p-value	Emotional intelligence	F/t	p-value
Cohabitants nervous about COVID-19		38.68	<.001		1.873	.132		26.464	<.001		1.753	.154		14.437	<.001		19.755	<.001
Never	19.82 (8.489)			9.83 (2.786)			23.32 (4.583)			7.69 (1.859)			40.85 (7.407)			82.38 (14.25)		
A few days	22.15 (7.767)			9.76 (2.481)			22.33 (4.334)			7.6 (1.648)			39.69 (6.691)			80.11 (12.645)		
More than half the time	25.02 (7.896)			9.8 (2.735)			21.92 (4.453)			7.51 (1.731)			39.24 (7.068)			77.72 (13.13)		
Almost every day	27.55 (10.203)			9.04 (3.934)			22.95 (5.4)			7.53 (2.21)			39.51 (9.341)			78.07 (16.68)		

Boldface indicates $p < .05$.

ANOVA = analysis of variance; F = F-statistics calculated by one-way ANOVA analysis; t = t-statistics calculated by t-test; RMB = renminbi.

^a 1 RMB = approximately .155 USD.

examine the associations between the categorical variables. Stepwise multiple linear regression was conducted to identify predictors of the psychological disorder scores. Statistical analyses were conducted in SPSS 25.0 (IBM, Chicago, IL), and results associated with $p < .05$ were considered statistically significant.

We developed a hypothetical path model using Amos 22.0 (SPSS Inc., Chicago, IL) to assess whether social support and emotional intelligence can mediate the relationship between pandemic exposure and psychological disorders. In this mediation model, pandemic exposure is the independent variable, social support and emotional intelligence are the mediator variables, and psychological disorders is the dependent variable. We assessed the fit of the model to our data using four indices: root means square error of approximation (RMSEA), goodness-of-fit index (GFI), comparative fit index (CFI), and normal of fit index (NFI). The model was deemed acceptable if the fit indices met the following criteria: GFI, CFI, and NFI $> .90$, and RMSEA $< .08$ [21].

The potential mediating effects of social support and emotional intelligence were tested for significance using the Bootstrap estimation procedure in Amos with a bootstrap sample of 5,000. We applied this procedure because the bootstrap method can generate the most accurate confidence intervals for indirect effects [22].

Results

Of the 6,079 completed surveys, 52 were eliminated because of illogical answers, such as all choices being 1 or 0. Therefore, 6,027 surveys were used in the final analysis (Table 1). Respondents comprised 3,518 women (58.4%) and 2,509 men (41.6%), and 75.8% reported being single. In total, 19.3% of students reported not having a good relationship with their families. The mean monthly household income was lower than 5000 RMB (approximately 774.5 USD) for 52.8% of respondents.

When asked about COVID-19, 9.0% of students reported showing panic about COVID-19 on social media, and 92.9% wanted to know more about the COVID-19 pandemic. In total, 29.9% of students were worried about getting infected themselves, and 53.8% were worried about their relatives being infected. Just over half of respondents (58.9%) reported that their cohabitants were nervous about COVID-19 to different degrees.

With respect to social support, the mean score for objective support was 9.8, subjective support was 22.7, and use of support 7.6. The mean total score for social support was 40.1, with 6.32% of respondents obtaining total scores lower than 29.

With respect to emotional intelligence, the mean scores were as follows: self-emotion appraisal 21.4, others' emotion appraisal 19.2, regulation of emotions 19.7, and use of emotions 20.6. The mean total score for emotional intelligence was 80.9, with 3.2% of respondents obtaining total scores lower than 56.

The mean K10 score was 21.4, with 45.3% of students obtaining scores higher than 21, indicating poor psychological health.

Table 2 shows the one-way analysis of variance results, the mean and standard deviations for different groups of every categorical variable. Males, students in a relationship, students who showed panic about COVID-19 on social media, students worried about getting infected oneself, and students worried about family getting infected showed higher prevalence of psychological disorders. Psychological disorders also increased with a bad family relationship and the degree of nervousness among cohabitants. In addition, female students, single students, students

with bad relationships with family and students showing panic about COVID-19 on social media had lower social support levels. Males also get higher scores in objective support and subjective support but lower scores in use of support. Meanwhile, male students, students with low household income and bad relationships with family, students showing panic about COVID-19 on social media, students worried about getting infected oneself, students worried about family getting infected showed lower level of emotional intelligence.

Table 3 presents the results of stepwise linear regression to identify predictors of psychological disorders. The regression model indicated that self-emotion appraisal was the most significant predictor (beta = -.179), followed by family relationship (beta = .121), others' emotion appraisal (beta = .112), showing panic about COVID-19 on the social media (beta = .109), use of support (beta = -.107), nervousness of cohabitants about COVID-19 (beta = .105), gender (beta = -.103), use of emotions (beta = -.102), objective support (beta = -.100), subjective support (beta = -.073), romantic relationship (beta = -.067), worry about family getting infected (beta = .065), regulation of emotions (beta = -.053).

Path analysis suggested that social support and emotional intelligence may mediate the relationship between pandemic exposure and psychological disorders in our sample (Figure 1). The path model showed good fit to the data, with GFI = .948, CFI = .925, NFI = .923, and RMSEA = .071. Partially consistent with this path model, bootstrap estimation in AMOS indicated that emotional intelligence, but not social support, helped mediate the impact of pandemic exposure on psychological status in our sample ($p = .001, p = .170$; Table 4).

Discussion

We conducted a survey among Chinese university students to explore the risk and protective factors of psychological disorders in COVID-19 and the possible mediating role of emotional intelligence and social support. We observed that males showed higher prevalence of psychological disorders than females. And single students had fewer psychological disorders than students who had partners. In addition, showing panic about COVID-19 on social media was the most significant predictor of psychological disorders among COVID-19-related factors. Using path analysis,

we confirmed that emotional intelligence mediated the relationship between COVID-19 exposure and psychological disorders. Nevertheless, social support did not serve as a mediator in this relationship.

Results showed that 45.3% of students are with poor psychological health, which indicates that the status of Chinese mental health is poor (Table 1). This is inconsistent with a study found in China that has the second-best mental health status in seven middle-income countries in Asia [23]. The possible explanation is respondents in this survey are with poor economic conditions, and poverty is a risk factor for higher mental disorders under COVID-19 [7].

Males showed higher psychological disorders

In our survey, males showed higher prevalence of psychological disorders than women (Table 2). This finding is inconsistent with previous research [24]. This discrepancy may reflect the fact that our study took into account the use of support. In our study, males appeared to have higher objective and subjective support than females. However, they reported making less use of this support. The insufficient use of support makes males get less social support. Individuals who report lower levels of social support get more depression symptoms [8]. Another explanation is that females tend to be more perceptive and have greater empathy than males, and they may possess greater emotional knowledge [25]. Therefore, females may deal with bad emotions more quickly, mitigating the harmful effects of stress on their mental health.

The single gets lower psychological disorders

Our results showed that students who were single had less mental distress than those who had partners (Table 2). This conclusion contradicts a previous study that found that a couple experienced lower psychological distress than single subjects during the COVID-19 pandemic [23]. We found that the factor 'worry about family getting infected' was more associated with psychological disorders than the factor 'worry about myself getting infected' (Table 3). A survey conducted in America also showed that university students felt more stressed about the health implications of COVID-19 for their family than for themselves [26]. These conclusions indicated that students cared

Table 3
Stepwise multiple linear regression to identify predictors of psychological disorders (based on K10 score) in survey participants

Variable	Beta	t	p-value	Collinear statistics	
				Tolerance	VIF
Gender	-.103	-8.67	<.001	.909	1.1
Romantic relationship	-.067	-5.715	<.001	.917	1.091
Relationship with family	.121	9.753	<.001	.83	1.205
Showing panic about COVID-19 on social media	.109	9.392	<.001	.95	1.052
Worried about family getting infected	.065	5.473	<.001	.894	1.119
Cohabitants nervous about COVID-19	.105	8.671	<.001	.875	1.143
Subjective support	-.073	-5.026	<.001	.601	1.665
Objective support	-.100	-7.638	<.001	.75	1.334
Use of support	-.107	-8.277	<.001	.766	1.306
Self-emotion appraisal	-.179	-11.548	<.001	.532	1.879
Regulation of emotion	-.053	-3.346	.001	.517	1.935
Use of emotion	-.102	-6.279	<.001	.489	2.047
Others-emotion appraisal	-.112	7.555	<.001	.585	1.71

Boldface indicates $p < .05$.

$R^2 = .232$; adjusted $R^2 = .230$.

Beta = standardized regression coefficient; K10 = 10-item Kessler Psychological Distress Scale; VIF = variance inflation factor.

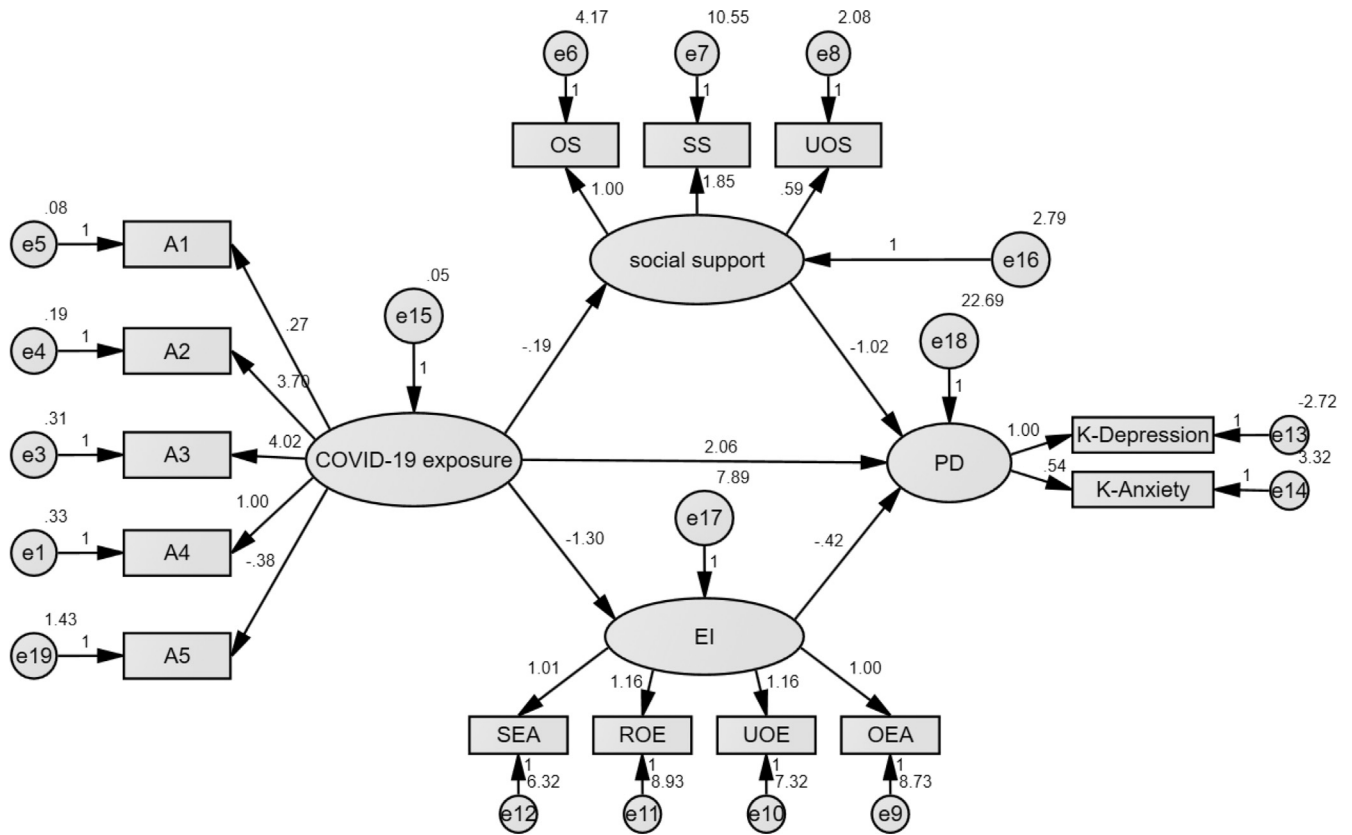


Figure 1. Path analysis showing how social support and emotional intelligence may mediate the relationship between COVID-19 pandemic exposure and psychological disorders. All coefficients in the figure are standardized and significant at the .001 level. A1 = showing panic about COVID-19 on the social media; A2 = worried about getting infected myself; A3 = worried about family getting infected; A4 = cohabitants nervous about COVID-19; A5 = opinions about media reports about the COVID-19 pandemic; EI = emotional intelligence; OEA = others-emotion appraisal; OS = objective support; PD = psychological disorders; ROE = regulation of emotion; SEA = self-emotion appraisal; SS = subjective support; UOE = use of emotion; UOS = use of support.

more about others than themselves. Therefore, one potential explanation is that single students did not have to worry about their partners, which reduced their stress. In addition, the majority of partners in our survey were isolated at home during the

COVID-19. They communicated online frequently. Frequent social media use may increase the psychological disorders caused by COVID-19 [27]. Another explanation may be that several types of emotions are likely to be socially contagious, and negative emotions are particularly transmissible [28,29]. The absence of communication with partners may reduce the anxiety of single students in our sample, which may help explain their lower prevalence of psychological disorders.

Table 4
Bootstrap analysis to detect multiple mediation effects

Model pathway	Estimated	Bias-corrected percentile method		
		Lower	Upper	p value
Pandemic exposure → social support	-.025	-.063	.011	.169
Social support → psychological disorders	-.327	-.359	-.295	.001
Pandemic exposure → emotional intelligence	-.099	-.130	-.065	.001
Emotional intelligence → psychological disorders	-.228	-.258	-.194	.001
Pandemic exposure → psychological disorders	.085	.055	.114	.001
Pandemic exposure → social support → psychological disorders	.008	-.003	.020	.170
Pandemic exposure → emotional intelligence → psychological disorders	.023	.015	.031	.001

Boldface indicates $p < .05$.

Factors to predict psychological disorders

In our sample, emotional intelligence and social support were the protective factors to predict psychological disorders. Self-emotion appraisal has the strongest influence (Table 3). Self-emotion appraisal, which relates to one’s capacity for emotional self-awareness and expression, is crucial for the ability of emotional intelligence to protect against disorders [30]. Previous research also found that emotional intelligence is a strong predictor of psychological disorders [13]. As emotional intelligence is an internal asset to show one’s self-perceived emotional competency, it can be one of the positive youth development attributes [31]. A study highlighted the protective role of positive youth development attributes in protecting adolescents from depression in Chinese adolescents [32].

Social support is believed to influence the individuals' responses to stressful events as an individual external asset under COVID-19 [9]. There is a common proposition that the developmental assets are factors facilitating adolescent development, which means social support can be one of the positive youth development attributes [31]. The protective effect of possessing strong positive youth development qualities on adolescents' mental health in stressful situations verified the social support protective role [32].

Among COVID-19-related factors, showing panic about COVID-19 on social media was the most important risk predictor of psychological disorders (Table 3). This finding is in line with a previous study which observed that students use social media to continue their learning during the COVID-19 pandemic, as well as to obtain more information about the pandemic [33]. A study conducted in Nepal also found the social media use as a mental health risk factor, and explained that social media might become a source of health-related information during crises [34].

Among COVID-19-related factors, the second most important risk predictor of psychological disorders was the feeling that cohabitants were nervous about COVID-19 (Table 3). A previous study showed that individuals may be consciously or unconsciously influenced by emotion and affective behavior experienced by others [35]. Worries about oneself getting infected and family getting infected also contributed to psychological disorders in our sample (Table 3). The emergency and infectivity of the pandemic, the prospect of being quarantined with COVID-19 alone, the many unknowns around how to manage and treat the disease, as well as the strict pandemic control measures—all these factors have likely contributed to people's stress.

Emotional intelligence mediates the relationship between pandemic exposure and psychological disorders

We found that emotional intelligence mediated the impact of pandemic exposure on psychological health in our sample (Table 4). During the pandemic, exposure to information about COVID-19 increases the psychological stress of the population, contributing to symptoms of anxiety and depression [2]. Emotional intelligence has been shown to vary negatively with stress and depressive symptoms [12]. In line with this literature, pandemic exposure predicted psychological disorders through the mediating effect of emotional intelligence in Chinese university students (Table 4). In other words, the students with higher level of pandemic exposure had a propensity to perform worse in emotional intelligence, which hence contributed to an increase in their psychological disorders.

In contrast, the mediating effect of social support was not significant among our students. Similarly, a previous study showed that pandemic exposure was not significantly related to social support [8]. One potential explanation may be that most of the problems in the assessment scale of social support do not change as a result of psychological stress caused by exposure to the pandemic. Our results suggest the need for social support instruments that specifically take into account the conditions during a global crisis or disaster.

Our study presents several limitations. First, the cross-sectional nature prohibits causal inference, thus the major findings of the current study should be corroborated longitudinally. Second, previous levels of participants' psychological disorders are unknown. Therefore, there is a possibility that those psychological symptoms are not completely caused by the

pandemic situation. Further studies should be conducted under the premise of controlling the effect of pre-existing mental disorders. Third, other confounding factors which have been proved to have an impact on mental health should be considered, such as physical symptoms after infected COVID-19 [36], facemask [37], social distancing [38], lockdown [39], and the use of vaccine [40]. Fourth, the assessment of COVID-19 pandemic exposure was somewhat limited. The scale used to measure pandemic exposure in this study was not verified. Other components of pandemic exposure were not assessed in the current study. Future research should consider using a verified or more comprehensive assessment of the exposure.

Levels of social support and emotional intelligence may significantly influence the mental health of university students who have quarantined at home during the COVID-19 pandemic. In terms of the pandemic-related factors, the most important predictor of psychological disorders in this group was showing panic about COVID-19 on social media. Females and single students were at lower risk of psychological disorders. Emotional intelligence, but not social support, served as a mediator in the relationship between pandemic exposure and psychological disorders. To ensure timely and appropriate psychological interventions for university students during the pandemic, mental health professionals should focus on increasing students' emotional intelligence. Schools can carry out cognitive behavior group therapy for emotional intelligence in four dimensions to improve students' ability in the regulation of emotion and utilization of emotion.

Funding Source

This work was supported by the National Natural Science Foundation of China (Grant No. 72001154), the project of Research Center for System Sciences and Enterprise Development, PR China (Grant No. Xq20B04), the postdoctoral project of Sichuan University, PR China (Grant No. skbsh2020-18), and the first-class discipline key project of Chengdu Normal University, PR China (Grant No. CS18SA02).

References

- [1] Wang C, Pan R, Wan X, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health* 2020;17:1729.
- [2] Wang C, Pana R, Wan X, et al. A longitudinal study on the mental health of general population during the COVID-19 epidemic in China [published online ahead of print, 2020 Apr 13]. *Brain Behav Immun* 2020;87:40–8.
- [3] Hao F, Tan W, Jiang L, et al. Do psychiatric patients experience more psychiatric symptoms during COVID-19 pandemic and lockdown? A Case-control study with Service and research implications for Immunopsychiatry. *Brain Behav Immun* 2020;87:100–6.
- [4] Hao F, Tam W, Hu X, et al. A quantitative and qualitative study on the neuropsychiatric sequelae of acutely ill COVID-19 inpatients in isolation facilities. *Transl Psychiatry* 2020;10:355.
- [5] Tan W, Hao F, McIntyre RS, et al. Is returning to work during the COVID-19 pandemic stressful? A study on Immediate mental health status and Psychoneuroimmunity Prevention measures of Chinese Workforce. *Brain Behav Immun* 2020;97:84–92.
- [6] Fu W, Yan S, Zong Q, et al. Mental health of college students during the COVID-19 epidemic in China. *J Affect Disord* 2021;280:7–10.
- [7] Shek DTL. COVID-19 and quality of life: Twelve reflections. *Appl Res Qual Life* 2021;16:1–22.
- [8] Grey I, Arora T, Thomas J, et al. The role of perceived social support on depression and sleep during the COVID-19 pandemic. *Psychiat Res* 2020; 293:113452.

- [9] Qi M, Zhou S-J, Guo Z-C, et al. The effect of social support on mental health in Chinese adolescents during the outbreak of COVID-19. *J Adolesc Health* 2020;67:514–8.
- [10] Sherry SB, Law A, Hewitt PL, et al. Social support as a mediator of the relationship between perfectionism and depression: A preliminary test of the social disconnection model. *Pers Individ Differ* 2008;45:339–44.
- [11] Lombas AS, Martín-Albo J, Valdivia-Salas S, Jiménez TI. The relationship between perceived emotional intelligence and depressive symptomatology: The mediating role of perceived stress. *J Adolesc* 2014;37:1069–76.
- [12] Gebregergis WT, Huang F, Hong J. The impact of emotional intelligence on depression among international students studying in China: The mediating effect of acculturative stress. *Int J Intercult Rel* 2020;79:82–9.
- [13] Forushani NZ, Besharat MA. Relation between emotional intelligence and perceived stress among female students. *Procedia-soc Behav Sci* 2011;30:1109–12.
- [14] Shek DTL. Chinese adolescent research under COVID-19. *J Adolesc Health* 2020;67:733–4.
- [15] Liu JW, Li FY, Lian YL. Investigation of reliability and validity of the social support scale. *J Xinjiang Med Univ* 2008;31:1–3. <https://doi.org/10.3969/j.issn.1009-5551.2008.01.001>.
- [16] Xiao SY. Theoretical basis and application of social support rating scale. *J Clin Psychiat* 1994;4:98–100.
- [17] Wong CS, Law KS. The effects of leader and follower emotional intelligence on performance and attitude: An exploratory study. *The Leadersh Q* 2002;13:243–74.
- [18] Mayer J, Salovey P. What is emotional intelligence? In: Sluyter D, Salovey P, eds. *Emotional Development and Emotional Intelligence: Implications for Educators*. New York: Basic Books; 1997:3–34.
- [19] Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med* 2002;32:959–76.
- [20] Patel V, Araya R, Chowdhary N, et al. Detecting common mental disorders in primary care in India: A comparison of five screening questionnaires. *Psychol Med* 2008;38:221–8.
- [21] Kline RB. *Principles and Practice of Structural Equation modeling*. New York, CA: The Guilford Press; 2010.
- [22] MacKinnon DP, Lockwood CM, Williams J. Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivar Behav Res* 2004;39:99–128.
- [23] Wang C, Tee M, Roy AE, et al. The impact of COVID-19 pandemic on physical and mental health of Asians: A study of seven middle-income countries in Asia. *PLoS One* 2021;16:e0246824.
- [24] Lim G Y, Tam W W, Lu Y, et al. Prevalence of depression in the community from 30 countries between 1994 and 2014. *Sci Rep* 2018;8:2861.
- [25] Fernandez-Berrocal P, Cabello R, Castillo R, Extremera N. Gender differences in emotional intelligence: The mediating effect of age. *Behav Psychol* 2012;20:77–89.
- [26] Cohen AK, Hoyt LT. Dull, B, A descriptive study of COVID-19-related experiences and Perspectives of a National sample of college students in spring. *J Adolesc Health* 2020;67:369–75.
- [27] Brailovskaia J, Cosci F, Mansueto G, Margraf J. The relationship between social media use, stress symptoms and burden caused by coronavirus (Covid-19) in Germany and Italy: A cross-sectional and longitudinal investigation. *J Affect Disord Rep* 2021;3:100067.
- [28] Behnke RR, Sawyer CR, King PE. Contagion theory and the communication of public speaking state anxiety. *Commun Educ* 1994;43:246–51.
- [29] Paukert AL, Pettit JW, Amacker A. The role of interdependence and perceived similarity in depressed affect contagion. *Behav Ther* 2008;39:277–85.
- [30] Santos A, Wang W, Lewis J. Emotional intelligence and career decision-making difficulties: The mediating role of career decision self-efficacy. *J Vocat Behav* 2018;10:295–309.
- [31] Shek DTL, Zhao L, Dou D, et al. The impact of positive youth development attributes on posttraumatic stress disorder symptoms among Chinese adolescents under COVID-19. *J Adolesc Health* 2021;68:676–82.
- [32] Zhou Z, Shek DTL, Zhu X, et al. Positive youth development and adolescent depression: A longitudinal study based on mainland Chinese high school students. *Int J Env Res Pub He* 2020;17:4457.
- [33] Radwan E, Radwan A, Radwan W. The role of social media in spreading panic among primary and secondary school students during the COVID-19 pandemic: An online questionnaire study from the Gaza Strip. *Palestine Heliyon* 2020;6:e05807.
- [34] Sharma V, Ortiz MR, Sharma N. Risk and protective factors for adolescent and young Adult mental health within the Context of COVID-19: A Perspective from Nepal. *J Adolesc Health* 2020;67:135–7.
- [35] Hatfield E, Cacioppo JT, Rapson RL. Emotional contagion. *Curr Dir Psychol Sci* 1993;2:96–100.
- [36] Wang C, Chudzicka-Czupała A, L Tee M, et al. Somatic or physical symptoms resembling COVID-19 infection: A chain mediation model on COVID-19 symptoms and mental health outcomes in Americans, Asians and Europeans. *Sci Rep* 2021;11:6481.
- [37] Wang C, Chudzicka-Czupała A, Grabowski D, et al. The association between physical and mental health and Face Mask Use during the COVID-19 pandemic: A comparison of two countries with different Views and Practices. *Front Psychiatry* 2020;11:569981.
- [38] Tran BX, Nguyen HT, Le HT, et al. Impact of COVID-19 on economic well-being and quality of life of the Vietnamese during the National social distancing. *Front Psychol* 2020;11:565153.
- [39] Le HT, Lai AJX, Sun J, et al. Anxiety and depression among people under the Nationwide partial lockdown in Vietnam. *Front Public Health* 2020;8:589359.
- [40] Chewa NWS, Cheongb C, Kong G, et al. An Asia-Pacific study on healthcare worker's perception and willingness to receive COVID-19 vaccination. *Int J Infect Dis* 2021;106:52–60.