Factors Associated With The Mental Health of Back-To-Wuhan College Students Based On Quantile Regression Model During The COVID-19 Period

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Research Article

Keywords: COVID-19, mental health, college students, quantile regression analysis, discrimination

Posted Date: September 14th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-778511/v1>

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Abstract

Background

The COVID-19 pandemic has been spreading rapidly in China and other countries since December 2019, which has increased the risk of infection, and brought the unbearable huge psychological pressure on people.

Methods

A cross-sectional questionnaire survey was conducted from 31 August 2020, to 14 September 2020 by convenience sampling on the back-to-Wuhan college students, which included the Generalized Anxiety Disorder Scale (GAD-7), Patient Health Questionnaire-9 (PHQ-9), the Insomnia Severity Index-7 (ISI-7), and the revised Impact of Event Scale (IES-R) scales and the basic demographic characteristics.

Results

The results from 1017 participants suggested that 44%, 47.5%, 37.7%, 57.7% were the prevalence rates of the anxiety, depression, insomnia, and distress respectively. Moreover, quantile regression analysis was used to identify the factors related to the mental health variables of the back-to-Wuhan college students during the COVID-19 period.

Conclusion

The finding showed that the respondents who were near graduation, discriminated owing to the experience in Wuhan, and worried about the future trend of COVID-19 had a higher risk of becoming negative psychological status, especially the bottom and median quantile, and might require more psycho-social interventions or support.

Background

The novel Coronavirus 2019(COVID-19) which was first reported in Wuhan, Hubei province, China in late December 2019 could be transmitted by respiratory tract and aerosol, and have had a huge impact on the world[1]. Owing to the quarantine measures lasted for more than two months, the number of new confirmed cases and suspected cases in China have gradually reduced, and the pandemic in China was under control [2]. Unfortunately, it wasn't the case in the other countries. As of Oct 31, 2020, the World Health Organization announced that the number of cumulative confirmed cases worldwide is nearly 460.2 million, and the cumulative dead patients are 1.2 million. Previous studies have showed that large-scale, unexpected public health events such as the severe acute respiratory syndrome (SARS) epidemic in China in 2003[3, 4] and the Middle East respiratory syndrome coronavirus in 2014[5, 6], not only threatened people's physical health, but also caused serious harm to people's psychology[7], and this psychological impact may last for a long time[8, 9].

As a worldwide public health emergency, the spread of the COVID-19 had a certain, negative effect on people's mental health, especially on some key populations[10]. At present, there have been many pieces of researches on public mental health, including medical staff, patients, children, the elderly during the COVID-19 outbreak. The research of a multi-center online survey on 1 563 medical staff suggested that the detection rates of depression, anxiety, insomnia and stress symptoms were as high as 50.7%, 44.7%, 36.1% and 73.4%[11]. Chen et al[12] surveyed of 12,759 medical staff, which indicated that the psychological abnormality detection rate of medical staff was 36.1%, higher than the public psychological abnormality examination rate during the COVID-19 epidemic[13]. Similarly, the COVID-19 had serious repercussions for the mental health of the discharged patients, whose proportion of moderate to severe anxiety was 10.4%, severe depression was 19%[14]. The elderly also suffered from serious mental health problems, who were hard to get psychological assistance online. [15].

During the SARS epidemic, college students who were not contaminated with the disease had SARS-related psychological problems with sex and demographic differences[16]. In the period of hemagglutinin type-1 neuraminidase type-1 influenza virus (H1N1), university students in Guangzhou, China had mental distress caused by fear of H1N1, and some preventive measures, including mental health education and promotion were warranted to alleviate the mental distress[17]. Since the COVID-19 outbreak was first reported, considerable attention has been drawn to physical and psychological health among college students, especially in Wuhan, the epicenter of the COVID-19 pandemic. Additionally, students regarded as carriers of the virus were discriminated against causing the stress, anxiety, and fear problems [18]. A large number of universities have postponed the beginning date of new term and adopted the E-learning mode[19]. While preliminary evidence illustrated that the home-quarantined college students worried about the COVID-19 were supposed to affect their mental health. 24.9% of 7,143 college students in home isolation suffered from mild anxiety and Above[20]. Among the 3881 undergraduates surveyed, the incidence of anxiety and depression were 26.60% and 21.16%, respectively [21], higher than the average prevalence rate for college students in the non-pandemic period [22]. Previous research suggested that there would be a long-term negative impact on people's psychological health in a public health crisis. Hence, the impact factors should be explored actively[23].

The implementation of off-line classroom teaching in American universities caused cluster of infection after the students returned to the university, approximately a total of 150 students were diagnosed during half a month. In September 2020, a large number of college students returned to school in Wuhan. To reduce the risk of infection, closed management measures, including students "unnecessarily not going out", wearing masks and maintaining social distance were put into effect (Ministry of Education of the People's Republic of China,2020), which might influence the study life and psychological well-being of back-to-Wuhan college students. Previous research showed that there were more suicidal behaviors among college students with post-traumatic

stress and poor mental health, especially for female college students[24]. Measuring and evaluating the mental health of college students are conducive to monitor mental health diseases and behavioral problems, and being able to predict and intervene in behavior changes (Greene, 2005). Therefore, it is necessary to pay attention to the mental health of back-to-Wuhan college students, identify key impact factors and implement efficient interventions as soon as possible[25].

For universities, how to guide the students to deal with the public health emergencies, control their feelings and avoid sinking into negative emotions have become an issue of far greater momentousness and urgency to solve. Thus, after the COVID19 epidemic, this current research surveyed mental health and influence factors of back-to-Wuhan college students makes sense.

The aims of this study are:(i) to analyze the mental health of back-to-Wuhan college students in Wuhan during the post-COVID-19 epidemic period; (ii) to find the key impact factors of mental health variable and then to provide a certain basis of preventing and intervening the mental health of college students measures.

Methods

Study Design

This research is a crossed-sectional survey, using an online questionnaire to measure mental health variables, including anxiety, depression, insomnia, and distress of back-to-Wuhan college students by the 'Questionnaire Star Application'. This research met ethical protocols (No: IORG0003571).

Convenience sampling was conducted to collect data from 31 August 2020, to 14 September 2020 in Wuhan. The purpose and content of this survey had been explained to each respondent, and the respondent's informed verbal consent had been obtained. Each questionnaire was filled out anonymously.

Participants

The questionnaires of participants were mostly completed online from different universities on account of the closed management. The inclusion criteria were:(i) college students covering undergraduate, master and doctoral candidate, who studied in Wuhan before the COVID-19 outbreak and currently; (ii) 18 years old and above. The samples missing the key items of questionnaire were excluded.

The formula of the target participant sample size is following $N = Z_{\alpha}^2 P(1-P) / \delta^2$ ($\alpha=0.05, Z_{\alpha}=1.96$, P means the positive rate of mental health problem), and the absolute allowable error of ratio estimate δ was 0.05. The positive rate is 38.4% at internalizing disorder especially depression and anxiety disorder among college students in the previous study[26]. For the reduce of sampling error, we expanded the sample size by 50% with the goal of participants at least 546 completed questionnaires. A total of 1,332 back-to-Wuhan college students were surveyed, 192 people refused to participate, and 1,017 valid samples were included, with an effectivity rate of 76.35%.

Measures

The general questionnaire mainly included two parts. The first part was sociodemographic information, such as age, gender, department category of the university, hometown, years from graduation, whether you have been discriminated against because of studying in Wuhan, and whether COVID-19 rebound again in China.

The second part was mental health variables, including anxiety, depression, insomnia, and distress, measured by the Generalized Anxiety Disorder Scale (GAD7) ranging 0-21, the Patient Health Questionnaire (PHQ-9) ranging 0-27, the Insomnia Severity Index (ISI-7) ranging 0-28, and the Impact of Event Scale-Revised (IES-R) respectively. These scales had good reliability and validity in previous studies [2, 27-29]. The scores of these scales are classified as follows: GAD-7, normal (0-4), mild (5-9), moderate (10-13), moderate to severe (14-18), and severe (19-21); PHQ-9, normal (0-4), mild (5-9), moderate to severe (10-14), and severe (20-27); ISI-7, normal (0-7), mild (8-14), moderate (15-21), severe (22-28); IES-R, normal (0-7), mild (8-14), moderate (15-21) and severe (22-28). The Cronbach's alpha coefficients of the Chinese versions of PHQ-9, GAD-7, ISI-7 and IES-7 were 0.929, 0.918, 0.903 and 0.899, respectively. Therefore, the internal consistency was excellent in the current study.

Statistical Analysis

Stata statistical software version 15.0 (StataCorp LLC, Texas, USA) was used to analyze the data. First, sociodemographic characteristics were illustrated by quantity and frequency. Normality distributions test was used for dependent variables. Pearson's correlations were performed to test the correlation among the influence factor and mental health variables. Secondly, the Kruskal-Wallis test was applied for the difference comparison among groups, in which the prevalence rate of anxiety ($GAD7 \geq 5$ points), depression ($PHQ-9 \geq 5$ points), insomnia ($ISI-7 \geq 8$ points), distress ($IES-7 \geq 8$ points) could be evaluated, respectively. Finally, quantile regression was used to explore regression relationship of mental health variables and sociodemographic characteristics. Moreover, considering the distribution characteristics of the dependent variables, the P_{25} , P_{50} , P_{75} conditional quantile points were selected as representatives to describe the quantile regression analysis results. The better group (represented by P_{25} quantile points), general group (represented by P_{50} quantile points), and poor group (represented by P_{75} quantile points) of each dependent variable showed the sociodemographic characteristics related to anxiety, depression, insomnia, and distress.

Results

Sociodemographic Characteristics

As is revealed in Table 1, a total of 1017 back-to-Wuhan college students participated in the questionnaire survey. Among them, 475 (46.7%) are males, and more than 92.8% participants are between 18–25 years old. The number and proportion of undergraduates, postgraduates, doctors are 490 (48.2%), 447 (44%), 80 (7.9%), respectively. 363 (35.7%) are medical students. There are 684 (67.2%) students with less than two years left before graduation. Only 41 (4%) of the university students surveyed are from Wuhan, 283 (27.8%) students are from Hubei Province except for Wuhan, and 693 (68.1%) students from other provinces. Most students [604 (59.4%)] have been discriminated against because of their experience in Wuhan. 258 (25.4%) respondents are optimistic about the COVID-2019 epidemic, 322 (31.7%) respondents believe that the epidemic might rebound.

Table 1
The sociodemographic characteristics of participants

	Total	%
Total	1017	100
Sex		
Male	475	46.7
Female	542	53.3
Age		
18–21	431	42.4
22–25	513	50.4
26–29	63	6.2
≥ 30	10	1
Highest Education level		
Undergraduate student	490	48.2
Master student	447	44
PHD student or above	80	7.9
Department category of the university		
Department of Medicine-related	363	35.7
Department of Non-Medicine-related	654	64.3
Years from graduation		
Within 1 year	348	34.2
Within 2 year	336	33
Within 3 year	242	23.8
4 years and above	91	8.9
Hometown		
Wuhan	41	4
Hubei except for Wuhan	283	27.8
Other provinces	693	68
Whether Be discriminated		
Yes	413	40.6
No	604	59.4
COVID-19 be rebounding again		
Yes	322	31.7
No	258	25.4
Uncertain	437	43

The Distribution And Correlation Among Variables

Table 2 presents the score distributions of GAD-7, PHQ-9, ISI-7, IES-R scales. From the skewness, kurtosis and extreme value distribution ratio, the scores of each dimension don't conform to the normal distribution ($P < 0.01$).

Table 3 provides the correlations between the sociodemographic characteristics and the mental health variables, respectively, and reflects the positive and negative correlations significantly in detail.

Table 2
The distribution characteristics of mental health variables.

	Mean	Standard deviation	Median	Mode	Skewness	Kurtosis	Normal-proportion	Severe- proportion	Normality
GAD-7	4.36	4.3	4	0	1.04	0.88	0.56	0.05	<0.01
PHQ-7	5.18	5.18	4	0	1.12	1.1	0.53	0.06	<0.01
ISI-7	6.76	5.49	6	0	0.87	0.31	0.62	0.11	<0.01
IES-R	8.75	5.01	8	8	0.39	0.11	0.42	0.13	<0.01
Note.GAD-7 = 7-item General Anxiety Disorder Scale, PHQ-9 = 9-item Patient Health Questionnaire(depression), ISI-7 = 7-item Insomnia Severity Index Scale, IES-R = the Impact of Event Scale-Revised(distress). **P < 0.01 *P < 0.05.									

Table 3
Pearson's correlations among variables.

Pearson's correlations among variables.								
Variable	1	2	3	4	5	6	7	8
1.Sex	1							
2.Age	0.10**	1						
3.Highest Education level	0.08*	0.76**	1					
4.Department category of the university	-0.19**	-0.17**	-0.10**	1				
5.Years from graduation	-0.04	-0.20**	-0.002	-0.09**	1			
6.Hometown	-0.03	-0.03	< 0.001	0.03	0.07*	1		
7.Whether be discriminated	-0.04	-0.11**	-0.10**	0.06	0.05	-0.22**	1	
8.COVID-19 be rebounding again	0.13**	-0.04	-0.03	0.04	-0.03	0.06*	0.06	1
9.GAD-7	0.01	0.04	0.04	-0.03	-0.07*	0.02	-0.09**	-0.10**
10.PHQ-9	0.05	0.10**	0.05	-0.02	-0.08**	-0.01	-0.09**	-0.07*
11.ISI-7	0.04	0.18**	0.16**	-0.02	-0.07*	-0.01	-0.10**	-0.08*
12.IES-R	-0.002	0.09**	0.05	-0.06*	-0.12**	-0.004	-0.17**	-0.08**
Note.GAD-7 = 7-item General Anxiety Disorder Scale, PHQ-9 = 9-item Patient Health Questionnaire(depression), ISI-7 = 7-item Insomnia Severity Index Scale, IES-R = the Impact of Event Scale-Revised(distress). **P < 0.01 *P < 0.05.								

The Severity Of Measurements And Associated Factors

As shown in Table 4, there is quite a large proportion of respondents with symptom of anxiety [447 (44%)], depression [483 (47.5%)], insomnia [383 (37.7%)], and distress [587 (57.7%)]. Kruskal-Wallis test demonstrates that the prevalence rates of anxiety, insomnia and distress varies among different ages, levels of education, whether the colleges were discriminated owing to the experience in Wuhan ($P < 0.05$). Also, the opposite attitude to the future trend of the COVID-2019 epidemic has led to the different infection rates of anxiety and distress ($P < 0.05$). For whom were discriminated due to the experience in Wuhan, they are easily to develop the psychological symptoms of depression ($P < 0.05$). Simultaneously, whether the participants suffering from the distress are affected by sex, year from graduation, and the attitude to the future trend of the COVID-2019 ($P < 0.05$).

In Table 5, the results of quantile regression suggest that the influence coefficient of various factors on the mental health variables of college students in different quantiles has changed significantly. Further, age, years from graduation, being discriminated against owing to the experience in Wuhan, and the attitude on the future of COVID-2019 are negatively associated to the mental health scores, while the education level is positively related to it.

The uncertainty on the future trend of COVID-2019, and being discriminated against owing to the experience in Wuhan are associated with an increase of anxiety and distress, especially for those in lower quantile. The column (1) of Table 4 reveals the effect of education level wildly across anxiety, 1.64 in the 25th quantile changing to 2.54 in the 50th quantile, and was merely significant at the lower quantiles.

Analogously, in column (2) of Table 4, the heavier the scientific research tasks, the more depression on the participants, changing from 2.04 in the 25th quantile to 2.84 in the 75th quantile. Columns 3–4 of Table 4 presents that those were both significant and negative at 25th, 50th, and 75th quantiles and the college students in graduation grade developed insomnia (25th= -2.32,75th=-3.33) and distress (25th= -1.74,75th=-2.16).

Table 4
The prevalence rates under different sociodemographic characteristics

	GAD-7		p-Value	PHQ-9		p-Value	ISI-7		p-Value	IES-R	
	<5	≥ 5		<5	≥ 5		<8	≥ 8		<8	≥ 8
Total	570(56)	447(44)		534(52.5)	483(47.5)		634(62.3)	383(37.7)		430(42.3)	587(57.7)
Sex											
Male	270(47.4)	205(45.9)	0.633	265(49.6)	210(43.5)	0.050	308(48.6)	167(43.6)	0.123	199(46.3)	276(47)
Female	300(52.6)	242(54.1)		269(50.4)	273(56.5)		326(51.4)	216(56.4)		231(53.7)	311(53)
Age											
18–21	262(46)	169(37.8)	0.024*	245(45.9)	186(38.5)	0.018*	304(47.9)	127(33.2)	<0.001**	205(47.7)	226(38.5)
22–25	266(46.7)	247(55.3)		254(47.6)	259(53.6)		297(46.8)	216(56.4)		199(46.3)	314(53.5)
26–29	37(6.5)	26(5.8)		31(5.8)	32(6.6)		29(4.6)	34(8.9)		23(5.3)	40(6.8)
≥ 30	5(0.9)	5(1.1)		4(0.7)	6(1.2)		4(0.6)	6(1.6)		3(0.7)	7(1.2)
Education level											
Undergraduate student	291(51.1)	199(44.5)	0.043*	275(51.5)	215(44.5)	0.064	337(53.2)	153(39.9)	<0.001**	223(51.9)	267(45.4)
Master student	237(41.6)	210(47)		215(40.3)	232(48)		255(40.2)	192(50.1)		175(40.7)	272(46.3)
PHD student or above	42(7.4)	38(8.5)		44(8.2)	36(7.5)		42(6.6)	38(9.9)		32(7.4)	48(8.2)
Department category of the university											
Department of Medicine-related	195(34.2)	168(46.3)	0.265	183(34.3)	180(37.3)	0.319	228(36)	135(35.2)	0.818	139(32.3)	224(38.2)
Department of Non-Medicine-related	375(65.8)	279(62.4)		351(65.7)	303(62.7)		406(64)	248(37.9)		291(67.7)	363(61.8)
Years from graduation											
Within 1 year	186(32.6)	162(36.2)	0.123	171(32)	177(36.6)	0.053	205(32.3)	143(37.3)	0.092	124(28.8)	224(38.2)
Within 2 year	185(32.5)	151(33.8)		174(32.6)	162(33.5)		211(33.3)	125(32.6)		143(33.3)	193(32.9)
Within 3 year	147(25.8)	95(21.3)		138(25.8)	104(21.5)		160(25.2)	82(21.4)		120(27.9)	122(20.8)
4 years and above	52(9.1)	39(8.7)		51(9.6)	40(8.3)		58(9.1)	33(8.6)		43(10)	48(8.2)
Hometown											
Wuhan	19(3.3)	22(4.9)	0.361	18(3.4)	23(4.8)	0.323	28(4.4)	13(3.4)	0.982	18(4.2)	23(3.9)
Hubei except Wuhan	171(30)	112(25.1)		161(30.1)	122(25.3)		173(27.3)	110(28.7)		116(27)	167(28.4)
Other provinces	380(66.7)	313(70)		355(66.5)	338(79)		433(68.3)	260(67.9)		296(68.8)	397(67.6)
Whether Be discriminated											
Yes	216(37.9)	197(44.1)	0.047*	198(37.1)	215(44.5)	0.016*	233(36.8)	180(47)	0.001**	134(31.2)	279(47.5)
No	354(62.1)	250(55.9)		336(62.9)	268(55.5)		401(63.2)	203(53)		296(68.8)	308(52.5)
The COVID-19 whether rebound again in China											
Yes	157(27.5)	165(36.9)	0.027*	154(28.8)	168(34.8)	0.261	190(30)	132(34.5)	0.175	110(25.6)	212(36.1)

Note.GAD-7 = 7-item General Anxiety Disorder Scale, PHQ-9 = 9-item Patient Health Questionnaire(depression), ISI-7 = 7-item Insomnia Severity Index Scale, IE: Impact of Event Scale–Revised(distress). ** $P < 0.01$ * $P < 0.05$.

	GAD-7		p-Value	PHQ-9		p-Value	ISI-7		p-Value	IES-R	
	<5	≥ 5		<5	≥ 5		<8	≥ 8		<8	≥ 8
No	160(28.1)	98(21.9)		149(27.9)	109(22.6)		164(25.9)	94(24.5)		128(29.8)	130(22.1)
Uncertain	253(44.4)	184(41.2)		231(43.3)	206(42.7)		280(44.2)	157(41)		192(44.7)	245(41.7)
Note.GAD-7 = 7-item General Anxiety Disorder Scale, PHQ-9 = 9-item Patient Health Questionnaire(depression), ISI-7 = 7-item Insomnia Severity Index Scale, IE: Impact of Event Scale-Revised(distress). ** $P < 0.01$ * $P < 0.05$.											

Table 5
Different quantiles analysis of mental health and associated factors

	(1) GAD-7			(2) PHQ-9			(3) ISI-7			(4) IES-R	
	P ₂₅	P ₅₀	P ₇₅	P ₂₅	P ₅₀	P ₇₅	P ₂₅	P ₅₀	P ₇₅	P ₂₅	P ₅₀
Sex	0.0909 (0.35)	0.2478 (0.53)	-0.327 (-0.73)	-0.765 (-0.57)	0.2500 (0.55)	0.5714 (0.87)	0.2500 (0.59)	-0.3333 (-0.95)	-0.6667 (-1.68)	0.1537 (0.59)	-0.3333 (0.63)
Age	-1.0000 (-1.85)	-2.2500* (-2.34)	-0.5230 (-0.71)	-0.0833 (-0.09)	1.0000 (1.06)	2.0000 (1.48)	0.0833 (0.09)	0.6667 (0.92)	0.3333 (0.41)	0.1111 (0.14)	-0.3333 (-0.31)
Highest Education level	0.3636* (1.64)	1.2700* (2.54)	0.2500 (0.86)	0.7500* (2.04)	1.0000** (2.59)	1.5714** (2.84)	0.3333 (0.93)	-0.2765 (-0.47)	-0.4160 (-0.72)	0.4444 (1.39)	0.3333 (0.75)
Department category of the university	-0.2727 (-1.00)	-0.5000 (-1.03)	-0.2750 (-0.70)	-0.2500 (-0.55)	-0.2500 (-0.53)	0.7143 (1.05)	-0.6667 (-1.51)	-1.0000** (-2.73)	-0.6667 (-1.62)	-0.4444 (-1.13)	-0.3333 (0.61)
Years from graduation	-0.0909 (-0.68)	-0.5000* (-2.12)	-0.2350 (-1.44)	-0.1460 (-1.13)	-0.2500 (-1.08)	-0.1429 (-0.43)	-0.5277* (-2.32)	-0.6667** (-3.74)	-0.6667** (-3.33)	-0.3333 (-1.74)	-0.6667* (-2.50)
Hometown	-0.4545 (-0.70)	-2.3600 (-1.73)	-0.2590 (-0.29)	0.1667 (0.15)	0.2500 (0.22)	-0.2857 (-0.18)	0.5000 (0.47)	-0.3860 (-0.69)	0.6032 (0.75)	-0.5556 (-0.59)	-1.6667 (-1.28)
Be discriminated or not	-0.5455* (-2.09)	-0.5000 (-1.08)	-0.2500 (-0.73)	-0.6667 (-1.54)	-0.7500 (-1.65)	-1.5714* (-2.41)	-1.7500** (-4.14)	-1.6667** (-4.76)	-1.6667** (-4.23)	-0.5556 (-1.48)	-1.6667** (-3.18)
COVID-19 be rebounding again or not	-0.5455** (-3.64)	-0.7500** (-2.81)	-0.3700 (-1.27)	-0.4167 (-1.67)	-0.1475 (-0.96)	-0.4286 (-1.14)	-0.4167 (-1.71)	-0.3333 (-1.66)	-0.3333 (-1.47)	-0.4444* (-2.05)	-0.3333 (-1.10)
Constant	4.9091** (2.82)	12.0000** (3.87)	9.7500** (4.27)	5.0000 (1.72)	5.0000 (1.65)	7.2857 (1.67)	9.3333** (3.30)	14.6667** (6.27)	16.0000** (6.08)	4.7778 (1.90)	12.0000** (3.42)
Note.GAD-7 = 7-item General Anxiety Disorder Scale, PHQ-9 = 9-item Patient Health Questionnaire(depression), ISI-7 = 7-item Insomnia Severity Index Scale, IE: Impact of Event Scale-Revised(distress). ** $P < 0.01$ * $P < 0.05$.											

Discussion

The results of the survey of 1,017 back-to-Wuhan college students indicated that the prevalence rates of anxiety, depression, insomnia, and distress were 44%, 47.5%, 37.7%, and 57.7%, respectively, which were higher than those during the non-epidemic periods[21, 22]. It has been demonstrated that the increasing number of confirmed cases, suspected cases, the outbreak rebounded in other provinces or countries [30] and the continuous negative news reports about the COVID19 [31], have incited people to worry about the future trend of the epidemic, leading to people's anxiety, depression.

Previous studies have shown that the psychological health of college students under the influence of public health emergencies to a large extent, [15, 32, 33] on account of the college students' easier access to information related to the pandemic[34], lack of experience in responding to public health emergencies, and their studies and future career development affected by the COVID-2019 [21].

Meanwhile, the result manifested the prevalence rates of anxiety, insomnia, and distress were significant different on college students of different ages and educational level, deriving from the greater pressure of scientific research of the master's and doctoral students, longer home isolation time, worse scientific research environment, and lower efficiency. There were no system online psychological, academic, and employment guidance courses for college students. Similar studies have indicated that some household income might be affected, consequently, some students could concern sources for tuition due to the outbreak of the pandemic [35].

In accordance with the hypothesis, the quantile regression confirmed the degree of education level has a positive influence on depression. It reports that those suffering more from anxiety could worry about the negative influence of COVID-2019 on their academics and science research, indicating that the degree of education level is a sensitive indicator that affects the score of depression. The impact of years from graduation on insomnia and distress is negative, and the

impact gradually becomes larger in the median and upper quantiles. The higher education level and the closer to graduation, the more anxiety, depression, insomnia, and distress the participants have. It might result from that limited ways of pressure release under closed management have affected the academic or employment development of college students near graduation.

Furthermore, it also classified and analyzed whether college students had ever been discriminated against due to the experience in Wuhan after returning to school, and the attitude on the future trend of COVID-2019. Due to experience related Wuhan city, some discrimination had also affected the mental health of college students to a certain extent, which is consistent with previous research results[36]. The results showed that there were differences in the level of mental health among college students with discrimination and worried about the rebound of the epidemic. It might be related to the stigmatization of Wuhan in the early stage of the epidemic[37]. At the same time, news of repeated fluctuations in the epidemic situation in Dalian, Beijing and other places would also affect the feeling of college students.

However, the gender on the prevalence rate was not significant difference, keeping with the previous research finding[20, 38], which might be caused by the narrowing of the gap of people's access to education and information currently. But the majority of surveys conducted previously found the significant difference among the different gender, such as American male college students are easily depressed than female [39], on the contrary to Alansari's research in Saudi Arabia [40]. To be further confirmed, the traditional views of many emotional women under the peer pressure and high expectation from society and family, might increase the risk of depression.

Although telephone and online chat psychiatric treatment were advocated during the COVID-19 pandemic [41], the universities should also pay more attention to the mental health of back-to-Wuhan college students, especially in Wuhan. At present, the psychological counseling centers for college students are passive, and they should actively carry out psychological interventions for students near graduation to understand the reasons behind and help them get out of their difficulties. This research innovatively chooses to investigate the mental health of college students returning to school in Wuhan in the post-epidemic period and proposes key associated factors of mental health, which is conducive to maintain the mental health of college students and provide education and management.

The current study has several limitations. First, quantile regression could capture the heterogeneous associations between mental health and explanatory variables, however, the cross-sectional survey was hard to deduce causal inference and had a certain amount of information offset. A longitudinal study could be performed in the further study. Secondly, the research only studied the mental health of back-to-Wuhan college students, and did not cover other parts of China, such as Beijing, Guangzhou, etc., which rebounded in a small range in the post-epidemic period. Third, owing to the unavailable sampling framework and close-off management of back-to-Wuhan college students, convenient sampling was used to collect data, which could not represent the interest population and existed bias. The sample size is not sufficiently representative, which may have a certain impact on the results. Then, the mental health variables were measured by maturity scales, while, self-report instruments might respond bias.

Conclusion

In conclusion, the findings of this crossed-sectional study suggested that COVID-19 caused the relatively high prevalence rate of the back-to-Wuhan students on depression, anxiety, insomnia, and distress syndrome. The back-to-Wuhan students near graduation, being discriminated against owing to the experience in Wuhan city and worrying about the future trend of COVID-2019 were linked with a higher risk of developing depression and anxiety symptoms than others. These effects were stronger in the bottom and median quantile of anxiety and distress. Moreover, the long-term psychological effects covering causal inference and mediation analysis will help specify the impact of mental health in this population are worth further research.

Abbreviations

COVID-19

Coronavirus disease-2019; GAD-7:Generalized Anxiety Disorder Scale; PHQ-9:Patient Health Questionnaire-9; ISI-7:Insomnia Severity Index-7; IES-R:Revised Impact of Event Scale; SARS:Severe acute respiratory syndrome coronavirus; H1N1:Hemagglutinin type-1 Neuraminidase type-1 influenza virus.

Declarations

Acknowledgments

We sincerely thank the ethical approval of Tongji Medical College, Huazhong University of Science and Technology. Also, we would like to thank all participants in this study.

Author's Contributions

Q.W.: Participated in the conceptualization, investigation, formal analysis, manuscript writing and validation; L.Z. (Lijun Zhuo): Participated in the investigation, data curation and validation; H.L.: Participated in the investigation and data curation; L.Z. (Ling Zheng): Participated in the investigation and editing; G.M.: Participated in the investigation and editing; H.T.: Participated in project administration and funding acquisition. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy.

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (protocol code IORG No: IORG0003571 and date of approval: 28 June 2020). And the informed consent was obtained from all subjects involved in the study. All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Conflicts of Interest

All authors declare no conflicts of interest.

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