

Psychological Status and Associated Factors During the Lockdown Period of the COVID-19 Epidemic in China: A Web-Based Survey

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Abstract

Background: The aim of this study was to survey the general public in China to better understand their levels of psychological state and its influencing factors after the Wuhan shutdown on 23 Jan.

Methods: A survey was conducted on Feb 20-24, using an online self-administrated questionnaire among 4071 participants. Data on subjective indicators of daily-life change was collected, and individual scores on changes in anxiety, depression, and stress were generated by 8-item, 11-item, and 6-item questions. After bivariate analyses, multiple linear regression analyses were conducted to investigate independent associations between socio-demographic variables, subjective indicators of changes in daily life and summary scores including anxiety, depression, and stress scores.

Results: Information from 3803 participants was available for analysis. Multivariable regression analyses showed that the anxiety ($B=-1.27$, 95%CI=-1.71 to -0.82), depression ($B=-1.47$, 95%CI=-2.06 to -0.88), and stress ($B=-0.79$, 95%CI=-1.13 to -0.46) scores of people in rural areas are lower than those in urban areas. People living in the other regions except Hubei, higher education were independent correlates of less negative emotions, while people with relatively high incomes had poor psychological status in anxiety ($B=0.73$, 95%CI=0.08 to 1.38), depression ($B=1.45$, 95%CI=0.60 to 2.30) and stress ($B=0.65$, 95%CI=0.17 to 1.13). Married people were less anxious ($B=-0.67$, 95%CI=-1.30 to -0.05), depressed ($B=-1.14$, 95%CI=-1.96 to -0.33), and stressed ($B=-0.47$, 95%CI=-0.93 to 0.00) than single people. The level of attention, self-assessed infection risk, impact of the daily life and mental-health help-seeking tended to be positively associated with the scores of anxiety, depression, and stress ($p<0.001$).

Conclusions: Usual residence, education, marital status, monthly income, the level of attention, self-assessed infection risk, impact of the daily life and mental-health help-seeking are important correlates of the scores of anxiety, depression, and stress. Awareness of these relevant factors could help the government and related personnel to prevent more severe psychological trauma in the later period.

1. Background

Being highly contagious, COVID-19 has arisen a national pandemic and a rapid transmission globally to a lot of countries worldwide[1]. In the wake of this global health crisis, stringent public health measures have been implemented to curtail the spread of COVID-19. In China, in order to prevent the further spread, a lockdown was imposed on Wuhan on 23 January, with travel restrictions, followed by the entire Hubei Province a day later. In addition, the government has taken some measures to prevent further dispersal, including closing entertainment venues, cancelling the party, extending the Chinese New Year holidays, forcing people to wear masks in public as well as limiting the number and frequency of outings per household. The Chinese experience actively treats infected patients, protects susceptible populations, and cuts off transmission routes, which are proved to be effective and stop at least 700,000 cases of COVID-19[2].

However, the outbreak itself and the measures taken to combat the epidemic could lead to widespread fear and panic, which may escalate into further negative psychological reactions including adjustment disorder and depression. With the closure of schools and business close, the negative emotions experienced by individuals become more complicated[3]. At the same time, as most residents are restricted to their homes, they tend to face too much negative news at home every day, which may lead to a psychological crisis. Previous evidence showed that quarantine and isolation of patients led to widespread fear and panic, resulting in negative psychological reactions including adjustment disorder and depression[4–8]. And one recent study pointed to an increase in psychological problems in this epidemic, including anxiety, depression, and stress[9]. Two studies had noted an increase of psychological problems during the epidemic, and emphasized that we should pay attention to the mental health of specific groups such as children, old adults, patients, and medical staff[10, 11]. However, no data is available examining the psychological impact of COVID-19 on the general population in China one month after the Wuhan shut down.

Therefore, we conducted the survey to investigate the residents' change of life and psychological conditions in one month after the Wuhan lockdown. This may assist government agencies and healthcare professionals in safeguarding the psychological wellbeing of the community in the face of COVID-19 outbreak expansion in China and different parts of the world.

2. Method

2.1 Study participants

We conducted an online survey in one month (Feb 20 to 24) later after the shutdown of Wuhan (Jan 23) and Hubei province (Jan 25) against the COVID-19 spread, and we received 4071 anonymous questionnaires in the investigation, covering 33 Chinese provinces and autonomous regions except Taiwan.

Inclusion Criteria: 1. Male or female ages 15–85 years; 2. Participants must have capacity to understand the study and provide informed consent; 3. Participants must be fluent in Chinese; 4. Participants currently live in China.

Exclusion Criteria: 1. Serious neurological (specific or focal) disorders preventing full participation in the protocol; 2. The illogical case in the questionnaire. Examples include: Select the same option consecutively; The results of similar choices vary widely.

After eliminating the invalid samples, 3803 (93.42%) valid questionnaires were finally obtained. This study was approved by the research ethics committees of Wuhan University. All participants provided informed consent. Based on the investigation of the psychological state after the disaster in China and compiled after the discussion of experts, the self-administrated questionnaires were mainly divided into three parts.

2.2 Changes in psychological status

Changes of psychological status: In the study, **21 feeling items** were used to measure the changes of psychologic status, including sorrow, fear, tired, irritability, loneliness, sleep condition, self-perceived uselessness, irritability and loneliness, weight, appetite, chest tightness, disturbed, muscle ache and others (see details in the Supplementary Materials). We rated these items in a 5-point response format. (“-2 = significantly decrease”, “-1 = decrease”, “0 = unchanged”, “1 = increase”, or “2 = significantly increase”). Sorting the items and calculating the scores can analyze the changes in the residents' psychological status in a more targeted manner. Therefore, literature review and experts interview methods were used to construct the index system firstly. According to the literatures[12–14], the 21 feeling items in the self-made questionnaires were classified into three categories: anxiety, depression, and stress. The total scores were calculated by simple addition based on the extent of the feeling. A negative score indicated that the negative emotions of the participants decreased compared to the previous week; otherwise, a positive score indicated that the negative emotions increased. The higher the score, the worse the psychological condition. **An additional movie file shows the questionnaire in more detail [see Additional file 1].** The reliability of the questionnaire checked using Cronbach's Alpha and reliability coefficient was 0.958.

2.3 Subjective indicators of changes in daily life

The status of daily life of residents after the Wuhan shutdown is composed of level of attention, self-assessed infection risk, impact of the daily life, self-perceived health status, mental health help-seeking and satisfaction with community work. The first 3 items were rated as “1 = decreased”, “2 = unchanged”, “3 = increased”; while the self-perceived health status was rated as “1 = good/very good”, “2 = average”, “3 = bad/very bad”, mental health help-seeking was related as “1 = found and tried”, “2 = found but not tried”, “3 = not found yet”, “4 = not looked for”, “5 = no need to adjust”, and the satisfaction with community work was rated as “1 = satisfied”, “2 = general”, “3 = unsatisfied”.

2.4 Covariates

Gender (1 = male, 0 = female), age (1 = < 30, 2 = 30–49, 3 = ≥ 50), education (1 = middle school or below, 2 = high school, 3 = college, 4 = master degree and above), place of living (1 = urban, 2 = rural), current residence (1 = Wuhan, 2 = other cities of Hubei, 3 = other areas of China), marital status (1 = single, 2 = married, 3 = divorced or other), occupation (0 = non-medical staff, 1 = medical staff), monthly income (Yuan) (1 = < 2000, 2 = 2000–5000, 3 = 5001–10000, 4 = ≥ 10000), number of cohabitants (1 = 0, 2 = 1, 3 = 2–3, 4 = ≥ 4), quarantine or not (0 = no, 1 = yes), confirmed cases in personal network (0 = no, 1 = yes).

2.5 Statistical analysis

Data were double-entered and cross-checked using Excel version 2019 (Microsoft Corp., Redmond, USA), R3.6.2 was used for data cleaning, SPSS 25.0 was used to conduct corresponding statistical analysis, and a two-sided *p* value less than 0.05 was considered statistically significant.

To identify the determinants of participants' psychological feelings, we first examined the effects of their characteristics on changes of anxiety, depression, and stress scores with one-way analysis of variance (ANOVA) or the nonparametric Kruskall-Wallis test for

categorical variables, depending on the distribution of the variables. The statistically significant variables were then allowed to enter the multiple linear regression model, and dummy variables were created when appropriate. Dichotomous variables were explored for the regression analysis in order to simplify the relationships. A series of multiple linear regression analyses (stepwise method) were explored to investigate the independent associations between socio-demographics, subjective indicators of changes in daily life and summary scores including anxiety, depression, and stress scores after checking the assumptions of distribution and independence of the residuals as well as multicollinearity. Normality was assessed by visual inspection of the P-P plot. Linearity and homoscedasticity was investigated by visual inspection of the plot of the predicted values and standardized residuals. A variance inflation factor (VIF) of greater than 10 was used to identify possible multicollinearity among independent variables.

3. Results

Table 1 describes the socio-demographic distribution of the study participants and the results of univariable analyses. During the study period, a total of 3803 residents participated in the study, with 34.4% male and 63.6% female. Participants aged below 30, 30–49 years old, 50 years old and above accounted for 30.2%, 52.2%, 17.5% respectively. 77.6% of participants were urban residents. Among the participants, people living in Wuhan and other cities in Hubei Province accounted for 31.4% and 24.3%, respectively. Residents in and outside Hubei Province each accounted for about half. The data showed that the large majority(83.7%) of the participants had university degrees or above, more than half (66.5%) of the subjects were married. The proportion of medical staff was 26.7%. At the time of the data collection, 432 (11.44%) people were in quarantine and 718 (18.9%) said that people they knew were diagnosed with COVID-19.

Table 1
Factors affecting anxiety, depression, and stress in the survey (n = 3803; X ± S ;n/%)

Variable	N(%)	Anxiety	t/F	P	Depression	t/F	P	Stress	t/F	P
Gender			0.038	0.845		0.014	0.907		0.034	0.853
Male	1307(34.4)	-2.96 ± 5.61			-2.73 ± 7.22			-2.16 ± 4.14		
Female	2496(65.6)	-2.99 ± 5.36			-2.70 ± 6.91			-2.18 ± 3.94		
Age			0.440	0.644		0.281	0.755		0.016	0.984
< 30	1150(30.2)	-3.02 ± 5.70			-2.65 ± 7.58			-2.16 ± 4.24		
30–49	1986(52.2)	-3.02 ± 5.43			-2.79 ± 6.93			-2.18 ± 3.98		
≥ 50	667(17.5)	-2.80 ± 5.06			-2.58 ± 6.23			-2.16 ± 3.68		
Place of living			40.493	<0.001		32.425	<0.001		29.019	<0.001
Urban	2953(77.6)	-2.68 ± 5.23			-2.36 ± 6.67			-1.98 ± 3.84		
Rural	850(22.4)	-4.02 ± 6.03			-3.91 ± 7.99			-2.82 ± 4.48		
Usual Residence			28.854	<0.001		17.346	<0.001		29.307	<0.001
Wuhan	1196(31.4)	-2.04 ± 5.17			-1.73 ± 6.45			0.33 ± 1.71		
Other cities of Hubei	923(24.3)	-3.09 ± 5.70			-3.01 ± 7.29			-0.05 ± 1.93		
Other areas of China	1684(44.3)	-3.59 ± 5.41			-3.24 ± 7.19			-0.21 ± 1.81		
Education			1.786	0.148		1.520	0.207		1.879	0.131
Middle school or below	130(3.4)	-3.05 ± 5.76			-2.76 ± 6.97			-2.22 ± 4.37		
High school	489(12.9)	-3.21 ± 5.91			-2.96 ± 7.63			-2.24 ± 4.35		
College	2413(63.4)	-3.05 ± 5.47			-2.81 ± 7.10			-2.25 ± 4.03		
Master degree and above	771(20.3)	-2.59 ± 4.98			-2.71 ± 7.02			-1.87 ± 3.63		
Marital status			0.532	0.588		0.812	0.444		0.241	0.786
Single	1101(29.0)	-2.99 ± 5.62			-2.55 ± 7.56			-2.15 ± 4.23		
Married	2530(66.5)	-3.01 ± 5.38			-2.81 ± 6.78			-2.19 ± 3.91		
Divorced/Other	172(4.5)	-2.56 ± 5.33			-2.31 ± 6.86			-1.99 ± 4.08		
Occupation			0.203	0.652		1.151	0.283		0.032	0.859
Medical staff	1015(26.7)	-2.91 ± 5.51			-2.91 ± 6.98			-2.19 ± 4.08		

Variable	N(%)	Anxiety	t/F	P	Depression	t/F	P	Stress	t/F	P
Non-medical staff	2788(73.3)	-3.00 ± 5.42			-2.64 ± 7.03			-2.16 ± 3.99		
Monthly income(Yuan)			3.171	0.023		3.914	0.008		2.804	0.038
<2000	779(20.5)	-3.48 ± 5.86			-3.31 ± 7.80			-2.50 ± 4.38		
2000–5000	1143(30.1)	-2.87 ± 5.59			-2.65 ± 6.97			-2.16 ± 4.08		
5001–10000	1030(27.1)	-2.96 ± 5.27			-2.79 ± 6.94			-2.14 ± 3.87		
>10000	851(22.4)	-2.69 ± 5.03			-2.14 ± 6.36			-1.93 ± 3.71		
Number of cohabitants			0.943	0.419		1.225	0.299		0.488	0.691
0	216(5.7)	-2.40 ± 5.93			-1.84 ± 7.64			-1.88 ± 4.29		
1	455(12.0)	-2.97 ± 5.61			-2.88 ± 7.12			-2.26 ± 4.12		
2–3	1921(50.5)	-2.98 ± 5.37			-2.74 ± 6.93			-2.17 ± 3.94		
≥ 4	1211(31.8)	-3.08 ± 5.41			-2.75 ± 7.00			-2.19 ± 4.02		
Quarantine or not			1.593	0.207		2.158	0.142		3.245	0.072
Yes	432(11.4)	-2.67 ± 5.48			-2.24 ± 7.15			-1.84 ± 4.05		
No	3371(88.6)	-3.02 ± 5.44			-2.77 ± 7.00			-2.21 ± 4.00		
Confirmed infected in personal network			36.915	<0.001		28.420	<0.001		32.041	<0.001
Yes	718(18.9)	-1.87 ± 5.20			-1.46 ± 6.40			-1.41 ± 3.77		
No	3085(81.1)	-3.24 ± 5.47			-3.00 ± 7.13			-2.35 ± 4.04		
Level of attention			29.968	<0.001		11.985	<0.001		27.088	<0.001
Decreased	1503(39.5)	-3.77 ± 5.34			-3.23 ± 7.20			-2.72 ± 3.98		
Unchanged	1148(30.2)	-2.17 ± 4.85			-1.90 ± 6.21			-1.59 ± 3.53		
Increased	1152(30.3)	-2.76 ± 5.98			-2.83 ± 7.46			-2.04 ± 4.39		
Self-assessed infection risk			166.344	<0.001		102.190	<0.001		153.937	<0.001
Decreased	2738(72.0)	-3.92 ± 5.56			-3.69 ± 7.38			-2.84 ± 4.10		

Variable	N(%)	Anxiety	t/F	P	Depression	t/F	P	Stress	t/F	P
Unchanged	849(22.3)	-0.87 ± 4.08			-0.38 ± 5.07			-0.66 ± 3.04		
Increased	216(5.7)	0.65 ± 4.81			0.57 ± 5.72			0.38 ± 3.49		
Impact of the daily life			138.122	<0.001		141.736	<0.001		132.702	<0.001
Decreased	873(23.0)	-5.42 ± 6.14			-5.95 ± 8.38			-3.93 ± 4.52		
Unchanged	1701(44.7)	-2.73 ± 4.66			-2.27 ± 5.99			-1.99 ± 3.43		
Increased	1229(32.3)	-1.60 ± 5.36			-1.01 ± 6.51			-1.17 ± 3.96		
Self-perceived health status			44.227	<0.001		32.554	<0.001		36.854	<0.001
Good/Very good	3509(92.3)	-3.22 ± 5.40			-2.97 ± 7.01			-2.33 ± 4.00		
Average	272(7.2)	-0.22 ± 5.00			0.28 ± 6.08			-0.27 ± 3.56		
Poor/Very poor	22(0.5)	0.73 ± 7.19			1.95 ± 8.58			-0.14 ± 4.24		
Mental health help-seeking			34.648	<0.001		35.967	<0.001		32.557	<0.001
Found and tried	263(6.9)	-4.33 ± 5.80			-4.63 ± 7.97			-0.45 ± 1.92		
Found but not tried	79(2.1)	-2.91 ± 5.69			-1.43 ± 6.72			0.05 ± 1.71		
Not found yet	82(2.2)	0.13 ± 5.59			0.72 ± 6.76			1.05 ± 1.94		
Not looked for	1169(30.7)	-1.73 ± 5.21			-1.04 ± 6.52			0.44 ± 1.78		
No need to adjust	2210(59.1)	-3.60 ± 5.35			-3.54 ± 6.96			-0.22 ± 1.77		
Satisfaction with community work			29.250	<0.001		22.894	<0.001		29.421	<0.001
Satisfied	3140(82.6)	-3.29 ± 5.50			-3.06 ± 7.15			-2.40 ± 4.04		
General	441(11.6)	-1.62 ± 4.87			-1.13 ± 6.02			-1.20 ± 3.71		
Dissatisfied	222(5.8)	-1.33 ± 5.09			-0.89 ± 6.27			-0.90 ± 3.58		

Univariate analysis showed that participants with different place of living, usual residence, monthly income, and whether there were diagnosed patients in the relationship network had significant differences in the scores of anxiety, depression and stress (Table 1). In addition, the differences in the six indicators of self-perception factors, that is, level of attention, self-assessed infection risk, impact of the daily life, self-perceived health status, mental health help-seeking and satisfaction with community work, also had significant differences in the scores of the three psychological conditions.

The assumptions for linear regression were met for our data. Linearity, homoscedasticity and normal distribution of residuals were validated in the models. The VIFs were less than 10, indicating multicollinearity was not observed in the models.

Multivariable analyses were then performed to identify these variables with a significantly independent impact on the changes in psychological status (Table 2). The scores of anxiety, depression, and stress were dependent variables and independent variables of the models were age (≥ 50 as reference), gender (male as reference), place of living (urban as reference), usual residence (other areas in China as reference), education (middle school or below as reference), marital status (single as reference), occupation (medical staff as reference), monthly income (< 2,000 yuan as reference), number of cohabitants (0 as reference), quarantine or not (yes as reference), confirmed infected in personal network (yes as reference), level of attention (increased as reference), self-assessed infection risk (increased as reference), mental health help-seeking (not found yet as reference) and satisfaction with community work (dissatisfied as reference).

Table 2
Multivariate regression model for factors associated with anxiety, depression, and stress

Variables	Categories	Anxiety	Depression	Stress
Gender	Male	Reference	Reference	Reference
	Female	-0.10(-0.44 to 0.25)	-0.10(-0.56 to 0.35)	-0.07(-0.32 to 0.19)
Age	≥ 50	Reference	Reference	Reference
	<30	0.39(-0.33 to 1.11)	0.48(-0.46 to 1.43)	0.45(-0.08 to 0.99)
	30–49	0.01(-0.45 to 0.46)	-0.06(-0.65 to 0.53)	0.14(-0.20 to 0.47)
Place of living	Urban	Reference	Reference	Reference
	Rural	-1.27*(-1.71 to -0.82)	-1.47* (-2.06 to -0.88)	-0.79*(-1.13 to -0.46)
Usual residence	Other provinces and cities	Reference	Reference	Reference
	Wuhan, Hubei	0.63* (0.20 to 1.06)	0.34(-0.22 to 0.90)	0.51* (0.20 to 0.83)
	Other cities in Hubei	0.58* (0.13 to 1.03)	0.43(-0.17 to 1.02)	0.39* (0.05 to 0.72)
Education	Middle school or below	Reference	Reference	Reference
	High school	-1.01* (-1.99 to -0.03)	-1.21(-2.50 to 0.07)	-0.60(-1.33 to 0.12)
	College	-1.38* (-2.30 to -0.45)	-1.90* (-3.12 to -0.69)	-1.03* (-1.71 to -0.34)
	Master degree and above	-1.13* (-2.14 to -0.13)	-1.68* (-2.99 to -0.37)	-0.82* (-1.56 to -0.08)
Marital status	Single	Reference	Reference	Reference
	Married	-0.67* (-1.30 to -0.05)	-1.14* (-1.96 to -0.33)	-0.47* (-0.93 to 0.00)
	Divorced/Other	-0.41(-1.38 to 0.56)	-0.88(-2.14 to 0.39)	-0.36(-1.08 to 0.35)
Occupation	Medical staff	Reference	Reference	Reference
	Non-medical staff	-0.25(-0.65 to 0.15)	-0.51(-1.03 to 0.02)	-0.24(-0.53 to 0.05)
Monthly income(Yuan)	<2000	Reference	Reference	Reference
	2000–5000	0.29(-0.26 to 0.84)	0.66(-0.06 to 1.38)	0.21(-0.20 to 0.61)
	5001–10000	0.27(-0.33 to 0.86)	0.56(-0.22 to 1.34)	0.30(-0.14 to 0.74)
	>10000	0.73* (0.08 to 1.38)	1.45* (0.60 to 2.30)	0.65* (0.17 to 1.13)
Number of cohabitants	0	Reference	Reference	Reference
	1	-0.23(-1.05 to 0.59)	-0.84(-1.91 to 0.23)	-0.15(-0.76 to 0.45)
	2 ~ 3	0.01(-0.72 to 0.74)	-0.34(-1.30 to 0.61)	0.11(-0.43 to 0.65)
	≥ 4	0.12(-0.64 to 0.88)	-0.11(-1.11 to 0.88)	0.20(-0.37 to 0.76)
Quarantine or not	Yes	Reference	Reference	Reference
	No	0.30(-0.21 to 0.81)	0.43(-0.23 to 1.10)	0.32(-0.05 to 0.70)
Confirmed infected in personal network	Yes	Reference	Reference	Reference

Variables	Categories	Anxiety	Depression	Stress
Level of attention	No	-0.32(-0.79 to 0.14)	-0.52(-1.13 to 0.09)	-0.18(-0.52 to 0.16)
	Increased	Reference	Reference	Reference
	Reduced	-0.95* (-1.35 to -0.54)	-0.39(-0.92 to 0.15)	-0.67* (-0.97 to -0.36)
Self-assessed infection risk	Unchanged	0.24(-0.19 to 0.67)	0.53(-0.02 to 1.09)	0.19(-0.13 to 0.50)
	Increased	Reference	Reference	Reference
	Reduced	-3.47* (-4.18 to -2.76)	-2.88* (-3.81 to -1.95)	-2.44* (-2.96 to -1.91)
Impact of the daily life	Unchanged	-1.17* (-1.93 to -0.42)	-0.60(-1.59 to 0.40)	-0.81* (-1.37 to -0.25)
	Increased	Reference	Reference	Reference
	Reduced	-2.86* (-3.32 to -2.41)	-4.06* (-4.66 to -3.47)	-2.10* (-2.43 to -1.76)
Mental health help-seeking	Unchanged	-0.81* (-1.19 to -0.43)	-1.02* (-1.52 to -0.52)	-0.60* (-0.89 to -0.32)
	Not found yet	Reference	Reference	Reference
	Found and tried	-3.29* (-4.53 to -2.05)	-4.05* (-5.68 to -2.42)	-2.22* (-3.14 to -1.29)
	Found but not tried	-2.22* (-3.76 to -0.67)	-1.09(-3.12 to 0.93)	-1.55* (-2.69 to -0.40)
	Not looked for	-1.34* (-2.47 to -0.22)	-1.18(-2.65 to 0.29)	-0.79(-1.62 to 0.04)
Satisfaction with community work	No need to adjust	-2.60* (-3.71 to -1.50)	-3.02* (-4.47 to -1.57)	-1.71* (-2.53 to -0.89)
	Dissatisfied	Reference	Reference	Reference
	satisfied	-0.40(-1.10 to 0.31)	-0.48(-1.40 to 0.44)	-0.39(-0.91 to 0.13)
general	general	0.18(-0.64 to 0.99)	0.12(-0.94 to 1.18)	0.01(-0.59 to 0.61)

People living in cities had more negative emotions than people in rural areas. The anxiety ($B=-1.27$, 95%CI=-1.71 to -0.82), depression ($B=-1.47$, 95%CI=-2.06 to -0.88), and stress ($B=-0.79$, 95%CI=-1.13 to -0.46) scores of people in rural areas are lower than those in urban areas. Besides, the mental state of people in Hubei Province is not as good as those in other parts of China. Compared with people living in Hubei Province, people in other parts of China have lower anxiety and stress scores. Compared to people with middle school education and below, the mental health status of people with high education is better. Married persons had lower anxiety, depression, and stress scores than single persons, that is, their mental health was relatively better. People with monthly incomes above 10,000 have higher anxiety, depression, and stress scores than those with monthly incomes below 2,000. The scores of anxiety and stress increased as the frequency of attention to the epidemic increased. Anxiety, depression, and stress were higher among those who thought they had an increased risk of contracting COVID-19 in recent days and those who believed that the epidemic's impact on their lives had increased. Taking people who had sought mental health help but not yet as a reference, people who had tried to adjust their mental state in some way and those who thought they did not need to adjust their mental state had lower scores of anxiety, depression, and stress. In addition, people who had received psychological help but had not yet tried had lower anxiety and stress scores. Gender, age, occupation, confirmed infected in personal network and satisfaction with community work appeared not to be significant correlates of the anxiety, depression, stress scores.

4. Discussion

Since COVID-19 outbreak sparked a global public health crisis by spreading across China and other countries, various mandatory precautions have been taken by governments and individuals[15]. To the best of our knowledge, the present investigation is the first

study to characterize people's psychological status in anxiety, depression and stress one month after the Wuhan lockdown, when the government's initiatives have achieved initial success. Studying the residents' psychological conditions at this time point can reflect the effectiveness of the anti-epidemic work of the government, communities and all walks of life from the side.

In multivariable analyses, we found that urban residents were more likely to gain anxiety, depression and stress than rural counterparts. In densely populated urban areas, well-planned efficient public transportation systems can facilitate residents' travel[16]. The disruption of daily life and absence of entertainment or recreation made it impossible to release the excess inner pressure of urban residents. A more important reason is that due to the high density of urban population and the greater mobility of people than rural areas, the risk of disease infection is greater. High population density increases people's exposure to infectious diseases[17], which may lead to increased negative emotions among urban residents. People living in Hubei province reported significantly higher anxiety and stress scores, perhaps because of Hubei in the center of the epidemic. Higher educated participants possibly have a better understanding of the epidemic and look for appropriate care for their condition, which might lead to lower levels of negative emotions and better coping strategies. People who were married reported greater mental health status, this might partly be attributable to the fact that married people can share the burden of negative emotions and obtain psychological support from their families[18, 19], indicating that family support is of great importance. It is well documented that low-income groups are more likely to suffer from depression and anxiety[20, 21]. However, our study showed that the epidemic had a greater impact on high-income groups, people with monthly incomes above 10,000 have higher anxiety, depression, and stress scores than those with monthly incomes below 2,000, their concerns about delays in working hours and subsequent deprivation of expected income may explain the high level of stress[22].

Another noteworthy finding of this study is that the subjective indicators of changes in daily life played an important role in the scores of people's anxiety, depression and stress. Our study found the greater the level of attention to COVID-19, the greater the negative emotions, which is in agreement with previous research[23]. In addition to the Wuhan lockdown, relevant actions including the urgent establishment of two quarantine hospitals (Huoshenshan Hospital and Leishenshan Hospital) within a 10-day span in response to the outbreak[24, 25]. Other protective measures have been enacted such as building a series of cabin hospital to receive people who have tested positive for the coronavirus but show no severe symptoms[26].Our investigation was carried out in mid-February, and there was no sign of improvement at the time. During this period, domestic and foreign media rush to report on the incident. Since people cannot differentiate true and false news, the more attention to COVID-19, the more unclear information may be received, which negatively affects respondents' psychological status. Therefore, the content of health information provided during the epidemic needs to be based on evidence to avoid adverse psychological reactions.

Our findings also revealed that the level of self-assessed infection risk also influenced participants' mental state. Anxiety, depression and stress outcomes were elevated with the increase of self-assessed infection risk. It may be resulted from actual conditions, respondents received signals from the surrounding environment and is supposed to make corresponding assessment of their risk of infection. The respondents who felt severely affected by the lockdown exhibited more obvious anxiety, depression, and stress than the rest of them. The respondents who were seriously affected by the quarantine exhibited more obvious anxiety, depression and stress than the rest of them. This gives an indication that guarantee day to day lives for the residents will be beneficial for mental health[27].

In addition, people who had tried to adjust their mental state in some way and those who thought they did not need to adjust their mental state had lower scores of anxiety, depression, and stress. And people who had received psychological help but had not yet tried had lower anxiety and stress scores. It reflected from the side that when one finds a problem with one's mental state, actively seeking a solution can effectively relieve negative emotions. During the COVID-19 epidemic, online mental health services have become the mainstream way of mental health services, including online cognitive behavioral therapy for depression, anxiety, and insomnia (e.g., on WeChat)[28]. So, for people with psychological problems, it is also a good choice to seek help from professionals on the Internet.

This study not only a supplementary of the psychological status of residents during the lockdown period, but also helps to better understand which group of people are more likely to produce negative emotions when the disease is epidemic, which makes a lot of sense to China and other countries.

5. Limitations

There are some limitations to the study. On the one hand, during the process of data collection, sources of bias include potential selection bias of respondents, as respondents were asked if they were willing to participate in the survey, resulting in volunteer bias

and may not be truly representative of the general population. On the other hand, although we have sufficient respondents, the sampling method may have non-response bias by two surveys[29].

6. Conclusion

In conclusion, the life and psychological state of the urban population had produced negative changes after the Wuhan shutdown in 23 Jan. Usual residence, education, marital status, monthly income, the level of attention, self-assessed infection risk, impact of the daily life and mental-health help-seeking are important correlates of the scores of anxiety, depression, and stress. At present, China has achieved great success in the fight against epidemics, but the epidemic situation in some parts of the world has not improved. Most residents are still in a state of quarantine at home. Awareness of these relevant factors could help the government and related personnel to prevent more severe psychological trauma in the later period.

Declarations

Ethics approval and consent to participate

The project was conducted through an online survey and we obtained the informed consent of the participants before doing the survey. Due to the epidemic situation, we cannot return to school for the time being. The statement of the Ethics Committee will be added after returning to school.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Author's contributions

Q.C. conceptualized and designed the study, coordinated and supervised the project, drafted the initial manuscript, and approved the final manuscript as submitted. M.L. and L.Z. designed the self-administration questionnaire. Q.C. contributed to data cleaning and the statistical analysis. L.R. and X.C. contributed to critical revision of the manuscript. Q.C. have full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. X.T. was the corresponding author of the study. All authors actively contributed to the final manuscript and agreed to be accountable for all aspects of the work.

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