

## Preplanned Studies

## Cross-Sectional Online Survey on Depression and Anxiety Among the Population Infected or Non-Infected with COVID-19 — China, December 2022

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### Summary

#### What is already known about this topic?

The psychological impact of the large-scale infection of the population resulting from the end of lockdown measures in China during the coronavirus disease 2019 (COVID-19) pandemic is unknown.

#### What is added by this report?

Among all participants, 55.7% had depression symptoms, with a significant difference between the infected and non-infected groups, and 30.1% had anxiety. Those who were young, unvaccinated, had lower incomes, and experienced chronic diseases were more likely to experience negative emotions.

#### What are the implications for public health practice?

Government officials should take into account the effect of policies on public sentiment during similar public health events and implement tailored community interventions to address any negative sentiment.

Coronavirus disease 2019 (COVID-19) is a global epidemic of infectious diseases. As of February 26, 2023, the World Health Organization (WHO) had reported 757,264,511 confirmed cases of COVID-19 (1). To prevent the spread of coronavirus, the Chinese government implemented the most stringent anti-COVID regimes in the world, known as the “zero-COVID” policy. This policy included strict and targeted lockdowns, mass testing, isolation or quarantine, and other measures. On December 7, 2022, the Chinese government announced the end of the policy, which came rapidly and unexpectedly, causing panic among the population due to fear of infection and shortages of medicine supplies. Therefore, it is necessary to understand the mental health status of Chinese residents after the policy adjustment. Assessing the impact of the pandemic on people’s mental health has been identified as a public

health research priority. Previous research has indicated that the COVID-19 epidemic has caused a rapid increase in the prevalence of anxiety and depression symptoms among the general population in China (2). However, there is limited research on people’s mental health after China released new COVID-19 rules. This study aimed to analyze the short-term depression and anxiety symptoms of the infected and non-infected populations after the abolition of strict pandemic control measures in China. This could provide evidence and suggestions for how to improve people’s mental health in the post-pandemic era.

From December 21–28, 2022, a cross-sectional online survey was conducted to investigate the symptoms of depression and anxiety among smartphone users. Convenience sampling strategies were used to recruit participants, who were electronically invited via WeChat, a Chinese social media APP. To increase the sample size, the link to the electronic questionnaire was shared to WeChat groups and Moments. Inclusion criteria: 1) Willing to participate in the study; 2) Living in Chinese mainland; 3) Able to use smartphones; 4) Knowing if he/she was infected. Exclusion criteria: 1) Participants with previously diagnosed mood disorders; 2) Incapable of completing the electronic questionnaire or unable to understand the questionnaire due to cognitive impairment or other diseases. Mature scales were used to investigate the psychological state, and data was cleaned according to the inclusion criteria and filling time (less than 120 seconds were excluded), and some data with logical errors were also excluded. A total of 5,310 electronic questionnaires were collected. According to the above criteria, 150 questionnaires were excluded, among which, 9 questionnaires had logical errors, 130 respondents were not sure whether they were infected with COVID-19, and 11 did not live in Chinese mainland. Finally, 5,160 (97.2% effective rate) valid questionnaires were included in this study. The questionnaire was composed of two parts.

The first part collected sociodemographic information, such as gender, age, education level, marital status, employment status, average monthly personal income, and residence area. Participants were also asked to report whether they had chronic diseases before COVID-19 infection, how many injections of vaccinations they had completed at most, and whether they were infected. The second part focused on evaluating the depression and anxiety status of respondents over the past two weeks using the Patient Health Questionnaire-9 (PHQ-9) and the General Anxiety Disorder-7 (GAD-7). PHQ-9 presented respondents with 9 statements, each with a four-point scale and the total score ranged from 0 to 27. The total score of PHQ-9 was divided into 5 scales: 0–4, 5–9, 10–14, 15–19, and 20–27, corresponding to none, mild, moderate, moderately severe, and severe depression symptoms, respectively. Considering the small number of respondents in the latter two scales, this study combined them into moderately severe and above depression. GAD-7 had 7 items, and each was scored 0–3 points from “Not at all” (0 points) to “Nearly every day” (3 points). According to the total score of GAD-7, anxiety symptoms were grouped into four categories. A score of 0–4 represented no anxiety, 5–9 mild anxiety, 10–14 moderate anxiety and scores greater than 14 indicated possibly severe anxiety. The Chinese versions of these scales have been demonstrated to have good reliability and validity (3–4). In this study, the Cronbach’s alpha of PHQ-9 and GAD-7 were 0.899 and 0.944, respectively, indicating great internal validity. Continuous variables were summarized as mean±standard deviation or median (interquartile range). Categorical data were reported as *n* (%) and compared with Pearson’s Chi-square test or Fisher’s exact test. Ordinal logistic regression was used to assess the relationships between anxiety and depression symptoms and explanatory variables. PHQ-9 and GAD-7 scores were used as four-category dependent variables, and demographic information was used as independent variables. Odds ratios (ORs) and 95% confidence intervals (CIs) of independent variables were reported. All statistical analyses were performed using Stata statistical software (Version 15.0, StataCorp LLC, Lakeway Drive, College Station, Texas, USA). *P*-values <0.05 were considered statistically significant.

A total of 5,160 valid questionnaires were included in this study, of which 1,153 (22.3%) reported not being infected and 4,007 (77.7%) reported being infected. Of all participants, 1,536 (29.8%) were male

and 3,624 (70.2%) were female. Most participants had an associate/bachelor degree or higher (83.8%). More than half of the participants were married (72.1%), employed (65.8%), had no history of chronic disease (83.1%), and had completed three doses of vaccination (80.8%), as shown in Table 1.

The mean PHQ-9 and GAD-7 scores were 6.1±5.3 and 3.1±3.9, respectively. The median scores of PHQ-9 and GAD-7 were 5 (2 to 9) and 2 (0 to 5), respectively. As shown in Table 2, 2,872 (55.7%) participants may have had depression symptoms and approximately one-third (30.1%) may have had anxiety symptoms. The Chi-square test revealed a significant difference in depression ( $P<0.001$ ) between infected and non-infected participants, but no difference in anxiety ( $P=0.066$ ) was observed.

The results of Chi-square test or Fisher’s exact test of different factors of depression and anxiety symptoms among participants revealed that most factors were statistically significant in predicting the risk of depression and anxiety ( $P<0.05$ ). Results of ordinal logistic regression of PHQ-9 showed that gender ( $OR=1.150$ , 95% *CI*: 1.023–1.293) was a risk factor for depressive symptoms. Age over 50 ( $OR<1$ ), being married ( $OR=0.748$ , 95% *CI*: 0.602–0.931), having a personal monthly income of more than 5,000 RMB ( $OR<1$ ), no history of chronic diseases ( $OR=0.740$ , 95% *CI*: 0.632–0.865), completion of four doses of vaccinations ( $OR=0.562$ , 95% *CI*: 0.392–0.806), and not being infected ( $OR=0.543$ , 95% *CI*: 0.476–0.619) were protective factors for depression, as shown in Table 3, which also displays the effect of variables on GAD-7 scores by ordinal logistic regression. Participants aged 50 or over were less likely to experience anxiety symptoms compared to those under 30 ( $OR<1$ ). Student status ( $OR=0.653$ , 95% *CI*: 0.477–0.895), having a monthly personal income of more than 5,000 CNY ( $OR<1$ ), having no history of chronic disease ( $OR=0.594$ , 95% *CI*: 0.497–0.711), and having completed four doses of vaccinations ( $OR=0.561$ , 95% *CI*: 0.371–0.848) were protective factors for anxiety.

## DISCUSSION

This study examined the prevalence of anxiety and depression among participants in China following changes to epidemic prevention and control policies during the ongoing COVID-19 pandemic. Results indicate that mental health is significantly impacted by the pandemic, and it is important to remain mindful of

TABLE 1. Demographic characteristics of participants (n=5,160).

Characteristic	Self-reported not infected (n=1,153)		Self-reported infected (n=4,007)		$\chi^2$	P-value
	No. of participants	Percentage (%)	No. of participants	Percentage (%)		
Gender					11.197	0.001
Male	389	33.7	1,147	28.6		
Female	764	66.3	2,860	71.4		
Age (years)					69.625	<0.001
<30	296	25.7	837	20.9		
30–39	170	14.7	934	23.3		
40–49	284	24.6	1,172	29.2		
50–59	260	22.5	708	17.7		
≥60	143	12.4	356	8.9		
Education level					47.819	<0.001
High school education or lower	250	21.7	586	14.6		
Associate/bachelor degree	644	55.9	2,199	54.9		
Graduate degree	259	22.5	1,222	30.5		
Marital status					22.078	<0.001
Single	303	26.3	881	22.0		
Married	772	67.0	2,947	73.5		
Others*	78	6.8	179	4.5		
Employment status					75.049	<0.001
Employed	639	55.4	2,758	68.8		
Retired	209	18.1	505	12.6		
Students	221	19.2	499	12.5		
Others	84	7.3	245	6.1		
Monthly personal income (CNY <sup>†</sup> )					94.531	<0.001
<3,000	362	31.4	810	20.2		
3,000–5,000	228	19.8	697	17.4		
5,000–10,000	296	25.7	1,076	26.9		
10,000–15,000	152	13.2	797	19.9		
>15,000	115	10.0	627	15.6		
Residence area					42.274	<0.001
Urban	992	86.0	3,698	92.3		
Rural	161	14.0	309	7.7		
Region					10.346	0.006
East	841	72.9	3,088	77.1		
Central	127	11.0	335	8.4		
Western	185	16.0	584	14.6		
History of physical illness					0.250	0.617
Chronic disease	200	17.3	670	16.7		
Healthy	953	82.7	3,337	83.3		
Vaccination					8.909	0.063
0	46	4.0	167	4.2		
1	11	1.0	32	0.8		
2	100	8.7	386	9.6		
3	922	80.0	3,246	81.0		
4	74	6.4	176	4.4		

\* Other marital statuses include divorced, widowed, cohabiting, and remarried.

<sup>†</sup> 10,000 Chinese Yuan≈1,476 US dollars in 2023.

TABLE 2. Symptoms of depression and anxiety among participants.

Symptoms	Self-reported not infected		Self-reported infected		$\chi^2$	P-value
	No. of participants	Percentage (%)	No. of participants	Percentage (%)		
PHQ-9					99.398	<0.001
Normal	660	57.2	1,638	40.9		
Mild depression	322	28.0	1,520	37.9		
Moderate depression	111	9.6	494	12.3		
Moderately severe and above depression	60	5.2	355	8.9		
GAD-7					7.176	0.066
Normal	799	69.3	2810	70.1		
Mild anxiety	285	24.7	888	22.2		
Moderate anxiety	52	4.5	214	5.3		
Severe anxiety	17	1.5	95	2.4		

Abbreviation: PHQ-9=patient health questionnaire-9; GAD-7=generalized anxiety disorder-7.

the mental health of vulnerable populations, both those infected and those who remain uninfected, as the pandemic continues.

Compared to existing studies conducted when “zero-COVID” policy was implemented, the percentages of participants with depression and anxiety were slightly higher in this study (5). Many people were unprepared for the sudden change in the epidemic prevention and control policy, leading to worries about infection, virus mutation, and re-outbreak of COVID-19, which resulted in negative emotions for many. Compared to Australia (6), the percentages of respondents with depression in this study were slightly higher, while anxiety was lower. The mean score of PHQ-9 was close to the scores of four European countries, and the mean score of GAD-7 was lower than those countries (7). Consistent with the findings of Lei et al. (8), we found that participants infected with COVID-19 had significantly more depressive symptoms than the uninfected. However, a large portion of the uninfected also experienced depression symptoms.

As for influential factors of mental health, we found that respondents who were older, had higher incomes, had no history of chronic diseases, and had completed vaccinations experienced fewer symptoms of depression and anxiety. Older adults were less likely to experience symptoms of depression and anxiety compared to younger adults, which is consistent with findings from an Australian survey and a global online survey that showed younger people were more prone to stress, depression, and anxiety (9). This may be related to the fact that the elderly were better able to cope with stress and worried less about working and financial burdens. Higher incomes corresponded to higher anti-risk

ability and the possibility of obtaining better medical resources, so participants with higher incomes were less likely to have psychological problems (10). People with chronic diseases were more susceptible to infection and mental illness, so attention should be paid to the health management of chronic disease patients. It is recognized that COVID-19 vaccines can effectively reduce the risk of infection, so older adults who may face a higher risk of complications from vaccine-preventable diseases should stay up to date on recommended vaccines. Valentina et al. (11) found that women suffered the worst short and long-term psychological problems, which was also supported by this study. Therefore, it is imperative to consider the effects of the pandemic on women’s mental health during the aftermath of COVID-19. Students were less likely to experience anxiety than employed people, which may be due to the heavy burden from work and family faced by workers.

This study has some limitations. The sample may not be representative of the broader population, as a large proportion of participants had received higher education and were employed. Additionally, since this was a cross-sectional study, it is not possible to determine the effect of epidemic prevention and control policy adjustments on people’s psychological health over time. Therefore, further longitudinal studies are needed to examine the long-term effect of the pandemic on mental health.

Following the conclusion of China’s “zero-COVID” policy, individuals continued to experience significant symptoms of depression and anxiety. Those who were young, female, unvaccinated, had low incomes, and had a history of chronic illnesses were more likely to

TABLE 3. Ordinal logistic regression of the patient health questionnaire-9 (PHQ-9) and the generalized anxiety disorder-7 (GAD-7) scales.

Variables	PHQ-9		GAD-7	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Gender				
Male	1.00 (Ref)		1.00 (Ref)	
Female	1.150 (1.023, 1.293)	0.019	1.029 (0.898, 1.178)	0.684
Age (years)				
<30	1.00 (Ref)		1.00 (Ref)	
30–39	0.972 (0.765, 1.236)	0.820	1.259 (0.963, 1.648)	0.093
40–49	0.792 (0.617, 1.018)	0.068	0.867 (0.652, 1.152)	0.324
50–59	0.563 (0.427, 0.743)	<0.001	0.568 (0.412, 0.785)	0.001
≥60	0.590 (0.408, 0.855)	0.005	0.617 (0.400, 0.952)	0.029
Education level				
High school education or lower	1.00 (Ref)		1.00 (Ref)	
Associate/bachelor degree	1.027 (0.858, 1.230)	0.769	1.064 (0.867, 1.306)	0.552
Graduate degree	1.079 (0.870, 1.338)	0.488	1.046 (0.818, 1.338)	0.720
Marital status				
Single	1.00 (Ref)		1.00 (Ref)	
Married	0.748 (0.602, 0.931)	0.769	0.827 (0.647, 1.058)	0.131
Other	0.957 (0.695, 1.318)	0.488	1.017 (0.710, 1.458)	0.925
Employment status				
Employed	1.00 (Ref)		1.00 (Ref)	
Retired	0.814 (0.631, 1.050)	0.113	0.825 (0.606, 1.123)	0.221
Students	0.784 (0.591, 1.039)	0.090	0.653 (0.477, 0.895)	0.008
Others	1.008 (0.788, 1.289)	0.951	1.009 (0.768, 1.325)	0.947
Monthly personal income (CNY)				
<3,000	1.00 (Ref)		1.00 (Ref)	
3,000–5,000	0.819 (0.661, 1.015)	0.069	0.791 (0.622, 1.006)	0.056
5,000–10,000	0.740 (0.589, 0.931)	0.010	0.671 (0.519, 0.867)	0.002
10,000–15,000	0.677 (0.526, 0.872)	0.003	0.571 (0.429, 0.760)	<0.001
>15,000	0.636 (0.484, 0.835)	0.001	0.488 (0.356, 0.668)	<0.001
Residence area				
Urban	1.00 (Ref)		1.00 (Ref)	
Rural	0.877 (0.721, 1.065)	0.185	0.914 (0.733, 1.140)	0.427
Region				
East	1.00 (Ref)		1.00 (Ref)	
Central	0.960 (0.795, 1.160)	0.674	0.996 (0.802, 1.236)	0.969
Western	1.105 (0.952, 1.282)	0.188	1.126 (0.953, 1.331)	0.164
History of physical illness				
Chronic disease	1.00 (Ref)		1.00 (Ref)	
Healthy	0.740 (0.632, 0.865)	<0.001	0.594 (0.497, 0.711)	<0.001
Vaccination				
0	1.00 (Ref)		1.00 (Ref)	
1	1.149 (0.615, 2.146)	0.663	0.951 (0.477, 1.895)	0.887
2	0.982 (0.720, 1.339)	0.908	0.906 (0.642, 1.278)	0.573
3	0.911 (0.696, 1.191)	0.494	0.802 (0.597, 1.079)	0.145
4	0.562 (0.392, 0.806)	0.002	0.561 (0.371, 0.848)	0.006
Infection				
Infected	1.00 (Ref)		1.00 (Ref)	
Not infected	0.543 (0.476, 0.619)	<0.001	1.030 (0.891, 1.191)	0.688

Abbreviation: OR=odds ratio; CI=confidence interval; CNY=Chinese Yuan.

experience mood disorders. To protect the mental health of these vulnerable populations and promote health equity, sustainable, effective, and tailored community interventions should be implemented in the future to address these issues.

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