

## RESEARCH ARTICLE

# Anxiety during the COVID-19 pandemic in prisoners who had high risks to suffer from mood disorders: A longitudinal study before and during the COVID-19

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**Abstract**

We compared the anxiety levels in prisoners before and after the COVID-19 outbreak and analyzed the causes of the changes in anxiety. The first survey was conducted in October 2019 (T0), and the second was conducted in March 2020 (T1). Generalized anxiety disorder-7 (GAD-7), Patient Health Questionnaire-9, and Insomnia Severity Index scales were selected to assess the quality of emotion and sleep among prisoners ( $N = 803$ ). Three subjective questions were asked to evaluate prisoners' personal feelings on the COVID-19. Paired Samples *T*-test, Binary, and Multivariate Logistic Stepwise Regression were used to analyze the data. GAD-7 scores decreased at T1 ( $p < 0.001$ ). For the prisoners without anxiety at T0 ( $n = 480$ ), GAD-7's mean value at T1 raised ( $p < 0.001$ ), whereas the mean value decreased ( $p < 0.001$ ) for the prisoners with anxiety at T0 ( $n = 323$ ). For the prisoners without anxiety, shorter years of education (OR = 0.843), COVID-19 (OR = 4.936), severer depression at T1 (OR = 1.683), and severer insomnia at T1 (OR = 1.134) were associated with the new onset of anxiety. For the prisoners with anxiety, anxiety was alleviated in 71.2% and exacerbated in 10.5% at T1. For the alleviators, severer depression at T1 (OR = 0.667) and COVID-19 (OR = 0.258) were associated with anxiety unrelief; severer anxiety at T0 (OR = 1.343) was associated with anxiety alleviation. For the exacerbators, severer anxiety at T0 (OR = 0.517) was associated with anxiety unaggravation; severer depression at T1 (OR = 1.196), COVID-19 (OR = 22.882), and severer depression at T0 (OR = 1.181) were associated with anxiety exacerbation. At the outbreak of COVID-19, prisoners' anxiety was reduced. The main factor was the baseline anxiety levels. That may be related to prison management and the Downward Social Comparison.

**KEYWORDS**

anxiety, COVID-19, longitudinal, prisoners, the downward social comparison

## 1 | INTRODUCTION

The COVID-19 virus exploded in China at the end of 2019 and quickly spread throughout the world. People were stressed as the prevalence and mortality rates skyrocketed. Many people suffered from mental problems during the epidemic (Druss, 2020; Fu et al., 2020; Li et al., 2020). The fear caused by COVID-19, economic and work pressures, and lifestyle changes induced by the epidemic all contribute to people's anxiety (Li et al., 2020). According to a Chinese online survey, anxiety and depression among Chinese adults have risen to 20.4% from 4% (Li et al., 2020). A study in Wuhan showed that 27.5% of people were anxious during the COVID-19 (Fu et al., 2020). Additionally, some global studies also concluded that the prevalence of mental problems such as anxiety was higher than in the past (Hyland et al., 2020; Son et al., 2020).

The risks of mental problems are exacerbated in many countries by the closed-off management of citizens following the spread of COVID-19 transmission (Martínez-Lezaun et al., 2020; Wolf et al., 2021). Closed-off management limits people's entertainment and interpersonal interactions. Moreover, most people's lives lack regularity in a closed environment. Anxiety is exacerbated by disrupted sleep and eating patterns, and a lack of exercise (Werneck et al., 2020). Closed-off management is an effective and necessary measure to stop the spread of the pandemic, but it impacts people's mental health as well. Which has a more significant negative impact on mental health, COVID-19 or closed environments?

According to studies, patients suffering from anxiety reported that the COVID-19 exacerbated their symptoms (Asmundson et al., 2020; Somer et al., 2020). The study of prisoners indicated that they have a high prevalence of mental problems. A survey in Taiwan showed that the prevalence of mental problems among prisoners was around 11.31%, with anxiety, dissociative, and somatoform disorders being the most common (49.48%), with a much higher incidence than in the general population (Tung et al., 2019). It implies that COVID-19 may exacerbate prisoners' anxiety. However, prisoners are subjected to long periods of closure due to their status, so the closed environment has little effect. That gives us an opportunity to investigate which has a more significant negative impact, the closed-off management or COVID-19.

There have been no studies on the mental health of prisoners during the epidemic. We investigated prisoners' anxiety symptoms before and after the COVID-19 outbreak. The purpose was to assess the magnitude of the closed environment and COVID-19 on mental health and the mental changes in prisoners with a high prevalence of mental problems. Prison administration changed dramatically after the outbreak, and the mental changes of the prisoners can provide ideas for management during the epidemic.

## 2 | METHODS

### 2.1 | Participants and procedure

We conducted a questionnaire survey in October 2019 at Prison X to collect prisoners' basic information and the severity of anxiety,

depression, and insomnia. After the COVID-19 outbreak, we redesigned the questionnaire and conducted the survey again.

Participants are the prisoners in a male prison in China. We excluded the prisoners with severe mental illnesses (e.g., schizophrenia and mental retardation) and people who could not complete the questionnaire at the beginning of the research.

The first survey (baseline: T0) started before the COVID-19 from October 2019 to November 2019. We received 1605 (88.6%) valid questionnaires out of the total 1819 questionnaires. The second survey (follow-up: T1) started from March 2020 to April 2020. We received 1467 (93.2%) valid questionnaires out of the total 1574 questionnaires. Eight hundred and nineteen prisoners completed the two surveys, and 16 prisoners over 65 years old were excluded. The longitudinal cohort consisted of 803 prisoners.

The ethics committee approved the study (Ethics No: XYEFL-LKY-2020-23-2). All participants in the study signed a written informed consent form. We conducted a pre-experiment with 200 prisoners before the first survey to test the difficulty and reasonableness of the questionnaire for the prisoners. At the same time, eight researchers received mentoring language training. In addition, two independent researchers reviewed all of the questionnaires.

### 2.2 | Measures

#### 2.2.1 | Sociodemographic

We collected sociodemographic data in the first survey (T0). It includes demographics and the information about serving a sentence. Demographics include six items: gender, age, marriage (Unmarried; Married; Others: divorced and widowed), years of education, history of smoking, and history of alcohol. Information about serving a sentence includes two items: sentence length and time served (Short-term  $\leq 36$  months; Mid-term 36–120 months; Long-term  $> 120$  months).

#### 2.2.2 | Questionnaire

##### *Scales*

We used the Generalized Anxiety Disorder-7 (GAD-7), the Patient Health Questionnaire-9 (PHQ-9), and the Insomnia Severity Index (ISI) to evaluate the anxiety, depression, and sleep quality of the prisoners at T0 and T1.

There are seven items in the GAD-7, with total scores ranging from 0 to 21. There are four levels of anxiety in the score: minimum (0–4), mild (5–9), moderate (10–14), and severe (15–21). A score higher than 4 indicates anxiety. The GAD-7 had good factorial validity and reliability (Cronbach's alpha coefficient of 0.941). Furthermore, the validity of the GAD scale in assessing anxiety in Chinese has been confirmed (Wu et al., 2019).

The PHQ-9 has nine entries with a total score of 0–27. The Chinese version of the PHQ-9 has been standardized and corrected. It had satisfactory reliability (Cronbach's alpha coefficient of 0.939) and extensive sensitivity and specificity (Leung et al., 2020). Higher scale scores indicate severer depression.

The ISI scale has 7 entries with a total score of 0–28. The Cronbach's alpha coefficient of ISI is 0.947, and the validity in Chinese has been confirmed (Chiu et al., 2016). Higher scale scores mean severer insomnia.

#### COVID-19-related questions

In order to better understand how prisoners learn about COVID-19 and their subjective feelings, we included three questions in the second survey (T1): (a) Did you learn about COVID-19 from television news? Did you try to learn more about the COVID-19 in other ways? (b) Are you concerned about infecting yourself or family members with the disease? (c) Do you experience any anxiety symptoms like nervousness, fidgeting, or restlessness? Prisoners who answered 'yes' to the last two questions will be considered anxious by COVID-19.

### 2.2.3 | Prison management

The prison was managed as follows during COVID-19: (a) One hour of outdoor exercise staggered in the morning and afternoon; (b) One hour of CCTV news every night; (c) The rest of the time was spent indoors (reading, playing chess, watching TV, etc.); (d) Once-a-week study sessions (including COVID-19 related information).

The prisoners followed a strict schedule from 6 AM to 10 PM. During COVID-19, the prison suspended work (sewing clothes).

### 2.3 | Statistical analysis

Descriptive statistics (frequencies, means, standard deviations) were used to evaluate the characteristics of the sample. Paired Sample *T*-test was applied to analyze the changes in anxiety, depression, and insomnia between the first and the second survey. Binary Logistic Stepwise Regression and Multivariate Logistic Stepwise Regression were used to analyze the correlations between anxiety and a range of independent variables (e.g., age, marriage, years of education, smoking history, drinking history, sentence length, time served, the scores of GAD-7, PHQ-9, ISI at T0, and the scores of PHQ-9, ISI at T1). All data were analyzed using SPSS Version 21.0.  $p < 0.05$  was considered statistically significant.

## 3 | RESULTS

### 3.1 | Sociodemographic

All participants in this study were male. The age range was 18–65 years, with a mean age of 40.2 years. Years of education ranged from 1 to 19 years. Most participants had an elementary school education or higher (66.3,  $n = 532$ ), while only 8.8% ( $n = 71$ ) had a high school education. Sentence length ranged from 3 to 418 months. There were 13.0% ( $n = 104$ ) short-term sentences, 53.7% ( $n = 431$ )

mid-term sentences, and 33.4% ( $n = 268$ ) long-term sentences (Table 1).

### 3.2 | Anxiety changes between T0 and T1

The mean values of the GAD-7 at T1 were significantly lower than the levels of T0 ( $p < 0.001$ ). The prisoners were separated into four groups based on their GAD-7 scores at T0, and the Chi-square test revealed no significant differences in the socio-demographic characteristics of the four groups. The paired samples *t*-test found that the mean value of GAD-7 at T1 raised ( $p < 0.001$ ) for the prisoners without anxiety at T0, whereas the mean value decreased ( $p < 0.001$ ) for the prisoners with anxiety at T0 (Table 2).

Figure 1 shows the distribution of the anxiety severity among prisoners at T0 and T1.

Of the 803 prisoners, 28.6% of their anxiety alleviates, and 15.9% exacerbates. For the prisoners without anxiety at T0 ( $n = 480$ ), the prevalence of anxiety was 19.6% at T1. For the prisoners with anxiety at T0 ( $n = 323$ ), anxiety was alleviated in 71.2% and exacerbated in 10.5% at T1.

TABLE 1 Sociodemographic characteristics of the prisoners

	$\bar{x} \pm s$	<i>n</i>	%
Age	40.2 ± 10.6		
18–35 years		314	39.2
35–50 years		334	41.6
50–65 years		155	19.2
Marriage			
Unmarried		180	22.4
Married		462	57.5
Other (divorced and widowed)		161	20.0
Years of education	8.2 ± 3.4		
1–6 years		271	33.7
7–9 years		333	41.5
10–12 years		128	15.9
>12 years		71	8.8
Sentence length			
Short-term (≤36 months)		104	13.0
Mid-term (36–120 months)		431	53.7
Long-term (>120 months)		268	33.4
Time served	46.6 ± 33.0		
≤12 months		90	11.2
12–36 months		301	37.5
36–60 months		191	23.8
>60 months		221	27.5

TABLE 2 Changes in the anxiety of prisoners with different anxiety levels at T0

	T0 $\bar{X} \pm S$	T1 $\bar{X} \pm S$	Difference (T0-T1)	n	p	t	95% CI
All prisoners	4.481 $\pm$ 5.638	3.550 $\pm$ 4.982	0.930 $\pm$ 6.174	803	0.000	4.270	0.503 to 1.358
Groups							
No anxiety	0.685 $\pm$ 1.203	2.460 $\pm$ 3.923	-1.775 $\pm$ 4.090	480	0.000	-9.509	-2.142 to -1.408
Mild anxiety	6.718 $\pm$ 1.211	4.075 $\pm$ 4.850	2.644 $\pm$ 4.817	188	0.000	7.525	1.951 to 3.337
Moderate anxiety	11.630 $\pm$ 1.419	5.671 $\pm$ 6.009	5.959 $\pm$ 6.284	73	0.000	8.102	4.493 to 7.425
Severe anxiety	18.661 $\pm$ 2.326	7.903 $\pm$ 7.478	10.758 $\pm$ 7.550	62	0.000	11.219	8.841 to 12.675

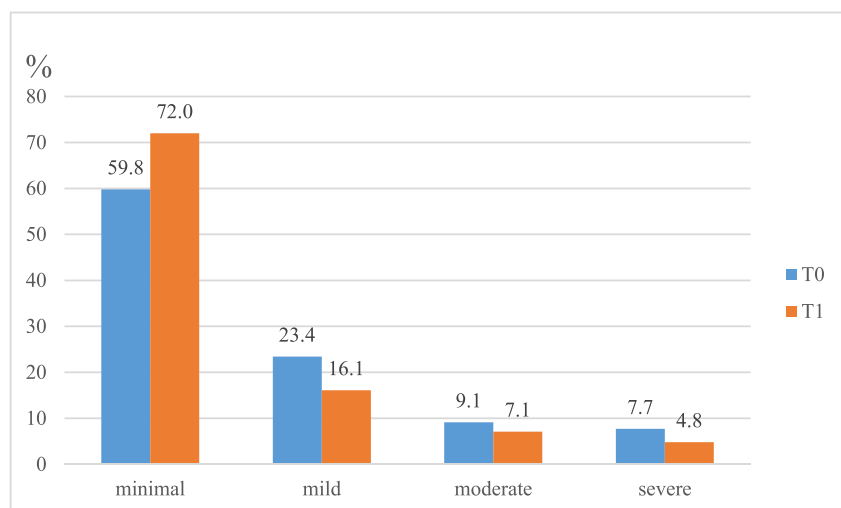


FIGURE 1 Anxiety severity at T0 and T1

### 3.3 | Influencing factors of the changes in anxiety among the prisoners without or with anxiety at T0

For the prisoners without anxiety, shorter years of education ( $\beta = -0.171$ , OR = 0.843,  $p < 0.01$ ), COVID-19 ( $\beta = 1.596$ , OR = 4.936,  $p < 0.001$ ), severer depression at T1 ( $\beta = 0.521$ , OR = 1.683,  $p < 0.001$ ), and severer insomnia at T1 ( $\beta = 0.125$ , OR = 1.134,  $p < 0.01$ ) were linked with the new onset of anxiety.

For the prisoners with anxiety, severer depression at T1 ( $\beta = -0.405$ , OR = 0.667,  $p < 0.001$ ) and COVID-19 ( $\beta = -1.353$ , OR = 0.258,  $p < 0.01$ ) were linked with anxiety unrelief. Severer anxiety at T0 ( $\beta = 0.295$ , OR = 1.343,  $p < 0.001$ ) was associated with anxiety alleviation.

Severer anxiety at T0 ( $\beta = -0.659$ , OR = 0.517,  $p < 0.001$ ) was linked with anxiety unaggravation. Severer depression at T1 ( $\beta = 0.179$ , OR = 1.196,  $p < 0.01$ ), COVID-19 ( $\beta = 3.130$ , OR = 22.882,  $p < 0.01$ ), and severer depression at T0 ( $\beta = 0.167$ , OR = 1.181,  $p < 0.05$ ) were associated with anxiety exacerbation (Table 3).

## 4 | DISCUSSION

To our knowledge, this study is the first longitudinal study conducted among prisoners during the COVID-19. One important result from this study is that the anxiety level of prisoners was significantly

reduced during COVID-19, which was surprised. That is different from studies of the general healthy population. Even in other special populations, such as adolescents and pregnant women, their prevalence of anxiety was higher than before COVID-19 (Biviá-Roig et al., 2020; Commodari & La Rosa, 2020). The risk of COVID-19 infection and closed-off management had a significant negative impact on their mental health (Biviá-Roig et al., 2020; Esposito et al., 2020). COVID-19 was also associated with the anxiety onset and exacerbation among the prisoners in our study, but the closed environment was familiar to them. And some prison management changes were implemented after the COVID-19 outbreak, which we believe may have reduced anxiety among the prisoners.

Prisoners must follow the regulations governing prison management, and many of the management measures during the epidemic are beneficial to mental health. First, prisoners are more familiar with the enclosed environment. A study by Burrai also showed that patients in the enclosed psychiatric community have lower stress levels than mentally healthy individuals due to their familiarity with the enclosed environment (Burrai et al., 2020). The enclosed space increases the emotional problems in the common population (Chandola et al., 2020; Zhu et al., 2020), but it does not have a negative impact on prisoners. Second, the way that prisoners receive information about COVID-19 differs from the general population. Due to media limits, prisoners could only obtain information from official media on television. Many studies have shown that

**TABLE 3** Influencing factors of the changes in anxiety among prisoners without or with anxiety at T0

	$\beta$	SE	Wald	$p$	OR	95% CI
Prisoners without anxiety ( $n = 480$ )						
Years of education	-0.171	0.065	6.957	0.008	0.843	0.742-0.957
COVID-19	1.596	0.445	12.846	<0.001	4.936	2.062-11.816
PHQ-9 <sub>1</sub>	0.521	0.076	46.435	<0.001	1.683	1.449-1.956
ISI <sub>1</sub>	0.125	0.041	9.553	0.002	1.134	1.047-1.227
Prisoners with anxiety ( $n = 323$ )						
Alleviation						
PHQ-9 <sub>1</sub>	-0.405	0.068	35.383	<0.001	0.667	0.584-0.762
COVID-19	-1.353	0.488	7.687	0.006	0.258	0.099-0.673
GAD-7 <sub>0</sub>	0.295	0.079	14.012	<0.001	1.343	1.151-1.567
Exacerbation						
GAD-7 <sub>0</sub>	-0.659	0.163	16.304	<0.001	0.517	0.376-0.712
PHQ-9 <sub>1</sub>	0.179	0.063	8.178	0.004	1.196	1.058-1.352
COVID-19	3.130	1.156	7.337	0.007	22.882	2.376-220.380
PHQ-9 <sub>0</sub>	0.167	0.074	5.034	0.025	1.181	1.021-1.367

Abbreviations: GAD, generalized anxiety disorder; GAD-7<sub>0</sub>, scores of GAD-7 at T0; GAD-7<sub>1</sub>, scores of GAD-7 at T1; ISI, Insomnia Severity Index; ISI<sub>0</sub>, scores of ISI at T0; ISI<sub>1</sub>, scores of ISI at T1; PHQ, Patient Health Questionnaire; PHQ-9<sub>0</sub>, scores of PHQ-9 at T0; PHQ-9<sub>1</sub>, scores of PHQ-9 at T1.

people feel worse about their anxiety if they spend more time on online media (Farooq et al., 2020; Liu & Tong, 2020; Pan et al., 2020; Schmidt et al., 2021), especially for those who choose social and commercial media (Zou et al., 2021), but paying more attention to official media is a protective factor (Liu & Tong, 2020; Lupton & Lewis, 2021). Third, prisoners maintain a daily routine and regular exercise during the epidemic. Some studies illustrate that regular physical activity is significantly associated with anxiety remission (Martínez-Lezaun et al., 2020; Wolf et al., 2021). And maintaining a routine also reduces COVID-19 stress (Ren et al., 2021). During the pandemic, the jail ceased working and increased exercise and leisure time for prisoners, which may have alleviated their pre-epidemic anxieties.

We found the major influencing factor on the change of anxiety was the anxiety levels at baseline. It means that prisoners who felt more anxious during COVID-19 are those without anxiety at baseline, but prisoners with anxiety felt less anxious.

The effect of the baseline anxiety level is consistent with some longitudinal studies of general population patients. A large cohort study concluded that patients with the most severe or chronic mood disorders showed a significant decrease in symptom severity (Pan et al., 2021). Kocavska found that people with severe insomnia before COVID-19 experienced clinically meaningful relief of symptoms after the outbreak, whereas people who slept well before COVID-19 experienced insomnia (Kocavska et al., 2020). Therefore, we speculate that patients with severe anxiety may perceive the risk of COVID-19 differently. We think they are more inclined to obtain Contrast Effects in the Downward Social Comparisons during the epidemic (Gerber et al., 2018). That is, those who have had a setback

or failure would compare themselves to those in worse conditions than they are to improve their confidence and sense of delight. It has been shown that people with low happiness levels are more likely to have Contrast Effects in Downward Social Comparisons (Lyubomirsky & Ross, 1997). That is consistent with our result that prisoners with higher anxiety levels at baseline are more likely to mitigate during COVID-19. It is also consistent with the previous findings (Kocavska et al., 2020; Pan et al., 2021).

In addition, the prisoners who had short years of education were more likely to be anxious. An online survey in Wuhan province showed that lower levels of education would cause severe anxiety (Fu et al., 2020). However, a study about teachers showed that higher levels of education lead to higher anxiety levels (Huang et al., 2020). The influence of education levels on anxiety appears to be still debatable, which could be due to participant differences.

The results showed that the COVID-19 had a negative impact on prisoners. It is a risk factor for prisoners' anxiety during the epidemic, like other studies (Druss, 2020; Fu et al., 2020; Hyland et al., 2020; Li et al., 2020; Son et al., 2020). However, the overall anxiety of the prisoners did not increase, so we believe that the negative psychological effects of closed isolation are more significant than COVID-19. Meanwhile, anxiety can be alleviated by physical exercise and establishing a regular rhythm of life. That offers suggestions for the management of prisoners in Public Health Emergency of International Concern (PHEIC) and applies to the general population. People should be encouraged to keep a basic schedule of living and sleeping, organize their study work and recreational activities appropriately, and acquire a certain amount of exercise every day in

the closed environment of a pandemic. People with weaker mental capacity should avoid following relevant media information for a long time. Most importantly, people in a closed environment should be closely monitored for their psychological condition to avoid the occurrence and aggravation of emotional problems.

This study fills the gap in the changes in the psychological status of prisoners in PHEIC. Also, it confirms to some extent the negative effects of the closed environment on mental health and the benefits of regular life and exercise, laying the groundwork for future research. Furthermore, our results differed from previous research on the general population and suggested recommendations for future controlled investigations. However, this study also has several limitations, as follows. First, the study solely looked at male prisoners and did not include any research on females. Second, the study lacks an investigation of the personality traits and coping styles of the prisoners, and it is not clear whether they have specific coping styles for PHEIC. Third, only the prisoners were surveyed in this study. There was no general population control, so the results described herein need to be interpreted with caution, and future longitudinal studies are needed to assess these associations.

## 5 | CONCLUSIONS

This cohort study suggests that the prevalence of anxiety among prisoners decreased nearly 4 months into the COVID-19 pandemic. That may be due to the prisoners' familiarity with the closed environment and the prison's specific management, such as adequate exercise and regular life. Furthermore, prisoners may be more psychologically vulnerable to the contrast effect in downward social comparisons because of their unique status. Compared to general population studies, we believe that closed isolation has a more significant negative influence on people's mental health than COVID-19. That further suggests that we should pay attention to the living conditions of people in closed environments to prevent the occurrence of anxiety.

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## CONFLICT OF INTEREST

The authors have no competing interests to report. All authors read and approved the final manuscript.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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