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## Original Article

## Depression and insomnia in COVID-19 survivors: a cross-sectional survey from Chinese rehabilitation centers in Anhui province



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## ABSTRACT

**Background:** Suffering from COVID-19 is a strong psychological stressor to the patients. Even after recovery, patients are prone to a variety of mental health problems. Recently, some studies focus on the psychological situation of patients when they got COVID-19. However, no study focused on the psychological status of recovered COVID-19-infected patients in China. Our study aims to investigate sleep and mood status, and detect the influencing factors of the psychological status of the COVID-19 patients after recovery.

**Methods:** One hundred and twenty-five COVID-19 patients were enrolled from February to April 2020. The social demographic information of all participants was collected by a self-designed questionnaire. Insomnia and depression symptoms were evaluated through the Insomnia Severity Index (ISI) and the Center for Epidemiology Scale for Depression (CES-D).

**Results:** The rates of insomnia and depression were 26.45% and 9.92% in the COVID-19 patients after recovery. There were significant differences in physical, mental impairment, and the need for psychological assistance between the COVID-19 recovered patients with depression and the patients without depression. In addition, age and health status may be the influencing factors for insomnia, and care about the views of others may be the influencing factor of depression ( $P < 0.05$ ).

**Conclusions:** Based on the results, we found that COVID-19 recovered patients had a low rate of depression and a high rate of insomnia. We need to pay more attention to their sleep condition than mood status.

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## 1. Introduction

The novel coronavirus disease (COVID-19) [1], which was first discovered in Wuhan, Hubei Province in December 2019, has proliferated to other regions of China and then to many other countries [2,3]. The World Health Organization (WHO) declared that the COVID-19 epidemic is a pandemic on March 11, 2020.

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According to the WHO, as of July 25, 2020, more than 15 million people were infected with COVID-19, 635,173 died worldwide [4].

The outbreak of COVID-19 has not only aroused international concern [5], but also brought great psychological stress to people [6–10]. Previous studies have shown that during the SARS outbreak, a range of mental disorders were reported, including depression, anxiety, and psychotic symptoms [11–13]. During the epidemic, the overall prevalence of sleep problems and depressive symptoms in the public were 18.2% and 20.1% [8]. A considerable proportion of health care workers reported symptoms of depression (50.4%), anxiety (44.6%), and insomnia (34.0%) [14]. Based on the past experience of severe novel pneumonia outbreaks globally and the psychosocial impact of viral epidemics, it is urgent for the government to establish appropriate mental health services to address the risk of mental illness.

The acute onset, rapid transmission, high mortality, lack of effective treatments, and large-scale isolation measures of COVID-19 have led to a variety of mental health problems [15–19], especially for the confirmed patients. Many patients experienced both physical and great psychological stress during their stay in the hospital [20]. However, the mental health status of the patients after discharge is still unknown.

Up to now, there have been few studies on the psychological follow-up investigation of the recovered COVID-19 patients. However, many previous studies have explored the mental health problems of patients after recovery and discharge from the hospital under a major epidemic [21–24]. Claudia et al. [21] reported a study on cognitive abilities, post-traumatic stress disorder (PTSD), and health-related quality of life (HRQoL) in patients during follow-up. They found that survivors of severe community-acquired pneumonia and acute respiratory distress syndrome had a relatively high incidence of cognitive dysfunction, reduced functional capacity, and high incidence of PTSD that was associated with diminished HRQoL and a decreased rate of return to work. Hans et al. [22] assessed mental morbidity and negative effects on health-related quality of life in long-term survivors of acute respiratory distress syndrome and found that long-term survivors of acute respiratory distress syndrome appear to face a major risk of mental health problems and significant damage to health-related quality of life in the long term. Besides, at present, the predominant assistance measure is based online [25–27], some patients with less use of smartphones, and the internet may benefit less from it [28]. In addition to preventing and treating COVID-19, the outbreak of COVID-19 has raised many challenges for the safe management of mental health problems in patients [29–31]. It is urgent to carry out appropriate crisis psychological intervention and long-term follow-up assessment of patients [20].

Therefore, as a designated hospital for treatment, we cannot ignore the psychological influence on the confirmed patients after discharge. To deal with mental health problems and perform psychological crisis intervention, the on-site psychological investigation of the recovered COVID-19 patients was carried out at two weeks after discharge.

## 2. Methods

### 2.1. Participants

All confirmed COVID-19 patients from Anhui Provincial Hospital and Anqing Hospital affiliated to Anhui Medical University were enrolled in the study and investigated at two weeks after discharge. All COVID-19 patients involved in this study were diagnosed according to the provisional guidelines of the world health organization [32] and all met the discharge criteria [33]. Approved by the clinical research ethics committee of Anhui Provincial Hospital before the beginning of the study, all subjects had informed consent before the investigation. Participants could terminate the survey at any time. The real name system was adopted to facilitate follow-up clinical intervention. All questionnaires are kept in a file and the survey results are strictly confidential.

### 2.2. Design and measurements

A self-designed questionnaire was conducted by uniformly trained and qualified investigators from February 21 to April 1, 2020. The contents of this questionnaire include three sections: social demographic characteristics, the Insomnia Severity Index (ISI), and the Center for Epidemiology Scale for Depression (CES-D).

The social demographic and clinical characteristics, such as gender, age, economic status, health status, physical and mental

impairment, family support, care about the views of people around them [34], need psychological assistance (yes or no) and receive psychological assistance (yes or no).

Insomnia was evaluated by the ISI [35], a seven-item self-report index including difficulty in falling asleep, maintaining sleep, and waking up early. Each item is scored from 0 to 4 points. The total score ranges from 0 to 28, the higher the score, the higher the severity of insomnia. The total score of ISI  $\geq 8$  is often used as a criterion to judge whether insomnia occurs in the general population [36].

The severity of depressive symptoms was assessed by the CES-D [37]. It consists of 20 items, each rated on a four-point scale (0–3) based on the frequency of depressive symptoms over the past two weeks. The score ranges from 0 to 60 and a higher score indicates a greater risk of depression. The total score of CES-D  $\geq 16$  is often used as a criterion for determining depression.

The Chinese versions of ISI [38] and CES-D [39] were validated and showed good psychometric characteristics.

### 2.3. Statistical analysis

The on-site questionnaire survey was entered in Excel format, and the database was established by using SPSS23.0 statistical software for analysis. Continuous variables were compared with the use of the t-test, such as age. The chi-square test or Mann–Whitney test was used to compare categorical variables. Independent variables will be included in multivariate logistic regression analysis, if  $P < 0.05$  in univariate analysis. All hypotheses were tested at a significance level of 0.05.

## 3. Results

### 3.1. Demographic and clinical characteristics of all participants

One hundred and twenty-five questionnaires were received, and 121 were valid, with a response rate of 96.8% (121/125). Among the 121 confirmed COVID-19 patients, the average age was  $41.72 \pm 13.61$  years, including 69 males (57.02%) and 52 females (42.98%), and insomnia and depression rates were 26.45% (32/121) and 9.92% (12/121), respectively (Table 1).

### 3.2. Comparison of demographic and clinical characteristics between the depression group and non-depression group in the recovered COVID-19 patients

A total of 12 people (9.92%) were identified as depression based on the CES-D score greater than 16. The results of the inter-group comparison showed that there was no significant difference in the prevalence of depression among patients with different gender, age, economic status, health status, family support, and psychological assistance ( $P > 0.05$ ). There were significant differences in the prevalence of depression among patients with physical and mental impairment, caring about the views of others, and whether they need psychological assistance ( $P < 0.05$ ) (see Table 1 for details).

### 3.3. Multivariate logistic regression analysis of the COVID-19 patients with depression

In the binary logistic regression analysis with depression as the dependent variable, patients with physical and mental impairment were 2.082 times more likely to suffer from depression than those without physical and mental impairment ( $P = 0.035$ , OR = 2.082, 95% CI = [1.053; 4.116]); patients who need psychological assistance were 18.441 times more likely to suffer from depression than

**Table 1**  
Demographic and clinical characteristics of the recovered COVID-19 patients with or without depression.

Variable	Total (%) (n = 121)	Non-depression (%) (n = 109)	Depression (%) (n = 12)	P
<b>Gender</b>				0.258
Male	69 (57.02)	64 (58.72)	5 (41.67)	
Female	52 (42.98)	45 (41.28)	7 (58.33)	
<b>Age (years)</b>	41.72 ± 13.61	40.94 ± 13.34	48.83 ± 14.58	0.056
<b>Economic</b>				0.05028
Wealth	5 (4.13)	5 (4.59)	0 (0.00)	
Medium	98 (80.99)	90 (82.57)	8 (66.67)	
Poverty	18 (14.88)	14 (12.84)	4 (33.33)	
<b>Health status</b>				0.081
Well	61 (50.41)	58 (53.21)	3 (25.00)	
General	58 (47.93)	49 (44.95)	9 (75.00)	
Bad	2 (1.65)	2 (1.83)	0 (0.00)	
<b>J1</b>				0.001
None	49 (40.50)	47 (43.12)	2 (16.67)	
Mild	50 (41.32)	47 (43.12)	3 (25.00)	
Medium	15 (12.40)	13 (11.93)	2 (16.67)	
Severe	4 (3.30)	0 (0.00)	4 (33.33)	
Very severely	3 (2.48)	2 (1.83)	1 (8.33)	
<b>J2</b>				0.638
Satisfaction	106 (87.60)	96 (88.07)	10 (83.33)	
General	15 (12.40)	13 (11.93)	2 (16.67)	
Dissatisfaction	0 (0.00)	0 (0.00)	0 (0.00)	
<b>J3</b>				0.020
Not mind	39 (32.23)	37 (33.94)	2 (16.67)	
General	73 (60.33)	67 (61.47)	6 (50.00)	
Mind	9 (7.44)	5 (4.59)	4 (33.33)	
<b>J4</b>				0.0004
Needless	112 (92.56)	105 (96.30)	7 (58.33)	
Need	9 (7.44)	4 (3.70)	5 (41.67)	
<b>J5</b>				1.000
No	115 (95.04)	103 (94.50)	12 (100.00)	
Yes	6 (4.96)	6 (5.50)	0 (0.00)	

Quantitative information is expressed as mean ± standard deviation, and qualitative information as n(%). J1: physical and mental impairment; J2: whether there is psychological support from family members; J3: whether they mind the views of people around them; J4: whether they need psychological assistance; J5: whether they receive psychological assistance.  
Bold numbers: P<0.05.

those who do not need (P = 0.004, OR = 18.441, 95% CI = [2.566; 132.517]) (see Table 2 for details).

**3.4. Comparison of demographic and clinical characteristics between the insomnia group and non-insomnia group in the enrolled COVID-19 patients**

A total of 32 people (26.45%) were diagnosed with insomnia based on the ISI score greater than 8. The results of the inter-group comparison showed that there was no significant difference in the prevalence of insomnia among patients with different gender, economic status, family support, caring about the views of others and receiving psychological assistance (P > 0.05). There were significant differences in the prevalence of insomnia among patients with age, health status, physical and mental impairment, and whether they need psychological assistance (P < 0.05) (see Table 3 for details).

**Table 2**  
Multivariate logistic regression analysis of the COVID-19 patients with depression.

Variable	B	SE	Wald	P	OR	OR95%CI
J1	0.733	0.348	4.447	<b>0.035</b>	2.082	1.053–4.116
J3	1.148	0.694	2.738	0.098	3.152	0.809–12.281
J4	2.915	1.006	8.390	<b>0.004</b>	18.441	2.566–132.517

J1: physical and mental impairment; J3: whether they mind the views of people around them; J4: whether they need psychological assistance.  
Bold numbers: P<0.05.

**Table 3**  
Demographic and clinical characteristics of insomnia and non-insomnia group in the recovered COVID-19 patients.

Variable	Total (%) (n = 121)	Non-insomnia (%) (n = 89)	insomnia (%) (n = 32)	P
<b>Gender</b>				0.176
Male	69 (57.02)	54 (60.67)	15 (46.87)	
Female	52 (42.98)	35 (39.33)	17 (53.13)	
<b>Age (years)</b>	41.72 ± 13.61	39.17 ± 13.28	48.81 ± 12.07	<b>0.000</b>
<b>Economic</b>				0.078
Wealth	5 (4.13)	4 (4.49)	1 (3.12)	
Medium	98 (80.99)	75 (84.27)	23 (71.88)	
Poverty	18 (14.88)	10 (11.24)	8 (25.00)	
<b>Health status</b>				<b>0.002</b>
Well	61 (50.41)	52 (58.43)	9 (28.13)	
General	58 (47.93)	37 (41.57)	21 (65.62)	
Bad	2 (1.65)	0 (0.00)	2 (6.25)	
<b>J1</b>				<b>0.000</b>
None	49 (40.50)	43 (48.31)	6 (18.75)	
Mild	50 (41.32)	37 (41.57)	13 (40.62)	
Medium	15 (12.40)	7 (7.87)	8 (25.00)	
Severe	4 (3.30)	0 (0.00)	4 (12.50)	
Very severely	3 (2.48)	2 (2.25)	1 (3.13)	
<b>J2</b>				0.984
Satisfaction	106 (87.60)	78 (87.64)	28 (87.50)	
General	15 (12.40)	11 (12.36)	4 (12.50)	
Dissatisfaction	0 (0.00)	0 (0.00)	0 (0.00)	
<b>J3</b>				0.107
Not mind	39 (32.23)	31 (34.83)	8 (25.00)	
General	73 (60.33)	54 (60.67)	19 (59.38)	
Mind	9 (7.44)	4 (4.49)	5 (15.62)	
<b>J4</b>				<b>0.010</b>
Needless	112 (92.56)	86 (96.63)	26 (81.25)	
Need	9 (7.44)	3 (3.37)	6 (18.75)	
<b>J5</b>				0.654
No	115 (95.04)	85 (95.51)	30 (93.75)	
Yes	6 (4.96)	4 (4.49)	2 (6.25)	

Quantitative information is expressed as mean ± standard deviation, and qualitative information as n(%). J1: physical and mental impairment; J2: whether there is psychological support from family members; J3: whether they mind the views of people around them; J4: whether they need psychological assistance; J5: whether they receive psychological assistance.  
Bold numbers: P<0.05.

**3.5. Multivariate logistic regression analysis of the COVID-19 patients with insomnia**

In the binary logistic regression analysis with insomnia as the dependent variable, age was a risk factor for the possibility of insomnia symptoms in COVID-19 patients (P = 0.002, OR = 1.063, 95% CI = [1.023; 1.105]), and patients with physical and mental impairment were 2.095 times more likely to suffer from insomnia than patients without physical and mental impairment (P = 0.005, OR = 2.095, 95% CI = [1.251; 3.509]) (see Table 4 for details).

**4. Discussion**

According to the results of the on-site investigation, COVID-19 patients had a high prevalence (26.45%) of insomnia at two weeks after discharge, and had risk factors for developing insomnia

**Table 4**  
Multivariate logistic regression analysis of the COVID-19 patients with insomnia.

Variable	B	SE	Wald	P	OR	OR95%CI
Age	0.061	0.020	9.880	<b>0.002</b>	1.063	1.023–1.105
Health status	0.754	0.482	2.450	0.118	2.125	0.827–5.463
J1	0.740	0.263	7.894	<b>0.005</b>	2.095	1.251–3.509
J4	1.545	0.873	3.129	0.077	4.688	0.846–25.965

J1: physical and mental impairment; J4: whether they need psychological assistance.  
Bold numbers: P<0.05.

[40], while the incidence of depression (9.92%) was relatively low. A similar study showed that the incidence of depressive symptoms in 131 patients was 18% at one month after discharge [41]. Mario et al. also showed similar results [42]. However, Many other similar studies have shown that the prevalence of depression and anxiety is the highest among patients with pre-existing diseases and COVID-19 infection [43–45], as well as among health care workers [14,25,46] and the public [8,47,48]. Recently, the mental health survey of 1257 health care workers showed a high prevalence of mental health symptoms (over 70%), with insomnia at 34% and depression at 50.4% [14]. In addition, the overall prevalence of sleep problems and depressive symptoms in the public were 18.2% and 20.1% during the epidemic [8].

Under different demographic data and self-assessment factors, our results showed that there were statistically significant differences in the incidence of insomnia and depression among COVID-19 patients with physical and mental impairment and the need for psychological assistance ( $P < 0.05$ ). According to the current results, age, and health status may be the influencing factors for insomnia; caring about the views of others may be the influencing factors for depression. It was reported that the majority of COVID-19-related deaths were older adults [49]. Therefore, after the outbreak of COVID-19, the older patients were greatly affected both physically and mentally. They had a low self-evaluation, faced with multiple pressures such as reinfection and property loss, were in a long-term high-tension state of mental stress, and were more prone to suffer from insomnia, depression, and other symptoms. Recent studies have shown that COVID-19-infected patients have a higher incidence of insomnia and depression due to social isolation, uncertainty, health status [50]. Due to long-term social isolation and subjective loneliness, COVID-19-infected patients' suicidal ideation and suicide attempts also increased accordingly [51]. Besides, about one in five participants had insomnia, suggesting that the uncertainty about the progress of the epidemic could put greater psychological pressure on the public [8,52,53]. The possible cause of insomnia and depression may be related to the perceived danger and fear of transmission of the virus to others. In addition, the rapid transmission, high mortality, and negative news of COVID-19 may increase the risk of insomnia and depression, worsen physical and mental impairment, and further impair the patients' daily functions and cognitive abilities [28].

At present, most doctors who follow-up the COVID-19 patients after discharge come from respiratory and infection departments, and they have not paid enough attention to the mental health problems. Moreover, this study showed that two weeks after discharge, the prevalence of depression was relatively low. The reasons may be as follows: the COVID-19-infected patients in Anhui are mainly mild, which are treated actively and free, the hospitalization time is short, the curative effect is good, and the sequelae are less. After timely and effective treatment of COVID-19, the prevalence of depression is relatively low, while the prevalence of insomnia is high. So we will further follow-up and investigate the mental health of the COVID-19-infected patients for 3 months, half a year, and a year, which is of great significance for early detection of mental symptoms to reduce the psychological burden and effectively carry out psychological intervention [50].

## 5. Limitations

This study has the following shortcomings: (1): As the object of this study is the confirmed COVID-19 patients, limited by the designated hospital and the workload of on-site investigation, we only selected all the confirmed patients from Anhui Provincial Hospital and Anqing Hospital affiliated to Anhui Medical University, which reduced the representativeness of the samples to some

extent. (2): Due to the physical and mental impact of COVID-19 on the confirmed patients, the questionnaire was designed to be as simple and easy to understand as possible, so as to avoid over-filling time affecting the patients with disease recovery. Therefore, no additional demographic variables were investigated and thus unable to analyze the correlation between mental problems and other variables. (3): Due to the outbreak of the disease, we could not measure the mental health status of COVID-19 patients before admission, so we cannot rule out that individual patients have mental health problems in the past.

## 6. Conclusions

This on-site investigation of the mental health status and its influencing factors in 125 COVID-19-infected patients at 2 weeks after discharge showed a high prevalence (26.45%) of symptoms of insomnia and a relatively low prevalence of depression (9.92%). There were significant differences in the prevalence of insomnia and depression among COVID-19-infected patients with physical and mental impairment and the need for psychological assistance. Age and health status may be the influencing factors for insomnia. Caring about the views of others may be the influencing factors of depression. The possible cause of insomnia and depression may be related to age, health status, economic status, social isolation, subjective loneliness, and the uncertainty about the epidemic.

The outbreak of COVID-19 has not only aroused great concern, but also brought great psychological distress to the confirmed patients. Therefore, the whole of society should give confirmed patients more support and attention. In addition to the emphasis on infection and respiratory physicians to follow-up the clinical symptoms of patients, psychologists and offline mental health services should also be included and further follow-up studies are of great significance for early guidance of psychological crisis intervention.

## Ethical approval

Approved by the clinical research ethics committee of Anhui Provincial Hospital, Hefei (No.2020-XG(H)-007).

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## Author contributions

FX, XXW and YGY completed the preliminary questionnaire design, data collation, and the first draft. YDS and LX performed the statistical analyses. HZL and XWH supervised in designing and revised the first draft critically. KZ critically read and revised the draft. All authors participated in planning the statistical analyses and determined the final manuscript.

## Conflict of interest

None.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: <https://doi.org/10.1016/j.sleep.2021.02.002>.

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