RESEARCH ARTICLE

Influencing factors of anxiety and depression of discharged COVID-19 patients in Wuhan, China

Zhenwei Dai[1‡], Weijun Xiao[1‡], Hao Wang[1‡], Yijin Wu[1], Yiman Huang[1], Mingyu Si[1], Jiaqi Fu[1], Xu Chen[1], Mengmeng Jia[1], Zhiwei Leng[1], Dan Cui[2,3], Liming Dong[1], Winnie W. S. Mak[4]*, Xiaoyou Su[1]*

1 School of Population Medicine and Public Health, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China, 2 National Clinical Research Center for Respiratory Diseases, China-Japan Friendship Hospital, Beijing, China, 3 The 2nd Affiliated Hospital of Harbin Medical University, Harbin Medical University, Harbin, China, 4 Diversity and Well-Being Laboratory, Department of Psychology, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong, China

‡ ZD, WX and HW are joint first authors to this work.
* suxiaoyou@hotmail.com (XS); wwsmak@cuhk.edu.hk (WWSM)

Abstract

Objectives

This study is intended to assess the prevalence of depression and anxiety in individuals who had recovered from COVID-19 and been discharged from hospital (RD hereafter) in Wuhan, China, and to explore the factors associated with these mental disorders.

Methods

Participants of this study were the RD who were infected at the beginning of the outbreak from 13 communities in Jianghan District of Wuhan City, Hubei Province, China by convenience sampling in mid-2021. The Generalized Anxiety Disorder Questionnaire, the Patient Health Questionnaire, the Short Version of COVID-19 Stigma Scale, the Peace of Mind Scale, the Resilience Style Questionnaire, and the Perceived Social Support Questionnaire were used to collect relevant information of the participants. Descriptive analyses, Pearson correlation analysis, and logistic regression analysis were used to describe and analyze the data and to examine the factors associated with the mental health status of this population.

Results

In total, we recruited 1601 participants from 3059 COVID-19 patients, and 1541 participants completed the questionnaire survey, with a response rate of 96.25%. Finally, 1297 participants met the inclusion and exclusion criteria in this study, of whom 28.8% and 37.9% reported mild to severe levels of anxiety and depression symptoms. Perceived better mental health status during hospitalization, higher frequency of alcohol use per week, peace of mind, higher education level, and resilience were negatively associated with anxiety, while stigma and history of psychological or emotional counseling before infection was positively associated with anxiety. More severe clinical classification of COVID-19 and stigma (AOR =

1.057, P<0.001) were both positively associated with depression, while perceived better mental health status during hospitalization (AOR = 0.564, P<0.001), higher frequency of alcohol use per week (AOR = 0.462, P = 0.004), peace of mind (AOR = 0.857, P<0.001), and social support (AOR = 0.972, P = 0.034) were negatively associated with depression.

Conclusions

Tailored interventions on reducing stigma, enhancing mindfulness and social support should be taken into account to alleviate anxiety and depression among RD.

Introduction

As a major public health threat in the 21st century, the coronavirus disease 2019 (COVID-19) pandemic has caused tremendous mental health impact worldwide, including among those ever infected with the virus at the beginning of the outbreak [1, 2]. While most of the hospitalized COVID-19 patients had recovered and been discharged from hospital after effective treatments, the rehabilitation of both physical and mental health of RD has become a growing concern recently [3].

The uncertainties affected by the mass lockdowns and economic recession, and the lingering 'long covid' illness (subsequent sequela in the aftermath of COVID-19 infection, both mental and physical), along with the stigma they confronted from the surroundings, may cause mental disorders and even suicide among the RD population [4]. The National Institutes of Health (NIH) describes "long-covid" as sequelae that extend beyond 4 weeks after initial infection [5]. Evidence suggested that COVID-19 had led to unprecedented hazards to the mental health of those who used to be infected by COVID-19, since COVID-19 could infect brain or trigger immune responses that had additional adverse effects on brain functioning as well as affect psychological outcomes [6–10]. For severe or critical COVID-19 patients, the experience of long stay in intensive care unit (ICU), severe symptoms like respiratory failure, pains caused by clinical intervention, clinical sequelae associated with COVID-19, and fear of death could contribute to their traumatic stress during and after their hospitalization [11–16]. For patients with mild or moderate symptoms, multiple factors like fear of recurrence, clinical sequelae, and stigma, could also lead to negative psychological consequences after discharge [14–16]. Previous studies identified that anxiety and depression were common mental health problems that occurred among RD. A cross-sectional survey conducted after the outbreak in Wuhan, China in January, 2020 showed that the prevalence of anxiety and depression among COVID-19 patients were 56.3% and 39.3%, respectively [17]. Another survey in Wuhan in April, 2020 demonstrated that 42.7% of COVID-19 survivors had symptoms of anxiety, and 65.7% depression [18].

Reports suggested that psychological problems among RD have multiple risk and protective factors. Discrimination and stigma due to the experience of infection were common among RD [19, 20]. A survey conducted in Korea showed that stigma caused by COVID-19 infection could contribute to patients' negative psychological symptoms [21]. Additionally, a previous study suggested that individuals with a peaceful mind tended to have better self-regulation capacity, especially affect-regulation capacity, and could upregulate positive affect as a way to cope with negative experiences [22]. In this case, peace of mind could be a positive factor associated with mental health of RD. Resilience, as a dynamic system to cope with adverse events and stress, could also serve as a positive indicator of mental health in various populations

during the pandemic [23]. Moreover, social support was shown to be a significant factor in alleviating psychological distress among COVID-19 patients and other population [24].

Since psychological distress is common among RD, it is of importance to identify the psychological symptoms and the associated factors among this population [25]. However, relevant evidence in this area has not been well characterized, especially among the RD in China. Based on the protocol we developed previously [3], the present cross-sectional study aims to investigate the prevalence of anxiety and depression in RD among participants who were infected at the beginning of the outbreak in Wuhan, China, and to examine their possible influencing factors, which is critical in psychological intervention of COVID-19 patients.

Materials and methods

Sampling and participants

The cross-sectional study was carried out among former COVID-19 patients in Jianghan District (Wuhan, China) from June 10 to July 25, 2021. According to the electronic medical records of the Health Bureau of Jianghan District and inclusion criteria, a total of 3059 COVID-19 patients were eligible for the study and they were infected with the original SARS-Cov-2 strain and were diagnosed between December 10, 2019 and April 20, 2020. Among them, 1601 COVID-19 survivors were invited for a questionnaire survey on their mental health status when they were receiving clinical re-examination, and 1541 completed the survey and were included in the study, with a response rate of 96.25%. All investigators and support staff in this study were trained based on the same protocol and were required to have an educational background in medicine or public health. Those who had a history of COVID-19 infection, and ever have been hospitalized and discharged were invited to complete an online structured questionnaire from June to July, 2021. Digital informed consent was obtained from all individuals to ensure their voluntary participation. Self-administered electronic questionnaires and digital consent were sent to patients through Redcap, an online survey platform that is used for delivering online questionnaire. After reading the informed consent form and clicking the "I agree to participate in this study" button on the first page, participants could continue to fill in the electronic questionnaire. Ethics approval for the questionnaire survey was obtained from the Ethics Review Committee of the Institute of Pathogen Biology, Chinese Academy of Medical Sciences, Beijing, China (IPB-2020-22). The participants had to meet the following criteria: 1) over 18 years old; 2) had a history of hospitalization due to COVID-19 infection; 3) proficiency in Chinese; 4) able to independently cooperate with researchers to complete various scale assessments; 5) had a mobile communication equipment such as a mobile phone, and a WeChat account; 6) able to access the Internet with mobile equipment at any time; 7) had not received interventions for mental disorders within 1 month prior to enrollment or currently in the study. Those who met any of the below criteria were excluded: 1) had serious cognitive impairment; 2) had serious heart, brain, lung, kidney, liver, and other medical diseases or tumors; 3) difficult to cooperate with the questionnaire study. In total, 1297 participants were included in the final analysis based on the criterion above.

Measures

Demographic characteristics. Demographic characteristics, including age ("≤60" or >"60"), gender ("Man" or "Woman"), marital status("Married" or "Unmarried/divorced /widowed"), income for 2020 ("<60000 yuan" or "≥60000 yuan"), dwelling state ("Living alone" or "Living together"), education level ("Senior high school or below" or "Above senior high school"); and items on COVID-19 infection, such as family members' infection, friends' infection, length of hospital stay ("≤20 days" or ">20 days"), experience at ICU, clinical

classification of COVID-19 ("Asymptomatic", "Mild", "Moderate", and "Critically severe"), perceived mental health status during hospitalization ("Poor", "Moderate", or "Good"), etc. were asked.

Anxiety.   The 7-item Generalized Anxiety Disorder Questionnaire (GAD-7) consists of 7 items that are rated on a 4-point Likert scaled from 0–3. It was developed for measuring the severity of generalized anxiety symptoms during the past two weeks [26]. The scores of the instrument range from 0 to 21. A cutoff score of ≥5 is recommended for considering significant anxiety symptoms, and scores between 5 and 9, 10 and 14, and 15 and higher represent mild, moderate, and severe anxiety symptoms respectively. This instrument has demonstrated to be reliable and valid among the Chinese population [27, 28]. In this study, the Cronbach's alpha of the instrument was 0.951.

Depression.   The 9-item Patient Health Questionnaire (PHQ-9) is a 9-item questionnaire that is used for screening and monitoring depression of varying degrees of severity during the past two weeks [29]. The items of the PHQ-9 are rated on a 4-point Likert scaled ranging from 0 to 3. The total score is utilized to assess the degree of depression of participants, with scores of ≥5 indicating depression, and scores of 5–9 mild depression; 10–14 moderate depression; 15–19 moderately severe depression; and scores of ≥20 severe depression. This instrument has been validated among various Chinese populations [30, 31]. In this study, the Cronbach's alpha of the instrument was 0.914.

Stigma.   The Short Version of COVID-19 Stigma Scale is a 12-item scale that is employed for evaluating the perceived stigma of patients of COVID-19 during the past two weeks [32]. Each item is scored on a Likert scale of 1–4. Higher total scores indicate greater stigmatization. In this study, the Cronbach's alpha of the instrument was 0.936.

Peace of mind.   The Peace of Mind Scale (PoM) comprises a total of 7 items rated on a 5-point scale ranging from 1 ("not at all") to 5 ("all of the time") and is used for measuring the peace of mind during the past two weeks [33]. Higher total scores indicate a more peaceful mind. In this study, the Cronbach's alpha of the instrument was 0.874.

Resilience.   The Resilience Style Questionnaire (RSQ) consists of 16 items that are rated on a 5-point Likert scaled from 1 to 5. It is used to measure the level of individual's resilience during the past two weeks [34]. Higher total scores of the 16 items indicate a greater ability to recover from negative events. This instrument was developed and validated among the Chinese population [35, 36]. In this study, the Cronbach's alpha of the instrument was 0.975.

Perceived social support.   The level of perceived social support of the participants was measured by two items including emotional support and material support during the past two weeks [37]. The items were: 1) "How much support can you obtain from family/friends/colleagues when you need to talk or to obtain emotional support?" and 2) "How much support can you obtain from family/friends/colleagues when you need material support (e.g., financial help)?" and each item was 11-point Likert scaled from 0–10. In this study, the Cronbach's alpha of the instrument was 0.819.

Statistical analysis

Descriptive analyses were performed to describe the participants' demographic and clinical characteristics, the prevalence of psychological problems, and potential influencing factors. Pearson correlation analysis was employed to estimate the association between psychological variables. Univariate logistic regression analysis began with the full set of demographics to evaluate their associations with anxiety and depression. As suggested by previous research, the type I error rate could be relaxed in univariate logistic regression to avoid omitting possible influencing factors. Hence, statistically significant variables at the level of p≤0.10 in the

univariate analysis as well as stigma, peace of mind, resilience, and social support were further entered into the multivariate logistic regression analysis [38]. In the multivariate logistic regression analysis, statistically significant variables in the univariate analysis, stigma, peace of mind, resilience, and social support were the independent variables; depression and anxiety were the dependent variables. Adjusted odds ratio (AOR) and the corresponding 95% confidence intervals (95% CI) were calculated to assess the results of the regression model. SAS9.4 was utilized to conduct all the analysis with level of significance determined at a 0.05 p-value.

Results

Demographic characteristics

Among the 1297 participants, 47.3% aged above 60 years old; 56.6% were men; 85.2% were married; 62.1% had an annual family income of less than RMB 60000 in 2020; 12.2% lived alone; 29.0% were at an educational level of undergraduate or above; 46.5% had other family members infected with COVID-19; 29.1% had friends or relatives infected with COVID-19; 47.1% were hospitalized for over 20 days; 3.6% used to be treated at intensive care unit (ICU); 13.7% were in critical condition after infection; 56.7% perceived good psychological status during infection; 9.9% had a history of psychological or emotional counseling before infection; 12.4% were current smoker; 9.0% drank more than 2 times a week. The results are displayed in Table 1.

Prevalence of anxiety and depression of RD

In this study, 28.8% and 37.9% of the participants reported mild to severe levels of anxiety and depression symptoms according to the cut-off values of GAD-7 and PHQ-9, as shown in Table 2.

Associations of psychological symptoms in the participants

The associations of anxiety, depression, stigma, resilience, peace of mind, and social support among the RD were all statistically significant at a 0.01 p-value, where anxiety and depression were all positively associated with stigma, and negatively associated with resilience, peace of mind, and social support. The results are illustrated in Table 3.

Variables associated with anxiety and depression of RD

The factors associated with anxiety and depression of the participants are presented in Tables 4 and 5. The univariate logistic regression analysis revealed that woman, experience at ICU, more severe clinical classification of COVID-19 infection, and history of psychological or emotional counseling before infection were positively associated with anxiety and depression, while higher family income for 2020, higher education level, perceived better mental health status during hospitalization, and higher frequency of alcohol use per week were negatively associated with the prevalence of anxiety and depression. These factors were later employed in multivariate logistic regression with stigma, peace of mind, resilience, and social support, to identify the potential influencing factors of anxiety and depression among RD.

In multivariate analysis, we conducted the diagnostic evaluation of the model, the samples were all independent and the variables showed no multicollinearity. The multivariate analysis revealed that perceived better mental health status during hospitalization (AOR = 0.441, P<0.001), higher frequency of alcohol use per week (AOR = 0.472, P = 0.011), and peace of mind (AOR = 0.826, P<0.001) were negatively associated with anxiety, and a non-significant trend was observed in negative associations between anxiety and higher education level

Table 1. Demographic and clinical characteristics of participants.

Variable	N	%
Age (years)		
≤60	683	52.70
>60	614	47.30
Gender		
Woman	734	43.40
Man	563	56.60
Marital status		
Married	1105	85.20
Unmarried/divorced /widowed	192	14.80
Income for 2020 (CNY)		
<60000	805	62.10
≧60000	492	37.90
Dwelling state		
Living alone	158	12.20
Living together	1139	87.80
Education level		
Senior high school or below	921	71.00
Above senior high school	376	29.00
Family members' infection		
Confirmed infection	603	46.50
No infection	694	53.50
Friends' infection		
Confirmed infection	378	29.10
No infection	909	70.10
Length of hospital stay, days		
≤20	686	52.90
>20	611	47.10
Experience at ICU		
Yes	47	3.60
No	1250	96.40
Clinical classification of COVID-19 patients		
Asymptomatic	60	4.60
Mild	927	71.50
Moderate	132	10.20
Critically severe	178	13.70
Perceived mental health status during hospitalization		
Poor	314	24.20
Moderate	247	19.00
Good	736	56.70
Having received psychological or emotional counseling before infection		
Yes	128	9.90
No	1169	90.10
Current smoker		
Yes	161	12.40
No	1136	87.60
Frequency of alcohol use per week		
< 2	1180	91.00
≧2	117	9.00

https://doi.org/10.1371/journal.pone.0276608.t001

Table 2. Mental health status of enrolled COVID-19 survivors.

Variable	n	%	Mean (SD)	Range
Stigma (Covid-19 Stigma Scale)				
Total score			28.04(7.33)	12–48
Peace of mind (Peace of Mind Scale)				
Total score			24.70(5.99)	7–35
Resilience (RSQ)				
Total score			56.82(14.04)	16–80
Social support				
Total score			14.25(5.18)	0–20
Anxiety				
No	923	71.2		
Mild	299	23.1		
Moderate	46	3.5		
Severe	29	2.2		
Depression				
No	805	62.1		
Mild	315	24.3		
Moderate	110	8.5		
Moderate severe	48	3.7		
Severe	19	1.5		

https://doi.org/10.1371/journal.pone.0276608.t002

(AOR = 0.727, P = 0.088), and resilience (AOR = 0.989, P = 0.074). While stigma (AOR = 1.068, P<0.001) was positively associated with anxiety, and non-significant trends were observed in positive associations between anxiety and history of psychological or emotional counseling before infection (AOR = 1.485, P = 0.090). Moreover, more severe clinical classification of COVID-19 (AOR = 1.714/1.287, P = 0.032/0.038) and stigma (AOR = 1.057, P<0.001) were both positively associated with depression, while perceived better mental health status during hospitalization (AOR = 0.564, P<0.001), higher frequency of alcohol use per week (AOR = 0.462, P = 0.004), peace of mind (AOR = 0.857, P<0.001), and social support (AOR = 0.972, P = 0.034) were negatively associated with depression.

Discussion

Mental disorders among RD are associated with their prognosis and may lead to more severe psychological sequelae without effective control [39]. Hence, this study aimed to investigate

Table 3. Correlation matrix of mental health status in enrolled COVID-19 survivors with Pearson correlation analysis.

	Depression	Anxiety	Stigma	Psychological resilience	Peace of mind	Social support
Depression	1					
Anxiety	0.824**	1				
Stigma	0.323**	0.330**	1			
Resilience	-0.213**	-0.206**	-0.125**	1		
Peace of mind	-0.190**	-0.215**	-0.063**	0.542**	1	
Social support	-0.256**	-0.222**	-0.181**	0.223**	0.207**	1

Note.

**: P < 0.01.

https://doi.org/10.1371/journal.pone.0276608.t003

Table 4. Univariate statistical analysis of adverse psychological outcomes in enrolled COVID-19 survivors.

	Anxiety		Depression	
	OR (95%CI)	P value	OR (95%CI)	P value
Age(years)				
≤60	1		1	
>60	0.941(0.739–1.197)	0.619	1.041(0.832–1.304)	0.732
Gender				
Man	1		1	
Woman	1.555 (1.214–1.993)	<0.001	1.489 (1.184–1.873)	0.001
Marital status				
Unmarried/divorced /widowed	1		1	
Married	0.849 (0.610–1.181)	0.331	0.832 (0.609–1.137)	0.832
Family income for 2020 (CNY)				
<60000	1		1	
≧60000	0.632 (0.489–0.817)	<0.001	0.687 (0.543–0.869)	0.002
Dwelling state				
Living alone	1		1	
Living with other people	0.888 (0.619–1.274)	0.519	1.029 (0.730–1.451)	0.870
Education level				
Senior high school or below	1		1	
Above senior high school	0.589 (0.444–0.780)	<0.001	0.739 (0.575–0.952)	0.019
Family members' infection				
No infection	1		1	
Confirmed infection	1.201 (0.944–1.527)	0.137	1.017 (0.812–1.273)	0.885
Friends' infection				
No infection	1		1	
Confirmed infection	1.0978 (0.829–1.402)	0.576	1.108 (0.867–1.417)	0.413
Length of hospital stay(days)				
≤20	1		1	
>20	1.043(0.820–1.327)	0.730	1.174(0.938–1.470)	0.161
Experience at ICU				
No	1		1	
Yes	2.245 (1.249–4.034)	0.007	2.083 (1.159–3.744)	0.014
Clinical classification of COVID-19 patients				
Asymptomatic	1		1	
Mild	1.402 (0.746–2.634)	0.294	1.542 (0.857–2.775)	0.149
Moderate	1.870 (0.918–3.811)	0.085	2.363 (1.213–4.602)	0.011
Critical severe	1.703 (0.854–3.396)	0.131	2.349 (1.234–4.471)	0.009
Perceived mental health status during hospitalization				
Poor	1		1	
Moderate	0.659 (0.467–0.928)	0.017	0.669 (0.479–0.935)	0.019
Good	0.297 (0.223–0.396)	<0.001	0.345 (0.263–0.453)	<0.001
Having received psychological or emotional counseling				
No	1		1	
Yes	2.008 (1.383–2.915)	<0.001	1.793 (1.243–2.586)	0.002
Current smoker				
No	1		1	
Yes	0.794 (0.543–1.160)	0.233	0.830 (0.587–1.174)	0.292
Frequency of alcohol use per week				

(*Continued*)

Table 4. (Continued）

	Anxiety		Depression	
	OR (95%CI)	P value	OR (95%CI)	P value
< 2	1		1	
≧2	0.512 (0.314–0.835)	0.007	0.485 (0.313–0.754)	0.001

https://doi.org/10.1371/journal.pone.0276608.t004

the conditions of anxiety and depression and examine their influencing factors among RD in China from an epidemiological perspective, which could help to understand the mental health problems in RD more comprehensively, and provide a reference for the development of related policy [40] In this study, the prevalence of anxiety and depression among participants were 28.8% and 37.9% respectively, both lower than the results of two surveys conducted among COVID-19 patients in January and April 2020 in Wuhan, China [17, 18]. Despite the

Table 5. Multivariate statistical analysis of adverse psychological outcomes in enrolled COVID-19 survivors.

	Anxiety		Depression	
	AOR (95%CI)	P value	AOR (95%CI)	P value
Gender				
Man	1		1	
Woman	1.171 (0.858–1.600)	0.320	1.204 (0.908–1.597)	0.198
Family income for 2020 (CNY)				
<60000	1		1	
≧60000	0.826 (0.595–1.148)	0.255	0.825 (0.614–1.110)	0.204
Education level				
Senior high school or below	1		1	
Above senior high school	0.727 (0.505–1.048)	0.088	0.992 (0.715–1.377)	0.964
Experience at ICU				
No	1		1	
Yes	1.627 (0.754–3.513)	0.215	1.310 (0.626–2.744)	0.474
Clinical classification of COVID-19 patients				
Asymptomatic	1		1	
Mild	1.702 (0.809–3.583)	0.161	1.818 (0.924–3.579)	0.084
Moderate	1.714 (0.738–3.981)	0.210	2.318 (1.073–5.006)	0.032
Critical severe	1.287 (0.560–2.960)	0.552	2.235 (1.047–4.770)	0.038
Perceived mental health status during hospitalization				
Poor	1		1	
Moderate	0.944 (0.630–1.416)	0.782	0.989 (0.672–1.456)	0.956
Good	0.441 (0.312–0.625)	<0.001	0.564 (0.409–0.778)	<0.001
Received psychological or emotional counseling				
No	1		1	
Yes	1.485 (0.941–2.346)	0.090	1.269 (0.821–1.964)	0.284
Frequency of alcohol use per week				
< 2	1		1	
≧2	0.472 (0.264–0.843)	0.011	0.462 (0.275–0.778)	0.004
Stigma	1.068(1.045–1.090)	<0.001	1.057 (1.037–1.078)	<0.001
Peace of mind	0.826(0.798–0.855)	<0.001	0.857 (0.831–0.883)	<0.001
Resilience	0.989(0.977–1.001)	0.074	1.007 (0.995–1.019)	0.236
Social support	0.989(0.961–1.018)	0.446	0.972 (0.947–0.998)	0.034

https://doi.org/10.1371/journal.pone.0276608.t005

steady overall improvement of mental health in RD over time, the current study showed that their mental health status was still worse than those who had never been infected [41–43]. In this case, psychological distress caused by COVID-19 infection should not be ignored in the time of long covid [44].

Based on the current study sample, we found that COVID-19 related stigma was positively associated with the occurrence of anxiety and depression among RD. Stigma has become a public health challenge during the COVID-19 pandemic and might cause severe mental illness in RD. Infected individuals who perceived being stigmatized could report guilt, self-isolation, self-depreciation, the experience of social exclusion, stereotyping, and insulation, hence they often suffer from psychiatric comorbidities, such as PTSD, anxiety, depression, and even suicidal ideation [45, 46]. Stigma due to fear of being re-infected was still common among RD in China, and the health authorities should enhance the appeals to stop stigmatizing RD, and improve public awareness and knowledge on the dynamics and modes of transmission of COVID-19 [46]. Moreover, social media were suggested to contribute to eliminating stigma by challenging stereotyping and stigmatization, spreading knowledge on COVID-19 to a wider audience, stopping rumors, and dispelling misinformation and conspiracy theories on COVID-19 [47].

In addition, the results of this study suggested that RD who had more severe clinical classification during hospitalization were more likely to develop depression. This finding is similar to the result of a multi-national cohort study in RD across six countries [48]. Literature also revealed RD who used to be bedridden for a week or longer were more intended to have obvious long-term anxiety and depression symptoms, while a mild course of acute illness of RD, such as fewer bedridden, was associated with their lower risk of mental disorders [48]. The possibility of infecting others, the unpredictable prognosis of COVID-19, and continued sequelae of COVID-19 may cause worry and helplessness among RD with more severe symptoms during hospitalization, thus leading to depression [48]. Accordingly, more attention should be paid to the mental health morbidities among RD with more severe symptomology during hospitalization, especially those who used to be bedridden for a week or longer [48].

By contrast, we found that perceived better mental health status during hospitalization and social support were protective factors against mental disorders among RD. Consistent with previous researches, RD who could perceive good mental health status usually viewed negative life events more optimistically, and could adapt themselves better to new lives after discharge, thus reducing the possibility of having psychological problems [49, 50]. Higher level of social support may help RD perceive the respect and care from their family, friends, and others more easily, hence, their depressive symptoms could be buffered when encountering negative events [24, 51, 52]. Government could consider enhancing social support for RD by providing more emotional and material support for them [53]. Additionally, health authorities could consider encouraging RD to actively participate in social activities and improve peer support, to alleviate their self-discrimination and negative emotions, thus preventing the occurrence of depression [54–56]. Furthermore, relative social media should consider appealing general population to support RD, to help RD perceive the support from their surroundings more easily and their depressive disorders could be reduced consequently [57, 58].

Additionally, findings of this study indicated that peace of mind and resilience were negatively related to mental disorders among RD. Previous research has suggested that peace of mind is associated with anxiety and depression [22]. Individuals with a higher level of peaceful mind were more inclined to experience inner peace and harmony, and could achieve a balance between positive and negative emotions, thus reducing the occurrence of psychological problems [33]. Despite a non-significant trend in this study, higher levels of psychological resilience could enable RD to take positive coping styles and mitigate the experience of anxious disorders

[59]. Resilience is a dynamic procedure to help individuals positively adapt to adverse contexts [60, 61]. Some literature also implied that psychological resilience might be a translational endpoint in the treatment of mental disorders [62, 63]. Evidence suggested that mindfulness practice could improve individuals' peace of mind [64]. Mindfulness practice centers on cultivating intentional awareness in unfolding present-moment experiences to achieve inner peace, which is associated with peace of mind in nature [65, 66]. Peace of mind was listed as an outcome in our mindfulness training protocol for RD in Wuhan [3]. As suggested by the Wuhan protocol, online mindfulness intervention via mobile phone could be more convenient and effective compared to face-to-face mindfulness practice. Since mindfulness intervention has been commonly used among various populations and proved effective to improve mental health, the health authorities could consider employing online mindfulness practice among RD to increase their peace of mind, thus reducing the occurrence of anxiety, and depression symptoms [67, 68]. Similar to peace of mind, the effect of mindfulness intervention on improving psychological resilience was obvious [69]. Therefore, relative health authorities could consider implementing mindfulness intervention in RD to improve their psychological resilience and peace of mind simultaneously. On the other hand, other interventions on psychological resilience such as cognitive-behavioral therapy, acceptance and commitment therapy, and problem-solving therapy could also be taken into account [70].

Although previous systematic reviews indicated substantial harm of alcohol use on health, the current study found alcohol use could protect RD from both anxiety and depression [71]. A cross-sectional study indicated that low to moderate alcohol use could alleviate depressive symptomatology among the elderly in the US [72]. A cohort study also suggested that low to moderate alcohol drinking was associated with better cognitive functions among middle-aged and elderly adults in the US [73]. However, while certain amount of alcohol use might improve individual's mental health to some extent, this did not apply to binge drinking, since binge drinking could harm mental health in the long term [74–76]. Moreover, alcohol consumption may increase pro-inflammatory markers and the mortality risk due to COVID-19-associated complications in RD [77]. Hence, although the present study suggested possible benefits of alcohol, public health agencies should remind RD of the long-term effects of drinking on mental health, and the importance of avoiding binge drinking.

Moreover, the findings of this study indicated that RD with a history of psychological or emotional counseling before infection might be at higher risk of anxiety. Evidence suggested that individuals with a history of psychological counseling might have experienced psychological distress before, and the distress was more likely to reoccur due to COVID-19 infection among RD [78, 79]. This finding suggested that more attention should be paid to the mental health of RD with a history of psychological or emotional counseling, and it is essential to prevent the reoccurrence of psychological problems among this population.

Overall, findings of this study suggested that the government, health authorities, as well as social media could consider alleviating mental disorders among RD from several dimensions, such as mobilizing society to stop stigmatizing, providing more support for RD, and implementing psychological interventions in RD.

This study has several limitations. First, a drawback of the cross-sectional study is that we can't make any statements regarding causality. As a consequence, findings on risk factors of adverse psychological outcomes should be accepted with caution. Second, our study was conducted more than 18 months after discharge of COVID-19 patients, which may lead to recall bias. Third, convenience sampling may decrease the representativeness of the population, and cause biased calculation of confidence interval in the logistic regression analysis. Fourth, the results may be biased due to various access to technology, connectivity, and skills to use mobile communication equipment. Fifth, we did not consider the heterogeneity between 13

communities of the jianghan district, which may cause bias. Sixth, in the categorization of some demographic variables, such as income and length of hospital stay, we set the cutoff point based on the data characteristics, which may be a little subjective. Seventh, in the evaluation of alcohol use, we only consider the drinking frequency without alcohol volumes, which may not accurate enough to assess alcohol use. Eighth, we recruited participants who had not received interventions for mental disorders within 1 month prior to enrollment without considering the bias caused by having received any type of psychological intervention two or more months prior to the survey. In addition, our study didn't collect mental health information about patients who died of COVID-19, which may underestimate the rate of mental health problems in discharged patients infected with COVID-19.

Conclusion

The prevalence of anxiety and depression in people who had recovered from COVID-19 and had been discharged from hospital in Wuhan, China were 28.8% and 37.9% in this study. We found that stigma caused by COVID-19 infection was positively associated with mental disorders, while social support, peace of mind, psychological resilience, and alcohol use were negatively associated with mental disorders like anxiety and depression in RD. More attention should be paid to RD with a history of psychological or emotional counseling before infection. Tailored interventions regarding reducing stigma, enhancing mindfulness level and social support should be taken into account to alleviate anxiety and depression among RD. Further research could focus on prospective studies or long-term follow-up to examine the causal relations between the factors identified in this study.

Supporting information

S1 Data.
(XLSX)

Author Contributions

Conceptualization: Zhenwei Dai, Weijun Xiao, Xiaoyou Su.

Data curation: Zhenwei Dai, Hao Wang, Xiaoyou Su.

Formal analysis: Zhenwei Dai, Yiman Huang, Xiaoyou Su.

Funding acquisition: Xiaoyou Su.

Investigation: Weijun Xiao, Hao Wang, Yijin Wu, Yiman Huang, Mingyu Si, Jiaqi Fu, Xu Chen, Zhiwei Leng, Dan Cui, Liming Dong.

Methodology: Zhenwei Dai, Weijun Xiao, Hao Wang, Xiaoyou Su.

Project administration: Xiaoyou Su.

Resources: Xiaoyou Su.

Software: Zhenwei Dai, Yijin Wu, Mengmeng Jia.

Supervision: Winnie W. S. Mak, Xiaoyou Su.

Validation: Yijin Wu, Mingyu Si.

Writing – original draft: Zhenwei Dai, Weijun Xiao.

Writing – review & editing: Winnie W. S. Mak, Xiaoyou Su.

References

1. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. N Engl J Med. 2020; 382(13):1199–207. Epub 2020/01/30. https://doi.org/10.1056/NEJMoa2001316 PMID: 31995857.

2. Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020; 395(10223):514–23. Epub 2020/01/28. https://doi.org/10.1016/S0140-6736(20)30154-9 PMID: 31986261.

3. Si MY, Xiao WJ, Pan C, Wang H, Huang YM, Lian J, et al. Mindfulness-based online intervention on mental health and quality of life among COVID-19 patients in China: an intervention design. Infect Dis Poverty. 2021; 10(1):69. Epub 2021/05/19. https://doi.org/10.1186/s40249-021-00836-1 PMID: 34001277.

4. Mahase E. Covid-19: What do we know about "long covid"? BMJ. 2020; 370:m2815. https://doi.org/10.1136/bmj.m2815 PMID: 32665317

5. Datta SD, Talwar A, Lee JT. A Proposed Framework and Timeline of the Spectrum of Disease Due to SARS-CoV-2 Infection: Illness Beyond Acute Infection and Public Health Implications. JAMA. 2020; 324(22):2251–2. Epub 2020/11/19. https://doi.org/10.1001/jama.2020.22717 PMID: 33206133.

6. Holmes EA, O'Connor RC, Perry VH, Tracey I, Wessely S, Arseneault L, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. Lancet Psychiatry. 2020; 7(6):547–60. Epub 2020/04/19. https://doi.org/10.1016/S2215-0366(20)30168-1 PMID: 32304649.

7. Del Rio C, Collins LF, Malani P. Long-term Health Consequences of COVID-19. Jama. 2020; 324 (17):1723–4. Epub 2020/10/09. https://doi.org/10.1001/jama.2020.19719 PMID: 33031513.

8. Mukaetova-Ladinska EB, Kronenberg G. Psychological and neuropsychiatric implications of COVID-19. Eur Arch Psychiatry Clin Neurosci. 2021; 271(2):235–48. Epub 2020/11/23. https://doi.org/10.1007/s00406-020-01210-2 PMID: 33221936.

9. Nienhuis CP, Lesser IA. The Impact of COVID-19 on Women's Physical Activity Behavior and Mental Well-Being. Int J Environ Res Public Health. 2020; 17(23). Epub 2020/12/10. https://doi.org/10.3390/ijerph17239036 PMID: 33291530.

10. Vahia IV, Jeste DV, Reynolds CF 3rd. Older Adults and the Mental Health Effects of COVID-19. Jama. 2020; 324(22):2253–4. Epub 2020/11/21. https://doi.org/10.1001/jama.2020.21753 PMID: 33216114.

11. Choon-Huat Koh G, Hoenig H. How Should the Rehabilitation Community Prepare for 2019-nCoV? Arch Phys Med Rehabil. 2020; 101(6):1068–71. Epub 2020/03/21. https://doi.org/10.1016/j.apmr.2020.03.003 PMID: 32194034.

12. Michel JP, Maggi S, Ecarnot F. Raising awareness of the needs of older COVID patients after hospital discharge. Aging Clin Exp Res. 2020; 32(8):1595–8. Epub 2020/06/14. https://doi.org/10.1007/s40520-020-01620-1 PMID: 32533501.

13. Xie J, Tong Z, Guan X, Du B, Qiu H, Slutsky AS. Critical care crisis and some recommendations during the COVID-19 epidemic in China. Intensive Care Med. 2020; 46(5):837–40. Epub 2020/03/04. https://doi.org/10.1007/s00134-020-05979-7 PMID: 32123994.

14. Kaseda ET, Levine AJ. Post-traumatic stress disorder: A differential diagnostic consideration for COVID-19 survivors. Clin Neuropsychol. 2020; 34(7–8):1498–514. Epub 2020/08/28. https://doi.org/10.1080/13854046.2020.1811894 PMID: 32847484.

15. Wang M, Hu C, Zhao Q, Feng R, Wang Q, Cai H, et al. Acute psychological impact on COVID-19 patients in Hubei: a multicenter observational study. Translational Psychiatry. 2021; 11(1). https://doi.org/10.1038/s41398-021-01259-0 PMID: 33602920

16. Xiong Q, Xu M, Li J, Liu Y, Zhang J, Xu Y, et al. Clinical sequelae of COVID-19 survivors in Wuhan, China: a single-centre longitudinal study. Clin Microbiol Infect. 2021; 27(1):89–95. Epub 2020/09/27. https://doi.org/10.1016/j.cmi.2020.09.023 PMID: 32979574.

17. Li T, Sun S, Liu B, Wang J, Zhang Y, Gong C, et al. Prevalence and Risk Factors for Anxiety and Depression in Patients With COVID-19 in Wuhan, China. Psychosom Med. 2021; 83(4):368–72. Epub 2021/05/06. https://doi.org/10.1097/PSY.0000000000000934 PMID: 33951724.

18. Liu D, Baumeister RF, Veilleux JC, Chen C, Liu W, Yue Y, et al. Risk factors associated with mental illness in hospital discharged patients infected with COVID-19 in Wuhan, China. Psychiatry Res. 2020; 292:113297. Epub 2020/07/25. https://doi.org/10.1016/j.psychres.2020.113297 PMID: 32707218.

19. Bao Y, Sun Y, Meng S, Shi J, Lu L. 2019-nCoV epidemic: address mental health care to empower society. Lancet. 2020; 395(10224):e37–e8. Epub 2020/02/12. https://doi.org/10.1016/S0140-6736(20)30309-3 PMID: 32043982.

20. Amadeo S, Rereao M, Vanquin David G, Nguyen N, Seguin M, Beauchamp G, et al. Suicide in French Polynesia: a retrospective analysis based on medicolegal documents and interview with family. J Int Med Res. 2021; 49(9):3000605211003452. Epub 2021/09/16. https://doi.org/10.1177/030006052110 03452 PMID: 34521240.

21. Kang E, Lee SY, Kim MS, Jung H, Kim KH, Kim KN, et al. The Psychological Burden of COVID-19 Stigma: Evaluation of the Mental Health of Isolated Mild Condition COVID-19 Patients. J Korean Med Sci. 2021; 36(3):e33. Epub 2021/01/20. https://doi.org/10.3346/jkms.2021.36.e33 PMID: 33463098.

22. Sikka P, Pesonen H, Revonsuo A. Peace of mind and anxiety in the waking state are related to the affective content of dreams. Sci Rep. 2018; 8(1):12762. Epub 2018/08/26. https://doi.org/10.1038/s41598-018-30721-1 PMID: 30143673.

23. Chernova A, Frajo-Apor B, Pardeller S, Tutzer F, Plattner B, Haring C, et al. The Mediating Role of Resilience and Extraversion on Psychological Distress and Loneliness Among the General Population of Tyrol, Austria Between the First and the Second Wave of the COVID-19 Pandemic. Front Psychiatry. 2021; 12:766261. Epub 2021/11/16. https://doi.org/10.3389/fpsyt.2021.766261 PMID: 34777068.

24. Yang X, Yang X, Kumar P, Cao B, Ma X, Li T. Social support and clinical improvement in COVID-19 positive patients in China. Nurs Outlook. 2020; 68(6):830–7. Epub 2020/09/28. https://doi.org/10.1016/j.outlook.2020.08.008 PMID: 32980152.

25. Wang PR, Oyem PC, Viguera AC. Prevalence of psychiatric morbidity following discharge after COVID-19 hospitalization. Gen Hosp Psychiatry. 2021; 69:131–2. Epub 2021/01/27. https://doi.org/10.1016/j.genhosppsych.2020.12.013 PMID: 33494979.

26. Spitzer RL, Kroenke K, Williams JB, Lowe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med. 2006; 166(10):1092–7. Epub 2006/05/24. https://doi.org/10.1001/archinte.166.10.1092 PMID: 16717171.

27. Miao Q, Xie L, Xing B, Wang X, Tang S, Luo H. Emotional states and coping methods in nursing and non-nursing students responding to COVID-19: a cross-sectional study in China. BMJ Open. 2021; 11(8):e054007. Epub 2021/08/28. https://doi.org/10.1136/bmjopen-2021-054007 PMID: 34446505.

28. Gong J, Chen G, Qi Z, Zhong S, Su T, Pan Y, et al. Psychological Effects of People Isolated in Hubei Due to COVID-19 Epidemic. Front Psychiatry. 2021; 12:597894. Epub 2021/08/17. https://doi.org/10.3389/fpsyt.2021.597894 PMID: 34393837.

29. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001; 16(9):606–13. Epub 2001/09/15. https://doi.org/10.1046/j.1525-1497.2001.016009606.x PMID: 11556941.

30. Yao YY, Wei ZJ, Zhang YC, Li X, Gong L, Zhou JW, et al. Functional Disability After Ischemic Stroke: A Community-Based Cross-Sectional Study in Shanghai, China. Front Neurol. 2021; 12:649088. Epub 2021/09/14. https://doi.org/10.3389/fneur.2021.649088 PMID: 34512499.

31. Hou T, Xie Y, Mao X, Liu Y, Zhang J, Wen J, et al. The Mediating Role of Loneliness Between Social Support and Depressive Symptoms Among Chinese Rural Adolescents During COVID-19 Outbreak: A Comparative Study Between Left-Behind and Non-left-behind Students. Front Psychiatry. 2021; 12:740094. Epub 2021/09/10. https://doi.org/10.3389/fpsyt.2021.740094 PMID: 34497549.

32. Imran N, Afzal H, Aamer I, Hashmi A, Shabbir B, Asif A, et al. Scarlett Letter: A study based on experience of stigma by COVID-19 patients in quarantine. Pak J Med Sci. 2020; 36(7):1471–7. Epub 2020/11/26. https://doi.org/10.12669/pjms.36.7.3606 PMID: 33235559.

33. Lee Y-C, Lin Y-C, Huang C-L, Fredrickson BL. The construct and measurement of peace of mind. Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being. 2013; 14(2):571–90. https://doi.org/10.1007/s10902-012-9343-5

34. Mak WWS, Ng ISW, Wong CCY, Law RW. Resilience Style Questionnaire: Development and Validation Among College Students and Cardiac Patients in Hong Kong. Assessment. 2019; 26(4):706–25. Epub 2016/12/23. https://doi.org/10.1177/1073191116683798 PMID: 28006974.

35. Li J, Chen YP, Zhang J, Lv MM, Valimaki M, Li YF, et al. The Mediating Role of Resilience and Self-Esteem Between Life Events and Coping Styles Among Rural Left-Behind Adolescents in China: A Cross-Sectional Study. Front Psychiatry. 2020; 11:560556. Epub 2020/12/18. https://doi.org/10.3389/fpsyt.2020.560556 PMID: 33329099.

36. Lin J, Ren YH, Gan HJ, Chen Y, Huang YF, You XM. Factors associated with resilience among non-local medical workers sent to Wuhan, China during the COVID-19 outbreak. BMC Psychiatry. 2020; 20(1):417. Epub 2020/08/25. https://doi.org/10.1186/s12888-020-02821-8 PMID: 32831045.

37. Li J, Mo PK, Wu AM, Lau JT. Roles of Self-Stigma, Social Support, and Positive and Negative Affects as Determinants of Depressive Symptoms Among HIV Infected Men who have Sex with Men in China. AIDS Behav. 2017; 21(1):261–73. Epub 2016/02/21. https://doi.org/10.1007/s10461-016-1321-1 PMID: 26896120.

38. Stoltzfus JC. Logistic regression: a brief primer. Acad Emerg Med. 2011; 18(10):1099–104. Epub 2011/ 10/15. https://doi.org/10.1111/j.1553-2712.2011.01185.x PMID: 21996075.

39. Khraisat B, Toubasi A, AlZoubi L, Al-Sayegh T, Mansour A. Meta-analysis of prevalence: the psychological sequelae among COVID-19 survivors. International journal of psychiatry in clinical practice. 2021:1–10. Epub 2021/10/29. https://doi.org/10.1080/13651501.2021.1993924 PMID: 34709105.

40. How epidemiology has shaped the COVID pandemic. Nature. 2021; 589(7843):491–2. Epub 2021/01/ 29. https://doi.org/10.1038/d41586-021-00183-z PMID: 33505041.

41. Xu Y, Su S, Jiang Z, Guo S, Lu Q, Liu L, et al. Prevalence and Risk Factors of Mental Health Symptoms and Suicidal Behavior Among University Students in Wuhan, China During the COVID-19 Pandemic. Front Psychiatry. 2021; 12:695017. Epub 2021/07/31. https://doi.org/10.3389/fpsyt.2021.695017 PMID: 34326787.

42. Johnson SU, Ebrahimi OV, Hoffart A. PTSD symptoms among health workers and public service providers during the COVID-19 outbreak. PLoS One. 2020; 15(10):e0241032. Epub 2020/10/22. https:// doi.org/10.1371/journal.pone.0241032 PMID: 33085716.

43. Yue J, Zang X, Le Y, An Y. Anxiety, depression and PTSD among children and their parent during 2019 novel coronavirus disease (COVID-19) outbreak in China. Curr Psychol. 2020:1–8. Epub 2020/11/24. https://doi.org/10.1007/s12144-020-01191-4 PMID: 33223783.

44. Dubey S, Biswas P, Ghosh R, Chatterjee S, Dubey MJ, Chatterjee S, et al. Psychosocial impact of COVID-19. Diabetes Metab Syndr. 2020; 14(5):779–88. Epub 2020/06/12. https://doi.org/10.1016/j. dsx.2020.05.035 PMID: 32526627.

45. Shoib S, Nagendrappa S, Grigo O, Rehman S, Ransing R. Factors associated with COVID-19 outbreak-related suicides in India. Asian J Psychiatr. 2020; 53:102223. Epub 2020/06/24. https://doi.org/ 10.1016/j.ajp.2020.102223 PMID: 32574941.

46. Yuan Y, Zhao YJ, Zhang QE, Zhang L, Cheung T, Jackson T, et al. COVID-19-related stigma and its sociodemographic correlates: a comparative study. Global Health. 2021; 17(1):54. Epub 2021/05/09. https://doi.org/10.1186/s12992-021-00705-4 PMID: 33962651.

47. Islam MS, Sarkar T, Khan SH, Mostofa Kamal AH, Hasan SMM, Kabir A, et al. COVID-19-Related Infodemic and Its Impact on Public Health: A Global Social Media Analysis. Am J Trop Med Hyg. 2020; 103 (4):1621–9. Epub 2020/08/14. https://doi.org/10.4269/ajtmh.20-0812 PMID: 32783794.

48. Magnusdottir I, Lovik A, Unnarsdottir AB, McCartney D, Ask H, Koiv K, et al. Acute COVID-19 severity and mental health morbidity trajectories in patient populations of six nations: an observational study. Lancet Public Health. 2022; 7(5):e406–e16. Epub 2022/03/18. https://doi.org/10.1016/S2468-2667(22) 00042-1 PMID: 35298894.

49. Kopilas V, Hasratian AM, Martinelli L, Ivkic G, Brajkovic L, Gajovic S. Self-Perceived Mental Health Status, Digital Activity, and Physical Distancing in the Context of Lockdown Versus Not-in-Lockdown Measures in Italy and Croatia: Cross-Sectional Study in the Early Ascending Phase of the COVID-19 Pandemic in March 2020. Front Psychol. 2021; 12:621633. Epub 2021/02/23. https://doi.org/10.3389/ fpsyg.2021.621633 PMID: 33613398.

50. Carbone EG, Echols ET. Effects of optimism on recovery and mental health after a tornado outbreak. Psychol Health. 2017; 32(5):530–48. Epub 2017/02/06. https://doi.org/10.1080/08870446.2017. 1283039 PMID: 28156138.

51. Yoneda K, Hababeh M, Kitamura A, Seita A, Kamiya Y. Prevalence and characteristics of Palestine refugee mothers at risk of postpartum depression in Amman, Jordan: a cross-sectional study. Lancet. 2021; 398 Suppl 1:S28. Epub 2021/07/07. https://doi.org/10.1016/S0140-6736(21)01514-2 PMID: 34227960.

52. Li Z, Ge J, Feng J, Jiang R, Zhou Q, Xu X, et al. Less Social Support for Patients With COVID-19: Comparison With the Experience of Nurses. Front Psychiatry. 2021; 12:554435. Epub 2021/02/27. https:// doi.org/10.3389/fpsyt.2021.554435 PMID: 33633601.

53. Liu Y, Zhu Y, Xia Y. Support-Seeking Strategies and Social Support Provided in Chinese Online Health Communities Related to COVID-19. Front Psychol. 2021; 12:783135. Epub 2021/12/07. https://doi.org/ 10.3389/fpsyg.2021.783135 PMID: 34867695.

54. Pfeiffer PN, Heisler M, Piette JD, Rogers MA, Valenstein M. Efficacy of peer support interventions for depression: a meta-analysis. Gen Hosp Psychiatry. 2011; 33(1):29–36. Epub 2011/03/01. https://doi. org/10.1016/j.genhosppsych.2010.10.002 PMID: 21353125.

55. Tang JPS, Liu T, Lu S, Sing CY, Sze LCY, Lum TYS, et al. 'It was the deepest level of companionship': peer-to-peer experience of supporting community-dwelling older people with depression—a qualitative study. BMC Geriatr. 2022; 22(1):443. Epub 2022/05/20. https://doi.org/10.1186/s12877-022-03121-4 PMID: 35590279.

56. Webber M, Fendt-Newlin M. A review of social participation interventions for people with mental health problems. Soc Psychiatry Psychiatr Epidemiol. 2017; 52(4):369–80. Epub 2017/03/14. https://doi.org/ 10.1007/s00127-017-1372-2 PMID: 28286914.

57. Abbas J, Wang D, Su Z, Ziapour A. The Role of Social Media in the Advent of COVID-19 Pandemic: Crisis Management, Mental Health Challenges and Implications. Risk Manag Healthc Policy. 2021; 14:1917–32. Epub 2021/05/21. https://doi.org/10.2147/RMHP.S284313 PMID: 34012304.

58. Thygesen H, Bonsaksen T, Schoultz M, Ruffolo M, Leung J, Price D, et al. Social Media Use and Its Associations With Mental Health 9 Months After the COVID-19 Outbreak: A Cross-National Study. Front Public Health. 2021; 9:752004. Epub 2022/02/05. https://doi.org/10.3389/fpubh.2021.752004 PMID: 35118039.

59. Wu Y, Sang ZQ, Zhang XC, Margraf J. The Relationship Between Resilience and Mental Health in Chinese College Students: A Longitudinal Cross-Lagged Analysis. Front Psychol. 2020; 11:108. Epub 2020/03/03. https://doi.org/10.3389/fpsyg.2020.00108 PMID: 32116918.

60. Ferreira M, Marques A, Gomes PV. Individual Resilience Interventions: A Systematic Review in Adult Population Samples over the Last Decade. Int J Environ Res Public Health. 2021; 18(14). Epub 2021/07/25. https://doi.org/10.3390/ijerph18147564 PMID: 34300018.

61. Waller MA. Resilience in ecosystemic context: evolution of the concept. Am J Orthopsychiatry. 2001; 71 (3):290–7. Epub 2001/08/10. https://doi.org/10.1037/0002-9432.71.3.290 PMID: 11495331.

62. Gao M, Xiao C, Zhang X, Li S, Yan H. Social capital and PTSD among PLWHA in China: the mediating role of resilience and internalized stigma. Psychol Health Med. 2018; 23(6):698–706. Epub 2018/01/16. https://doi.org/10.1080/13548506.2018.1426869 PMID: 29334231.

63. Rakesh G, Morey RA, Zannas AS, Malik Z, Marx CE, Clausen AN, et al. Resilience as a translational endpoint in the treatment of PTSD. Mol Psychiatry. 2019; 24(9):1268–83. Epub 2019/03/15. https://doi.org/10.1038/s41380-019-0383-7 PMID: 30867558.

64. Xu W, Rodriguez MA, Zhang Q, Liu X. The Mediating Effect of Self-Acceptance in the Relationship Between Mindfulness and Peace of Mind. Mindfulness. 2015; 6(4):797–802. https://doi.org/10.1007/s12671-014-0319-x

65. Kabat-Zinn J. Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness, 15th anniversary ed. New York, NY, US: Delta Trade Paperback/Bantam Dell; 2005. xxxiii, 471-xxxiii, p.

66. Liu X, Xu W, Wang Y, Williams JM, Geng Y, Zhang Q, et al. Can Inner Peace be Improved by Mindfulness Training: A Randomized Controlled Trial. Stress Health. 2015; 31(3):245–54. Epub 2013/11/23. https://doi.org/10.1002/smi.2551 PMID: 24265118.

67. Kang C, Sun S, Yang Z, Fan X, Yuan J, Xu L, et al. The Psychological Effect of Internet-Based Mindfulness-Based Stress Reduction on the Survivors of Breast Cancer During the COVID-19. Front Psychiatry. 2021; 12:738579. Epub 2021/10/19. https://doi.org/10.3389/fpsyt.2021.738579 PMID: 34658972.

68. Rodriguez-Vega B, Palao A, Munoz-Sanjose A, Torrijos M, Aguirre P, Fernandez A, et al. Implementation of a Mindfulness-Based Crisis Intervention for Frontline Healthcare Workers During the COVID-19 Outbreak in a Public General Hospital in Madrid, Spain. Front Psychiatry. 2020; 11:562578. Epub 2020/12/18. https://doi.org/10.3389/fpsyt.2020.562578 PMID: 33329103.

69. Galante J, Dufour G, Vainre M, Wagner AP, Stochl J, Benton A, et al. A mindfulness-based intervention to increase resilience to stress in university students (the Mindful Student Study): a pragmatic randomised controlled trial. Lancet Public Health. 2018; 3(2):e72–e81. Epub 2018/02/10. https://doi.org/10.1016/S2468-2667(17)30231-1 PMID: 29422189.

70. Helmreich I, Kunzler A, Chmitorz A, König J, Binder H, Wessa M, et al. Psychological interventions for resilience enhancement in adults. Cochrane Database Syst Rev. 2017; 2017(2).

71. Collaborators GBDA. Alcohol use and burden for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet. 2018; 392(10152):1015–35. Epub 2018/08/28. https://doi.org/10.1016/S0140-6736(18)31310-2 PMID: 30146330.

72. Scott RG, Wiener CH, Paulson D. The Benefit of Moderate Alcohol Use on Mood and Functional Ability in Later Life: Due to Beers or Frequent Cheers? Gerontologist. 2020; 60(1):80–8. Epub 2018/10/26. https://doi.org/10.1093/geront/gny129 PMID: 30358833.

73. Zhang R, Shen L, Miles T, Shen Y, Cordero J, Qi Y, et al. Association of Low to Moderate Alcohol Drinking With Cognitive Functions From Middle to Older Age Among US Adults. JAMA Netw Open. 2020; 3(6):e207922. Epub 2020/07/01. https://doi.org/10.1001/jamanetworkopen.2020.7922 PMID: 32597992.

74. Avery AR, Tsang S, Seto EYW, Duncan GE. Stress, Anxiety, and Change in Alcohol Use During the COVID-19 Pandemic: Findings Among Adult Twin Pairs. Front Psychiatry. 2020; 11:571084. Epub 2020/10/23. https://doi.org/10.3389/fpsyt.2020.571084 PMID: 33088277.

75. Yazdi K, Fuchs-Leitner I, Rosenleitner J, Gerstgrasser NW. Impact of the COVID-19 Pandemic on Patients With Alcohol Use Disorder and Associated Risk Factors for Relapse. Front Psychiatry. 2020; 11:620612. Epub 2021/01/05. https://doi.org/10.3389/fpsyt.2020.620612 PMID: 33391060.

76. Eastman MR, Finlay JM, Kobayashi LC. Alcohol Use and Mental Health among Older American Adults during the Early Months of the COVID-19 Pandemic. International journal of environmental research and public health. 2021; 18(8):4222. https://doi.org/10.3390/ijerph18084222 PMID: 33923483.

77. Alberca RW, Rigato PO, Ramos YAL, Teixeira FME, Branco ACC, Fernandes IG, et al. Clinical Characteristics and Survival Analysis in Frequent Alcohol Consumers With COVID-19. Front Nutr. 2021; 8:689296. Epub 2021/06/22. https://doi.org/10.3389/fnut.2021.689296 PMID: 34150832.

78. Liu Z, Liu R, Zhang Y, Zhang R, Liang L, Wang Y, et al. Latent class analysis of depression and anxiety among medical students during COVID-19 epidemic. BMC Psychiatry. 2021; 21(1):498. Epub 2021/10/14. https://doi.org/10.1186/s12888-021-03459-w PMID: 34641795.

79. Orhan M, Korten N, Paans N, de Walle B, Kupka R, van Oppen P, et al. Psychiatric symptoms during the COVID-19 outbreak in older adults with bipolar disorder. Int J Geriatr Psychiatry. 2021; 36(6):892–900. Epub 2020/12/29. https://doi.org/10.1002/gps.5489 PMID: 33368692.