Clinical Research Article

Depression, anxiety and post-traumatic growth among COVID-19 survivors six-month after discharge

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ABSTRACT

Background: Pre-hospitalisation, hospitalisation and post-hospitalisation factors may significantly affect depression, anxiety and post-traumatic growth (PTG) among COVID-19 survivors.

Objective: Our study investigated depression, anxiety and PTG and their correlates among COVID-19 survivors.

Method: A cross-sectional telephone survey recruited 199 COVID-19 patients (Mean age = 42.7; 53.3% females) at six-month follow-up after hospital discharge in five Chinese cities (i.e. Wuhan, Shenzhen, Zhaohui, Dongguan and Nanning). Their demographic information, clinical records and experiences during (e.g. severity of covid-19 symptoms, treatment and exposure to other patients’ suffering) and after hospitalisation (e.g. perceived impact of covid-19, somatic symptoms after hospitalisation), and psychosocial factors (e.g. perceived discrimination, self-stigma, affiliation stigma, resilience and social support) were investigated. Depressive and anxiety symptoms were measured by the Patient Health Questionnaire (PHQ-9) and the Generalised anxiety disorder (GAD-7) scale, respectively. PTG was examined by the Post-traumatic Growth Inventory (PTGI) instrument.

Results: The proportion of depressive symptoms ≤5, ≥5 and <10, ≥10 were 76.9%, 12.0% and 11.1%, respectively. The proportion of anxiety symptoms ≤5, ≥5 and <10, ≥10 were 77.4%, 15.1% and 7.5%, respectively. Multivariate logistic regression showed that receiving mental health care services during hospitalisation, somatic symptoms after discharge, perceived affiliation stigma and perceived impact of being infected with COVID-19 were significantly and positively associated with probable depression. Significant correlates of probable anxiety also included permanent residents of the city, somatic symptoms after discharge, perceived impact of being infected with COVID-19 and self-stigma. Social support, self-stigma and receiving mental health care services during hospitalisation were positively associated with PTG.

Conclusions: The results suggest that post-hospitalisation and psychosocial factors had relatively stronger associations with depression, anxiety and PTG than pre-hospitalisation and hospitalisation factors. Promoting social support and social inclusion may be useful strategies to improve the mental health of COVID-19 survivors.

Depresión, ansiedad y crecimiento postraumático entre sobrevivientes de COVID-19 seis meses después del alta

Antecedentes: Los factores pre-hospitalización, durante la hospitalización y post-hospitalización pueden afectar significativamente la depresión, la ansiedad y el crecimiento postraumático (CPT) en los sobrevivientes de COVID-19.

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HIGHLIGHTS

• Post-hospitalisation and psychosocial factors had relatively stronger associations with depression, anxiety and PTG than pre-hospitalisation and hospitalisation factors, promoting social support and social inclusion may be useful strategies to improve mental health of COVID-19 survivors.
**1. Introduction**

Increasing research evidence has revealed that COVID-19 survivors experience psychiatric syndromes, including depression, anxiety, post-traumatic stress disorder (PTSD), insomnia, sleep disturbances and cognitive impairment (Huang et al., 2021; Leung et al., 2020; Nalbandian et al., 2021; Tarsitani et al., 2021; Wu et al., 2020). Three studies in China (sample size range: 57–675) (Cai et al., 2020; D. Liu et al., 2020; Zhang, Lu, et al., 2020) and one study in Italy (Mazza et al., 2020) investigated the psychological impact of COVID-19 and the prevalence of depression and anxiety were reported to range from 10.4% to 42%. One study in Wu Han in China reported that the prevalence of anxiety, depression and sleep difficulties were approximately one-quarter of COVID-19 survivors at six months follow-up (Huang et al., 2021). A large-scale observational study conducted in the United States recruited 62,354 COVID-19 survivors after discharge and found that the incidence of psychiatric illness was 18.1% (Taquet, Luciano, Geddes, & Harrison, 2021). Empirical studies on the long-term mental health consequences of COVID-19 on these survivors after discharge are still lacking.

Previous studies have extensively investigated negative consequences and mental distress as results of contracting COVID-19, but few studied potential positive consequences. Post-traumatic growth (PTG) is a set of positive changes and improvements in self-perceptions, relationships with others and existential beliefs...
Psychosocial factors including stigma (e.g. perceived discrimination, self-stigma, affiliate stigma), resilience and social support, may also affect mental health problems and PTG among recovered COVID-19 patients. COVID-19 survivors may experience great minority stress (e.g. stigma and discrimination) related to COVID-19 (Bagcchi, 2020; Yuan et al., 2021). Public stigma and discrimination are likely to be consequences of multiple socio-ecological drivers, such as fear of the infection or the quarantine, misinformation, infodemic (i.e. excessive circulation of misinformation) and blame to self or others for contracting the disease (Logie, 2020). Internalised stigma or self-stigma are likely to be another great minority stress (Yang & Mak, 2017, 2017). Also, COVID-19 survivors may perceive that their family members experience discrimination and internalise and attribute the negative treatment from the public to their relationships (i.e. perceived affiliate stigma) (Chiu, Yang, Wong, & Li, 2015; Yang, 2015). As far as we know, no study has investigated the role of stigma/discrimination in developing PTG in this population.

Resilience and social support are potentially important protective factors of depression, anxiety and PTG (Yang et al., 2020). Resilience is a personal protective factor, and refers to a stable trajectory of healthy functioning across time following adversity, which includes the capacity for the processes of generative experiences, cognitive flexibility, and positive emotions (Bonanno, 2004). Social support is also a key source of resilience that can facilitate individuals’ mental health and PTG (Cai et al., 2020; Yang et al., 2020). We identified one study investigating the correlation of social support with mental health of COVID-19 survivors, and reported significant associations of social support with post-traumatic stress disorder (PTSD) but not with depression or anxiety (Cai et al., 2020).

3. Aim of this study

Therefore, our study aimed to investigate the depression, anxiety and PTG and their correlates among COVID-19 survivors after six-month discharge. We were particularly interested in the factors related to the clinical records and experiences during (e.g. severity of covid-19 symptoms, treatment and exposure to other patients’ suffering) and after hospitalisation (e.g. perceived impact of covid-19, somatic symptoms after hospitalisation), and psychosocial factors (e.g. perceived discrimination, self-stigma, affiliate stigma, resilience and social support).

4. Methods

4.1. Study design

This cross-sectional telephone survey recruited 199 COVID-19 survivors at six-month follow-up after
hospital treatment. The study was conducted from August to September 2020.

### 4.2. Participants and data collection

Participants were adult patients recovered from COVID-19 who were discharged from hospitals between 1 February and 30 April 2020. The convenience sampling study sites included five hospitals located in five Chinese cities (i.e. Wuhan, Shenzhen, Zhuhai, Dongguan and Nanning). Wuhan is the capital city of Hubei Province which is the city with the largest number of reported COVID-19 cases in China. Shenzhen, Zhuhai and Dongguan are cities in Guangdong Province which has the second largest number of reported COVID-19 cases in China. Nanning is the capital city of Guangxi Province, which is relatively less affected by the COVID-19 epidemic.

According to the management guidelines of COVID-19 patients after discharge, patients with COVID-19 are centralised quarantined for 14 days in designated facilities and then quarantined for another 14 days at home. Recruitment was facilitated by medical staff in the five participating hospitals, who were responsible to provide follow-up assessments and services for recovered COVID-19 patients after hospital discharge. They contacted all discharged COVID-19 patients listed in their registries. With the informed consent before the telephone survey, they screened prospective participants’ eligibilities to join the study, briefed them about the purpose and logistics of the study, and invited them to complete a telephone interview. Upon appointment, trained interviewers confirmed their informed consent and conducted the telephone interview, which took about 35 minutes. Ethics approval was obtained from Sun Yat-sen University (Shenzhen) (Ref#2020-031).

Of the 317 recovered COVID-19 patients discharged from these hospitals, 27 were under 18 years old, 22 changed telephone number and one deceased in a car accident; the remaining 267 eligible patients were contacted by the research team. A total of 68 eligible patients refused to participate in the study due to lack of time, and the other 199 eligible patients provided consent and completed the telephone survey. The response rate was 74.5%. (Wuhan: 31/49, 63.3%; Nanning: 56/72, 77.8%; Shenzhen: 38/50, 76.0%; Zhuhai: 39/51, 76.5%; and Dongguan: 35/45, 77.8%).

### 4.3. Measures

#### 4.3.1. Development of the questionnaire

A team consisting of one epidemiologist, two public health researchers, a health psychologist and a clinician was formed to develop the questionnaire used in this study.

#### 4.3.2. Demographic and pre-hospitalisation variables

Participants’ demographic information was collected, such as age, sex, permanent resident status, highest education level, relationship status, monthly personal income and employment status. Participants were asked to report whether they received the diagnosis of any chronic diseases (i.e. hypertension, diabetes, cancers and other chronic heart/lung/liver/renal diseases) before COVID-19 infection. In addition, they were asked whether they had a family member(s) who had been infected with COVID-19 or died of COVID-19 infection.

#### 4.3.3. Hospitalisation variables

Information about severity level of COVID-19 at hospital admission, days in the hospital, ICU admission, use of invasive ventilation and corticosteroid therapy and presence of severe complications or sequelae of COVID-19 were extracted from their medical record. Participants were asked whether they witnessed the painful experiences and death of other COVID-19 patients who were treated in the same ward. In addition, participants were asked whether they received any mental health care services during hospitalisation.

#### 4.3.4. Post-hospitalisation variables

Participants reported whether they received positive SARS-Cov-2 nucleic acid testing results and mental health care services after hospital discharge.

Somatic symptoms after discharge were measured by the Patient Health Questionnaire (PHQ-15) (Kroenke, Spitzer, & Williams, 2002). It inquires about 15 somatic symptoms or symptom clusters that account for more than 90% of the physical complaints (excluding upper respiratory tract symptoms) reported in the outpatient setting (Kroenke, Arrington, & Mangelsdorff, 1990; Schappert, 1992). Also, the symptoms inquired about in the PHQ-15 include 14 of the 15 most prevalent DSM-IV somatisation disorders (i.e. those with a prevalence of 3% or greater in the general population) (Liu, Clark, & Eaton, 1997). The most frequently reported symptoms to include fatigue, low energy, sleeping trouble and pain (back pain, headaches, abdominal pain and chest pain) (Hanel et al., 2009; Hiller, Rief, & Brähler, 2006). Participants rate the severity of each symptom as 0 (‘not bothered at all’), 1 (‘bothered a little’) or 2 (‘bothered a lot’). A higher total score indicates a greater somatic symptom severity. The total PHQ-15 score scores of ≥5 and <10, ≥10 and <15, ≥15 represent mild, moderate and severe levels of somatisation, respectively. The internal consistency of the scale was acceptable in the current sample (Cronbach’s alpha = 0.88).
Perceived discrimination was measured by nine questions asking whether the participants experienced any negative treatment after discharge, including being fired, being treated unfairly and being socially excluded by family members, colleagues, and community (0 = no and 1 = yes; Cronbach’s alpha = 0.69). Self-stigma was measured by the Self-Stigma Scale (Mak & Cheung, 2010). Sample items include ‘I fear that others would know that I was infected with COVID-19’. Items were rated on a Likert scale from 1 (strongly disagree) to 4 (strongly agree). The Cronbach’s alpha was 0.94. Perceived affiliate stigma was measured by seven questions assessing to what extent the survivors perceived their family members endorsing and internalising COVID-19 stigma (1 = strongly disagree to 4 = strongly agree). The scale had excellent reliability in the current sample (Cronbach’s alpha = 0.94).

Perceived impact of being infected with COVID-19 was assessed by three questions. Participants were asked: ‘to what extent do you think COVID-19 infection has adverse impacts on your life, work, and socializing?’ Questions are rated on Likert scales, ranging from 0 (no influence at all) to 10 (severe influence). A higher score indicates a greater negative influence of COVID-19 infection on the survivors. The reliability of the 3-item scale was good (Cronbach’s alpha = 0.89).

Resilience was measured by the 2-item Connor-Davidson Resilience Scale (CD-RISC2) (Vaishnavi, Connor, & Davidson, 2007). The two items (‘Able to adapt to change’ and ‘Tend to bounce back after illness or hardship’) are rated on Likert scales, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher total score indicates a higher level of psychological resilience. The Cronbach’s alpha of the scale was 0.90 in the current sample.

Social support was measured by four questions to measure the extent of received emotional and instrumental (e.g. financial) support from family and friends (Yang et al., 2020). Items were rated on a 10-point Likert Scale ranging from 0 (none) to 10 (tremendous). The scale had good reliability in the current sample (Cronbach’s alpha = 0.80).

4.3.5. Outcomes
Depressive symptoms were measured by the Patient Health Questionnaire (PHQ-9) (Kroenke & Spitzer, 2002). Respondents evaluate the presence (0 = none to 3 = almost every day) of 9 criteria of a depressive episode in the past two weeks according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Depressive symptoms were categorised into three groups: <5, ≥5 and <10, ≥10. The cut-off point of probable depression is 5 (Levis, Benedetti, & Thoms, 2019; Löwe et al., 2008; Wu et al., 2020). The Chinese version has been used in previous studies (Tsai et al., 2014), and had good internal consistency (Cronbach’s alpha = 0.91). For comparison with other literatures (Cai et al., 2020; D. Liu et al., 2020; Zhang, Lu, et al., 2020), we also adopted 10 and above as cut-off values for depression.

Anxiety symptoms were measured by the 7-item Generalised anxiety disorder (GAD-7) scale (Spitzer, Kroenke, Williams, & Löwe, 2006). It is based on DSM-IV criteria and is used to measure the severity of generalised anxiety disorder over the past two weeks. Participants respond according to a 4-point Likert type scale (0 = none to 3 = almost every day). Anxiety symptoms were categorised into three groups: <5, ≥5 and <10, ≥10. The cut-off point of probable anxiety is 5 (Levis et al., 2019; Löwe et al., 2008; Wu et al., 2020). The Chinese version has been validated in previous studies (Tong, An, McGonigal, Park, & Zhou, 2016). It had a Cronbach’s alpha of 0.92 in the current sample. For comparison with other literatures (Cai et al., 2020; D. Liu et al., 2020; Zhang, Lu, et al., 2020), we also adopted ten and above as cut-off values for anxiety.

PTG was assessed by the Post-traumatic Growth Inventory (PTGI) (Kilmer et al., 2009). Sample questions included ‘As a result of having COVID-19, I experienced the change that I can handle problems better than I used to’. Ratings were made on 4-point Likert scales (0 = no change to 3 = a lot). Higher scores indicated higher levels of PTG. The Chinese version has been used in Chinese adult populations (Yang et al., 2020). The scale had good reliability in the current sample (Cronbach’s alpha = 0.90).

4.4. Statistical analysis
Descriptive statistics were computed for both demographic and independent variables (i.e. hospitalisation factors and post-hospitalisation factors). Univariate and multivariate Logistics regression analyses (with all the demographic factors adjusted for and all the independent factors entered, forward method and Conditional selection standard was used) were conducted to test the associations of these variables with probable depressive or probable anxiety. Odds ratio (OR) and 95% CI were reported. Univariate and multivariate linear regression analyses (with all the demographic factors adjusted for and all the independent factors entered, stepwise method was used) were also conducted to test the correlates with PTG. Standardised regression coefficients (β) and 95% confidence interval (CI) were reported. Collinearity diagnosis was performed on the multivariate regression model to clarify the intercorrelations among variables (e.g. perceived discrimination, self-stigma, and perceived affiliate stigma). The variance inflation factor (VIF) was used to detect collinearity between variables (VIF greater than ten means
significantly collinearity). The level of statistical significance was 0.05. SPSS for Windows (version 24.0, IBM Corp. Armonk, NY) was used.

5. Results

5.1. Demographic characteristics of participants

Table 1 shows the demographic characteristics of participants and subsamples with probable depression/anxiety. More than half of the participants were aged 50 years or below (63.8%, n = 127), female (53.3%, n = 106), married or cohabited with a partner (81.9%, n = 163), did not attain tertiary education (55.3%, n = 110), without permanent residency of the city (73.4%, n = 146), with personal income less than $931.8 per month (74.4%, n = 148), without a full-time work (59.8%, n = 119) and having at least one child (80.4%, n = 160).

5.2. Somatic and psychosocial characteristics of participants

Tables 1 and 2 presents the characteristics of somatic status in hospital and psychosocial status after discharge. Among the participants, 44.7% (n = 89) reported having at least one family member infected with COVID-19, and 1.5% (n = 3) had a family member died of COVID-19. The proportion of depressive symptoms <5, ≥5 and <10, ≥10 were 76.9%, 12.0% and 11.1%, respectively. The proportion of anxiety symptoms <5, ≥5 and <10, ≥10 were 77.4%, 15.1% and 7.5%, respectively. 23.1% and 22.6% of the participants had probable depression and anxiety (≥5), respectively. 11.1% and 7.5% of the participants had depression and anxiety (≥10), respectively. The prevalence of mild, moderate, and severe somatisation was 16.6%, 7.0%, and 7.5%, respectively.

5.3. Correlates of probable depression

Table 3 shows the significant results of univariate and multivariate Logistic regression analyses of probable depression. Hospitalisation factors (exposure to other patients’ suffering during hospitalisation, receiving mental health care services during hospitalisation) and post-hospitalisation factors (somatic symptoms after discharge, perceived impact of being infected with COVID-19, discrimination, self-stigma, perceived affiliate stigma, resilience and social support) were significant correlates of probable depression in the univariate regression model (p < .050).

Collinearity diagnosis of multivariate Logistic regression analyses for probable depression was performed, and the variance inflation factor (VIF) of variables were less than 5 (the maximum was 3.116, the result was not tabulated). Multivariate Logistic regression analyses showed that receiving mental health care services during hospitalisation (OR = 4.999, 95%CI = 1.648 ~ 15.166, p = .004), somatic symptoms after discharge (OR = 6.242, 95%CI = 3.317 ~ 11.748, p < .001), perceived impact of being infected with COVID-19 (OR = 1.378, 95%CI = 1.051 ~ 1.806, p = .020), and perceived affiliate stigma (OR = 1.164, 95%CI = 1.049 ~ 1.291, p = .004) were significantly associated with probable depression.

5.4. Correlates of probable anxiety

Table 4 shows the significant factors of probable anxiety, included sex, having children, exposure to other patients’ suffering during hospitalisation, receiving mental health care services during hospitalisation, somatic symptoms after discharge, perceived impact of being infected with COVID-19, discrimination, self-stigma, perceived affiliate stigma, resilience and social support in the univariate regression model (p < .050).

The variance inflation factor (VIF) of variables were less than 5 (the maximum was 3.116, the result was not tabulated). Multivariate Logistic regression analysis showed that permanent residents of the city (OR = 3.585, 95%CI = 1.349 ~ 9.525, p = .010), somatic symptoms after discharge (OR = 1.974, 95%CI = 1.258 ~ 3.098, p = .003), perceived impact of being infected with COVID-19 (OR = 1.112, 95%CI = 1.046 ~ 1.182, p = .001) and self-stigma (OR = 1.095, 95%CI = 1.008 ~ 1.188, p = .031) were significantly associated with probable anxiety.

5.5. Correlates of PTG

Univariate linear regression analysis showed that having children, receiving mental health care services during hospitalisation, and social support were significantly associated with PTG (p < .050, Table 5).

The variance inflation factor (VIF) of variables were less than 5 (the maximum was 4.439, the result was not tabulated). Multivariate linear regression analysis showed that significant protective factors of PTG included social support (β = 0.195, 95%CI = 0.039 ~ .208, p < .004), clinical classification of COVID-19 at entry (β = 0.165, 95%CI = 0.204 ~ 1.976, p = .016), and receiving mental health care services during hospitalisation (β = 0.248, 95%CI = 1.372 ~ 4.703, p < .001). However, we also found that self-stigma was positively associated with PTG (β = 0.237, 95%CI = 0.093 ~ 0.327, p < .001).

6. Discussion and conclusion

This study investigating prevalence and correlated factors of depression and anxiety among COVID-19...
survivors six-month discharge, as well as the first study testing correlated factors of PTG in this population. In general, the results support our hypotheses that pre-hospitalisation, hospitalisation and post-hospitalisation factors may significantly correlate with depression, anxiety and post-traumatic growth (PTG) among COVID-19 survivors. We found that the prevalence of mental health problems (i.e. depression and anxiety) in our sample is lower than that of the recent studies among newly recovered patients from COVID-19 infection (Cai et al., 2020; D. Liu et al., 2020; Mazza et al., 2020; Zhang, Lu, et al., 2020). It is reasonable as our participants were investigated at six-month follow-up after discharge. Nevertheless, it still deserves attention from mental health professionals and service providers since the prevalence is still high, compared to the general population or healthy population (D. Liu, Baumeister, & Zhou, 2021). This high prevalence may suggest that COVID-19 infection and hospitalisation might have long-term impacts on survivors’ mental health. Follow-up and intervention efforts are warranted to monitor the change in their mental health status after discharge and to estimate mental health care needs at different stages of recovery in this population.

Consistent with previous studies (Cai et al., 2020), being female, and having no child were significant background and risk factors of mental health problems, including depression and anxiety. This may be because these groups have lower social capital and thus have less coping resources than their counterparts.

Three hospitalisation-related factors, namely severity of COVID-19 symptoms at entry, exposure to other patients’ suffering and receiving mental health care services during hospitalisation, were positively associated with mental health problems. Severe symptoms and exposure to other patients’ suffering may be major traumatic events and can result in PTSD in the long term. It also explains the depressive and anxiety symptoms of COVID-19 survivors after discharge (D. Liu et al., 2020; Xiao, Luo, & Xiao, 2020). In addition, the aetiology of the psychiatric consequences of COVID-19 infection might also include the direct effects of viral infection (including brain infection), the immunological response, cerebrovascular disease, the degree of physiological compromise (e.g. hypoxia) and medical interventions depending on the severity of the symptoms (Rogers et al., 2020). Intriguingly, receiving mental health care services during

Table 1. Demographic characteristics of participants (n = 199).

| Variables                                      | Total                  | Participants with probable depression | Participants with probable anxiety |
|------------------------------------------------|------------------------|---------------------------------------|-----------------------------------|
|                                                | n   | %      | n   | %      | n   | %      |
| Age group (years), mean ± SD                   |     |        |     |        |     |        |
| 18–30                                          | 42.723 | 17.528  | 46.065 | 13.607  | 48.622 | 13.178 |
| 31–40                                          | 33   | 16.6   | 6   | 13.3   | 3   | 6.7    |
| 41–50                                          | 35   | 17.6   | 9   | 19.6   | 9   | 20.0   |
| 51–60                                          | 33   | 16.6   | 9   | 19.6   | 10  | 22.2   |
| >60                                            | 39   | 19.6   | 9   | 19.6   | 11  | 24.4   |
| Sex                                             |     |        |     |        |     |        |
| Male                                           | 93   | 46.7   | 18  | 39.1   | 13  | 28.9   |
| Female                                          | 106  | 53.3   | 28  | 60.9   | 32  | 71.1   |
| Relationship status                            |     |        |     |        |     |        |
| Currently single                                | 36   | 18.1   | 4   | 8.7    | 4   | 8.9    |
| Married/cohabited with a partner               | 163  | 81.9   | 42  | 91.3   | 41  | 91.1   |
| Having children                                |     |        |     |        |     |        |
| No                                             | 39   | 19.6   | 6   | 13.0   | 3   | 6.7    |
| Yes                                            | 160  | 80.4   | 40  | 87.0   | 42  | 93.3   |
| Highest education attained                     |     |        |     |        |     |        |
| Junior high or below                           | 53   | 26.6   | 15  | 32.6   | 12  | 26.7   |
| Senior high                                    | 57   | 28.6   | 14  | 30.4   | 15  | 33.3   |
| College and above                              | 86   | 43.2   | 17  | 37.0   | 18  | 40.0   |
| Refuse to disclose                             | 3    | 1.5    | 0   | 0.0    | 0   | 0.0    |
| Permanent residents of the city                |     |        |     |        |     |        |
| No                                             | 146  | 73.4   | 34  | 73.9   | 29  | 64.4   |
| Yes                                            | 53   | 26.6   | 12  | 26.1   | 16  | 35.6   |
| Monthly personal income ($)                    |     |        |     |        |     |        |
| No fixed income                                | 71   | 35.7   | 18  | 39.1   | 19  | 42.2   |
| < 465.9                                       | 25   | 12.6   | 7   | 15.2   | 8   | 17.8   |
| 465.9–931.7                                    | 52   | 26.1   | 7   | 15.2   | 7   | 15.6   |
| 931.8–1552.9                                   | 24   | 12.1   | 7   | 15.2   | 6   | 13.3   |
| ≥1553                                         | 27   | 13.6   | 7   | 15.2   | 5   | 11.1   |
| Employment status                              |     |        |     |        |     |        |
| Full-time employment                           | 80   | 40.2   | 20  | 43.5   | 16  | 35.6   |
| Free-lanced                                    | 32   | 16.1   | 7   | 15.2   | 7   | 15.6   |
| Students                                      | 15   | 7.5    | 1   | 2.2    | 1   | 2.2    |
| Unemployed                                     | 17   | 8.5    | 6   | 13.0   | 6   | 13.3   |
| Retired                                       | 55   | 27.6   | 12  | 26.1   | 15  | 33.3   |
| Diagnosis of any chronic diseases before infection | 67   | 33.7   | 20  | 43.5   | 21  | 46.7   |
| Having at least one family member infected with COVID-19 | 89   | 44.7   | 21  | 44.7   | 22  | 48.9   |
| Having a family member died of COVID-19        | 3    | 1.5    | 1   | 2.2    | 1   | 2.2    |
### Table 2. Hospitalisation variables and Post-hospitalisation variables of participants (n = 199).

| Variables | Hospitalisation variables | Participants with probable depression | Participants with probable anxiety |
|-----------|---------------------------|---------------------------------------|----------------------------------|
|           | n | % | n | % | n | % |
| **Clinical classification of COVID-19 at entry** | | | | | | |
| Asymptomatic | 3 | 1.5 | 1 | 2.2 | 0 | 0.0 |
| Mild | 42 | 21.1 | 7 | 15.2 | 6 | 13.3 |
| Common | 111 | 55.8 | 26 | 56.5 | 27 | 60.0 |
| Severe | 25 | 12.6 | 7 | 15.2 | 8 | 17.8 |
| Critically severe | 18 | 9.0 | 5 | 10.9 | 4 | 8.9 |
| ICU admission | 5 | 2.5 | 1 | 2.2 | 1 | 2.2 |
| Use of invasive assisted ventilation | 7 | 3.5 | 2 | 4.3 | 3 | 6.7 |
| Use of corticosteroid therapy | 24 | 12.1 | 8 | 17.4 | 7 | 15.6 |
| Having serious complications | 11 | 5.5 | 3 | 6.5 | 4 | 8.9 |
| Length of stay (days), mean + SD | 20.883 | 15.831 | 17.848 | 14.534 | 21.200 | 14.065 |
| Sequelae of COVID-19 before discharge | 12 | 6.0 | 3 | 6.5 | 3 | 6.7 |
| Exposure to other patients suffering during hospitalisation, mean + SD | 0.376 | 0.673 | 0.717 | 0.834 | 0.778 | 0.850 |
| Receiving mental health care services during hospitalisation | 85 | 42.7 | 28 | 60.9 | 25 | 55.6 |
| **Post-hospitalisation variables** | | | | | | |
| Receiving positive SARS-Cov-2 nucleic acid testing results | 7 | 3.5 | 3 | 6.5 | 2 | 4.4 |
| Receiving mental health care services after hospital discharge | 44 | 22.1 | 12 | 26.1 | 24 | 52.4 |
| Somatic symptoms after discharge, mean + SD | 4.005 | 5.440 | 10.457 | 6.817 | 9.511 | 7.175 |
| Mild somatisation | 33 | 16.6 | 14 | 30.4 | 11 | 24.4 |
| Moderate somatisation | 14 | 7.0 | 10 | 21.7 | 8 | 17.8 |
| Severe somatisation | 15 | 7.5 | 13 | 28.3 | 12 | 26.7 |
| Perceived impact of being infected with COVID-19, mean + SD | 9.572 | 9.208 | 18.238 | 7.486 | 18.532 | 6.851 |
| Perceived discrimination, mean + SD | 1.718 | 1.844 | 2.870 | 1.951 | 2.756 | 2.002 |
| Self-stigma, mean + SD | 2.777 | 0.927 | 8.318 | 0.068 |
| Perceived affiliate stigma, mean + SD | 7.554 | 1.862 | 6.826 | 1.842 | 6.667 | 1.954 |
| Resilience, mean + SD | 28.049 | 9.608 | 24.222 | 11.652 | 23.358 | 11.789 |

### Table 3. Univariate and multivariate Logistic regression analyses of correlates with probable depression.

| Background characteristics | Univariate analysis | Multivariate analysis |
|---------------------------|---------------------|----------------------|
|                          | OR(95% CI)          | P        | OR(95% CI)          | P        |
| Age                       | 1.005(0.984, 1.027) | 0.648   |                     |          |
| Sex                       | ref                 |          |                     |          |
| Male                      | ref                 |          |                     |          |
| Relationship status       | ref                 |          |                     |          |
| Currently single          | 1.000(0.764, 2.928) | 0.240   |                     |          |
| Married/cohabited with a partner | 2.777(0.927, 8.318) | 0.068 |
| Having children           | ref                 |          |                     |          |
| No                        | ref                 |          |                     |          |
| Yes                       | 1.033(0.716, 4.696) | 0.207   |                     |          |
| Highest education attained | ref                |          |                     |          |
| Junior high or below      | ref                 |          |                     |          |
| Senior high               | 0.735(0.353, 1.530) | 0.657   |                     |          |
| College and above         | 0.362(0.281, 1.380) | 0.248   |                     |          |
| Permanent residents of the city | ref             |          |                     |          |
| No                        | ref                 |          |                     |          |
| Yes                       | 1.000(0.456, 2.039) | 0.924   |                     |          |
| Monthly personal income ($) | ref               |          |                     |          |
| No fixed income           | ref                 |          |                     |          |
| < 465.9                   | 1.000(0.624, 1.539) | 0.905   |                     |          |
| 465.9–931.7               | 0.706(0.343, 1.436) | 0.314   |                     |          |
| 931.8–1552.9              | 0.312(0.158, 0.624) | 0.017   |                     |          |
| ≥1553                     | 1.000(0.374, 2.839) | 0.954   |                     |          |
| Employment status         | ref                 |          |                     |          |
| Full-time                 | 1.000(0.528, 2.701) | 0.669   |                     |          |
| Free-lanced               | 1.000(0.350, 2.880) | 0.995   |                     |          |
| Students                  | 0.356(0.030, 3.457) | 0.256   |                     |          |
| Unemployed                | 0.356(0.030, 3.457) | 0.256   |                     |          |
| Retired                   | 0.356(0.030, 3.457) | 0.256   |                     |          |
| Hospitalisation variables | ref                 |          |                     |          |
| Clinical classification of COVID-19 at entry | 0.986(0.900, 1.082) | 0.772   |                     |          |
| Exposure to other patients suffering during hospitalisation | 3.252(1.612, 6.560) | 0.001 | 2.870(0.983, 8.382) | 0.054 |
| Receiving mental health care services during hospitalisation | 2.886(1.438, 5.793) | 0.003 | 4.999(1.648, 15.166) | 0.004 |
| Post-hospitalisation variables | ref               |          |                     |          |
| Somatic symptoms after discharge | 5.430(3.288, 8.968) | <0.001 | 6.242(3.317, 11.748) | <0.001 |
| Perceived impact of being infected with COVID-19 | 1.154(1.101, 1.211) | <0.001 |                     |          |
| Perceived discrimination | 1.076(1.237, 1.761) | <0.001 | 1.378(1.051, 1.806) | 0.020 |
| Self-stigma               | 1.197(1.120, 1.279) | <0.001 |                     |          |
| Perceived affiliate stigma | 1.197(1.120, 1.279) | <0.001 | 1.164(1.049, 1.291) | 0.004 |
| Resilience                | 0.787(0.666, 0.931) | 0.003 |                     |          |
| Social support            | 0.946(0.915, 0.978) | <0.001 |                     |          |
hospitalisation was positively associated with mental health problems. We speculate that receiving such services indicates that these individuals were probably suffering from anxiety/depression or whatever kind of mental health condition prior to the exposure to COVID-19. Having a previous mental health problem that has been related to adverse response to stressors in multiple settings; thus, they were more vulnerable to mental health problems in the long term. Ongoing, effective, tailored and high-quality mental health monitor and follow-up services after discharge should be warranted for this population.

All the post-hospitalisation variables were significantly associated with mental health problems. Furthermore, the associations were stronger than those with socio-demographic, pre-hospitalisation and hospitalisation-related factors, and remained significant after controlling for other factors. These results highlight the importance in understanding the role of post-hospitalisation factors of mental health. Specifically, somatic symptoms after discharge had the strongest associations with mental health problems. Somatisation is one of the most common issues in health care services, associated with mental distress, substantial functional impairment and health care utilisation (Steinbrecher, Koerber, Frieser, & Hiller, 2011). As high as 31.2% of the participants were still classified as having at least mild somatisation at six-month follow-up after discharge, which health care service providers should beware of this situation. However, due to the cross-sectional nature of this study, the conclusions of this study should be interpreted with caution, as post-hospitalisation somatisation is a mental health problem itself, which is closely associated with anxiety and depression.

Stigma is one of the key concerns and social issues related to COVID-19 and survivors that need to be urgently addressed (Bagcchi, 2020). It is a contribution of the current study by providing empirical evidence on the positive associations between stigma and mental health problems in COVID-19 survivors (D. Liu et al., 2020). Furthermore, we identified the important roles of different types of stigma, including perceived discrimination, self-stigma and perceived affiliate stigma, in relating to depression and anxiety. This study extends the minority stress model (Meyer, 2015) to understand mental health problems experienced by COVID-19 survivors. It highlights that COVID-19 may not only lead to health consequences but also social and interpersonal burdens. These stigma experiences and consequences may last even when people have recovered from the infection and may continuously play as fuel of their mental health problems; they can also act as a barrier in help-seeking

### Table 4. Univariate and multivariate logistic regression analyses of correlates with probable anxiety.

| Background characteristics | Univariate analysis | Multivariate analysis |
|----------------------------|---------------------|----------------------|
|                            | OR (95% CI)         | P        |
|                            | OR (95% CI)         | P        |
| Age                        | 1.019 (0.997, 1.041) | 0.087    |
| Sex                        |                     |          |
| Male                       | Ref                 |          |
| Female                     | 2.661 (1.298, 5.456) | 0.008    |
| Relationship status        |                     |          |
| Currently single           | Ref                 |          |
| Married/cohabited with a partner | 2.689 (0.897, 8.061) | 0.077    |
| Having children            |                     |          |
| No                         | Ref                 |          |
| Yes                        | 4.271 (1.249, 14.603) | 0.021    |
| Highest education attained |                     |          |
| Junior high or below       | Ref                 |          |
| Senior high                | 1.220 (0.510, 2.920) | 0.655    |
| College and above          | 0.904 (0.396, 2.068) | 0.812    |
| Permanent residents of the city |                     |          |
| No                         | Ref                 |          |
| Yes                        | 1.745 (0.855, 3.561) | 0.126    |
| Employment status          |                     |          |
| Full-time                  | 0.667 (0.297, 1.495) | 0.325    |
| Free-lanced                | 0.747 (0.267, 2.085) | 0.747    |
| Students                   | 0.190 (0.023, 1.577) | 0.124    |
| Unemployed                 | 1.455 (0.457, 4.632) | 0.526    |
| Hospitalisation variables  |                     |          |
| Clinical classification of COVID-19 at entry | 1.023 (0.923, 1.132) | 0.667    |
| Exposure to other patients’ suffering during hospitalisation | 3.890 (1.916, 7.986) | <0.001 |
| Receiving mental health care services during hospitalisation | 1.996 (1.011, 3.938) | 0.046 |
| Post-hospitalisation variables |                 |          |
| Somatic symptoms after discharge | 3.378 (2.267, 5.033) | <0.001 |
| Perceived impact of being infected with COVID-19 | 1.162 (1.096, 1.221) | <0.001 |
| Perceived discrimination   | 1.410 (1.185, 1.679) | <0.001 |
| Self-stigma                | 1.192 (1.116, 1.273) | <0.001 |
| Perceived affiliate stigma | 1.125 (1.055, 1.200) | <0.001 |
| Resilience                 | 0.748 (0.631, 0.887) | 0.001    |
| Social support             | 0.935 (0.904, 0.968) | <0.001    |
and the potential factors among COVID-19 survivors. Indeed, both resilience and social support are important coping resources that can help individuals to adaptively cope with difficulties and stress (Meyer, 2015). The results suggest that promoting resilience and social support may be useful strategies to improve mental health of COVID-19 survivors.

Furthermore, it is the first study to investigate PTG and the potential factors among COVID-19 survivors. Again, the significant protective effects of social support and resilience on PTG suggest the importance of enhancing these modifiable psychosocial factors to facilitate recovery and promote PTG among survivors (Bensimon, 2012; Guo et al, 2020; Rzeszutek, Oniszczenko, & Firl-Burkacka, 2017). Social support and resilience-enhancement interventions thus, should be urgently warranted. Such interventions have been demonstrated to be effective in a range of populations after traumatic events (e.g. people living with HIV) and can be conducted by non-professionals (Hayes, 2012; Shrout & Bolger, 2002). Hence, they may be widely utilised in the community of COVID-19 survivors and patients.

This study has several limitations. First, the study had a relatively small sample size, and the participants were recruited in five Chinese cities. Generalisation of the findings should be made cautiously to other geographic locations in China. Second, this study employed a cross-sectional design which limits causal inference. Third, we were not able to collect information on the clinical charts or psychosocial status from survivors who refused to participate in the study. Those who refused to complete the survey may have different characteristics from the participants such as hospitalising experience, psychosocial status and resilience. Selection bias thus existed. Fourth, some measures (except the hospitalisation variables) were self-reported and might be susceptible to recall bias. Last but not least, we did not have information on the clinical charts or psychosocial status. Selection bias thus existed.

Table 5. Univariate and multivariate linear regression analyses of correlates with post-traumatic growth.

| Background characteristics                                | Univariate analysis | Multivariate analysis |
|-----------------------------------------------------------|---------------------|-----------------------|
|                                                          | β (95% CI)          | P                     | β (95% CI)          | P                     |
| Age                                                       | 0.047 (−0.037, 0.074) | 0.505                 | 0.181 (0.016, 0.109) | 0.008                 |
| Sex                                                       | Ref                 |                       | Ref                 |                       |
| Male                                                      | 0.000 (−1.699, 1.710) | 0.995                 |                       |                       |
| Female                                                    |                      |                       |                      |                       |
| Relationship status                                       | Ref                 |                       | Ref                 |                       |
| Currently single                                          | 0.119 (−0.317, 4.070) | 0.093                 | 0.227 (1.278, 4.848) | 0.001                 |
| Married/cohabited with a partner                          |                      |                       |                      |                       |
| Having children                                           | −0.206 (−5.231, −1.038) | 0.004                 | −0.297 (−6.011, −2.363) | <0.001                |
| No                                                        |                      |                       |                      |                       |
| Highest education attained                                | Ref                 |                       | Ref                 |                       |
| Junior high or below                                      | 0.008 (−2.150, 2.357) | 0.090                 | 0.079 (−1.075, 3.227) | 0.325                 |
| Senior high                                               | 0.097 (−0.873, 3.240) | 0.258                 | 0.174 (0.211, 4.102) | 0.030                 |
| College and above                                         |                      |                       |                      |                       |
| Employment status                                         | 0.031 (−1.706, 2.472) | 0.718                 | −0.178 (−5.845, −0.471) | 0.021                 |
| Full-time                                                 |                      |                       |                      |                       |
| Free-lanced                                               | 0.169 (0.138, 5.440) | 0.039                 | 0.164 (0.186, 5.392) | 0.036                 |
| Students                                                  | −0.026 (−4.061, 2.885) | 0.739                 | 0.036 (−2.169, 3.560) | 0.633                 |
| Unemployed                                                | 0.019 (−2.893, 3.725) | 0.804                 | 0.022 (−1.803, 2.378) | 0.786                 |
| Retired                                                   |                      |                       |                      |                       |
| Hospitalisation variables                                 | Ref                 |                       | Ref                 |                       |
| Clinical classification of COVID-19 at entry               | 0.010 (−0.228, 0.263) | 0.887                 | 0.165 (0.204, 1.976) | 0.016                 |
| Exposure to other patients’ suffering during hospitalisation | −0.018 (−2.175, 1.691) | 0.805                 |                       |                       |
| Receiving mental health care services during hospitalisation | −0.240 (−4.605, −1.244) | 0.001                 | 0.248 (1.372, 4.703) | <0.001                |
| Post-hospitalisation variables                            |                      |                       |                      |                       |
| Somatic symptoms after discharge                          | 0.126 (−0.015, 0.291) | 0.076                 | 0.027 (0.015, 0.329) | 0.780                 |
| Perceived impact of being infected with COVID-19          | 0.072 (−0.045, 0.140) | 0.315                 | 0.062 (0.030, 0.105) | 0.870                 |
| Perceived discrimination                                  | 0.020 (−0.389, 0.518) | 0.780                 | 0.191 (−0.334, 0.617) | 0.505                 |
| Self-stigma                                               | 0.190 (0.046, 0.290) | 0.007                 | 0.237 (0.093,0.327) | <0.001                |
| Perceived affiliate stigma                                | 0.096 (−0.049, 0.262) | 0.178                 | 0.111 (0.046, 0.177) | 0.146                 |
| Resilience                                                | 0.119 (−0.068, 0.464) | 0.095                 | 0.181 (0.016, 0.109) | 0.008                 |
| Social support                                            | 0.155 (0.010, 0.185) | 0.028                 | 0.195 (0.039, 0.208) | 0.004                 |

for (mental) health problems (Xiang et al., 2020). Therefore, continuous monitoring of their stigma experiences and consequences and according to stigma prevention programmes, may be warranted (Guo et al., 2020). For example, strategies such as educating the public about disease and provision of health information can contribute to stigma reduction in the society (Singh, Bhutani, & Fatima, 2020). Long-term strategies for building empathy and social justice for pandemics is also encouraged. However, we found that self-stigma was positively associated with PTG, this found was contrary to our expected results. One possible speculate was that there may be an unknown confounding factor that as a function of intermediary between self-stigma and PTG (Mahmoudi et al., 2021).
records of mental health status before hospitalisation of the participants. This is a significant limitation, as prior depression and anxiety would be significant risk factors for symptom recurrence during and after hospitalisation (Scholten et al., 2013).

The results suggest that high prevalence of COVID-19 survivors may suffer from mental health problems and somatisation after discharge. Post-hospitalisation and psychosocial factors, such as stigma, resilience, and social support, had relatively stronger associations with mental health problems and PTG than pre-hospitalisation and hospitalisation factors. Our results reveal that promoting social support and social inclusion may be useful strategies to improve mental health of COVID-19 survivors.

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Data Availability Statement

The data that support the findings of this study are openly available in [‘figshare’] at https://doi.org/10.6084/m9. figshare.14752377.v1 [doi], reference number [14752377].

Disclosure statement

No potential conflict of interest was reported by the author(s).

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