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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, Zhuhai, 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, affiliate 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 affiliate 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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Depression; anxiety; post-traumatic growth; COVID-19; survivor

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Depresión; ansiedad; crecimiento postraumático; COVID-19; sobreviviente

关键词
抑郁; 焦虑; 创伤后成长; COVID-19; 幸存者

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.

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Objetivo: Nuestro estudio investigó la depresión, la ansiedad y el CPT y sus correlatos en sobrevivientes de COVID-19.
Método: Una encuesta telefónica transversal reclutó a 199 pacientes con COVID-19 (edad promedio = 42,7; 53,3% mujeres) a los seis meses de seguimiento después del alta hospitalaria en cinco ciudades chinas (Wuhan, Shenzhen, Zhuhai, Dongguan y Nanning). Su información demográfica, registros clínicos y experiencias durante la hospitalización (e.g. gravedad de los síntomas de COVID-19, tratamiento, exposición al sufrimiento de otros pacientes) y después de la hospitalización (e.g. impacto percibido de COVID-19, síntomas somáticos después de la hospitalización) y factores psicosociales (e.g. discriminación percibida, autoestigma, estigma de afiliación, resiliencia, apoyo social) fueron investigados. Los síntomas depresivos y de ansiedad se midieron mediante el Cuestionario de Salud del Paciente (PHQ-9 en su sigla en inglés) y la escala de trastorno de ansiedad generalizada (GAD-7 en su sigla en inglés) respectivamente, el CPT se examinó mediante el instrumento Inventario de Crecimiento Postraumático (PTGI en su sigla en inglés).
Resultados: La proporción de síntomas depresivos <5, ≥5 y <10, y ≥10 fue 76,9%, 12,0% y 11,1% respectivamente. La proporción de síntomas de ansiedad <5, ≥5 y <10, y ≥10 fue del 77,4%, 15,1% y 7,5% respectivamente. La regresión logística multivariante mostró que recibir servicios de atención de salud mental durante la hospitalización, los síntomas somáticos después del alta, el estigma de afiliación percibido y el impacto percibido de estar infectado con COVID-19 se asociaron significativa y positivamente con una probable depresión. Los correlatos significativos de ansiedad probable también incluyeron ser residente permanente de la ciudad, síntomas somáticos después del alta, impacto percibido de estar infectado con COVID-19 y autoestigma. El apoyo social, el autoestigma y recibir servicios de salud mental durante la hospitalización se asociaron positivamente con el CPT.
Conclusiones: Los resultados sugieren que los factores psicosociales y posteriores a la hospitalización tuvieron asociaciones relativamente más fuertes con la depresión, la ansiedad y el CPT que los factores previos a la hospitalización y hospitalización. Promover el apoyo social y la inclusión social pueden ser estrategias útiles para mejorar la salud mental de los sobrevivientes de COVID-19.

COVID-19 幸存者出院六个月后的抑郁、焦虑和创伤后成长

背景： 住院前、住院和住院后因素可能会显著影响 COVID-19 幸存者的抑郁、焦虑和创伤后成长 (PTG)。
目的： 我们的研究考查了 COVID-19 幸存者的抑郁、焦虑和 PTG 及其相关性。
方法： 在中国五个城市（即武汉、深圳、珠海、东莞和南宁）进行的一项横断面电话调查招募了出院后六个月随访中的199 名 COVID-19 患者（平均年龄 = 42.7；53.3% 女性）。对其人口统计信息、临床记录和经历（例如，covid-19 症状的严重程度、治疗、暴露于其他患者的痛苦）和住院后（例如，covid-19 的感知影响、住院后的躯体症状），以及社会心理因素（例如，感知歧视、自我污名、内化污名、心理韧性、社会支持）进行了调查。抑郁和焦虑症状分别通过患者健康问卷（PHQ-9）和广泛性焦虑量表（GAD-7）测量，PTG通过创伤后成长量表（PTGI）工具评估。
结果： 抑郁症状<5、≥5和<10、≥10的比例分别为76.9%、12.0%和11.1%。焦虑症状<5、≥5和<10、≥10的比例分别为77.4%、15.1%和7.5%。多变量逻辑回归显示，住院期间接受心理保健服务、出院后的躯体症状、感知内化污名和感染 COVID-19 的感知影响与可能的抑郁显著正相关。可能焦虑的显著相关因素包括城市的常住居民、出院后的躯体症状、感染 COVID-19 的感知影响以及自我污名。住院期间的社会支持、自我污名和接受心理保健服务与PTG呈正相关。
结论： 结果表明，出院后和心理社会因素与抑郁、焦虑和 PTG 的相关性强于入院前和住院因素。促进社会支持和社会包容可能是改善 COVID-19 幸存者心理健康的有用策略。

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

(e.g. greater appreciation of life and spirituality) that follow a traumatic event (Tedeschi & Calhoun, 2004). PTG is a well-documented protective factor of immunity, treatment adherence and hospitalisation in various patient populations (Milam, 2004; Siegel, Schrimshaw, & Pretter, 2005). It has been commonly studied in the areas of traumatic events and stressful life events, such as earthquake survivorship, HIV and cancer research (Guo et al., 2020; Scrignaro, Barni, & Magrin, 2011). However, no study has investigated PTG as a potential outcome of recovering from COVID-19.

2. Correlates of depression, anxiety and PTG among COVID-19 survivors

It is particularly urgent to investigate the main correlates of anxiety, depression and PTG of COVID-19 survivors for developing the intervention strategies. Pre-hospitalisation (e.g. demographic factor, comorbidity), hospitalisation (e.g. severity of covid-19 symptoms, treatment and exposure to other patients' suffering), post-hospitalisation factors (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) may significantly affect depression, anxiety and post-traumatic growth (PTG) among COVID-19 survivors, however, the cross-sectional association between these correlates and depression, anxiety and PTG in COVID-19 survivors after six-month discharge remain to be elucidated.

Several hospitalisation-related factors, including severity of COVID-19 symptoms, negative experiences and pain during and after treatment, and exposure to other patients' suffering during hospitalisation, can lead to mental health problems and PTG among recovered COVID-19 patients (Kaseda & Levine, 2020). Patients with severe COVID-19 symptoms frequently experience respiratory symptoms which may progress to respiratory failure and induce painful experiences (Xie et al., 2020). Experiences of fighting COVID-19 may involve extreme stressors for patients, including fear of death from a life-threatening illness, pain from medical interventions such as endotracheal intubation, limited ability to communicate, and feelings of loss of control (McGinty, Presskreischer, Anderson, Han, & Barry, 2020). ICU treatment, invasive ventilation and longer duration of mechanical ventilation have been associated with increased mental distress (Shaw et al., 2009; Twigg, Humphris, Jones, Bramwell, & Griffiths, 2008). Additionally, hospitalised COVID-19 patients may also experience trauma, such as witnessing the suffering or death of other patients during hospitalisation. Exposure to such scenes may also be a cause of PTSD. In addition, somatic symptoms may last and affect patients' life, work and social functioning even after discharge (D. Liu et al., 2020).

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 in China, discharged 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 disorder somatic symptoms (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, & Thombs, 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 unvariate 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

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

	Total		Participants with probable depression		Participants with probable anxiety	
Variables	*n*	%	*n*	%	*n*	%
Age group (years), mean + SD	42.723	17.528	46.065	13.607	48.622	13.178
18–30	33	16.6	6	13.3	3	6.7
31–40	59	29.6	13	28.3	12	26.7
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

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 2. Hospitalisation variables and Post-hospitalisation variables of participants ($n = 199$).

Variables	Total		Participants with probable depression		Participants with probable anxiety	
Hospitalisation variables	*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	11	24.4
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	18.221	6.887	23.978	6.002	23.933	5.993
Perceived affiliate stigma, mean + SD	13.799	5.480	17.556	5.526	16.502	6.126
Resilience, mean + SD	7.554	1.862	6.826	1.842	6.667	1.954
Social support, 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.

	Univariate analysis		Multivariate analysis	
Background characteristics	OR(95% CI)	*P*	OR(95% CI)	*P*
Age	1.005(0.984, 1.027)	0.648		
Sex				
Male	ref			
Female	1.496(0.764, 2.928)	0.240		
Relationship status				
Currently single	ref			
Married/cohabited with a partner	2.777(0.927, 8.318)	0.068		
Having children				
No	ref			
Yes	1.833 (0.716, 4.696)	0.207		
Highest education attained				
Junior high or below	ref			
Senior high	0.825(0.353, 1.928)	0.657		
College and above	0.624(0.281, 1.388)	0.248		
Permanent residents of the city				
No	ref			
Yes	0.964(0.456, 2.039)	0.924		
Monthly personal income ($)				
No fixed income	ref			
< 465.9	1.145(0.411, 3.187)	0.795		
465.9–931.7	0.458(0.176, 1.195)	0.111		
931.8–1552.9	1.212(0.433, 3.396)	0.714		
≥1553	1.031(0.374, 2.839)	0.954		
Employment status				
Full-time	1.194 (0.528, 2.701)	0.669		
Free-lanced	1.003 (0.350, 2.880)	0.995		
Students	0.256 (0.030, 2.148)	0.256		
Unemployed	1.955(0.599, 6.378)	0.267		
Retired	ref			
Hospitalisation variables				
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				
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	1.476 (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	1.192 (1.111, 1.278)	<0.001	1.164 (1.049, 1.291)	0.004
Resilience	0.787 (0.666, 0.931)	0.005		
Social support	0.946 (0.915, 0.978)	<0.001		

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

	Univariate analysis		Multivariate analysis	
Background characteristics	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		ref	
Yes	1.745 (0.855, 3.561)	0.126	3.585 (1.349, 9.525)	0.010
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		
Retired	Ref			
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, 7.896)	<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	1.974 (1.258, 3.098)	0.003
Perceived impact of being infected with COVID-19	1.162 (1.106, 1.221)	<0.001	1.112 (1.046, 1.182)	0.001
Perceived discrimination	1.410 (1.185, 1.679)	<0.001		
Self-stigma	1.192 (1.116, 1.273)	<0.001	1.095 (1.008, 1.188)	0.031
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		

hospitalisation was positively associated with mental health problems. We speculate that receiving such services indicates that these individuals were probably already 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 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				
Male	Ref			
Female	0.000 (−1.699, 1.710)	0.995		
Relationship status				
Currently single	Ref		ref	
Married/cohabited with a partner	0.119(−0.317, 4.070)	0.093	0.227 (1.278, 4.848)	0.001
Having children				
No	Ref		ref	
Yes	−0.206 (−5.231, −1.038)	0.004	−0.297 (−6.011, −2.363)	<0.001
Highest education attained				
Junior high or below	Ref		ref	
Senior high	0.008(−2.150, 2.357)	0.090	0.079 (−1.075, 3.227)	0.325
College and above	0.097(−0.873, 3.240)	0.258	0.174 (0.211, 4.102)	0.030
Employment status				
Full-time	0.031(−1.706,2.472)	0.718	−0.178 (−5.845, −0.471)	0.021
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	Ref		ref	
Hospitalisation variables				
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		
Perceived impact of being infected with COVID-19	0.072 (−0.045, 0.140)	0.315		
Perceived discrimination	0.020 (−0.389, 0.518)	0.780		
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		
Resilience	0.119 (−0.068, 0.843)	0.095		
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).

Resilience and social support are two significant protective factors of mental health. Consistently, a study in COVID-19 patients also found that resilience was inversely associated with anxiety and depression (Zhang, Yang, et al., 2020). A recent study on COVID-19 survivors also reported a negative association between social support and mental health problems (Cai et al., 2020). 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, & Firląg-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 records) were self-reported and might be susceptible to recall bias. Last but not least, we did not have

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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