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## Regular Research Article

# Psychological Distress and Its Correlates Among COVID-19 Survivors During Early Convalescence Across Age Groups

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## ABSTRACT

**Objective:** To examine the psychological distress and the associated predictor factors of the 2019 corona-virus disease (COVID-19) on survivors in the early convalescence in Shenzhen. **Method:** A survey questionnaire consisting of post-traumatic stress disorder self-rating scale (PTSD-SS), self-rating depression scale (SDS), and self-rating anxiety scale (SAS) was presented to COVID-19 survivors still in quarantine. Scores of each scale and subscale were dependent variables in the Mann-Whitney test and stepwise regression analysis. **Results:** A total of 126 subjects were included in the study, the mean scores of PTSD-SS, SDS, and SAS were  $45.5 \pm 18.9$ ,  $47.3 \pm 13.1$ , and  $43.2 \pm 10.2$ , respectively, meanwhile, 9 (31.0%), 28 (22.2%), and 48 (38.1%) of the survivors met the cut-score for clinical significant symptoms of stress response, anxiety, and depression, respectively. Infected family members, and postinfection physical discomforts were significantly associated with scores on all three scales. Social support, retirement, and being female had significant associations with the PTSD-SS score. The survivors aged 60 or above experienced less severe stress response symptoms, fewer emotional symptoms of depression, and fewer anxiety symptoms than younger survivors. **Conclusion:** The occurrence rate of psychological distress among the COVID-19 survivors in early convalescence was high, highlighting the need for all COVID-19 survivors to be screened for psychological distress regularly for timely intervention. The predictors indicated by the current study may help to identify those at high-risk. Besides, the results indicated the older survivors suffered less emotional reactivity and fewer stress response symptoms from infectious diseases than the younger ones. (Am J Geriatr Psychiatry 2020; 28:1030–1039)

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## BACKGROUND AND OBJECTIVE

2019 corona-virus disease (COVID-19) is highly contagious.<sup>1</sup> Since the first case reported in early December 2019, the epidemic has transmitted throughout China and many other countries and was declared as a “public emergency of international concern” by the World Health Organization (WHO) emergency committee.<sup>1</sup> In order to prevent the spread of the epidemic, the Chinese government has been implementing strict self- and forced-quarantine measure across the country. Widespread unbearable psychological pressure and distress were reported.<sup>2–4</sup> Patients who suffered from COVID-19, in many ways, are similar to those who have experienced the 2003 Severe Acute Respiratory Syndrome (SARS),<sup>5</sup> also experiencing mental problems, including PTSD, anxiety, and depression, even after they have been cured and discharged from hospital.<sup>6–8</sup> Previous experiences highlight the need to pay attention to the mental health of COVID-19 survivors.

Currently, few epidemiological data are available on the mental health problems and psychiatric morbidity of those diagnosed with COVID-19. Accumulating cases reported recurrence of positive severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RNA.<sup>9,10</sup> To minimize the risk of infection, the COVID-19 survivors in convalescence must quarantine and undergo clinical observation for 14 days after being cured and discharged from hospital in Shenzhen, China. Shenzhen Samii Medical Center (SSMC) is the location for isolation and observation of COVID-19 convalescent survivors designated by Shenzhen Municipal Health Commission, rendering it a suitable place to identify eligible study subjects. Our study examined the psychological distress and its associated predictor factors of COVID-19 convalescent survivors who were still under quarantine in SSMC.

The older adults are the fastest growing age demographic.<sup>11</sup> Literature exploring older adults’ experience of traumatic events and development of mental health problems indicates that psychiatric disorders are more prevalent among this population than previously assumed.<sup>12–14</sup> Therefore, the current study also aims to contribute to a growing body of research in the area of geriatric psychiatry by evaluating differences in symptoms of psychological distress and its correlates among COVID-19 survivors across their lifespan.

## METHOD

### Participants

All cured COVID-19 patients, according to the Guideline for the Diagnosis and Treatment of COVID-19 (the seventh trial edition) published by the National Health Commission of China, were discharged from the Third People’s Hospital of Shenzhen and then transferred to SSMC for a 14-day quarantine from 20th February to 15th March, 2020. This study was approved by the Ethics Committee of SSMC. A total of 126 COVID-19 survivors enrolled in the current study.

### Measures

#### *Post-traumatic stress disorder self-rating scale (PTSD-SS)<sup>15</sup>*

PTSD-SS is a self-report measure developed by Chinese experts Liu, et al.<sup>15</sup> to capture the level of symptomatic responses to a specific traumatic stressor. The scale has demonstrated high internal consistency, with a Cronbach’s alpha of 0.92, good test–retest reliability and validity. The scale contains 24 items and 5 subscales, namely subjective assessment of traumatic events, intrusion, avoidance, hyperarousal, and impaired social function. The degree of distress for each item is rated on a 5-point scale, ranging from the absence of a symptom (score of 1) to maximal symptoms (score of 5). For symptoms of intrusion, avoidance, and hyperarousal, scores of each subscale were calculated and an average score above 2 was used as the cutoff value. A cut-score of 50 on the PTSD-SS total score indicated the clinically significant stress response. The higher the score, the more severe the stress reaction.<sup>15</sup>

#### *Self-rating depression scale (SDS)<sup>16</sup>*

SDS (William W.K.Zung, 1965) is a self-report instrument designed to detect symptoms related to depression and to measure the severity of depression in the general medical outpatient population. It contains 20 declarative sentences and corresponding question items, reflecting 4 specific symptoms of depression: emotional symptoms, physical symptoms, psychomotor disorder, and psychological

disorders. All items are rated on a 4-point scale, ranging from the absence of a symptom (score of 1) to maximal symptoms (score of 4), for each item related to the 4 specific symptoms. A standard score of 53 (equal to the original raw score of 41) was used as the cut-score for Chinese clinical significance.<sup>17</sup> The higher the score, the more severe the depressive mood.

#### *Self-rating anxiety scale (SAS)<sup>18</sup>*

SAS (William W.K. Zung, 1971) is a self-rating scale designed to detect symptoms related to anxiety in the general medical outpatient population. SAS is very similar to SDS in the items contributed to the scale and the specific evaluation method. A standard score of 50 (equal to the original raw score of 40) was used as the cut-score for clinical significance.<sup>18</sup>

#### **Procedures**

An online survey questionnaire, consisting of PTSD-SS, SAS, and SDS was delivered to those who consented to join the study via WeChat, a popular Chinese mobile messenger app, to collect information about COVID-19 related psychological variables. Information about sociopsychological variables was collected by telephone interviews, including social support (the number of people with whom they could talk and share their worries), presence of family members or close relatives being infected, bereavement due to COVID-19, postinfection physical discomforts, history of psychiatric disorders, and history of psychoactive substance abuse. Medical records were reviewed to collect information about medical background and overall medical parameters of COVID-19.

#### **Statistical Analysis**

Data were analyzed with the SPSS Version 23.0 (IBM SPSS Statistics 23). The percentage of subjects of all ages and of subjects aged 60 and above who met the cutoffs for outcome measures is summarized in [Table 2](#). However, the total scores of the scales and the relevant subscales were tested as dependent variables, as our main interest focused on symptoms of psychological distress rather than the diagnosis. Tests of normality related to the distribution of the scores of

each scale were significant, indicating a non-normal distribution. To investigate correlates of psychological symptoms, scores of each scale and subscale were the dependent variables in the statistical analysis. A non-parametric test, Mann-Whitney test, was used to investigate the effects of discrete predictor variables, Pearson correlations was used for continuous predictor variables. Stepwise regression analysis was used to examine the association between the covariates with a p value below 0.1 and scores of each scale and subscale. A p value less than 0.05 is considered statistically significant.

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## **RESULTS**

### **Characteristics of the Participants**

[Table 1](#) indicates the social demographic and medical characteristics of the subjects included in the current study. Among the participants, 66 (52.4%) were women. Their ages ranged from 11 to 72 (mean = 45.7; SD = 14.0). In China, people aged 60 or above are defined as older adults. Therefore, the current study divided those aged 60 or above into the older adults group and those under 60 into the younger group, with in the former 26 (20.6%) and 100 (79.4%) in the latter. Those who had received college education or above were regarded as having received high education, with 73 (57.9%) in this group, and the remaining 53 (42.1%) who had a lower level of education were divided into the non-high education group. There was only one medical staff participant in this study. Thirty-two (25.4%) participants were retired and 96 (76.2%) were working or studying and faced resultant pressure. Regarding the number of people with whom they could talk and share their worries, 30 (23.8%) reported low social support, while 93 (73.8%) reported good social support. Seventy-three (57.9%) participants had family members or relatives diagnosed with COVID-19, among whom only one reported bereavement due to COVID-19.

As for medical history, 24 (19%) subjects reported a history of one or more chronic medical illnesses. Twenty-three (18.3%) participants had a history of psychiatric disorders, with 2 having a history of depressive moods but no clinical diagnosis, 4 had a history of anxious moods, and 17 had a history of chronic insomnia. None of the subjects in the study

**TABLE 1. Characteristics of the Participants (n = 126)**

		Variables	N (%) or mean ± S.D
Demographic information	Age (year)		45.7 ± 14.0
	Age groups	Older age	26 (20.6%)
		Younger age	100 (89.4%)
	Gender	Female	66 (52.4%)
		Male	60 (47.6%)
	Education background	High education	73 (57.9%)
		Non-high education	53 (42.1%)
Profession	Retired	32 (25.4%)	
	Not retired	94 (74.6%)	
Social variables	Social support	Good social support	30 (23.8%)
		Low social support	96 (76.2%)
	Presence of infected family members or close relatives	Yes	73 (57.9%)
		No	53 (42.1%)
	Bereavement due to COVID-19	Yes	1 (0.8%)
No		125 (99.2%)	
Medical history	History of chronic medical illnesses	Yes	24 (19%)
		No	102 (81%)
	History of psychiatric problems	Yes	23 (18.3%)
		No	103 (81.7%)
Overall medical parameters of COVID-19	Days of hospitalization (day)		25.4 ± 7.1
	Treatment of intravenous glucocorticoids	Yes	16 (12.7%)
		No	110 (87.3%)
	Respiratory support	Yes	22 (17.5%)
		No	104 (82.5%)
	Clinical type and diagnosis of COVID-19	Mild illness - moderate pneumonia	111 (88.1%)
		Severe pneumonia - ARDS	15 (11.9%)
Postinfection physical discomforts	Yes	16 (12.7%)	
	No	110 (87.3%)	

Note. ARDS: acute respiratory distress syndrome.

reported a prior diagnosis of PTSD or other psychiatric diagnoses. And none reported a history of psychoactive substance abuse.

Overall medical parameters of COVID-19, including hospitalization days, intravenous use of glucocorticoids, respiratory support including additional

**TABLE 2. Overall Information of Scale/Subscale Scores and Psychological Distress of All Ages and of the Older**

	Scores of all subjects (n = 126) (mean ± S.D)	N <sup>a</sup> (%)	Scores of the older survivors (n = 26) (mean ± S.D)	N <sup>b</sup> (%)
PTSD	45.5 ± 18.9	39 (31%)	39.5 ± 15.6	7 (26.9%)
Intrusion	15.4 ± 6.8	52 (41.2%)	13.3 ± 5.6	8 (30.8%)
Avoidance	11.9 ± 5.7	35 (27.7%)	10.8 ± 5.0	8 (30.8%)
Hyperarousal	11.3 ± 5.0	51 (40.4%)	9.7 ± 3.7	8 (30.8%)
Anxiety	43.2 ± 10.2	28 (22.2%)	33.2 ± 6.4	3 (11.5%)
Depression	47.3 ± 13.1	48 (38.1%)	39.6 ± 10.5	12 (46.2%)
Emotional symptoms	2.8 ± 1.1	25 (19.8%)	2.2 ± 0.4	0
Physical symptoms	15.6 ± 4.0	68 (53.9%)	16.5 ± 3.9	16 (61.5%)
Psychomotor symptoms	4.6 ± 2.3	81 (64.2%)	5.2 ± 2.2	21 (80.8%)
Psychological symptoms	15.1 ± 5.3	57 (45.2%)	15.7 ± 5.3	11 (42.3%)

Note. PTSD: Post-traumatic stress disorder.

<sup>a</sup>The number of subjects whose scale/subscale scores met the cutoff value of each diagnosis included in the study.

<sup>b</sup>The number of subjects whose scale/subscale scores met the cutoff value of each diagnosis among the older survivors.

oxygen inhalation and ventilator assistance, and the clinical type and diagnosis of COVID-19, were obtained after checking their medical records. The hospitalization duration varied from 10 to 49 days (mean = 25.4; SD = 7.1). Sixteen (12.7%) participants had received intravenous glucocorticoids treatment and 22 (17.5%) once required respiratory support. One hundred and eleven (88.1%) participants were diagnosed with mild illnesses (n = 23) or moderate pneumonia (n = 88), and the remaining 15 (11.9%) had severe pneumonia (n = 14) or acute respiratory distress syndrome (ARDS, n = 1). Using telephone interviews, 16 (12.7%) participants reported persistent physical discomfort post infection, with gastrointestinal symptoms and respiratory symptoms being common complaints.

**Results of the Scales and Occurrence Rate of Psychiatric Distress, Including Subgroup Analysis of Older Adults**

The overall occurrence rate of psychiatric distress among this clinical cohort was 54.8% (n = 69).

Co-morbidity of clinically significant stress response, anxiety, and depression was 11.9% (n = 15). Table 2 reports the overall information of scores of each scale and subscale and the proportions of psychological distress for subjects of all ages and subjects aged 60 and above. Details related to the significant findings between the older subjects and the younger subjects are reported in Tables 3 and 4.

The mean score on PTSD-SS among all survivors and among the older survivors was 45.5 (SD = 18.9) and 39.5 (SD = 15.6) respectively. Those with clinically significant stress response accounted for a percentage of 31% among all survivors and 26.9% among the older survivors. Mann-Whitney test indicated that the older survivors experienced less severe stress response symptoms than younger ones (26 versus 100, z = -2.057, p = 0.04). Mean raw scores on SAS among all subjects and among the older subjects were 43.2 (SD = 10.2) and 33.2 (SD = 6.4), respectively. Survivors with clinically significant anxiety symptoms accounted for 22.2% among all survivors and 11.5% among the older survivors. The older subjects reported less severe anxiety symptoms than the younger ones, which was not significant as per

**TABLE 3. Predictor Variables with Significant Difference Indicated by Mann-Whitney Test (n = 126)**

Dependent variables	Predictor variables (n)	z	p
Scores of PTSD-SS	Older age	No (100) Yes (26)	-2.057 0.04*
	Retirement	No (84) Yes (32)	-2.832 0.005**
	Female sex	No (60) Yes (66)	-2.150 0.032*
	Good social support	No (96) Yes (30)	-1.879 0.06
	Family members or close relatives infected	No (53) Yes (73)	-1.859 0.063
	Post-infection physical discomfort	No (110) Yes (16)	-2.225 0.026*
Scores of SAS	Family members or close relatives infected	No (53) Yes (73)	-4.223 <0.001***
	Post-infection physical discomfort	No (110) Yes (16)	-3.228 0.001**
Scores of SDS	High education	No (53) Yes (73)	-2.463 0.015*
	History of psychiatric problems	No (103) Yes (23)	-1.669 0.095
	Family members or close relatives infected	No (53) Yes (73)	-4.506 <0.001***
	Postinfection physical discomfort	No (110) Yes (16)	-2.875 0.004**

Note. PTSD-SS: Post-traumatic stress disorder self-rating scale. SAS: Self-rating anxiety scale. SDS: Self-rating depression scale.

\* p < 0.05.

\*\* p < 0.01.

\*\*\* p < 0.001.

TABLE 4. Predictors of Psychological Distress Symptoms Indicated by Stepwise Regression Analysis (n = 126)

Dependent variables	Predictor variables	Unstandardized coefficients		Standardized coefficients		p
		B	Std. Error	$\beta$	t	
PTSD-SS score	Good social support	-12.645	3.551	-0.295	-3.561 <sup>a</sup>	0.001**
	Retirement	-12.371	3.621	-0.279	-3.417 <sup>a</sup>	0.001**
	Female sex	9.211	3.096	0.244	2.975 <sup>a</sup>	0.004**
	Family members or close relatives infected	6.657	3.082	0.174	2.160 <sup>a</sup>	0.033*
	Postinfection physical discomforts	9.553	4.676	0.169	2.043 <sup>a</sup>	0.043*
Intrusion score	Good social support	-4.151	1.279	-0.271	-3.245 <sup>a</sup>	0.002**
	Retirement	-4.198	1.304	-0.265	-3.218 <sup>a</sup>	0.002**
	Family members or close relatives infected	2.635	1.110	0.193	2.373 <sup>a</sup>	0.019*
	Female sex	3.087	1.115	0.229	2.768 <sup>a</sup>	0.007**
	Postinfection physical discomforts	3.610	1.685	0.178	2.143 <sup>a</sup>	0.034*
Avoidance score	Good social support	-4.554	1.081	-0.355	-4.213 <sup>a</sup>	<0.001***
	Retirement	-2.907	1.122	-0.220	-2.590 <sup>b</sup>	0.011*
	Female sex	2.342	0.955	0.208	2.452 <sup>b</sup>	0.016*
Hyperarousal score	Postinfection physical discomforts	3.437	1.249	0.229	2.752 <sup>a</sup>	0.007**
	Being female	2.320	0.815	0.232	2.845 <sup>a</sup>	0.005**
	Older age	-3.296	1.019	-0.267	-3.235 <sup>a</sup>	0.002**
	Good social support	-2.926	0.952	-0.258	-3.075 <sup>a</sup>	0.003**
	Family members or close relatives infected	1.649	0.826	0.163	1.998 <sup>a</sup>	0.048*
SAS score	Family members or close relatives infected	5.492	1.371	0.331	4.007 <sup>b</sup>	<0.001***
	Postinfection physical discomforts	5.606	2.029	0.228	2.764 <sup>b</sup>	0.008**
	Older age	-3.401	1.666	-0.168	-2.041 <sup>b</sup>	0.045*
SDS score	Family members or close relatives infected	8.203	1.724	0.386	4.757 <sup>c</sup>	<0.001***
	Postinfection physical discomforts	6.108	2.557	0.194	2.389 <sup>c</sup>	0.018*
Emotional symptoms score	Older age	-1.029	0.224	-0.378	-4.582 <sup>d</sup>	<0.001***
	Family members or close relatives infected	0.537	0.181	0.241	2.973 <sup>d</sup>	0.004**
	Good social support	-0.593	0.206	-0.237	-2.872 <sup>d</sup>	0.005**
	Being female	0.383	0.179	0.174	2.141 <sup>d</sup>	0.034*
Physical symptoms score	Family members or close relatives infected	2.523	0.667	0.316	3.781 <sup>c</sup>	0.002**
	Postinfection physical discomforts	2.422	0.989	0.204	2.448 <sup>c</sup>	0.018*
Psychomotor symptoms score	Family members or close relatives infected	1.650	0.383	0.360	4.303 <sup>c</sup>	<0.001***
Psychological Symptoms score	Family members or close relatives infected	3.901	0.890	0.366	4.381 <sup>c</sup>	<0.001***

Note. PTSD-SS: Post-traumatic stress disorder self-rating scale. SAS: Self-rating anxiety scale. SDS: Self-rating depression scale.

\* p < 0.05.

\*\* p < 0.01.

\*\*\* p < 0.001.

<sup>a</sup> df = 121.

<sup>b</sup> df = 123.

<sup>c</sup> df = 124.

<sup>d</sup> df = 122.

<sup>e</sup> df = 125.

the Mann-Whitney test, but significant as per stepwise regression analysis ( $\beta = -0.168$ ,  $t = -2.041$ ,  $df = 123$ ,  $p = 0.045$ ). Mean raw scores on SDS among all subjects and among the older subjects were 47.3 (SD = 13.1) and 39.6 (SD = 10.5), respectively. Survivors with clinically significant depression symptoms accounted for 38.1% among all survivors and 46.2% among the older survivors respectively. No significant difference in the severity of depression symptoms was found between the older survivors and the survivors of other ages. However, stepwise regression analysis indicated that older age had a significant inverse association

with the severity of emotional symptoms of depression ( $\beta = -0.378$ ,  $t = -4.582$ ,  $df = 122$ ,  $p < 0.001$ ).

### Predictors Associated with Symptoms of Psychological Distress Among the COVID-19 Survivors

Table 3 reports the predictive factors of psychological distress symptoms with significant difference or with p value below 0.1 suggested by Mann-Whitney test. Table 4 reports significant predictors of

psychological distress symptoms indicated by Stepwise Regression analysis.

Retired subjects scored significantly lower on PTSD-SS than those who had not retired (32 versus 84,  $z = -2.832$ ,  $p = 0.005$ ). Stepwise regression analysis suggested that retirement had significant inverse associations with PTSD-SS scores, including intrusion and avoidance scores, but the association between hyperarousal, SAS, and SDS scores was not significant. The female subjects scored significantly higher on PTSD-SS than the male subjects (66 versus 60,  $z = -2.150$ ,  $p = 0.032$ ). And being female was found to be significantly related to depressive emotional and PTSD-SS scores, including intrusion, hyperarousal, and avoidance scores, but its association with SAS, SDS, and other depression subscale scores was not significant. The subjects reporting good social support were prone to lower depressive emotional and PTSD-SS scores, including Intrusion, hyperarousal, and avoidance scores, than those reporting poor social support. But the relationship between social support and SAS, SDS, and other depression subscale scores was not significant. The presence of family members or close relatives infected was significantly related to all scale and subscale scores except avoidance scores. Post-infection physical discomfort was significantly related to scores of PTSD-SS, intrusion, hyperarousal, SAS, SDS, and physical symptoms of depression, but its association with avoidance scores and other depression subscales was not significant. Associations between older age and psychological distress symptoms were reported above (seen in paragraph 3.1). No significant association was found between medical parameters of COVID-19 or medical history and psychological distress symptoms.

As for the strength of predictors on psychological distress symptoms, the relationship between social support and PTSD-SS scores was strong ( $\beta = -0.295$ ,  $t = -3.561$ ,  $df = 121$ ,  $p = 0.001$ ), wherein the predictive strength on avoidance and intrusion scores was the strongest ( $\beta = -0.355$ ,  $t = -4.213$ ,  $df = 123$ ,  $p < 0.001$ ;  $\beta = -0.271$ ,  $t = -3.245$ ,  $df = 121$ ,  $p = 0.002$ , respectively). While the association between retirement and PTSD-SS scores was significant ( $\beta = -0.279$ ,  $t = -3.417$ ,  $df = 121$ ,  $p = 0.001$ ), which overshadowed the relationship between older age and PTSD-SS, the relationship between older age and hyperarousal score was the strongest ( $\beta = -0.267$ ,  $t = -3.235$ ,  $df = 121$ ,  $p = 0.002$ ). The presence of family members

or close relatives infected was the strongest predictor of SAS ( $\beta = 0.331$ ,  $t = 4.077$ ,  $df = 123$ ,  $p < 0.001$ ) and SDS scores ( $\beta = 0.386$ ,  $t = 4.757$ ,  $df = 124$ ,  $p < 0.001$ ). Older age had the strongest relationship with the emotional symptoms score of depression ( $\beta = -0.378$ ,  $t = -4.82$ ,  $df = 122$ ,  $p < 0.001$ ).

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## DISCUSSION

To the best of our knowledge, the current study is one of the few to present data on the short-term mental health consequences of COVID-19. The overall prevalence of psychological distress among the 126 COVID-19 survivors in early convalescence is 54.8%, with 31%, 22.2%, and 38.1% meeting the criteria for excessive stress, anxiety, and depression, respectively. Previous studies worldwide indicated the incidence of mental disorders after major disasters was from 10% to 20%.<sup>6-8,19</sup> Our results are much higher than that. The possible reasons are speculated as follows. First, the features of COVID-19, being highly contagious,<sup>1,20</sup> lack of antiviral drugs with definite efficacy<sup>20</sup> and the possibility of recurrence of the positive SARS-CoV-2 RNA in convalescence,<sup>9,10</sup> lead to widespread fears, horrors, and worries. Second, with the popularization of internet and smart-phones, people are overwhelmed with all kinds of information, resulting in more misunderstandings about the disease, excessive worries, and unnecessary fears. A recent study found that heavy media use increases the incidence of PTSD and depression in social unrest.<sup>21</sup> Third, the isolation from family members and friends brings out helplessness and loneliness.<sup>2</sup> Idleness during the isolation period is likely to lead to an increase in negative mood states, as well as worry about one's physical health.<sup>2</sup> Fourth, as indicated by the burden hypothesis,<sup>22</sup> the COVID-19 epidemic affects employment and incomes of most families, which adds to psychological distress. Fifth, remorse and worries about the infection of family members and close relatives add to more passive emotions, strongly supported by the significant associations between the presence of family members or close relatives and all kinds of psychological symptoms indicated by the current study. Last, with respect to telephone interviews, a majority of the survivors found that they were afraid of being stigmatized because they were infected and that they were



overwhelmed with the idea they may be henceforth treated differently. Apart from the dramatically high incidence of short-term psychological problems indicated by the current study, data from previous studies on SARS about 1-year psychological distress<sup>8</sup> indicated that survivors may develop more persistent psychological disorders with time after recovering from infectious diseases. Therefore, we suggested that all COVID-19 survivors should be screened for stress disorder, anxiety, and depression regularly to identify those with psychological distress for timely intervention.

To help identify the COVID-19 survivors at-high-risk for psychological problems, the current study suggested several predictors significantly associated with the development of psychological distress. The presence of infected family members or close relatives was associated with more symptoms of stress, anxiety as well as depression, wherein, the strength of association with stress symptoms was weak, while with depression and anxiety symptoms were strong. Concerns about the health problems of infected family members and guilt of being a source of infection lead to deterioration of mood, adding to more depression and anxiety symptoms, which may degrade and vanish as loved ones recover, or deteriorate and persist otherwise. Postinfection physical discomfort had minor associations with stress and depression symptoms, but it showed a high predictive value for more severe anxiety symptoms. As physical discomforts may be the cause as well as the effect of passive emotions, we failed to distinguish the confounding effects. Good social support was strongly associated with less severe stress symptoms and emotional symptoms of depression in the current study, consistent with the results found by previous studies that good social support helps to alleviate the emotional stress associated with traumatic events.<sup>23,24</sup> Being female was moderately related to more severe stress symptoms and emotional symptoms of depression, corresponding to the findings of previous studies about SARS related psychological distress, which indicated that being female leads to more vulnerability to stress events.<sup>8</sup> Retirement was found to be associated with less severe stress symptoms, which may be explained by the burden hypothesis that those who had not retired are at higher risk for psychological distress because of greater social and financial responsibilities.<sup>22</sup> The association between older age and

psychological distress and the confounding effects between retirement and older age will be discussed later. The current study found no significant associations between psychological distress and the survivors' educational background, medical history including history of psychiatric disorders as well as overall medical parameters of COVID-19. On one hand, it may be that the huge social-psycho impact brought by the COVID-19 epidemic exceeds the decisive role of the disease itself. On the other hand, the relevant information was collected by the survivors' recall and dictation, which may lead to information inaccuracy, especially history of psychiatric disorders. Moreover, the subjects included in the current study all completed the online questionnaire by themselves, which indicates that they all had access to online sources of information, thus attenuating the impact of educational background.

The current study also contributes to knowledge of geriatric psychiatry, specifically about older survivors' psychological response to infectious diseases. Although the relationship between older age and PTSD-SS scores was overshadowed by that of retirement and PTSD-SS scores in Stepwise Regression analysis, Mann-Whitney test suggested that older COVID-19 survivors were about less than twice as likely to develop excessive stress symptoms. Moreover, older age was found to be strongly related to less severe hyperarousal symptoms and emotional symptoms of depression, and minorly associated with less severe anxiety symptoms. No significant difference was found between older COVID-19 survivors and the younger survivors for depression symptoms. Our findings about stress response corresponds to a prior study<sup>25</sup> that found people over 60 years old had significantly fewer PTSD symptoms than all other age groups. Community-based surveys also confirmed that PTSD symptoms were less prevalent among the older population.<sup>26</sup> A meta-analysis concerning post human induced disasters came to the same conclusion as ours that older adults (with the age above 65) were about less than twice as likely to experience PTSD symptoms, while finding no significant difference between older adults and younger adults for depression.<sup>27</sup> Our finding, that, compared with survivors of other ages, older COVID-19 survivors reported fewer emotional symptoms and fewer anxiety symptoms, indicates that the older adults had less emotional reactivity to the infection, which may

protect them from excessive stress response. Similar findings have been reported in previous studies and several theories may explain why.<sup>21,22,28,29</sup> Prior experiences, as cognitive theory suggested, make it less likely for the older adults to incorporate traumatic events as a central part of their identity than the younger population,<sup>28</sup> and, as inoculation hypothesis suggested, may result in decreased emotional reactivity to subsequent exposure among the older adults.<sup>21</sup> Besides, maturation helps the older adults develop an adaptive coping style with greater resilience to psychological distress than the younger adults.<sup>29</sup> According to the burden hypothesis, older adults bear fewer social and financial responsibilities during the traumatic events than the younger adults.<sup>22</sup> It may also explain why the retired COVID-19 survivors suffer less psychological distress than the ones who had not in the current study. Most of the older survivors belong to the retirement group. Older age and retirement may have a mutual influence on psychological response. However, we failed to eliminate the confounding effects between older age and retirement as a result of a small sample size in the stratified analysis.

There are a few limitations of this study. Online questionnaire surveys screened out those survivors who did not know how to use smartphones, failing to get psychological data from those with low levels of education or very old individuals and who were inaccessible to online information. The participants were COVID-19 patients cured and under quarantine in the hospital designated by the government in Shenzhen city, where medical sources and daily necessities were abundant. In some countries people have been forced to quarantine in their own homes rather than in government designated center, which may have significant impact on the COVID-19 survivors' mental well being. Therefore, the present findings may not be readily generalized to all COVID-19 survivors. Besides, the current study was conducted at an early stage of recovery. Psychological distress may improve with time as the survivors return to normal routines or as their infected family members get better. Stress response symptoms may be over-reported in the present study, especially in young individuals who are concerned about returning to work. Such findings should be further substantiated by the administration of outpatient follow-ups, after quarantine, for PTSD and mood disorder to differentiate it from other

diagnoses such as adjustment disorders. There is also limitation in statistical analysis. The number of statistical tests was huge and type I error was inflated in the current study. In this retrospective study, small number of participants may limit the power of finding significant relationships between predictor variables and psychological distress not indicated by the current study.

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## CONCLUSION

The current study presents data on the short-term mental health consequences of COVID-19, suggesting that COVID-19 survivors during early convalescence suffer a high incidence of psychological distress, including excessive stress, anxiety and depressive moods, which may improve after quarantine. However, data from previous studies of 1-year SARS related psychological distress<sup>8</sup> indicated that survivors may develop more persistent psychological disorders with time after recovering from infectious diseases. Therefore, we suggested all COVID-19 survivors, both undergoing quarantine and after quarantine, should be screened for psychological distress regularly for timely intervention. Predictors significantly associated with COVID-19 related psychological distress suggested by the study may help identify those at-high-risk for timely interventions. Besides, the current study contributed to accumulating data on geriatric psychiatry, specifically about older adults' psychological responses to infectious diseases, indicating that older COVID-19 survivors have less emotional reactivity to infection, fewer anxiety symptoms and fewer stress reaction symptoms than younger survivors.

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## DISCLOSURE

*All authors declare no conflicts of interest.*

*Data analysis and interpretation, draft of the manuscripts by Xin Cai. Acquisition of the scale data by Xiaopeng Hu. Manuscript revision by Ekumi Ivo Otte and Yawen An. Conception of the study by Jianchun Wang. Acquisition of the data related to overall parameters of COVID-19 by Zhiwen Li. Design of the study, and approval to the final version by Bo Yuan.*

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