LETTER TO EDITOR

Mental health status and related influencing factors of COVID-19 survivors in Wuhan, China

Dear editor,

In late December 2019, a novel contagious pneumonia named coronavirus disease 2019 (COVID-19) has broken out in Wuhan, China.1 On January 30, 2020, World Health Organization (WHO) declared COVID-19 as a Public Health Emergency of International Concern. On March 11, 2020, WHO characterized COVID-19 as a pandemic.2,3 Much research work has been done for hospitalized COVID-19 patients, mainly in clinical characteristics.4 However, few studies have reported the post-discharge follow-up status, especially the mental health status of COVID-19 survivors. Therefore, in this descriptive case series, we enrolled a large number of COVID-19 survivors in Wuhan, China. We aimed to report the post-discharge mental health status of these survivors and explore relevant influencing factors.

This study was conducted in Wuhan Jinyintan Hospital. All patients were confirmedly diagnosed with COVID-19.1 The flowchart is shown in Figure S1. Eventually, 370 COVID-19 survivors were included in this study. Verbal consent of follow-up was obtained in all the 370 survivors. Survivors’ readmission status and the reasons were inquired. Post-discharge respiratory symptoms were inquired. Whether the survivors worried about COVID-19 recurrence was inquired. Whether the survivors worried about COVID-19 infection to others (family members) was inquired. Home quarantine lifestyles status was inquired. Anxiety was measured using The Generalized Anxiety Disorder Screener (GAD-7). Total score 0-4 refers to no anxiety; total score 5-21 refers to anxiety.5 Depression was measured using Patient Health Questionnaire-9 (PHQ-9). Total score 0-4 refers to no depression; total score 5-27 refers to depression.6

Statistical analysis was performed using SPSS (Version 24.0). Continuous variables were presented by mean ± standard deviation (SD) or median with inter quartiles (IQR). Categorical variables were presented by number with percentage. Student’s t-test and Chi-square test were used as appropriate. \( P < .05 \) was statistically significant.

Clinical data and post-discharge status were summarized in Table 1. The median time from discharge to follow-up were 22 days (IQR 20-30 days). Six (1.6%) survivors were readmitted to hospital during the follow-up, including two for cough without SARS-CoV-2 RNA positive, two for pneumonia without SARS-CoV-2 RNA positive, one for transient SARS-CoV-2 RNA positive without pneumonia, and one for lumbar disease. No SARS-CoV-2-positive pneumonia recurred in any survivors during the follow-up.

Sixty (16.2%) survivors had post-discharge cough and 45 (12.2%) had breathlessness after activity. Twenty (5.4%) survivors had sputum production during the follow-up. One hundred seventy-three (46.8%) survivors worried about recurrence and 174 (47.0%) worried about infection to others. Two hundred ninety-three (79.2%) survivors took a home quarantine lifestyle. Fifty (13.5%) survivors occurred anxiety. Forty (10.8%) survivors occurred depression.

As shown in Table S1, survivors (39.2%) were most bothered by feeling nervous, anxious, or on edge. As shown in Table S2, a high proportion of 29.5% survivors were bothered by sleeping disorders. Four survivors (1.1%) once had thoughts of suicide in several days.

As shown in Table 2, survivors with post-discharge respiratory symptoms, worry about recurrence, or worry about infection to others had significantly increased incidence of anxiety \( (P < .05) \). Female, or survivors with post-discharge respiratory symptoms, worry about recurrence, worry about infection to others, or home quarantine lifestyle had significantly increased incidence of depression \( (P < .05) \). Anxiety and depression were not associated with age, family infection, comorbidity, and so on.

In this study, we conducted a post-discharge follow-up of COVID-19 survivors. No SARS-CoV-2-positive pneumonia was recurrent in this population during the follow-up period. We identified one survivor with transient SARS-CoV-2 RNA turning into positive. However, the positive SARS-CoV-2 RNA soon turned into negative again (interval: 5 days) just when he was readmitted. We Chinese experts pointed out that SARS-CoV-2 RNA turning into positive in survivors is not equal to recurrence or re-infection.7 There might be two reasons for transient SARS-CoV-2 RNA positive in survivors: first, it comes from the nucleic acid fragments of the inactivated SARS-CoV-2; second, the virus titer lowers to a level that can hardly be detected at discharge, the residual virus fluctuated at post-discharge but would be
### TABLE 1  Clinical characteristics and post-discharge status of the enrolled survivors (N = 370)

| Parameters                              | All patients |
|-----------------------------------------|--------------|
| Age (years)                             | 50.5 ± 13.1  |
| Male                                    | 203 (54.9%)  |
| Huanan seafood market exposure          | 113 (30.5%)  |
| Infection with family members           | 25 (6.8%)    |
| Infected medical staffs                 | 33 (8.9%)    |
| Current smoking                         | 21 (5.7%)    |
| Common comorbidity                      |              |
| Hypertension                            | 79 (21.4%)   |
| Diabetes                                | 31 (8.4%)    |
| Common symptoms and signs at disease onset |            |
| Fever                                   | 326 (88.1%)  |
| Highest temperature (°C)                | 38.7 ± 0.65  |
| Cough                                   | 288 (77.8%)  |
| Breathlessness or dyspnea               | 125 (33.8%)  |
| Sputum                                  | 111 (30.0%)  |
| Timeline                                |              |
| Days from disease onset to admission    | 10 (7~13)    |
| Days from admission to discharge        | 12 (9~14)    |
| Days from discharge to follow-up        | 22 (20~30)   |
| Post-discharge status                   |              |
| Readmission                             | 6 (1.6%)     |
| Readmission for cough without SARS-CoV-2 RNA positive | 2 |
| Readmission for pneumonia without SARS-CoV-2 RNA positive | 2 |
| Readmission for transient SARS-CoV-2 RNA positive without pneumonia | 1 |
| Readmission for lumbar disease          | 1            |
| Readmission for recurrent SARS-CoV-2 pneumonia | 0 |
| Respiratory symptoms in post-discharge period |          |
| Cough                                   | 60 (16.2%)   |
| Sputum                                  | 20 (5.4%)    |
| Breathlessness after activity           | 45 (12.2%)   |
| Worry about recurrence                  | 173 (46.8%)  |
| Worry about infection to others         | 174 (47.0%)  |
| Both worry about recurrence and infection to others | 136 (36.8%) |
| Home quarantine lifestyle               | 293 (79.2%)  |
| Anxiety (GAD-7 measurement)            | 50 (13.5%)   |
| Depression (PHQ-9 measurement)          | 40 (10.8%)   |
| Comorbid anxiety and depression         | 23 (6.2%)    |
| Willingness to return to hospital for health examination | 356 (96.2%) |

GAD-7, The Generalized Anxiety Disorder Screener; PHQ-9, Patient Health Questionnaire-9.

soon cleared by body immunity. COVID-19 survivors should not be overly worried for a rare event of recurrence, as we found a high proportion of survivors (46.8%) worried about recurrence.

An epidemic disease, such as SARS in 2003, generally accompanies with multiple psychiatric morbidities, including anxiety, depression, and even suicide. In our study, we found anxiety and depression existed in approximately 10% of COVID-19 survivors. We also found a high proportion of 29.5% survivors were bothered by sleeping disorders. For those survivors with severe sleeping disorders, some medications could be prescribed to help them improve the sleep. Survivors with suicidality (1.1%) must be closely followed up and cared by psychiatrists.
| Variable                        | With anxiety (n = 50) | Without anxiety (n = 320) | P-value* | With depression (n = 40) | Without depression (n = 330) | P-valueb |
|--------------------------------|----------------------|--------------------------|----------|--------------------------|----------------------------|----------|
| Age                            | 52.9 ± 13.3          | 50.1 ± 13.1              | .171     | 54 ± 14.2                | 50.1 ± 13.0                | .074     |
| Female                         | 26 (52.0%)           | 141 (44.1%)              | .294     | 24 (60.0%)               | 143 (43.3%)               | .045*    |
| Infection with family members  | 1 (2.0%)             | 24 (7.5%)                | .255     | 2 (5.0%)                 | 23 (7.0%)                 | .892     |
| Infected medical staffs        | 3 (6.0%)             | 30 (9.4%)                | .609     | 4 (10.0%)                | 29 (8.8%)                 | 1.000    |
| Current smoking                | 2 (4.0%)             | 19 (5.9%)                | .824     | 1 (2.5%)                 | 20 (6.1%)                 | .577     |
| Common comorbidity             |                      |                          |          |                          |                            |          |
| Hypertension                   | 13 (26.0%)           | 66 (20.6%)               | .388     | 13 (32.5%)               | 66 (20.0%)                | .068     |
| Diabetes                       | 2 (4.0%)             | 29 (9.1%)                | .354     | 3 (7.5%)                 | 28 (8.5%)                 | 1.000    |
| Respiratory symptoms in post-discharge period | | | | | | |
| Cough                          | 15 (30.0%)           | 45 (14.1%)               | .004*    | 17 (42.5%)               | 43 (13.0%)                | <.001*   |
| Sputum                         | 7 (14.0%)            | 13 (4.1%)                | .011*    | 9 (22.5%)                | 11 (3.3%)                 | <.001*   |
| Breathlessness after activity   | 14 (28.0%)           | 31 (9.7%)                | <.001*   | 15 (37.5%)               | 30 (9.1%)                 | <.001*   |
| Worry about recurrence         | 34 (68.0%)           | 139 (43.3%)              | <.001*   | 32 (80.0%)               | 141 (42.7%)               | <.001*   |
| Worry about infection to others | 37 (74.0%)           | 137 (42.8%)              | <.001*   | 34 (85.0%)               | 140 (42.4%)               | <.001*   |
| Home quarantine lifestyle       | 44 (88.0%)           | 249 (77.8%)              | .099     | 39 (97.5%)               | 254 (77.0%)               | .003*    |

*P-value: with anxiety versus without anxiety.

bP-value: with depression versus without depression.

We found anxiety and depression are significantly associated with post-discharge residual symptoms, worry about recurrence, and worry about infection to others. Besides, females were more susceptible to depression. We clinicians should explain to survivors that residual respiratory symptom is common in the recovery period of pneumonia. As time goes by, most residual respiratory symptom would gradually disappear.

In Chinese national diagnosis and treatment scheme of COVID-19,9 all COVID-19 survivors are suggested to take a post-discharge home quarantine lifestyle for 2 weeks. The main requirements of home quarantine lifestyle included living in single drafty room, reduction of close contact with family, separate meals, and avoidance of outdoor activity. This conduct is necessary to avoid unexpected infections to others. However, we found home quarantine lifestyle is associated with increased incidence of depression. Therefore, effective measures need to be taken to relieve the depression caused by home quarantine lifestyle, such as online chat or video chat with family, indoor exercise, and so on.

In summary, about 10% of COVID-19 survivors develop anxiety or depression, because of post-discharge respiratory symptoms, worry about recurrence, and infection to others. Female COVID-19 survivors are more susceptible to depression. COVID-19 survivors should not be overly worried about a rare event of recurrence. In addition, depression caused by home quarantine lifestyle should also be noted and relieved.

**CONFLICT OF INTEREST**

The authors declared no conflict of interest.

**DATA AVAILABILITY**

The data used to support the findings of this study are available from the corresponding author upon appropriate request.

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