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The psychological status of people affected by the COVID-19 outbreak in China

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ABSTRACT

Objective: An outbreak of 2019 coronavirus disease (COVID-19) occurred in Wuhan (Hubei, China) in December, 2019. Facing this large scale infectious public health event, everyone is under great psychological pressure. The aim was to investigate the psychological status of people affected by the COVID-19 outbreak in China.

Methods: The online cross-sectional study involving 922 participants (656 medical staff and 266 general population) was conducted in China between February and March, 2020. The psychological status was evaluated using the Symptom Check List 90 Revised (SCL-90). Linear and logistic regression analysis were used to examine the effect in the study.

Results: Of the 922 participants, approximately 18.3% had psychological health problems. The score of the SCL-90 was significant higher in medical staff (mean = 1.49) than that in general population (mean = 1.36). In addition, the participants enrolled in March were less likely to have psychological health problems than in February (odds ratio = 0.42, 95% confidence interval [CI] = 0.30 to 0.59). Female had a 1.44-fold risk of psychological health problems than male (95% CI = 1.01 to 2.03).

Conclusions: In the study, 18.3% had psychological health problems during the outbreak of COVID-19 epidemic. With the remission of the epidemic, the psychological health status of participants has been improved. Medical staff were likely to have higher SCL-90 scores than general population and female had more psychological problems than male. Our findings can be used to formulate psychological interventions for improving the mental health of vulnerable groups during the COVID-19 epidemic.

1. Introduction

Since December 2019, an outbreak of coronavirus disease 2019 (COVID-19) in Wuhan, Hubei province, China has aroused public concern nationwide (Wu et al., 2009). As of March 30, 2020, there were 81518 confirmed cases in China and the morbidity rate was up to 4.05% (National Health Commission of the People’s Republic of China, 2020). In order to control the rapid spread of the COVID-19 outbreak, the Chinese government has taken active and effective measures, including national blockade (Lau et al., 2020). Up to now, the city in lockdown has lasted for more than two months. With the long-term isolation, it is urgent to explore people’s psychological health status in China (Bao et al., 2020).

The epidemic has brought great psychological pressure to everyone, including medical staff and the general population. With the high pressure and pandemic risk, medical staff are at great risk of developing...
psychological problems (Chen et al., 2020). As far as we know, the virus is mainly transmitted via virus-laden respiratory droplets. Due to the face-to-face contact and communication with patients in their work, medical staff are at higher risk of COVID-19 infection than the general population. In addition, at the early stage of the outbreak, the shortage of medical supplies and equipment was also aggravating psychological distress among medical staff. With regarding to the general population, people have to stay at home and isolate themselves in society to prevent infection. As a result, long-term isolation brings a series of problems to life and work, including loss of work and life embarrassment. The COVID-19 epidemic is still in progress, and a timely understanding of psychological status among the affected people is an urgent need for society.

On 15 March 2020, the World Health Organization (WHO) declared this disease a global pandemic (WHO, 2020b). In the world, there were 754948 confirmed cases and 36571 confirmed deaths involving 203 countries, areas or territories with cases (Updated data: 1 April 2020, 02:06 GMT +) (WHO, 2020a). People all over the world are committed to fighting the COVID-19 pandemic in all aspects. Therefore, it is of great significance to assess psychological health status for medical staff and the general population, which could improve the effect of epidemic control and promote rapid social recovery. In the current study, we conducted a cross-sectional study to investigate the psychological status of people affected by the COVID-19 outbreak in China.

### 2. Methods

We conducted a cross-sectional study to evaluate the current psychological status during the outbreak of the COVID-19 epidemic between February 17 and March 10, 2020, in China. As the Chinese Government recommended the public to isolate themselves at home, subjects were electronically invited to participate in the study. Medical staff were included if they were from the hospitals for treatment of COVID-19 patients. The general population are non-health care workers. After receiving a detailed explanation of the study, a total of 922 individuals (656 medical staff and 266 general public) approved and filled in the questionnaire. The research protocol was approved by the ethics committees of Union Hospital, Tongji Medical College, Huazhong University of Science and Technology [No. (2020) 0029].

The investigation was carried out in accordance with the latest version of the Declaration of Helsinki.

### 2.1 Participants

| Variables | All population | Positive psychological symptoms (n = 169) | Negative psychological symptoms (n = 753) | X² or t | P |
|-----------|----------------|------------------------------------------|------------------------------------------|--------|---|
| Date      |                |                                          |                                          |        |   |
| February  | 387 (42.0)     | 99 (58.6)                                | 288 (38.2)                               |        |   |
| March     | 535 (58.0)     | 70 (41.4)                                | 465 (61.8)                               |        |   |
| Residence |                |                                          |                                          |        |   |
| Wuhan     | 490 (53.1)     | 94 (55.6)                                | 396 (52.6)                               |        |   |
| Non-Wuhan | 432 (46.9)     | 75 (44.4)                                | 357 (47.4)                               |        |   |
| Gender    |                |                                          |                                          |        |   |
| Male      | 410 (44.5)     | 66 (39.1)                                | 344 (45.7)                               |        |   |
| Female    | 512 (55.5)     | 103 (60.9)                               | 409 (54.3)                               |        |   |
| Age (years) |            |                                          |                                          |        |   |
| ≤35       | 287 (31.1)     | 62 (36.7)                                | 225 (29.9)                               |        |   |
| ≥40       | 306 (33.2)     | 53 (31.3)                                | 253 (33.6)                               |        |   |
| Work      |                |                                          |                                          |        |   |
| General population | 266 (28.9) | 35 (20.7) | 231 (30.7) |        |   |
| Medical staff | 656 (71.1) | 134 (79.3) | 522 (69.3) |        |   |

Data shown as n (%) or mean ± standard deviation.

Table 1

The descriptive characteristics of the participants.

Psychological problems (Chen et al., 2020). As far as we know, the virus is mainly transmitted via virus-laden respiratory droplets. Due to the face-to-face contact and communication with patients in their work, medical staff are at higher risk of COVID-19 infection than the general population. In addition, at the early stage of the outbreak, the shortage of medical supplies and equipment was also aggravating psychological distress among medical staff. With regarding to the general population, people have to stay at home and isolate themselves in society to prevent infection. As a result, long-term isolation brings a series of problems to life and work, including loss of work and life embarrassment. The COVID-19 epidemic is still in progress, and a timely understanding of psychological status among the affected people is an urgent need for society.

On 15 March 2020, the World Health Organization (WHO) declared this disease a global pandemic (WHO, 2020b). In the world, there were 754948 confirmed cases and 36571 confirmed deaths involving 203 countries, areas or territories with cases (Updated data: 1 April 2020, 02:06 GMT +) (WHO, 2020a). People all over the world are committed to fighting the COVID-19 pandemic in all aspects. Therefore, it is of great significance to assess psychological health status for medical staff and the general population, which could improve the effect of epidemic control and promote rapid social recovery. In the current study, we conducted a cross-sectional study to investigate the psychological status of people affected by the COVID-19 outbreak in China.

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|-----------|----------------|------------------------------------------|------------------------------------------|--------|---|
| Date      |                |                                          |                                          |        |   |
| February  | 387 (42.0)     | 99 (58.6)                                | 288 (38.2)                               |        |   |
| March     | 535 (58.0)     | 70 (41.4)                                | 465 (61.8)                               |        |   |
| Residence |                |                                          |                                          |        |   |
| Wuhan     | 490 (53.1)     | 94 (55.6)                                | 396 (52.6)                               |        |   |
| Non-Wuhan | 432 (46.9)     | 75 (44.4)                                | 357 (47.4)                               |        |   |
| Gender    |                |                                          |                                          |        |   |
| Male      | 410 (44.5)     | 66 (39.1)                                | 344 (45.7)                               |        |   |
| Female    | 512 (55.5)     | 103 (60.9)                               | 409 (54.3)                               |        |   |
| Age (years) |            |                                          |                                          |        |   |
| ≤35       | 287 (31.1)     | 62 (36.7)                                | 225 (29.9)                               |        |   |
| ≥40       | 306 (33.2)     | 53 (31.3)                                | 253 (33.6)                               |        |   |
| Work      |                |                                          |                                          |        |   |
| General population | 266 (28.9) | 35 (20.7) | 231 (30.7) |        |   |
| Medical staff | 656 (71.1) | 134 (79.3) | 522 (69.3) |        |   |

Data shown as n (%) or mean ± standard deviation.

Table 1

The descriptive characteristics of the participants.
score of the scale, is a widely used global index of distress (Ignatyev et al., 2016). Higher scores indicate more severe psychopathologic symptoms. If the total score of the SCL-90 scale is more than 160 points, it suggests a subject with positive psychological problems (Jin et al., 2010).

Categorical variables for basic characteristics were expressed as a number (%) and continuous variables for the ages of the participants and the SCL-90 scores were shown as the mean and standard deviation (SD). The chi-square test, t-test and one-way analysis of variance (ANOVA) were used to examine the distribution differences of the SCL-90 scores in the groups. We also calculated the effect sizes (Cohen’s d) to describe the standardized mean difference of an effect. Cohen’s d is directly related to a t-test as small (d = 0.2), medium (d = 0.5), large (d = 0.8), and η² is widely reported in ANOVA to define small (η² = 0.01), medium (η² = 0.06), and large (η² = 0.14) effects (Lakens, 2013). To identify the potential risk factors that were associated with psychopathology, all related variables were included in the forward stepwise multiple linear and logistic regression models for analysis. All tests were two-tailed, and p < 0.05 was considered statistically significant. Statistical analysis was conducted using SPSS Statistic 22.0 (SPSS Inc., Chicago, IL, USA).

3. Results

The basic characteristics of our study population are shown in Table 1. Of the 922 participants, 387 (42.0%) were recruited in February and 535 (58.0%) in March. About 53.1% lived in Wuhan city, and 44.5% were male. The average ages of participants were 37.86 years old (SD = 7.67), 31.1% of them were no more than 35 years old, 35.7% were 36–39 years old, and 33.2% were 40 years old or older. There were 656 (71.1%) medical staff, of which 485 (73.9%) came from the third-level hospital, 59.0% were enrolled in February, 48.9% were in Wuhan city, and 47.7% were male. The average ages for medical staff were 37.28 years old (SD = 6.36). Approximately 18.3% of the participants had psychological health problems. Compared with the controls, the subjects with psychological health problems were more enrolled in February and more medical staff. When restricted to medical staff, there were significant differences between the subjects with positive and negative psychological symptoms in hospital classification, survey time and residence.

Table 2 lists the distribution of the SCL-90 scores in the study. Overall, the GSI of SCL-90 were significantly lower in March than that in February (mean = 1.37, SD = 0.45; mean = 1.57, SD = 0.62, respectively, Cohen’s d = 0.360). The mean SCL-90 score of 1.49 in medical staff (SD = 0.57) was significantly higher than in general staff (mean = 1.36, SD = 0.46, Cohen’s d = 0.264). Furthermore, medical staff from the second-level hospital showed the highest scores (mean = 1.65, SD = 0.68) than that of other two types hospital (mean = 1.35, SD = 0.65 for the first-level hospital; mean = 1.46, SD = 0.52 for the third-level hospital, η² = 0.021). Also, compared with the survey in February, the GSI of SCL-90 was significant lower in March (mean = 1.57, SD = 0.62 for February; mean = 1.37, SD = 0.45 for March, Cohen’s d = 0.367). Medical staff living in Wuhan city were likely to have higher SCL-90 scores than those medical staff who not in Wuhan city (mean = 1.55, SD = 0.59 for Wuhan; mean = 1.43, SD = 0.53 for non-Wuhan, Cohen’s d = 0.218). Similar results were observed in the other nine subscales (p < 0.05).

To identify the risk factors associated with psychological health status among the participants, multiple linear regression models were applied for analysis (Table 3). Survey time was significantly associated with the total scores in the SCL-90 scale (β = −0.19, 95% confidence interval [CI] = −0.27 to −0.11 for in March vs. in February). Similar results were observed when restricted to medical staff. The survey conducted in March and medical staff resident in Wuhan were significantly associated with the scores of SCL-90 scale (β = −0.18, 95% CI = −0.27 to −0.09 and β = 0.10, 95% CI = 0.02 to 0.19, respectively) Besides, the participants enrolled in March were less likely to have psychological health problems than in February (odds ratio [OR] = 0.42, 95% CI = 0.30 to 0.59) (Table 4). We observed gender difference in the risk of poor psychological health. Female were associated with an increased 1.44-fold risk of psychological health problems than male (95% CI = 1.01 to 2.03).

4. Discussion

In December 2019, an outbreak of novel coronavirus pneumonia (COVID-19) epidemic occurred in Wuhan, Hubei province, and rapidly spread throughout China, which brings a huge impact on the whole Chinese people. In the current study, we investigated the psychological status of affected by the COVID-19 outbreak in China between February to March, 2020. Approximately 18.3% of the participants had psychological health problems during the epidemic. We found that the participants enrolled in March were associated with lower scores of SCL-90 than those in February. In addition, Medical staff were likely to have higher scores of the SCL-90 than general population. To identify the risk of poor psychological health, we observed that female had a 1.44-fold risk of having psychological problems than male.

In the study, we found the prevalence of poor psychological health was approximately 18.3%. Previous studies had reported the immediate psychological responses during the COVID-19 epidemic in China (Wang et al., 2020; Li et al., 2020; Zhai and Du, 2020). Wang et al. conducted a study involving 1210 participants from 31 January to 2 February 2020, the initial phase of COVID-19 outbreak in China, and revealed 53.8% of the participants reported their psychological impact as moderate-to-severe, and approximately 28.8% as moderate-to-severe anxiety (Wang et al., 2020). In addition, the psychological impact of severe acute respiratory syndrome (SARS) on medical staff and general population were also observed (Chong et al., 2004; Liu et al., 2012; Wu et al., 2009). Therefore, great attention should be paid to the psychological health problems of the general public during the epidemic.

In response to the outbreak of pneumonia caused by the COVID-19, China has implemented a series of control and prevention measures. On January 23, 2020, the local government in Wuhan announced the suspension of public transportation to prevent further disease transmission. Quarantine is a traditional but very effective measure to counter a deadly epidemic. To meet the growing number of patients, Wuhan had built specialty hospitals for infectious diseases (Huoshenshan hospital, Leishenshan hospital and mobile Fangcang hospitals) to provide medical treatment. Additionally, health care workers, including military medical teams, from across the Chinese mainland arrived in Hubei province to provide medical assistance (Yang et al., 2020). With these draconian measures, more than 70% have recovered and been discharged in early March, 2020. The WHO claimed that China is bringing its epidemic under control (WHO, 2020c). In the present study, compared with the survey in February, mental health status has been effectively improved for people in March. As the epidemic situation improves, the psychological issues faced by the general public are alleviated.

Medical staff were at particularly higher risk of psychological problems than general population. In the stage of the outbreak, the number of confirmed COVID-19 cases increased nationwide rapidly. The medical staff was obviously insufficient, which resulted in high workload of medical staff. The medical staff had more psychological pressure than general population in the pandemics and public health emergencies. A number of previous studies had reported that clinical workers who were at high risk of contracting SARS appear to have elevated levels of depression and anxiety (Lim et al., 2018; Brooks et al., 2018; Lee et al., 2007; Liu et al., 2012; Cheng et al., 2004; Lu et al., 2006). In addition, it is suggested that the psychological problems of medical staff in secondary-level hospitals were more serious than those in first-level or third-level hospitals in China. For the first-level hospitals, it generally provides basic medical services, but do not treat for COVID-19 patients.
### Table 2
The distribution of SCL-90 scores stratified by different demographic categories.

| Variables | n  | SCL-90 | GSI | Cohen's d or $\eta^2$ | Somatization | Cohen's d or $\eta^2$ | Obsessive-compulsive | Cohen's d or $\eta^2$ | Interpersonal sensitivity | Cohen's d or $\eta^2$ | Depression | Cohen's d or $\eta^2$ |
|-----------|----|--------|-----|-----------------------|--------------|-----------------------|----------------------|-----------------------|--------------------------|-----------------------|-------------|---------------------|
| All population | | | 0.360 | 0.294 | 0.404 | 0.328 | 0.358 |
| Date | | | February | 387 | 1.57 ± 0.62 | 1.47 ± 0.61 * | 1.79 ± 0.73 * | 1.58 ± 0.72 * | 1.68 ± 0.73 * | 0.360 |
| | | | March | 535 | 1.37 ± 0.45 | 1.31 ± 0.43 | 1.52 ± 0.58 | 1.36 ± 0.53 | 1.44 ± 0.56 | 0.264 |
| Residence | | | Wuhan | 490 | 1.47 ± 0.56 | 1.41 ± 0.56 | 1.64 ± 0.68 | 1.46 ± 0.65 | 1.56 ± 0.66 | 0.264 |
| | | | Non-Wuhan | 432 | 1.42 ± 0.51 | 1.33 ± 0.46 | 1.62 ± 0.64 | 1.45 ± 0.60 | 1.51 ± 0.64 | 0.264 |
| Gender | | | Male | 410 | 1.43 ± 0.50 | 1.34 ± 0.48 | 1.62 ± 0.63 | 1.44 ± 0.59 | 1.50 ± 0.58 | 0.264 |
| | | | Female | 512 | 1.47 ± 0.57 | 1.40 ± 0.54 | 1.64 ± 0.68 | 1.46 ± 0.66 | 1.57 ± 0.69 | 0.264 |
| Age (years) | | | ≤35 | 287 | 1.49 ± 0.63 | 1.42 ± 0.63 | 1.96 ± 0.73 | 1.49 ± 0.73 | 1.59 ± 0.75 | 0.264 |
| | | | 36-39 | 329 | 1.44 ± 0.51 | 1.34 ± 0.47 | 1.62 ± 0.64 | 1.45 ± 0.58 | 1.51 ± 0.59 | 0.264 |
| | | | ≥40 | 306 | 1.42 ± 0.48 | 1.37 ± 0.52 | 1.59 ± 0.60 | 1.42 ± 0.57 | 1.52 ± 0.61 | 0.264 |
| Work | | | General population | 266 | 1.36 ± 0.46 | 1.29 ± 0.42 * | 1.47 ± 0.56 * | 1.37 ± 0.56 * | 1.49 ± 0.60 * | 0.264 |
| | | | Medical staff | 656 | 1.49 ± 0.57 | 1.41 ± 0.55 * | 1.70 ± 0.68 * | 1.49 ± 0.65 * | 1.58 ± 0.66 * | 0.264 |
| Hospital classification | | | The first-level hospital | 48 | 1.35 ± 0.65 | 1.42 ± 0.70 * | 1.48 ± 0.71 * | 1.32 ± 0.70 * | 1.39 ± 0.69 * | 0.264 |
| | | | The second-level hospital | 123 | 1.65 ± 0.66 | 1.55 ± 0.62 * | 1.67 ± 0.72 * | 1.64 ± 0.67 * | 1.76 ± 0.78 * | 0.264 |
| | | | The third-level hospital | 485 | 1.46 ± 0.52 | 1.38 ± 0.51 | 1.67 ± 0.66 | 1.47 ± 0.61 | 1.55 ± 0.62 | 0.264 |
| Date | | | February | 387 | 1.57 ± 0.62 | 1.47 ± 0.61 | 1.79 ± 0.73 | 1.58 ± 0.72 | 1.68 ± 0.73 | 0.264 |
| | | | March | 535 | 1.37 ± 0.45 | 1.33 ± 0.44 | 1.56 ± 0.59 | 1.36 ± 0.50 | 1.43 ± 0.51 | 0.264 |
| Residence | | | Wuhan | 490 | 1.55 ± 0.59 | 1.48 ± 0.60 | 1.76 ± 0.71 | 1.53 ± 0.68 | 1.66 ± 0.69 | 0.264 |
| | | | Non-Wuhan | 335 | 1.43 ± 0.53 | 1.34 ± 0.49 | 1.63 ± 0.66 | 1.45 ± 0.61 | 1.49 ± 0.62 | 0.264 |
| Gender | | | Male | 313 | 1.45 ± 0.52 | 1.36 ± 0.50 | 1.67 ± 0.66 | 1.47 ± 0.60 | 1.52 ± 0.59 | 0.264 |
| | | | Female | 343 | 1.52 ± 0.60 | 1.46 ± 0.59 | 1.72 ± 0.71 | 1.51 ± 0.69 | 1.63 ± 0.72 | 0.264 |
| Age (years) | | | ≤35 | 203 | 1.54 ± 0.68 | 1.47 ± 0.69 | 1.76 ± 0.78 | 1.54 ± 0.78 | 1.62 ± 0.78 | 0.264 |
| | | | 36-39 | 273 | 1.45 ± 0.52 | 1.36 ± 0.48 | 1.66 ± 0.65 | 1.47 ± 0.58 | 1.52 ± 0.58 | 0.264 |
| | | | ≥40 | 180 | 1.48 ± 0.49 | 1.42 ± 0.46 | 1.68 ± 0.61 | 1.47 ± 0.57 | 1.60 ± 0.63 | 0.264 |

### Table 2 (continued on next page)
#### Table 2 (continued)

| Variables | n  | SCL-90 | Gender | Age (years) | Work | Medical staff | Hospital classification | Date | Residence |
|-----------|----|--------|--------|------------|------|--------------|-------------------------|------|-----------|
| **Wuhan** | 490 | 1.49 ± 0.64 * | 1.46 ± 0.61 | 1.35 ± 0.59 | 1.37 ± 0.57 | 1.32 ± 0.53 | 1.30 ± 0.51 | 1.30 ± 0.51 | 1.30 ± 0.51 |
| **Non-Wuhan** | 432 | 1.39 ± 0.56 * | 1.44 ± 0.59 | 1.31 ± 0.51 | 1.36 ± 0.57 | 1.30 ± 0.51 | 1.30 ± 0.51 | 1.30 ± 0.51 | 1.30 ± 0.51 |
| **Male** | 410 | 1.39 ± 0.54 * | 1.43 ± 0.60 | 1.30 ± 0.49 | 1.38 ± 0.55 | 1.31 ± 0.49 | 1.31 ± 0.54 | 1.31 ± 0.54 | 1.31 ± 0.54 |
| **Female** | 512 | 1.48 ± 0.65 * | 1.46 ± 0.61 | 1.35 ± 0.60 | 1.35 ± 0.58 | 1.31 ± 0.49 | 1.31 ± 0.54 | 1.31 ± 0.54 | 1.31 ± 0.54 |
| **≤35** | 267 | 1.49 ± 0.70 | 1.48 ± 0.70 | 1.37 ± 0.63 | 1.39 ± 0.65 | 1.36 ± 0.61 | 1.36 ± 0.61 | 1.36 ± 0.61 | 1.36 ± 0.61 |
| **36-39** | 329 | 1.42 ± 0.56 | 1.47 ± 0.60 | 1.31 ± 0.51 | 1.38 ± 0.58 | 1.29 ± 0.48 | 1.29 ± 0.48 | 1.29 ± 0.48 | 1.29 ± 0.48 |
| **≥40** | 306 | 1.43 ± 0.56 | 1.40 ± 0.50 | 1.32 ± 0.52 | 1.32 ± 0.47 | 1.29 ± 0.46 | 1.29 ± 0.46 | 1.29 ± 0.46 | 1.29 ± 0.46 |
| **General population** | 266 | 1.33 ± 0.53 * | 1.36 ± 0.53 * | 1.27 ± 0.50 * | 1.27 ± 0.45 * | 1.26 ± 0.45 * | 1.26 ± 0.45 * | 1.26 ± 0.45 * | 1.26 ± 0.45 * |
| **Medical staff** | 656 | 1.40 ± 0.56 * | 1.48 ± 0.63 * | 1.35 ± 0.57 * | 1.40 ± 0.61 * | 1.33 ± 0.54 * | 1.33 ± 0.54 * | 1.33 ± 0.54 * | 1.33 ± 0.54 * |
| **Hospital classification** | 0.17 | 0.21 | 0.11 | 0.23 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| **The first-level hospital** | 48 | 1.30 ± 0.66 * | 1.37 ± 0.71 * | 1.24 ± 0.63 * | 1.26 ± 0.66 * | 1.22 ± 0.64 * | 1.22 ± 0.64 * | 1.22 ± 0.64 * | 1.22 ± 0.64 * |
| **The second-level hospital** | 123 | 1.63 ± 0.72 * | 1.67 ± 0.77 * | 1.47 ± 0.67 * | 1.58 ± 0.79 * | 1.49 ± 0.67 * | 1.49 ± 0.67 * | 1.49 ± 0.67 * | 1.49 ± 0.67 * |
| **The third-level hospital** | 480 | 1.47 ± 0.59 * | 1.45 ± 0.57 * | 1.33 ± 0.54 * | 1.37 ± 0.54 * | 1.30 ± 0.49 * | 1.30 ± 0.49 * | 1.30 ± 0.49 * | 1.30 ± 0.49 * |
| **Date** | 0.404 | 0.251 | 0.342 | 0.301 | 0.348 | 0.348 | 0.348 | 0.348 | 0.348 |
| **February** | 387 | 1.59 ± 0.68 * | 1.55 ± 0.68 * | 1.43 ± 0.64 * | 1.47 ± 0.68 * | 1.41 ± 0.61 * | 1.41 ± 0.61 * | 1.41 ± 0.61 * | 1.41 ± 0.61 * |
| **March** | 269 | 1.35 ± 0.50 * | 1.40 ± 0.53 * | 1.25 ± 0.44 * | 1.30 ± 0.48 * | 1.23 ± 0.41 * | 1.23 ± 0.41 * | 1.23 ± 0.41 * | 1.23 ± 0.41 * |
| **Residence** | 0.290 | 0.095 | 0.148 | 0.112 | 0.140 | 0.140 | 0.140 | 0.140 | 0.140 |
| Wuhan | 321 | 1.58 ± 0.68 * | 1.52 ± 0.64 | 1.40 ± 0.62 | 1.43 ± 0.62 | 1.37 ± 0.56 | 1.37 ± 0.56 | 1.37 ± 0.56 | 1.37 ± 0.56 |
| Non-Wuhan | 335 | 1.40 ± 0.57 * | 1.46 ± 0.61 | 1.31 ± 0.52 | 1.37 ± 0.60 | 1.30 ± 0.52 | 1.30 ± 0.52 | 1.30 ± 0.52 | 1.30 ± 0.52 |
| **Gender** | 0.175 | 0.058 | 0.126 | 0.010 | 0.023 | 0.023 | 0.023 | 0.023 | 0.023 |
| **Male** | 313 | 1.43 ± 0.57 * | 1.47 ± 0.61 | 1.32 ± 0.49 | 1.40 ± 0.58 | 1.33 ± 0.50 | 1.33 ± 0.50 | 1.33 ± 0.50 | 1.33 ± 0.50 |
| **Female** | 343 | 1.54 ± 0.68 * | 1.50 ± 0.64 | 1.39 ± 0.64 | 1.40 ± 0.64 | 1.34 ± 0.57 | 1.34 ± 0.57 | 1.34 ± 0.57 | 1.34 ± 0.57 |
| **Age (years)** | 0.008 | 0.003 | 0.005 | 0.002 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| ≤35 | 203 | 1.56 ± 0.75 | 1.52 ± 0.73 | 1.40 ± 0.68 | 1.44 ± 0.72 | 1.37 ± 0.65 | 1.37 ± 0.65 | 1.37 ± 0.65 | 1.37 ± 0.65 |
| 36-39 | 273 | 1.43 ± 0.56 | 1.49 ± 0.62 | 1.31 ± 0.52 | 1.40 ± 0.59 | 1.30 ± 0.49 | 1.30 ± 0.49 | 1.30 ± 0.49 | 1.30 ± 0.49 |
| ≥40 | 180 | 1.49 ± 0.58 | 1.43 ± 0.51 | 1.35 ± 0.51 | 1.37 ± 0.49 | 1.33 ± 0.48 | 1.33 ± 0.48 | 1.33 ± 0.48 | 1.33 ± 0.48 |

Data shown as mean ± standard deviation.

*: \( p < 0.05 \).

SCL-90: The Symptom Check List 90; GSI: The Global Severity Index.
Table 3
Risk factors associated with psychological health status in all population and restricted in the medical staff.

| Variables | β (95% CI) | P       |
|-----------|------------|---------|
| All population Date | | |
| February | Ref | |
| March | −0.19 (−0.27, −0.11) | < 0.001 |
| Medical staff Date | | |
| February | Ref | |
| March | −0.18 (−0.27, −0.09) | < 0.001 |
| Residence | | |
| Non-Wuhan | Ref | |
| Wuhan | 0.10 (0.02, 0.19) | 0.020 |

CI: confidence interval.

Table 4
Odds risk of psychological health problems in logistic models.

| Variables | OR (95% CI) | P       |
|-----------|------------|---------|
| Date | | |
| February | Ref | |
| March | 0.42 (0.30, 0.59) | < 0.001 |
| Gender | | |
| Male | Ref | |
| Female | 1.44 (1.01, 2.03) | 0.041 |

CI: confidence interval; OR: odds ratio.

such as community hospitals. For the medical staff that are from the third-level hospital, they are mainly middle-level backbone staff with working experience and psychological capacity. In addition, due to the contact with many diagnosed or suspected patients, they provide with sufficient psychological preparation and will pay more attention to their own safety. However, medical staff that are from the second-level hospitals, including county-level or district-level hospitals, is responsible for the treatment of a large number of patients with COVID-19 infection. The lack of protective equipment and work experience leads to the most serious mental health problems among all medical staff.

There are other risk factors for psychological problems, such as gender. In the current study, females suffered greater psychological problems of the outbreak than male. This finding is consistent with previously extensive epidemiological studies. Lim et al. reported that women were at higher risk of depression (Lim et al., 2018). In addition, female was associated with a greater psychological impact of the outbreak and higher levels of stress, anxiety, and depression than male (Wang et al., 2020).

This study has several limitations. First, we collected information on the basic demographic characteristics of the participants, but we did not investigate related socioeconomic characteristics (such as education and marriage status) and the knowledge and behavior of the epidemic. Some potential factors that may contribute to the risk of psychological health problems were not identified in the analysis. Second, more large-scale cohort studies are needed to investigate the long-term psychological health effect of the epidemic on medical staff and general population.

5. Conclusions

In conclusion, approximately 18.3% of the participants had psychological health problems during the epidemic. With the remission of the epidemic, the psychological health status of participants has been improved. In addition, medical staff were more psychologically distressed than the general population, and female was likely to have more poor psychological health than male. This may assist government agencies and healthcare professionals in safeguarding the psychological status of the medical staff and general population in the face of the COVID-19 outbreak.

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CRediT authorship contribution statement

Zhen Zhu: Software, Investigation, Data curation, Data curation, Writing - review & editing. Qi Liu: Investigation, Data curation, Writing - original draft. Xiaobing Jiang: Investigation, Resources. Upasana Manandhar: Investigation, Writing - review & editing. Zhongyu Luo: Methodology, Software, Investigation. Xu Zheng: Investigation, Resources. Yuanyuan Li: Conceptualization, Methodology, Software, Writing - original draft. Jun Xie: Conceptualization, Methodology, Writing - original draft, Supervision. Bo Zhang: Conceptualization, Methodology, Writing - original draft, Supervision.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jspychires.2020.05.026.

References

Bao, Y., Sun, Y., Meng, S., Shi, J., Lu, L., 2020. 2019-nCoV epidemic: address mental health care to empower society. Lancet 395 (10224), e37–e38. https://doi.org/10.1016/S0140-6736(20)30309-3.
Brooks, S.K., Dunn, R., Amlot, R., Rubin, G.J., Greenberg, N., 2018. A systematic, thematic review of social and occupational factors associated with psychological outcomes in healthcare employees during an infectious disease outbreak. J. Occup. Environ. Med. 60 (3), 248–257. https://doi.org/10.1097/JOM.0000000000001235.
Chen, Q., Liang, M., Li, Y., Guo, J., Fei, D., Wang, L., He, L., Sheng, C., Cai, Y., Li, X., Wang, J., Zhang, Z., 2020. Mental health care for medical staff in China during the COVID-19 outbreak. Lancet Psychiatry 7 (4), e15–e16. https://doi.org/10.1016/S2215-0366(20)30078-X.
Cheng, S.K., Wong, C.W., Tsang, J., Kong, K.C., 2004. Psychological distress and negative appraisals in survivors of severe acute respiratory syndrome (SARS). Psychol. Med. 34 (7), 1187–1195. https://doi.org/10.1017/s0033291704002272.
Chong, M.Y., Wang, W.C., Heisch, W.C., Lee, Y.Y., Chiu, N.M., Yeh, W.C., Huang, O.L., Wen, J.K., Chen, C.L., 2004. Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. Br. J. Psychiatry 185, 127–133. https://doi.org/10.1192/bjp.185.2.127.
Ignatyev, Y., Fritsch, R., Priewe, S., Mundt, A.P., 2016. Psychometric properties of the symptom check-list-90-R in prison inmates. Psychiatr. Res. 239, 226–232. https://doi.org/10.1016/j.psychres.2016.03.007.
Jin, C., Zhao, G., Zhang, F., Feng, L., Wu, N., 2010. The psychological status of HIV-positive people and their psychosocial experiences in eastern China. HIV Med. 11, 253–259. https://doi.org/10.1111/j.1468-1293.2009.00770.x.
Lakens, D., 2013. Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. Front. Psychol. 4, 863. https://doi.org/10.3389/fpsyg.2013.00863.
Lau, H., Khorashawipour, V., Kochbach, P., Mikołajczyk, A., Schubert, J., Bania, J., Khorashawipour, T., 2020. The positive impact of lockdown in Wuhan on containing the COVID-19 outbreak in China. J. Trav. Med. https://doi.org/10.1093/jtm/ttaa037. [Epub ahead of print].
Lee, A.M., Wong, J.G., McAlonan, G.M., Cheung, V., Cheung, C., Sham, P.C., Chu, C.M., Wong, P.C., Tsang, K.W., Chu, S.E., 2007. Stress and psychological distress among SARS survivors 1 year after the outbreak. Can. J. Psychiatry. 52 (4), 233–240. https://doi.org/10.1177/070674370705200405.
Li, Z., Ge, J., Yang, M., Feng, J., Qiao, M., Jiang, R., Bi, J., Zhan, G., Xu, X., Wang, L., Zhou, Q., Zhou, C., Pan, Y., Liu, S., Zhang, H., Yang, J., Zhu, B., Hu, Y., Hashimoto, Z. Zhu, et al. Journal of Psychiatric Research 129 (2020) 1–7
K., Jia, Y., Wang, H., Wang, R., Liu, C., Yang, C., 2020. Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. Brain Behav. Immun. https://doi.org/10.1016/j.bbi.2020.03.007. [Epub ahead of print].

Lim, G.Y., Tam, W.W., Lu, Y., Ho, C.S., Zhang, M.W., Ho, R.C., 2018. Prevalence of depression in the community from 30 countries between 1994 and 2014. Sci. Rep. 8, 2861. https://doi.org/10.1038/s41598-018-21243-x.

Liu, C., Wang, S., 2014. The experience of left-behind and mental health of college students from second generation of floating peasants: based on the perspective of reform in floating population system. Youth Stud. 398, 23–32 [in Chinese].

Liu, X., Kakade, M., Fuller, C.J., Fan, B., Fang, Y., Kong, J., Guan, Z., Wu, P., 2012. Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. Compr. Psychiatr. 53 (1), 15–23. https://doi.org/10.1016/j.comppsych.2011.02.003.

Lu, Y.C., Shu, B.C., Chang, Y.Y., Lung, F.W., 2006. The mental health of hospital workers dealing with severe acute respiratory syndrome. Psychother. Psychosom. 75, 370–375. https://doi.org/10.1159/000095443.

National Health Commission of the People’s Republic of China, 2020. Report of novel coronavirus-infected pneumonia in China (in Chinese). http://www.nhc.gov.cn/xcs/yqtb/202003/cc26895be7164608ff57c899c74bb7.shtml (accessed 1 April 2020).

Wang, Z.Y., 1984. Symptom checklist SCL–90. Shanghai Arch. Psychiatry 2, 68–70 [in Chinese].

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C.S., Ho, R.C., 2020. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. Int. J. Environ. Res. Publ. Health 17 (5), 1729. https://doi.org/10.3390/ijerph17051729.

WHO, 2020a. Coronavirus disease (COVID-19) outbreak situation. https://www.who.int/emergencies/diseases/novel-coronavirus-2019 (accessed 1 April 2020).

WHO, 2020b. Rolling updates on coronavirus disease (COVID-19): WHO characterizes COVID-19 as a pandemic. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen (accessed 1 April 2020).

WHO, 2020c. WHO Director-General’s opening remarks at the media briefing on COVID-19 - 9 March 2020. https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—9-march-2020 (accessed 30 March 2020).

Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., Liu, X., Fuller, C.J., Susser, E., Lu, J., Hoven, C.W., 2009. The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. Can. J. Psychiatr. 54 (5), 302–311. https://doi.org/10.1177/070674370905400504.

Yang, Y., Peng, F., Wang, R., Guan, K., Jiang, T., Xu, G., Sun, J., Chang, C., 2020. The deadly coronaviruses: the 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. J. Autoimmun. 102434. https://doi.org/10.1016/j.jaut.2020.102434.

Zhai, Y., Du, X., 2020. Mental health care for international Chinese students affected by the COVID-19 outbreak. Lancet Psychiatr. 7 (4), e22. https://doi.org/10.1016/S2215-0366(20)30089-4.