Impact of COVID-19 on psychology of nurses working in the emergency and fever outpatient: A cross-sectional survey

CURRENT STATUS: UNDER REVIEW

BMC Psychiatry  BMC Series

Shasha Cui
Nantong Health college of Jiangsu Province
ORCiD: https://orcid.org/0000-0003-0578-5989

Yujun Jiang
Affiliated Hospital of Qingdao University

Qianyu Shi
Nantong Health College of Jiangsu Province

Lei Zhang
Navy Medical University

Dehua Kong
The 940th Hospital of Joint Logistics Support Force of Chinese People's Liberation Army

Meijuan Qian
Nantong Health College of Jiangsu Province

Jing Chu
15050607279@163.com Corresponding Author
ORCiD: https://orcid.org/0000-0002-0981-3644

DOI: 10.21203/rs.3.rs-20777/v1

SUBJECT AREAS
Psychiatry

KEYWORDS
COVID-19, Nurses, Psychological health, Mental health, Stress, Anxiety, Coping
Abstract

Background COVID-19 poses a great challenge to the global health system. The nurses of emergency and fever outpatient (EFO) act as gatekeepers to the health care system in the public health response to COVID-19 epidemic. This study examined the psychological impact of COVID-19 upon EFO nurses in Chinese hospitals.

Methods In midmonth of February, 2020, convenience sampling was used to recruit EFO nurses from hospitals in Jiangsu Province. Data were obtained by self-administered online questionnaires, which consisted of a general questionnaire, the Self-Rating Anxiety Scale, Perceived Stress Scale-14 and Simplified Coping Style Questionnaire. A total of 481 questionnaires were returned and 453 valid questionnaires were recovered. Multiple linear regression was used to explore the influence of socio-psychological and working condition factors on anxiety, stress and stress coping tendency. Pearson correlation coefficients were calculated to assess the associations among anxiety, stress and coping tendency.

Results Among the participants, 281(62.03%) had no anxiety symptoms, 154(34.00%) had mild anxiety, 16(3.53%) had moderate anxiety, and 2(0.44%) had severe anxiety. There were 146(32.23%) participants with scores greater than 25 in the PSS, indicating excessive stress. We found that 229(50.55%) participants were more likely to respond positively to stress, while 224(49.45%) were more likely to respond negatively. The models we used included gender, fear of infecting family members, regretting being a nurse, having children, confidence in fighting outbreak, rest time, professional attitudes, having attended infection prevention training, and number of night shifts; and they were all predictors of the mental health of EFO nurses. Pearson correlation showed a positive correlation of the anxiety with stress score (r=0.443, P<0.001), while the coping tendency score was found negatively correlated with anxiety (r=-0.268, P<0.001) and stress (r=-0.503, P< 0.001).

Conclusion COVID-19 has a certain psychosocial impact upon EFO nurses. Effective measures, such as strengthening protection training, adequate nurses for emergency and fever clinics, reducing night shifts, and timely updates of latest epidemic situation, should be taken. Moreover, greater attention should be paid to female EFO nurses and nurses with children.
Background
H1N1, SARS, Ebola, Zika and other infectious diseases frequently occur in recent years, posing serious threats to human health and development [1-5]. In December 2019, Corona Virus Disease 2019 (COVID-19) epidemic broke out in Wuhan, Hubei Province, and quickly spread to the whole country [6]. COVID-19 soon gained global attention due to rapidly growing infected cases. WHO officially declared the outbreak of COVID-19 as a Public Health Emergency of International Concern (PHEIC) on 30 January, 2020. Till Feb 20, 2020, a total of 75 465 infected cases have been confirmed in China, and 2 236 of them have died [7]. Although the outbreak has been effectively under control, the numbers of confirmed and suspected patients are still increasing. COVID-19 is highly infectious and human-to-human transmission is confirmed [8, 9]. Doctors, nurses and ambulance men are more likely to be infected than any other groups. By February 11, 2020, 1 716 (3.8% of the country's confirmed cases) medical workers in China had been infected, and six of them have died, accounting for 0.4% of all deaths in the country [10].

Many hospitals in China have been flooded by the outbreak. Health care workers are at high risk of infection and are also fearful. Meanwhile, they have great burdens in clinical treatment and public prevention. High expectations, lack of time, skills and social support may cause occupational stress, and stresses and challenges can lead to anxiety, post-traumatic stress disorder [11, 12], great distress, and burnout or physical illness. As a result, they may not be able to provide high-quality medical services and may even quit the job as a nurse [13, 14].

Nurses serve as an important force in the fight against the epidemic, and they are under the highest pressure of all medical workers [12, 15]. In order to reduce human-to-human transmission in hospitals, many Chinese hospitals have closed some outpatient clinics, only keeping emergency and fever clinic open to receive patients, and EFO nurses act as gatekeepers to the health care system, identifying suspected and confirmed patients by carefully evaluating their clinical manifestations, contact history, and travel history. They are critical to control transmission among patients, staff, visitors, and the community [16]. EFO nurses are most likely to come into contact with suspected patients, which leads to high risk of exposure. Compared with the frontline nursing staffs, EFO nurses receive relatively less
attention, their protection training is not so intense, and some staffs may have fluke mentality, with inadequate protective measures. In addition to the higher risk of infection, EFO nurses also have a heavy workload and fear for the safety of their families, which can affect their mental health. During major outbreaks, most studies focused on the mental health of nurses caring for confirmed patients in isolation wards [12, 17–20]. Understanding the anxiety, major stressors and coping styles of EFO nurses can help to design intervention and training programs, so as to better meet the psychological needs of EFO nurses, providing actionable guidance for all those involved.

Methods

Participants

The present study was conducted more than a month after the COVID-19 outbreak. In midmonth of February 2020, an online questionnaire was used to investigate the mental health status of EFO nurses in Jiangsu Province. All the participants agreed to participate in the cross-sectional study. The inclusion criteria were as follows: ① registered nurses; ② working in hospitals in Jiangsu Province; ③ emergency or fever outpatient (EFO) nurses, who have been exposed to the epidemic for more than one month. Exclusion criteria were as follows: ① nursing students; ② other medical workers.

Measures

This was a cross-sectional study using data obtained by self-administered online questionnaires, which consisted of a general questionnaire and the Self-Rating Anxiety Scale, Perceived Stress Scale and Simplified Coping Style Questionnaire. The general information consisted of questions on the descriptive and professional characteristics of the nurses, including their gender, age, technical title, education level, marital status, reproductive history, hospital grade, rest time each week and number of night shifts in the past month, professional attitude, confidence and willingness in fighting transmission, whether the hospitals having confirmed patients, whether they have been in contact with confirmed patients, whether they have attended infection prevention training recently, whether their family supported them, and whether they worried about bringing the virus home?

Instruments

Self-rating anxiety scale (SAS)
SAS, compiled by ZUNG [21] in 1971, can better measure the anxiety feelings and severity of the subjects, and is widely used in various professions. In China SAS scale had been used for the nurses [22, 23]. SAS has 20 items and uses a 4-point scoring system to measure the frequency of symptoms (1=no or little time, 2=a small part of the time, 3=a considerable amount of time, 4=most or all of the time). Of these, 15 items use negative words, which are scored according to the above method from 1 to 4, while the other 5 items use positive words, which are scored in reverse. Adding the scores of all items produces the rough score, and multiplying the score by 1.25 produces the standard score. The higher the standard SAS score, the higher the anxiety level (Chinese norm: normal: <50points; 50 to 59 points for mild anxiety; 60 to 69 points for moderate anxiety; and above 69 points for severe anxiety) [24].

**Perceived stress scale (PSS)**

PSS is a representative tool for measuring stress. There are three versions of PSS: PSS-14, PSS-10 and PSS-4. The original PSS was compiled by professor Cohen, and consisted of 14 items and 2 dimensions [25]. The shorter forms of the items were selected from the original PSS-14. The PSS scale had been used to measure stress of patients, police, students, nurses, pregnant women and the elderly in many countries [26-36]. PSS-14 was first introduced for Chinese population by professor Yang et al in 2003 [34]. The Chinese version of PSS-14 scale adopted a 5-point scoring system (0=never, 1=almost never, 2=sometimes, 3=fairly often, 4=always). Of these, 7 items (1, 2, 3, 8, 11, 12, 14) belong to the negative dimension, and are scored from 0 to 4, while the other 7 items (items 4, 5, 6, 7, 9, 10, 13) belong to positive dimension, and are scored in reverse. PSS score is obtained by adding the 14 items together, the higher the score the greater the perceived stress. (Chinese norm: normal: ≤25points; stress: >25 points)[34].

**Simplified Coping Style Questionnaire (SCSQ)**

Professor XIE compiled the SCSQ scale based on the overseas pressure coping style scale and the characteristics of Chinese population [37]. SCSQ is an effective and sensitive instrument for
measuring stress response and it included two dimensions: positive coping (12 items) and negative coping (8 items). The SCSQ uses a 4-point scoring system (0=never, 1=seldom, 2=sometimes, 3=often). Chinese norm: the average score of positive coping dimension is 1.78, while the average score of negative coping dimension is 1.59. When individuals are under stress, they will take various coping measures, including both positive coping style and negative coping style. The following formula can be used to judge the individual's tendency of coping style [24]:

\[
\text{Coping tendency} = \text{positive coping standard score} - \text{negative coping standard score}
\]

\[
\text{Positive coping standard score} = \frac{\text{Individual average score for positive coping dimension} - \text{Sample positive coping dimension mean}}{\text{Sample standard deviation}}
\]

\[
\text{Negative coping standard score} = \frac{\text{Individual average score for negative coping dimension} - \text{Sample negative coping dimension mean}}{\text{Sample standard deviation}}
\]

When coping tendency score is greater than 0, it indicates that the positive coping style is mainly adopted; if less than 0, negative coping style is mainly adopted.

**Statistical data analysis**

Statistical analysis was performed using IBM SPSS 23.0 Statistics. Descriptive statistics included frequency, proportions (%), mean, and standard deviations. Multiple linear regression analysis with a stepwise selection of predictor variables was used to identify the influencing factors of EFO nurses’ anxiety, perceived stress and stress coping tendency. Pearson correlation coefficients were calculated to assess the associations among anxiety, stress and coping tendency. Linearity assumptions were checked by tolerance > 0.1, variance inflation factor < 10, condition index < 30 and eigenvalue > 0.01 [38]. Homogeneity of variances was checked by scatterplots. The multicollinearity test reported that minimum and maximum variable inflation factors were 1.001 and 1.160 respectively, indicating that there was no multicollinearity. In the final adjusted multiple regression, variables with \( p < 0.05 \) were considered significantly correlated with the measured values. Standardized Beta and 95% confidence interval (CI) coefficients were calculated to evaluate the statistical significance of multivariate regression analysis.
Results

Descriptive statistics

A total of 481 participants were investigated, and 453 (94.18%) valid questionnaires were finally included. Demographic statistics, work characteristics and socio-psychological variables of the participants were described in Table 1 (at the end of the document). Of the 453 nurses, 16 (3.53%) were males and 437 (96.47%) were females. Mean age was 33.15 years (SD=8.38). Mean working time was 11.33 years (SD=9.25).

Table 1 Characteristics and coding of socio-psychological and working condition variables.

| Variables                        | Variable categories | Code | N (%)          |
|----------------------------------|---------------------|------|----------------|
| Gender                           | Male                | 1    | 16(3.53%)      |
|                                  | Female              | 0    | 437 (96.47%)   |
| Technical title                  | Primary nurse       | 1    | 93 (20.53%)    |
|                                  | Nurse practitioner  | 2    | 217 (47.90%)   |
|                                  | Nurse-in-charge.    | 3    | 118 (26.05%)   |
|                                  | Co-chief superintendent nurse and above | 4 | 25 (5.52%) |
| Education level                  | College degree      | 1    | 116 (25.61%)   |
|                                  | Bachelor degree     | 2    | 333 (73.51%)   |
|                                  | Master degree or above | 3 | 4 (0.88%)   |
| Rank of the hospital             | Grade II Class B hospital and below | 1 | 39 (8.61%) |
|                                  | Grade II Class A hospital | 2 | 63 (13.91%) |
|                                  | Grade III Class B hospital | 3 | 197 (43.49%) |
|                                  | Grade III Class A hospital | 4 | 154 (34.00%) |
| Marital status                   | Married             | 1    | 312 (68.87%)   |
|                                  | Unmarried           | 0    | 141 (31.13%)   |
| Having children                  | Yes                 | 1    | 163 (35.98%)   |
|                                  | No                  | 0    | 290 (64.02%)   |
| Rest time each week in the past month | Less than 1 day per week | 1 | 17 (3.75%)  |
|                                  | One day per week    | 2    | 111 (24.50%)   |
|                                  | Two days per week   | 3    | 257 (56.73%)   |
|                                  | More than two days per week | 4 | 68 (15.01%) |
| Number of night shifts in a week | Zero                | 0    | 147 (32.45%)   |
|                                  | One night shift a week | 1 | 87 (19.21%)  |
|                                  | Two night shifts a week | 2 | 109 (24.06%) |
|                                  | Three or more night shifts a week | 3 | 110 (24.28%) |
| Contact with a confirmed patient | Yes                 | 1    | 65 (14.35%)    |
|                                  | No                  | 0    | 388 (85.65%)   |
| Regretting being a nurse         | Yes                 | 1    | 20 (4.42%)     |
|                                  | No                  | 0    | 433 (95.58%)   |
| Professional attitude            | Negative            | 0    | 3 (0.66%)      |
|                                  | General             | 1    | 19 (4.19%)     |
|                                  | Positive            | 2    | 97 (21.41%)    |
|                                  | Strongly positive   | 3    | 334 (73.73%)   |
| Confidence in fighting transmission | Lack of confidence | 1 | 1 (0.22%)     |
|                                  | General confident   | 2    | 26 (5.74%)     |
|                                  | Quite confident     | 3    | 426 (94.04%)   |
| Signed up to go to Hubei Province for support | Yes | 1 | 385 (84.99%) |
|                                  | No                  | 0    | 68 (15.01%)    |
| Having attended infection prevention training | Yes | 1 | 328 (72.41%) |
|                                  | No                  | 0    | 125 (27.59%)   |
| Family support                   | Yes                 | 1    | 435 (96.03%)   |
|                                  | No                  | 0    | 18 (3.97%)     |
| Hospital for confirmed patient   | Yes                 | 1    | 181 (39.96%)   |
|                                  | No                  | 0    | 272 (60.04%)   |
| Fear of infecting family members | Yes                 | 1    | 361 (79.69%)   |
|                                  | No                  | 0    | 92 (20.31%)    |
Overall, the results of the scales were SAS (mean=49.01, SD=5.46), PSS-14(mean=21.09, SD=7.76) and SCSQ (positive coping mean=1.97, SD=0.57; negative coping mean=1.13 SD=0.48). Among the participants, 281(62.03%) had no anxiety symptoms, 154(34.00%) had mild anxiety, 16(3.53%) had moderate anxiety, and 2(0.44%) had severe anxiety. There were 146(32.23%) participants with scores greater than 25 in the PSS, indicating excessive stress. 229(50.55%) participants were more likely to respond positively to stress, while 224(49.45%) were more likely to respond negatively. Positive coping scores were higher than the Chinese norm, while negative coping scores were lower than the norm (table 2).

Table 2 Descriptive statistics of the anxiety, stress and coping style

| Variable          | N (%)      | Mean    | SD  |
|-------------------|------------|---------|-----|
| Anxiety[1]        |            |         |     |
| None              | 281(62.03%)| 49.01   | 5.46|
| Mild anxiety      | 154(34.00%)|         |     |
| Moderate anxiety  | 16(3.53%)  |         |     |
| Severe anxiety    | 2(0.44%)   |         |     |
| Perceived stress[2]|           | 21.09   | 7.76|
| Normal            | 307(67.77%)|         |     |
| Stress            | 146(32.23%)|         |     |
| Coping style[3]   |            |         |     |
| coping tendency>0 | 229(50.55%)| 1.97    | 0.57|
| positive coping   |            |         |     |
| negative coping   | 224(49.45%)| 1.13    | 0.48|

Effects of socio-psychological and working condition variables on scores of anxiety, stress and stress coping tendency

The coding of socio-psychological and working condition variables are shown in table 1. The results showed that 19.2% total variation in the anxiety was explained by variables in the model (Adjusted R² = 0.192, P=0.032). Fear of infecting family members (β=0.263, P=0.000), regretting being a nurse (β=0.216, P=0.000) and having children (β=0.096, P=0.028) were positively associated with anxiety. Confidence in fighting transmission (β=-0.147, P=0.001), gender (β= -0.106, P= 0.015) and rest time each week in the past month (β= -0.092, P=0.032) were inversely associated with anxiety. And female gender, less rest time, having children, lack of confidence in fighting transmission, regretting being a nurse and fear of infection in family were risk factors of anxiety (table 3 see Additional file 1). In perceived stress domain, 13.7% total variance was explained by the variables in the model.
Fear of infecting family members ($\beta$=0.239, $P$=0.000), regretting being a nurse ($\beta$=0.199, $P$=0.000) and number of night shifts in a week ($\beta$=0.109, $P$=0.014) were positively associated with stress. Having attended infection prevention training ($\beta$=-0.122, $P$=0.006) was inversely associated with stress. The analysis showed that regretting being a nurse, not having an emergency protection training, fear of infection in family and the more night shifts were risk factors of perceived stress (table 4 see Additional file 2).

About 13.2% total variation in stress coping tendency was explained by variables in the model (Adjusted $R^2$=0.132, $P$=0.029). Professional attitude ($\beta$=0.125, $P$=0.008), having attended infection prevention training ($\beta$=0.108, $P$=0.015) and signing up to go to Hubei Province for rescue ($\beta$=0.099, $P$=0.029) were positively associated with stress coping tendency. Fear of infecting family members ($\beta$=-0.188, $P$=0.000) and regretting being a nurse ($\beta$=-0.155, $P$=0.001) were inversely associated with stress coping tendency. In other words, participants with a positive professional attitude, not regretting being a nurse, training in emergency preparedness, willingness to go to Hubei Province for rescue, and not fearing infecting family members responded more positively to stress (table 5 see Additional file 3).

**The correlation among levels of SAS, PSS and SCSQ.**

After controlling for socio-psychological and working condition variables, Pearson correlation coefficients were calculated to assess associations among anxiety, stress and coping tendency. The calculated correlation coefficients were shown in Table 6. Statistically significant positive correlations were found between stress with anxiety ($r$=0.443, $P$<0.001), while coping tendency score was negatively correlated with anxiety ($r$=-0.268, $P$< 0.001) and stress ($r$=-0.503, $P$< 0.001).

| Variables          | Anxiety | Stress | Coping tendency |
|--------------------|---------|--------|-----------------|
| Anxiety            | 1       |        |                 |
| Stress             | 0.443*  | 1      |                 |
| Coping tendency    | -0.268* | -0.503*| 1               |

[1] Chinese norm: normal: <50 points, 50 to 59 points for mild anxiety, 60 to 69 points for moderate
anxiety, and above 69 points for severe anxiety.

b Chinese norm: normal: ≤25 points, stress: >25 points.

[3] Chinese norm: the average score of positive coping dimension is 1.78, while the average score of negative coping dimension is 1.59.

* P<0.001

Discussion
The purpose of this study was to investigate the psychological impact of COVID-19 on EFO nurses in Chinese hospitals. We explored the effects of socio-psychological variables and working conditions on anxiety, stress and stress coping tendency, as well as the correlation of anxiety, stress, and stress coping tendency in EFO nurses.

Anxiety, stress and stress coping style of EFO nurses
Stress and anxiety are common mental health problems among nurses. The results of this study showed an anxiety score of 49.01±5.46, which was slightly higher than those reported by Yu [22] and Yang [23]. We found that 32.23% of EFO nurses had perceived stress in the present study, and previous studies also revealed that being a nurse was highly stressful [12, 15], especially for nurses working in emergency departments [39]. During the outbreak of COVID-19 in China, EFO nurses served as gatekeepers of the medical system. Unlike nurses in other departments, EFO nurses have a higher risk of exposure to COVID-19. In addition, factors such as excessive workload, fear of family member infection, and the death of medical staff can also lead to stress and anxiety [12, 40, 41].

Coping is the cognitive and behavioral measure taken by individuals to life events and their own unbalanced state. In this study, the score of positive coping of EFO nurses was 1.97±0.57, which was higher than the Chinese norm (1.78±0.52). While the score of negative coping was 1.13±0.48, which was lower than Chinese norm (1.59±0.66) [24]. Among the participants, 229(50.55%) were more
likely to respond positively to stress, while 224(49.45%) were more likely to respond negatively which was similar to the previous study in China [42]. Nearly half of EFO nurses responded to stress mainly in a negative way, suggesting that appropriate interventions should be given to improve their coping style.

**Predictors of stress, anxiety, and stress coping tendency**

The models we used included gender, fear of infecting family members, regretting being a nurse, having children, confidence in fighting outbreak, rest time, professional attitudes, having attended infection prevention training, and number of night shifts; and they were all predictors of the mental health of EFO nurses.

Socio-psychological variables and working conditions as predictors, accounted for 19.2% of the variance in anxiety, 13.7% in stress domain, and 13.2% in stress coping tendency. Among variables, fear of infecting family members was the most influential and predictive of all three criterions. During infectious disease epidemic it was difficult for hospital workers to return home from the hospital because they worried about family infection [12, 40, 41]. Nurses are vulnerable to infection during outbreaks of infectious disease [40, 43-45], especially when there are emerging infectious diseases with infectious nature not entirely clear. During the COVID-19 outbreak, emergency and fever clinics in Chinese hospitals are the high-risk workplaces, where nurses are more likely to be exposed. COVID-19 is highly infectious, which make nurses even more worried about their family members, subsequently making them more anxious, stressed and more inclined to adopt negative coping methods.

Those who regretted becoming a nurse reported higher levels of anxiety, stress and mainly adopted negative coping style. Nurses who reported serving voluntarily were less stressed than those who were appointed [46]. Some studies also suggested that the potential turnover rate for nurses may be high during an outbreak and that they may face more psychological problems [47, 48]. Wong et al found that 76.9% community nurses were unwilling to work because of psychological stress and fear of being infected by H1N1 influenza, and those who reported unwillingness were more depressed and
were more stressful [41]. It is unclear why respondents regretted becoming a nurse during the COVID-19 pandemic. We can only assume to the following reasons: protective working conditions or facilities may be unavailable [49], fears of infection, excessive workload, childcare responsibilities and prioritization of family members [50].

We also noted that 72.41% (328) respondents had attended infection prevention training, which resulted in lower levels of stress and adoption of positive coping style. Inadequate training in infection control, lack of knowledge and unclear specific tasks increased perceived personal risk and reduced willingness to work [41]. Not only nurses, but also all those involved need to be trained for the skills necessary to protect them from infection [51]. Institutional preparedness is a positive predictor of individual perceptions of preventive measures [52]. Protection training can help to understand the nature of infectious diseases, standardize protection measures, enhance confidence, and improve nurses' compliance with infection control measures, thus reducing the risk of disease transmission. Protection training is necessary, especially for the highly infectious COVID-19. Medical institutions should attach great importance to improving the protection training system, and online and offline comprehensive training should be used to improve the occupational protection ability of EFO nurses. Those who took fewer breaks and more night shifts each week had higher levels of anxiety and stress. The length of rest time and the number of night shifts can reflect whether the nursing resources are sufficient or not and the workload. Previous studies have suggested that long hours and high workloads are predictors of stress [12, 13, 40, 51]. Nurses' duties may change in response to the outbreak, which can also lead to stress and anxiety. Overworking can make the EFO nurse lose the sense of control to the life, produce the feeling of powerless, and even cause insomnia, headache, loss of appetite and other physical problems [53]. Therefore, hospitals should ensure that the emergency and the fever clinics are adequately staffed with nurses, and the head nurse should arrange the shift of nurses in a coordinated way to ensure that they can get sufficient rest.

There were 35.98% (163) of the respondents had children and had higher levels of anxiety, similar to the results of Maunder [12] and Leslie [15], but unlike Chen's study [46] who found that nurses with more than two children reported the lowest levels of job stress, while nurses without children reported
the highest levels of job stress and were more likely than other nurses to have destructive stress coping strategies. The opposite finding may be due to the timing of the survey. During infectious disease outbreaks, nurses have a duty to protect their own children from being infected and the burden of caring for children grows as schools are closed. The double burden of family and work makes them more anxious.

Women made up the majority (96.47%) of our respondents and had higher levels of anxiety. Previous studies have shown that gender had different effects on mental health. During Ebola outbreak, male health workers experienced more mental distress [54]. This is different from the results of this study, which may be due to the fact that the emergency and fever outpatient have undertaken most diagnosis and treatment in this COVID-19 epidemic, and the workload is large. Compared with women, men can better cope with the high workload. However, only 16 nurses in this study were male, so the findings should be applied only in the appropriate context and further research is needed.

Confidence in fighting the outbreak was negatively correlated with anxiety levels among EFO nurses. Confidence is a display of perseverance and optimism, which can reduce the degree of individual stress response and avoid psychological disorder. Confident nurses tend to have more abundant clinical professional knowledge and abilities, and can effectively manage their time and tasks [55]. Confidence can help to stimulate professional potential, overcome pressure and difficulties, and maintain a good physical and mental state. In addition, Professional attitude is a positive predictor of stress coping tendency. The more positive the professional attitude, the more likely EFO nurses were to adopt positive coping tendency. Lam et al. found that during the influenza outbreak, nurses endured a considerable amount of hardship. They overcame their own risk of infection and provided nursing service largely because of professional loyalty, mission and obligation to perform professional duties [40]. A strong professional attitude contributes to the quality of care [56]. Therefore, it is recommended that medical institutions should summarize the epidemic prevention and control work on a daily basis, and encourage nurses to share their clinical experience and feelings, affirm their professional value, and improve their professional identity and confidence in fighting the epidemic.
Correlation among stress, anxiety, and stress coping tendency

While controlling for socio-psychological and working condition variables, we found that stress was positively correlated with anxiety score, which is consistent with previous findings [57, 58]. It has been shown that constant high work stress may have negative physical and psychological effects on health (anxiety, depression, and burnout) [59]. Coping tendency score was negatively correlated with anxiety and stress score, which is also consistent to those of previous studies [58, 60]. However, mental health is the result of multiple factors, so the relationship between variables and whether there is mediating effect is worthy of further discussion.

Limitations

Our study also had some limitations. First, the convenience sampling method to recruit respondents from hospitals may reduce the generalizability of the results. Second, the cross-sectional nature of the data constrains us from drawing any conclusions about causality among anxiety, stress, and coping tendency. Finally, the present survey relied only on the self-reported questionnaire, which may lead to lack of objective source in data collection.

Conclusions

The sudden onset and strong infectivity of COVID-19 pose a great challenge in clinical prevention and control of the outbreak. Our results indicate that the COVID-19 outbreak in China has a certain psychosocial impact on EFO nurses. Psychological intervention is necessary and effective measures should be taken, and they may include strengthening protection training to improve self-protection ability, ensuring adequate nurses for emergency and fever clinics, reducing the number of night shifts and ensuring adequate rest time, timely updates of the latest information to keep nurses informed, and encouraging EFO nurses to share clinical experience and feelings. Moreover, greater attention should be paid to female EFO nurses and nurses with children, providing more support for their families.

Our research was carried out at the peak of the COVID-19 outbreak in China, when knowledge of the epidemic was limited and information was rapidly changing. In the following investigation, it is
necessary to combine qualitative and quantitative methods, so as to better understand the psychosocial impact on EFO nurses.

Abbreviations
COVID-19: Corona Virus Disease 2019; EFO: nurses of emergency and fever outpatient; PHEIC: Public Health Emergency of International Concern; SAS: Self-Rating Anxiety Scale; PPS-14: Perceived Stress Scale-14; SCSQ: Simplified Coping Style Questionnaire

Declarations

Ethics approval and consent to participate
This study received ethical approval from the Committee on Ethics of Medical Research, Navy Medical University (Formerly known as the Second Military Medical University), HJEC number 2020-LW-001. All participants gave written consent, in keeping with Ethics Committee requirements. Individual data is not reported in this study.

Consent for publication
Not applicable.

Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests
The authors declare that they have no competing interests.

Funding
This work was supported by grants from the Health Bureau of logistics support department of Central Military Commission (20WQ010) and Youth Fund Project of Nantong Health Commission (QB2019011). The funders had no role in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

Authors’ contributions
Study design: SC, JC; Scale selection: MQ, YJ, QS; Data collection: SC, MQ, QS; Data analysis: SC, YJ,
Acknowledgments

The author would like to thank the participants in this study for their valuable time and data. And thank them for their efforts during the COVID-19 outbreak.

Authors’ information (optional)
Not applicable

References

1. Cardoso CW, Paploski IA, Kikuti M, Rodrigues MS, Silva MM, Campos GS, Sardi SI, Kitron U, Reis MG, Ribeiro GS: Outbreak of Exanthematous Illness Associated with Zika, Chikungunya, and Dengue Viruses, Salvador, Brazil. *Emerg Infect Dis* 2015, 21(12):2274-76.

2. Team WHOER, Aylward B, Barboza P, Bawo L, Bertherat E, Bilivogui P, Blake I, Brennan R, Briand S, Chakauya JM et al: Ebola virus disease in West Africa--the first 9 months of the epidemic and forward projections. *N Engl J Med* 2014, 371(16):1481-95.

3. Abdalla O, Mohammed M, Hakawi AM, Aljifri A, Abdalla M, Eltigani S, Mujib SA, Assiri A: Hospital-based surveillance of influenza A(H1N1)pdm09 virus in Saudi Arabia, 2010-2016. *Ann Saudi Med* 2020, 40(1):1-6.

4. Hussein A: Guest Editorial[SARS-future considerations for nurses. *Journal of advanced nursing* 2004, 45(2):111-12.

5. Carlson CJ, Dougherty ER, Getz W: An Ecological Assessment of the Pandemic Threat of Zika Virus. *PLoS Negl Trop Dis* 2016, 10(8):e0004968.

6. Epidemiology Working Group for NCIP Epidemic Response, Chinese Center for Disease Control and Prevention: The epidemiological characteristics of an outbreak of 2019
novel coronavirus diseases (COVID-19) in China. Chin J Epidemiol 2020, 41(2):145-51.

7. National Health Commission of the People's Republic of China.
   http://www.nhc.gov.cn/xcs/yqtb/202002/ac1e98495cb04d36b0d0a4e1e7fab545.shtml.
   Accessed 21 Feb 2020.

8. Schwartz D, Graham A: Potential Maternal and Infant Outcomes from (Wuhan) Coronavirus 2019-nCoV Infecting Pregnant Women: Lessons from SARS, MERS, and Other Human Coronavirus Infections. Viruses 2020, 12(2).

9. Nishiura H, Linton NM, Akhmetzhanov AR: Initial Cluster of Novel Coronavirus (2019-nCoV) Infections in Wuhan, China Is Consistent with Substantial Human-to-Human Transmission. J Clin Med 2020, 9(2).

10. National Health Commission of the People's Republic of China.
    http://www.nhc.gov.cn/xcs/fkdt/202002/5329d7ab7af24690a1d5b66982333af3.shtml.
    Accessed 14 Feb 2020.

11. Shultz JM, Baingana F, Neria Y: The 2014 Ebola outbreak and mental health: current status and recommended response. JAMA 2015, 313(6):567-68.

12. Maunder R: The experience of the 2003 SARS outbreak as a traumatic stress among frontline healthcare workers in Toronto: lessons learned. Philos Trans R Soc Lond B Biol Sci 2004, 359(1447):1117-25.

13. Ruotsalainen JH, Verbeek JH, Marine A, Serra C: Preventing occupational stress in healthcare workers. Cochrane Database Syst Rev 2015(4):CD002892.

14. Chen R, Chou KR, Huang YJ, Wang TS, Liu SY, Ho LY: Effects of a SARS prevention programme in Taiwan on nursing staff's anxiety, depression and sleep quality: a longitudinal survey. Int J Nurs Stud 2006, 43(2):215-25.

15. Nickell LA, Crighton EJ, Tracy CS, Al-Enazy H, Bolaji Y, Hanjrah S, Hussain A, Makhlouf S, Upshur RE: Psychosocial effects of SARS on hospital staff:survey of a large tertiary
16. Lam SKK, Kwong EWY, Hung MSY, Pang SMC, Chien WT: A qualitative descriptive study of the contextual factors influencing the practice of emergency nurses in managing emerging infectious diseases. *Int J Qual Stud Health Well-being* 2019, 14(1):1626179.

17. Lehmann M, Bruenahl CA, Addo MM, Becker S, Schmiedel S, Lohse AW, Schramm C, Lowe B: Acute Ebola virus disease patient treatment and health-related quality of life in health care professionals: A controlled study. *J Psychosom Res* 2016, 83:69-74.

18. Smith MW, Smith PW, Kratochvil CJ, Schwedhelm S: The Psychosocial Challenges of Caring for Patients with Ebola Virus Disease. *Health Secur* 2017, 15(1):104-109.

19. Chang CS, Du PL, Huang IC: Nurses’ perceptions of severe acute respiratory syndrome relationship between commitment and intention to leave nursing. *J Adv Nurs* 2006, 54(2):171-79.

20. Wu J, Song X, Chen F, Diao Y, Chen D, Jing X, Gong X: Investigation on sleep quality of first-line nurses in fighting against novel coronavirus pneumonia and its influencing factors. *Nursing Research of China* 2020, 34(4):1-5.

21. Zung WW: A rating instrument for anxiety disorders. *Psychosomatics* 1971, 12(6):371-79.

22. Yu J, Song Y, Dong H, Su X, Zhang P: Factors associated with the general well-being of nurses in a tertiary Chinese hospital: A cross-sectional study. *J Nurs Manag* 2020.

23. Yang J, Tang S, Zhou W: Effect of Mindfulness-Based Stress Reduction Therapy on Work Stress and Mental Health of Psychiatric Nurses. *Psychiatr Danub* 2018, 30(2):189-196.

24. Dai X, Zhang J, Cheng Z. Manual of commonly used psychological assessment scale. People's military medical press. Beijing: Academic; 2015.p.99-101, 170-74.
25. Cohen S, Kamarck T, Mermelstein R: A global measure of perceived stress. *J Health Soc Behav* 1983, 24(4):385-96.

26. Andreou E, Alexopoulos EC, Lionis C, Varvogli L, Gnardellis C, Chrousos GP, Darviri C: Perceived Stress Scale: reliability and validity study in Greece. *Int J Environ Res Public Health* 2011, 8(8):3287-98.

27. Deeken F, Häusler A, Nordheim J, Rapp M, Knoll N, Rieckmann N: Psychometric properties of the Perceived Stress Scale in a sample of German dementia patients and their caregivers. *Int Psychogeriatr* 2018, 30(1):39-47.

28. Eklund M, Bäckström M, Tuvesson H: Psychometric properties and factor structure of the Swedish version of the Perceived Stress Scale. *Nord J Psychiatry* 2014, 68(7):494-99.

29. Lee EH, Chung BY, Suh CH, Jung JY: Korean versions of the Perceived Stress Scale (PSS-14, 10 and 4): psychometric evaluation in patients with chronic disease. *Scand J Caring Sci* 2015, 29(1):183-92.

30. Mimura C, Griffiths P: A Japanese version of the Perceived Stress Scale: cross-cultural translation and equivalence assessment. *BMC psychiatry* 2008, 8:85.

31. Al-Dubai SA, Alshagga MA, Rampal KG, Sulaiman NA: Factor Structure and Reliability of the Malay Version of the Perceived Stress Scale among Malaysian Medical Students. *Malays J Med Sci* 2012, 19(3):43-49.

32. Dao-Tran TH, Anderson D, Seib C: The Vietnamese version of the Perceived Stress Scale (PSS-10): Translation equivalence and psychometric properties among older women. *BMC psychiatry* 2017, 17(1):53.

33. Lu W, Bian Q, Wang W, Wu X, Wang Z, Zhao M: Chinese version of the Perceived Stress Scale-10: A psychometric study in Chinese university students. *PloS one* 2017, 12(12):e0189543.
34. Yang TZ; Huang HT: An epidemiological study on stress among urban residents in social transition period. *Chinese Journal of Epidemiology* 2003, 24(9):760-64.

35. Yokokura A, Silva A, Fernandes JKB, Del-Ben CM, Figueiredo FP, Barbieri MA, Bettiol H: Perceived Stress Scale: confirmatory factor analysis of the PSS14 and PSS10 versions in two samples of pregnant women from the BRISA cohort. *Cad Saude Publica* 2017, 33(12):e00184615.

36. Wang Z, Chen J, Boyd JE, Zhang H, Jia X, Qiu J, Xiao Z: Psychometric properties of the Chinese version of the Perceived Stress Scale in policewomen. *PloS one* 2011, 6(12):e28610.

37. Xie Y: A preliminary study on the reliability and validity of the Simplified Coping Style Questionnaire. *Chin J Clin Psychol* 1998, 6(2):114-115.

38. Wu M: Questionnaire statistical analysis practice -SPSS operation and application. Chongqing university press.Chongqing:Academic; 2010.p.390-391.

39. Ettorre G, Greco MR: Assessment and management of work-related stress in hospital emergency departments in Italy. *J Med Pract Manage* 2016, 31(5):280-83.

40. Lam KK, Hung SY: Perceptions of emergency nurses during the human swine influenza outbreak: a qualitative study. *Int Emerg Nurs* 2013, 21(4):240-46.

41. Wong EL, Wong SY, Kung K, Cheung AW, Gao TT, Griffiths S: Will the community nurse continue to function during H1N1 influenza pandemic: a cross-sectional study of Hong Kong community nurses? *BMC Health Serv Res* 2010, 10:107.

42. Guo W, Wang W: Investigation on sleep quality of nurses in emergency departments of tertiary hospitals and analysis of influencing factors. *Chin J Ind Hyg Occup Dis* 2019, 37(4):286-89.

43. Wise ME, De Perio M, Halpin J, Jhung M, Magill S, Black SR, Gerber SI, Harriman K, Rosenberg J, Borlaug G et al: Transmission of pandemic (H1N1) 2009 influenza to
healthcare personnel in the United States. Clin Infect Dis 2011, 52 Suppl 1:S198-204.

44. Olu O, Kargbo B, Kamara S, Wurie AH, Amone J, Ganda L, Ntsama B, Poy A, Kuti-George F, Engedashet E et al: Epidemiology of Ebola virus disease transmission among health care workers in Sierra Leone, May to December 2014: a retrospective descriptive study. BMC Infect Dis 2015, 15:416.

45. Venkat A, Hunter R, Hegde GG, Chan-Tompkins NH, Chuirazzi DM, Szczesiul JM: Perceptions of participating emergency nurses regarding an ED seasonal influenza vaccination program. J Emerg Nurs 2012, 38(1):22-29.

46. Chen CK, Lin C, Wang SH, Hou TH: A study of job stress, stress coping strategies, and job satisfaction for nurses working in middle-level hospital operating rooms. J Nurs Res: JNR 2009, 17(3):199-211.

47. Tam DK, Lee S, Lee SS: Impact of SARS on avian influenza preparedness in healthcare workers. Infection 2007, 35(5):320-25.

48. Stuart RL, Gillespie EE: Hospital pandemic preparedness: health care workers' opinions on working during a pandemic. Med J Aust 2007, 187(11-12):676.

49. Tsai MT, Ya-Ti H: A resource-based perspective on retention strategies for nurse epidemiologists. J Adv Nurs 2008, 61(2):188-200.

50. McMahon SA, Ho LS, Brown H, Miller L, Ansumana R, Kennedy CE: Healthcare providers on the frontlines: a qualitative investigation of the social and emotional impact of delivering health services during Sierra Leone's Ebola epidemic. Health Policy Plan 2016, 31(9):1232-39.

51. Mohammed A, Sheikh TL, Poggensee G, Nguku P, Olayinka A, Ohuabunwo C, Eaton J: Mental health in emergency response: lessons from Ebola. Lancet Psychiatry 2015, 2(11):955-57.

52. Imai T, Takahashi K, Todoroki M, Kunishima H, Hoshuyama T, Ide R, Kawasaki T,
Koyama N, Endo K, Fujita H et al: Perception in relation to a potential influenza pandemic among healthcare workers in Japan: Implications for preparedness. *J Occup Health* 2008, 50(1):13-23.

53. Johal SS: Psychosocial impacts of quarantine during disease outbreaks and interventions that may help to relieve strain. *N Z Med J* 2009, 122(1296):47-52.

54. Li L, Wan C, Ding R, Liu Y, Chen J, Wu Z, Liang C, He Z, Li C: Mental distress among Liberian medical staff working at the China Ebola Treatment Unit: a cross sectional study. *Health Qual Life Outcomes* 2015, 13:156.

55. Fiske E: Nurse Stressors and Satisfiers in the NICU. *Adv Neonatal Care* 2018, 18(4):276-84.

56. Teng CI, Dai YT, Shyu YI, Wong MK, Chu TL, Tsai YH: Professional commitment, patient safety, and patient-perceived care quality. *J Nurs Scholarsh* 2009, 41(3):301-309.

57. Chen CH, Wang J, Yang CS, Fan JY: Nurse practitioner job content and stress effects on anxiety and depressive symptoms, and self-perceived health status. *J Nurs Manag* 2016, 24(5):695-704.

58. Chen J, Li J, Cao B, Wang F, Luo L, Xu J: Mediating effects of self-efficacy, coping, burnout, and social support between job stress and mental health among young Chinese nurses. *J Adv Nurs* 2020, 76(1):163-73.

59. Ruotsalainen J, Serra C, Marine A, Verbeek J: Systematic review of interventions for reducing occupational stress in health care workers. *Scand J Work Environ Health* 2008, 34(3):169-78.

60. Mark G, Smith AP: Occupational stress, job characteristics, coping, and the mental health of nurses. *Br J Health Psychol* 2012, 17(3):505-21.

Supplementary Files
This is a list of supplementary files associated with this preprint. Click to download.

Additional file 1.xls
Additional file 2.xls
Additional file 3.xls