

RESEARCH ARTICLE

Prevalence and influencing factors of anxiety and depression symptoms among surgical nurses during COVID-19 pandemic: A large-scale cross-sectional study

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Abstract

Aim: To evaluate the prevalence and influencing factors of anxiety and depression symptoms in surgical nurses during the COVID-19 epidemic in Anhui, China.

Methods: A cross-sectional, multicentre quantitative study was conducted among surgical nurses in Anhui province. SAS, SDS and SSRS scales were used for the investigation. Data were collected between 3 March 2020 to 19 March 2020.

Results: A total of 3,492 surgical nurses completed the survey. The average level of anxiety and depression of surgical nurses were higher than that of the Chinese norm. Levels of social support for surgical nurses were significantly negatively associated with the degree of anxiety and depression. Fertility status, participation in care for COVID-19 patients, likelihood of being infected with COVID-19 and social support were significantly influencing surgical nurses' anxiety degree. Similarly, these characteristics were significantly associated with the odds of depression symptoms in surgical nurses.

Conclusion: These findings suggest that targeted psychological interventions to promote mental health of surgical nurses need to be immediately implemented.

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KEYWORDS

anxiety, COVID-19, depression, mental health, social support, surgical nurses

1 | INTRODUCTION

The outbreak of the coronavirus 2019 (COVID-19), formerly known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; Zheng, 2020), is continuously posing a serious public health threat worldwide. In response to COVID-19 pandemic, Nation Health Commission of China has placed COVID-19 under the statutory category B management of infectious diseases, and measures for class A infectious diseases should be taken for the prevention and control of COVID-19. Since January 2020, COVID-19 has spread rapidly in 218 countries and regions.

2 | BACKGROUND

Previous studies have shown that public health emergencies can easily cause anxiety and panic among healthcare workers, such as the severe acute respiratory syndrome (Chong et al., 2004). Healthcare staff around the world are likely to be put in an unprecedented stressful situation by the COVID-19 pandemic (Chew et al., 2020), and nurses are no exception (Stelnicki et al., 2020). The COVID-19 pandemic presents significant challenges for healthcare workers and impacts the entire healthcare system, with sustained strain on the system. In addition to the physical health, the potential psychological and mental health impacted by the COVID-19 pandemic should also be taken seriously. As this pandemic continues to exert a grave toll on the mental status of healthcare workers, there is an urgent need for health psychology research. Previous research has suggested that COVID-19 has psychological impacts on the frontline medical staff (Huang, Liu, et al., 2020; Song et al., 2020) administrative staff (Luo et al., 2020). Moreover, a recent study warns that we should not neglect the mental health of the staff from other medical departments during the pandemic (Liang et al., 2020). Wu et al found that in addition to the frontline healthcare workers, the working life of physicians and nurses is severely disrupted even in the usual hospital wards (Wu et al., 2020). When dealing with challenges of the COVID-19 epidemic, surgical nurses are at increased risk of psychological health problems during the outbreak. Therefore, the psychological states of nurses working in the surgery department require our attention. Therefore, the aim of our study was to examine the anxiety and depression levels of surgical nurses and to identify the risk factors for anxiety and depression in China during the COVID-19 epidemic. Our findings could help governments or health authorities to recognize the causes of increased anxiety in healthcare workers and then to provide early effective measures to reduce that anxiety.

3 | METHODS**3.1 | Study design and participants**

A cross-sectional, correlation study was conducted among nurses employed in different surgical wards in Anhui province (China) from 3 March 2020 to 19 March 2020. Stratified sampling method was used to recruit participants. Firstly, Anhui Province was divided into 3 parts as southern, central and northern regions. Secondly, 2 cities were selected from each part with simple random sampling method. Then, 2 tertiary hospitals and 2 secondary hospitals were selected from each city with simple random sampling method. As a result, there were 12 tertiary hospitals and 12 secondary hospitals in our study. Finally, 200 surgical nurses in every tertiary hospital and 100 surgical nurses in every secondary hospital were enrolled as the participants. The surgical nurses in each hospital were numbered according to their working numbers from small to large; then, the research objects were selected by systematic sampling method. In all, there were 2,400 surgical nurses from 12 tertiary hospitals and 1,200 surgical nurses from 12 secondary hospitals in our study.

The inclusion criteria were as follows: (1) registered surgical nurses, (2) duration of the service over 1 year, (3) willing to be investigated. Exclusion criteria were as follows: (1) not in Anhui province, (2) with serious mental illness, such as schizophrenia or an intellectual disability; (3) with physical disease affecting anxiety or depression, such as hypothyroidism or coronary heart disease; (4) not on duty during the investigation period, such as maternity leave and sick leave. Socio-demographic characteristics and mental health measurements were collected by electronic questionnaires through Wechat. Research Ethics Committee approval of this study was issued by our university's Institutional Review Board (IRB).

3.2 | Survey methods**3.2.1 | Sample size estimation**

It is estimated from the reference that the detection rate of anxiety in nurses is 20% (Zung, 1971). Stratified cluster sampling method was used to recruit participants. The sample size calculation formula is as follows:

$$N = d_{\text{eff}} \frac{u^2 p(1-p)}{\delta^2}$$

$$p = .2, \delta = 0.2 \times 15\% = 0.03, d_{\text{eff}} = 1.5, \alpha = 0.05, u = 1.96.$$

After index insertion, $N = 1,024.42 \approx 1,025$. Then, Anhui province is divided into 3 layers according to geographical conditions, and the total number is $1,025 \times 3 = 3,075$. Allowing for a 15% rejection rate, the total sample size is 3,618, and the integer is 3,600.

3.3 | Survey tools

3.3.1 | General information questionnaire

By using the self-designed questionnaire, we have obtained the general demographic characteristics of the respondents, including age, gender, education level, character, marital status, fertility status, technical title, position, years registered as nurse, personnel relations, type of hospital, department, participation in care for COVID-19 patients, self-perceived likelihood of being infected COVID-19 (perception of being infected).

3.3.2 | Zung's self-rating anxiety scale

The self-rating anxiety scale (SAS; Zung, 1971) was used to assess anxiety symptoms of surgical nurses. The SAS includes 20 items, using a 4-point scale ranging from 1 (none, or a little of the time) to 4 (most, or all of the time), with total raw scores ranging from 20–80 (Zung, 1974). Based on raw data multiplied by 1.25, the standardized scores were classified into four categories, including normal (<49), mild anxiety (50–59), moderate anxiety (60–70) and severe anxiety (>70). The index score of 50 is set as the morbidity cut-off. The SAS has been shown to have good internal consistency with a Cronbach's alpha of 0.82 (Tanaka-Matsumi & Kameoka, 1986). Cronbach's α was 0.863 in the current study.

3.3.3 | Zung's self-rating depression scale

The self-rating depression scale (SDS) was employed to assess the frequency of depression symptoms in surgical nurses. The SDS is a 20-item Likert and norm-referenced scale, the higher the score, the greater degree of depression (Zung, 1965). Similar to SAS, the sum of the SDS raw scores was obtained on the 20 items by 80 and converted to a whole number which ranges from 25–100 (Tanaka-Matsumi & Kameoka, 1986). According to the Chinese norm (Zung, 1965), we also utilized the standard score of 53 as the critical value to divide depression in this study. An alpha coefficient of 0.81 was reported by Tanaka and Kameoka (Tanaka-Matsumi & Kameoka, 1986), while 0.792 was in our study.

3.3.4 | Social support rating scale

The levels of social support for surgical nurses were evaluated by using the 14-item social support rate scale (SSRS; Xu et al., 2018).

It contains three dimensions of objective support, subjective support and availability of support. The aggregate scores range from 12–66, with higher scores indicating greater levels of perceived social support. Social support is categorized into three levels according to the total score, low (≤ 22), moderate (23–44) and high (≥ 45). The Cronbach's alpha for internal consistency for the use of the SSRS was 0.808 (Zhang et al., 2015). The Cronbach's alpha of the SSRS was 0.796 in this sample.

3.4 | Procedures

The Electronic "Questionnaire Star" Questionnaire (<http://www.wjx.cn>) was employed as the survey tool in the present study. The information on the participants was collected by WeChat. "Questionnaire Star" is a professional online survey platform, which can be used for questionnaire surveys, evaluation, voting and other purposes (Huang, Lei, et al., 2020). After completing the questionnaire, participants' data were submitted electronically to a database that was read into a statistical software package (SPSS) for data analysis. Participants were informed that their responses would be kept confidential and that they were free to withdraw from the study at any time.

3.5 | Statistical analysis

Data were analysed using the statistical software package (SPSS) 20.0 (SPSS Institute Inc.). The data are presented using unadjusted means with standard deviations (SD) for continuous variables and unadjusted proportions for categorical variables. Comparison between groups was performed by *t* test and one-way ANOVA. Pearson's correlation analysis was used for correlation analysis. Linear regression models were used to evaluate the association between various factors and symptoms of anxieties and depression. A two-sided *p* value < .05 was considered statistically significant.

4 | RESULTS

4.1 | Participant characteristics

Of 3600 invited nurses in the Anhui surgical wards, 108 questionnaires were excluded for the irrational completion time (a dropout rate of 3.00%), while data from 3,492 patients (97.00%) were eligible for the analysis. Their baseline characteristics are shown in Table 1. Socio-demographic characteristics and mental health measurements from the surgical nurses were obtained. Levels of anxiety, depression and social support were measured using validated clinical questionnaires and scoring systems. The mean age was 32.3 years, and the largest age group was 30–40 years old. The majority of the sample was female (93.21%) and married (73.25%), had a bachelor's degree or above (67.99%). Most participants had one child or more

TABLE 1 Participant characteristics at baseline (N, %)

Variables	Subgroups	Number	Percentage (%)
Gender	Male	237	6.79
	Female	3,255	93.21
Age	<30 years	1,337	38.29
	30–40 years	1,745	49.97
	>40 years	410	11.74
Character	Introversion	785	22.48
	Extroversion	659	18.87
	Mixed personality	1,833	52.49
	uncertainty	215	6.16
Educational level	Technical school	69	1.98
	College	1,049	30.04
	University and over	2,374	67.98
Marital status	Single	865	24.77
	Married	2,558	73.25
	Divorce/Widowed	69	1.98
Fertility status	One and more children	2,389	68.41
	No child	1,103	31.59
Technical title	Junior	1,693	48.48
	Intermediate	1,741	49.86
	Senior	58	1.66
Position	Nurse	3,039	87.03
	Head nurse	399	11.43
	Department head nurse and over	54	1.54
Years registered as nurse	1–5 year	993	28.44
	6–10 year	1,122	32.13
	>10 year	1,377	39.43
Personnel relations	Formal establishment	765	21.91
	Personnel agency	1,024	29.32
	Engaging system	1,703	48.77
Hospital	Tertiary hospital	2,021	57.88
	Secondary hospital	1,471	42.12
Department	General surgery department	1,037	29.7
	Urinary surgery	553	15.8
	Orthopaedics department	500	14.3
	Neurosurgery department	459	13.1
	Cardiothoracic surgery department	400	11.5
	Orthopaedic burn surgery	137	3.9
Participation in care for COVID-19 patients	Yes	196	5.61
	No	3,296	94.39
Self-perception for being infected with COVID-19	None	166	4.75
	Mild	1,992	57.04
	Moderate	973	27.86
	Severe	361	10.34

children (68.41%). Among them, approximately half (49.86%) had intermediate technical titles, and 1.66% had senior technical titles. Most patients came from a clinical surgical department (87.03%),

12.97% involved in administration and 95.25% of the participants perceived that they would be infected with COVID-19, and a total of 196 (5.61%) surgical nurses directly treated the COVID-19 patients

Variables	Non	Mild	Moderate	Severe
Anxiety	2625 (75.17%)	663 (18.99%)	170 (4.87%)	34 (0.97%)
Depression	2710 (77.61%)	603 (17.26%)	154 (4.41%)	25 (0.72%)

TABLE 2 Prevalence of depression and anxiety in surgical nurses ($N = 3,492$)

as shown in Table 1. Moreover, the confounding factors for our study could include age, gender, education level, character, marital status, fertility status, technical title, position, years registered as nurse, personnel relations, without vaccine or sense of security, environment of unknown SARS-CoV-2.

4.2 | Status of anxiety and depression in surgical nurses during COVID-19 pandemic

To explore the psychological status of surgical nurses after the occurrence of COVID-19, we investigated the mean of anxiety and depression among these individuals using SAS and SDS questionnaires. Many participants experienced psychological symptoms, with 867 (24.83%) and 782 (22.39%) showing positive for anxiety and depression respectively (Table 2). Based on the scoring algorithm of SAS, the prevalence of anxiety was 24.83% (867/3492), with 663 respondents suffering from mild anxiety (18.99%), 170 from moderate anxiety (4.87%) and 34 from severe anxiety (0.97%). According to SDS scoring method, the prevalence of depression was 22.39% (782/3492). A total of 603 respondents suffered from mild depression (17.26%), 154 from moderate depression (4.41%) and 25 nurses from severe depression (0.72%) (Table 2).

As shown in Table 3, the prevalence of anxiety and depression symptoms was higher among surgical nurses during COVID-19 pandemic than the Chinese national norms ($p < .001$ and $p < .001$ respectively).

4.3 | Anxiety and depression status of surgical nurses with different demographic characteristics

The associations between various factors and risk of anxiety are shown in Table 4. There is a significant difference between these two groups in terms of the variables of gender, age group, marital status, fertility status, technical title and working year ($p < .05$). Similarly, higher mean anxiety subscale scores were observed in surgical nurses in tertiary hospitals ($p > .05$). The anxiety score was much higher as the self-perceived likelihood of being infected with COVID-19 increased ($p < .05$). The average anxiety score was significantly higher in surgical nurses who had directly treated COVID-19 cases, than the score in those who had not ($p < .001$). However, there was no statistical difference in anxiety scores with regards to the variables of gender, character, education, position and personnel relation ($p > .05$).

Similar findings were made in the associations between different demographic characteristics and the anxiety level of the surgical nurses, as shown in Table 5. Furthermore, comparison of

anxiety and depression scores of male surgical nurses with different demographic characteristics is shown in Tables S2 and S3. There is a significant difference between these groups in terms of the variables of hospitals, self-perception for being infected with COVID-19 ($p < .05$). The results for the female surgical nurses are similar to the overall result, as shown in Tables S4 and S5.

4.4 | Correlation between anxiety, depression and social support in surgical nurses during COVID-19 pandemic

Pearson's correlation analysis revealed that the SAS and SDS scores had negative correlation with the SSRS total scores and the scores of its three dimensions, as shown in Tables 6 and 7. There was a significant negative correlation between the SAS total scores and the SSRS total scores ($r = -0.630$, $p < .05$), and a negative correlation between the SAS scores and the scores of subjective support ($r = -0.560$, $p < .001$), the scores of objective support ($r = -0.495$, $p < .001$) and the scores for availability of support ($r = -0.405$, $p < .001$). Similarly, there was a negative association between the SDS total scores and the SSRS total scores ($r = -0.578$, $p < .05$) and a negative correlation between the SDS scores and the scores of three dimensions ($p < .001$). Tables 6 and 7 summarize these results.

The similar results for the relationships between SAS/SDS scores and SSRS scores of male and female surgical nurses are shown in Tables S6 and S7. Moreover, the total SSRS scores, the scores of two dimensions of female surgical nurses, had be higher than that of the male surgical nurses, as shown in Table S1.

4.5 | Multiple-factor analysis on anxiety and depression of surgical nurses during COVID-19 pandemic

Linear regression analysis revealed that having children, being in tertiary hospitals, participation in care for COVID-19 patients, perception of being infected and social support were the influencing factors for anxiety symptoms in surgical nurses ($p < .05$). However, there was no statistical significance between the association of anxiety symptom and age, technical title and working years ($p > .05$). Table 8 lists the results. The similar findings were shown in the Table 9 on the relationship between demographics, work related factors and social support with depressive symptoms. Divorce/widowed was also associated with higher mean scores in the depression.

Further analysis for gender difference has been conducted. The results of multivariate analysis showed that six factors influenced the anxiety level of the female surgical nurses, those are

TABLE 3 Comparison of the average level of anxiety and depression between surgical nurses and the Chinese norms during COVID epidemic (score, $\bar{x} \pm s$)

Variables	Surgical nurses	Chinese norm	t-value	p-value
SAS score	43.32 ± 9.01	37.23 ± 12.59	39.981	<.001
SDS score	45.09 ± 9.61	41.88 ± 10.57	19.764	<.001

character, fertility status, hospital levels, participation in care for COVID-19, self-perception for being infected with COVID-19 and social support ($p < .05$), as shown in Tables S10 and S11. As for male surgical nurses, there are only two factors, hospital levels and social support degree ($p < .05$). Tables S8 and S9 list the results.

5 | DISCUSSION

5.1 | High positive rate of anxiety and depression symptoms among surgical nurses during COVID-19

Although several studies reported that medical staff might suffer adverse psychological disorders, such as anxiety, fear and stigmatization, the psychological well-being of surgical nurses are little studied, and this should not be neglected. Importantly, surgical nurses encountering this situation are under extreme pressures. In the current cross-sectional study of 3,492 surgical nurses, 24.83% and 22.39% of participants reported anxious and depressive symptoms, respectively, during the COVID-19 epidemic in Anhui province of China. Compared with the normal Chinese SAS and SDS score, the anxious and depressive levels of surgical nurses were relatively high.

Due to the special feature of surgical nursing care, COVID-19 epidemic may impact on the mental welling of surgical nurses. Firstly, COVID-19 causes many medical personnel to be easily infected in a short time when treating patients. Probably, the COVID-19 pandemic has shaken the hospital workers' sense of security (Mattila et al., 2021). Also surgical nurses play an important role in this pandemic; hence, they face huge challenge and experience more stress. Secondly, in the initial period of COVID-19, not all patients undergoing emergency operation have been tested for viral nucleic acid, and it was impossible to determine whether the patient had a history of exposure to SARS-CoV-2. For those patients undergoing emergency operation, there was no time to test for viral nucleic acid. In addition, there were some confirmed SARS-CoV-2 cases that required surgical treatment. Moreover, although some patients who needed elective surgery would choose to postpone their surgery during the height of the pandemic in China, emergency surgery could not be reduced and some other elective surgery patients such as tumour patients would prefer to be operated on as soon as possible. Therefore, overall surgical patients were more than internal medicine patients. Consequently, these surgical nurses may have felt that the likelihood

of COVID-19 presenting in their workplace was greater, even though they did not always face COVID-19 directly. A survey from a tertiary general hospital in Wuhan from 13 January–12 March 2020 showed that most surgical patients received elective surgeries before COVID-19 was diagnosed, and infection of hospitalized medical staff with COVID-19 pneumonia mainly occurred in the surgical ward, including 9 ward nurses and 6 surgeons (Hou et al., 2020). Obviously, COVID-19 infection is a potential threat to surgical nurses, which may bring about psychological pressure on surgical nurses, such anxiety and depression. A European survey indicates that the surgical staff working in emergency departments was faced with a fear of potential COVID-19 infection (Karampelias et al., 2020). Similarly, nurses working at surgical unites in the current study also faced such unprecedented challenges.

5.2 | Influencing factors of anxiety and depression in surgical nurses during COVID-19

There were several factors that may have resulted in reduced mental well-being among surgical nurses during COVID-19. As shown in the results of this study, several risk factors have been found to influence poor well-being in surgical nurses following the outbreak. Those factors include having children, being in tertiary general hospitals, participation in care for COVID-19 patients, perception of being infected and lack of social support. In general, those surgical nurses having children, being in tertiary general hospitals, participating in care for COVID-19 patients, self-perception of being infected and having lower level of social support, were more likely to have anxious and depressive symptoms during the COVID-19 epidemic.

5.3 | Having children and divorce/widowed

Our study also identified having children and divorce/widowed as an influencing factor. The majority of this sample was married, had children and usually played multiple roles of nurses, parents, spouses and children. These surgical nurses might face more pressure not only at home but also at work. This could impose an additional emotional burden on them. Salopek-Žiha indicates that parenting of minor children is one of the anticipated possible risk factors for the mental health of medical staff (Salopek-Žiha et al., 2020). Our study also shows that surgical nurses having children were more anxious than those no children. Moreover, Shanafelt et al. (2020) held eight listening sessions with groups of physicians, nurses, advanced practice clinicians, residents and fellows (involving a total of 69 individuals) to explore their specific sources of anxiety and fear during the COVID-19 pandemic. They found that these discussions consistently centred on 8 sources of anxiety, and taking the infection home to their family was one of 8 sources of anxiety. It is shown that nurses may experience fears of spreading the virus to loved ones, including children (Smith et al., 2020). 1085 (55%) hospital staff were afraid of

TABLE 4 Comparison of anxiety status among surgical nurses with different demographic characteristics (score $\bar{x} \pm s$)

Variables	Subgroups	N	Anxiety scores	F/t-value	p-value
Gender	Male	237	43.58 ± 8.85	0.450	.653
	Female	3,255	43.31 ± 9.02		
Age	<30 years	1,337	42.39 ± 8.82	14.968	<.001
	30–40 years	1,745	44.14 ± 8.92		
	>40 years	410	42.91 ± 9.68		
Character	Introversion	785	43.83 ± 9.51	2.235	.082
	Extroversion	659	43.73 ± 9.39		
	Mixed personality	1,833	42.97 ± 8.57		
	Uncertainty	215	43.30 ± 9.44		
Educational level	Technical school	69	44.81 ± 8.39	1.006	.366
	College	1,049	43.22 ± 9.27		
	University and over	2,374	43.32 ± 8.91		
Marital status	Single	865	41.82 ± 8.74	27.114	<.001
	Married	2,558	43.69 ± 9.00		
	Divorce/Widowed	69	48.75 ± 9.27		
Fertility status	One and more children	2,389	44.05 ± 9.13	7.216	<.001
	No child	1,103	41.76 ± 8.53		
Technical title	Junior	1,693	42.86 ± 9.02	4.443	.012
	Intermediate	1,741	43.75 ± 9.01		
	Senior	58	44.10 ± 8.22		
Position	Nurse	3,039	43.33 ± 9.01	0.196	.822
	Head nurse	399	43.19 ± 9.08		
	Department head nurse and over	54	44.00 ± 8.48		
Years registered as nurse	1–5 year	993	42.05 ± 8.61	14.124	<.001
	6–10 year	1,122	43.90 ± 9.20		
	>10 year	1,377	43.77 ± 9.05		
Personnel relations	Formal establishment	765	43.14 ± 8.99	0.983	.374
	Personnel agency	1,024	43.10 ± 8.61		
	Engaging system	1,703	43.54 ± 9.25		
Hospital	Tertiary hospital	2,021	43.97 ± 9.12	4.969	<.001
	Secondary hospital	1,471	42.44 ± 8.77		
Participation in care for COVID-19 patients	Yes	196	48.73 ± 11.02	8.750	<.001
	No	3,296	43.00 ± 8.77		
Self-perception for being infected with COVID-19	None	166	40.69 ± 9.89	172.149	<.001
	Mild	1,992	40.87 ± 7.42		
	Moderate	973	46.56 ± 8.83		
	Severe	361	49.37 ± 11.19		

infecting a family member in a northern Europe study (Elina et al., 2021). Li et al suggest that the healthcare workers showed serious concern about their possibility of infection, and a total of 41.12% of the healthcare workers worried about their families mainly due to the high risk of infection caused by the HCW themselves (Li et al., 2020). Traditional Chinese values dictate that women need undertake more responsibility for their families, such as raising children and housework, which could put them at high risk of psychological problems

(Zhang et al., 2020). Recently, a Canadian study similarly found that most of the critical care nurses reported worry over bringing the virus home to their families (Crowe et al., 2021). Perhaps, the same is true for female surgical nurses with children. Our study also suggests that the divorce or widowed nurses experienced more depression than the single and married nurses during the COVID-19 pandemic. Similarly, Chinese medical workers who were widowed were found experiencing greater levels of anxiety in non-epicentre

TABLE 5 Comparison of depression status among surgical nurses with different demographic characteristics (score, $\bar{x} \pm s$)

Variables	Subgroups	N	Depression scores	F/t-value	p-value
Gender	Male	237	46.17 ± 9.82	1.783	.075
	Female	3,255	45.02 ± 9.59		
Age	<30 years	1,337	43.31 ± 9.41	7.325	.001
	30–40 years	1,745	45.60 ± 9.69		
	>40 years	410	45.50 ± 9.76		
Character	Introversion	785	45.54 ± 10.15	1.785	.148
	Extroversion	659	45.54 ± 9.42		
	Mixed personality	1,833	44.77 ± 9.33		
	uncertainty	215	44.87 ± 10.45		
Educational level	Technical school	69	46.96 ± 8.58	1.585	.205
	College	1,049	45.24 ± 9.77		
	University and over	2,374	44.98 ± 9.57		
Marital status	Single	865	43.39 ± 9.26	18.635	<.001
	Married	2,558	45.63 ± 9.68		
	Divorce/Widowed	69	46.62 ± 8.94		
Fertility status	One and more children	2,389	45.90 ± 9.77	7.522	<.001
	No child	1,103	43.36 ± 9.03		
Technical title	Junior	1,693	44.50 ± 9.51	6.486	.002
	Intermediate	1,741	45.64 ± 9.68		
	Senior	58	46.24 ± 9.63		
Position	Nurse	3,039	45.08 ± 9.58	0.677	.508
	Head nurse	399	45.01 ± 9.77		
	Department head nurse and over	54	46.59 ± 10.44		
Years registered as nurse	1–5 year	993	43.71 ± 9.23	14.607	<.001
	6–10 year	1,122	45.57 ± 9.65		
	>10 year	1,377	45.70 ± 9.75		
Personnel relations	Formal establishment	765	45.02 ± 9.91	1.615	.199
	Personnel agency	1,024	44.69 ± 9.09		
	Engaging system	1,703	45.37 ± 9.77		
Hospital	Tertiary hospital	2,021	45.86 ± 9.63	5.576	<.001
	Secondary hospital	1,471	44.04 ± 9.48		
Participation in care for COVID-19 patients	Yes	196	51.68 ± 12.11	7.933	<.001
	No	3,296	44.70 ± 9.30		
Self-perception for being infected with COVID-19	None	166	42.41 ± 10.53	167.813	<.001
	Mild	2,012	42.51 ± 7.65		
	Moderate	973	48.39 ± 9.95		
	Severe	341	51.68 ± 11.89		

of COVID-19 (Zhang et al., 2020). As women who divorced or widowed, while being lack of emotion support, suffering more difficulties, our patients also faced this challenges in the crisis. If possible, at the COVID-19 outbreak, surgical nurses may be encouraged and supported to use alternative accommodations to reduce the risk of family transmission. Policy makers need to ensure they provide appropriate logistic and financial support to help with this course of action (Bagnasco et al., 2020).

5.4 | Being in tertiary hospitals

Compared to the surgical nurses in the secondary hospitals, those working in tertiary hospitals may have perceived more anxiety and depression in our investigation. In China, hospitals are evaluated based on a three-tier system of hospital functions, facilities and technical strength, designated as primary, secondary or tertiary institutions. In general, tertiary hospitals are medical service centres within

TABLE 6 Relationships between SAS scores and SSRS scores of surgical nurses during COVID-19 pandemic (N = 3,492)

Variables	Score scope	$\bar{x} \pm s$	Anxiety ($\bar{x} \pm s$)		r-value	p-value
			None (<50, N = 2625)	Anxiety (≥ 50 , N = 867)		
Subject support	8–32	21.36 \pm 4.65	22.68 \pm 4.13	17.37 \pm 3.79	-0.560	<.001
Objective support	1–22	10.84 \pm 3.76	11.73 \pm 3.60	8.15 \pm 2.87	-0.495	<.001
Availability of support	3–12	8.42 \pm 1.92	8.81 \pm 1.81	7.25 \pm 1.79	-0.405	<.001
Total score	12–66	40.62 \pm 8.33	43.22 \pm 7.16	32.77 \pm 6.48	-0.630	<.001

TABLE 7 Relationships between SDS scores and SSRS scores of surgical nurses during COVID-19 pandemic (N = 3,492)

Variables	Score scope	$\bar{x} \pm s$	Depression ($\bar{x} \pm s$)		r-value	p-value
			None (<53, N = 2750)	Depression (≥ 53 , N = 742)		
Subject support	8–32	21.36 \pm 4.65	22.44 \pm 4.23	17.62 \pm 4.07	-0.514	<.001
Objective support	1–22	10.84 \pm 3.76	11.56 \pm 3.65	8.34 \pm 3.02	-0.449	<.001
Availability of support	3–12	8.42 \pm 1.92	8.74 \pm 1.83	7.31 \pm 1.81	-0.381	<.001
Total score	12–66	40.62 \pm 8.33	42.74 \pm 7.41	33.27 \pm 7.06	-0.578	<.001

TABLE 8 Multivariate linear regression analysis of the influencing factors of anxiety in surgical nurses during COVID-19 (N = 3,492)

Variables	β	SE	Standard regression coefficient	t-value	p-value	95%CI
(Constant)	66.089	0.983	–	67.248	<.001	64.162–68.015
Fertility status	1.469	0.489	0.076	3.004	.003 ^a	0.510–2.427
Hospital	-0.611	0.117	-0.068	-5.212	<.001 ^a	-0.841–-0.381
Participation in care for COVID-19	2.229	0.529	0.057	4.211	<.001 ^a	1.191–3.267
Self-perception for being infected with COVID-19	1.146	0.180	0.094	6.369	<.001 ^a	0.793–1.499
Total score of SSRS	-0.623	0.015	-0.576	-40.540	<.001 ^a	-0.653–-0.593

Abbreviations: B, Standardized Beta Coefficient; CI, Confidence Interval; SE, Standard Error; β , Unstandardized Beta.

^aMean $p < .05$; the total score of anxiety was taken as the dependent variable and the variable with differences in Table 8 as the independent variable. $F = 252.942$, $p < .001$.

the region, and they are on larger scale and have more functions and stronger technology and medical expertise than secondary hospitals (Zhang et al., 2018). Generally, tertiary hospitals were far more likely to treat the COVID-19 patients than secondary hospitals. Secondly, the tertiary hospitals treat more emergency and severe surgical patients who possibly have history of exposure to SARS-CoV-2. Additionally, a tertiary hospital requires highly specialized expertise and skill to cope with the complex situation of COVID-19 (Elina et al., 2021). Therefore, compared with those in secondary hospital, surgical nurses in tertiary hospitals could report higher scores on scales measuring symptoms of depression and anxiety during the COVID-19 pandemic.

5.5 | Participation in care for COVID-19 patients

In our study, 196 (5.61%) surgical nurses had been transferred to work on the frontline in COVID-19 wards and fever clinics in

their own hospital or in Wuhan during the outbreak of COVID-19. Emerging evidence demonstrates that the frontline staff participating in treatments or procedures for infected COVID-19 cases experienced more stress, as they were at high potential risk of infection (Crowe et al., 2021; Liu et al., 2020). Likewise, surgical nurses having direct contact with COVID-19 patients suffered higher anxiety and depression scores than those who worked in the usual surgical departments. Moreover, some frontline nurses reported feeling stigmatized by friends, community and even family for fearing that the nurses would infect them with COVID-19 (Crowe et al., 2021). Due to COVID-19 related work, surgical nurses in the COVID-19 units also worried about the social stigma, suffered from psychological problems. The risk-mitigating strategies (Koh et al., 2011) can be adopted in the frontline work, such as organizational implementation of infection control measures, avoidance of patients and complying with personal protective equipment.

TABLE 9 Multivariate linear regression analysis of the influencing factors of depression in surgical nurses during COVID-19 (N = 3,492)

Variables	β	SE	Standard regression coefficient	t-value	p-value	95%CI
(Constant)	66.024	1.094	—	60.347	<.001	63.879–68.169
Marital status	-2.654	1.089	-0.038	-2.438	.015 ^a	-4.788--0.520
Fertility status	1.640	0.544	0.079	3.013	.003 ^a	0.573–2.707
Hospital	-0.808	0.131	-0.084	-6.187	<.001 ^a	-1.064--0.552
Participation in care for COVID-19	3.410	0.589	0.082	5.786	<.001 ^a	2.255–4.566
Self-perception for being infected with COVID-19	1.464	0.200	0.113	7.308	<.001 ^a	1.071–1.857
Total score of SSRS	-0.597	0.017	-0.517	-34.904	<.001 ^a	-0.631--0.564

Abbreviations: B, Standardized Beta Coefficient; CI, Confidence Interval; SE, Standard Error; β , Unstandardized Beta.

^aMean $p < .05$; the total score of depression was taken as the dependent variable and the variable with differences in Table 8 as the independent variable. $F = 204.127$, $p < .001$.

5.6 | Perception for likelihood of being infected with COVID-19

Feeling unsafe and vulnerable to infection with COVID-19 was also closely related to the poor mental health in surgical nurses. Perceived threat or lack of safety has also been shown to be predictors of anxiety and depression symptoms. Clevenger 2021 considered that stressors for healthcare workers that increased stress-load related to the COVID-19 pandemic include worry stress about contracting COVID-19, about close friends, family and/or colleagues and about infecting others close to them. Our study also illustrated that the more likely surgical nurses felt being infected, the more anxious they were. The sense of security was important for the mental well-being during the pandemic.

It should be noted that poor mental health may bias estimates of risk, and so the correlation between perceived risk and mental health symptoms may be bidirectional. Hence, treatment of the anxiety and depression symptoms themselves, or cognitive behavioural approaches designed to improve the psychological health of those with potential risk. Furthermore, precise and clear information about control measures may help reduce their anxiety and depression. The specialized training may minimize the amount of risk felt by surgical nurses and thus lead to more positive outcomes. Educational interventions aimed at addressing psychological distress and developing coping mechanisms to manage the fear of infection or infecting others should be developed and tested (Brooks et al., 2018).

5.7 | Level of social support

Our findings demonstrate that there was a negative association between anxiety/depression symptoms and social support. Great social support could be a protective factor against anxiety/depression, while those with poor perceived support were more likely to suffer from adverse outcomes. A recent study indicated that there was a

negative correlation between the SSRS scores and the SAS scores, similar to our findings (Xiao et al., 2020). Generally, the categories of social support comprise material aid, physical assistance, advice and guidance, social participation, positive feedback and private feelings. In our opinion, 'material aid' perhaps includes 'use of single size PPE kit', while 'long duty hours' may be a kind of the 'physical assistance'. Perhaps, these factors were the situational stressors for the mental well-being of surgical nurses. Firstly, as family members or friends provide social and emotional support and share empathy (Yang, Xiao, Cao, et al., 2018; Yang, Xiao, Wang, et al., 2018), social support could help surgical nurses reduce anxiety and depression levels. Furthermore, social interactions are considered to reduce negative emotions such as anxiety and can improve the mood (Yang, Xiao, Cao, et al., 2018; Yang, Xiao, Wang, et al., 2018). Adamczyk & Segrin (2015) suggested that having a wide social network could help reduce the perception of the threat of stressful events and the physiological response. Brooks suggested that social support from both employers and friends and families appeared to be useful for medical staff (Brooks et al., 2018). Therefore, building and encouraging the communications between surgical nurses and their families, employers, may relieve their psychological stress and strengthen the confidence in fighting COVID-19. Our findings support for the implementation of measures to improve the social support for surgical nurses during COVID-19 pandemic. In order to reduce feelings of social isolation in surgical nurses, Web-based communication, such as Wechat, QQ and microblog, is recommended to provide support during the crisis with no fear of transmission.

With surgical nurses as one of the medical forces to combat COVID-19, we must not ignore their psychological well-being while preventing and controlling the epidemic. As the pandemic is ongoing, important policy and clinical strategies are needed to support surgical nurses. To a certain extent, mental health problems will affect the performance of surgical nurses. Firstly, we need to identify and adjust the poor psychological status of surgical nurses and promote the prevention and intervention of mental diseases. At the same time, professional psychotherapy teams should take the initiative to

support their psychological health and provide individually targeted interventions. Secondly, healthcare managers should ensure there is regular adequate communication of up-to-date facts about the epidemic and how to best protect themselves. Meanwhile, managers should prepare their employees for the potential impact of negative experiences, such as anxiety and depression, and provide support measures for those. Lu et al. (2020) suggested that in the future advancement of a hospital in China, a human-oriented culture should be promoted to help the medical staff to deal with strain and reduce the risk of suffering from anxiety and depression. Significantly, some measures should be taken to improve the social support level of male surgical nurses and thus reduce their negative emotions. Regarding stress reduction, leisure activities and training on how to relax can be properly arranged. Moreover, hospital supporting staff can be organized better to reduce the pressure of ward administration for the surgical nurses. Recently, several UK researchers developed a digital package including evidence-based guidance, support and signposting relating to psychological well-being for healthcare workers. They recommend that this package is appropriate for supplementing strategic health and well-being provisions for healthcare workers during and after the COVID-19 pandemic (Blake et al., 2020). Certainly, this e-package may be suitable for surgical nurses.

5.8 | Limitations

Our study has several limitations. Firstly, our survey was conducted in March 2020, when COVID-19 was generally considered to be under control in China; our study has no way to ascertain the burn-out mental status of surgical nurses at the onset or peak period of COVID-19 crisis. Also we were unable to distinguish pre-existing anxiety from new cases of anxiety and depression. In fact, COVID-19-related anxiety is likely to be dynamic, waxing and waning in response to stressors. In our study, however, we were unable to explore anxiety and depression in surgical nurses at different stages. Future research should be aimed at collecting more comprehensive data, such as other situational stressors by the COVID-19 crisis, on the mental well-being of surgical nurses. Due to ethical requirements on anonymity and confidentiality, we were not allowed to collect contact details and personal information from the respondents. As a result, we could not conduct a prospective study that would provide a concrete finding to support the need for a focussed public health initiative. Secondly, although large sample size gives more reliable results and the conclusions may be more applicable in general conditions, our study explored a cross-sectional design that can only suggest associations rather than causality. Prospective, longitudinal studies and randomized controlled trials are needed to adequately explore risk factors. Thirdly, the present study was performed only in one province of China, which may limit the generalizability of the findings. Hence, caution should be taken in generalizing the results to all medical staff in China. Follow-up studies could help assess the progression or even a potential rebound effect of psychological manifestations once the imminent threat of COVID-19 subsides.

Finally, subjective self-reported questionnaires were used to obtain the data in this study. Future studies may employ the objective indicators of anxiety and depression, such as serum cortisol level.

6 | CONCLUSIONS

Our study highlights that surgical nurses are at high risk of psychological distress during the COVID-19 outbreak. In a sample of 3492 surgical nurses, we found a sizable portion reached the cut-off levels of disorders in anxiety (24.83%) and depression (22.39%). Meanwhile, those who had children, worked in tertiary hospitals and treated COVID-19 patients directly, perceived themselves more likely to be infected with SARS-CoV-2, and those who had lower levels of social support were at a higher risk of developing anxious and depressive symptoms. These factors, together with the fear of being contagious and infecting others, could increase the possibility of psychological disorders among surgical nurses.

It is worth recommending that the formal psychological screening procedures could be used for the surgical nurses either before the deployment or afterwards. In order to protect the mental health of surgical nurses, early psychological interventions targeting this vulnerable group may be beneficial. It may be useful to have preparatory training packages and interventions to encourage surgical nurses to focus on the potential positive impact of their work and coping strategies, which may help them to see the positive effects of working in a crisis. Possibly, pre-crisis training and emphasizing the potential psychological impact of the outbreak are conducive to the mental health of surgical nurses. Moreover, healthcare organizations can make organizational supports congruent with nurses' specific needs and help nurses reduce feelings of uncertainty and fear when these crises occur, to improve the quality of life.

7 | RELEVANCE FOR CLINICAL PRACTICE

Surgical nurses are at high risk of psychological distress during the COVID-19 outbreak. Our study could help governments and health authorities to recognize the relevant factors for increased anxiety and depression in surgical nurses and then to consider offering early interventions to alleviate possible mental health problems in surgical nurses. In addition, our findings remind nurses to pay attention to mental health during the COVID-19 period.

7.1 | What does this paper contribute to the wider global clinical community?

- The research demonstrates for the first time that the surgical nurses are at high risk of psychological distress in China during the COVID-19 outbreak.
- Levels of social support for surgical nurses are significantly negatively correlated with the degree of anxiety and depression.

- Health authorities and nurse leaders need to recognize the relevant factors for increased anxiety and depression in surgical nurses and then to consider offering early interventions.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

CXR, CHW and DQY contributed to the conceptualization and design of the study. DCZ, BZL, YS, SHY, LJ, FQY, YLD, DQP, XHC and LW conducted the survey, while CXR, YGF and WFZ conducted data analysis. CXR wrote the first draft, which underwent substantial revision based on the inputs from all other authors. DCZ supervised the whole study process. All the authors have read and approved the final version of the manuscript.

ETHICAL APPROVAL

Approval code of ethics with number: No. 2020R011.

PATIENT CONSENT

There were no patients in this study.

DATA AVAILABILITY STATEMENT

All data included in this study are available upon request by contact with the corresponding author.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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