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A cross-sectional examination of the relationship between nurses' experiences of skin lesions and anxiety and depression during the COVID-19 pandemic: Exploring the mediating role of fear and resilience

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Abstract

Aim: To explore the mediating role of fear and resilience on the relationship between clinical nurses' reporting of skin lesions and their anxiety and depression during the coronavirus disease 2019 (COVID-19) pandemic.

Background: Prolonged personal protective equipment wearing may cause severe skin lesions among clinical nurses. The possible relationship between clinical nurses' reporting of skin lesions and their anxiety and depression remains unknown. Moreover, little is known about what factors could mediate such a relationship.

Methods: This is a cross-sectional online survey. CHERRIES was used to report results.

Results: Of 2014 participants, 94.8% ($n = 1910$) reported skin lesions. Skin lesions were positively related to anxiety ($p < .001$, $\beta = .228$, $SE = .099$) and depression ($p < .001$, $\beta = .187$, $SE = .093$). Fear activated while resilience buffered the relationship between clinical nurses' reporting of skin lesions and anxiety and between skin lesions and depression.

Conclusion: Reduced fear and enhanced resilience level were related to decreased levels of anxiety and depression among clinical nurses.

Implications for nursing management: Nurse managers should evaluate the occurrence and severity of clinical nurses' skin lesions, arrange reasonable working duration to relieve skin lesions, provide appropriate psychological support to reduce clinical nurses' fear and implement various strategies to enhance their resilience, thereby decreasing their anxiety and depression.

Clinical trial registration number: ChiCTR2000030290

KEYWORDS
anxiety, COVID-19, depression, fear, resilience, skin lesions

Rumei Yang and Qiaohong Ke contributed equally.

1 | INTRODUCTION

During the coronavirus disease 2019 (COVID-19) pandemic, wearing personal protective equipment (PPE) (e.g., N95 masks, goggles, gloves and gown) is crucial to prevent the spread of disease and safeguard health care workers (HCWs) (WHO, 2020). Prolonged PPE wearing may cause severe skin lesions among clinical nurses (Lan et al., 2020). The most common reported skin lesions included pressure ulcers (Aguilera et al., 2020), contact dermatitis, acne and eczema (Montero-Vilchez et al., 2021). Skin lesions may destroy the skin barrier and facilitate the invasion of coronavirus into the blood circulation (Gefen, 2020). Realizing the increased risk of infection, clinical nurses may suffer psychological distress.

Anxiety and depression are common psychological distress among clinical nurses (Chen et al., 2021). A meta-analysis indicated a pooled prevalence of 37% for anxiety in 73 studies and 35% for depression in 62 studies among clinical nurses (Al Maqbali et al., 2021). Clinical nurses' anxiety and depression originates from an overwhelming workload, negative coping, poor sleep quality and self-isolation (Chen et al., 2021; Wang et al., 2021). Unmanaged anxiety and depression may negatively affect clinical nurses' decision-making ability and work efficiency, which may eventually lead to increased absenteeism even turnover (Labrague & Santos, 2020).

To date, the possible relationship between clinical nurses' reporting of skin lesions and their anxiety and depression remains unknown. Moreover, little is known about what factors could mediate such a relationship. Exploring this relationship is essential as it will provide implications for nurse managers to identify strategies to better support clinical nurses.

1.1 | Conceptual framework

According to Masten's risk-resilience model (Masten, 2001), risks and adversities increase the propensity of negative outcomes, whereas resilience could overturn negative outcomes to positive outcomes. Risks involve potential internal and external adverse factors (e.g., pandemic/epidemic and recent traumatic events) that individuals may encounter. Whereas mediators provide additional insight into the possible relationship between risks and positive/negative outcomes (Bennett, 2000) (Figure 1). Drawing upon this model, Yıldırım's study identified the mediating role of fear and resilience underlying the relationship between the perceived risks of infection and negative outcomes (e.g., anxiety, depression and stress) among HCWs during the COVID-19 pandemic (Yıldırım et al., 2020). However, this study focuses on HCWs' perceived risks of infecting COVID-19; skin lesions related to PPE wearing were not given full attention. Skin lesions damage the body's natural barrier and can be viewed as risks which pose threats to the safety of clinical nurses (Gefen, 2020). Therefore, the risk-resilience model suggests a mediation lens to explore multiple factors that may mediate the possible relationship between clinical nurses' reporting of skin lesions and their anxiety and depression.

The COVID-19 pandemic generated intense fear and panic among the clinical nurses (Labrague & Santos, 2021). Fear of COVID-19 was conceptualized as an individual's negative emotion under the perception of infection risk (Presti et al., 2020). Globally, it is estimated that up to 180,000 HCWs have died from COVID-19 between January 2020 and May 2021 (WHO, 2021a). In China, there were more than 3387 infections among HCWs and 34 deaths as of 5 March 2020 (Department of Human Resources, 2020). A certain degree of fear might increase clinical nurses' awareness of self-protection and
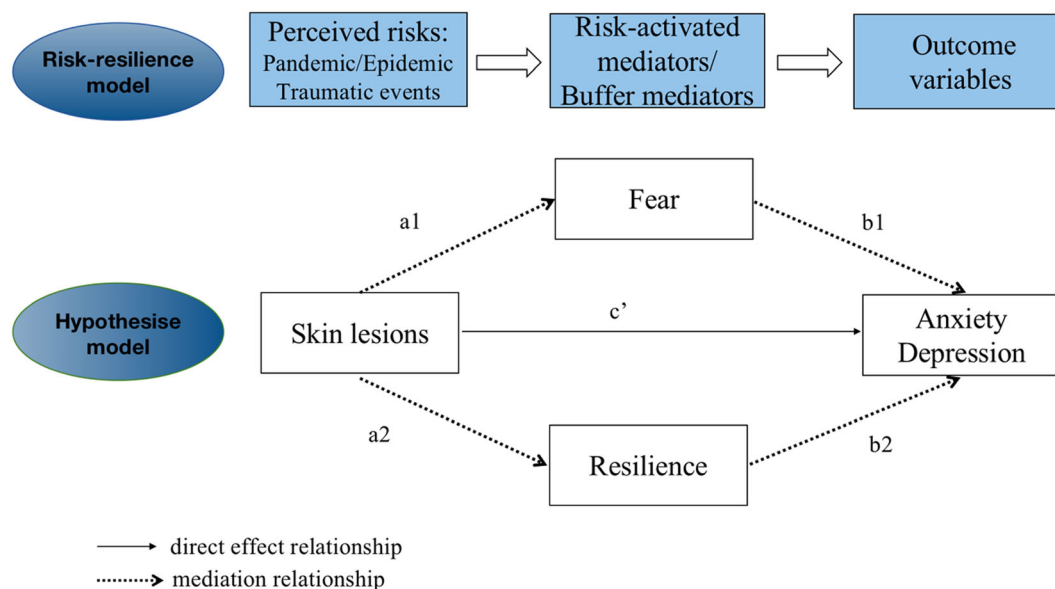

FIGURE 1 Hypothesized model adapted from Masten's risk-resilience model (Masten, 2001). The indirect effects of skin lesions on anxiety and depression via fear and via resilience were represented by path a1*path b1and path a2*path b2, respectively. The total effect was the sum of the total indirect effects and the direct effect, path c' (a1*b1 + a2*b2 + c')

the compliance with protective behaviours, whereas high levels of fear could exacerbate their psychological distress (Sloan et al., 2021).

Resilience is an individual's ability to bounce back from difficulties and challenges in life and at work and can help individuals effectively manage and endure stressful adversities (Cooper et al., 2020). During the COVID-19 pandemic, clinical nurses confronted different sources of adversities including insecurity working environment and deteriorated mental health (Liu et al., 2020). Evidence suggests that resilience is a protective factor as it can help clinical nurses to overturn adversities into positive self-growth experiences, which might also contribute to their physical and psychological health and reduce turnover intentions (Baskin & Bartlett, 2021; Labrague et al., 2021). Thus, it is reasonable to hypothesize that resilience could mediate the relationship between clinical nurses' reporting of skin lesions and their anxiety and depression.

The hypothesized model of this study was developed based on the Masten's risk-resilience model (Figure 1). The hypotheses of this study were as follows:

- There is a possible relationship between clinical nurses' reporting of skin lesions and their anxiety and depression.
- Fear and resilience may mediate the relationship between clinical nurses' reporting of skin lesions and their anxiety and depression.

2 | METHODS

2.1 | Study design

This is a part of large-scale cross-sectional (open survey) study that investigated clinical nurses' mental health status and its associated factors during the outbreak of COVID-19 (Hu, Kong, et al., 2020). A secondary data analysis was conducted to further explore the possible relationship between clinical nurses' reporting of skin lesions and their anxiety and depression, as well as the mediating role of fear and resilience underlying this relationship. The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) was used in reporting (Eysenbach, 2004).

2.2 | Setting and participants

The study venues were two hospitals in Wuhan, China. One was a university-affiliated tertiary hospital with 2000 clinical nurses working there, and the other was a temporary hospital built especially for suspected and confirmed cases with 600 clinical nurses working there. The 2600 nurses consisted of local nurses from Wuhan and nurses from other provinces to support the epidemic control. As required by the hospitals' infection control protocol, each clinical nurse should wear PPE when they had close contact with suspected and confirmed cases.

Nurses were eligible if they provided direct care for COVID-19 cases for more than one shift. Nurses who were infected with COVID-19 or had no contact with patients and those who were diagnosed with any previous mental disorders were excluded.

2.3 | Sample size

Raosoft was used to estimate the sample size (http://www.raosoft.com/samplesize.html). The number of clinical nurses in Wuhan was estimated to be 83,000, including 54,400 local nurses (Wuhan Municipal Health Commission, 2020) and 28,600 nurses coming from other provinces (NHC of China, 2020). A minimum of 383 participants was needed with a 5% marginal error, 95% confidence interval (CI) and 50% response rate. The directors of nursing departments in the two participating hospitals suggested to recruit all the clinical nurses to know better about the status of their skin lesions and mental health to inform the development of targeted strategies. Thus, all 2600 clinical nurses in the two participating hospitals were approached in this survey.

2.4 | Questionnaire and measurements

Socio-demographic and clinical variables were collected using a questionnaire developed by the research group. Data collection included age, sex, marital status, child-rearing, education, professional title, work experience (years), working duration in the frontline (days), working hours per shift, original place of work, job title in the original and Wuhan hospitals, change in working units, prior training and prior experience. Adaptive questioning was used in collecting job title in the original hospitals when participants responded 'No' to indicate their original place of work was not Wuhan. The questionnaire included 18 pages; each page contained 5–20 questionnaire items. Before distributing the survey, the questionnaire had been pre-tested by the members from the research group, ensuring the usability and technical functionality of the questionnaire. During the pre-test, the mean of timeframe used to fill in the questionnaire was 12 min (Standard Deviation: 6.8 min); thus, 5 min was set as a cut-off point.

Skin Lesion Scale (SLS, Chinese version) was a self-developed scale that used to examine whether clinical nurses experienced 11 common skin lesions associated with wearing PPE (Sichuan Academy of Medical Sciences, 2020). Common skin lesions include facial redness, lip blisters, skin maceration, skin ulcers, skin allergies, skin indentations, skin cracks, cutaneous lichen, erythema with clear boundaries, skin blisters and solitary pyoderma. Each nurse was asked whether they had such skin lesions, with a text explanation of the causes and an illustration of the clinical manifestations. If the nurses had one type of skin lesion, the 'yes' answer was given a score of 1. The total possible score ranged from 0 to 11. The content validity of SLS was assessed by 10 experts, and the total Content Validity Index (CVI) was 1.0. For our study, the Cronbach's alpha was .73.

To evaluate clinical nurses' anxiety and depression levels, Zung's Self-Rating Anxiety Scale (SAS) and Zung's Self-Rating Depression Scale (SDS) were applied (Zung, 1965, 1971). The SAS and SDS were

translated into Chinese in 1982 and have been widely used in China. SAS was reported to have a test–retest reliability of .70 and criterion-related validity of .60 (Chen et al., 2006). SDS was reported to have a test–retest reliability of .73 and the criterion-related validity of .37 (Chen et al., 2006). Each scale contains 20 items, and each item is scored by a 4-point scale. Higher scores indicate higher levels of anxiety and depression (total score: 25–100). For our study, the Cronbach's alpha values of SAS and SDS were .87 and .88, respectively.

Fear Scale for Healthcare Professionals (FS-HPs, Chinese version) was developed by the research group to measure clinical nurses' fear of COVID-19 contagion and death (Hu, Kong, et al., 2020). The FS-HPs consists of eight items, and each item is scored by a 5-point scale, with higher scores indicating higher fear (total score: 8–40). Ten experts assessed the content validity of the FS-HPs, giving a total CVI of 1.0. For our study, the Cronbach's alpha was .80.

To evaluate clinical nurses' resilience level, Connor–Davidson Resilience Scale-10 (CD-RISC-10, Chinese version) was used (Connor & Davidson, 2003). This scale has been widely applied to evaluate resilience levels of Chinese population, with a Cronbach's alpha value of .91 (Yu & Zhang, 2007). The CD-RISC-10 contains 10 items, and each item is measured by a 5-point Likert scale. Higher scores indicate better resilience (total score: 0–40). For our study, the Cronbach's alpha was .96.

2.5 | Data collection

The popular online survey tool 'Questionnaire Star' was used for data collection. The data collection began on 13 February when the status of COVID-19 was severe in Wuhan (WHO, 2021b). The head nurses of the study venues were informed of the eligibility criteria. And then they sent the survey link to eligible nurses via the WeChat group platform. WeChat is a famous social media platform in China, and each user has a unique WeChat ID. When the questionnaire was distributed, interested nurses opened the link to answer the questionnaire. The survey was developed with the features that each WeChat ID could only access the survey once and all questions had to be answered before submission. Participants were able to scroll up and down the screen to review and change their answers before submission. Once finished, nurses received monetary compensation (50 Chinese Yuan, equivalent to 7 USD based on 2020 currency exchange rate). On 24 February, survey was stopped due to no more new responses emerged.

2.6 | Ethical considerations

Ethical approvals were obtained from the Institutional Review Boards (IRB) of last authors' university (Xiamen University, XDYX2020001, 11 February 2020) and two participating hospitals (Wuhan Union Hospital, Huazhong University of Science and Technology, No. 20200025, 6 February 2020; Huo Shen Shan Hospital, No. 2020001, 12 February 2020). The study information was presented on the front page. Participants were informed that the possible length of time of the survey will be 10–20 min. Interested nurses ticked the 'Yes' box to indicate their participation willingness. Data confidentiality was also guaranteed. The data were downloaded and stored in the computer of the corresponding authors, and only authorized researchers were eligible to access the data. The study registration was ChiCTR 2000030290.

2.7 | Data analysis

Descriptive statistics were used to summaries the participants' characteristics. A t test (e.g., age and work experience) or Chi-square test (e.g., sex, marital status and child-rearing) was applied to compare the demographic characteristics of participants with and without skin lesions. The bootstrapping procedure (bootstrapping sample = 10,000) with the Lavaan package in R (version 3.5.0) was used to test whether the relationship between skin lesions and anxiety (i.e., direct effect) and the relationship between clinical nurses' reporting of skin lesions and depression (i.e., direct effect) were mediated by fear and resilience (i.e., indirect effect). The indirect effects of clinical nurses' reporting of skin lesions on each outcome variable (anxiety and depression) via fear and via resilience were represented by path a1*path b1and path a2*path b2, respectively (Figure 1). The total indirect effect was the sum of both fear-and resilience-mediated effects for each outcome variable (path a1*path b1 + path a2*path b2), whereas the total effect was the sum of the total indirect effects and the direct effect, path c′ (a1*b1 + a2*b2 + c′). The results were presented using an unadjusted mediation model (Model 1) and an adjusted mediation model that considered covariates of age, sex, education, marital status, work experience (years) and prior experience caring for patients with viral infection (Model 2) with 95% CIs. Statistical significance was suggested if the 95% bootstrap CI did not include 0. All statistical tests were considered significant if $p < .05$.

3 | RESULTS

3.1 | Socio-demographic characteristics among participants

The online questionnaire was distributed to 2600 nurses from the chosen study venues, 2110 nurses opened the survey link (view rate: 81.2%) and nine nurses showed they were unwilling to participate in this study. Finally, 2101 nurses responded (participation rate: 80%). After preliminary screening, 68 clinical nurses indicated that they had not begun caring for COVID-19 patients, and 19 clinical nurses completed the survey with the timeframe less than 5 min; thus, 87 questionnaires were discarded. Finally, 2014 questionnaires were analysed. Table 1 presents the participants' characteristics with ($n = 1910$, 94.8%) and without ($n = 104$, 5.2%) skin lesions.

TABLE 1 Participants' socio-demographic characteristics (N = 2014)

Variables	No (n = 104, 5.2%) M (SD)/N (%)	Yes (n = 1910, 94.8%) M (SD)/N (%)	Skin lesion proportion (%)	t/χ^2	p value
Age (years)[a]	30.20 (6.21)	31.04 (6.16)		−1.344	.179
Sex[b]				10.083	<.001**
Male	24 (23.1%)	236 (12.4%)	90.8%		
Female	80 (76.9%)	1674 (87.6%)	95.4%		
Marital status[b]				0.270	.603
Married	61 (58.7%)	1169 (61.2%)	95.0%		
Other marital status [c]	43 (41.3%)	741 (38.8%)	94.5%		
Child-rearing[b]				2.490	.115
None	55 (52.9%)	859 (45.0%)	94.0%		
Have one or more children	49 (47.1%)	1051 (55.0%)	95.5%		
Education[b]				8.864	.003**
Diploma or below	35 (33.7%)	406 (21.3%)	92.1%		
Bachelor or above	69 (66.3%)	1504 (78.7%)	95.6%		
Professional title[b]				3.225	.073
Junior	85 (81.7%)	1410 (73.8%)	94.3%		
Intermediate and senior	19 (18.3%)	500 (26.2%)	96.3%		
Work experience (years)[a]	7.83 (6.14)	9.04 (6.52)		−1.852	.064
Working duration in the frontline (days)[a]	17.51 (11.14)	20.90 (13.01)		−2.605	.009**
Working hours per shift [a]				0.143	.705
≤ 4 h	16 (15.4%)	321 (16.8%)	95.3%		
> 4 h	88 (84.6%)	1589 (83.2%)	94.8%		
Original place of work[b]				3.952	.047*
Wuhan	59 (56.7%)	1265 (66.2%)	95.5%		
Outside Wuhan	45 (43.3%)	645 (33.8%)	93.5%		
Job title in original hospital[b]				0.519	.471
Bedside nurse	96 (92.3%)	1722 (90.2%)	94.7%		
Nurse manager	8 (7.7%)	188 (9.8%)	95.9%		
Job title in Wuhan hospital[b]				0.007	.933
Bedside nurse	98 (94.2%)	1796 (94.0%)	94.8%		
Nurse manager	6 (5.8%)	114 (6.0%)	95.0%		
Change in working units[b]				3.085	.079
Yes	47 (45.2%)	700 (36.6%)	93.7%		
No	57 (54.8%)	1210 (63.4%)	95.5%		
Prior training of caring for patients with viral infections[b]				2.022	.155
Yes	80 (76.9%)	1574 (82.4%)	95.2%		
No	24 (23.1%)	336 (17.6%)	93.3%		
Prior experience caring for similar patients with a viral infection[b]				0.259	.611
Yes	43 (41.3%)	742 (38.8%)	94.5%		
No	61 (58.7%)	1168 (61.2%)	95.0%		

Abbreviation: SD, standard deviation.

[a]Mean (SD) with Independent two-sample t test.

[b]n (%) with Chi-square test.

[c]Other marital status: including single, separated and divorced.

[d]Skin lesion proportion = number of participants with skin lesions/(number of participants with skin lesions + number of participants without skin lesions).

*p < .05. **p < .01.

Participants with skin lesions tended to be female, had a bachelor's degree or above and had longer working days as clinical nurses (all $p < .001$).

3.2 | Clinical characteristics for skin lesions among participants

Table 2 describes the clinical characteristics of the skin lesions among the participants. Skin indentations ($n = 1,744$, 86.6%) and maceration ($n = 1482$, 73.6%) were the most common skin lesions, followed by facial redness ($n = 926$, 46.0%), skin ulcers ($n = 916$, 45.5%) and skin cracks ($n = 851$, 42.3%). Cutaneous lichen ($n = 140$, 7.0%) and skin blisters ($n = 162$, 8.0%) were the least reported skin lesions.

3.3 | Test of mediation effects

Tables 3 and 4 display the results of mediation effects of fear and resilience on the relationship between clinical nurses' reporting of skin lesions and anxiety and between skin lesions and depression, respectively. Clinical nurses' reporting of skin lesions was positively related to anxiety ($p < .001$, $\beta = .228$, $SE = .099$) and depression ($p < .001$, $\beta = .187$, $SE = .093$). Fear ($p = .002$, $\beta = .016$, $SE = .025$) and resilience ($p = .033$, $\beta = .021$, $SE = .049$) significantly mediated the relationship between skin lesions and anxiety (Model 1 in Table 3), and these mediation effects persisted after controlling for covariates of age, sex, education, marital status, work experience and prior experience caring for patients with a viral infection (indirect effect of fear of skin lesions: $p < .001$, $\beta = .017$, $SE = .026$; indirect effect of resilience: $p = .014$, $\beta = .021$, $SE = .050$; Model 2 in Table 3). Similar mediation effects were also found in the relationship between clinical nurses' reporting of skin lesions and depression. Fear ($p = .010$, $\beta = .008$, $SE = .015$) and resilience ($p = .035$, $\beta = .029$, $SE = .068$) significantly mediated the relationship between skin lesions and depression (Models 1 in Table 4). After controlling for covariates of age, sex,

education, marital status, work experience and prior experience caring for patients with a viral infection, the mediation effect remained (indirect effect of fear on skin lesions: $p = .009$, $\beta = .008$, $SE = .016$; indirect effect of resilience: $p = .037$, $\beta = .029$, $SE = .070$; Model 2 in Table 4). Final model of the relationship between clinical nurses' reporting of skin lesions and their anxiety and depression could be seen in Figure 2.

4 | DISCUSSION

This is the first study in China to investigate the relationship between clinical nurses' reporting of skin lesions and their anxiety and depression and to explore the mediating role of fear and resilience on this relationship. Overall, clinical nurses' reporting of skin lesions were found to be positively related to clinical nurses' anxiety and depression. This relationship was mediated by fear and resilience.

In our study, sex, education and working duration in the frontline (days) were related to clinical nurses' reporting of skin lesions. Consistent with our study, other study also found that participants with skin lesions tended to be female (Lin et al., 2020). People with higher educational level were more engaged in self-protection practices (Gao et al., 2020). The increased compliance of PPE wearing and hand hygiene made higher-educated clinical nurses to be more susceptible to develop skin lesions. A systematic review also indicated that participants with skin lesions tended to have longer working duration in the frontline (Montero-Vilchez et al., 2021).

In our study, 94.8% of participants reported skin lesions. Skin indentations and skin maceration were the most common skin lesions for clinical nurses. Studies have shown that the prevalence of skin lesions among HCWs ranges from 75% to 97% (Lan et al., 2020; Montero-Vilchez et al., 2021). To ensure the seal of PPE, clinical nurses bind the mask and press the metal clip firmly. The excessive pressure of N95 masks and the stiffness of the metal clip may cause skin indentations (Hu, Fan, et al., 2020). Furthermore, the prolonged wearing of PPE creates an air-tight system, making it difficult for perspiration and water vapour to evaporate. Skin maceration occurred when the humid environment formed under the PPE (Jiang et al., 2020).

Results of the current study showed that skin lesions were positively related to clinical nurses' anxiety and depression. Once skin integrity compromised, the skin no longer acts as a natural barrier to support the body's immune system (Gefen, 2020). Clinical nurses perceived an elevated risk of infection, and their anxiety and depression increased. Similarly, a study also indicated that skin lesions would cause anxiety among HCWs and reduce their enthusiasm for work (Lan et al., 2020). The increased anxiety and depression may negatively affect the quality of care and reduce nurses' job satisfaction (Salari et al., 2020). Thus, nurse managers should train clinical nurses about prevention and treatment of skin lesions (Jiang et al., 2020), thereby decreasing their anxiety and depression.

In the present study, fear significantly mediated the relationship between skin lesions and anxiety and between skin lesions and

TABLE 2 Clinical characteristics of skin lesions among participants ($n = 2014$)

	Type of skin lesions n (%)
Skin indentations	1744 (86.6%)
Skin maceration	1482 (73.6%)
Facial redness	926 (46.0%)
Skin ulcers	916 (45.5%)
Skin cracks	851 (42.3%)
Skin allergies	679 (33.7%)
Solitary pyoderma	557 (27.7%)
Erythema with clear boundaries	225 (11.2%)
Lip blisters	200 (9.9%)
Skin blisters	162 (8.0%)
Cutaneous lichen	140 (7.0%)

TABLE 3 Mediation model summary for anxiety

	Model 1			Model 2		
	β	SE	p	β	SE	p
Effect of skin lesions (total score) on fear (a1)	.078	.083	.002**	.078	.083	<.001**
Effect of skin lesions (total score) on resilience (a2)	−.055	.082	.033*	−.055	.083	.014*
Effect of fear on anxiety (b1)	.203	.028	<.001**	.211	.029	<.001**
Effect of resilience on anxiety (b2)	−.389	.031	<.001**	−.391	.031	<.001**
Direct effect of skin lesions (total score) on anxiety (c′)	.228	.099	<.001**	.225	.100	<.001**
Indirect effect via fear (a1*b1)	.016	.025	.002**	.017	.026	<.001**
Indirect effect via resilience (a2*b2)	.021	.049	.033*	.021	.050	.014*
Total indirect effect via fear and resilience (a1*b1 + a2*b2)	.037	.056	<.001**	.038	.057	<.001**
Total effect (c′ + a1*b1 + a2*b2)	.265	.111	<.001**	.263	.113	<.001**

Note: Model 1 has no covariates. Model 2 was adjusted for covariates of age, sex, education, marital status, work experience and prior experience caring for similar patients with a viral infection. All path coefficients are standardized coefficients (β), and SE is the standard error.
*p < .05. **p < .01.

TABLE 4 Mediation model summary for depression

	Model 1			Model 2		
	β	SE	p	β	SE	p
Effect of skin lesions (total score) on fear (a1)	.078	.083	.002**	.078	.082	.002**
Effect of skin lesions (total score) on resilience (a2)	−.055	.083	.035*	−.055	.084	.037*
Effect of fear on depression (b1)	.099	.030	<.001**	.108	.031	<.001**
Effect of resilience on depression (b2)	−.531	.030	<.001**	−.535	.030	<.001**
Direct effect of skin lesions (total score) on depression (c′)	.187	.093	<.001**	.181	.093	<.001**
Indirect effect via fear (a1*b1)	.008	.015	.010**	.008	.016	.009**
Indirect effect via resilience (a2*b2)	.029	.068	.035*	.029	.070	.037*
Total indirect effect via fear and resilience (a1*b1 + a2*b2)	.037	.070	.010**	.038	.072	.010**
Total effect (c′ + a1*b1 + a2*b2)	.224	.110	<.001**	.219	.110	<.001**

Note: Model 1 has no covariates. Model 2 was adjusted for covariates of age, sex, education, marital status, work experience and prior experience caring for similar patients with a viral infection. All path coefficients are standardized coefficients (β), and SE is the standard error.
*p < .05. **p < .01.

depression. Two paths were involved in this indirect relationship. Skin lesions were positively related to fear, and fear was positively related to anxiety and depression. Clinical nurses were aware of the elevated risk of infection and death especially when they developed skin lesions; thus, their fear escalated. Moreover, an increased level of fear exacerbates the levels of anxiety and depression among clinical nurses (Labrague & Santos, 2021). Educating clinical nurses with adequate knowledge of COVID-19 is essential to reduce their fear (Mubarak et al., 2021). A digital learning package involving guidance on COVID-19 related practices and emotional support was proven to be effective in managing clinical nurses' fear as well as other psychological impacts from the COVID-19 in United Kingdom (Blake et al., 2020).

Our result indicated that resilience mediated the relationship between clinical nurses' reporting of skin lesions and their anxiety and depression. Skin lesions were negatively related to resilience, and resilience was negatively related to anxiety and depression. Clinical nurses' resilience would be provoked when they confronted a variety of challenges including skin lesions (Liu et al., 2020). Resilient nurses actively explored multiple support resources and used self-adjustment skills, which were beneficial to decrease their anxiety and depression (Liu et al., 2020). Moreover, resilient nurses might foster protective strategies involving planning skills and problem-solving skills to adjust well to adversities, which also contributed to better mental health (Labrague, 2021). Similarly, other studies highlighted resilience's protective role against negative mental health outcomes (Lorente et al., 2021). Strengthening social connections, promoting nurses' self-care, nurturing nurses' growth and enhancing positivity were identified as beneficial strategies to cultivate nurses' resilience (Wei et al., 2019). Also, acknowledging and rewarding clinical nurses' contribution during the pandemic is another strategy to enhance their resilience (Tomlin et al., 2020). An inter-professional, web-based nightly debriefing programme was demonstrated to be effective to enhance HCWs' resilience in the United States (Azizoddin et al., 2020).
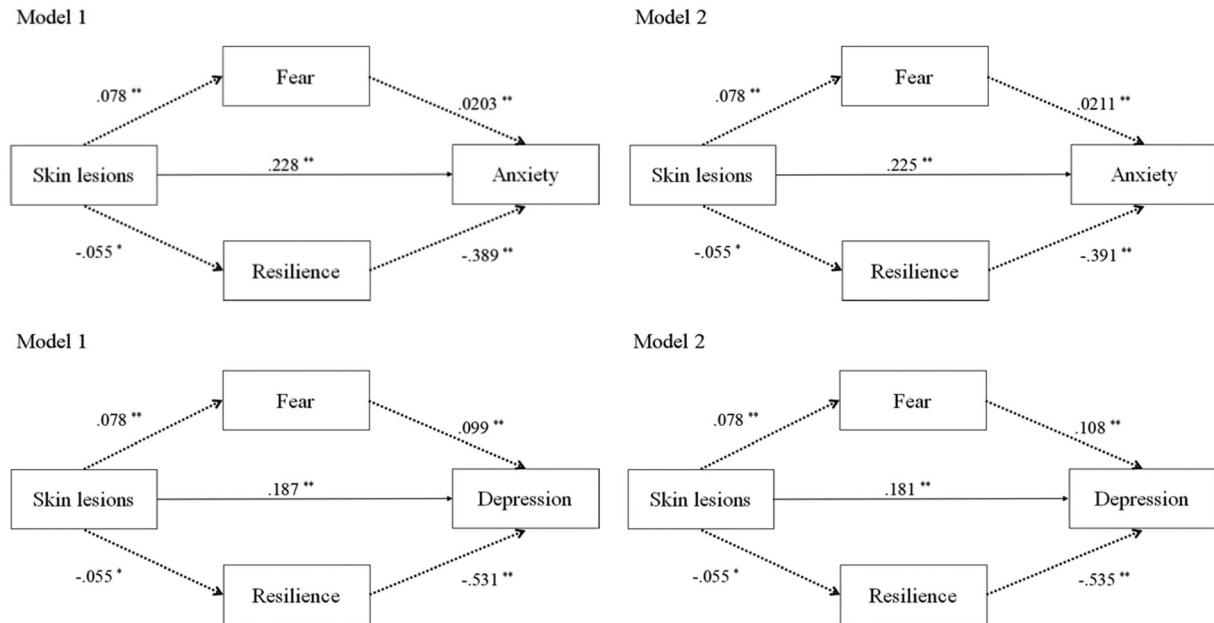
Model 1

Model 2

Model 1

Model 2

FIGURE 2 Skin lesions-anxiety/depression model. *Note*: *p < .05. **p < .01. Model 1 has no covariates. Model 2 was adjusted for covariates of age, sex, education, marital status, work experience and prior experience caring for similar patients with a viral infection

4.1 | Limitations

This study has several limitations. The skin lesions were based on clinical nurses' self-reports, which were not assessed by a dermatologist. The severity of skin lesions among clinical nurses was not evaluated; thus, the possible relationship between the severity of clinical nurses' reporting of skin lesions and their anxiety and depression in the present study cannot be further explored. Besides, the fear scale was developed by the research group, and the reliability of this scale was only assessed by our study. Future studies are needed to test the reliability and thresholds of the fear scale. Moreover, this study was conducted in the first wave, and little data were collected to identify pre-existing mental health conditions of clinical nurses. Finally, the cross-sectional study poses some challenges to draw a conclusive relationship between clinical nurses' reporting of skin lesions and their anxiety and depression. Longitudinal studies are warranted to further explore the research question.

5 | CONCLUSION

During the COVID-19 pandemic, prolonged PPE wearing may cause severe skin lesions among clinical nurses. Reduced levels of fear and enhanced levels of resilience were related to decreased levels of anxiety and depression among clinical nurses. Thus, nurse managers should implement strategies to reduce fear and foster resilience among clinical nurses. This management is extremely critical for the ongoing and future pandemics.

6 | IMPLICATIONS FOR NURSING MANAGEMENT

This study suggests that reducing clinical nurses' skin lesions, decreasing fear and fostering resilience among clinical nurses may protect them against anxiety and depression. Therefore, nurse managers should reduce skin lesions and fear and foster resilience by implementing evidence-based programmes or interventions.

Nurse managers should evaluate the occurrence and severity of skin lesions. Self-reports of skin lesions and early tele-consultation with dermatologists should be encouraged to clinical nurses (Keng et al., 2021). In addition, nurse managers should provide support for those who are at risk of developing skin lesions such as female nurses, high-educated nurses or nurses with longer working duration. For example, training programmes with evidence-based knowledge such as using soft facial cleaner, applying moisture or barrier creams and proper donning and doffing PPE, should be offered to clinical nurses to increase their awareness and knowledge of skin protection (Padula et al., 2021). Moreover, nurse managers should arrange reasonable working duration for clinical nurses to reduce prolonged facial pressure caused by PPE.

Nurse managers can gauge clinical nurses' fear status and provide timely interventions. Psychological support should target nurses with escalated fear such as promoting expression of feeling, engaging in their social connections and applying strategies of self-adjustment (Labrague, 2021). Moreover, updated knowledge of COVID-19 should be disseminated to clinical nurses, and appropriate mental health support should be provided to nurses in need, thereby reducing their anxiety and depression (Mubarak et al., 2021).

Furthermore, nurse managers should apply various strategies to build and maintain clinical nurses' resilience, such as encouraging nurses' self-care and career development, celebrating and sharing successes (Rieckert et al., 2021). During the COVID-19 pandemic, innovative ways of mental support such as webinars, online counselling or other e-technologies would be beneficial to support clinical nurses' psychological resilience (Bao et al., 2020).

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

ETHICAL APPROVAL

Ethical approval was obtained from the Institutional Review Board of the two participating hospitals (Wuhan Union Hospital, Huazhong University of Science and Technology, 20200025; Huo Shen Shan Hospital, 2020001) and the last author's institution (Xiamen University, XDYX2020001).

DATA AVAILABILITY STATEMENT

Authors do not wish to share the data.

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