Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Journal of Contextual Behavioral Science 19 (2021) 64–71

Contents lists available at ScienceDirect

Journal of Contextual Behavioral Science

journal homepage: www.elsevier.com/locate/jcbs

Occupational stressors, mental health, and sleep difficulty among nurses during the COVID-19 pandemic: The mediating roles of cognitive fusion and cognitive reappraisal

Chun-Qing Zhang [a,1], Ru Zhang [b,1], Yongzan Lu [c], Hongguo Liu [d], Suhua Kong [e], Julien S. Baker [f], Hongguang Zhang [g,*]

[a] Department of Psychology, Sun Yat-sen University, Guangzhou, China
[b] School of Physical Education & Sports Science, South China Normal University, Guangzhou, China
[c] Shandong Provincial Chest Hospital, Jinan, Shandong, China
[d] Zhangjiakou City Hospital of Traditional Chinese Medicine, Zhangjiakou, Hebei, China
[e] Zhangjiakou Infectious Disease Hospital, Zhangjiakou, Hebei, China
[f] Department of Sport, Physical Education and Health, Hong Kong Baptist University, Hong Kong, China
[g] The Affiliated Hospital of Shandong University of Traditional Chinese Medicine, Jinan, Shandong, China

ARTICLE INFO

Keywords:
Emotion regulation
Healthcare workers
Mental health disorders
Sleep disturbances
Work-related stressors

ABSTRACT

This study aimed to examine the relationships between occupational stressors, mental health problems, and sleep difficulty, and the mediating roles of cognitive fusion and cognitive reappraisal on the relationships in Chinese nurses. A total of 323 nurses (mean age = 32.11 ± 6.75 years) from 25 hospitals in China participated a cross-sectional online survey. Participants were asked to refer to the period during the severest time of the COVID-19 pandemic in China (January to March 2020) when assessing the psychological variables. The direct links from occupational stressors to cognitive fusion, cognitive reappraisal, mental health and sleep difficulty were significant. Cognitive fusion and cognitive reappraisal mediated the links from occupational stressors to mental health problems, while cognitive fusion and mental health problems mediated the links from occupational stressors to sleep difficulty. The sequential mediation via cognitive fusion and mental health problems as well as via cognitive reappraisal and mental health problems on the links from occupational stressors to sleep difficulty were also significant. Findings from the current study indicate that intervention strategies focusing on the reduction of cognitive fusion and improvement of cognitive reappraisal could help better prepare nurses to alleviate mental health problems and sleep difficulties that are related to COVID-19 and potentially similar pandemics in the future.

1. Introduction

The outbreak of coronavirus diseases (CVOID-19) occurred in Wuhan in December 2019 (Zhu et al., 2020), which quickly spread across China to 213 countries and territories around the world (C. Wang, Horby, Hayden, & Gao, 2020). During the COVID-19 pandemic, nurses faced several occupational stressors such as heavy workload, communicating with the patients, work shifts and so on, which contribute to the risk of mental health and sleep problems (Deng, Liu, & Fang, 2020; Lu, Wang, Lin, & Li, 2020). Nurses were also under high levels of pressure of being infected by COVID-19 patients, facing a shortage of personal protective equipment, and as a result spreading the coronavirus to their families, friends or colleagues (Jackson, Anders, Padula, Daly, & Davidson, 2020; Liu et al., 2020; Xiang et al., 2020). Indeed, during the COVID-19 pandemic, nurses experienced unprecedented amounts of mental health problems, such as fear, anxiety, depression and psychological distress (Q. Cai, Tu, et al., 2020; Sun et al., 2020; Zhao et al., 2020). Supporting nurses to maintain mental health and providing medical environment work efficiency is therefore essential in controlling the COVID-19 pandemic (Huang & Zhao, 2020; Maben & Bridges, 2020; Mo et al., 2020).

During the COVID-19 pandemic, nurses have experienced poor sleep

* Corresponding author.
E-mail address: hong-guang.zhang@outlook.com (H. Zhang).
[1] Chun-Qing Zhang and Ru Zhang are joint first authors.

https://doi.org/10.1016/j.jcbs.2020.12.004
Received 4 August 2020; Received in revised form 10 December 2020; Accepted 15 December 2020
Available online 17 December 2020
2212-1447/© 2020 Association for Contextual Behavioral Science. Published by Elsevier Inc. All rights reserved.

quality (Du et al., 2020; Kang, Ma et al., 2020; Pappa et al., 2020). Sleep disturbances were prevalent for nurses during the COVID-19 pandemic (Huang & Zhao, 2020; Xiao, Zhang, Kong, Li, & Yang, 2020; S. Wang, Horby, et al., 2020). In particular, the frontline healthcare workers tended to have a high prevalence of sleep disturbances and poor sleep quality during the COVID-19 pandemic (Qi et al., 2020; Zhou et al., 2020). The sleep problems of nurses were also negatively affected by their occupational stressors experienced during the COVID-19 pandemic (Ballesio, Lombardo, Lucidi, & Violani, 2020; Deng et al., 2020; Zhuo, Gao, Wang, Zhang, & Wang, 2020). This may be because negative emotions and repetitive negative thinking are related to the problems of initiating and maintaining sleep (Baglioni, Spiegelhalder, Lombardo, & Riemann, 2010; Lancee, Eisma, van Zanten, & Topper, 2017). Although it seems that the relationships between mental health problems (e.g., anxiety and depression) and sleep disturbances are bidirectional in nature (Alvaro, Roberts, & Harris, 2013), the occupational stress and mental health problems might be independent predictors of nurses' sleep disturbances (Dong, Zhang, Sun, Sang, & Xu, 2017; Hsieh et al., 2011). In other words, the occupational stressors might be linked to sleep disturbances via mental health problems.

To prevent the impacts of occupational stressors during the COVID-19 pandemic on nurses' mental health problems and sleep quality, it is important to develop effective coping strategies to help nurses to manage their work-related stress (H. Cai, Tu, et al., 2020; Edwards & Burnard, 2003; Wu et al., 2020). Cognitive fusion and cognitive reappraisal can be viewed as two important mediators of occupational stressors on mental health problems and sleep quality. For nurses, occupation stressors might lead to mental health problems via cognitive fusion, in which nurses construct their thoughts towards the stressors and cannot distinguish between thoughts and facts (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). In other words, nurses might develop mental health problems with their natural tendency to entangle with thoughts due to strong beliefs in the literal contents of the occupational stressors as truth (Gillanders et al., 2014). On the other hand, cognitive reappraisal, which is defined as cognitively constructing the negative situation to alleviate the emotional impact from stressors (Gross & John, 2003), can also help nurses to manage their occupational stressors and regulate emotions and thoughts to reduce mental health problems. That said, nurses adopt cognitive reappraisal techniques that can help them mitigate the influences of occupational stressors on mental health and sleep quality (Blake, Bermingham, Johnson, & Tabner, 2020). However, it seems that there is a lack of empirical evidence on testing the mediating roles of cognitive fusion and cognitive reappraisal on the pathways from occupational stressors to mental health and sleep quality in nurses.

Understanding the pathways linking occupational stressors during the COVID-19 pandemic and mental health and sleep quality can help nurses to better prepare for future pandemics (Kang, Li et al., 2020), as well as to develop effective psychological intervention programs for nurses to deal with their mental health and sleep problems (Pappa et al., 2020). Building on a proposed mediation model (see Fig. 1), the purpose of the current study was to examine the relationships between occupational stressors, mental health problems and sleep difficulty, and the mediating roles of cognitive fusion and cognitive reappraisal on the relationships in a sample of Chinese nurses. Specifically, we hypothesized that: (a) the direct links from occupational stressors to cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty are positive and significant; (b) the direct links from cognitive fusion to mental health problems and sleep difficulty are positive and significant, while the direct links from cognitive reappraisal to mental health disorders and sleep difficulty are negative and significant; and (c) the direct link from mental health to sleep difficulty is positive and significant. In terms of the indirect links, cognitive fusion and cognitive reappraisal significantly mediate the positive links: (a) from occupational stressors to mental health problems as well as (b) from occupational stressors to sleep difficulty. It is also hypothesized that (c) mental health significantly mediate the positive link from occupational stressors to sleep difficulty. Moreover, it is hypothesized that sequentially (d) cognitive fusion and mental health problems and (e) cognitive reappraisal and mental health problems significantly mediate the link from occupational stressors to sleep difficulty.

2. Methods

2.1. Study design and participants

Using a cross-sectional design, we conducted an online survey via a platform named Tencent Questionnaire (https://wj.qq.com/). Data collection was conducted during 25–31 May 2020 by sending invitations to nurses individually or in a group format via their colleagues in hospitals. The inclusion criteria were: (a) having worked in a hospital for at least 6 months and (b) being able to read Chinese characters. We recruited a convenience sample of Chinese nurses from 25 hospitals in Shandong and Hebei provinces in China. Two of those were COVID-19 designated hospitals. The online response rate was 36% and we successfully recruited 323 Chinese nurses (296 women and 27men, mean age = 32.11 ± 6.75 years) who provided online consent and completed the survey. We did not provide incentives to participants for completing the survey, which was voluntary. We obtained ethical approval from the Research Ethics Committee of the [masked for review] University.

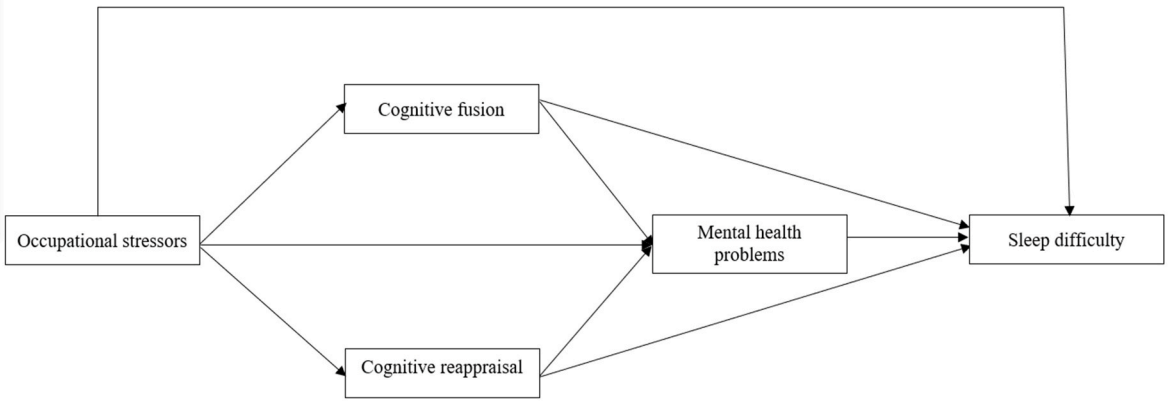

Fig. 1. The proposed model of occupational stressor, cognitive fusion, cognitive reappraisal, and mental health problems predicting sleep difficulty among Chinese nurses (n = 323). *Note.* Standardized path coefficients. Covariates include age, gender, Body Mass Index (BMI), education, marital status, number of children, household income, nursing position, working hours per day, and taking care COVID-19 patients were controlled. Solid lines indicate significant paths and dashed lines indicate non-significant paths. *$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed).

2.2. Measures

The online survey included demographical variables (i.e., age, gender, marital status, having children, height, weight, education, household income, nursing position, working hours per day, and taking care of COVID-19 patients), and key psychological and behavioral variables (i.e., occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty). When assessing the psychological and behavioral variables, participants were asked to refer to the period from January to March 2020 when the COVID-19 pandemic was most severe in China (Xu, Wu, & Cao, 2020).

Occupational stressors. We measured participants' occupational stressors using the 25-item Chinese version Nurses' Occupational Stressor Scale (NOSS; Chen et al., 2020). For each item (e.g., "I cannot take an uninterrupted 30-min mealtime break."), we included a stem of "Please rate the following statements according to your experiences during the severest period of COVID-19 pandemic in China (January–March 2020)." Participants were asked to rate using a 4-point Likert scale from 1 (*strongly disagreed*) to 4 (*strongly agreed*). We used the mean of the 25 items to estimate the participants' occupational stressors. In the current study, NOSS showed satisfactory internal consistency reliability (Cronbach's $\alpha = 0.91$).

Cognitive fusion. We measured participants' cognitive fusion by using the 7-item Cognitive Fusion Questionnaire (CFQ; Gillanders et al., 2014), which has been translated and validated in Chinese (Zhang, Chung, Si, & Gucciardi, 2016). Participants were asked to rate the items (e.g., "My thoughts cause me distress or emotional pain") using a 7-point Likert scale from 1 (*never*) to 7 (*always*). We used the mean of the seven items to evaluate participants' cognitive fusion. In the current study, the Chinese version CFQ showed satisfactory internal consistency reliability (Cronbach's $\alpha = 0.94$).

Cognitive reappraisal. We used items from the 6-item cognitive reappraisal subscale of Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). The Chinese version ERQ has been shown to be reliable and valid (Li & Wu, 2020). Participants were asked to evaluate the six items of cognitive reappraisal (e.g., "When I want to feel less negative emotion, I change the way I think about the situation") using a 7-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). In the current study, the internal consistency reliability for cognitive reappraisal was satisfactory (Cronbach's $\alpha = 0.86$).

Mental health problems. We used the Chinese version of the 12-item General Health Questionnaire (GHQ-12; Goldberg et al., 1997) to assess participants' mental health problems during the severest period of the COVID-19 pandemic in China from January to March 2020. The Chinese version GHQ-12 has been demonstrated to be reliable and valid (Liang, Wang, & Yin, 2016). The GHQ-12 included six positive items (e.g., "capable of making decisions") and six negative items (e.g., "loss of sleep over worry"). Participants were asked to rate the 12 items using a 4-point Likert scale from 1 (*never*) to 4 (*always*). Positive items were scored from 0 (*always*) to 3 (*never*), while the negative items were scored from 3 (*always*) to 0 (*never*). We summarized scores of the 12 items to evaluate participants' mental health problems. Higher scores indicated a decrease in mental health status. In the current study, the Chinese version GHQ-12 showed satisfactory internal consistency reliability (Cronbach's $\alpha = 0.84$).

Sleep difficulty. We assessed participants' sleep difficulty using the 18-item Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989; Buysse et al., 1991). The Chinese version PSQI showed good reliability and validity (Tsai et al., 2005). The PSQI measures included seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Items were rated on a 4-point Likert scale from 0 (no problem at all/very good) to 3 (three or more times per week/very bad). Total scores of the seven domains can be summarized as a sleep quality index, ranging from 0 to 21. Higher scores indicate poor sleep quality. In the current study, the internal consistency reliability of the Chinese version PSQI was acceptable (Cronbach's $\alpha = .72$).

Covariates. We measured covariates by collecting demographic variables including: age, gender, body mass index (calculated using participants' height and weight), education, marital status, number of children, household income, nursing position, working hours per day, as well as whether they had taken care of COVID-19 patients during the severest period of the COVID-19 pandemic from January to March 2020 (Xu et al., 2020).

2.3. Data analysis

We analyzed the descriptive statistics of the demographic variables (i.e., age, gender, body mass index, education, marital status, number of children, household income, nursing position, working hours per day, and taking care of COVID-19 patients) using the IBM SPSS Statistics 25 (Armonk, NY; IBM Corp, 2017). We also analyzed the descriptive statistics, reliability, and zero-order bivariate correlations of occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty using the IBM SPSS Statistics 25. We tested the proposed model (see Fig. 1) with path analysis using the robust maximum likelihood (MLR) estimation method within Mplus 6.12 (Muthén & Muthén, 1998–2012). Demographic variables were included in the proposed model as covariates to control their influences on cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty. To minimize the potential inflated correlation between the variables of mental health problems and sleep difficulty, the sleep-related item on the General Health Questionnaire (GHQ-12) was removed from the correlation and path analysis.

We used multiple criteria to determine the goodness of fit for the proposed model with the data, including: the comparative fit index (CFI), the root-mean-square error of approximation (RMSEA) and the standardized root mean square residual (SRMR). The model is considered as a good fit with the CFI exceeding 0.90, and RMSEA and SRMR less than 0.05 and 0.08, respectively (Marsh, Hau, & Grayson, 2005; Yu,

Table 1
Descriptive characteristics of demographic variables, occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty among Chinese nurses ($n = 323$).

Variables	Mean ± *SD* or *n* (%)
Covariates	
Age (yrs.)	32.11 ± 6.75
Gender, women, *n* (%)	296 (91.6%)
Marital status, married, *n* (%)	243 (75.2%)
Having children, *n* (%)	215 (66.6%)
Body mass index, (kg/m^2)	22.70 ± 3.15
Education, *n* (%)	
Low (College education and below)	64 (19.8%)
High (Bachelor and above)	259 (80.2%)
Household income, *n* (%)	
Low (<¥ 5,000)	102 (31.6%)
Middle (¥ 5,000 - ¥ 10,000)	138 (42.7%)
High (≥¥ 10,000)	83 (25.7%)
Nursing position, *n* (%)	
Junior nurse	207 (64.1%)
Supervisor/co-chief/chief nurse	116 (35.9%)
Working hours per day	8.48 ± 1.96
Taking care COVID-19 patients, *n* (%)	130 (40.2%)
Occupational stressors[a]	2.76 ± 0.38
Cognitive fusion[b]	3.56 ± 1.07
Cognitive reappraisal[b]	4.77 ± 0.78
Mental health problems[c]	12.79 ± 4.76
Sleep difficulty[d]	8.73 ± 3.49

Note.
[a] Likert-scale ranging from 1 (*strongly disagreed*) to 4 (*strongly agreed*).
[b] Likert-scale ranging from 1 (*never*) to 7 (*always*).
[c] Ranging from 0 to 36, higher scores indicate worse mental health status.
[d] Ranging from 0 to 21, higher scores indicate severer sleep difficulty.

2002). A significant mediation will be confirmed when the indirect link of a predictor variable (e.g., occupational stressor) on an outcome variable (e.g., sleep difficulty) via a mediator (e.g., mental health problems) was statistically significant and the confidence interval of the effect size did not include zero.

3. Results

3.1. Descriptive characteristics

Table 1 shows the descriptive characteristics of the demographic variables (i.e., age, gender, body fat mass, education, marital status, number of children, household income, nursing position, and working hours per day) and key psychological and behavioral variables (i.e., occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty). The current study consisted of 323 nurses (M_{age} = 32.11 years; SD = 6.75), 91.6% women (n = 296) and 8.4% men (n = 27). During the severest period of the COVID-19 pandemic in China from January to March 2020, nurses spent an average of 8.48 (±1.96) hours working per day, and 40.2% (n = 130) of the nurses had an experience of making contact with and taking care of COVID-19 patients. Missing data were revealed in the first four items of the Pittsburgh Sleep Quality Index (PSQI) (3.56%) and were the two demographic variables: age (0.62%) and working hours per day (0.93%). Regarding sleep duration, nurses reported an average of M = 6.60 h of actual sleep per night, while on average nurses rated their overall sleep quality as fairly good to fairly bad (M = 1.66, 0 = very good, 1 = fairly good, 2 = fairly bad, 3 = very bad).

Table 2 shows the internal consistency reliabilities and bivariate correlations among occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty. Cronbach's alpha coefficients of the psychological variables were all above .70. Sleep difficulty was significantly and positively correlated with occupational stressors (r = .449, p < .001), cognitive fusion (r = 0.448, p < .001), and mental health problems (r = 0.492, p < .001). In addition, mental health problems were significantly and positively correlated with occupational stressors (r = 0.388, p < .001), cognitive fusion (r = 0.592, p < .001), and was significantly and negatively correlated with cognitive reappraisal (r = −0.156, p = .005).

Table 2
Internal consistency reliabilities and zero-order correlations of occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty among Chinese nurses (n = 323).

		1	2	3	4	5
1	Occupational stressors	.91				
2	Cognitive fusion	.472***	.94			
3	Cognitive reappraisal	.192**	.027	.86		
4	Mental health problems	.388***	.592***	-.156**	.84	
5	Sleep difficulty	.449***	.448***	-.011	.492***	–

Note. Cronbach's alpha coefficients for the psychological variables at the diagonal.– Not applicable.
*p < .05, **p < .01, ***p < .001 (two-tailed).

3.2. Path analysis

The model exhibited adequate fit with the data, χ^2 (1) = 0.183, p = .669, CFI = 1.00, SRMR = 0.002, RMSEA (90% CI) = 0.000 (0.000, 0.112), after controlling age, gender, body mass index, education, marital status, number of children, household income, nursing positions, working hours per day, and taking care of COVID-19 patients. We present the standardized path coefficients for the integrated model of occupational stressor, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty in Fig. 1 and Table 3.

Overall, occupational stressors had a direct and positive link to cognitive fusion (β = 0.503, p < .001). This means that nurses with more occupational stressors are associated with higher levels of cognitive fusion, entangling their thoughts on occupational stressors. Likewise, occupational stressors showed a positive link to cognitive reappraisal (β = 0.169, p = .009). This means that higher levels of occupational stressors among nurses are related to more frequent use of cognitive reappraisal to reconstruct the perceptions on the stressors.

Table 3
Direct and indirect links for the proposed model of occupational stressor, cognitive fusion, cognitive reappraisal, mental health problems predicting sleep difficulty among Chinese nurses (n = 323).

Links			CI_{95}	
	β	p	LL	UL
Direct links				
Occupational stressor → Cognitive fusion	.503	<.001	.405	.601
Occupational stressor → Cognitive reappraisal	.169	.009	.042	.296
Occupational stressor → Mental health problems	.178	<.001	.085	.271
Cognitive fusion → Mental health problems	.501	<.001	.418	.583
Cognitive reappraisal → Mental health problems	-.174	<.001	-.267	-.080
Occupational stressor → Sleep difficulty	.244	<.001	.138	.350
Cognitive fusion → Sleep difficulty	.148	.022	.021	.275
Cognitive reappraisal → Sleep difficulty	-.006	.913	-.105	.094
Mental health problems → Sleep difficulty	.305	<.001	.182	.427
Indirect links				
Occupational stressor → Cognitive fusion → Mental health problems	.252	<.001	.179	.325
Occupational stressor → Cognitive reappraisal → Mental health problems	-.029	.024	-.055	-.004
Cognitive fusion → Mental health problems → Sleep difficulty	.153	<.001	.085	.220
Cognitive reappraisal → Mental health problems → Sleep difficulty	-.053	.006	-.091	-.015
Occupational stressor → Cognitive fusion → Sleep difficulty	.074	.028	.008	.141
Occupational stressor → Cognitive reappraisal → Sleep difficulty	-.001	.914	-.018	.016
Occupational stressor → Mental health problem → Sleep difficulty	.054	.002	.019	.089
Occupational stressor → Cognitive fusion → Mental health problem → Sleep difficulty	.077	<.001	.038	.116
Occupational stressor → Cognitive reappraisal → Mental health problem → Sleep difficulty	-.009	.049	-.018	.000
Total indirect links				
Occupational stressor → Mental health problems	.223	<.001	.150	.296
Occupational stressor → Sleep difficulty	.196	<.001	.123	.268

Note. β = standardized path coefficient; CI_{95} = 95% confidence interval of path coefficient; LL = lower limit; UL = upper limit.
Age, gender, Body Mass Index (BMI), education, marital status, children, household income, nursing position, working hours per day, and taking care COVID-19 patients were included in the model as covariates.

Significant links from occupational stressors to nurses' mental health problems ($\beta = 0.178$, $p < .001$) and sleep difficulty ($\beta = 0.244$, $p < .001$) were also revealed. Nurses' occupational stressors seem to be directly and significantly linked to their mental health problems and sleep difficulty during the COVID-19 pandemic.

Cognitive fusion was positively and significantly associated with mental health problems ($\beta = 0.501$, $p < .001$) and sleep difficulty ($\beta = 0.148$, $p = .022$). It seems that nurses' tendency to entangle with their thoughts and beliefs might be associated with higher levels of mental health problems and more sleep difficulty. In addition, cognitive reappraisal was significantly and negatively associated with mental health problems ($\beta = -.174$, $p < .001$), although the association with cognitive reappraisal to sleep difficulty was non-significant ($\beta = -0.006$, $p = .913$). This means that nurses with higher levels of cognitive reappraisal ability are associated with less mental health problems but not related to sleep difficulty. Moreover, the significant and positive link from mental health problems to sleep difficulty ($\beta = .305$, $p < .001$) indicates that nurses with higher levels of mental health problems are related to more sleep difficulty during the COVID-19 pandemic.

3.3. Indirect links

As Table 3 shows, the indirect links from occupational stressors to mental health problems via cognitive fusion ($\beta = 0.252$, $p < .001$) and cognitive reappraisal ($\beta = -0.029$, $p = .024$) were significant. The indirect link from occupational stressors to sleep difficulty via mental health problems ($\beta = 054$, $p = .002$) was also significant. Furthermore, significant indirect links were revealed from occupational stressors to sleep difficulty sequentially via cognitive fusion and mental health problems ($\beta = .077$, $p < .001$) as well as sequentially via cognitive reappraisal and mental health problems ($\beta = -0.009$, $p = .049$). Although the indirect link from occupational stressors to sleep difficulty via cognitive fusion ($\beta = 0.074$, $p = .028$) was significant, the indirect link from occupational stressors to sleep difficulty via cognitive reappraisal ($\beta = -0.001$, $p = .914$) was non-significant. There are also significant indirect links from cognitive fusion ($\beta = 0.153$, $p < .001$) and cognitive reappraisal ($\beta = -0.053$, $p = .006$) on sleep difficulty via mental health problems. Moreover, the total indirect links from occupational stressors to mental health ($\beta = .223$, $p < .001$) and sleep difficulty ($\beta = 0.196$, $p < .001$) among nurses were significant. It should be noted that the significance of the corresponding unstandardized indirect links were further evaluated with bias-corrected (BC) bootstrapped asymmetric confidence intervals. The BC bootstrap method is viewed as being able to obtain more accurate confidence intervals in mediation analysis (MacKinnon, Lockwood, & Williams, 2004; Shrout & Bolger, 2002) and the bootstrapped confidence intervals calculated by the BC bootstrap method (i.e., bootstrap = 10000) converged with the confidence intervals presented in Table 3.

3.4. Controlled direct links from covariates to key study variables

The standardized parameter estimates of the direct links from the covariates (i.e., age, gender, body mass index, education, marital status, number of children, household income, nursing positions, working hours per day, and taking care of COVID-19 patients) to the key psychological and behavioral variables (i.e., occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty) are presented at Table 4. In general, the direct links from those covariates to the key psychological and behavioral variables were non-significant. However, there are also several significant direct links. For example, significant direct links were revealed from working hours per day to occupational stressors ($\beta = 0.258$, $p < .001$), from education to cognitive fusion ($\beta = -0.104$, $p = .047$) and cognitive reappraisal ($\beta = 0.116$, $p = .030$), from body mass index ($\beta = 0.104$, $p = .017$) and taking care of COVID-19 patients ($\beta = -0.096$, $p = .034$) to mental health problems, as well as from gender ($\beta = -0.103$, $p = .035$) and household income ($\beta = -0.124$, $p = .020$) to sleep difficulty.

Table 4
Controlled direct links from covariates to occupational stressor, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty (n = 323).

Direct links			CI_{95}	
	β	p	LL	UL
Age → Occupational stressor	.152	.088	-.023	.327
Gender → Occupational stressor	-.052	.346	-.161	.056
Marital status → Occupational stressor	.134	.151	-.049	.317
Number of Children → Occupational stressor	-.072	.400	-.241	.096
Body mass index → Occupational stressor	.051	.324	-.050	.151
Education → Occupational stressor	.055	.381	-.068	.177
Household income → Occupational stressor	-.102	.100	-.223	.020
Nursing position→ Occupational stressor	-.081	.286	-.230	.068
Working hours per day → Occupational stressor	.258	<.001	.132	.385
Taking care COVID-19 patients → Occupational stressor	.024	.655	-.082	.130
Age → Cognitive fusion	-.122	.162	-.294	.049
Gender → Cognitive fusion	.058	.195	-.030	.147
Marital status → Cognitive fusion	.002	.981	-.144	.148
Number of Children → Cognitive fusion	-.110	.171	-.267	.047
Body mass index → Cognitive fusion	.017	.742	-.083	.117
Education → Cognitive fusion	-.104	.047	-.206	-.001
Household income → Cognitive fusion	.026	.632	-.081	.134
Nursing position→ Cognitive fusion	.131	.076	.014	.275
Working hours per day → Cognitive fusion	.010	.835	-.080	.099
Taking care COVID-19 patients → Cognitive fusion	-.035	.465	-.130	.060
Age → Cognitive reappraisal	.077	.419	-.110	.265
Gender → Cognitive reappraisal	-.084	.056	-.171	.002
Marital status → Cognitive reappraisal	.018	.802	-.120	.155
Number of Children → Cognitive reappraisal	.015	.841	-.134	.165
Body mass index → Cognitive reappraisal	.005	.924	-.107	.118
Education → Cognitive reappraisal	.116	.030	.011	.221
Household income → Cognitive reappraisal	.091	.152	-.034	.215
Nursing position→ Cognitive reappraisal	.056	.494	-.105	.217
Working hours per day → Cognitive reappraisal	-.022	.672	-.122	.079
Taking care COVID-19 patients → Cognitive reappraisal	.087	.117	-.022	.196
Age → Mental health problems	-.040	.574	-.180	.100
Gender → Mental health problems	.001	.982	-.088	.090
Marital status → Mental health problems	-.072	.270	-.201	.056
Number of Children → Mental health problems	-.009	.894	-.142	.124
Body mass index → Mental health problems	.104	.017	.019	.189
Education → Mental health problems	.087	.077	-.009	.183
Household income → Mental health problems	-.087	.104	-.193	.018
Nursing position→ Mental health problems	-.057	.368	-.180	.067
Working hours per day → Mental health problems	.033	.467	-.057	.124
Taking care COVID-19 patients → Mental health problems	-.096	.034	-.184	-.007
Age → Sleep difficulty	.120	.127	-.034	.273
Gender → Sleep difficulty	-.103	.035	-.198	-.007
Marital status → Sleep difficulty	.081	.244	-.055	.217
Number of Children → Sleep difficulty	-.047	.513	-.189	.094
Body mass index → Sleep difficulty	-.010	.832	-.103	.083
Education → Sleep difficulty	.015	.774	-.089	.120
Household income → Sleep difficulty	-.124	.020	-.229	-.019
Nursing position→ Sleep difficulty	-.104	.123	-.236	.028
Working hours per day → Sleep difficulty	-.011	.808	-.101	.079
Taking care COVID-19 patients → Sleep difficulty	.065	.174	-.029	.158

Note. β = standardized path coefficient; CI_{95} = 95% confidence interval of path coefficient; LL = lower limit; UL = upper limit.

4. Discussion

The aim of the current study was to examine the relationships among occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty among Chinese nurses during the COVID-19 pandemic in a proposed mediation model. Based on the findings of this cross-sectional survey, we found that occupational stressors were significantly linked to nurses' mental health problems during the COVID-19 pandemic, and cognitive fusion and cognitive reappraisal of nurses significantly mediated the links from occupational

stressors to mental health problems. It should be noted that occupational stressors were also directly and significantly related to sleep difficulty among nurses during the pandemic. Cognitive fusion and mental health problems significantly mediated the link from occupational stressors to sleep difficulty but not cognitive reappraisal. Findings from the current study can be used to inform the development of psychological interventions to help nurses deal with the mental health problems and sleep disturbances during the COVID-19 pandemic.

Nurses' occupational stressors were directly linked to mental health problems during the COVID-19 pandemic. This finding is consistent with recent studies regarding the relationship between high levels of occupational stressors and mental health problems (Lai et al., 2020; Liu et al., 2020; Pappa et al., 2020). It highlights the importance of providing support for nurses to reduce their occupational stressors in order to alleviate their mental health problems (Mo et al., 2020). In addition, the mediating roles of cognitive fusion and cognitive reappraisal on the links from occupational stressors to mental health problems among nurses were confirmed. Therefore, future interventions and applied research may consider training nurses to better understand cognitive reappraisal ability and how to construct the negative situation during the COVID-19 pandemic to alleviate the emotional impact of the stressors (Saedpanah, Salehi, & Moghaddam, 2016; Wilkins, 2014). In order to reduce the impacts of occupational stressors on mental health and sleep difficulty among nurses, it is also suggested that cognitive defusion could be improved by using the Acceptance and Commitment Therapy (ACT; Hayes et al., 2006). According to the psychological flexibility model of ACT (Levin, Hildebrandt, Lillis, & Hayes, 2012), the cognitive defusion technique can be practiced by nurses to help them avoid fusing with thoughts and feelings which can further reduce mental health problems and sleep difficulty (Barrett & Stewart, 2020; Kaipainen, Välkkynen, & Kilkku, 2017; Salari et al., 2020). The effectiveness of ACT on helping nurses in reducing cognitive defusion and alleviating mental health problems has been preliminarily demonstrated (Frögéli, Djordjevic, Rudman, Livheim, & Gustavsson, 2016). Future research is required to confirm the effectives of ACT and demonstrate the underlying changing mechanisms.

Nurses' occupational stressors are also directly linked to sleep difficulty during the COVID-19 pandemic. Indeed, occupational stressors during the COVID-19 pandemic may cause sleep problems during the pandemic (Pappa et al., 2020; S. Wang, Horby, et al., 2020; Zhou et al., 2020). Furthermore, the direct link from mental health problems to sleep difficulty indicates that mental health problems are directly related to sleep disturbances of nurses during the COVID-19 pandemic (Huang & Zhao, 2020; Xiao et al., 2020). It should be noted that, even without the pandemic, the prevalence of sleep disturbances among nurses is still higher than the general population (Qiu, Yu, Li, Li, & Xiao, 2020), which are caused by work-related stress (Deng et al., 2020). Given that the direct links from cognitive reappraisal to sleep difficulty was non-significant, the indirect links from occupational stressors to sleep difficulty via cognitive reappraisal cannot be confirmed. However, the indirect links from occupational stressors to sleep difficulty via the sequential mediation of cognitive fusion and mental health problems were significant. Likewise, the indirect links from occupational stressors to sleep difficulty via the sequential mediation of cognitive reappraisal and mental health problems were also significant. This indicates that occupational stressors are linked to sleep difficulty via cognitive coping strategies but via mental health problems. Implications from the findings are that we should focus more on reducing cognitive fusion and mental health problems in order to help reduce the sleep difficulty of nurses.

Evidence-based mental health interventions can equip nurses with abilities to regulate their psychological states to prevent mental health and sleep problems at times of pandemics like COVID-19 (Kang, Ma et al., 2020; Mo et al., 2020; Teng et al., 2020). It can also help to minimize the impacts of burnout and loss of the nursing workforce (Ballesio et al., 2020). Psychological interventions for dealing with mental health problems conducted in China for nurses were passive or the interventions only included brief training rather than a systematic multi-stage training regime (Sun et al., 2020). The current study provided explanations for the pathways from occupational stressors to mental health problems and sleep difficulty via cognitive fusion and cognitive reappraisal. Findings can be incorporated into training programs to better prepare front-line nurses in the fight against COVID-19 and other potential future pandemics (Edwards & Burnard, 2003; Maben & Bridges, 2020). To reach a wider population, well-designed mHealth and eHealth interventions are needed for helping nurses alleviate the psychological impacts of COVID-19 or other pandemics (Zhang, Wu, Zhao, & Zhang, 2020). For example, a digital learning package was developed to help UK healthcare workers mitigate psychological impacts of COVID-19 (Blake et al., 2020). Nonetheless, in order to develop effective interventions for nurses during the COVID-19 pandemic a comprehensive assessment with a scientific evidence-based approach is required (Duan & Zhu, 2020).

Limitations of the current study should be acknowledged. Firstly, the current study used a cross-sectional design. Therefore, the relationships among the key variables for the proposed model are temporal in nature. Although the peak period of the COVID-19 pandemic for each country and region are different and only last a few months, future research should consider applying a prospective design to follow the long-term impacts of the stressors on the mental health and sleep quality of nurses. Secondly, we asked participants to recall the occupational stressors, mental health problems, and sleep difficulty during the COVID-19 pandemic in a retrospective way. Although it is not feasible to collect data from nurses while they were busy taking care of COVID-19 patients during the pandemic, there might be bias using the recall method. Future research should consider collecting data using brief scales and collecting dairy data for evaluating the stressors, mental health, and sleep quality. Thirdly, there were 40.2% of the nurses in our survey that had been taking care of COVID-19 patients. To increase variances and to ensure that we could recruit a large enough sample of participants, we did not set an inclusion criterion that participants should be nurses who have been taking care of COVID-19 patients. Future studies should consider examining the stressors, mental health, and sleep quality issues of the nurses who have taken care of COVID-19 patients during the peak of the pandemic. Fourthly, in the current study we only examined two important mediators of cognitive fusion and cognitive reappraisal, without examining other important mediators such as social support. Previous studies revealed that social support was positively related to sleep quality and negatively related to the mental health problems of anxiety and stress among nurses (Liu et al., 2020; Xiao et al., 2020). In addition to the cognitive strategies of cognitive defusion and cognitive reappraisal, future studies may also consider examining and promoting social support for nurses to deal with their mental health and sleep problems (H. Cai, Tu, et al., 2020).

5. Conclusions

Based on a proposed mediation model, the current study examined and confirmed the relationships among occupational stressors, cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty among Chinese nurses during the COVID-19 pandemic. Significant direct links from occupational stressors to cognitive fusion, cognitive reappraisal, mental health problems, and sleep difficulty were revealed. In addition, the mediating roles of cognitive fusion and cognitive reappraisal on the link from occupational stressors to mental health problems were confirmed. The indirect link from occupational stressors to sleep difficulty via cognitive fusion and mental health problems were significant but not for cognitive reappraisal. The link from occupational stressors to sleep difficulty via the sequential mediation of cognitive fusion and mental health as well as cognitive reappraisal and mental health were demonstrated. Findings from this study indicate that the two important mediators, cognitive fusion and cognitive reappraisal,

could be incorporated into future training programs for nurses to better prepare them in the fight against COVID-19 and other potential future pandemics.

Author statement contributors

All authors have made substantial contributions to all of the following: (a) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (b) drafting the article or revising it critically for important intellectual content, and (c) final approval of the version to be submitted.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethics approval

Research ethics approval was obtained from Research Ethics Committee (REC) of Hong Kong Baptist University (REC/19–20/0458).

Declaration of competing interest

The authors declare that there are no conflicts of interests.

Acknowledgements

The authors would like to thank all the nurses who participated in the current study and for their great contribution in saving lives and bring the pandemic under control in China.

References

Alvaro, P. K., Roberts, R. M., & Harris, J. K. (2013). A systematic review assessing bidirectionality between sleep disturbances, anxiety, and depression. *Sleep, 36*(7), 1059–1068. https://doi.org/10.5665/sleep.2810

Baglioni, C., Spiegelhalder, K., Lombardo, C., & Riemann, D. (2010). Sleep and emotions: A focus on insomnia. *Sleep Medicine Reviews, 14*, 227–238. https://doi.org/10.1016/j.smrv.2009.10.007

Ballesio, A., Lombardo, C., Lucidi, F., & Violani, C. (2020). Caring for the carers: Advice for dealing with sleep problems of hospital staff during the COVID-19 outbreak. *Journal of Sleep Research*. , Article e13096. https://doi.org/10.1111/jsr.13096

Barrett, K., & Stewart, I. (2020). A preliminary comparison of the efficacy of online Acceptance and Commitment Therapy (ACT) and Cognitive Behavioural Therapy (CBT) stress management interventions for social and healthcare workers. *Health and Social Care in the Community*. https://doi.org/10.1111/hsc.13074

Blake, H., Bermingham, F., Johnson, G., & Tabner, A. (2020). Mitigating the psychological impact of COVID-19 on healthcare workers: A digital learning package. *International Journal of Environmental Research and Public Health, 17*(9), 2997. https://doi.org/10.3390/ijerph17092997

Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Hoch, C. C., Yeager, A. L., & Kupfer, D. J. (1991). Quantification of subjective sleep quality in healthy elderly men and women using the Pittsburgh Sleep Quality Index (PSQI). *Sleep, 14*, 331–338.

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*(2), 193–213.

Cai, Q., Feng, H., Huang, H., et al. (2020a). The mental health of frontline and non-frontline medical workers during the coronavirus disease 2019 (COVID-19) outbreak in China: A case-control study. *Journal of Affective Disorders, 275*, 210–215. https://doi.org/10.1016/j.jad.2020.06.031

Cai, H., Tu, B., Ma, J., Chen, L., Fu, L., Jiang, Y., et al. (2020b). Psychological impact and coping strategies of frontline medical staff in Hunan between January and March 2020 during the outbreak of coronavirus disease 2019 (COVID-19) in Hubei, China. *Medical Science Monitor, 26*. https://doi.org/10.12659/MSM.924171. e924171-1.

Chen, Y.-C., Guo, Y.-L. L., Lin, L.-C., Lee, Y.-J., Hu, P.-Y., Ho, J.-J., et al. (2020). Development of the nurses' occupational stressor scale. *Environmental Research and Public Health, 17*(2), 649. https://doi.org/10.3390/ijerph17020649

Deng, X., Liu, X., & Fang, R. (2020). Evaluation of the correlation between job stress and sleep quality in community nurses. *Medicine, 99*(4), Article e18822. https://doi.org/10.1097/MD.0000000000018822

Dong, H., Zhang, Q., Sun, Z., Sang, F., & Xu, Y. (2017). Sleep disturbances among Chinese clinical nurses in general hospitals and its influencing factors. *BMC Psychiatry, 17*(1), 241. https://doi.org/10.1186/s12888-017-1402-3

Duan, L., & Zhu, G. (2020). Psychological interventions for people affected by the COVID-19 epidemic. *The Lancet Psychiatry, 7*, 300–302. https://doi.org/10.1016/S2215-0366(20)30073-0

Du, J., Dong, L., Wang, T., Yuan, C., Fu, R., Zhang, L., & Bouey, J. (2020). Psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. *General Hospital Psychiatry, 67*, 144–145. https://doi.org/10.1016/j.genhosppsych.2020.03.011

Edwards, D., & Burnard, P. (2003). A systematic review of stress and stress management interventions for mental health nurses. *Journal of Advanced Nursing, 42*(2), 169–200. https://doi.org/10.1046/j.1365-2648.2003.02600.x

Frögéli, E., Djordjevic, A., Rudman, A., Livheim, F., & Gustavsson, P. (2016). A randomized controlled pilot trial of acceptance and commitment training (ACT) for preventing stress-related ill health among future nurses. *Anxiety, Stress & Coping, 29*(2), 202–218. https://doi.org/10.1080/10615806.2015.1025765

Gillanders, D. T., Bolderston, H., Bond, F. W., Dempster, M., Flaxman, P. E., Campbell, L., et al. (2014). The development and initial validation of the cognitive fusion questionnaire. *Behavior Therapy, 45*(1), 83–101. https://doi.org/10.1016/j.beth.2013.09.001

Goldberg, D. P., Gater, R., Sartorius, N., Ustun, T. B., Piccinelli, M., Gureje, O., et al. (1997). The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychological Medicine, 27*, 191–197. https://doi.org/10.1017/S0033291796004242

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships and well-being. *Journal of Personality and Social Psychology, 85*(2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348. 348

Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behaviour Research and Therapy, 44*(1), 1–25. https://doi.org/10.1016/j.brat.2005.06.006

Hsieh, M. L., Li, Y. M., Chang, E. T., Lai, H. L., Wang, W. H., & Wang, S. C. (2011). Sleep disorder in Taiwanese nurses: A random sample survey. *Nursing and Health Sciences, 13*(4), 468–474. https://doi.org/10.1111/j.1442-2018.2011.00641.x|

Huang, Y., & Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: A web-based cross-sectional survey. *Psychiatry Research, 288*, 112954. https://doi.org/10.1016/j.psychres.2020.112954

Jackson, D., Anders, R., Padula, W. V., Daly, J., & Davidson, P. M. (2020). Vulnerability of nurse and physicians with COVID-19: Monitoring and surveillance needed. *Journal of Clinical Nursing, 29*, 3584–3587. https://doi.org/10.1111/jocn.15347

Kaipainen, K., Välkkynen, P., & Kilkku, N. (2017). Applicability of acceptance and commitment therapy-based mobile app in depression nursing. *Translational Behavioral Medicine, 7*(2), 242–253. https://doi.org/10.1007/s13142-016-0451-3

Kang, L., Li, Y., Hu, S., Chen, M., Yang, C., Yang, B. X., … Chen, J. (2020a). The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. *The Lancet Psychiatry, 7*(3), e14. https://doi.org/10.1016/S2215-0366(20)30047-X

Kang, L., Ma, S., Chen, M., Yang, J., Wang, Y., Li, R., & Hu, S. (2020b). Impact on mental health and perceptions of psychological care among medical and nursing staff in wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study. *Brain, Behavior, and Immunity, 87*, 11–17. https://doi.org/10.1016/j.bbi.2020.03.028

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., et al. (2020). Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Network Open, 3*(3). https://doi.org/10.1001/jamanetworkopen.2020.3976. e203976-e203976.

Lancee, J., Eisma, M. C., van Zanten, K. B., & Topper, M. (2017). When thinking impairs sleep: Trait, daytime and nighttime repetitive thinking in insomnia. *Behavioral Sleep Medicine, 15*(1), 53–69. https://doi.org/10.1080/15402002.2015.1083022

Levin, M. E., Hildebrandt, M. J., Lillis, J., & Hayes, S. C. (2012). The impact of treatment components suggested by the psychological flexibility model: A meta-analysis of laboratory-based component studies. *Behavior Therapy, 43*(4), 741–756. https://doi.org/10.1016/j.beth.2012.05.003

Liang, Y., Wang, L., & Yin, X. (2016). The factor structure of the 12-item general health questionnaire (GHQ-12) in young Chinese civil servants. *Health and Quality of Life Outcomes, 14*(1), 1–9. https://doi.org/10.1186/s12955-016-0539-y

Liu, Q., Luo, D., Haase, J. E., Guo, Q., Wang, X. Q., Liu, S., et al. (2020). The experiences of health-care providers during the COVID-19 crisis in China: A qualitative study. *The Lancet Global Health, 8*, e790–e798. https://doi.org/10.1016/S2214-109X(20)30204-7

Li, C. H., & Wu, J. J. (2020). Psychometric evaluation of the Chinese version of the emotion regulation questionnaire in Taiwanese college students. *Assessment, 27*(6), 1300–1309. https://doi.org/10.1177/1073191118773875

Lu, W., Wang, H., Lin, Y., & Li, L. (2020). Psychological status of medical workforce during the COVID-19 pandemic: A cross-sectional study. *Psychiatry Research, 228*, 112936. https://doi.org/10.1016/j.psychres.2020.112936

Maben, J., & Bridges, J. (2020). Covid-19: Supporting nurses' psychological and mental health. *Journal of Clinical Nursing, 29*, 2742–2750. https://doi.org/10.1111/jocn.15307

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*(1), 99–128. https://doi.org/10.1207/s15327906mbr3901_4

Marsh, H. W., Hau, K.-T., & Grayson, D. (2005). Goodness of fit in structural equation models. In A. Maydeu-Olivares, & J. J. McArdle (Eds.), *Multivariate applications book series. Contemporary psychometrics: A festschrift for roderick P. McDonald* (pp. 275–340). Lawrence Erlbaum Associates Publishers.

Mo, Y., Deng, L., Zhang, L., Lang, Q., Liao, C., Wang, N., et al. (2020). Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic. *Journal of Nursing Management, 28*, 1002–1009. https://doi.org/10.1111/jonm.13014

Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V. G., Papoutsi, E., & Katsaounou, P. (2020). Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. *Brain, Behavior, and Immunity, 88*, 901–907. https://doi.org/10.1016/j.bbi.2020.05.026

Qiu, D., Yu, Y., Li, R. Q., Li, Y. L., & Xiao, S. Y. (2020). Prevalence of sleep disturbances in Chinese healthcare professionals: A systematic review and meta-analysis. *Sleep Medicine, 67*, 258–266. https://doi.org/10.1016/j.sleep.2019.01.047

Qi, J., Xu, J., Li, B. Z., Huang, J. S., Yang, Y., Zhang, Z. T., et al. (2020). The evaluation of sleep disturbances for Chinese frontline medical workers under the outbreak of COVID-19. *Sleep Medicine, 72*, 1–4. https://doi.org/10.1016/j.sleep.2020.05.023

Saedpanah, D., Salehi, S., & Moghaddam, L. F. (2016). The effect of emotion regulation training on occupational stress of critical care nurses. *Journal of Clinical and Diagnostic Research, 10*(12), VC01–VC04. https://doi.org/10.7860/JCDR/2016/23693.9042

Salari, N., Khazaie, H., Hosseinian-Far, A., Khaledi-Paveh, B., Ghasemi, H., Mohammadi, M., et al. (2020). The effect of acceptance and commitment therapy on insomnia and sleep quality: A systematic review. *BMC Neurology, 20*(1), 1–18. https://doi.org/10.1186/s12883-020-01883-1

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7*(4), 422–445. https://doi.org/10.1037/1082-989X.7.4.422

Sun, N., Shi, S., Jiao, D., Song, R., Ma, L., Wang, H., Wang, H., et al. (2020). A qualitative study on the psychological experience of caregivers of COVID-19 patients. *American Journal of Infection Control, 48*(6), 592–598. https://doi.org/10.1016/j.ajic.2020.03.018

Teng, Z., Wei, Z., Qiu, Y., et al. (2020). Psychological status and fatigue of frontline staff two months after the COVID-19 pandemic outbreak in China: A cross-sectional study. *Journal of Affective Disorders, 275*, 247–252. https://doi.org/10.1016/j.jad.2020.06.032

Tsai, P. S., Wang, S. Y., Wang, M. Y., Su, C. T., Yang, T. T., Huang, C. J., et al. (2005). Psychometric evaluation of the Chinese version of the Pittsburgh Sleep Quality Index (CPSQI) in primary insomnia and control subjects. *Quality of Life Research, 14*, 1943–1952. https://doi.org/10.1007/s11136-005-4346-x

Wang, C., Horby, P. W., Hayden, F. G., & Gao, G. F. (2020a). A novel coronavirus outbreak of global health concern. *The Lancet, 395*, 470–473. https://doi.org/10.1016/S0140-6736(20)30185-9

Wang, S., Xie, L., Xu, Y., Yu, S., Yao, B., & Xiang, D. (2020b). Sleep disturbances among medical workers during the outbreak of COVID-2019. *Occupational Medicine, 70*(5), 364–369. https://doi.org/10.1093/occmed/kqaa074

Wilkins, J. (2014). The use of cognitive reappraisal and humour as coping strategies for bullied nurses. *International Journal of Nursing Practice, 20*(3), 283–292. https://doi.org/10.1111/ijn.12146

Wu, W., Zhang, Y., Wang, P., Zhang, L., Wang, G., Lei, G., & Huang, F. (2020). Psychological stress of medical staffs during outbreak of COVID-19 and adjustment strategy. *Journal of Medical Virology, 92*, 1962–1970. https://doi.org/10.1002/jmv.25914

Xiang, Y., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., et al. (2020). Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *The Lancet Psychiatry, 7*, 228–229. https://doi.org/10.1016/S2215-0366(20)30046-8

Xiao, H., Zhang, Y., Kong, D., Li, S., & Yang, N. (2020). The effects of social support on sleep quality of medical staff treating patients with coronavirus disease 2019 (COVID-19) in January and February 2020 in China. *Medical Science Monitor, 26*. https://doi.org/10.12659/MSM.923549. e923549-1.

Xu, W., Wu, J., & Cao, L. (2020). COVID-19 pandemic in China: Context, experience and lessons. *Health Policy and Technology, 9*, 633–678. https://doi.org/10.1016/j.hlpt.2020.08.006

Yu, C. Y. (2002). *Evaluating cutoff criteria of model fit indices for latent variable models with binary and continuous outcomes* (Vol. 30). Los Angeles, CA: University of California, Los Angeles.

Zhang, C.-Q., Chung, P.-K., Si, G., & Gucciardi, D. F. (2016). Measuring decentering as a unidimensional construct: The development and initial validation of the decentering scale for sport. *Psychology of Sport and Exercise, 24*, 147–158. https://doi.org/10.1016/j.psychsport.2016.02.006

Zhang, J., Wu, W., Zhao, X., & Zhang, W. (2020). Recommended psychological crisis intervention response to the 2019 novel coronavirus pneumonia outbreak in China: A model of west China hospital. *Precision Clinical Medicine, 3*(1), 3–8. https://doi.org/10.1093/pcmedi/pbaa006

Zhao, K., Zhang, G., Feng, R., Wang, W., Xu, D., Liu, Y., et al. (2020). Anxiety, depression and insomnia: A cross-sectional study of frontline staff fighting against COVID-19 in wenzhou, China. *Psychiatry Research, 292*, 113304. https://doi.org/10.1016/j.psychres.2020.113304

Zhou, Y., Yang, Y., Shi, T., Song, Y., Zhou, Y., Zhang, Z., et al. (2020). Prevalence and demographic correlates of poor sleep quality among frontline health professionals in liaoning province, China during the COVID-19 outbreak. *Frontiers in Psychiatry, 11*, 520. https://doi.org/10.3389/fpsyt.2020.00520

Zhuo, K., Gao, C., Wang, X., Zhang, C., & Wang, Z. (2020). Stress and sleep: A survey based on wearable sleep trackers among medical and nursing staff in wuhan during the COVID-19 pandemic. *General Psychiatry, 33*, Article e100260. https://doi.org/10.1136/gpsych-2020-100260

Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., et al.Niu, P. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *New England Journal of Medicine, 382*, 727–733. https://doi.org/10.1056/NEJMoa2001017