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EMPIRICAL RESEARCH QUANTITATIVE

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Relationship between work engagement and healthy work environment among Chinese ICU nurses: The mediating role of psychological capital

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Abstract

Aim: To evaluate the relationship between healthy work environment and work engagement considering the effect of psychological capital among ICU nurses.

Design: The study was cross-sectional design.

Methods: The subjects were 671 registered nurses from 20 ICUs in 18 general hospitals in Shandong province between October 2021 and December 2021. The questionnaires testing nurses' perception of healthy work environment, their work engagement, and psychological capital were used. Structural equation modeling was used to explore their relationship.

Results: Work engagement was positively affected by a healthy work environment and psychological capital. The structural equation modeling showed psychological capital mediated the relationship between healthy work environment and their work engagement.

Patient or Public Contribution: There were 681 clinical nurses reported at public contribution for responding to the questionnaires and providing valuable data for the study and there was no patient contribution in this study.

KEYWORDS
healthy work environment, intensive care unit, mediating role, psychological capital, structural equation modelling, work engagement

1 | INTRODUCTION

Increasing work-related pressure and staffing shortages in intensive care units (ICUs) have caused new workforce redesign initiatives in the healthcare field. Many of these initiatives have targeted models of nursing work delivery (Havaei et al., 2019). One of the most popular models about nursing work delivery is the job demand–resource (JD-R) model. The JD-R model is restricted to a limited set of predictor variables related to the physical, psychological, social, and organizational aspects of the job (Bakker & Demerouti, 2017). In particular, job resources affect motivation or work engagement when job demands are high. In this study, we examined the effects of two important predictors, one organizational variable and one personal variable, on work engagement among nurses in the ICU, a department with high work demand.

A nurse's work environment is defined as the setting that facilitates or constrains professional nursing practice. It is known that work environment plays a key role in influencing nursing care quality and has been linked to patient outcomes (Hegazy et al., 2021). It is also recognized as a key predictor of job-related outcomes such as job satisfaction, job engagement, and turnover (Huang et al., 2021; Lake et al., 2019). Creating a healthy working environment for nurses is a topic of global interest because improving working conditions in hospitals is critical to maintaining adequate nurse staff, ensuring high quality patient care, and achieving high nurse engagement and retention. Psychological capital (PsyCap) is defined as an individual's positive state of psychological development. PsyCap is characterized by (a) having confidence (self-efficacy) to take on challenging tasks and the will to put in the effort to accomplish the tasks; (b) optimism about succeeding now and in the future; (c) persevering toward goals and, when necessary, redirecting efforts in order to succeed; and (d) bouncing back and even beyond adversity (resiliency) to achieve success. (Hystad et al., 2014). PsyCap is positively correlated with positive employee attitudes, behaviours, and performance, including job satisfaction and work engagement, while PsyCap is negatively associated with nurse burnout and intent to leave (An et al., 2020; Guo & Zhu, 2018).

2 | BACKGROUND

Working in the ICU is challenging because of pressure from end-of-life care issues, ethical dilemma from decision-making, continuous human suffering, disproportionate care, poor communication between the nurse and patients, and various demands from family members (Alhussaini, 2021; Kompanje et al., 2013; Lantos, 2018). In addition, ICU professionals must constantly maintain and expand their skills to provide the treatment required by patients (Henriksen et al., 2021). ICU nurses have higher rates of burnout than general care nurses, and nearly 86% of ICU nurses may have burnout syndrome (Costa & Moss, 2018).

In China, the reported ratio of nurses to patients in the ICU is1 to 2.5–3. However, the actual radio is lower in some hospitals. According to the anesthesia and intensive care standards of the Polish Association of Anesthesiology and Intensive Care, the nurse-to-patient ratio should be 1:1 to 1.5. The relatively low ratio in China could cause work-related problems such as high workload and burnout. Furthermore, the development of critical care medicine has increased the needed nurse-to-bed ratio because more specialized critical care is required, including high-quality care (Falk & Wallin, 2016; Law et al., 2018), ventilator-associated pneumonia treatment, and adverse event protection (Hugonnet et al., 2007). Therefore, researchers and nursing managers seek to identify ways to improve work engagement among nurses to ensure high-quality nursing services.

Work engagement (WE) refers to a persistent positive work-related state of mind characterized by vigor, dedication, and absorption (Schaufeli et al., 2002). A large body of research suggests that high WE can improve the care quality and decrease burnout rate and turnover (Cao & Chen, 2021; Loerbroks et al., 2017; Wee & Lai, 2021). Research on how to improve work engagement among nurses suggests the importance of creating a healthy work environment (HWE; Li et al., 2019).

As recognized by the American Association of Critical Care Nurses (AACN), HWE plays an important role in the delivery of quality health care. HWE can affect the nurse retention, satisfaction, and decision-making along with nurse communication skills and respect (Ulrich et al., 2019). However, studies on HWE in ICUs remain rare in China and worldwide.

PsyCap is another important concept related to work engagement. PsyCap is defined as a positive psychological state characterized by self-efficacy, optimism, hope, and resiliency (Luthans et al., 2008). PsyCap may benefit the outcomes of both employees and organizations (Durukan Köse et al., 2018). Several researches have explored the relationship between PsyCap and employees' work attitudes, behaviors, and performance (Avey et al., 2011). Higher levels of PsyCap lead to higher levels of performance over a longer periods of time (Nordin et al., 2019).Self-efficacy, hope, resilience, and optimism along with overall PsyCap have been shown to be positively related to WE (Joo et al., 2016).

According to the JD-R model, WE is determined by the employee's resources (i.e., job and personal resources) and job demand (Van den Broeck et al., 2017). Job resources can motivate the worker to foster their work willingness to dedicate their efforts and abilities to work task. Work environments can offer organizational resources, whilePsyCap can provide personal resources (self-efficacy, optimism, and self-esteem). However, it is not clear how HWE affects work engagement, and the relationships among HWE, PsyCap, and work engagement require further exploration, particularly in ICU nurses.Therefore, we conducted the study to (1) explore the levels of HWE, PsyCap, and WE among Chinese ICU nurses and (2) examine the relationships among HWE, PsyCap, and work engagement in ICU nurses in China. Specifically, we tested three hypotheses:

Hypothesis 1. Work engagement is directly affected by perceived HWE.

Hypothesis 2. Work engagement is directly affected by PsyCap.

Hypothesis 3. The effect of HWE on job engagement among ICU nurses is mediated by PsyCap.

3 | THE STUDY

3.1 | Aim

The aim of this study was to explore the relationship between HWE and WE in consideration of the effect of PsyCap in ICU nurses.

3.2 | Design

The study was cross-sectional.

3.3 | Participants

Clinical nurses working in the ICU were surveyed, and the inclusion criteria were as follows: (1) clinical registered nurse; (2) had been worked in the ICU for more than 1 year; and (3) agreed to participate in the study and the nurses who (1) nursing workers for advanced study and practice; (2) on maternity leave; (3) suffering from serious illness; (4) unwillingness to participate in the study are excluded.

3.4 | Sample size analysis

The number of subjects required for Structural Equations Model (SEM) in this study was calculated by the thumb rules from Tinsley and Tinsley that a ratio of the number of people (*N*) to the number of measured variables (*p*) would be 5–10 (Tinsley & Tinsley, 1987). The total number of the measured variables was 53, and the sample size would be 530. Considering a 20% loss to follow-up, a sample size of at least 636 is required. In addition, according to Schumacher & Lomax (2015), in SEM, the sample can get as high as 100–500 or more per study. At last, questionnaires were distributed to 681 nurses from 20 ICUs in 18 general hospitals in Shandong province.

3.5 | Data collection

Data collection occurred between Octobe and December 2021, and 681 nurses working in the ICU from 20 ICUs in 18 general hospitals in Shandong province were surveyed. Permission was allowed by the ICU nurse managers. The potential participants were clearly explained about the study-related informed consent, voluntary participation, and the anonymity. The questionnaires were distributed using Questionnaire Star, an electronic questionnaire platform. The link of the electronic questionnaire was sent to ICU nurse managers via WeChat, and the nurse leaders distributed it to the nurses.Finally, the questionnaires that were fully completed without logical errors were analyzed.

The perceived HWE was evaluated using a Chinese version of the AACN Critical Care Nurse Work Environment Survey instrument (Ding et al., 2019) based on 18 items encompassing six dimensions: effective decision making (six items); appropriate staffing (six items); true collaboration (six items); meaningful recognition (six items); skilled communication (six items); and authentic leadership (six items). Each item was scored in the range of 1–5, with higher scores indicating greater HWE. The Cronbach's α value of HWE was 0.908, and the test–retest correlation coefficient was 0.870.

WE was tested by the Chinese version of the Utrecht Work Engagement Scale (C-UWES; Zhang & Gan, 2005). The UWES contains 15 items in three subscales: vigor (six items), dedication (four items), and absorption (five items). Each item was rated from 1 to 7, with higher scores indicating a higher engagement. The Cronbach's α value of the scale was 0.90 (0.767 for vigor, 0.735 for dedication, and 0.753 for absorption).

PsyCap was measured using the Chinese version of the PsyCap scale (Lou, 2010), which includes 20 items in four subscales: self-efficacy (six items), hope (six items), optimism (three items), and resiliency (five items). The Cronbach's α value for this scale was 0.854. Each item was scored in the range of 1–6. The scales were rated as follows: mean ≤ 2.25 very low, mean: 2.26–3.5, lower, mean: medium: 3.51–4.75 and mean: high ≥ 4.76 (Juan, 2015).

3.6 | Ethical considerations

Research Ethics Committee approval was obtained from Ethics Committee of the hospital. Participants have the right to informed consent and voluntary participation. Informed consent to participate was obtained after the study contents, purposes, and protocols, data confidentiality and anonymity procedures, and participants' freedom to discontinue the study had been explained.

3.7 | Data analysis

SPSS 25.0 was used for descriptive analysis, and AMOS 24.0 was used to construct the structural equation models (SEM). In the SEM, the dimension scores of each scale were considered as measurement variables, and the composite scores of each scale were considered as latent variables. The covariance matrix was estimated by the maximum likelihood method, and the direct and indirect effects were tested by bootstrap test. The model was considered to agree with the data when the ratio of chi-square to degrees of freedom (χ^2/df ≤ 5), standardized root mean square residual index (SRMR) ≤ 0.05, root-mean-square error of approximation (RMSEA) ≤ 0.08, goodness-of-fit index (GFI) ≥ 0.9, and the normed fit index (NFI) ≥ 0.9, incremental fit index (IFI) ≥ 0.9, Tucker–Lewis index (TLI) ≥ 0.9, comparative fit index (CFI) ≥ 0.9 (Wu, 2020).

3.8 | Validity, reliability, and rigor

All questionnaires used in this study have been adopted for and used previously in China, and the reliability and internal consistency were found to be acceptable.

4 | RESULTS

4.1 | Data description

A total of 681 nurses were investigated, and the data from 671 nurses (98.4%) were analyzed. Most of the participants were female (544, 81.81%), married (383, 57.1%), and contract employees

(506, 75.4%). Regarding educational background, 525 (78.2%) held a Bachelors' degree or above. In terms of work experience, 349 (52%) nurses had <6 years of work experience, 181 (27%) had between 6 and 10 years, and 141 (21%) had over 10 years of work experience.

4.2 | Scores

Medium levels of HWE, work engagement, and PsyCap were found among the ICU nurses. The mean HWE score was 3.70 with a standard deviation (SD) of 0.69. The HWE score was below 3.00 for 15.35% of participants, and the dimension with the lowest score was true collaboration. The mean work engagement score was 3.91 (SD = 1.48), and 28.76% of participants had work engagement scores below 3.00. The mean PsyCap score was 4.70 (SD = 0.85); 40.24% of participants had high PsyCap sores (>5; Table 1).

4.3 | Model testing

The correlation matrix of the all the variables is shown in Table 2. HWE was positively correlated with PsyCap ($r = 0.535$, $p < 0.01$) and work engagement ($r = 0.341$, $p < 0.01$).

The SEM between the three variables revealed a good discriminant validity (Table 2). Table 3 presents the path coefficients between various structural variables. Table 4 shows the detailed fit indices of the model indicating a good fit of the data. The path coefficients for each variable of the model are shown in Figure 1. The bootstrap test suggested that the direct effect of HWE on WE was insignificant ($\beta = 0.031$), while the indirect effect was significant ($\beta = 0.320$), indicating that PsyCap fully mediated the effect of HWE on WE.

5 | DISCUSSION

We found a moderate level of WE in 671 ICU nurses, lower than the level of work engagement reported by (Ghazawy et al., 2019). We found moderate HWE and PsyCap scores, consistent with previous reports (Yang et al., 2020; Zhang et al., 2020). All the hypothesises were confirmed by the data, as discussed below.

5.1 | Relationship between HWE and work engagement

Li et al. (2019) reported a positive relationship between HWE and job engagement, which was confirmed in our study or ICU nurses (Hypothesis 1). We found a significant positive correlation between HWE and work engagement. Compared to other departments, ICUs often have higher nurse-to-patient ratios (1:2.0 during the day and 1:2.9 at night; Shen et al., 2020). Greater communication and collaboration between healthcare workers may contribute to increasing HWE; However, nurses in ICUs are usually under pressure because of the high demand for patient care, high workload, instrument alarms, frequently night shifts, and frequent rescue measures ("Advances in Patient Safety," 2008; Lewandowska et al., 2020), which can affect work engagement among nurses. In our study, the age, marital status, years of work experience, education level, job title, and hospital-grade different significantly among the participants. Therefore, to enhance nurse engagement, nurse managers should consistently take measures to create supportive work environments by providing sufficient decision-making autonomy, sufficient resources, and scheduling support to balance their job demands (Moloney et al., 2020; Ogata et al., 2021; Saunders et al., 2021).

5.2 | Relationship between PsyCap and WE

We also demonstrated that PsyCap is significantly correlated with WE among Chinese ICU nurses (Hypothesis 2). Empirical evidence suggests that exploiting the motivation of workers has the greatest effect on WE when job demands are high (Bonner, 2016; García-Iglesias et al., 2021). Abbas and Raja (2015) reported that PsyCap may encourage individuals to regard job demands in a positive way, making them more likely to thrive. PsyCap has a sound theoretical foundation for measuring performance in the workplace (Luthans & Youssef, 2004). In the present study, we found a moderate PsyCap level, higher than those reported previously (An et al., 2020; Zhu et al., 2021).This might be because nurses in the ICU inherently show optimism, self-efficacy, and resilience. Interestingly, no significant differences in the level of PsyCap were observed for any variables except gender, potentially because male nurses are generally more optimistic and resilient (Pan et al., 2017). PsyCap is an important concept in positive psychology that can be harnessed to improve work engagement.

5.3 | The mediating role of PsyCap on the association between HWE and WE

The most interesting finding of this study was that PsyCap fully mediated the association between HWE and WE. In other words, HWE affects the WE of nurses via PsyCap. This finding provides a more complete understanding of the interactions between HWE, PsyCap, and work engagement. PsyCap is of great significance to the self-cognition and behavior (Luthans et al., 2007). PsyCap can affect a person's psychological state, improve their ability to cope with the negative events and emotions, and facilitate a positive outlook about their work (Di Maggio et al., 2021). Thus, PsyCap could help nurses find the meaning of the work and

TABLE 1 Characteristics of participants and levels of HWE, PsyCap, and WE among ICU nurses.

	Health work environment		Psychological capital		Work engagement	
Variables	M ± SD	*t*/*F*	M ± SD	*t*/*F*	M ± SD	*t*/*F*
Gender						
Male (18.9%)	3.69 ± 0.73	−0.205	4.97 ± 1.02	3.362**	4.08 ± 1.57	1.366
Female (81.1%)	3.70 ± 0.68		4.64 ± 0.80		3.88 ± 1.47	
Age group, year						
≤ 25 (21.0%)	3.92 ± 0.62	5.306**	4.86 ± 0.86	1.708	4.53 ± 1.34	8.351**
26–30 (45.0%)	3.66 ± 0.69		4.69 ± 0.87		3.81 ± 1.51	
31–35 (22.2%)	3.57 ± 0.69		4.62 ± 0.85		3.66 ± 1.44	
36–40 (8.2%)	3.69 ± 0.77		4.62 ± 0.77		3.67 ± 1.44	
≥41 (3.6%)	3.72 ± 0.62		4.71 ± 0.73		3.74 ± 1.32	
Marital status						
Married (57.1%)	3.64 ± 0.72	−2.663**	4.68 ± 0.84	−0.933	3.76 ± 1.50	−3.042**
Single (42.9%)	3.78 ± 0.64		4.74 ± 0.87		4.11 ± 1.44	
Employment						
Permanent (24.6%)	3.71 ± 0.71	0.130	4.60 ± 0.79	−1.731	3.63 ± 1.45	−2.852**
Contract or Others (75.4%)	3.70 ± 0.68		4.73 ± 0.87		4.01 ± 1.48	
Length of work experience						
≤ 5 (52.0%)	3.81 ± 0.66	4.481**	4.79 ± 0.89	2.084	4.16 ± 1.46	5.116**
6–10 (27.0%)	3.57 ± 0.69		4.60 ± 0.78		3.61 ± 1.46	
11–15 (14.2%)	3.59 ± 0.73		4.64 ± 0.87		3.69 ± 1.48	
16–20 (4.3%)	3.63 ± 0.68		4.53 ± 0.74		3.75 ± 1.50	
≥21 (2.5%)	3.74 ± 0.69		4.76 ± 0.80		3.78 ± 1.33	
Education level						
Profession school (21.8%)	3.92 ± 0.72	11.524**	4.72 ± 0.93	1.439	4.01 ± 1.58	0.786
Junior college (76.6%)	3.65 ± 0.67		4.71 ± 0.83		3.90 ± 1.46	
College or above (1.6%)	3.24 ± 0.69		4.27 ± 0.84		3.48 ± 1.08	
Job title						
Nurse (34.6%)	3.85 ± 0.68	6.020**	4.74 ± 0.93	0.629	4.21 ± 1.47	4.860**
Junior Nurse (40.8%)	3.61 ± 0.68		4.69 ± 0.85		3.72 ± 1.51	
Nurse in charge (23.4%)	3.64 ± 0.69		4.66 ± 0.74		3.81 ± 1.41	
Deputy Chief Nurse or above (1.2%)	3.85 ± 0.58		5.00 ± 0.77		4.06 ± 0.93	
Hospital grade						
Grade III A (63.3%)	3.57 ± 0.65	17.530**	4.75 ± 0.91	1.755	3.98 ± 1.47	1.080
Grade III B (19.8%)	3.89 ± 0.71		4.63 ± 0.76		3.88 ± 1.49	
Grade II A (16.4%)	4.01 ± 0.67		4.62 ± 0.72		3.79 ± 1.55	
Grade III B (0.4%)	3.39 ± 0.53		4.05 ± 1.39		4.76 ± 1.11	
Health work environment	3.70 ± 0.69					
Psychological capital	4.70 ± 0.85					
Work engagement	3.91 ± 1.48					

Abbreviations: HWE, Health work environment; PsyCap, Psychological capital; WE, Work engagement.
**$p < 0.01$.

increase their willing to strengthen their WE. In contrast, HWE can promote hope, optimism, self-efficacy, and resilience among nurses to improve their work engagement (An et al., 2020; Guo & Zhu, 2018).

5.4 | Implications for nurse managers

To our knowledge, this study was the only one that has applied the JD-R model to ICU nurses. According to the JD-R model, coping

TABLE 2 Correlation matrix for the study variables.

	AVE	R^2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. HWE	0.690		1															
2. EDM			0.958**	1														
3. AS			0.949**	0.905**	1													
4. TC			0.927**	0.856**	0.836**	1												
5. MR			0.938**	0.879**	0.860**	0.855**	1											
6. SC			0.938**	0.868**	0.883**	0.845**	0.852**	1										
7. AL			0.955**	0.925**	0.901**	0.848**	0.873**	0.868**	1									
8. PsyCap	0.629		0.535**	0.501**	0.496**	0.539**	0.480**	0.499**	0.515**	1								
9. Self-efficacy			0.547**	0.512**	0.499**	0.557**	0.497*	0.507**	0.521**	0.915**	1							
10. Hope			0.510**	0.477**	0.474**	0.509**	0.455**	0.478**	0.493**	0.963**	0.844**	1						
11. Resiliency			0.447*	0.419**	0.414**	0.451**	0.402**	0.420**	424**	0.943**	0.802**	0.879**	1					
12. Optimism			0.474**	0.440**	0.448**	0.473**	0.419**	0.437**	0.469**	0.869**	0.695**	0.811**	0.800**	1				
13. WE	0.608		0.341**	0.304**	0.331**	0.341**	0.308**	0.312**	0.335**	0.586**	0.483**	0.570**	0.552**	0.585**	1			
14. Vigor			0.350**	0.310**	0.348**	0.331**	0.322**	0.325**	0.346**	0.574**	0.474**	0.561**	0.539**	0.568**	0.929**	1		
15. Dedication			0.322**	0.282**	0.305**	0.337**	0.290**	0.297**	0.312**	0.547**	0.449**	0.533**	0.514**	0.551**	0.954**	0.831**	1	
16. Absorption			0.292**	0.269**	0.284**	0.294**	0.260**	0.260**	0.288**	0.534**	0.441**	0.517**	0.505**	0.533**	0.938**	0.800**	0.849**	1
1&8 (r^2)		0.286																
1&13 (r^2)		0.116																
8&13 (r^2)		0.343																

Abbreviations: AL, authentic leadership; AS, appropriate staffing; EDM, effective decision making; HWE, healthy work environment; MR, meaningful recognition; PsyCap, Psychological capital; SC, skilled communication; TC, true collaboration; WE, work engagement.

*$p < 0.05$, **$p < 0.01$.

TABLE 3 Path coefficients of the models.

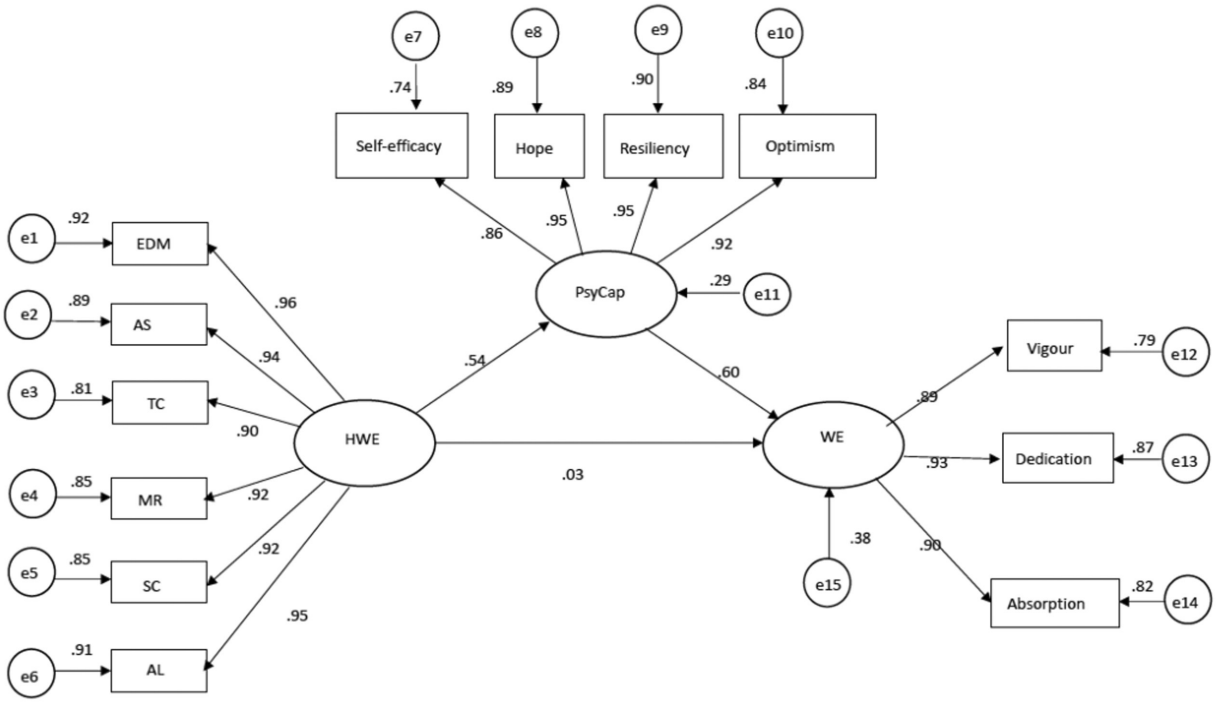
Model path		β^a	95% CI	*p*
Direct effect				
Work engagement (Y)	Health work environment (X)	0.025	[−0.055, 0.108]	0.533
Psychological capital (M)	Health work environment (X)	0.539	[0.481, 0.599]	0.001
Work engagement (Y)	Psychological capital (M)	0.604	[0.527, 0.674]	0.001
Indirect effect				
Work engagement (Y)	Psychological capital (M)	0.326	[0.271, 0.384]	0.001

[a]Standardized path coefficient.

TABLE 4 Fit indices of the models.

	Chi-Square	Chi-Square/df	SRMR	RMSEA	GFI	NFI	IFI	TLI	CFI
The model	259.3	4.182	0.035	0.069	0.945	0.976	0.982	0.977	0.982
The standard		≤5	≤0.05	≤0.08	≥0.90	≥0.90	≥0.90	≥0.90	≥0.90

Abbreviations: CFI, comparative fit index; GFI, goodness-of-fit index; IFI, incremental fit index; NFI, normed fit index; RMSEA, root-mean-square error of approximation; SRMR, standardized root-mean-square residual; TLI, Tucker–Lewis index.



HWE: healthy work environment; EDM: effective decision making; AS: appropriate staffing; TC: true collaboration; MR: meaningful recognition; SC: skilled communication; AL: authentic leadership; PsyCap: Psychological capital; WE: work engagement

FIGURE 1 The model. AL, authentic leadership; AS, appropriate staffing; EDM, effective decision making; HWE, healthy work environment; MR, meaningful recognition; PsyCap, psychological capital; SC, skilled communication; TC, true collaboration; WE, work engagement

strategies improve WE can be provided from the perspective of job resource (i.e., HWE created by managers). According to the AACN HWE standards, to improve the perceived HWE, nurse managers should establish a supportive, fair, and impartial work environment, provide job autonomy, maintain effective communications with nurses (Hegazy et al., 2021), empower nurses to participate in

important decisions, help nurses with career development, care about the well-being of nurses (Huang et al., 2021); improve the professionalism of nurses in critical care; and find nurses appropriate roles within multidisciplinary teams (Gottlieb et al., 2021; Wei et al., 2018). Besides, managers should provide appropriate pressure on nurses to make them stay active because a manageable workload can contribute to positive work attitude and motivation (Li et al., 2019). The PsyCap levels of nurses have been shown to be increased by group intervention, mindfulness-based stress reduction, and strength-based intervention to improve hope, self-efficacy, and optimism (Harty et al., 2015; Meyers & van Woerkom, 2017; Samouei & Ghasemi, 2015).

5.5 | Limitations

The study also showed some limitations. First, almost all the samples came from eastern China, and the results may not be generalizable to the whole country. Future research studies could include a larger sampling range. Second, the data for each variable originated at the same time from each nurse's self-report, and the cross-sectional study design may have resulted in common method bias. So, longitudinal multi-source data collection should be considered. Third, other factors may not be considered in this study, which may influence WE through mediating effects. Therefore, more variables should be considered for a further exploration. Finally, in the future, studies should be conducted with intervention designs.

6 | CONCLUSION

This study confirmed the associations between HWE, PsyCap, and WE among ICU nurses in China. The results demonstrate that both HWE and PsyCap have the ability to influence WE among nurses. Thus, improving both environment factors and individual PsyCap levels can contribute to increasing work engagement. This study also demonstrated the mediating effect of PsyCap, suggesting that nurse managers should not only improve the working environment but also intervene to enhance PsyCap among nurses. To address the shortage of nurses in the workforce, critical care managers have to address the following challenges: achieve high-quality patient care; train more professional critical care nurses to handle advanced treatment technology; and take measures to reduce turnover, improve retention, increase work engagement, and maintain active performance.

AUTHOR CONTRIBUTIONS

Xiujuan Xue, Jianhong Qiao, Cuiping Xu: Made substantial contributions to conception and design, or acquisition of data. Xiujuan Xue, Jianhong Qiao, Qiuyue Zhang: Involved in drafting the manuscript or revising it critically for important intellectual content. Yupei Li, Yeqing Wang, Jianhao Wang: Acquisition of data and analysis and interpretation of data. Xiujuan Xue, Jianhong Qiao, Yupei Li, Qiuyue Zhang, Yeqing Wang, Jianhao Wang, Cuiping Xu: Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. Xiujuan Xue, Jianhong Qiao, Yupei Li, Qiuyue Zhang, Yeqing Wang, Jianhao Wang, Cuiping Xu: Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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REFERENCES

Abbas, M., & Raja, U. (2015). Impact of psychological capital on innovative performance and job stress. *Canadian Journal of Administrative Sciences*, *32*, 128–138. https://doi.org/10.1002/cjas.1314

Alhussaini, A. (2021). Improve communicating uncertainty in intensive care unit with patient and family (ICU-PF). *Cureus*, *13*(12), e20837. https://doi.org/10.7759/cureus.20837

An, M., Shin, E. S., Choi, M. Y., Lee, Y., Hwang, Y. Y., & Kim, M. (2020). Positive psychological capital mediates the association between burnout and nursing performance outcomes among hospital nurses. *International Journal of Environmental Research and Public Health*, *17*(16), 5988. https://doi.org/10.3390/ijerph17165988

Avey, J. B., Reichard, R. J., Luthans, F., & Mhatre, K. H. (2011). Meta-analysis of the impact of positive psychological capital on employee attitudes, behaviors, and performance. *Human Resource Development Quarterly*, *22*(2), 127–152. https://doi.org/10.1002/hrdq.20070

Bakker, A. B., & Demerouti, E. (2017). Job demands-resources theory: Taking stock and looking forward. *Journal of Occupational Health Psychology*, *22*(3), 273–285. https://doi.org/10.1037/ocp0000056

Bonner, L. (2016). A survey of work engagement and psychological capital levels. *The British Journal of Nursing*, *25*(15), 865–871. https://doi.org/10.12968/bjon.2016.25.15.865

Cao, X., & Chen, L. (2021). Relationships between resilience, empathy, compassion fatigue, work engagement and turnover intention in haemodialysis nurses: A cross-sectional study. *Journal of Nursing Management*, *29*(5), 1054–1063. https://doi.org/10.1111/jonm.13243

Costa, D. K., & Moss, M. (2018). The cost of caring: Emotion, burnout, and psychological distress in critical care clinicians. *Annals of the American Thoracic Society*, *15*(7), 787–790. https://doi.org/10.1513/AnnalsATS.201804-269PS

Di Maggio, I., Ginevra, M. C., & Nota, L. (2021). The role of psychological Capital in Human Service Professionals' work experiences. *European Journal of Investigation in Health, Psychology and Education*, *11*(3), 639–648. https://doi.org/10.3390/ejihpe11030046

Ding, Z. Y., Zhuang, Y. Y., Chen, X. P., Li, Q. J., & Lao, Y. W. (2019). Reliability and validity of the Chinese version of AACN healthy work environment assessment tool. *Chinese Nursing Management*, *19*(1), 70–74.

Durukan Köse, S., Köse, T., & Ugurluoglu, Ö. (2018). The antecedent of organizational outcomes is psychological capital. *Health & Social Work*, *43*(3), 155–164. https://doi.org/10.1093/hsw/hly020

Falk, A. C., & Wallin, E. M. (2016). Quality of patient care in the critical care unit in relation to nurse patient ratio: A descriptive study. *Intensive & Critical Care Nursing*, *35*, 74–79. https://doi.org/10.1016/j.iccn.2016.01.002

García-Iglesias, J. J., Gómez-Salgado, J., Fagundo-Rivera, J., Romero-Martín, M., Ortega-Moreno, M., & Navarro-Abal, Y. (2021). Predictive factors for burnout and work engagement levels among doctors and nurses: A systematic review. *Revista Española de Salud Pública*, *95*, e202104046. (Factores predictores de los niveles de burnout y work engagement en médicos y enfermeras: una revisión sistemática.)

Ghazawy, E. R., Mahfouz, E. M., Mohammed, E. S., & Refaei, S. A. (2019). Nurses' work engagement and its impact on the job outcomes. *International Journal of Healthcare Management*, *14*(2), 320–327. https://doi.org/10.1080/20479700.2019.1644725

Gottlieb, L. N., Gottlieb, B., & Bitzas, V. (2021). Creating empowering conditions for nurses with workplace autonomy and agency: How healthcare leaders could Be guided by strengths-based nursing and healthcare leadership (SBNH-L). *Journal of Healthcare Leadership*, *13*, 169–181. https://doi.org/10.2147/jhl.S221141

Guo, B. M., & Zhu, A. F. (2018). The relationship among psychological capital psychological contract and work engagement in nurses. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi*, *36*(8), 614–617. https://doi.org/10.3760/cma.j.issn.1001-9391.2018.08.013

Harty, B., Gustafsson, J. A., Björkdahl, A., & Möller, A. (2015). Group intervention: A way to improve working teams' positive psychological capital. *Work*, *53*(2), 387–398. https://doi.org/10.3233/wor-152227

Havaei, F., MacPhee, M., & Dahinten, V. S. (2019). The effect of nursing care delivery models on quality and safety outcomes of care: A cross-sectional survey study of medical-surgical nurses. *Journal of Advanced Nursing*, *75*(10), 2144–2155. https://doi.org/10.1111/jan.13997

Hegazy, A. M., Ibrahim, M. M., Shokry, W. A., & El Shrief, H. A. (2021). Work environment factors in nursing practice. *Menoufia Nursing Journal*, *6*(2), 65–73. https://doi.org/10.21608/menj.2021.206247

Henriksen, K. F., Hansen, B. S., Wøien, H., & Tønnessen, S. (2021). The core qualities and competencies of the intensive and critical care nurse, a meta-ethnography. *Journal of Advanced Nursing*, *77*(12), 4693–4710. https://doi.org/10.1111/jan.15044

Huang, X., Wang, L., Dong, X., Li, B., & Wan, Q. (2021). Effects of nursing work environment on work-related outcomes among psychiatric nurses: A mediating model. *Journal of Psychiatric and Mental Health Nursing*, *28*(2), 186–196. https://doi.org/10.1111/jpm.12665

Hughes, R. G. (Ed.). (2008). *Patient safety and quality: An evidence-based handbook for nurses*. Advances in Patient Safety, Agency for Healthcare Research and Quality (US).

Hugonnet, S., Uçkay, I., & Pittet, D. (2007). Staffing level: A determinant of late-onset ventilator-associated pneumonia. *Critical Care*, *11*(4), R80. https://doi.org/10.1186/cc5974

Hystad, S. W., Bartone, P. T., & Eid, J. (2014). Positive organizational behavior and safety in the offshore oil industry: Exploring the determinants of positive safety climate. *The Journal of Positive Psychology*, *9*(1), 42–53. https://doi.org/10.1080/17439760.2013.831467

Joo, B.-K., Lim, D., & Kim, S. (2016). Enhancing work engagement: The roles of psychological capital, authentic leadership, and work empowerment. *Leadership & Organization Development Journal*, *37*, 1117–1134. https://doi.org/10.1108/LODJ-01-2015-0005

Juan, W. (2015). *Investigation about Relation among Psychological Capital, Job Burnout and Turnover Intention of Emergency Nurses* [master, Bengbu Medical College]. http://d--wanfangdata--com--cn--https.wanfangdata.qfsy.yuntsg.cn:7002/thesis/ChJUaGVzaXNOZXdTMjAyMjExMTkSB0Q2NjYyOTIaCHEyNGpud3c5

Kompanje, E. J., Piers, R. D., & Benoit, D. D. (2013). Causes and consequences of disproportionate care in intensive care medicine. *Current Opinion in Critical Care*, *19*(6), 630–635. https://doi.org/10.1097/mcc.0000000000000026

Lake, E. T., Sanders, J., Duan, R., Riman, K. A., Schoenauer, K. M., & Chen, Y. (2019). A meta-analysis of the associations between the nurse work environment in hospitals and 4 sets of outcomes. *Medical Care*, *57*(5), 353–361. https://doi.org/10.1097/mlr.0000000000001109

Lantos, J. D. (2018). Ethical problems in decision making in the neonatal ICU. *The New England Journal of Medicine*, *379*(19), 1851–1860. https://doi.org/10.1056/NEJMra1801063

Law, A. C., Stevens, J. P., Hohmann, S., & Walkey, A. J. (2018). Patient outcomes after the Introduction of statewide ICU nurse staffing regulations. *Critical Care Medicine*, *46*(10), 1563–1569. https://doi.org/10.1097/ccm.0000000000003286

Lewandowska, K., Weisbrot, M., Cieloszyk, A., Mędrzycka-Dąbrowska, W., Krupa, S., & Ozga, D. (2020). Impact of alarm fatigue on the work of nurses in an intensive care environment-asystematic review. *International Journal of Environmental Research and Public Health*, *17*(22), 8409. https://doi.org/10.3390/ijerph17228409

Li, B., Li, Z., & Wan, Q. (2019). Effects of work practice environment, work engagement and work pressure on turnover intention among community health nurses: Mediated moderation model. *Journal of Advanced Nursing*, *75*(12), 3485–3494. https://doi.org/10.1111/jan.14130

Loerbroks, A., Glaser, J., Vu-Eickmann, P., & Angerer, P. (2017). Physician burnout, work engagement and the quality of patient care. *Occupational Medicine (London)*, *67*(5), 356–362. https://doi.org/10.1093/occmed/kqx051

Lou, H. Z. (2010). Reliability and validity of psychological capital questionnaire verified in nurses. *Chinese Journal of Behavioral Medical Science*, *19*(9), 853–854.

Luthans, F., & Youssef, C. M. (2004). Human, social, and now positive psychological capital management: Investing in people for competitive advantage. *Organizational Dynamics*, *33*(2), 143–160. https://doi.org/10.1016/j.orgdyn.2004.01.003

Luthans, F., Youssef, C. M., & Avolio, B. J. (2007). *Psychological capital: Developing the humancompetitive edge*. Oxford University Press.

Luthans, K. W., Lebsack, S. A., & Lebsack, R. R. (2008). Positivity in healthcare: Relation of optimism to performance. *Journal of Health Organization and Management*, *22*(2), 178–188. https://doi.org/10.1108/14777260810876330

Meyers, M. C., & van Woerkom, M. (2017). Effects of a strengths intervention on general and work-related well-being: The mediating role of positive affect. *Journal of Happiness Studies*, *18*(3), 671–689.

Moloney, W., Fieldes, J., & Jacobs, S. (2020). An integrative review of how healthcare organizations can support hospital nurses to thrive at work. *International Journal of Environmental Research and Public Health*, *17*(23), 8757. https://doi.org/10.3390/ijerph17238757

Nordin, N., Rashid, Y., Panatik, S., & Rashid, A. H. (2019). Relationship between psychological capital and work engagement. *Journal of Research in Psychology*, *1*, 6–12. https://doi.org/10.31580/jrp.v1i4.1115

Ogata, Y., Sato, K., Kodama, Y., Morioka, N., Taketomi, K., Yonekura, Y., Katsuyama, K., Tanaka, S., Nagano, M., Ito, Y. M., & Kanda, K. (2021). Work environment for hospital nurses in Japan: The relationships between nurses' perceptions of their work environment and nursing outcomes. *Nursing Open*, *8*(5), 2470–2487. https://doi.org/10.1002/nop2.762

Pan, X., Mao, T., Zhang, J., Wang, J., & Su, P. (2017). Psychological capital mediates the association between nurses' practice environment and work engagement among Chinese male nurses. *International Journal of Nursing Sciences*, *4*(4), 378–383. https://doi.org/10.1016/j.ijnss.2017.09.009

Samouei, R., & Ghasemi, F. (2015). Role of mindfulness training on psychological capital of Isfahan University of Medical Sciences students. *International Journal of Educational and Psychological Researches*, *1*, 293. https://doi.org/10.4103/2395-2296.163936

Saunders, J., Sridaromont, K., & Gallegos, B. (2021). Steps to establish a healthy work environment in an academic nursing setting. *Nurse Educator*, *46*(1), 2–4. https://doi.org/10.1097/nne.0000000000000829

Schaufeli, W. B., Salanova, M., González-romá, V., & Bakker, A. B. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *Journal of Happiness Studies*, *3*, 71–92.

Schumacher, R. E., & Lomax, R. G. (2015). *A Beginner's guide to structural equation modeling* (4th ed.). Routledge.

Shen, Y., Jian, W., Zhu, Q., Li, W., Shang, W., & Yao, L. (2020). Nurse staffing in large general hospitals in China: An observational study. *Human Resources for Health*, *18*(1), 3. https://doi.org/10.1186/s12960-020-0446-5

Tinsley, H. E. A., & Tinsley, D. J. (1987). Uses of factor analysis in counseling psychology research. *Journal of Counseling Psychology*, *34*(4), 414–424. https://doi.org/10.1037/0022-0167.34.4.414

Ulrich, B., Barden, C., Cassidy, L., & Varn-Davis, N. (2019). Critical care nurse work environments 2018: Findings and implications. *Critical Care Nurse*, *39*(2), 67–84. https://doi.org/10.4037/ccn2019605

Van den Broeck, A., Elst, T. V., Baillien, E., Sercu, M., Schouteden, M., De Witte, H., & Godderis, L. (2017). Job demands, job resources, burnout, work engagement, and their relationships: An analysis across sectors. *Journal of Occupational and Environmental Medicine*, *59*(4), 369–376. https://doi.org/10.1097/jom.0000000000000964

Wee, K. Z., & Lai, A. Y. (2021). Work engagement and patient quality of care: A meta-analysis and systematic review. *Medical Care Research and Review*, *79*, 345–358. https://doi.org/10.1177/1077558721030388

Wei, H., Sewell, K. A., Woody, G., & Rose, M. A. (2018). The state of the science of nurse work environments in the United States: A systematic review. *International Journal of Nursing Sciences*, *5*(3), 287–300. https://doi.org/10.1016/j.ijnss.2018.04.010

Wu, M. L. (2020). *The structural equation model: AMOS operation and application* (2nd ed.). Chongqing University Press.

Yang, S., Huang, H., Qiu, T., Tian, F., Gu, Z., Gao, X., & Wu, H. (2020). Psychological capital mediates the association between perceived organizational support and work engagement among Chinese doctors. *Frontiers in Public Health*, *8*, 149. https://doi.org/10.3389/fpubh.2020.00149

Zhang, X., Ma, X., Liu, Y., & Li, Z. (2020). Investigation on nurses practice environment in tertiary hospitals in Shandong Province. *Chinese Journal of Nursing*, *55*(11), 1680–1684.

Zhang, Y. E., & Gan, Y. Q. (2005). The Chinese version of Utrecht work engagement scale: An examination of reliability and validity. *Chinese Journal of Clinical Psychology*, *13*(3), 268–270. https://doi.org/10.16128/j.cnki.1005-3611

Zhu, X., Shen, L., Du, P., & Guan, J. (2021). The mediating role of psychological capital between Dayadi stress and job burnout in female nurses with two children. *Translational Pediatrics*, *10*(10), 2449–2458. https://doi.org/10.21037/tp-21-375

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