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The relationship between transformational leadership and work engagement among intensive care unit nurses: the mediating function of organizational climate

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Abstract

Background The high attrition rate and nursing shortage have a negative impact on the stability and advancement of the nursing business. For this reason, it is imperative to delve into the factors influencing nurses' professional stability. Work engagement and transformational leadership are positively correlated with a decrease in nursing staff burnout. The aim of this study is to probe into the possible mediating function of organizational climate in this relationship.

Methods In this cross-sectional study, 359 intensive care unit (ICU) nurses completed self-reported questionnaires to rate the transformational leadership and organizational climate in their workplaces and their work engagement. A structural equation model was developed to validate the associations among the variables.

Results Transformational leadership, organizational climate and work engagement are all correlated. The relation between transformational leadership and work engagement is mediated by organizational climate.

Conclusions The results indicate that organizational climate serves as an intermediary factor between transformational leadership and work engagement in ICU nursing staff. The study facilitates a deep understanding into the mechanism by which transformational leadership affects work engagement. This lends credence to the proposal that thorough intervention techniques for organizational climate need to be developed. Nursing managers need to prioritize transformational leadership and execute initiatives to improve organizational climate to elevate work engagement in nurses.

Keywords Transformational leadership, Work engagement, Organizational climate, Nurse

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Introduction

The healthcare sector is an unique environment that undergoes escalating complexity and uncertainty, mainly related to decreasing resources, increasing costs, existing inefficiencies and heightened intricacy [1]. In this sector, nurses are the largest workforce group [2], and the stability and steady growth of the caring profession is crucial. However, the nursing industry worldwide suffers from issues of understaff and high turnover rate [3]. This has prompted the World Health Organization (WHO) to recognize the management of this shortfall as a critical priority [4]. Of various work settings of nurses, intensive care unit (ICU) is a specialized unit for centralized treatment, intensive care, and constant monitoring of patients with critical illnesses. ICU nurses often have to face long working hours, irregular shifts (including overnight duties), high intensity of work, heavy responsibilities, and confined working environment. Such characteristics as high-risk, high-intensity, and high-pressure [5] may result in lowered work motivation in the nurses and even the idea of leaving their jobs. This situation seriously threatens the stability of the nursing team. In addition, ICU nurses are required to have a high level of expertise and their training costs are high, which makes them difficult to replace, and the high turnover rate may increase the operation costs of hospital [6]. Therefore, it becomes particularly important to maintain the nurses in their positions. Currently, researchers are striving to ascertain the factors that can improve the retention rate of nurses [7, 8].

Work engagement (WE)

Work engagement (WE) refers to a positive emotional and cognitive state demonstrated at work [9, 10]. It is characterized by dedication, vigour and focus, reflecting a strong sense of identification and concentration at work. A range of studies have shown that WE in nurses helps reduce job burnout, alleviate occupational stress, decrease tendency to leave the job, increase career satisfaction, and promote professional success [9–13]. Nurses with high WE are enthusiastic for their work while not addicted to it. They work hard because they find it interesting and they can integrate into their work roles quickly. WE is an representation of an individual's attitude towards work, which is not easily changed and can affect organizational efficiency and productivity [14]. Researchers have extensively explored the influential factors for WE in nurses and discovered that it is impacted by not only individual subjective psychological factors but also external factors such as workload, leadership style, and organizational climate [15, 16]. To reduce the turnover rate of ICU nurses, it is crucial for hospitals to understand the antecedents of nurses' WE in high-stress working environments.

Transformational leadership (TL)

Transformational leadership (TL) refers to the ability to help organizational members to understand the importance of achieving organizational goals so as to arouse their higher level of needs, such as esteem and self-actualisation, thus motivating the members to genuinely willing to trade their rightful personal gains for organizational interests, ultimately resulting in better performance of the members than expected [17]. It is a style of leadership that emphasises value addition and human-centered development. The nursing industry is currently experiencing staff shortages and high rates of employee burnout, while leaders are considered critical in employee retention [18]. TL makes employees feel being supported by their organizations, and it fosters attachment among members. Such leadership builds strong connections between employees and the organization, thereby encouraging employees to endorse and support the organizational goals. In short, TL works through the process of social influence among members to create a mission-oriented culture within the organization [19]. Studies have indicated that TL can promote work engagement, enhance job performance, increase job satisfaction, and improve employee well-being, and it also plays a positive role in reducing work-related stress and burnout [1, 15, 18, 20–22]. However, research on TL among ICU nurses is scarce. In view of the situation in ICU nursing profession, it is critical to explore TL among ICU nurses and its complex impacts on the nursing profession.

Organizational climate (OC)

Organizational climate (OC) refers to the perception or feeling of members about the organizational environment, typically derived from the psychological perception of individual members about their work environment [23]. The OC of an organization exerts a significant influence on every member in it, subtly guiding the development of individuals as well as the entire organization. As a critical component of the organizational environment, OC directly influences employee behavior. It has thus been a heated topic in organizational behavior studies and is regarded as an important perspective for understanding employees' work attitudes and behaviours. Studies have demonstrated a positive correlation between OC and job performance [23, 24]. OC can influence and predict nurse turnover intention [25]. It has a negative impact on job alienation in nurses [26] and may enhance their WE [16]. By far, there is no documented research investigating OC in ICU nurses, this study was conducted in response to this paucity. For ICU nurses, OC has substantial influence on their career success, and it is of great significance to know how OC can be used to enhance their engagement in work. Studies have shown that transformational leaders play a role in developing

appropriate OC to achieve desired changes, and they also influence nurses' engagement by manipulating the team climate. To maintain sustained and healthy development of the ICU nursing profession, it is important to enhance WE of the nurses and facilitate them to adopt a positive attitude and create positive emotions to deal with stresses in work and life.

Theoretical framework

The present study adopts transformational leadership theory [27, 28] and group dynamics theory [29] as the research paradigms. According to TL theory, the head nurse as a leader can raise other nurses' dedication to work by leading them to perceive the importance of their tasks and thus put the organizational goals of the hospital above personal interests. Group dynamics theory suggests that both the head nurse and member nurses share the common goal of facilitating patient recovery, and they form a subgroup with its own organizational structure that exerts constraints and influences on the members therein. In the group structure, group leadership and group climate will impact group dynamics. According to TL theory and group dynamics theory, OC can be an important mediating variable for individual WE while TL is a prerequisite for WE. The conceptual framework presented in this study is constructed based on these two theories. We hypothesise that OC may play a mediating role between TL and WE in nurses.

Research hypothesis

A conceptual model for this study is proposed based on previous theoretical frameworks (Fig. 1). Given that TL is the independent variable, WE is the dependent variable, and OC serves as a moderator, the following hypotheses are proposed.

H1 TL is significantly and positively correlated with WE among ICU nurses.

H2 TL is significantly, positively connected with OC among ICU nurses.

H3 OC is positively linked with WE among ICU nurses.

H4 OC mediates the relationship between TL and WE among ICU nurses.

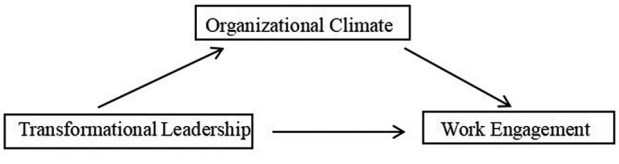

Fig. 1 Simplified model of the relationship between study variables

Significance of the study and research gap

The issues of high turnover rate and shortage of nurses deserve attention. Job engagement is crucial for the stability or this career, which is impacted by various factors. Enwereuzor et al. [15] identified a positive and significant predictive effect of TL on follower engagement. Abd-El et al. [30] surveyed the nursing staff of a Saudi Arabian university-hospital and found that the resilience and WE of the nurses increased with the increase in the support of transformational leaders and the practice of empowering leadership. Kalhor et al. [16] reported a boosting effect of positive and effective OC on nurse WE.

Previous studies have indicated that both TL and OC can enhance WE in nurses. However, the joint effect of the two has not yet been investigated. To gain a comprehensive understanding of the relationship between TL and WE, it is also necessary to examine the potential mediators in between. In this study, we explored OC as a possible mediator between TL and WE. By analyzing the connections among the three, we may provide targeted suggestions to boost WE in ICU nurses, empowering them to better engage in patient care and further realise their personal and social values. In doing so, our research endeavors to establish a more comprehensive theoretical framework for the influence of TL on WE. The investigation of the mediating effect of OC will expand the existing knowledge about TL and WE.

Purpose of the study

This study examined the relationship between TL and WE, with OC as the mediator.

Methods

Research design and participants

This study adopted a cross-sectional research design. Convenience sampling method was used to select ICU nurses from six tertiary hospitals (top-tier hospitals in China) in Shaanxi and Shanxi provinces, China, from July to August 2024 as the study population. The inclusion criteria are: (1) registered nurses who had completed their rotations and were stationed in ICU for long time; (2) informed consent and voluntary participation in the study. The exclusion criteria are: (1) temporary change to other departments during the survey period; (2) leave of absence during the survey period.

The sample size was determined according to Kendall (1975) [31]. There were totally 65 items in the questionnaire, and an additional 10% was included in case of potential loss of sample size due to incomplete work. Consequently, the sample size was calculated as $N=[(6+24+26+9)x5\times(1+10\%)]=358$, i.e., a minimum of 358 participants being needed. The survey ended up with 359 questionnaires collected.

Data collection

The questionnaire was distributed and responses were collected through an online questionnaire platform. Prior to the survey, we communicated with the hospitals involved in this study and the nursing departments of the hospitals to get their consent for participation. With the assistance of the hospital administrators, we sent an anonymized electronic version of the questionnaire to the nursing departments via WeChat, China's largest social networking platform, which was subsequently forwarded to the ICU nurses. The first page of the questionnaire informed the participants of the purpose of the study and precautions to consider when completing the questionnaire. The back end of the survey software was configured to allow only one submission per IP address to avoid receiving duplicate responses. In addition, intelligent logic was implemented to check for invalid responses (e.g., the same answer for all questions, inconsistency with reality, etc.). Altogether 390 responses were collected, of which 359 were identified as valid (effective recovery rate 92.05%). In addition to machine-based detection, manual verification was performed by two researchers independently to ensure data accuracy.

Research tools

General characteristics of participants

The demographic characteristics of the ICU nurses included gender, age, professional title, education level, marital status, and length of employment.

Transformational leadership (TL) scale

The scale for assessing the TL degree perceived by employees was the questionnaire developed by Chaoping Li and Kan Shi [32] in 2005 based on the multifactorial leadership questionnaire proposed by Bass [33], combined with China's national conditions and unique culture. The Cronbach's α for each dimension of the scale is validated to be between 0.84 and 0.92. The scale contains 26 items, divided into 4 dimensions: morale modelling (8 items), visionary (6 items), individualized consideration (6 items), and charisma (6 items). A Likert-5 scale is used, ranging from 1 (strongly disagree) to 5 (strongly agree). Given the 26 items, the total score ranges from 26 to 130 points, with higher scores indicating higher levels of TL. This instrument has been extensively employed in domestic studies and has demonstrated strong reliability and validity [34]. In this study, the overall Cronbach's α was 0.96, and those for the dimensions of morale modelling, visionary, individualized consideration and charisma were 0.93, 0.84, 0.86 and 0.87, respectively.

Organizational climate (OC) scale

The instrument for assessing OC was the nursing OC scale developed by Heripin et al. [35] in 2011, which has been widely used in domestic studies [23, 25]. The scale contains 24 entries grouped into four dimensions, namely, equitable support behaviour (10 items), intimate and aggressive climate behaviour (5 items), collegial behaviour (5 items), and interpersonal climate behaviour (4 items). It uses a 5-point Likert scale ranging from 1 (very non-conforming) to 5 (very conforming). The total score ranges from 24 to 120 points; the higher the score, the better the OC. The aggregate Cronbach's α of the scale is validated to be 0.927. The overall Cronbach's α in this study was 0.98, and those for the four dimensions of equitable support behaviour, intimate and aggressive climate behaviour, collegial behaviour, and interpersonal climate behaviour were 0.88, 0.76, 0.74 and 0.72, respectively.

Work engagement (WE) scale

The scale used for assessing WE was originally developed by Schaufeli [36], then translated into Chinese and modified by Li Fuye [37], which has been widely applied in studies in China [9, 38]. The total Cronbach's α of the Chinese scale is 0.93. It contains a total number of nine items, divided into three dimensions: dedication (3 items), vitality (3 items) and concentration (3 items). A total score of 0 to 54 points is achieved by scoring each item on a 7-point Likert scale, with a range of 0 (never) to 6 (always). A higher score indicates a greater commitment to work. In this study, the total Cronbach's α was 0.88, and those for the three dimensions of vitality, dedication, and concentration were 0.77, 0.87and 0.85, respectively.

Data analysis

Mean and standard deviation of TL, OC and WE were calculated using SPSS 26.0 software. The number of cases and percentage (%) were used to describe the qualitative data. T-test and ANOVA were performed to analyse differences in participants' demographic characteristics. Pearson's correlation coefficient was employed to analyse the correlations between variables. Finally, Amos 24.0 software was used to create and measure structural models to test our hypotheses. The hypothesized model consisted of three latent variables (TL, OC and WE) and eleven observational variables (morale modelling, visionary, individualized consideration, charisma, equitable support behaviour, collegial behaviour, interpersonal climate behaviour, intimate and aggressive climate behaviour, vitality, dedication, and concentration).

Ethical recognition

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki [39]. The research was not related to human clinical trials or animal experimentation. All participants submitted an

anonymous written informed consent form and were advised of their right to refuse or withdraw from the study at any moment during the trial. The questionnaire was completed anonymously. The investigative procedures were approved by the Independent Ethics Committee of the Second Affiliated Hospital of Air Force Military University (K202409-10).

Results

As this study was conducted with all data collected by a self-assessment questionnaire, there was a chance of common methodological bias. Therefore, Harman's one-way analysis of variance was employed to detect the biases. Exploratory factor analysis of the 59 items identified 10 factors with eigenvalues greater than 1, with the first factor accounting for 39.3% (< 40%) of the variance. This suggested that there was no significant common methodological bias in this study.

Of the 359 respondents, 349 (97.2%) were female. Most respondents (314, 87.5%) obtained a bachelor's degree. A large portion of them (294, 81.9%) were married, and a small portion were unmarried (60, 16.7%). The general demographic characteristics of the participants are presented in Table 1.

The potential differences of WE between different demographic variables were analysed using the independent samples t-test or ANOVA. The results suggested associations of WE with age and length of employment ($p < 0.05$).

As is shown in Table 2, the total scores for TL, OC and WE were 98.03 ± 23.27, 93.12 ± 16.74 and 33.91 ± 10.79, respectively. Person correlation analysis revealed positive correlations among the variables (TL with OC: $r = 0.790$, $p < 0.01$; TL with WE: $r = 0.893$, $p < 0.01$; OC with WE: $r = 0.843$, $p < 0.01$).

The study hypotheses and the resulting associations among variables were examined using AMOS 24.0. The path coefficient results are displayed in Fig. 2.

As is shown in Table 3, the Cronbach's α values of all the three variables were higher than the generally accepted cutoff point of 0.7, indicating an acceptable internal consistency among the variables. The composite

Table 1 Demographic characteristics of ICU nurses (N=359)

Variables	N (%)	Work Engagement				
		Mean ± SD	F or t	*P*	Post hop test	*p*
gender			-0.27	0.791		
female	349(97.2)	33.88± 10.87				
male	10(2.8)	34.80± 7.89				
age			2.89	*0.036		
20-30 years	146(40.7)	32.20± 11.27			②>①	0.102
31-40 years	141(39.3)	34.27± 10.31			③>②	0.157
41-50 years	53(14.8)	36.72± 10.84			③>④	0.947
>50 years	19(5.3)	36.53± 8.51			④>①	0.098
education level			0.412	0.662		
junior college	39(10.9)	32.69± 10.01				
Undergraduate	314(87.5)	34.01± 10.90				
Postgraduate and above	6(1.7)	36.33± 11.06				
marital status			1.12	0.327		
unmarried	60(16.7)	32.30± 11.94				
married	294(81.9)	34.30± 10.46				
divorce or separation	5(1.1)	30.40± 15.88				
professional title			1.312	0.270		
nurse	41(11.4)	33.454± 11.43				
nurse Practitioner	113(31.5)	32.50± 10.99				
nures-in-charge	163(45.4)	34.44± 10.86				
associate chief nurse and above	42(11.7)	36.00± 9.11				
length of employment			5.513	**0.001		
1~5 years	82(22.8)	32.22± 11.76			①>②	0.703
6~10 years	107(29.8)	31.63± 11.20			③>②	0.008
11~20 years	115(32.0)	35.40± 9.56			④>③	0.178
21 years and above	55(15.3)	37.75± 9.56			④>①	0.003

*$p < 0.05$. **$p < 0.001$, SD Standard deviation, *N* Number

Table 2 Correlations among study variables (N=359)

Variables	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 morale modelling	29.86（8.79）	1													
2 visionary	22.56（5.66）	.647**	1												
3 individualized consideration	22.00（6.01）	.590**	.757**	1											
4 charisma	23.60（5.92）	.733**	.769**	.721**	1										
5 Transformational Leadership	98.03(23.27)	.876**	.882**	.853**	.907**	1									
6 equitable support behavior	37.43（8.67）	.641**	.621**	.632**	.691**	.735**	1								
7 collegial behavior	19.85（3.93）	.601**	.568**	.606**	.629**	.684**	.703**	1							
8 interpersonal climate behavior	16.77（3.10）	.525**	.552**	.555**	.567**	.622**	.519**	.696**	1						
9 intimate and aggressive climate behavior	19.07（3.87）	.489**	.500**	.528**	.530**	.580**	.549**	.668**	.627**	1					
10 Organizational Climate	93.12(16.74)	.683**	.673**	.694**	.733**	.790**	.906**	.882**	.762**	.789**	1				
11 vitality	12.25（4.04）	.640**	.646**	.585**	.641**	.715**	.623**	.588**	.524**	.547**	.685**	1			
12 dedication	11.01（4.53）	.653**	.664**	.657**	.696**	.757**	.681**	.590**	.545**	.531**	.715**	.489**	1		
13 concentration	10.61（4.48）	.658**	.630**	.637**	.672**	.740**	.665**	.578**	.506**	.499**	.689**	.549**	.536**	1	
14 Work Engagement	33.91(10.79)	.787**	.782**	.759**	.811**	.893**	.795**	.708**	.635**	.635**	.843**	.807**	.825**	.846**	1

M Mean, SD Standard deviation, **p<0.01

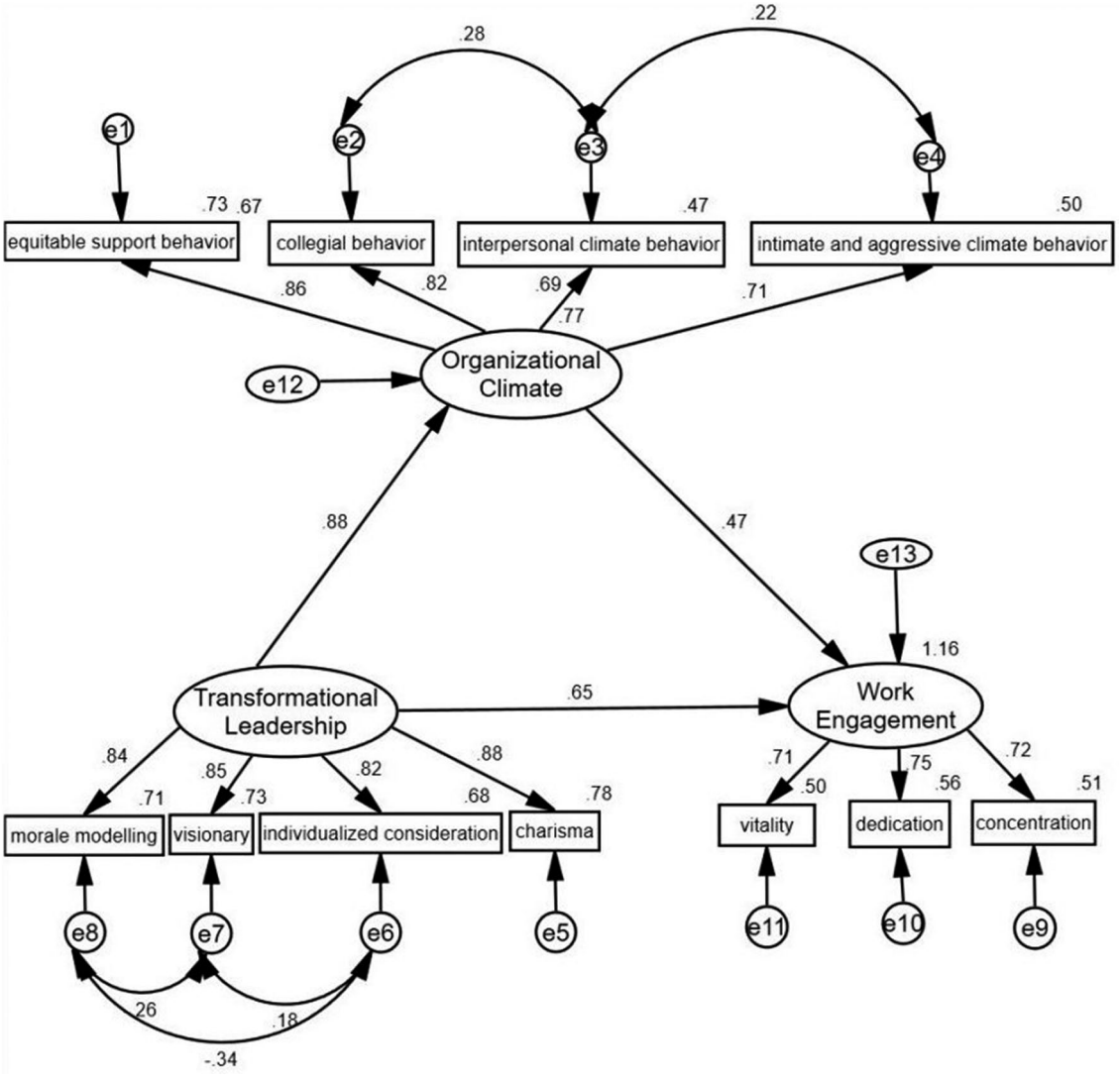

Fig. 2 The validated model

Table 3 Cronbach's alpha, composite reliability, and average variance extracted

	Cronbach's alpha	CR	AVE
Organizational Climate	0.92	0.85	0.59
Transformational Leadership	0.96	0.91	0.72
Work Engagement	0.88	0.77	0.52

AVE average variance extracted, CR composite reliability

Table 4 Comparison of model fit for the modified model to the hypothetical model

Index	$\chi 2$	df	$\chi 2$/df	GFI	AGFI	NFI	IFI	CFI	TLI	SRMR	RMSEA
Fitted model	89.959		2.499	0.958	0.924	0.970	0.982	0.982	0.972	0.025	0.065
Fitting criteria	>0.05	36	<5.0	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	<0.08	<0.08

Abbreviations: $\chi 2$ Discrepancy Chi Square, $\chi 2$ /df Chi-square/degree of freedom, CFI Comparative fit index, TLI Tucker–Lewis index, RMSEA Root-mean-square error of approximation, SRMR Standardized root mean square residual, CI Confidence interval, GFI goodness-of-fit index, AGFI Adjusted Goodness of Fit, NFI normed fit index, IFI Incremental Fit Index

Table 5 The mediating analysis of organizational climate on transformational leadership and work engagement (N=359)

					95%CI			
	Dependent variables	Independent variables	β	SE	LLCI	ULCI	*p*	Effect proportion
Model path	OC	TL	0.878	0.038	0.812	0.938	<0.01	
	WE	OC	0.467	0.171	0.219	0.737	<0.01	
	WE	TL	0.645	0.166	0.381	0.885	<0.01	61.14%
Type of effect	Direct effect							
	Indirect effect	TL-OC-WE	0.410	0.159	0.201	0.683	<0.01	38.86%
	Total effect	TL-WE	1.055	0.025	1.018	1.099	<0.01	

TL Transformational Leadership, OC Organizational Climate, WE Work Engagement

reliability score for each of the three variables exceeded the recommended threshold of 0.7, demonstrating their robust composite reliability. In addition, extracted average variance (AVE) was employed to measure convergent validity, and all three variables demonstrated AVE values indicative of reliable convergent validity at the recommended cut-off of 0.5.

All of the measures were within the predicted ranges (Table 4), indicating a good fit with the data [40].

Mediation analysis revealed the overall effect of TL on WE ($\beta = 1.055$, $p < 0.01$). TL was directly positively correlated with WE ($\beta = 0.645$, $p < 0.01$) (Support for H1), and was positively correlated with OC ($\beta = 0.878$, $p < 0.01$) (Support for H2). OC was positively correlated with WE ($\beta = 0.467$, $p < 0.01$) (Support for H3). These results suggested that OC served as a mediator between TL and WE and exerted a significant indirect effect. The direct effect (0.645) and intermediate effect (0.410) accounted respectively for 61.14% and 38.86% of the total effect (1.055) (Support for H4) (see Table 5).

Discussion

Improved work engagement (WE) among nurses is critical for increasing nurse retention, stabilizing the nursing workforce, and maintaining the physical and mental health of clinical nurses. The present study investigated the relationships among transformational leadership (TL), organizational climate (OC) and WE in ICU nurses in China. A mediation analysis was also performed to assess the effect of OC in mediating the relationship between TL and WE.

Previous research has shown that increasing WE of nurses can produce a range of favourable outcomes. The WE score of ICU nurses in this study was only 33.91 ± 10.79, which was lower than that reported in the study of Wu et al. [9] on male nurses in China. For one thing, the participants in this study were mostly females (97.2%) who bear dual responsibility of familial care alongside their hospital obligations. For another, this study targeted ICU nurses in top-tier hospitals that admit and treat numerous critically ill patients, and the ICU nurses experience high intensity workloads. The constant pressure from their heavy duties as well as the stressful work environment may result in low WE in this group. It

is imperative that nursing supervisors take practical measures to tackle this issue.

Our analysis revealed significant impacts of age and length of employment on WE. The nurses who had worked for 6–10 years had a lower level of WE as compared with those with 1–5 years' of employment and those with 11–20 years' of employment. This may be due to the fact that nurses who have worked for 6–10 years are more experienced than those with a shorter length of employment and are more capable of taking important responsibilities. It is more likely that they will be assigned additional tasks or activities such as training and competitions. Meanwhile, in comparison with nurses with longer years of employment, they have greater needs of career development and promotion. As a result, this group of nurses may suffer from relatively high occupational stress [10], thus affecting their commitment to their work. It is necessary that nursing administrators be cognizant of such status and develop corresponding policies to relieve the pressure over these nurses.

Within nurses 20–50 years old, age presented a positive correlation with the level of WE. Compared with younger nurses, the older nurses demonstrated greater engagement. This might be because people grow mature as they age and will develop deeper understandings of their jobs. To seek career development, they are willing to invest more energy into their work. This revelation drawn from this observed phenomenon is that managers should pay more attention to young nurses who have the potential to become more engaged. Timely communication and care is extremely important, through which the managers may perceive what the young staff think and need, help them form appropriate attitudes toward their career, and foster a sense of belonging among them. It is also necessary that managers provide personalised career management and planning based on nurses' individual potentials and willingness, and take effective measures to motivate them and increase their engagement. The WE scores of nurses over 50 in this study were lower. One of the possible reasons is that the study subjects were ICU nurses and this job is somewhat physically difficult for older staff. The small sample size of nurses over 50 in this study is a partial proof. Given the limited number of nurses over 50 in this study, it is yet difficult to draw any conclusion at this stage. Further research involving more samples is needed for a more solid and comprehensive understanding of WE in this age group.

The present study found that TL of ICU nurses positively predicted WE, which is consistent with the finding of Enwereuzor et al. [15]. Both our result and the previous finding show that TL behaviours of immediate leaders have an impact on their subordinates' engagement. This is because the leadership practices of nursing managers may affect nurses' attitudes towards the profession and their relationships with their colleagues [41, 42], and TL may build trust between managers and nurses and enables nurses to make positive changes [43]. Therefore, hospitals need attach importance to developing TL behavioural skills in nursing managers and fostering an organizational culture suitable for TL [17].

A strong correlation between TL and OC was identified in this study. Transformational leaders effectively motivate nurses by establishing inspiring visions, creating a positive work environment, and setting high moral standards, thereby instilling a sense of meaning in their work [44]. Through these actions, transformational leaders recognise and support the unique needs and growth of each nurse, creating an atmosphere of valuing and appreciation, thereby enhance the sense of OC [45]. In addition, transformational leaders place great emphasis on interprofessional collaboration and teamwork [44]. In such a collaborative atmosphere, nurses will feel supported and connected to their colleagues, and in turn contribute to the creation of a positive OC.

Our finding of the promoting effect of positive and effective OC on WE is consistent with that reported by Kalhor et al. [16] and Motlagh et al. [46]. One possible explanation is that positive OC gives nurses the sense of belonging and irreplaceability of the hospital [47–49], thereby deepening their job embeddedness, enhancing their intrinsic motivation, and increasing their engagement. Nursing managers, including head nurses, may need strengthen communication within the department, organize divers collective activities, enhance nurses' collective awareness, and create a positive climate so as to boost WE.

In addition, this study identified that TL directly or indirectly influenced nurses' WE through OC. This finding illuminates the underlying mechanism of the effect of OC on WE, and suggests that OC is a key factor in explaining why and how TL influences WE. Specifically, transformational leaders make nurses feel supported and valued, so they will be willing to share and collaborate. The colleagues collaborate effectively to create a positive atmosphere, in which they are more likely to be motivated and engaged in their roles.

Strengths and limitations of this study

The present study reveals the impact of TL and OC on WE. Our results may enrich the current literature and advance the domain of hospital and nursing management. However, the study has certain limitations. First, the data in this study was collected using self-report questionnaires, which might lead to bias in the data and limit the generalisability of the results. Secondly, the participants were recruited through convenience sampling, which restricted the representativeness of the sample, and the results may not be applicable to other populations of ICU

nurses. Future research based on random sampling is needed for the sake of generalization. Finally, the study was cross-sectional, which did not allow an examination of the causal relationship between variables. A follow-up study is recommended to verify the causal links between the variables under investigation.

Conclusion

This study validates the mediating role of organizational climate (OC) in the relationship between transformational leadership (TL) and work engagement (WE) among ICU nurses, thus providing theoretical support for further understanding of the mechanisms underlying the effect of TL on WE and for the implementation of a comprehensive intervention to improve OC. Our results show that OC is an important mediating factor for the effect of TL on WE. Nursing managers should pay attention to TL and promote a positive OC to increase WE.

Implications for nursing management

In nursing managerial practice, administrators need fully understand and recognize the role of organizational climate (OC) in the managerial practices of head nurses and the performance of member nurses. They need make efforts to create positive OC so as to form a positive, united and efficient atmosphere within the nursing department. It should be organizational responsibility and practice to promote the development of individual nurses. Meanwhile, positive OC may facilitate the formation of a high-quality communicative relationship within the department, in which nurses can feel a higher level of trust, support, respect, and care from their colleagues. This may enable nurses to maintain a proactive and energetic state at work and improve their job engagement. Hospital administrators should encourage nursing managers to stimulate the higher-level needs of nurses through transformational leadership practices, thereby enhancing their intrinsic motivation, increasing their enthusiasm at work, and promoting their professional development. What's more, the managers need to build positive OC that creates a favourable psychological atmosphere for nurses, thus promoting the nurses strive to realize organizational goals.

Abbreviations

TL	Transformational leadership
WE	Work engagement
OC	Organizational climate
ICU	Intensive care unit
SD	Standard deviation
M	Mean
CI	Confidence interval
χ2/df	Chi-square/degree of freedom
χ2	Discrepancy Chi Square
GFI	Goodness-of-fit index
CFI	Comparative fit index
SEM	Structural Equation Modeling
AGFI	Adjusted Goodness of Fit
IFI	Incremental Fit Index
NFI	Normed fit index
TLI	Tucker–Lewis index
SRMR	Standardized root mean square residual
RMSEA	Root-mean-square error of approximation

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Author contributions

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Data availability

In order to protect the privacy of the participants, the data generated during this study will not be made public. Nevertheless, it may be accessible to the corresponding author upon reasonable request.

Declarations

Ethics clearance and participation consent

The Declaration of Helsinki's guiding principles were followed in the conduct of this investigation. Every participant gives written, informed consent in addition to their consent to participate. The Independent Ethics Committee of the Second Affiliated Hospital of Air Force Medical University gave its approval.

Permission to publicate

Not relevant.

Competing interests

The authors declare no competing interests.

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