Journal of Multidisciplinary Healthcare Dovepress

Open Access Full Text Article ORIGINAL RESEARCH

The Impact of Abusive Supervision on Nurses' Organizational Silence: The Multiple Linear Mediation of Psychological Capital and Fear

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Purpose: To assess abusive supervision and organizational silence among nurses and investigate the mediating influence of psychological capital and fear.

Background: Since the end of 2019, China's National Development and Reform Commission (NDRC) department has decided to start the construction of regional medical centers in Shanxi, reducing cross-provincial and cross-regional medical care. In order to improve the overall standard of care in a hospital in a short period of time, health care leadership decision makers may adopt various effective leadership management practices to achieve the set goals and have high work pressure at the same time. In this case, abusive management may occur.

Methods: A cross-sectional survey design was employed. In January -March 2024, a convenience sampling method was used to collect data from 470 nurses in a total of 5 hospitals in Shanxi province they were required to complete the questionnaires online anonymously. The chain mediation model was tested using the PROCESS macro program in the SPSS software and multiple linear regression model was used to verify the mediating effect.

Results: Psychological capital and fear mediate the relationship between abusive supervision and nurses' organizational silence, playing indirect mediating roles. Abusive supervision was positively associated with nurses' organizational silence. Additionally, psychological capital plays a negative mediating role, accounting for 48.48% of the indirect effect, and fear plays a positive mediating role, accounting for 45.83% of the indirect effect. They form a chain intermediary, accounting for 5.69% of the indirect effect.

Conclusion: Psychological capital and fear mediate the impact of abusive supervision on nurses' organizational silence. Positive leadership training should be conducted to help reducing the level of head nurses' abusive supervision behaviors, while also fostering actions that elevate nurses' psychological capital levels.

Keywords: Abusive supervision, Nurses' organizational silence, psychological capital, fear, mediating effect

Introduction

With the continuous advancement of medical and healthcare reforms, in order to meet the health needs of the general public,China's public hospitals have entered a stage of high-quality development.[1] In the context of high quality development of hospitals across the country, since the end of 2019, China's National Development and Reform Commission (NDRC) department has decided to start the construction of regional medical centers in Shanxi and other relatively weak areas of medical resources, which will select high-quality medical institutions in Beijing, Shanghai, Wuhan and other high-quality medical institutions, and through the construction of sub-centers, branches, and implementation of custodial management in Shanxi and other weak areas of medical care, to promote the grouping of high-quality medical resources, branding development, and to better meet the needs of the masses for medical services. The

Received: 27 June 2024
Accepted: 7 October 2024
Published: 16 October 2024

programme clearly indicate, through three to five years of efforts, in the shortage of high-quality medical resources in the region to build a number of high-level medical groups, reduce the gap with Beijing, Shanghai and other developed cities, reduce cross-provincial and cross-regional medical care.[2] In order to improve the overall standard of care in a hospital in a short period of time, health care leadership decision makers may adopt various effective leadership management practices to achieve the set goals and have high work pressure at the same time. Previous study[3] has shown that managers with high levels of job stress are likely to resort to abusive supervision.

Abusive supervision refers to the perceptions held by subordinates regarding the extent to which supervisors consistently exhibit hostile verbal and nonverbal behaviors, excluding any form of physical contact.[4] Since Tepper[4] introduced the concept of abusive supervision in 2000, managers have increasingly emphasized its negative impact.[5,6] Studies have shown that abusive supervision adversely affects employees' organizational performance, innovation, well-being, and work engagement.[6–8] Moreover, it contributes to an increase in employees' organizational silence.[9] Dyne and Ang defined organizational silence as the act of self-preservation involving the withholding of pertinent ideas, information, or opinions due to fear.[10] Based on employee motives, Dyne distinguished three types of silence: Acquiescent Silence, Defensive Silence, and Prosocial Silence. Chinese scholar Yang[11] further categorized nurses' organizational silence into negative silence, defensive silence, prosocial silence, and indifferent silence. Numerous studies have corroborated that abusive supervision practices can induce organizational silence.[9,12] Previous studies have dwelt upon that there is an important relationship between subordinates' fear and the leadership style of leaders.

Psychological capital is "a positive state of mind reflected in the growth and development of an individual", comprising self-efficacy, hope, optimism, and resilience.[13] Psychological capital has measurable and developable properties. Developing psychological capital allows individuals to persevere towards their goals and, if necessary redefine the path when necessary (hope), make positive attributions about the present and future (optimism), maintain and bounce back and even surpass when plagued by problems and adversity (resilience), and have the confidence to engage in the effort necessary to successfully to successfully complete challenging tasks (self-efficacy).[14] Earlier research on psychological capital primarily explored its impact on the organizational performance of nurses, indicating its potential to enhance their work efficiency.[15,16] Nevertheless, its function in the context of abusive supervision and organizational silence requires further elucidation.

Nurses, being the largest professional group in healthcare, have garnered escalating attention regarding their physical and psychological well-being, as well as organizational performance.[17,18] In the nursing domain, scholars have observed that abusive supervision by nurse leaders elevates nurses' levels of organizational silence.[19,20] Data suggested that the incidence of abusive supervision is 46.6%,[21] and it has been reported that the level of abusive supervision is moderate in China.[22] Abusive supervision centers on subordinates' perception of their supervisors' harmful intentions.[4] Additionally, dispositional and attitudinal variables may influence subordinates' perception of abusive behavior.[23] Consequently, scholars are increasingly focusing on intermediary variables.

Shanxi as a pilot of regional medical construction, whether the level of abusive supervision perceived by nurses will be at a high level has become a concern. Previous studies focused on the mediation of job burnout and emotional exhaustion. To date, no research has attempted to examine the intermediary effect of psychological capital and fear on the relationship between abusive supervision and nurses' organizational silence. This paper aims to investigate the extent of abusive supervision and nurses' organizational silence in tertiary hospitals in Taiyuan, Shanxi Province, China. Additionally, it seeks to explore psychological capital and fears mediating effect. Understanding this relationship will guide hospital and nursing administrators when designing leadership programs and other institutional initiatives to reduce nurses organizational silence.

Research Hypotheses

First, abusive supervision has an direct effect on nurses' organizational silence.

Second, abusive supervision impacts nurses' organizational silence through the mediation of psychological capital. Third, abusive supervision impacts nurses' organizational silence through the mediation of fear. Fourth, psychological capital and fear mediate the impact of abusive supervision on nurses' organizational silence.

Methods

Participants

In January.5 -March.20. 2024, participants were selected from five tertiary hospitals in Taiyuan,Shanxi,which receiving regional medical construction.

Tertiary hospitals are medical institutions classified by China's current "The measures for the administration of the hospital grade", and are the highest level in the "three levels, six grades" classification of hospitals in mainland China.[24] Tertiary hospitals are classified as Class III A and Class III B, and are rich in medical resources and represent a high level of expertise in China. The subjects of the present study were nurses in a total of 5 tertiary hospitals in Taiyuan Shanxi Province, China.

The study enlisted nurses actively involved in clinical nursing work with at least one year of experience, while excluding rotating and trainee nurses (Avoid transferring attitudes towards the nurse manager of the former unit to the nurse manager of the unit where they currently work to avoid creating bias).

Sample and Sampling Method

Convenience sampling method was used in this study for the cross-sectional survey. We selected five major tertiary hospitals in Taiyuan and adopted convenient sampling to ensure the representativeness and diversity of samples.

This study contained general demographic information 8 items, the single dimension of the Abuse Supervision Scale 15 items, the 4 dimensions of The Psychological Capital Scale 24 items, The Fear of Negative Emotions Scale 4 items, and The Nurses' Organisational Silence Scale 20 items. According to Kendall's guidelines for rough sample sampling, the sample size is 10–20 times the number of main scale entries, and the sample size for this study was calculated to be in the range of 240–480. Out of 470 collected questionnaires, 28 were deemed invalid and excluded from analysis, leaving 442 questionnaires for data analysis.

Study Tools

Tepper's Abusive Supervision Scale[4] was utilized to assess the level of abusive supervision experienced by nurses. This scale comprises 15 items and is unidimensional, rated on a 5-point Likert-type scale ranging from 1 (completely disagree) to 5 (completely agree), with a total score range of 15 to 75. Higher scores indicate greater perceived abusive management by nurses. This scale has been used among the Chinese participants before[25–27] and shown good reliability and validity. Cronbach's alpha coefficient for the scale was calculated as 0.975, indicating high internal consistency. Confirmatory factor analysis (CFA) suggested that all the factor loadings ranged from 0.51 to 0.78, and the unidimensional model fitted the data well: $\chi 2/df = 2.48$, TLI = 0.946, CFI = 0.917, RMSEA = 0.042, SRMR = 0.028.

To assess psychological capital, Luthans's Psychological Capital Scale[13] was employed. This scale comprises four dimensions: self-efficacy, optimism, hope, and resilience, with six questions/items for each dimension. Participants rated each item on a 5-point Likert-type scale ranging from 1 (completely disagree) to 5 (completely agree). In order to study the correlation between each variable of psychological capital and the research topic and propose potential strategies to improve psychological capital from different dimensions, the four dimensions of psychological capital are analyzed in the research method. This scale has been used among the Chinese participants before[28–30] and shown good reliability and validity. The Cronbach's alpha coefficients for self-efficacy, optimism, hope, and resilience were calculated as 0.945, 0.942, 0.758, and 0.896, respectively, indicating high internal consistency for self-efficacy, optimism, and resilience, and acceptable internal consistency for hope. CFA suggested that all the factor loadings ranged from 0.46 to 0.75, and the four-factor model fitted the data well: $\chi 2/df = 2.52$, TLI = 0.963, CFI = 0.921, RMSEA = 0.039, SRMR = 0.042.

Nurses were requested to assess fear using three items from the Negative Affect Schedule.[31] These items measured the degree to which nurses experienced fear regarding their immediate supervisor on a 5-point scale, ranging from 1 (very slightly) to 5 (very much so). The Cronbach's alpha coefficient for these items was calculated as 0.925, indicating high internal consistency. This scale have good reliability and validity in previous study[32,33] among the Chinese participants. CFA suggested that all the factor loadings ranged from 0.49 to 0.73, and the unidimensional model fitted the data well: $\chi 2/df = 2.91$, TLI = 0.966, CFI = 0.974, RMSEA = 0.048, SRMR = 0.036.

Nurses' Organizational Silence level was assessed using the Nurses' Group Organizational Silence Behavior Scale developed by Yang Jing, Yang Hui et al in 2017.[11] This scale consists of four dimensions: acquiescent silence, defensive silence, prosocial silence, and apathetic silence, In Yang Jing's research, the scale's Cronbach's alpha coefficients is 0.918,Coefficients for each dimension is 0.791–0.857,CFA reported all the factor loadings ranged from 0.42 to 0.87, $\chi 2/df = 3.90$, TLI = 0.96, CFI = 0.95, RMSEA = 0.077. In this study, Cronbach's alpha coefficients for each dimension were calculated as follows: 0.931 for acquiescent silence, 0.947 for defensive silence, 0.966 for prosocial silence, and 0.910 for apathetic silence. CFA suggested that all the factor loadings ranged from 0.55 to 0.79, and the four-factor model fitted the data well: $\chi 2/df = 2.73$, TLI = 0.979, CFI = 0.965, RMSEA = 0.041, SRMR = 0.038.

Collection of Date

In order to avoid the unreal effect caused by on-site questionnaire filling, and to avoid potential bias, we used the Questionnaire Star online tool anonymous survey, through Wechat app distribute to participants,In this way, the privacy of the questionnaire can be guaranteed. Questionnaire Star is a commonly used electronic questionnaire collection tool in China, which is operated online to facilitate rapid data collection. The questionnaire was transformed into a questionnaire star, and the questionnaire survey was conducted anonymously, the purpose and significance of the study were explained in detail to the nurses prior to conducting the survey. The participants were free to withdraw at any point in time. The completion and submission of the questionnaire were regarded as informed consent to participate in the study.

Data Analysis

First, data screening revealed that there were no outliers in our data, and then responses with missing data were excluded from the data processing. Second, whether data followed normal distribution was examined. All of the variables are normally distributed (skewness $<|2.0|$ and kurtosis $< |7.0|$). The mediation model analysis was developed according to the following steps. First,Descriptive statistics and Pearson's correlations for the variables were computed using SPSS 26.0. Then Multiple linear regression was used in this study,The main reasons for choosing multiple linear regression for mediating effects analysis include its applicability and its application in testing mediating effects. Multiple linear regression analysis is applicable to the study of the relationship between multiple variables. It can consider the influence of multiple variables at the same time, so as to analyze the relationship between variables more fully. At the same time, it can provide coefficient estimation and significance test, and understand the direct and indirect influence of independent variables on dependent variables. Multiple linear regression analysis and mediation analysis were conducted using SPSS, with the mediation effect size calculated using the SPSS macro PROCESS program (model 6). Bootstrapping analysis with 5000 resamples was conducted to test the significance of the mediation effects. All study variables were standardized in Model 6 before data analyses. The significance level was set at $P < .05$.

Ethics Statement

All participants were required to furnish informed consent before responding to the survey. This study received approval from the hospital ethics committee of Shanxi Bethune Hospital of China (YXLL-2024-058) and conducted in accordance with the Declaration of Helsinki. There are no conflicts of interest in this study.

Results

Common Method Variance Test

The self-reported data collected posed a potential risk of common method bias. To address this concern, a Harman's one-factor test was employed to examine the presence of such bias. The results showed that only 31.32% of the variance was attributed to a single factor, falling below the critical threshold of 40%. Therefore, the study did not exhibit a substantial common method bias problem.

General Characteristics of Participants

The general characteristics of the study participants are presented in Table 1. Among the 442 nurses, 415 were female, accounting for 93.90%, and 6.10% were male. They are mainly aged between 26 and 40, accounting for 79.4%; their education level is mainly undergraduate, accounting for 88.2%; their work is mainly contract system, accounting for 74.9%; and the median length of service is 10 (5–13). The titles of nurses are mainly junior nurse and nurse in charge, accounting for 74.5%. The distribution departments of nurses surveyed include internal medicine and surgery, emergency, ICU and other departments.

Scores and Correlation Analysis

Table 2 presents the scores of each variable. In this study, nurses' perceived abusive supervision had a total score of 22.73±11.62 with an average score of 1.41 ±0.93. The highest scoring item was "my supervisor criticized me in front of others" with a score of 1.98. Nurses' organizational silence had a total score of 50.28 ±18.51, with an average score of 2.51 ±0.93. Psychological capital had a total score of 90.94±14.27, with an average score of 3.79 ±0.59. Negative Affect Schedule fear had a total of 9.08±4.4, with an average score of 2.26 ±1.10. The correlation among abusive supervision, psychological capital, fear, and nurses' organizational silence is shown in Table 3. Nurses' organizational silence was positively correlated with abusive supervision (r =0.408, P <0.001), and fear (r =0.373, P <0.001),negatively correlated with psychological capital (r =−.365 P <0.001).

Table 1 General Information on 442 Nurses (N = 442)

Items		N	(%)	Items	N	(%)
sex				establishment		
	male	27	6.10%	regular employee	111	25.10%
	female	415	93.90%	contract system	331	74.90%
age (Y)				work age (median,(25%-75%)	10	(5–13)
	20–25	41	9.30%	professional		
	26–30	105	23.80%	primary nurse	85	19.20%
	30–35	157	35.50%	junior nurse practitioner	149	33.50%
	36–40	89	20.10%	nurse-in-charge	181	41.00%
	41–45	22	5%	deputy chief nurse	27	6.10%
	46–50	12	2.70%	chief nurse	0	0.20%
	51–55	15	3.40%	department		
	56–60	1	0.20%	internal medicine	125	19.20%
education attainment				surgery	134	20.40%
	junior college	41	9.30%	emergency	65	14.70%
	undergraduate	390	88.20%	ICU	30	6.80%
	graduate	11	2.50%	obstetrics	28	6.30%
				gynecology	16	3.60%
	unmarried	107	24.20%	outpatient service	18	4.10%
	married	328	74.20%	others	26	24.90%

Table 2 The Scores of Each Variable (n=442)

Item	Scoring Range(points)	Score (points, x±s)	M(SD)
abusive supervision	15–75	22.73 ±11.62	1.41 ±0.93
psychological capital	36–120	90.94 ±14.27	3.79 ±0.59
self-efficacy	6–30	24.48 ±4.58	4.08 ±0.76
hope	11–35	26.93 ±4.96	3.84 ±0.71
resilience	5–26	18.78 ±4.15	3.76 ±0.73
optimism	9–30	20.74 ±3.01	3.45 ±0.50
fear	4–20	9.08 ±4.4	2.26 ±1.10
nurses' organizational silence	20–100	50.28 ±18.51	2.51 ±0.93
z	6–30	15.73 ±6.12	2.62 ±1.02
defensive silence	7–35	17.78 ±7.31	2.53 ±1.04
prosocial silence	4–20	10.84 ±4.52	2.71 ±1.13
apathetic silence	4–20	8.54 ±3.70	2.13 ±0.93

Table 3 Correlations Among Variables (n=442)

	1	2	3	4	5	6	7	8	9	10
1. abusive supervision	1									
2. self-efficacy	−0.278**	1								
3. hope	−0.372**	0.828**	1							
4. resilience	−0.214**	0.605**	0.600**	1						
5. optimism	−0.356**	0.549**	0.618**	0.578**	1					
6. fear	0.364**	−0.144**	−0.241**	−0.183**	−0.243**	1				
7. acquiescent silence	0.396**	−0.232**	−0.329**	−0.219**	−0.327**	0.376**	1			
8. defensive silence	0.411**	−0.240**	−0.324**	−0.249**	−0.324**	0.369**	0.824**	1		
9. prosocial silence	0.296**	−0.159**	−0.217**	−0.163**	−0.242**	0.306**	0.742**	0.805**	1	
10. apathetic silence	0.353**	−0.372**	−0.434**	−0.368**	−0.429**	0.294**	0.669**	0.704**	0.608**	1

Note: **p<0.001.

Multiple Mediation Model

A multiple-chained mediation analysis was conducted to explore the mediating roles of psychological capital and fear. We utilized multiple linear regression equations to assess the significance of the mediating effect. As demonstrated in Table 4, the mediation effect was observed to be partial (c: 0.53,: c':0.393). Furthermore, we employed PROCESS v4.1 to examine the effect size. As shown in Table 5, the mediation effect represented 41.8% of the total effect (β = 0.227, 95% CI: 0.156–0.304),the direct and indirect mediating effects of psychological capital and fear were established.

Table 4 Results of Regression Analysis of Variable Relationships in the Mediation Model (n=442)_

Outcome	Predictors	R^2(%)	AdjustedR^2(%)	F	B	t	LLCI	ULCI
Equation1								
psychological capital	abusive supervision	12.9	12.7	64.983	−0.296	−8.061	−0.368	−0.224
Equation2								
fear	abusive supervision	14.5	14.1	37.099	0.491	6.786	0.349	0.633
	psychological capital				−0.221	−2.518	−0.393	−0.048
Equation3								
nurses' organizational silence	abusive supervision	27.4	26.9	55.079	0.315	5.353	0.2	0.431
	psychological capital				−0.344	−5.026	−0.478	−0.209
	fear				0.202	5.475	0.13	0.275
Equation4								
nurses' organizational silence	abusive supervision	17	16.8	90.109	0.53	9.493	0.42	0.64

Table 5 The Effects and 95% Confidence Intervals (N = 442)

Model pathways	Estimated	95% CI		Proportion of effect
		Lower	Upper	
Direct effect	0.316	0.2	0.431	58.2%
Indirect effect	0.227	0.156	0.304	41.8%
Indirect effect1	0.110	0.061	0.167	48.48%
Indirect effect2	0.104	0.056	0.160	45.83%
Indirect effect3	0.013	0.002	0.031	5.69%

Notes: Indirect effect1: abusive supervision→psychological capital→nurses' organizational silence. Indirect effect2: abusive supervision→fear→nurses' organizational silence. Indirect effect3: abusive supervision→psychological capital→fear→nurses' organizational silence.

Path Model of the Multi-Mediating Effects Between the Variables

The relationship between abusive supervision and nurses' organizational silence was examined using the PROCESS macro (Model 6), with psychological capital and fear as multiple mediators. First, abusive supervision had a significant effect on the mediating variable of psychological capital ($\beta = 0.437$, $P < 0.001$) (Figure 1). The model was found to have a good fit ($F = 63.74$, $P < 0.001$), with a statistical power of 12.7% ($R^2 = 0.127$). Second, abusive supervision have a direct significant effect on fear ($\beta = 0.120$, $P<0.001$)(Figure 1). It was found that psychological capital as mediator variable 1 had a significant effect on the fear as mediator variable 2 ($\beta = -0.037$, $P < 0.001$) (Figure 1). The model was found to have a good fit ($F = 36.601$, $P < 0.001$), with a statistical power of 13.9% ($R^2 = 0.139$). Third, abusive supervision as an independent variable have a direct significant effect on nurses' organizational silence ($\beta = 0.393$, $P < 0.001$), while Psychological capital had a significant effect on nurses' organizational silence ($\beta = -0.037$, $P < 0.001$), and fear had a significant effect on nurses' organizational silence ($\beta = 1.013$, $P < 0.001$) (Figure 1). These results can be seen in Figure 1, where the total effect of abusive supervision on nurses' organizational silence was statistically significant ($\beta = 0.53$, $P < 0.001$). The model was found to have a good fit ($F = 90.109$, $P < 0.001$) with, a statistical power of 17.0% ($R^2 = 0.17$).

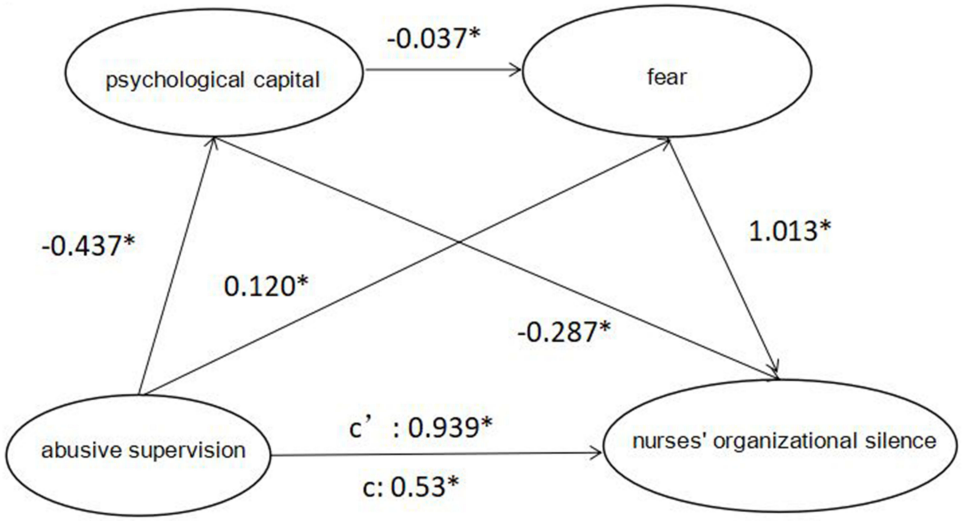

Figure 1 Path model of the multi-mediating effects between the variables.
Note: * P<0.001 c':Total effect of X on Y.

Discussion

In this study, nurses' perception of abusive supervision scores resembled those found in a study by Chinese scholar Xu[34] and lyu's[35] research result, but were lower than those in Li's study,[36] indicating a moderate-to-low level of abusive supervision, we considered this reason may be related to Li's research was older (2014). In the Chinese cultural tradition,Authoritarian leadership (AL)as a pervasive leadership style has been existed for many years, which in the form of abusive supervision and emphasizes hierarchy and relationalism between those in upper positions and those in lower positions.[37] Therefore, we should pay attention to reducing the influence of Chinese traditional authoritative leadership on head nurses, increasing positive leadership training for head nurses, such as transformational leadership, authentic leadership, which have been confirmed that have a positive impact on the management of head nurses.[38,39] On the other hand, researches have shown that the workload and work stress will increase the risk of abusive supervision by head nurses.[18,40,41] It provides us with some references that we should start by reducing the workload to reduce the stress of nurse leaders, and monitor the working pressure and nursing management status of the head nurse in real time, and adjust the workload of the head nurse in time.

Psychological capital exhibited a negative correlation with abusive supervision, suggesting its potential to mitigate abusive supervision levels. Conversely, fear demonstrated a positive association with abusive supervision.

In this study, the overall mean score for psychological capital was 3.79 (SD = 0.8), similar to another study in China[42] Psychological capital has garnered increased attention in recent years and has been validated as a mediating variable.[43,44] This reminds that we can reduce nurses' organizational silence caused by abusive supervision by raising levels of psychological capital. As early as 2006, Luthans proposed the psychological capital microintervention model and confirmed it increased the level of psychological capital of participants. It includes goal design (concrete end points to measure success; an approach rather than an avoidance framework; the importance of identifying sub-goals in order to reap the benefits of even small"-wins"), pathway generation (generate multiple pathways to this goal; form a group and get advice from others in the group, such as alternative potential pathways; inventory pathways), and overcoming obstacles (consider the potential obstacles and self reflection, team members provide strategies for overcoming obstacles).[45] Based on the psychological capital micro-intervention model, senior manager of hospital can design intervention program to develop nurses' psychological capital. By intervening in nurses' psychological capital, alleviate nurses' fear and the impact of abusive supervision on their organizational silence.

Strengths and Limitations

This study established the mediating roles of psychological capital and fear in the link between abusive management and nurses' organizational silence, providing further insight into how abusive management leads to nurses' organizational silence.

However, the cross-sectional data limits causal inference and some potential confounding variables not accounted for. Our research is based on a self-report questionnaire, so the results may be subjective. We will consider the inclusion of objective measures or third-party evaluations in future research. The study's participants were limited to a single city in China, restricting the generalizability of the findings. Additionally, the reliance on self-reported data in the current results may introduce response bias and subjectivity. Furthermore, the study did not propose specific strategies or interventions for addressing abusive supervision and nurses' silence. Future research could explore tailored strategies and treatments in this area.

Implications of the Study

Addressing abusive supervision by nurse leaders is imperative. Leadership training and stress management programs should be implemented for nurses' chiefs. Additionally, activities aimed at enhancing the psychological capital level of nurses should be organized.

Conclusion

The present study examining the mediating roles of psychological capital and fear among Chinese nurses. The results suggest that we should pay more attention to positive leadership training for head nurses and implement the intervention to improve the psychological capital level of nurses.

Data Sharing Statement

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

Ethical Approval

This study was approved by the Institutional Review Board of Shanxi Bethune Hospital of China (YXLL-2024–058) and conducted in accordance with the Declaration of Helsinki. All nurses provided informed consent.

Author Contributions

Yali Liang and Yunxin Zhang are the co-first author of this paper. All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

There is no financial supporting body for this article.

Disclosure

The authors declare no conflicts of interest.

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