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ORIGINAL RESEARCH

Mediating and Suppressing Effects of Coping Styles Between Resilience and Empathy for Pain in Clinical Nurses: A Cross-Sectional Study

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Purpose: This study aimed to investigate the current state of empathy for pain among clinical nurses, analyze the relationship between resilience and empathy for pain, and explore the mediating effects of coping styles.

Methods: This was a multicenter cross-sectional study conducted among 1601 clinical nurses in Guangdong Province, China. The convenience sampling method was used to collect data from Sociodemographic information, the 14-Item Resilience Scale, the Simplified Coping Style Questionnaire, and the Chinese version of the Empathy for Pain Scale from June to September 2023. To analyze the relationship between resilience, coping styles, and empathy for pain among clinical nurses with descriptive statistics, Spearman correlation analysis, and mediation analysis.

Results: The empathy for pain score among Chinese clinical nurses was 2.92 ± 0.79, with the empathy reactions dimension at 3.56 ± 0.74, and the body and mind discomfort reactions dimension at 2.70 ± 0.89. Clinical nurses' resilience was positively related to the coping styles and the empathy reactions dimension, whereas negatively associated with the body and mind discomfort reactions dimension. Coping styles were negatively related to the empathy for pain and the body and mind discomfort reactions dimension, whereas positive with the empathy reactions dimension. Coping styles partially mediated between resilience and empathy reactions dimension (β=0.127, 95% CI: 0.070~0.183), accounting for 56.19% of the total effect. There were suppressing effects of coping styles between resilience and empathy for pain (β=−0.157, 95% CI: −0.189~-0.126), the body and mind discomfort reactions dimension (β=−0.172, 95% CI: −0.203~-0.142).

Conclusion: The effects of resilience on clinical nurses' empathy for pain were partially mediated and suppressed by coping styles. During clinical pain management, nursing administrators should focus on developing clinical nurses' resilience and positive coping strategies to improve nurses' physical and mental health, optimize pain management, and foster a heightened sense of empathy for pain.

Keywords: resilience, coping styles, empathy for pain, mediating effect, suppressing effect

Introduction

Pain, a prevalent and far-reaching health concern, has gradually attracted the attention of patients and healthcare professionals. Recognized as the fifth vital sign, it has generated widespread research and emphasis.[1,2] The US Centers for Disease Control and Prevention (CDC) estimated that approximately 20.4% (50.0 million) of US adults suffer from chronic pain.[3] Current research indicates that chronic pain affects more than 30% of the global population, causing a heavy burden on individuals and healthcare systems.[3] Pain may interfere with physiologic and emotional well-being, resulting in diminished quality of life, which makes pain management a critical task in clinical practice.[4,5] It has been found that empathy plays a pivotal role in pain management: Effectively empathizing with patients' pain is

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conducive to maintaining a good physician-patient relationship, enhancing patient satisfaction, and promoting treatment adherence, all of which facilitate recovery.[6–8]

Empathy for pain represents a typical and specific form of empathy. It is defined as the perception, judgment, and emotional response to another person's pain that arises upon perceiving another person's state of pain or injury,[9] and is considered a pro-social behavior. Goubert concludes that the generative process of empathy for pain involves both emotional and cognitive empathy, and these distinct mental processing pathways affect emotional and behavioral responses to the pain of others.[10,11] Empathy for pain can prompt individuals to perceive the pain of others, generate empathy, and maintain positive interpersonal relationships, as well as aid individuals in staying vigilant to avoid potential dangers. For healthcare professionals, the ability to empathy for pain enables them to collect more valid information about patients with pain, enhances patient engagement in healthcare, improves the precision of pain assessments, and alleviates the fear of pain in patients.[10]

Notably, compared with the general working population and other medical personnel, clinical nurses, owing to the nature of their work, need to face traumatic events such as illness, disability, and death, as well as therapeutic operations like injections and wound care over extended periods, resulting in sustained exposure to pain-filled environments and suffering from a greater experience of stress.[12,13] Meanwhile, as important participants in pain management, clinical nurses consistently play a crucial role throughout the pain management process,[14] which has led to increased research attention on empathy for pain among nurses in recent years.[14–16] Empathy for pain can be measured with a specialized assessment tool.[10] Studies[14,16] have shown that clinical nurses generally showed a moderate to high level of empathy for pain and could effectively empathize with patients' pain experiences, but some nurses displayed a low level of empathy for pain and even showed body and mind discomfort reactions. Empathy for pain in nurses may be influenced by various factors, including age, professional title, educational level, hours of work, own trauma or pain experiences, relevant training, emotions, pain knowledge, attitudes, and so on.[14–16] Strengthening empathy for pain has the potential to enhance nurses' understanding of patients' pain and foster the development of pro-social behaviors such as sympathy, caring, and comforting for patients, which contribute to accurate assessment and effective management of pain, promote patient comfort, and establish a close nurse-patient relationship.[14,16,17] Therefore, improving empathy for pain among clinical nurses has significant clinical implications and is a pressing and challenging concern for clinical nursing management.

In recent years, with the application of positive psychology in the healthcare field, there is growing evidence that positive psychological resources can enhance the positive emotions and abilities of medical personnel to effectively cope with trauma, threats, stress, and other adverse effects of the work environment, promote physical and mental health, and enhance well-being.[18–20] Resilience, a significant concept in positive psychology, is recognized as an intrinsic protective factor and a positive psychological resource for the individual.[21] It is defined as the capacity of the individual to maintain persistence in the orientation towards the purpose of existence, which can be understood as the ability to overcome with perseverance the difficulties experienced in the different spheres of life, as well as a good knowledge of one's internal coherence through the activation of a personal growth project.[21]

Furthermore, resilience has been correlated with various factors, including the environment, social support, emotional state, self-esteem, self-efficacy, and attitudes toward life.[21,22] More studies on resilience have established its significance in the field of nursing, and it is recognized as key to improving the quality of nursing care and the sustainability of medical personnel.[23] For example, the resilience of clinical nurses is negatively correlated with the willingness to quit,[24] and positively correlated with work engagement,[25] affecting patient satisfaction.[23] At the same time, resilience can buffer the negative effects of work stressors, and effectively enhance individual quality of life and mental health. Nurses with higher resilience showed higher work satisfaction, less severe depressive symptoms, and reduced burnout.[26] Moreover, related studies have shown that resilience also has a certain effect on the individual's empathy: Medical students' resilience is significantly and positively related to empathic ability.[27] Enhancing resilience can effectively reduce compassion fatigue among clinical nurses, improve empathy satisfaction,[26] and promote pro-social behavior. Although the relationship between resilience and empathy has been investigated, the specific association between resilience and empathy for pain is currently unclear.

Coping is defined as a cognitive and behavioral strategy used by individuals to manage the internal and external demands of stressful situations and can be categorized into two types, negative and positive coping, depending on the approach taken.[28] According to the transactional theory of stress, individuals undergo a subjective process involving cognitive appraisal and coping responses when confronted with a stressor and that stress arises as a consequence of the interaction between the individual and the environment.[29,30] The primary appraisal is the individual's perception of whether a potential gain or loss exists from the stressor; and in the secondary appraisal, the situation is perceived as stressful when individuals perceive a gap between the demands of external events and the resources they believe are available internally and externally.[29,30] Coping is a key mediator in dealing with psychological stress. When individuals appraise situations as damaging or threatening, they are more inclined to adopt negative coping styles; conversely, when they appraise situations as challenging, they are more inclined to adopt positive coping styles.[31] Positive coping enhances positive emotions and attitudes, improves work satisfaction and human resource retention, and promotes the quality of life for nurses; while on the contrary, negative coping tends to generate more negative emotions and self-doubt, which affects the development of physical and mental health.[32,33]

Given the impact of coping styles on nurses' well-being, studies have found that resilience is a significant positive predictor of coping styles among clinical nurses,[34] with greater resilience prompting individuals to adapt to situations and use positive coping strategies, whereas low resilience is associated with more negative responses. Additionally, there is a significant positive correlation between coping styles and empathic abilities among clinical nurses.[35] Currently, research on coping styles in the nursing field focuses on exploring relationships with positive psychology, physical and mental health, and other relevant aspects, with coping styles often assuming the role of a mediating variable.[32]

To date, studies on the relationship between resilience, empathy, and coping styles have been tested in nursing. However, there remains significant for further investigation into the current status of empathy for pain among clinical nurses in China, and the current research lacks an examination of the triadic association and internal mechanisms between resilience, coping styles, and empathy for pain among clinical nurses. Prolonged exposure to pain-filled environments, accompanied by events such as trauma, end-of-life situations, and death, involves nurses in more intense stressful experiences and psychological shock,[12,13] but the coping responses and adaptational outcomes when confronted with pain stressors are currently unknown. Based on the transactional theory of stress, resilience, as a positive psychological resource, is also an element of the secondary appraisal that influences the individual's appraisal of the stressful event, while coping styles are the strategies employed following the appraisal.[36] Therefore, we hypothesized that coping styles may play a mediating role between resilience and empathy for pain in clinical nurses and that resilience may indirectly influence clinical nurses' response to empathy for pain through the choice of coping styles, as well as directly influencing response to empathy for pain.

Therefore, this study aims to draw on the transactional theory of stress to explore the effect of resilience on empathy for pain among clinical nurses and analyze the role of coping styles in both. The goal is to provide a theoretical foundation for clinical nursing administrators to develop targeted prevention and measures that enhance clinical nurses' empathy for pain and optimize pain management. Based on the literature review, the theoretical model for this study is presented in Figure 1, which includes the following four hypotheses:

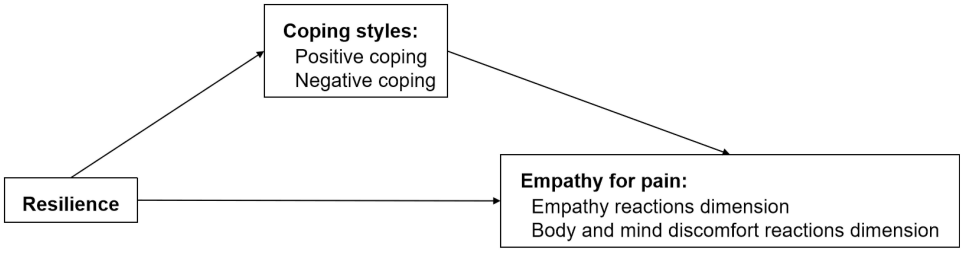

Figure 1 Theoretical model.

(1) Clinical nurses' resilience is positively related to coping styles.
(2) Clinical nurses' resilience is positively related to empathy for pain.
(3) Clinical nurses' coping styles are positively related to empathy for pain.
(4) Coping styles mediate the relationship between resilience and empathy for pain.

Material and Methods

Design

A multicenter, cross-sectional quantitative study was used.

Participants and Setting

This study was conducted from June to September 2023 using a convenience sampling method. A total of 1601 clinical nurses from 43 hospitals in Guangdong Province, China, including 36 general hospitals and 7 specialized hospitals, participated in the survey. Recruitment departments included wards, outpatient services, emergency departments, intensive care units, operating rooms, and others. The inclusion criteria for nurses participating in the survey were as follows: (1) 18 years old ≤ age ≤ 60 years old (Comprehensive reference to the Regulations of the People's Republic of China on Nurses, the legal age of majority and the statutory retirement in China). (2) Registered nurses work in clinical nursing. (3) Engaged in nursing work for more than 1 year. (4) Informed consent and voluntary participation in this study. The exclusion criteria were as follows: (1) Nurses who go out for further training. (2) Nurses on long-term leave. (3) Internship and rehired nurses.

Sample Size

The sample size was calculated using multiple statistical methods. Based on the criteria suggested by Kendall,[37] the sample size was at least 5 to 10 times the number of items. This study included total item numbers of 82 for the three scales, multiplied by 10, with a loss rate of 20% taken into account, the required minimum sample size for this study was 1025. Furthermore, Kline[38] proposed that a sample size of at least 200 is necessary to construct a stable model. The final number of actual participants received for this study was 1601, exceeding the minimum requirements and meeting the criteria for creating a stable model. The larger sample size enhanced the statistical power of the study and increased the reliability of the findings.[39,40]

Data Collection

The researcher inputted the questionnaire into the Questionnaire Star software and generated a Quick Response (QR) code link. After explaining the study's purpose and significance to the nursing department of each hospital and obtaining their approval, the QR code link of the questionnaire was sent through the WeChat platform to the heads of the hospitals, who then forwarded it to the clinical nurses in their respective departments. The researcher provided participants with an informed consent statement, sent alongside the questionnaire's QR code, explaining the purpose, significance, principles of participation, and contact information of the researchers. The statement also informed participants about the anonymity and confidentiality of the study, with the right to withdraw from the study at any time, emphasizing that all data would be protected, accessible only to our research team, and used solely for scientific research purposes. After reading the statement, participants who voluntarily agreed to participate could click the link to complete the questionnaire. The questionnaire included: a description of the purpose and procedures of the study, instructions for completing the questionnaire, a survey of sociodemographic information, as well as the measures of resilience, coping styles, and empathy for pain. It took approximately 20 to 25 minutes to complete the questionnaire. To avoid duplicate participation and ensure the quality and integrity of the questionnaire, the survey link was set so that the same Internet Protocol (IP) address could only submit one response. Participants completed all questionnaire elements independently and then submitted them. A total of 1656 clinical nurses completed the questionnaires in this study, and after excluding 55 missing or irrelevantly answered questionnaires, 1601 valid questionnaires were finally recovered for analysis, with a valid return rate of 96.68%. The screening process for participants in this study is shown in Figure 2.

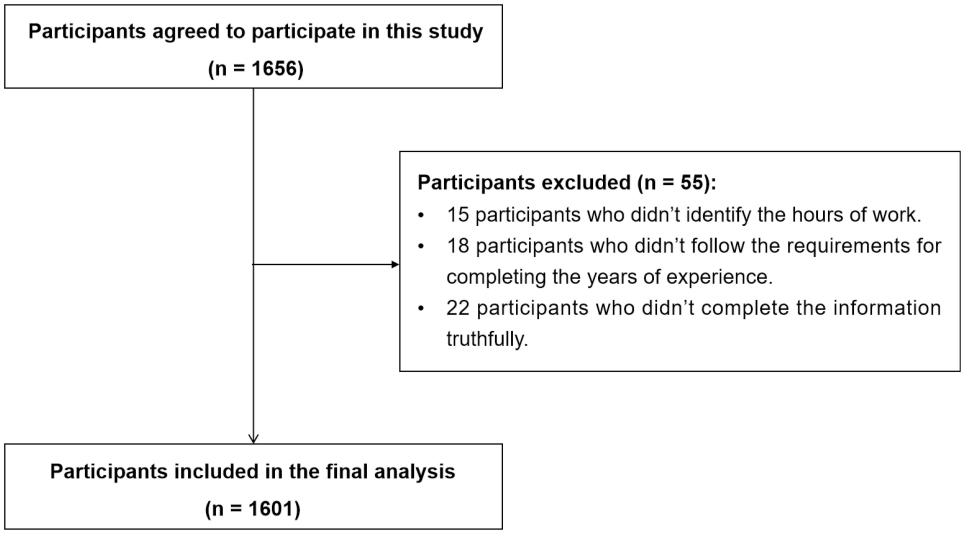

Figure 2 Flow chart for participant screening.

Instruments

Sociodemographic Information Questionnaire

Through literature review and consultation with nursing experts, a self-designed questionnaire was developed by the research team to collect sociodemographic information from participants, including gender, age, educational level, one-child family, marriage, childbearing, professional title, years of experience, department, and hours of work.

14-Item Resilience Scale (RS-14)

To measure participants' resilience, we used the 14-Item Resilience Scale (RS-14) by Qianyu Ni. The RS-14, created by Wagnild et al[41] in 1993, was revised and validated for the Chinese population in Chinese version by Ni[42] and her team in 2011, establishing it as a reliable tool for assessing resilience among Chinese adults. The scale consists of 14 items, including 2 dimensions of personal ability (10 items) and positive perception (4 items), and is rated on a 7-point Likert scale, ranging from 1 to 7 on a scale of "not at all" to "completely", with the total score ranging from 14 to 98. Higher scores indicate higher levels of resilience. The original Chinese version of the scale demonstrated good reliability and validity, with a Cronbach's alpha coefficient of 0.928, and the Cronbach's alpha coefficient for the scale in this study was 0.962.

Simplified Coping Style Questionnaire (SCSQ)

The Simplified Coping Style Questionnaire (SCSQ) was used to assess the participants' coping styles, which was developed by Chinese scholar Xie[43] in 1998, with two dimensions: positive coping (1~12 items) and negative coping (13~20 items), totaling 20 items. The scale is based on a 4-point scale, with scores from 0 to 3 indicating "never used, occasionally used, sometimes used, frequently used", respectively. Coping styles tendency score = standardized score of positive coping - standardized score of negative coping (standardized scores were obtained by *Z*-transformation of the mean and standard deviation of the positive and negative coping), which served as the participant's final coping styles score for this study.[44] When the score is greater than 0, it indicates the tendency to adopt a positive coping style, and vice versa, the tendency to adopt a negative coping style. The Cronbach's alpha coefficient for SCSQ was 0.90. In this study, the Cronbach's alpha coefficient for the scale was 0.919.

Chinese Version of the Empathy for Pain Scale (EPS)

To assess the level of participants' empathy for pain, we utilized the Chinese version of the Empathy for Pain Scale (EPS). The EPS, developed by Giummarra et al[45] in 2014, was translated and revised into Chinese in 2020 by Chinese scholars Shang et al[46] from the Department of Nursing at Naval Medical University, with validation conducted among

Chinese medical students, demonstrating good reliability and validity. The Chinese version of the Empathy for Pain Scale includes 2 dimensions: body and mind discomfort reactions (9 items) and empathy reactions (3 items). It is divided into four painful scenarios: undergoing surgery, after surgery, physical assault, and accidental injury. Each scenario contains the same 12 items, resulting in a total of 48 items on the scale. A Likert 5-point scale is used, ranging from 1 to 5 on a scale of "totally disagree" to "totally agree", and the mean score of each item represents the score of the scale, with a scale score greater than 3 indicating a high level of empathy for pain, as well as the Cronbach's alpha for the scale was 0.914. The Cronbach's alpha coefficient for the scale in this study was 0.975.

Data Analysis

Data analysis was performed using IBM SPSS Statistics 26.0. Descriptive statistics were employed for analyzing sociodemographic variables, as well as levels of resilience, coping styles, and empathy for pain. Frequency and percentage (%) were used to describe count data. Quantitative data following a normal distribution were described by mean ± standard deviation (M ± SD), while data with a skewed distribution were described by median (lower quartile, upper quartile). The Spearman correlation analysis test was used to analyze the relationship between resilience, coping styles, and empathy for pain among clinical nurses. When study data rely on self-reporting, common method biases may be present, as tested using Harman's single-factor test, and it is generally considered to explain no more than 40% of the total variance by the first common factor.[47] Mediation analysis: The mediating role of coping styles between resilience and empathy for pain was explored using model 4 of SPSS PROCESS 3.0 macro, as well as further exploring its role in the two different dimensions of empathy reactions and body and mind discomfort reactions, respectively, 5000 Bootstrap resamples were employed to adjust the 95% confidence interval (CI) of the effect. In general, mediating effects were considered significant with 95% CI excluding zero. $P<0.05$ was considered a statistically significant difference.

Ethical Considerations

The study was approved by the Ethics Committee of Dongguan Eighth People's Hospital (Dongguan Children's Hospital) and was conducted following the Declaration of Helsinki. Before the study commenced, all participants provided informed consent and voluntarily chose to participate, with the right to withdraw from the study at any point. All data collected were anonymized and used exclusively for our research.

Results

Common Method Biases Test

An unrotated exploratory factor analysis of all items from the three scales of RS-14, SCSQ, and EPS showed a total of 10 common factors for extracting feature roots greater than 1, and the first common factor explained 28.78% of the total variance, which was less than the 40% threshold standard. Therefore, the data in this study do not suffer from serious common method biases.

Sociodemographic Information of Clinical Nurses

A total of 1601 clinical nurses, aged (33.80 ± 7.54) years, participated in this study, and the majority of the nurses were female, with 1561 (97.5%), while male nurses were 40 (2.5%). In terms of education, 945 were undergraduate degrees or above, accounting for 59.1%. In terms of marriage and childbearing status, 1196 (74.7%) were married and 1134 (70.8%) had given birth. Approximately 55.7% of the total had the professional title of senior nurse or below, 12 (7, 19) years of nursing experience, and 48 (42, 52) hours of work per week. Other specific sociodemographic information is shown in Table 1.

Scores on Resilience, Coping Styles, and Empathy for Pain

The resilience score for 1601 clinical nurses was 75 (63, 84), with a score of 53 (44, 60) for the personal ability dimension and 22 (19, 25) for the positive perception dimension. The coping styles score was −0.22 (−0.90, 0.74), of which 719 were >0 (positive coping tendency) and 882 were <0 (negative coping tendency), in addition, 24 (21, 29) for

Table 1 Sociodemographic Information (n = 1601)

Variables		n (%) or M ± SD or Median (IQR)
Gender	Male	40 (2.5)
	Female	1561 (97.5)
Age		33.80 ± 7.54
Educational level	Secondary school	52 (3.2)
	Post-secondary	604 (37.7)
	Undergraduate or above	945 (59.1)
One-child family	Yes	79 (4.9)
	No	1522 (95.1)
Marriage	Unmarried	374 (23.4)
	Married	1196 (74.7)
	Divorced	26 (1.6)
	Widowed	5 (0.3)
Child bearing	Yes	1134 (70.8)
	No	467 (29.2)
Years of experience		12 (7, 19)
Professional title	Nurse	301 (18.8)
	Senior nurse	591 (36.9)
	Supervisor nurse	566 (35.4)
	Co-chief nurse or above	143 (8.9)
Working hours per week		48 (42, 52)
Department	Internal Medicine	376 (23.5)
	Surgery	354 (22.1)
	Emergency department	64 (4.0)
	Outpatient service	112 (7.0)
	Maternity ward	124 (7.7)
	Pediatric ward	93 (5.8)
	Intensive care unit	100 (6.2)
	Operating rooms	89 (5.6)
	Other departments	289 (18.1)

Abbreviations: M, Mean; SD, Standard deviation; IQR, Interquartile range.

positive coping dimension and 11 (8, 16) for negative coping dimension. The total empathy for pain score of 2.92 ± 0.79 and the body and mind discomfort reactions dimension score of 2.70 ± 0.89 were at a medium level, while the empathy reactions dimension score of 3.56 ± 0.74 was at a high level (Table 2).

Table 2 Scores on Resilience, Coping Styles, and Empathy for Pain (n = 1601)

Variables	M ± SD or Median (IQR)
14-Item Resilience Scale	75 (63, 84)
Personal ability dimension	53 (44, 60)
Positive perception dimension	22 (19, 25)
Simplified Coping Style Questionnaire	−0.22 (−0.90, 0.74)
Positive coping dimension	24 (21, 29)
Negative coping dimension	11 (8, 16)
Chinese version of the Empathy for Pain Scale	2.92 ± 0.79
Body and mind discomfort reactions dimension	2.70 ± 0.89
Empathy reactions dimension	3.56 ± 0.74

Abbreviations: M, Mean; SD, Standard deviation; IQR, Interquartile range.

Correlation Among Resilience, Coping Styles, and Empathy for Pain

Spearman correlation analysis showed that the resilience of clinical nurses was positively related to coping styles, positive coping, and negative coping (r=0.454, 0.717, 0.166, P<0.01). Resilience did not exhibit a significant relationship with the total empathy for pain score, but was positively related to the empathy reactions dimension (r=0.257, P<0.01), and negatively related to the body and mind discomfort reactions dimension (r=−0.058, P<0.05). Coping styles were negatively related to the empathy for pain and body and mind discomfort reactions dimension (r=−0.246, −0.302, P<0.01), and positively related to the empathy reactions dimension (r=0.062, P<0.05). The positive coping was positively related to the empathy for pain and empathy reactions dimension (r=0.052, 0.282, P<0.05). Negative coping was positively related to the empathy for pain, empathy reactions dimension, and the body and mind discomfort reactions dimension (r=0.321, 0.221, 0.320, P< 0.01) (Table 3).

Mediating and Suppressing Effects of Coping Styles Between Resilience and Empathy for Pain

Further analysis of the role of coping styles in the relationship between resilience and empathy for pain was conducted with empathy for pain (as well as empathy reactions dimension, body and mind discomfort reactions dimension) as the dependent variable, resilience as the independent variable, and coping styles as the mediating variable. The mediating effect was tested with 5000 Bootstrap resamples by PROCESS 3.0 macro. Detailed results are shown in Table 4, and model schematics are provided in Figures 3–5.

Table 3 Correlation Among Resilience, Coping Styles, and Empathy for Pain (n = 1601, r)

Variable	1	2	3	4	5	6	7
1. Resilience	1						
2. Coping styles	0.454**	1					
3. Positive coping	0.717**	0.515**	1				
4. Negative coping	0.166**	−0.539**	0.355**	1			
5. Empathy for pain	0.001	−0.246**	0.052*	0.321**	1		
6. Empathy reactions	0.257**	0.062*	0.282**	0.221**	0.614**	1	
7. Body and mind discomfort reactions	−0.058*	−0.302**	−0.005	0.320**	0.979**	0.461**	1

Notes: *P<0.05, **P<0.01.

Table 4 Mediating and Suppressing Effects of Coping Styles Between Resilience and Empathy for Pain (Standardization)

Model	Effect	Path	Effect Value	Standard Error	95% CI	Percentage of Total Effect
1	Total effect		0.030	0.025	(−0.019, 0.079)	/
	Direct effect		0.186	0.027	(0.134, 0.239)	/
	Indirect effect	Resilience→Coping styles→Empathy for pain	−0.157	0.016	(−0.189, −0.126)	/
2	Total effect		0.226	0.024	(0.178, 0.274)	/
	Direct effect		0.099	0.033	(0.034, 0.164)	43.81%
	Total indirect effect		0.127	0.029	(0.070, 0.183)	56.19%
	① Indirect effect	Resilience→Positive coping→Empathy reactions dimension	0.095	0.030	(0.036, 0.153)	42.03%
	② Indirect effect	Resilience→Negative coping→Empathy reactions dimension	0.032	0.008	(0.018, 0.048)	14.16%
		①-②	0.062	0.033	(−0.002, 0.126)	
3	Total effect		−0.028	0.025	(−0.077, 0.021)	/
	Direct effect		0.144	0.026	(0.092, 0.196)	/
	Indirect effect	Resilience→Coping styles→Body and mind discomfort reactions dimension	−0.172	0.016	(−0.203, −0.142)	/

Notes: Model 1: empathy for pain as the dependent variable, resilience as the independent variable, and coping styles as the mediating variable; Model 2: empathy reactions dimension as the dependent variable, resilience as the independent variable, positive coping and negative coping as mediating variables; Model 3: body and mind discomfort reactions dimension as the dependent variable, resilience as the independent variable, and coping styles as the mediating variable.
Abbreviation: CI, Confidence Interval.

Model 1 was tested with empathy for pain as the dependent variable, resilience as the independent variable, and coping styles as the mediating variable. The results showed a 95% CI (−0.019, 0.079) for the total effect, which was not statistically significant. However, the direct effect had a 95% CI (0.134, 0.239), which was significant. Resilience positively predicted coping styles (a=0.457, $P<0.001$), coping styles negatively predicted empathy for pain (b=−0.343, $P<0.001$), and the indirect effect 95% CI (−0.189, −0.126) was significant as well as accounting for 78.5% of the direct effect. This suggested a suppressing effect, as supported by a previous study[48] which concluded that the direct and indirect effects are significant and opposite, while the total effect is not significant. Thus, coping styles played a suppressing effect between resilience and empathy for pain (Figure 3).

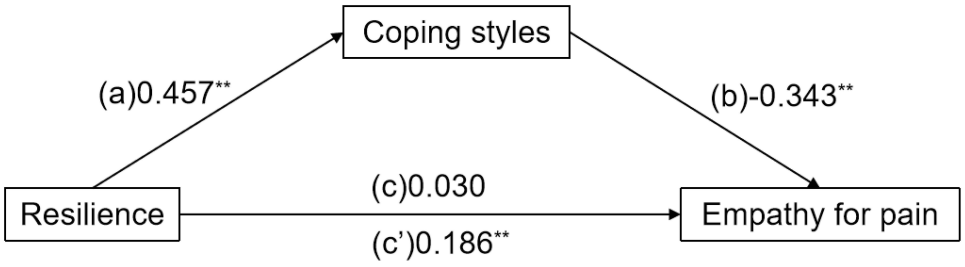

Figure 3 Model of the suppressing effect of clinical nurses' coping styles between resilience and empathy for pain.
Notes: **$P<0.001$; (a) the effect of resilience on coping styles; (b) the effect of coping styles on empathy for pain; (c) the total effect of resilience on empathy for pain. (c') the direct effect of resilience on empathy for pain.

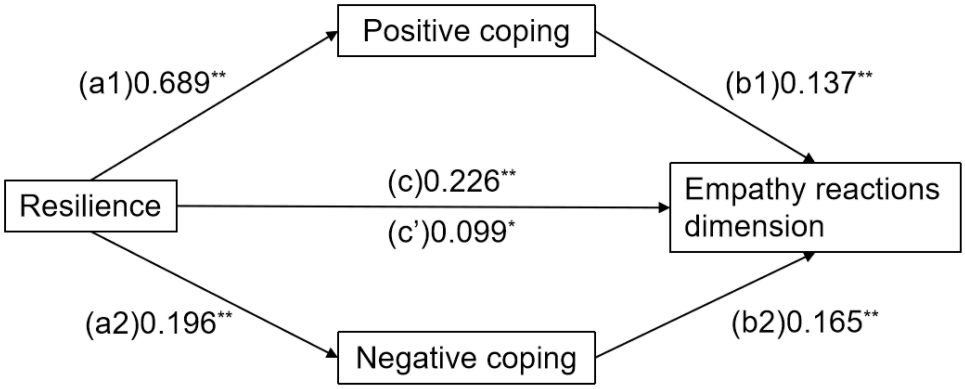

Figure 4 Model of the mediating effect of clinical nurses' coping styles between resilience and empathy reactions dimension.
Notes: *P<0.01; **P<0.001; (a1) the effect of resilience on positive coping; (b1) the effect of positive coping on empathy reactions; (a2) the effect of resilience on negative coping; (b2) the effect of negative coping on empathy reactions; (c) the total effect of resilience on empathy reactions; (c′) the direct effect of resilience on empathy reactions.

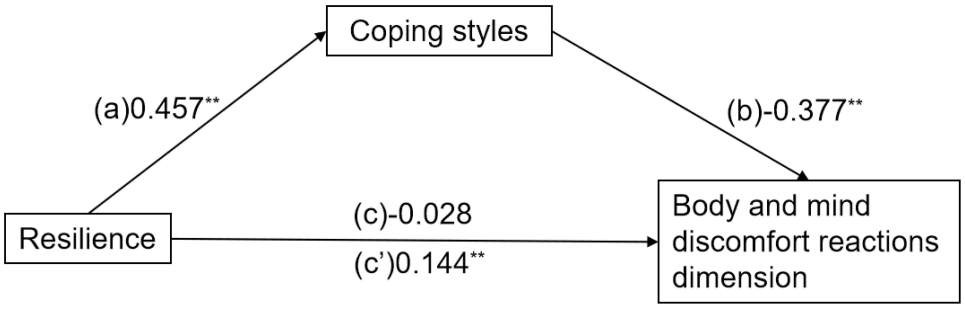

Figure 5 Model of the suppressing effect of clinical nurses' coping styles between resilience and body and mind discomfort reactions dimension.
Notes: **P<0.001; (a) the effect of resilience on coping styles; (b) the effect of coping styles on body and mind discomfort reactions; (c) the total effect of resilience on body and mind discomfort reactions; (c′) the direct effect of resilience on body and mind discomfort reactions.

In Model 2, empathy reactions dimension was tested as the dependent variable, resilience as the independent variable, as well as positive coping and negative coping as mediating variables. The results showed a 95% CI (0.178, 0.274) for the total indirect effect, with a significant mediating effect, in which the indirect effect of positive coping between resilience and empathy reactions was statistically significant (0.036, 0.153), and that of negative coping was also significant (0.018, 0.048). Although the indirect effect of positive coping accounted for 42.03%, and that of negative coping was 14.16%, the difference between the two mediating effects was not significant. Therefore, both positive coping and negative coping played a partial mediating role (Figure 4).

In Model 3, body and mind discomfort reactions dimension was tested as the dependent variable, resilience as the independent variable, and coping styles as the mediating variable. The results showed a 95% CI (−0.077, 0.021) for the total effect, which was not statistically significant. The 95% CI (0.092, 0.196) for the direct effect, which was significant. Resilience positively predicted coping styles (a=0.457, P<0.001), and coping styles negatively predicted body and mind discomfort reactions (b=−0.377, P<0.001). The 95% CI (−0.203, −0.142) for the indirect effect was significant, and the absolute value of the ratio of the indirect to direct effect was 1.19. Coping styles played a suppressing effect on resilience and body and mind discomfort reactions (Figure 5).

Discussion

This study examined the current state of empathy for pain among clinical nurses, analyzed the relationship between resilience and empathy for pain, and explored the mediating effects of coping styles. The results demonstrated that resilience was positively correlated with coping styles and the empathy reactions dimension, while showing a negative

correlation with the body and mind discomfort reactions dimension. Coping styles were negatively correlated with empathy for pain and the body and mind discomfort reactions dimension, but positively correlated with the empathy reactions dimension. Notably, the effects of resilience on clinical nurses' empathy for pain were partially mediated and suppressed by coping styles.

Findings in this study showed that clinical nurses' empathy for pain was below the high empathy for pain threshold of 3 points on the EPS scale. This suggested that Chinese clinical nurses' empathy for pain was at a medium to high level and needed to be improved. Among the two dimensions of empathy for pain, the empathy reactions dimension was at a relatively high level, while the body and mind discomfort reactions dimension was at a medium level. This is consistent with previous reports of related studies, which[14] concluded that clinical nurses with extensive practical experience tend to exhibit higher levels of empathy for pain than school medical students and that positive empathy reactions promote pro-social behaviors, such as understanding, comfort, and concern for patients, which are more beneficial to pain management and nurse-patient relationship harmony. However, painful environments may also induce body and mind discomfort reactions in nurses, which may affect work productivity as well as physical and mental well-being. The findings of this study showed that the majority of clinical nurses exhibited strong empathy reactions, could perceive the patient's pain, generate empathy, and effectively empathize with the patient. At the same time, they did not exhibit serious body and mind discomfort reactions when confronted with a patient's trauma or pain, suggesting that the clinical nurses were able to avoid the potentially detrimental impacts of empathy for pain on themselves. To delve into the reasons, pain as a unique sensory and emotional experience, compared with other social situations, can trigger different types of sympathetic or empathetic responses,[45] as clinical nurses, although not directly undergoing the disease or pain themselves, the hearing and sensation of long-term exposure to traumatic environments and closest contact with patients can easily lead to empathic responses to pain. Furthermore, the group of clinical nurses in this study mainly consisted of females, and compared to males, females typically excel in emotional expression, listening and sharing, as well as caring for others, which contributes to the improvement of empathy, due to the influence of hormone levels, personality traits, and other factors.[49] Empathy is an innate human capacity and can also be cultivated through post-learning, such as previous experience affects the way we empathize with pain.[45] With growth and experience, clinical nurses' upbringing with illness, childbirth, and pain, as well as growth in work experience with caring for patients in pain, enhances their ability to sense the pain and psychological changes in patients and display empathy reactions. On the other hand, medical personnel are more concerned about the psychological well-being of patients and are more sensitive to their feelings because educational institutions and hospitals are paying more attention to the development of psychosocial skills of medical personnel, and there is also a growing emphasis on education and training in humanistic qualities.[50,51] At the same time, as shown in many studies,[14,45] witnessing others experiencing pain may increase one's subjective pain intensity, somatic discomfort, and so on. Therefore, nursing managers should also pay attention to the potential adverse effects of empathy for pain on the physical and mental well-being of clinical nurses, and adopt targeted interventions to avoid body and mind discomfort reactions as well as promote empathy reactions, to effectively improve the level of empathy for pain among clinical nurses.

According to the study findings, the correlation between resilience and empathy for pain among clinical nurses was not statistically significant, which contradicted the initial hypothesis. However, further analysis showed that resilience was positively correlated with the empathic reactions dimension and negatively correlated with the body and mind discomfort reactions dimension. This result may arise from the differing nature of the two dimensions of empathy for pain (empathic reactions and body and mind discomfort reactions), which have contrasting correlations with resilience, resulting in a lack of significant association between the total empathy for pain score and resilience. In this study, the higher the resilience scores were, the higher the level of empathy reactions, and the lower the level of body and mind discomfort reactions of the clinical nurses. This is similar to the findings of a previous study,[52] which reported that there was a positive relationship between resilience and empathy. As resilience increased, medical students demonstrated heightened empathy, suggesting that increased resilience is an effective mechanism for preventing the erosion of empathy. Research[53] has shown that the affiliative brain and biobehavioral synchrony are involved in the construction of resilience: the neural structure of the "affiliative brain" allows individuals to extend love to strangers, social groups, and so on, while through "biobehavioral synchrony" individuals can influence each other's physiological functions through the coordination of facial socio-emotional signals without physical contact. It can be seen that clinical nurses with high resilience are more adept at receiving patients' pain signals, perceiving

patients' distress, and conveying their understanding and concern to each other. Due to the self-regulatory nature of resilience,[53] nurses can more effectively regulate themselves and adopt positive coping strategies when confronted with pain or trauma, which reduces the negative impact on themselves. Clinical nurses' particular work environments and experiences not only tend to trigger empathic distress but also diminish nurses' resilience to a certain extent. Developing resilience strategies can improve empathy while simultaneously preventing empathic distress and empathy burnout.[54] Therefore, in addressing empathy for pain among clinical nurses, clinical managers can formulate effective strategies to increase the resilience of clinical nurses from a positive psychology perspective, thereby promoting empathy reactions as well as reducing body and mind discomfort reactions.

In addition, coping styles were positively related to resilience and empathy reactions dimension, while negatively related to empathy for pain as well as body and mind discomfort reactions dimension. This suggested that clinical nurses who tended to adopt positive coping had higher levels of resilience and demonstrated higher empathy reactions as well as lower levels of body and mind discomfort reactions when empathizing with patients. The study by Palacio[55] noted that resilience contributed to the reduction of psychological problems, pain perception, and emotional distress, in addition to promoting individual adaptability and effective coping. It might be that positive attitudes increase the tendency of clinical nurses to adopt positive coping and use problem-solving strategies to avoid escaping from stressful events. Coping styles are closely related to individual mental health, empathy, well-being, and so on.[56–58] On the one hand, positive coping contributes to nurses' gradual escape from difficulties and the adverse effects of stress, which is beneficial to physical and mental health; while negative coping adversely affects physical and emotional health, leading to decreased quality of care, burnout, and increased turnover.[33,35,56] In recent years, studies have found that coping styles are related to individual empathy: passive coping style can prevent individuals from being directly exposed to stressors, but prolonged passive coping cannot solve problems, and may instead lead to persistent self-denial, self-doubt, low self-efficacy, and more psychological problems, such as emotional exhaustion, depersonalization, and indifference to others.[35,59] This was also reflected in the relationship we found between coping styles and empathy for pain, where clinical nurses who used positive coping were able to understand patients' pain, express concern and empathy for patients, escape the negative effects of chronic illness, trauma, and painful circumstances, as well as better avoid own somatic discomfort.

The findings of the mediating effects analysis in our study showed that coping styles played an important role in the relationship between resilience and empathy for pain among clinical nurses. This study found that with the introduction of the variable of coping styles, resilience significantly and positively predicted empathy for pain under the direct effect and that nurses with high resilience could reduce the level of empathy for pain by facilitating coping under the indirect effect, where coping styles playing a suppressing role between them. It could be inferred that resilience is a positive predictor of empathy for pain, yet this association is suppressed by coping styles. At the same time, this could further explain the lack of significant correlation between resilience and empathy for pain described above, potentially due to coping styles suppressing its primary effect. As a result, highly resilient clinical nurses, when faced with a painful environment, perceive themselves as having sufficient coping resources, which in turn promotes positive coping strategies[33,57,59,60] and reduces levels of empathy for pain. Further analysis of the role of coping styles, we conducted mediation analyses in terms of the two dimensions of empathy for pain.

First, resilience directly and positively predicted empathy reactions dimension and affected empathy reactions by acting on coping styles, which indicated that positive coping and negative coping acted as a mediating role between resilience and empathy reactions in clinical nurses. It meant that the higher the level of clinical nurses' resilience, the better empathy reactions they would have, and plentiful resilience could drive individuals to adopt positive coping strategies, which could facilitate empathic expression and show sympathy, understanding, and comfort to patients. Cao[59] concluded that highly resilient individuals preferred problem-solving coping avoided emotion-centered coping, and were adept at utilizing effective resources available (such as social support, etc) for self-regulation, which contributed to better perception and coping with the patient's condition and emotional changes, as well as reduced compassion fatigue. However, the mediating model of our study also showed a positive effect of negative coping, which was inconsistent with the expected hypothesis. It might be that some of the negative coping styles (eg, avoidance, waiting, self-soothing, etc), when confronted with painful environments, insulate clinical nurses from the negative effects of painful stimulus events

to a certain extent, gaining buffer time to seek additional psychological resources which in turn maintain the level of empathy reactions.[18]

On the other hand, Palacio[55] concluded that promoting resilient coping among caregivers reduces the suffering caused by disease-related changes in the biopsychosocial and spiritual dimensions. Our study found that with the introduction of the variable of coping styles, resilience significantly and positively predicted body and mind discomfort reactions dimension under the direct effect, while nurses with high resilience could reduce the level of body and mind discomfort reactions by facilitating coping under the indirect effect, where coping styles playing a suppressing role. It followed that when clinical nurses are confronted with potentially painful situations as stressors, their perception of having sufficient internal and external resources to meet the demands of coping with the external event, along with adopting positive coping strategies,[33,57,59,60] which contributed to reducing reactions of own subjective somatic discomfort when witnessing and empathizing with patients in pain.

Overall, resilience positively predicted empathy for pain, and coping styles played a mediating and suppressing role in this relationship. However, both empathy reactions and body and mind discomfort reactions are dimensions of empathy for pain, and the level of empathy for pain decreases with the reduction of body and mind discomfort reactions. Hence, we need to improve the overall level of empathy for pain by increasing empathy reactions and decreasing body and mind discomfort reactions among clinical nurses.

In summary, it is particularly important to acquire and maintain sufficient psychological resources to keep high levels of psychological resilience and choose more positive coping strategies for clinical nurses when confronting pain-filled environments and managing pain. These findings have significant theoretical and practical implications for nursing management and policy development. Alongside prioritizing patient care in clinical management, it is equally important to address the mental and physical health of healthcare workers. Based on this, it is recommended that nursing managers should organize activities related to enhancing psychological resilience (eg, systematic and diversified psychological course training[57]) from positive psychology and transactional theory of stress, enabling clinical nurses to choose more positive coping strategies, which will improve empathy for patients in pain and alleviate physical and psychological stress in both themselves as well as patients. Furthermore, when nurses experience adverse mental or physical conditions, it is crucial to help them acquire and maintain sufficient psychological resources. This can be achieved through psychological counseling and support, including establishing a comprehensive psychological support system, a strong social support network, and a positive work environment to enhance nurses' mental well-being and the quality of care.

Limitations

Despite the rigorous methodology used in this study, there are some limitations. First, this study was a cross-sectional study, so we could not infer a causal relationship between the study variables. Furthermore, the study sample recruited for this study was from only one province in China using convenience sampling and self-reported questionnaires, which could introduce bias and limit the representativeness and generalizability of the findings. Consequently, the results may not apply to nurses in other regions. Future studies should employ random sampling methods, expand the sample size of nurses, and conduct multi-country, multi-region, and large-sample studies to improve the diversity of samples and the generalizability of findings. Moreover, the design of longitudinal studies, experimental studies, and qualitative studies should be increased to explore the associations between study variables further. In addition, our study only focused on the effects of resilience and coping styles on empathy for pain, and future research needs to explore more predictors of empathy for pain among clinical nurses.

Conclusion

This study confirmed the significant relationship between resilience, coping styles, and empathy for pain among Chinese clinical nurses, and coping styles play a partially mediating and suppressing role between resilience and empathy for pain, validating the transactional theory of stress, which may provide some theoretical basis for improving empathy for pain and optimizing pain management among clinical nurses. Nursing managers should pay more attention to cultivating the level of resilience and positive coping strategies to promote empathy for pain among clinical nurses.

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Disclosure

The authors report no conflicts of interest in this work.

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