

Latent profile analysis of caring nurse-patient interactions among Chinese clinical nurses: a crosssectional study

Li Rongli

Taizhou Hospital of Zhejiang Province Affiliated to Wenzhou Medical University

Zhang Jiali

Taizhou Hospital of Zhejiang Province Affiliated to Wenzhou Medical University

Cai Panpan

Taizhou Hospital of Zhejiang Province Affiliated to Wenzhou Medical University

Zhang Jiayi

Taizhou Hospital of Zhejiang Province Affiliated to Wenzhou Medical University

Chen Xinying

`chenxy7484@enzemed.com`

Taizhou Hospital of Zhejiang Province Affiliated to Wenzhou Medical University

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Abstract

Background

Caring nurse-patient interaction is central to high-quality nursing services and improves patient satisfaction, treatment adherence, and health outcomes. Although previous studies have evaluated nurses' interaction competence, little is known about its heterogeneity among clinical nurses in China.

Aim

We aimed to describe the current status of this competence, identify latent subgroups alongside their characteristics using latent profile analysis, and explore associated factors of potential subgroup.

Methods

We conducted a cross-sectional survey between September and November 2025. A total of 431 clinical nurses were recruited by convenience sampling from one tertiary hospital in Zhejiang Province. We collected data using a general information questionnaire, the Psychological Capital Questionnaire, and the Caring Nurse-Patient Interaction Scale. Latent profile analysis identified subgroups of nurses' interaction competence, and logistic regression explored factors associated with subgroup membership.

Results

Clinical nurses demonstrated a moderate-to-high level of caring nurse-patient interaction competence. Latent profile analysis identified three subgroups: low-competence (25.5%), moderate-competence (46.4%), and high-competence (28.1%). Logistic regression showed that years of working experience, professional title, psychological capital, and nurse-patient conflict in the past three months were related factors of subgroup membership ($P < 0.05$).

Conclusions

Caring nurse-patient interaction competence varies considerably among clinical nurses and falls into three latent profiles. Nursing managers should identify nurses' profile types and develop tailored training interventions according to their specific characteristics to enhance care quality.

1. Background

The nurse-patient interaction is central to high-quality nursing care and provides the essential context for clinical practice [1]. Based on Watson's Theory of Human Caring, caring nurse-patient interaction refers to the attitudes, behaviors, and skills nurses demonstrate in building therapeutic relationships with patients. This interaction promotes patient recovery, respects patient dignity, and lies at the heart of nursing services [2]. The 23-item Caring Nurse-Patient Interaction Scale (CNPI-23) measures this construct across four dimensions: clinical, relational, humanistic, and comforting care [3]. These dimensions cover both clinical competence and relational aspects, including communication, emotional support, and empathy [4].

Evidence suggests that high-quality nurse-patient interaction improves patient outcomes [5]. Effective nurse-patient communication and relationship-building are associated with higher satisfaction, better treatment adherence, and improved clinical recovery [6]. In contrast, poor caring behaviors are linked to negative patient outcomes. The quality of nurse-patient interaction also affects nurses' well-being: greater interaction competence is associated with higher job satisfaction and lower turnover intention [7]. With growing demands on healthcare systems, strengthening nurses' interaction competence has become an important strategy for improving care quality.

Previous studies on nurse-patient interaction competence have mostly used a variable-centered approach, focusing on total scores and their correlations with demographic or organizational factors [8, 9]. These studies have advanced our understanding of the average level of interaction competence and its associated factors. However, nurses may vary considerably in their caring interactions, and research using latent profile analysis (LPA) to explore this individual heterogeneity is still limited. LPA is a person-centered approach that identifies latent subgroups based on individuals' response patterns [10]. Unlike methods relying on arbitrary cut-off scores, LPA allows subgroups to emerge empirically from the data. Regarding potential related factors, previous studies have linked caring nurse-patient interaction competence to demographic and occupational factors such as work experience, professional title, and educational background, as well as to psychological capital. These variables were therefore included as covariates in the present study.

The aims of this study were threefold: (1) to identify latent profiles of clinical nurses' caring nurse-patient interaction competence using LPA based on the 23 item scores of the CNPI-23 scale; (2) to describe the demographic and occupational characteristics of each identified profile; (3) and to explore related factors that distinguishing profile groups, particularly psychological capital and work-related experiences. This study adopted a person-centered approaches to identify heterogeneity in nurses' caring interaction competence and to inform the development of tailored interventions for improving nurse-patient interaction quality and patient outcomes.

2. Methods

2.1 Subjects of investigation

This cross-sectional study employed a convenience sampling method. From September 16 to November 5, 2025, clinical nurses were recruited from a single public hospital in Zhejiang Province. This hospital is a tertiary Grade A general hospital integrating medical care, scientific research, education, and disease prevention; it comprises both the Linhai Campus and the Dong Campus, which was officially opened in 2021, with a total of 1,500 beds.

Inclusion criteria: (1) Registered nurses in active clinical practice; (2) Completed a nurse residency program. Exclusion criteria: (1) Nurses with a history of mental illness or those unable to provide direct patient care; (2) Those on leave or away for training during the study period; (3) Nurses from auxiliary departments such as the laboratory, imaging, and ultrasound centers, who did not perform clinical nursing procedures.

The determination of sample size needs to balance the requirements of LPA and subsequent regression analyses. For LPA, existing simulation studies provide clear sample size reference guidelines: when the discrimination between classes is at a medium-to-high level and continuous indicators are used for latent discriminant analysis, a sample size of 300 to 500 cases is recommended [11]. According to Kendall's sample size calculation principle, the required sample size is 5 to 10 times the number of variables [12]. This study included a total of 59 variables, comprising 12 items for general demographic data, 23 items from the CNPI scale, and 24 items from the Psychological Capital Questionnaire. Accounting for a 10% attrition rate, the total sample size ranged from 328 to 655 cases. Finally, 431

nurses were included in the study; this sample size satisfied both Kendall's criterion and LPA's requirements for sample size, thereby ensuring the stability of model estimation and the reliability of categorical classification.

2.2 Survey instrument

2.2.1 General information questionnaire

Based on literature review results and discussions among the research team, we have developed a questionnaire containing the following basic information

Gender; Age (years); Having children; Marital status; Professional title; Years of working experience; Clinical department; Education level; Employment type; Average number of night shifts per month; Voluntarily chose nursing as a career; Nurse-patient conflict in past 3 months. The assessment method is a single-item self-assessment.

2.2.2 Caring Nurse-Patient Interaction Scale-23

This scale was refined by Cossette et al. in 2006 [3], and was cross-culturally adapted into Chinese, with its reliability subsequently tested by Zhi et al. in 2014 to assess caring nurse-patient interaction among clinical nurses [13]. The CNPI-23 is a short scale of 23 items with a 5-point Likert scale (1 = not at all to 5 = extremely). It reflects 4 main domains of nursing care, including clinical care (9 items), relational care (7 items), humanistic care (4 items), and comforting care (3 items). Scores range from 23 to 115, with higher scores indicating better interaction quality. We calculated Cronbach's α coefficients to assess the scale's reliability. The overall α coefficient was 0.942 in previous studies (ranging from 0.742 to 0.899 across dimensions). In our sample, the overall α coefficient was 0.959 (ranging from 0.858 to 0.963 across dimensions), indicating good reliability in our study population.

2.2.3 Psychological Capital Questionnaire-24

This questionnaire was compiled by Luthans F et al. in 2007. Which contains 24

items in four dimensions: self-efficacy (6 items), hope (6 items), resilience (6 items), and optimism (6 items) [14]. The scale contains three reverse-scored items (13,20,23). Each item was scored on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). The overall score was between 24 and 144, with higher scores indicating more level of psychological capital. We obtained a Cronbach's α coefficient of 0.928 for the questionnaire, indicating good reliability. (Permission to use the Psychological Capital Questionnaire (PCQ) for this research was obtained from Mind Garden, Inc. Copyright © 2007 Fred L. Luthans, Bruce J. Avolio, and James B. Avey. All rights reserved).

2.3 Data collection

Before data collection, we recoded the reverse-coded items of the Psychological Capital Questionnaire-24 (items 13, 20, 23), ensuring that higher scores consistently indicate stronger psychological capital.

A pre-test was conducted to assess the questionnaire's structure, wording, content conciseness, appropriateness, and clarity. Thirty nurses meeting the inclusion-exclusion criteria were randomly selected for the pre-test and did not participate in the subsequent formal survey. Drawing on participant feedback, minor modifications were implemented to enhance item clarity. The completion time ranged from 280 to 457 seconds. Through research group discussions and with reference to related literature [15], questionnaires completed in less than 240 seconds were excluded from the formal survey to ensure response quality. The pre-test results indicated that the overall Cronbach's α for the scale was 0.943.

An online data collection approach was employed using the Questionnaire Star platform. We provided standardized instructions on the first page of the questionnaire, explaining the study's objectives and completion procedures. Respondents completed all items, and submission was considered informed consent. All participants were informed of the study objectives, content, and principles of voluntary participation through the informed consent section on the questionnaire homepage; We contacted the nurse managers who agreed to participate and assured them that the survey would not adversely affect the nurses. The QR code was then disseminated by the managers via departmental WeChat groups, providing nurses with the opportunity to participate voluntarily and anonymously. A total of 500 questionnaires were distributed in this study, after excluding questionnaires completed in less than 240 seconds and those with identical responses across all items, a total of 466 questionnaires were collected. Finally, 431 valid questionnaires were retained, resulting in an effective response rate of 86.2%.

2.4 Statistical methods

SPSS 29.0 and Mplus 8.3 software were used for statistical analysis; categorical variables were presented as frequencies and percentages, while continuous variables were reported as mean $\pm$ standard deviation. For the univariate analysis of clinical nurses' caring nurse-patient interactions, categorical variables were analyzed using the χ^2 test or Fisher's exact test, and continuous variables were analyzed using ANOVA (the total score approximately follows a normal distribution). $P < 0.05$ was defined as statistically significant.

This study conducted latent profile analysis using Mplus 8.3. The optimal latent classification of nurses' caring interaction competence was determined by progressively increasing the number of classes and comprehensively evaluating multiple fit indices, including the Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample-size adjusted BIC (aBIC) (smaller values indicate better fit), entropy (values > 0.80 are preferred), as well as the Lo-Mendell-Rubin (LMR) test and Bootstrap Likelihood Ratio Test (BLRT) ($P < 0.05$ indicating statistical significance) [16]. The optimal model was selected based on convergent evidence across multiple statistical indicators, while also requiring that the identified classes be theoretically interpretable and that each class account for no less than 5% of the total sample [17].

Harman's single-factor test was used to evaluate common-method bias [18]. Exploratory factor analysis was performed on all self-reported items with an unrotated solution. A variance-explained threshold of 40% for the first extracted factor was adopted; a value below this cutoff indicated that no serious common-method bias was present in the study.

- We used the robust three-step method (R3STEP) in Mplus to examine related factors of latent class membership [19]. Following Vermunt's procedure, we first fitted a latent profile model without covariates. We then calculated each participant's most likely class probability and classification error. In the final step, we regressed class membership on covariates using logistic regression, with error rates fixed to account for classification uncertainty. This method yields unbiased estimates and robust standard errors. We entered covariates that were significant in univariate analyses and reported results as odds ratios (ORs) with 95% confidence intervals (CIs).

3. Results

3.1 Common-method bias assessment

The first unrotated factor from Harman's single-factor analysis accounted for 31.159% of the total variance. This percentage fell below the 40% cutoff, suggesting that common-method bias was unlikely to substantially affect the results.

3.2 Latent Profile Analysis of Caring Nurse-Patient Interactions Among Clinical Nurses

Latent profile analysis was performed on 431 clinical nurses using the 23-item scores of the CNPI-23 scale as manifest variables. Model-fit indices are shown in Table 1. The three-class model yielded the lowest information-criterion values (AIC, BIC, aBIC), the highest entropy (0.976), and statistically significant LMR and BLRT tests ($P < 0.05$). Accordingly, the three-class model was selected as the optimal solution. The average latent class probabilities for the three profiles were 98.9%, 98.8%, and 99.4%, respectively.

Table 1
Latent profile analysis of Caring Nurse-Patient Interaction

Category	AIC	BIC	aBIC	Entropy	LMRT(p)	BLRT(p)	Category probability(%)
1	22999.399	23186.440	23040.463	—	—	—	100
2	19048.108	19332.735	19110.595	0.968	<0.0001	<0.0001	63.1/36.9
3	16989.053	17371.267	17072.965	0.976	<0.0001	<0.0001	25.5/46.4/28.1
4	16415.926	16895.727	16521.263	0.968	0.4165	<0.0001	10.2/42.9/18.1/28.8
5	15907.832	16485.220	16034.593	0.965	0.5589	<0.0001	5.3/19.5/25.2/23.0/27.0

Figure 1 presents the average item scores across the 23 items of the CNPI-23 scale for each latent profile. On the basis of their overall response patterns, the three profiles were labelled as follows:

Profile 1: Low-Competence Group (Relationship-Care Deficient Type, $n = 110$, 25.5%) had the lowest scores on all items, particularly in items related to relationship care. The average scores for all 7 items in this dimension are below 3 points.

Profile 2: Moderate-Competence Group (Balanced Development Type, $n = 200$, 46.4%) was characterized by all entries have scores between profile 1 and profile 3.

Profile 3: High-Competence Group (Comprehensive Excellence Type, $n = 121$, 28.1%) had the highest scores on all items, nearly approaching the maximum possible score.

[Insert Table 1 and Fig. 1 Here]

3.3 Univariate Analysis of Latent Profiles of Caring Nurse-Patient Interactions Among Clinical Nurses

Table 2 presents the demographic and occupational characteristics, as well as psychological-capital scores, for the total sample and across the three latent profiles. Significant differences among the three profiles of clinical nurses' caring nurse-patient interaction competence were observed for age, professional title, working years, voluntary career choice of nursing, experience of nurse-patient conflict in the past three months, and scores on the Psychological Capital Questionnaire (all $P < 0.05$).

Table 2
Univariate analysis of latent profile of Caring Nurse-Patient Interaction among clinical nurses (n = 431)

Variables	Total sample (n = 431)	Low-Competence Group (n = 110)	Moderate-Competence Group (n = 200)	High-Competence Group (n = 121)	χ^2 /F	P
Gender					0.525	0.769
Male	23(5.3)	6(5.5)	12(6)	5(4.1)		
Female	408(94.7)	104(94.5)	188(94)	116(95.9)		
Age (years)					11.987	0.017
< 30	151(35.1)	50(45.5)	69(34.5)	32(26.4)		
30–39	163(37.8)	40(36.4)	70(35.0)	53(43.8)		
> 39	117(27.1)	20(18.1)	61(30.5)	36(29.8)		
Having children					4.247	0.120
Yes	281(65.2)	65(59.1)	129(64.5)	87(71.9)		
No	150(34.8)	45(40.9)	71(35.5)	34(28.1)		
Marital status					2.673	0.263
Married	308(71.5)	72(65.5)	148(74.0)	88(72.7)		
Other (divorced, single, widowed, etc.)	123(28.5)	38(34.5)	52(26.0)	33(27.3)		
Professional title					11.066	0.004
Junior	212(49.2)	69(62.7)	87(43.5)	56(46.3)		
Intermediate/Senior	219(50.8)	41(37.3)	113(56.5)	65(53.7)		
Years of working experience					22.273	0.001
< 5	81(18.8)	25(22.7)	43(21.5)	13(10.7)		
5–10	134(31.0)	47(42.8)	49(24.5)	38(31.4)		
11–15	61(14.2)	11(10.0)	27(13.5)	23(19.0)		
> 15	155(36.0)	27(24.5)	81(40.5)	47(38.8)		
Clinical department					8.297	0.217
Internal medicine	124(28.8)	28(25.5)	60(30.0)	36(29.8)		
Surgery	119(27.6)	26(23.6)	51(25.5)	42(34.7)		
Special units (ICU, emergency, anesthesia, operating room)	165(38.3)	49(44.5)	76(38.0)	40(33.1)		
Others (obstetrics, gynecology, pediatrics)	23(5.3)	7(6.4)	13(6.5)	3(2.5)		

Variables	Total sample (n = 431)	Low-Competence Group (n = 110)	Moderate-Competence Group (n = 200)	High-Competence Group (n = 121)	χ^2 / F	P
Education level					1.944	0.746
Associate degree or below	201(46.6)	54(49.1)	93(46.5)	54(44.6)		
Bachelor's degree or higher	230(53.4)	56(50.9)	107(53.5)	67(55.4)		
Employment type					5.417	0.067
Permanent (established post)	280(65.0)	63(57.3)	130(65.0)	87(71.9)		
Non-permanent (contract)	151(35.0)	47(42.7)	70(35.0)	34(28.1)		
Average number of night shifts per month					6.518	0.164
< 4	201(46.7)	45(40.9)	95(47.5)	61(50.4)		
4–8	173(40.1)	43(39.1)	82(41.0)	48(39.7)		
> 8	57(13.2)	22(20.0)	23(11.5)	12(9.9)		
Voluntarily chose nursing as a career					16.547	<0.001
Yes	300(69.6)	62(56.4)	140(70.0)	98(81.0)		
No	131(30.4)	48(43.6)	60(30.0)	23(19.0)		
Nurse–patient conflict in past 3 months					10.075	0.006
Yes	114(26.5)	38(34.5)	56(28.0)	20(16.5)		
No	317(73.5)	72(65.5)	144(72.0)	101(83.5)		
Psychological capital $\boxtimes$ (mean $\pm$ SD)	106.90 $\pm$ 16.72	94.21 $\pm$ 13.59	107.70 $\pm$ 14.67	117.12 $\pm$ 14.94	72.652	< 0.001

Note: $\boxtimes$ Psychological capital was measured as a continuous variable and compared using one-way ANOVA; data presented as mean $\pm$ standard deviation.

The mean total score of the CNPI-23 Scale was 95.88 ± 13.11 , and the overall average score was 4.17 ± 0.82 . Subscale average scores were 4.29 ± 0.76 for clinical care, 3.90 ± 0.88 for relational care, 4.10 ± 0.83 for humanistic care, and 4.52 ± 0.61 for comforting care.

[Insert Table 2 Here]

3.4 Multivariate Analyses of Factors Associated With Latent Profiles of Caring Nurse-Patient Interactions Among Clinical Nurses

Adopting the Mplus-implemented robust three-step approach, using the high-competence group as the reference, we explored factors linked to clinical nurses' latent profile membership in the context of caring nurse-patient interactions. The outcomes are summarized in Table 3.

Table 3
Factors associated with latent profile membership: results from the robust three-step approach

Variable	B	SE	Z	P	OR	95% CI
Profile 1 vs. Profile 3 (Ref.)						
Constant term	12.251	1.418	8.642	< 0.001	—	—
Professional title (Ref.: Junior)						
Intermediate/Senior	0.791	0.677	1.169	0.242	2.206	0.585–8.314
Years of working experience (Ref.: <5 years)						
5–10 years	–0.614	0.550	–1.117	0.264	0.541	0.184–1.591
11–15 years	–2.285	0.920	–2.485	0.013	0.102	0.017–0.618
> 15 years	–2.073	1.029	–2.015	0.044	0.126	0.017–0.945
Voluntarily chose nursing as a career(Ref.: No)						
Yes	–0.089	0.362	–0.245	0.806	0.915	0.450–1.860
Nurse–patient conflict in past 3 months (Ref.:No)						
Yes	0.770	0.368	2.093	0.036	2.159	1.050–4.443
Psychological capital	–0.111	0.013	–8.725	< 0.001	0.895	0.872–0.918
Profile 2 vs. Profile 3 (Ref.)						
Constant term	6.427	1.146	5.607	< 0.001	—	—
Professional title (Ref.: Junior)						
Intermediate/Senior	1.140	0.527	2.161	0.031	3.126	1.113–8.783
Years of working experience (Ref.: <5 years)						
5–10 years	–1.049	0.479	–2.191	0.028	0.350	0.137–0.896
11–15 years	–1.881	0.724	–2.597	0.009	0.152	0.037–0.630
> 15 years	–1.654	0.831	–1.990	0.047	0.191	0.038–0.975
Voluntarily chose nursing as a career (Ref.: No)						
Note: Profile 1 is the low-competence group, Profile 2 is the moderate-competence group, Profile 3 is the high-competence group.						

Variable	B	SE	Z	P	OR	95% CI
Yes	-0.119	0.315	-0.378	0.705	0.888	0.479–1.646
Nurse–patient conflict in past 3 months (Ref.: No)						
Yes	0.572	0.307	1.862	0.063	1.772	0.971–3.234
Psychological capital	-0.046	0.010	-4.746	< 0.001	0.955	0.936–0.974
Note: Profile 1 is the low-competence group, Profile 2 is the moderate-competence group, Profile 3 is the high-competence group.						

Compared with nurses in high-competence group, nurses who experienced nurse-patient conflict were more likely to belong to low-competence group. Longer working experience (11-15 years, > 15 years) significantly decreased the odds of being classified into low-competence group. Higher psychological capital was associated with a lower probability of belonging to low-competence group. For moderate-competence group versus high-competence group, intermediate-senior professional title predicted a higher likelihood of moderate-competence group membership. Nurses with working experience ≥ 5 years had significantly reduced odds to fall into moderate-competence group. Psychological capital remained a significant protective factor for high-competence group membership. Nurse-patient conflict showed a marginally significant trend ($p = 0.063$).

[Insert Table 3 Here]

4. Discussion

4.1 Three distinct nurse-patient interactions profiles

Using latent profile analysis based on item-level scores of the CNPI-23 scale, this study identified three heterogeneous profiles of caring nurse-patient interactions among 431 clinical nurses: the low-competence group (relationship-care deficient type, 25.5%), the moderate-competence group (balanced development type, 46.4%), and the high-competence group (comprehensive excellence type, 28.1%). The entropy value of the optimal three-class solution reached 0.976, and average latent class probabilities exceeded 98%, indicating good classification accuracy and relatively stable subgroup division.

From a person-centered perspective, our findings demonstrated that clinical nurses do not distribute along a simple continuous spectrum of caring interaction capability; instead, they form discrete subgroups with distinct item-response patterns. Especially, the low-competence subgroup showed prominent deficits in relational-care items. This phenomenon could not be detected by merely comparing total scale scores, which highlights the value of latent profile analysis for exploring subgroup-specific characteristics of caring nurse-patient interactions.

4.2 Characterization of the three nurse-patient interactions profiles

This study found that the total score for nurse-patient interaction was 95.88 ± 13.11 , with an overall mean score of 4.17 ± 0.82 , which is higher than that reported by Abu Sharour et al [20]. This difference may be attributed to varying research contexts: The research by Abu Sharour et al. was set in the acute outbreak phase of the COVID-19 pandemic, whereas the present study was situated in the post-pandemic period when nursing care had returned to a more normalized environment. In this study, the proportions of the low-, moderate-, and high-competence groups were 25.5%,

46.4%, and 28.1%, respectively. Although no obvious structural problems were identified, approximately 72% of nurses fell into the low- and moderate-competence groups. The nurse-patient relationship is central to healthcare quality and is associated with outcomes such as patient satisfaction, perceived care quality, and hospital length of stay [21]. Schumacher et al. [22] introduced competency-based medical education (CBME), a learner-centered approach that tailors instruction to individual needs and targets specific competencies. This model suggests that nursing managers should update training strategies, address nurses' learning needs, and strengthen interaction competence to improve care quality [23].

4.2.1 Low-Competence Group (Relationship-Care Deficient Type)

The low-competence group scored lowest on all CNPI-23 items, with mean scores below 3 on all seven relational care items. Relational care involves building constructive nurse-patient relationships, helping patients find personal meaning in their health conditions, restoring life balance, and reframing cognitive appraisals to support psychosomatic integration and adaptive coping [3]. The low relational care scores in this group may reflect limited experience, insufficient communication training, or a tendency to prioritize task completion over relationship-building under heavy workloads. This is consistent with Jiang et al. [24], who noted that relational nursing is essential to effective interaction and requires ongoing development. Most nurses in this group had less than ten years of experience and had experienced nurse-patient conflicts in the past three months, suggesting that early-career adversities may contribute to maladaptive interaction patterns. We therefore recommend that nursing administrators incorporate scenario-based relational care training and reflective dialogue into both pre-service and continuing education. Flexible scheduling and psychological support could help reduce relationship-related stress from heavy workloads. Regular debriefing and case review of conflict incidents, along with mentorship, should also be prioritized for low-competence nurses to support capability building.

4.2.2 Moderate-Competence Group (Balanced Development Type)

The moderate-competence group had moderate scores on all CNPI-23 items, with no notable weaknesses or strengths in any dimension. This suggests that these nurses have basic competence across all aspects of caring interaction but have not yet reached a proficient level. They may be in a transitional professional phase—having acquired foundational knowledge and skills, but still needing further development through experience and targeted training. This group was the largest (46.4%) and may represent an intermediate stage between low and high competence, which deserves further longitudinal investigation. We therefore recommend that nursing managers develop structured training pathways with progressive goals, peer-support, and regular assessments, using case-based reflection and clinical simulations to strengthen interactive skills.

4.2.3 High-Competence Group (Comprehensive Excellence Type)

The high-competence group scored highest on all CNPI-23 items, with several items near the maximum score. These nurses performed well across clinical, relational, humanistic, and comforting care domains, demonstrating both technical skills and strong interpersonal communication and empathy. This profile offers a useful reference for nursing education and professional development [25]. This group also showed stronger autonomous career choice motivation and higher psychological capital, suggesting that intrinsic motivation and psychological resources contribute to high interaction competence [26, 27]. We therefore recommend that nursing administrators use highly competent nurses as role models and mentors through structured mentoring and experience-sharing. It is also important to regularly assess psychological capital in this group to sustain their strengths.

4.3 Mechanisms linking psychological and demographic factors to caring nurse-patient interaction profiles

Multivariate analysis conducted using the robust three-step method revealed that

psychological capital is a key factor of latent profile membership of caring nurse-patient interaction competence; additionally, years of work experience, professional title, and history of nurse-patient conflict also exerted significant influence.

4.3.1 Psychological capital as an Internal resource supply

Nurses with higher scores on the Psychological Capital Questionnaire were more likely to belong to the high-competence group. Specifically, for each 1-point increase in psychological capital, the odds of being in the low-competence group decreased by 10.5% (OR = 0.895, 95% CI: 0.872–0.918, $P < 0.001$), and the odds of being in the moderate-competence group decreased by 4.5% (OR = 0.955, 95% CI: 0.936–0.974, $P < 0.001$). From the perspective of the Conservation of Resources (COR) theory [28], people with abundant personal resources are more capable of engaging in and maintaining positive altruistic behaviours. Psychological capital comprises four core elements: self-efficacy, hope, resilience, and optimism. Such personal resources assist nurses in managing occupational stress and maintaining high-quality caring interactions amid high clinical workloads [26, 29]. As suggested by the Broaden-and-Build Theory [30], positive emotions associated with higher psychological capital can broaden nurses' cognitive and behavioural capacities and facilitate long-term professional growth. Nurses with richer psychological resources tend to interact with patients with greater confidence and positivity. Our findings support the implementation of interventions including positive-emotion training and solution-focused coaching, which can foster nurses' psychological capital and enhance their nurse-patient interaction skills [20].

4.3.2 Other contextual and demographic factors

Work experience was a significant protective factor for both the low-competence and moderate-competence groups. Compared with nurses with less than 5 years of experience, those with 11–15 years (OR = 0.102, 95% CI: 0.017–0.618, $P = 0.013$) and > 15 years (OR = 0.126, 95% CI: 0.017–0.945, $P = 0.044$) of experience were significantly less likely to belong to the low-competence group. Similarly, nurses with 5–10 years (OR = 0.350, 95% CI: 0.137–0.896, $P = 0.028$), 11–15 years (OR = 0.152, 95% CI: 0.037–0.630, $P = 0.009$), and > 15 years (OR = 0.191, 95% CI: 0.038–0.975, $P = 0.047$) of experience showed a reduced likelihood of being in the moderate-competence group. This developmental pattern suggests that nurse-patient interaction competence grows with clinical experience, reflective practice, and the internalization of caring behaviors over time. This is consistent with Benner's novice-to-expert model, which describes professional growth as an experience-driven, incremental process and implies that training should be tailored to the nurse's competency level [31]. Accordingly, we recommend that nursing managers adopt a stratified training approach tailored to the nurse's actual competency level [32, 33].

Intermediate/senior professional titles were associated with an increased likelihood of belonging to the moderate-competence group (relative to the high-competence group) (OR = 3.126, 95% CI: 1.113–8.783, $P = 0.031$). This finding is counterintuitive, as higher professional rank might be expected to correlate with greater competence. However, this result may reflect the complex relationship between professional advancement and interactive competence. Nurses holding intermediate/senior titles may be at a career stage where administrative duties, teaching responsibilities, and managerial tasks compete with direct patient care for time and attention, thereby reducing opportunities for meaningful nurse-patient interactions [34, 35]. Moreover, the current professional title promotion system in Chinese hospitals tends to emphasize clinical skills, research output, and teaching experience, rather than nurse-patient relationships or caring competencies. Therefore, we suggest that future title evaluation criteria incorporate "soft skills" (e.g., humanistic caring and communication skills), while ensuring that intermediate/senior nurses are guaranteed sufficient direct patient care time through role optimization and supportive assistance.

This study found that nurses who had experienced nurse-patient conflicts within the previous three months were 2.159 times more likely to belong to the low-competence group than to the high-competence group (OR = 2.159, 95% CI: 1.050–4.443, $P = 0.036$), whereas the comparison between the moderate-competence groups and high-competence groups was not significant (OR = 1.772, 95% CI: 0.971–3.234, $P = 0.063$). From the perspective of the Conservation of Resources (COR) theory [28], conflict itself may not be a direct cause of low interaction competence, but rather tends to act as a resource-depleting event that exposes and amplifies deficiencies in individuals with low interaction competence. For those with sufficient resource reservoirs (e.g., rich experience, psychological resilience, and organizational support), similar conflict experiences did not produce significant negative effects and may even trigger self-adjustment, enabling nurses to maintain a positive and optimistic work attitude. Therefore, we recommend prioritizing immediate support for low-resource nurses after conflict events, such as emotional debriefing and self-efficacy rebuilding, to prevent adverse effects from persisting [36].

4.4 Practical implications

Based on these findings, we propose a stratified training approach: relational-care simulations and reflective training for the low-competence group, structured progression pathways for the moderate-competence group, and mentorship-based sharing for the high-competence group. Psychological capital can be strengthened through positive-emotion training and coaching. Reflective practice offers nurses valuable opportunities to learn from daily work. In professional title evaluation, we suggest giving more weight to interpersonal skills such as humanistic communication, and adjusting job responsibilities accordingly. Emotional debriefing and self-efficacy rebuilding should be prioritized for junior or low-competence nurses.

5. Conclusion

Using latent profile analysis, we identified three profiles of caring nurse-patient interaction competence among clinical nurses: low-competence (25.5%), moderate-competence (46.4%), and high-competence (28.1%). Profile membership was associated with psychological capital, years of work experience, professional title, and history of nurse-patient conflicts. These findings suggest that nursing managers should recognize competence differences and adopt tailored training strategies for each group to improve interaction quality. Future studies could examine how nurses in the moderate-competence group develop toward higher competence and what factors facilitate or impede this process.

6. Limitations

This study has several limitations. First, the cross-sectional design prevents causal conclusions, so the associations we found should be viewed as correlational. Second, our sample came from a single tertiary hospital in Zhejiang Province, which may limit the generalizability of the results. Third, we relied on nurses' self-reports of their interactions, which could be influenced by social desirability and may not fully capture actual behaviors. Future work could supplement self-reports with patient satisfaction surveys, direct observations, or peer ratings. Fourth, we used single items to assess some demographic variables (e.g., career choice, conflict history), which may have introduced recall bias and reduced precision; multi-item scales could improve accuracy in future studies. Finally, the pathways linking psychological capital, demographic factors, and interaction competence remain to be clarified, and longitudinal or experimental designs would help establish causal relationships and guide interventions.

Abbreviations

LPA
latent profile analysis

CNPI
23-Caring Nurse-Patient Interaction Scale
AIC
Akaike information criterion
BIC
Bayesian information criterion
BLRT
Bootstrapped likelihood ratio test

Declarations

Ethics approval and consent to participate

The Ethics Committee of Taizhou Hospital of Zhejiang Province approved this study (approval number: K20250906), and all procedures were performed in accordance with the guidelines of our institutional ethics committee. The ethics committee approved a waiver of the requirement for written informed consent. All participants were informed of the study objectives, content, and principles of voluntary participation through the informed consent section on the questionnaire homepage; submission of the questionnaire constitutes valid informed consent. The study does not involve risks of personal privacy leakage, and data are collected anonymously.

Consent for publication

Not applicable.

Clinical trial number

Not applicable.

Availability of data and materials

The relevant datasets can be requested from the corresponding author upon reasonable request.

Competing interests

The authors declare no competing interests.

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Authors' contributions

Li Rongli: Conceptualization, Methodology, Writing original draft, Supervision, Project administration, Guarantor.

Zhang Jiali: review and editing, Visualization.

Cai Panpan: Data curation, Validation.

Zhang Jiayi: Conceptualization, Investigation, Data curation.

Chen Xinying: Methodology, Validation, review and editing.

All authors: Data collection, Formal analysis, Interpretation of results. All authors have read and approved the final manuscript.

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Figures

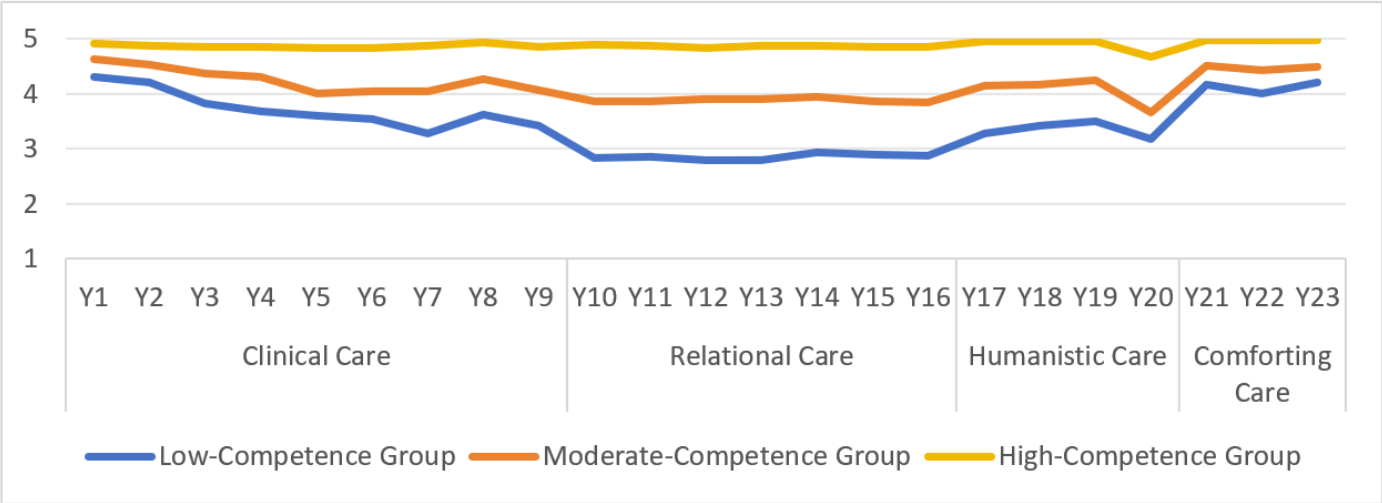


Figure 1

Caring Nurse-Patient Interaction among clinical nurses: Feature distribution of the 3 latent profiles

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