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ORIGINAL RESEARCH

Stress/Resource Complex, Sense of Coherence and Professional Identity Among Nursing Students: A Latent Profile and Mediation Analysis

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Purpose: Sense of coherence is significant to mental health and professional development in nursing students. However, the association among stress/resource complex, sense of coherence, and professional identity is less explored in nursing students. This study was designed to identify latent subtypes of stress/resource complex and to evaluate the mediating role of sense of coherence between stress/resource complex types and professional identity in nursing students.

Participants and Methods: A total of 595 nursing students were recruited from Be Resilient to Nursing Career (BRNC) between October and December 2021 and administered with 10-item Connor-Davidson Resilience Scale, General Self-efficacy Scale, 10-item Chinese Perceived Stress Scale, 13-item Sense of Coherence Scale, and Professional Identity Questionnaire for Undergraduate Students. Latent profile analysis and mediation analysis were performed.

Results: Three latent subtypes of stress/resource complex were identified: Flexibility (14.8%), Ordinary (44.2%), and Maladjustment (41.0%). Nursing students with role model were prone to Ordinary (OR = 1.48, 95% CI 1.03–2.13, p = 0.035) and Flexibility (OR = 1.92, 95% CI 1.17–3.16, p = 0.011). The association between stress/resource complex types and professional identity was mediated by sense of coherence (P < 0.05).

Conclusion: There exists heterogeneity in nursing students' stress/resource complex. The association between stress/resource complex subtypes and professional identity was mediated by sense of coherence.

Keywords: latent profile analysis, mediation analysis, nursing students, professional identity, stress/resource complex, sense of coherence

Introduction

Nowadays, the global shortage of nurses was estimated to be 5.9 million and an 8% annually increasement should be done to solve the problem before 2030.[1] Nursing students, as the backbone of the nursing workforce in the future, receive increasing attentions from multidiscipline researchers. Professional identity refers to the attitudes, values, knowledge, beliefs, and skills that are shared with others in a professional group,[2–4] which is an integral part of professional career development.[5] The current studies have shown that undervaluation of the nursing profession is one of the risk factors to the turnover intention.[6,7] Given the importance of professional identity in nursing students, it is crucial to identify nursing students with low levels of professional identity and take effective strategies to improve students' professional well-beings.[3]

The sense of coherence (SoC) is an integral concept of the salutogenic model[8] that refers to an individual's ability to use existing or potential resources to cope with stress and promote good health, including three stable characteristics: universality, dynamism, and continuity.[9] The SoC is an important psychological resource for professionals involved in health care,[10] and SoC has been confirmed as a significant predictor to burnout or professional identity in nurses.[11,12] For example, Champine et al[13] found that nursing students with higher SoC levels were more likely to have greater career prospects and

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positive professional perceptions. The level of SoC is affected by the various resources that individuals use in response to stress, which are known as general resistance resources (GRRs,[8] including self-efficacy,[14] resilience,[15] etc.). Reguera-García et al[16] found that the most resilient people present greater levels of a sense of coherence and vice versa. Furthermore, self-efficacy can also provide favorable conditions for the formation and development of SoC.[17] Studies have demonstrated that GRRs are associated with stress awareness, which assists individuals in buffering against stress.[18,19] The salutogenic model depicts a reciprocal dynamic relationship between SoC and GRRs, in which GRRs contribute to the development of SoC, and in turn, SoC mobilizes GRRs to address stressors effectively.[8,9] Based on this theory, the resilience and self-efficacy at different levels of stress perception are viewed as an ensemble, named stress/resource complex.[20] To be brief, SoC may be an important indicator to professional identity in nursing students and stress/resource complex may be significantly associated with SoC.[21] In addition, we also have interests whether there exists heterogeneity in stress/resource complex and a hypothesized framework is described in Figure 1. To be brief, stress/resource complex and SoC might be independent factors to professional identity,[2,11,12,22] while the associations between stress/resource complex, SoC, and professional identity combined have not been fully explored. Therefore, in the current study, the heterogeneity of stress/resource complex was examined from a resource-oriented perspective. Additionally, we had interests whether SoC played a meditation role between stress/resource complex subtypes and professional identity. We hypothesized that (Figure 1):

Hypothesis 1 (H1). There might exist heterogeneity in nursing students' stress/resource complex and would be identified by latent profile analysis (LPA).

Hypothesis 2 (H2). LPA-based stress/resource complex types might positively predict professional identity.

Hypothesis 3 (H3). LPA-based stress/resource complex types might demonstrate differences in the levels of SoC and professional identity.

Hypothesis 4 (H4). SoC might play a mediation role between LPA-based stress/resource complex subtypes and professional identity.

Materials and Methods

Study Design and Participants

A cross-sectional design was adopted. A total of 613 nursing students were approached from Be Resilient to Nursing Career (BRNC) between October and December 2021.[2,22] A total of 595 completed the booklet resulting in a response rate of 97.1%. A sample size of 500 provides good test power and convergent validity for the model indicators.[23,24] Thus, the sample

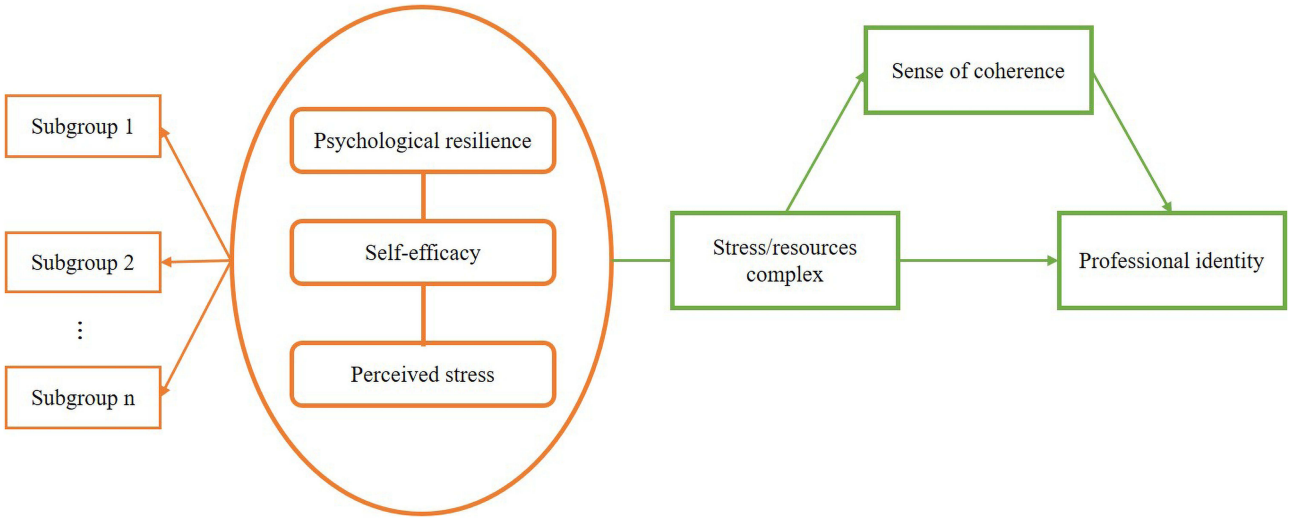

Figure 1 The hypothetical framework of stress/resource complex, sense of coherence and professional identity among nursing students.

size of 595 in the current study was efficiently powerful. The inclusion criteria were as follows: (1) newly enrolled nursing students in 2020; (2) could communicate fluently in Chinese; (3) willing to participate in this study. The exclusion was participants who had any mental disorder in the previous 6 months, which were diagnosed by clinical psychiatrists.

Ethics

This study is part of the Be Resilient to Nursing Career (BRNC, Registration number: ChiCTR2000038693) and was approved by the Ethics Committee of the First Affiliated Hospital of Guangzhou University of Traditional Chinese Medicine (No: ZYYEC-ERK [2020] 132). Written informed consents were obtained from all participants before completing the survey, which was conducted in accordance with the principles of the Declaration of Helsinki. The participants were reassured that their personal data would be kept confidentially and reported anonymously.

Instruments

Demographic Characteristics

Demographic characteristics including gender, age, educational level, and place of residence were collected. Also, professional-related characteristics, including nursing role model, willing to leave the profession, etc., were collected according to previous research.[2,22,25,26]

10-Item Connor-Davidson Resilience Scale (CD-RISC-10)

CD-RISC-10 is a generic resilience instrument[27] to measure the ability to recover in a suffering situation and is based on a 5-point Likert scale with higher scores indicating higher resilience levels (ranging from 0 to 40). The Cronbach's alpha value of 0.85 was identified in the current study.

General Self-Efficacy Scale (GSES)

The GSES was developed by Zhang and Schwarzer,[28] and the Chinese version has been proved to be reliable.[29] The GSES was used to assess participants' beliefs regarding appropriate behaviors in the face of stress. It has 10 items and is a 4-point-Likert scale ranging from 10 to 40. High scores indicate higher self-efficacy levels. The Cronbach's alpha for GSES was 0.900 in the current study.

10-Item Chinese Perceived Stress Scale (CPSS-10)

The CPSS-10 was developed by Cohen,[30] and the Chinese version has been proved to be reliable.[31] CPSS-10 comprises two domains including "Perceived Helplessness" and "Perceived Self-efficacy" to evaluate the degree to which individuals experience stress following adverse events. The total score ranges from 0 to 40 (5-point Likert scale), with a higher score indicating a higher stress level. The Cronbach's alpha was 0.877 in the current study.

13-Item Sense of Coherence Scale (SoC-13)

In order to assess how stress-related coping resources are used to maintain and promote physical and mental health, the SoC-13 was used. The SoC-13 was developed by Antonovsky,[8,32] and the Chinese version has been proved to be reliable.[33] The SoC-13 has three domains including comprehensibility, manageability and meaningfulness. The range of the scores is 13–91 points (7-point Likert scale), with higher scores indicating stronger SoC. The overall Cronbach's alpha was 0.766 in the current study.

Professional Identity Questionnaire for Undergraduate Students (PIQUS)

The Chinese Version of PIQUS was developed by Qin[34] to evaluate nursing students' perceptions and attitudes toward their majors, which consists of 23 items and includes four dimensions: cognitive identity, emotional identity, behavioral identity, and fit identity. The total score of PIQUS ranges from 23 to 115 (5-point Likert scale) with high scores indicating high levels of professional identity. The overall Cronbach's alpha coefficients were 0.916 in the current study.

Data Analyses

First, demographic and professional-related characteristics were described as frequencies and proportions (%). Univariate analysis was employed to explore the potential factors to professional identity. Second, Pearson correlational analysis was performed to assess the associations among perceived stress, psychological resilience, self-efficacy, SoC, and professional identity. Strength of relationship was categorized as follows: weak ($|r|<0.3$); moderate ($0.3\leq|r|<0.5$); strong ($|r|\geq0.5$).[35] Third, latent profile analysis (LPA) was performed to identify potential subgroups with different stress/resource complex types. It began with a one-class model, continuing until fit indices could not be significantly improved. We evaluated models based on the fitting indexes of Bayesian Information Criteria (BIC), Akaike's Information Criteria (AIC), and Entropy value. Also, Lo-Mendell-Rubin (LMR) was used to evaluate the fitting differences among potential profile models. If the P-value reached the significance level, the model with k categories was significantly superior to the model with k-1 categories.[36,37] In addition, univariate ($p < 0.2$) and multivariate logistic regressions were conducted to recognize potential indicators to LPA-based stress/resource complex types.[38] Moreover, ANOVA was applied to compare the psychological functions and professional identity among nursing students with different stress/resource complex profiles. At last, the mediating role of SoC (continuous variable) was estimated between LPA-based stress/resource complex types (category variable) and professional identity (continuous variable). The data were run by Statistical Product and Service Solutions (SPSS, version 22.0), Mplus (version 8.3), and JASP (version 0.16.0). Significance was set at 0.05.

Results

Demographic Characteristics

In total, 60.3% of nursing students had a bachelor's degree, and 63.2% were from the countryside. Significant differences of professional identity were identified, including educational level, place of residence, nursing role model, willing to leave profession, resilience, self-efficacy, perceived stress, and SoC (all $p < 0.001$). Other information is presented in Table 1.

The Analysis of the Correlations Among Perceived Stress, Psychological Resilience, Self-Efficacy, Sense of Coherence, and Professional Identity

The mean and standard deviations of variables were perceived stress (26.04 ± 7.06), psychological resilience (25.00 ± 6.02), self-efficacy (15.81 ± 5.71), sense of coherence (59.00 ± 12.32), and professional identity (87.56 ± 16.84). Pearson correlation heatmap is presented in Figure 2. The blue color indicated a positive correlation, while the red color indicated a negative correlation. A darker square represents a stronger correlation. Perceived stress was negatively associated with resilience ($r = -0.70$, $p < 0.001$), self-efficacy ($r = -0.57$, $p < 0.001$), and SoC ($r = -0.62$, $p < 0.001$). Additionally, SoC was positively associated with professional identity ($r = 0.45$, $p < 0.001$).

Latent Profiles Analysis of Stress/Resource Complex

One to five latent subgroups were checked based on fitting indicators and the 3-class model was optimal in consideration of (1) relatively small AIC, BIC, and aBIC, (2) the sample size of each class was more than 50, (3) the significant p value of Lo-Mendell-Rubin (LMR). Other information is detailed in Table 2 and Figure 3. Thus, three stress/resource complex types were identified and named as Flexibility (14.8%, Class 3), Ordinary (44.2%, Class 2), and Maladjustment (41.0%, Class 1). Logistic regression showed that only nursing role model was the significant indicator to stress/resource complex types (OR = 1.48, 95% CI 1.03–2.13, $p = 0.035$; OR = 1.92, 95% CI 1.17–3.16, $p = 0.011$) after controlling the covariates (Table 3). Significant differences in the resilience, self-efficacy, perceived stress, SoC, and professional identity are identified across three subtypes ($P < 0.001$), and more information is described in Table 4.

Mediation Analysis of SoC Between LPA-Based Stress/Resource Complex Types and Professional Identity

All potential confounders were controlled in advance (Table 5 and Figure 4). We took maladjustment group as reference, 95% Bootstrap confidence intervals of indirect effect (0.04, 0.10), direct effect (0.14, 0.28) and total effect (0.20, 0.35)

Table 1 Demographic and Relevant Variables Differences in Scores of Professional Identity

Variables	Overall Sample (N=595)	p value
Gender, n (%)		0.616
Male	215 (36.1)	
Female	380 (63.9)	
Educational level, n (%)		**<0.001**
Junior college education	236 (39.7)	
Bachelor education	359 (60.3)	
Only children, n (%)		0.868
No	488 (82.0)	
Yes	107 (18.0)	
Place of residence, n (%)		**0.031**
Countryside	376 (63.2)	
Cities and towns	219 (36.8)	
Any medical staffs as relatives, n (%)		0.612
No	425 (71.4)	
Yes	170 (28.6)	
Nursing role model, n (%)		**<0.001**
No	352 (59.3)	
Yes	242 (40.7)	
Willingness to leave the profession, n (%)		**<0.001**
No	508 (85.4)	
Yes	87 (14.6)	
Psychological resilience, M±SD	26.04±7.06	
Self-efficacy, M±SD	25.00±6.02	
Perceived stress, M±SD	15.81±5.71	
Sense of coherence, M±SD	59.00±12.32	

Note: Bold figures highlight statistically significant in the univariate analysis.

indicated that SoC significantly mediated the relationship between Ordinary and professional identity, with a mediating effect of 25.93%. On the other hand, the indirect effect (0.09, 0.18), direct effect (0.21, 0.39) and total effect (0.36, 0.50) indicated that SoC significantly mediated the relationship between Flexibility and professional identity, with a mediating effect of 30.23%. The model accounted for 34.4% of the variance in professional identity ($p < 0.001$).

Discussion

First, three stress/resource complex types were identified in nursing students, which were named as Maladjustment (difficult to adapt to pressure sources), Ordinary (generally self-adjusting), and Flexibility (resilient to stressors). Thus,

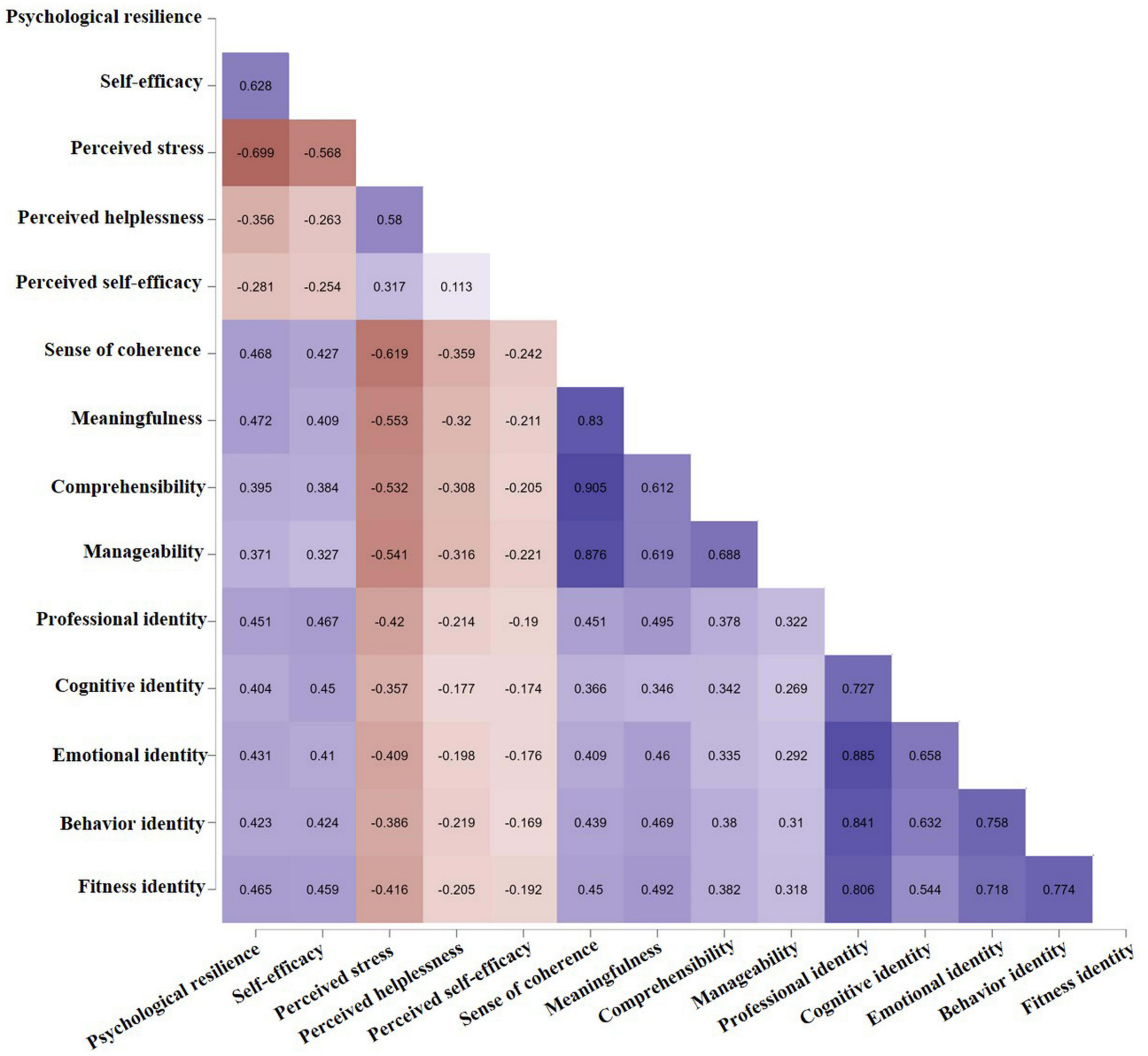

Figure 2 Pearson correlation heatmap among stress/resource complex, sense of coherence and professional identity.

H1 was confirmed. More attentions should be paid to individuals with Maladjustment type (41.0%) as this subgroup had difficulty coping with the stressors derived from learning and clinical nursing practice, was susceptible to public image,[39] and tended to have a negative attitude to the nursing profession.[3] In addition, it demonstrated that students who had nursing role models were prone to Flexibility and were more self-adjusted to academic stress than those who did not have nursing role models, which was consistent with our previous studies.[2,22] In the pandemic of COVID-19, nursing role models helped nursing students recognize the value and possibilities of nurses, thus changing their negative attitude to the nursing profession.[40] According to Motivational Theory of Role Modeling, nursing role models could inspire and motivate nursing students to achieve professional identification and internalization.[41]

Second, stress/resource complex was positively associated with SoC and professional identity, which was consistent with previous research.[42,43] Thus, H2 was verified. In the current study, Flexibility group had the highest levels of SoC and professional identity, while the Maladjustment group had the lowest. Thus, H3 was confirmed. An effective stress management for stress/resource complex might help improve nursing students' SoC levels.[18] For example, previous studies have shown that psychological resources (eg, mental toughness, self-efficacy, etc.) were related to professional

Table 2 Fitting Index and Group Size of Latent Profile Analysis Models

Indicators	LPA Model				
	1-Class	2-Class	3-Class	4-Class	5-Class
Fit statistics					
LL	−21699.12	−18978.13	**−18190.55**	−17746.64	−17446.71
AIC	43518.24	38138.26	**36625.1**	35799.29	35261.41
BIC	43781.55	38537.61	**37160.51**	36470.74	36068.91
aBIC	43591.07	38248.72	**36773.19**	35985.01	35484.77
Entropy	1.000	0.965	**0.945**	0.935	0.951
LMR (P)	—	<0.001	**0.003**	0.179	0.496
Group size (%)					
C1	595 (100.0)	359 (60.3)	**244 (41.0)**	110 (18.5)	52 (8.74)
C2	—	236 (39.7)	**263 (44.2)**	184 (30.9)	265 (44.5)
C3	—	—	**88 (14.8)**	250 (42.0)	34 (5.7)
C4	—	—	**—**	51 (8.6)	186 (31.3)
C5	—	—	**—**	—	58 (9.7)

Note: Bold figures highlight the selected class solution.
Abbreviations: LL, Log-likelihood; AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; aBIC, Adjusted BIC; LMR, Lo, Mendell, and Rubin likelihood ratio test.

identity.[2,44,45] Furthermore, self-efficacy and resilience could be enhanced by specific programs. For example, as for resilience, Ye developed a program named as Be Resilient to Breast Cancer to promote breast cancer patients' resilience resulting in increased quality of life (QoF).[46–49] In addition, Mindfulness-based Cognitive Therapy (MBCT)[50,51] assisted nursing students in alleviating negative emotions and improving SoC levels. What was more, aerobic exercise treatment

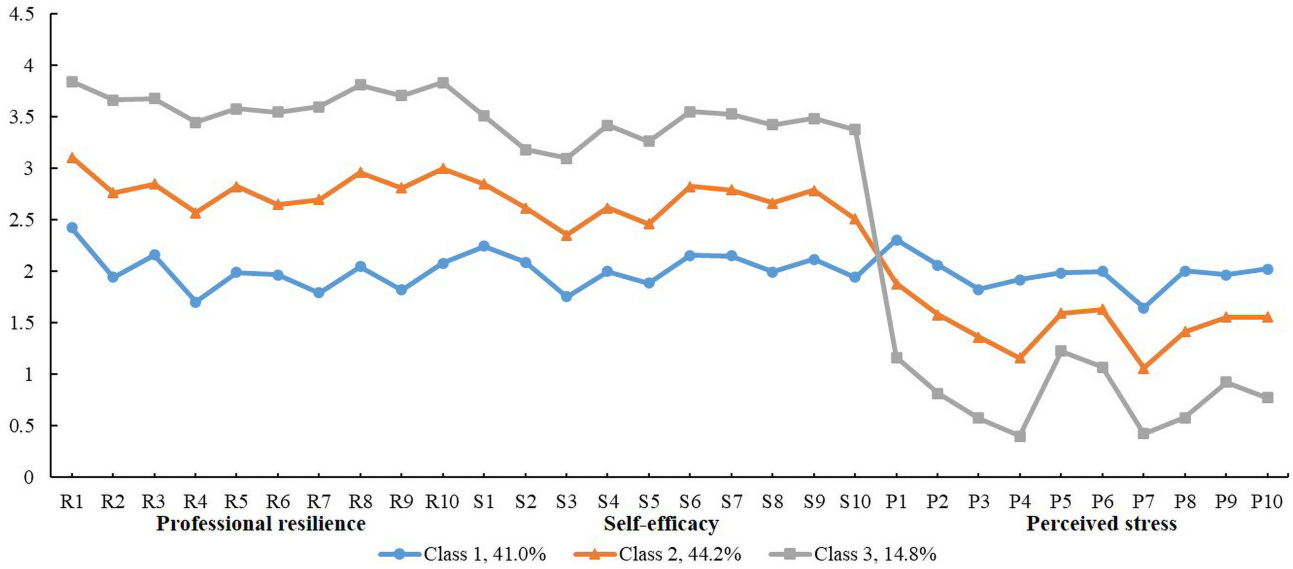

Figure 3 Parameters for the final three-class patterns.
Notes: C1 = Maladjustment, C2 = Ordinary; C3 = Flexibility.

Table 3 Univariate and Multivariate Logistic Regression results for Predicting External Features on the 3-Class Pattern

Variables	LPA-Based Stress/Resource Complex Types							
	Univariate Analysis				Multivariate Analysis			
	Ordinary vs Maladjustment		Flexibility vs Maladjustment		Ordinary vs Maladjustment		Flexibility vs Maladjustment	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Gender (female as ref)	1.35 (0.94–1.94)	0.109	1.41 (0.85–2.33)	0.186	1.34 (0.93–1.93)	0.123	1.38 (0.83–2.29)	0.217
Educational level (junior college as ref)	1.10 (0.77–1.57)	1.096	1.10 (0.67–1.82)	0.700				
Only children (no as ref)	1.05 (0.66–1.67)	0.838	1.46 (0.80–2.66)	0.220				
Place of residence (countryside as ref)	0.83 (0.58–1.19)	0.310	0.84 (0.51–1.39)	0.496				
Any medical staffs as relatives (no as ref)	1.21 (0.82–1.78)	0.341	1.25 (0.73–2.13)	0.423				
Nursing role model (no as ref)	1.48 (1.04–2.13)	0.032	2.03 (1.24–3.33)	0.005	**1.48 (1.03–2.13)**	**0.035**	**1.92 (1.17–3.16)**	**0.011**
Willingness to leave the profession (no as ref)	0.97 (0.60–1.57)	0.903	0.45 (0.20–1.06)	0.067	1.04 (0.64–1.69)	0.866	0.51 (0.22–1.20)	0.124

Note: Bold figures highlight statistically multivariate logistic regression.
Abbreviations: OR, Odds ratio; CI, confidence interval.

Table 4 ANOVA Comparisons of Scale Scores Across Three Latent Classes

Subgroups	Psychological Resilience	Self-Efficacy	Perceived Stress	Sense of Coherence	Professional Identity
Maladjustment (a)	19.89±3.93	20.17±3.29	19.73±3.99	53.68±10.07	80.04±16.78
Ordinary (b)	28.17±4.11	26.49±3.79	14.84±3.58	59.79±10.72	89.67±13.49
Flexibility (c)	36.72±3.38	33.90±4.68	7.90±5.51	71.38±13.08	102.14±14.67
F	660.04	472.65	284.74	87.31	73.93
P	<0.001	<0.001	<0.001	<0.001	<0.001
η^2	0.690	0.615	0.490	0.228	0.200
Post-hoc	c > b > a	c > b > a	a > b > c	c > b > a	c > b > a

Notes: Post-hoc comparisons were conducted using the Bonferroni multiple comparison test; η^2= eta squared represents variance of a dependent variable by three LPA-based subgroups.

Table 5 The Mediating Effect of Sense of Coherence on Professional Identity

Variables	β	SE	t	P	LLCI	ULCI	R^2
	Mediating variable model (Outcome variable: Sense of coherence)						0.251
Ordinary type	0.25	0.04	6.89	<0.001	0.18	0.32	
Flexibility type	0.50	0.04	12.20	<0.001	0.42	0.58	
	Dependent variable model (Outcome variable: Professional identity)						0.344
Ordinary type	0.21	0.04	5.33	<0.001	0.14	0.28	
Flexibility type	0.30	0.05	6.61	<0.001	0.21	0.39	
Sense of coherence	0.26	0.04	6.70	<0.001	0.18	0.34	
	Direct and indirect effect of general resistance resources on professional identity						
	Variables		Effect	SE	t	LLCI	ULCI
Indirect effect	Ordinary type		0.07	0.01	4.53	0.04	0.10
	Flexibility type		0.13	0.02	5.65	0.09	0.18
Direct effect	Ordinary type		0.21	0.04	5.33	0.14	0.28
	Flexibility type		0.30	0.05	6.61	0.21	0.39
Total effect	Ordinary type		0.27	0.04	7.07	0.20	0.35
	Flexibility type		0.43	0.04	11.53	0.36	0.50

Notes: Educational level, place of residence, nursing role model, and willingness to leave the profession are controlled statistically. Maladjustment type is used as the reference.

Abbreviations: SE, standard error; LLCI, lower level of confidence interval; ULCI, upper level of a confidence interval.

or a Flexibility/Strength Exercise treatment (FLEX) was confirmed to contribute to the improvement of individuals' mental health.[52] These successful programs could be adapted and utilized in nursing students.

Third, SoC had a significant mediation role in the association between stress/resource complex types and professional identity among nursing students. Thus, H4 were confirmed. Maladjustment type was prone to report lower levels of SoC and professional identity and needed more attentions from university managers and policymakers. Their perception of the problem (comprehensibility) might limit their abilities to recognize the internal and external resources available to them, which was a barrier to cope with the stress of a professional crisis (manageability). According to Antonovsky's

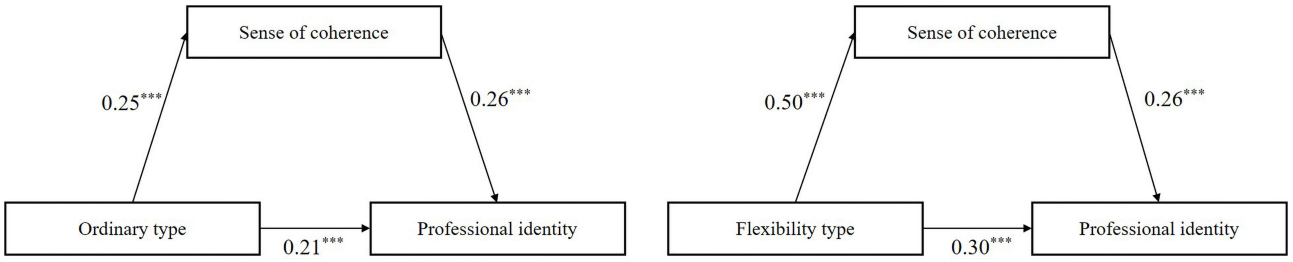

Figure 4 A hypothesized mediator model with three stress/resource complex types as independent variable (X), sense of coherence as a mediator (M), and professional identity as dependent variable (Y).
Notes: ***P < 0.001; Educational level, place of residence, nursing role model, and willingness to leave the profession are controlled statistically, and the control variables are not presented in the figure for brevity. Maladjustment type is used as the reference.

framework,[32] nursing students in Maladjustment could not get useful information from past experiences and create a negative professional identity. In this case, faculty should pay more attention to this group, such as promoting advanced examples of nursing role models, which contributes to the enhancement of the professional identity and sense of mission.[2] A good student–faculty relationship is also something that contributes to the level of professional identity of nursing students.[53] Educational institutions should focus on psychological counseling and intervention for nursing students, adopting MBCT[51] and FLEX[52] to alleviate their negative emotions. Furthermore, excellent faculty is one of the most effective ways to enhance nursing students' professional identity.[54]

Limitations

Some limitations should be considered. First, the sample was collected from two universities in China, which might be not representative resulting in selective bias. The extrapolation of the findings should be further explored in consideration of the differences in cultural background. Second, due to the cross-sectional nature of the current study, causal relationship could not be established, and a longitudinal study should be performed to replicate these findings. An ongoing 2-year follow-up assessment of this cohort (BRNC) will provide additional insights in the future.

Conclusion

There exists heterogeneity in nursing students' stress/resource complex and stress/resource complex subtypes are positively associated with professional identity. Additionally, the association between stress/resource complex subtypes and professional identity is mediated by SoC. More attentions should be given to nursing students in Maladjustment type.

Data Sharing Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Disclosure

The authors declare no conflicts of interest in this work.

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