

RESEARCH

Open Access



Factors influencing resilience and its relationship with spiritual coping strategies among nursing college students: a latent profile analysis

Shuang Hu¹, Siying Liu², Qizhi Yang³, Ting Zhao¹, Batool Shumaila⁴, Yajing Xian¹, Hongyang Liu⁵, Dandan Xu⁶, Huiping Hu^{7*} and Xianhong Li^{1*}

Abstract

Background Previous studies have primarily examined overall resilience about coping strategies and demographics, overlooking individual heterogeneity. This study identifies distinct resilience profiles among nursing students, examines their associations with spiritual coping strategies, and determines demographic factors associated with these profiles.

Method A cross-sectional study of 1,223 nursing students was conducted using convenience sampling from May 13 to 24, 2024. Latent profile analysis identified resilience subgroups, while the Bolck-Croon-Hagenaars approach assessed how spiritual coping strategies varied across profiles. The Three-Step Approach for Auxiliary Variables evaluated demographic predictors.

Result Four resilience profiles emerged: low resilience-low strength (Profile 1), low resilience-balanced development (Profile 2), high resilience-balanced development (Profile 3), and high resilience-high tenacity (Profile 4). Positive spiritual coping strategies demonstrated progressively increasing mean scores, which were statistically significant from Profile 1 to 4. In negative spiritual coping strategies, the mean scores decreased progressively from Profile 1 to 3, with each decrease being statistically significant. Female students were likelier in Profiles 1 ($\beta = -1.01, p < 0.05$), 2 ($\beta = -1.02, p < 0.001$), and 3 ($\beta = -0.73, p < 0.01$) compared to Profile 4; Students with leadership experience were more often found in Profiles 3 ($\beta = 0.66, p < 0.001$) and 4 ($\beta = 0.74, p < 0.01$) compared to Profile 2, and students who live in urban areas were more likely to belong to Profile 4 than Profile 1 ($\beta = 0.77, p < 0.05$).

Conclusion There was notable individual heterogeneity in resilience among students, with distinct differences in the use of spiritual coping strategies across these profiles. Future educational interventions promoting positive spiritual coping strategies could consider resilience as a core element. The primary focus of future resilience research

*Correspondence:

Huiping Hu
13007433762@163.com
Xianhong Li
xianhong_li@csu.edu.cn

Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

and education should be on female students living in rural areas and students without leadership experience during college.

Clinical trial number Not applicable.

Keywords Latent profile analysis, Nursing student, Resilience, Spiritual coping strategy

Background

Nursing students play a pivotal role in addressing the global nurse shortage [1], yet they experience significantly higher stress levels compared to peers in other disciplines [2]. A survey conducted in the U.S. found that nursing college students report significantly more stress than general students, with 52.3% of students reporting above-average stress levels and 17.6% reporting extreme stress levels [3]. High levels of stress not only jeopardize their mental health, leading to issues such as anxiety and burnout [4, 5], but also deter potential candidates from pursuing nursing, further exacerbating workforce shortages [6].

Spiritual coping strategies provide nursing students with a sense of purpose that transcends material concerns, serving as a vital component of stress management [7, 8]. Spiritual coping strategies are defined as thoughts and behaviors based on non-materialistic or transcendent sources used to manage stressors [9, 10]. In this study, spirituality is defined as a multidimensional construct that includes both religious and secular pathways to meaning-making, transcendence, and connection [11]. While in Western contexts (e.g., UK/Europe), spirituality is often closely associated with religion, the Chinese context reflects a broader interpretation. Here, spirituality represents an internal vital force, encounters with suffering, traditional Chinese cultural values (e.g., ancestor veneration), and religious practices (e.g., Buddhist meditation) [12]. Despite their diverse expressions, these spiritual elements share a common purpose: guiding individuals through challenges and helping them find meaning [11]. Given their profound impact on overcoming challenges and fostering long-term career success, spiritual coping strategies are increasingly recognized by educators and researchers [7, 8].

Resilience refers to “the ability to rise above difficult situations; adapt better than expected in the face of significant adversity; and recover from difficulty and overcome adverse circumstances in one’s life” [13]. Emerging evidence, including empirical studies [14, 15] and the Matching model [16], suggests that resilience may significantly influence an individual’s use of spiritual coping strategies, highlighting the importance of understanding this relationship. Additionally, demographic factors, such as age and gender, can shape resilience levels [17]. To build resilience and help nursing students better manage stress, it is crucial to explore the relationships between

resilience, spiritual coping strategies, and the demographic factors that influence resilience [17].

To investigate these relationships, a systematic literature review was conducted using Medline (Ovid). The following strategy was used: (Students, Nursing/ or nursing student*.mp.) and (resilience.mp. or Resilience, Psychological/) and (Cross-Sectional Studies/ or cross-sectional stud*.mp.). The search, performed on April 5, 2024, identified 97 articles on resilience among nursing students without date restrictions. Among these, only one study explicitly examined resilience and coping strategies, revealing a strong positive correlation with adaptive coping ($r=0.50$) and a negative correlation with maladaptive coping ($r=-0.31$) [18]. A separate manual search identified a study of Iranian nursing students reporting a positive correlation between psychological capital and spiritual well-being ($r=0.62$) [19]. Additionally, six studies [17, 20–24] explored factors associated with resilience among nursing students, identifying gender, age, whether the participant was an only child in their family, family residence, and whether they had been a student leader during college as the most commonly mentioned demographic factors.

Existing research predominantly focuses on aggregated resilience levels [25, 26], their correlation with coping strategies [18], and associated demographic factors. However, individual heterogeneity in resilience, its associations with specific spiritual coping strategies, and the influence of demographic factors on resilience heterogeneity remain underexplored. Specifically, resilience is a multidimensional construct comprising three distinct dimensions: tenacity, strength, and optimism [27]. Students with similar aggregate resilience scores may exhibit significant variations across these dimensions, highlighting the need for different intervention components [27, 28]. Consequently, studies relying on aggregate measures may lack the precision needed to design effective intervention programs, potentially diminishing their impact [29].

Latent Profile Analysis (LPA), a person-centered statistical method, enables the identification of unobserved subpopulations (latent profiles) within a sample based on patterns of responses to continuous variables [30]. This approach is particularly valuable for examining individual differences in complex constructs like resilience, where distinct subgroups may exist despite similar overall scores [30]. Therefore, this study employs latent

profile analysis to answer the following questions: (1) What types of resilience profiles were revealed among nursing college students? (2) Did scores on each spiritual coping strategy differ as a function of resilience profile membership? (3) How can demographic factors, including gender, age, only child status, family residence, and leadership experience during college, predict the likelihood of resilience profile membership?

Methods

Study design

This is a cross-sectional study. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist [31] to guide our reporting.

Setting

The cross-sectional study involved nursing students from one college in Changsha, China. This institution comprises 16 schools offering 32 majors, with a focus on medical-related fields such as clinical medicine, medical imaging, and nursing. The nursing school has two types of nursing programs, a diploma nursing program (3 years) and an undergraduate nursing program (4 years). The total number of nursing students enrolled on campus is 3,400, which includes 2,536 undergraduate students and 864 diploma students.

Participants

We invited all nursing students from the college to participate in our study. The inclusion criteria were as follows: (1) majoring in nursing, (2) currently enrolled in the school during the survey, and (3) providing informed consent. The exclusion criterion was nursing students who were currently participating in other intervention studies.

The sample size was determined based on simulation studies showing that latent profile analysis (LPA) requires at least 500 participants to reliably detect profiles with large interclass distances (Cohen's $d \geq 0.8$) [32]. Given that resilience profiles in previous studies had effect sizes ranging from Cohen's $d = 0.9$ to 2.08 [33], and our model used three Connor-Davidson Resilience Scale dimensions as indicators, we selected a minimum sample size of 1,000 to ensure robust results, consistent with recommendations for stable LPA solutions in Mplus [32].

Variables and measurement

We designed demographic variables based on previous studies [23, 24] for the participants, including gender (male = 1 and female = 2), age (values), whether the participant was an only child in their family (no = 1 and yes = 2), family residence (rural = 1 and urban = 2), and whether they had been a student leader during college (no = 1 and yes = 2).

Resilience. Resilience was assessed using the Connor-Davidson Resilience Scale (CD-RISC), which was originally developed by Connor and Davidson [27]. This scale consists of 25 items grouped into five dimensions. It has a Cronbach's α of 0.89 and a test-retest correlation of 0.87 in an American sample. Yu and Zhang [34] translated it into Chinese and used it to evaluate positive psychological qualities. The Chinese version of CD-RISC includes 25 items and three dimensions: tenacity (13 items), strength (8 items), and optimism (4 items). For example, the tenacity dimension encompasses items such as "Prefer to take the lead in problem solving", the strength dimension includes statements like "Tend to bounce back after illness or hardship", and the optimism dimension features items such as "Can deal with whatever comes." The scale uses a 5-point Likert scoring system, where 1 represents "not true at all" and 5 represents "true all the time." The higher the score, the greater the level of psychological resilience. The total Cronbach's α of the Chinese version (CD-RISC) of the scale was 0.91, and each dimension's Cronbach's α ranged from 0.60 to 0.88 [34]. This scale has been widely used in the Chinese population [35, 36]. In the present study, the Cronbach's alpha of this scale was measured as 0.95.

Spiritual coping strategies. The Spiritual Coping Questionnaire (SCQ), developed by Charzynska [14], was used to evaluate participants' spiritual coping strategies. Tao et al. [37] translated it into Chinese. In 2022, we evaluated the reliability and validity of the Chinese version of the SCQ among nursing students (Hu et al. [38]). The results indicated that a four-dimensional structure appeared more meaningful to Chinese nursing students than the seven-dimensional format. The tested SCQ version includes 26 items and two subscales: positive (17 items) and negative (nine items) spiritual coping strategies. The positive subscale comprises three dimensions (personal, environmental, and transcendent), while the negative subscale has one dimension. For instance, the personal dimension includes items such as "I seek meaning in the things that happen," while the negative subscale features items like "I feel that life has no purpose." The scale employs a 5-point Likert scoring system, ranging from "very inaccurate" to "very accurate," scored from 1 to 5, respectively. Total scores range from 26 to 180, with a higher score indicating a stronger tendency to use these coping strategies. The overall Cronbach's α for the questionnaire and its dimensions ranged from 0.83 to 0.94. In the present study, Cronbach's alpha of this questionnaire was measured as 0.84.

Data collection

Data was collected from May 13 to 24, 2024. The following steps were taken: (1) An online questionnaire was designed using a popular online survey platform in China

(<https://www.wenjuan.com/>), and the link was generated for easy access to the survey form. Each question was mandatory, requiring participants to answer all questions before submitting. However, if they encountered questions they preferred not to answer, they could exit the survey at any time without submitting. (2) The research team developed a recruitment letter outlining the study's purpose, the principle of voluntary participation, and the anonymity of the questionnaire responses. The letter also encouraged participants to answer the questionnaire based on their own opinions and to avoid discussing the questions with their classmates or being influenced by others. (3) The research team obtained survey approval from the nursing college and acquired the QQ contact information (a widely used social media application in China) for the class monitor. We then sent recruitment letters with survey links to these monitors. (4) Each class monitor distributed the survey link within their Tencent QQ group, which included all students in the class, and (5) Interested students could click the link with their phones to access the informed consent form. Students who agreed to participate could click the "informed consent" button before proceeding to complete the questionnaire. The completion time for the questionnaires was approximately 10 min. We did not offer any incentives or compensation; participants' involvement in the study was entirely voluntary. The original survey data were securely stored on an encrypted USB drive that was physically isolated from internet access. The drive remained under the custody of the principal investigator, with access restricted exclusively to the first author and the principal investigator. To ensure research transparency while protecting participant confidentiality, the de-identified dataset generated and analyzed during this study has been deposited in the Open Science Framework (OSF) repository (<https://doi.org/10.17605/OSF.IO/PGU87>).

Statistical methods

SPSS 27.0 and Mplus 8.3 were used for data analysis. To enhance the quality of the data, we screened the data in two steps. First, we calculated the total score and standard deviation for each participant on each scale. Based on the standard deviation [39] and researchers' experience, we excluded questionnaires with a standard deviation less than 0.4 or greater than 1.9. Then, we used Harman's Single-Factor Test to test the Common Method Variance (CMV) in our dataset [40]. The generated Principal Component Analysis output revealed 7 distinct factors accounting for 60% of the total variance. The first unrotated factor captured only 32% of the variance in the data. Thus, no single factor emerged, and the first factor did not capture most of the variance. These results suggest that CMV is not an issue in this study.

For the remaining data, mean and standard deviation, frequency, and percentage were used for statistical description. Latent profile analysis (LPA) was conducted to explore latent profiles of resilience among nursing students. After standardizing the scores of dimensions [41], models with one to five profiles were freely estimated using 1,000 random sets of start values, and the 200 best solutions were retained for final-stage optimization. The analyses used the Yuan-Bentler [42] correction for test statistics and sandwich estimator standard errors, which are known to be robust to non-normality. These methods were implemented through the Maximum Likelihood Robust (MLR) estimator in Mplus. An optimal number of profiles was selected using the following model fit indices: Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), sample-size adjusted BIC (SABIC), adjusted Lo-Mendell-Rubin likelihood ratio test (aLMR), bootstrap likelihood ratio test (BLRT), and entropy [43, 44]. Lower values of AIC, BIC, and SABIC indicate better model fit, while aLMR and BLRT are used to compare the model with k profiles with a model with $k-1$ profiles (s), and a significant result indicates that the k profile model is superior to the $k-1$ profile model. A higher entropy suggests a more accurate classification; values greater than 0.80 indicate that the latent classes are highly discriminative [32]. The proportion of individuals classified into a certain profile should generally be at least 5% [45].

Next, we examined whether distal outcomes (i.e., positive and negative coping strategies) differed across different resilience profiles. This LPA test was performed using the Bolck-Croon-Hagenaars approach via the BCH function in Mplus [46]. The BCH method prevents latent class shifts by performing a weighted multiple-group analysis [47]. This method entails a weighted analysis of variance, where weights are inversely correlated with classification error. Through this approach, we obtained equality test results comparing the class-specific means of distal outcomes across latent profiles.

We conducted a collinearity test on demographic variables using SPSS 27.0. The results indicated that all variables had Variance Inflation Factor values below 2, suggesting minimal influence among the demographic variables, thus allowing for analysis to proceed [48]. After that, we used the R3STEP (Three-Step Approach for Auxiliary Variables) option in Mplus to evaluate the associations between demographic characteristics and resilience profiles. Initially, this process determined the optimal number of resilience profiles using solely indicator variables to avoid the influence of auxiliary variables in forming the solution. Subsequently, it derived the most probable profile memberships with posterior probabilities for each student. Finally, the most likely membership of each class was regressed on demographic

Table 1 Sociodemographic characteristics and spiritual coping strategies of students (N = 1223)

Variables	Classification	n	%
Gender	Male	223	18.23
	Female	1000	81.77
Whether the participant was an only child in their family	No	951	77.76
	Yes	272	22.24
Family residence	Urban	750	61.32
	Rural	473	38.68
Whether they had been a student leader during college	No	826	67.54
	Yes	397	32.46
Age, year (M ± SD)		19.20 ± 1.37	

M: Mean, SD: Standard deviation

characteristics, accounting for classification error in a categorical latent variable multinomial logistic regression [49]. The predictors included gender, age, whether the participant was an only child, family residence, and whether they had been a student leader during college.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Results

Participants

Among the 3,400 students enrolled in school, 1,585 (46.62%) participated in our study by submitting their questionnaires. After data screening (see “Statistical Methods”), a total of 1,223 (77.16%) questionnaires were included for further analysis. As indicated in Table 1, the average age of the nursing students was 19.20 ± 1.37 years. The majority of participants were female (81.77%), lived in urban areas (61.32%), and had no prior experience as a student leader during college (67.54%). Nearly four-fifths of them were the only child in their family (77.76%).

Latent profile analysis of resilience

The four-profile model was chosen as the best fit for several reasons. First, while AIC, BIC, and SABIC values decreased with more profiles, the rate of decrease plateaued after the fourth model. Second, the fourth model had the highest entropy (0.85), indicating superior classification accuracy. Third, the aLMR test for the fifth model was not significant, showing no improvement over the fourth model. Lastly, the fifth model included a group with only 1.88% of the sample, which is below the 5% threshold for adequate representation, compromising its validity [45]. Detailed results are shown in Table 2.

Figure 1 presents the standardized resilience dimension scores across the four profiles. These scores, interpreted

Table 2 Model fitting indexes for LPA in resilience (N = 1223)

Model	LL	Scaling	#FP	AIC	BIC	SABIC	aLMR	BLRT	Entropy	Latent class probability (%)
1-Profile	-5206.09	1.00	6	10424.17	10454.83	10435.77				100
2-Profile	-4644.52	1.30	10	9309.04	9360.13	9328.37	0.00	0.00	0.76	59.69 40.31
3-Profile	-4413.57	1.39	14	8855.14	8926.67	8882.20	0.00	0.00	0.80	39.25 10.87 49.89
4-Profile	-4223.73	1.31	18	8483.46	8575.43	8518.25	0.00	0.00	0.85	6.86 9.16 44.56 39.41
5-Profile	-4174.16	1.28	22	8392.32	8504.72	8434.84	0.08	0.00	0.82	1.88 42.11 12.67 34.6 8.75

LL: model log-likelihood; Scaling: scaling factor associated with MLR log-likelihood estimates; #FP: number of free parameters; AIC: Akaike information criterion; BIC: Bayesian information criterion; SABIC: sample-size adjusted BIC; aLMR: adjusted Lo-Mendell-Rubin adjusted likelihood ratio test for k vs. k - 1 profiles; BLRT: bootstrap likelihood ratio

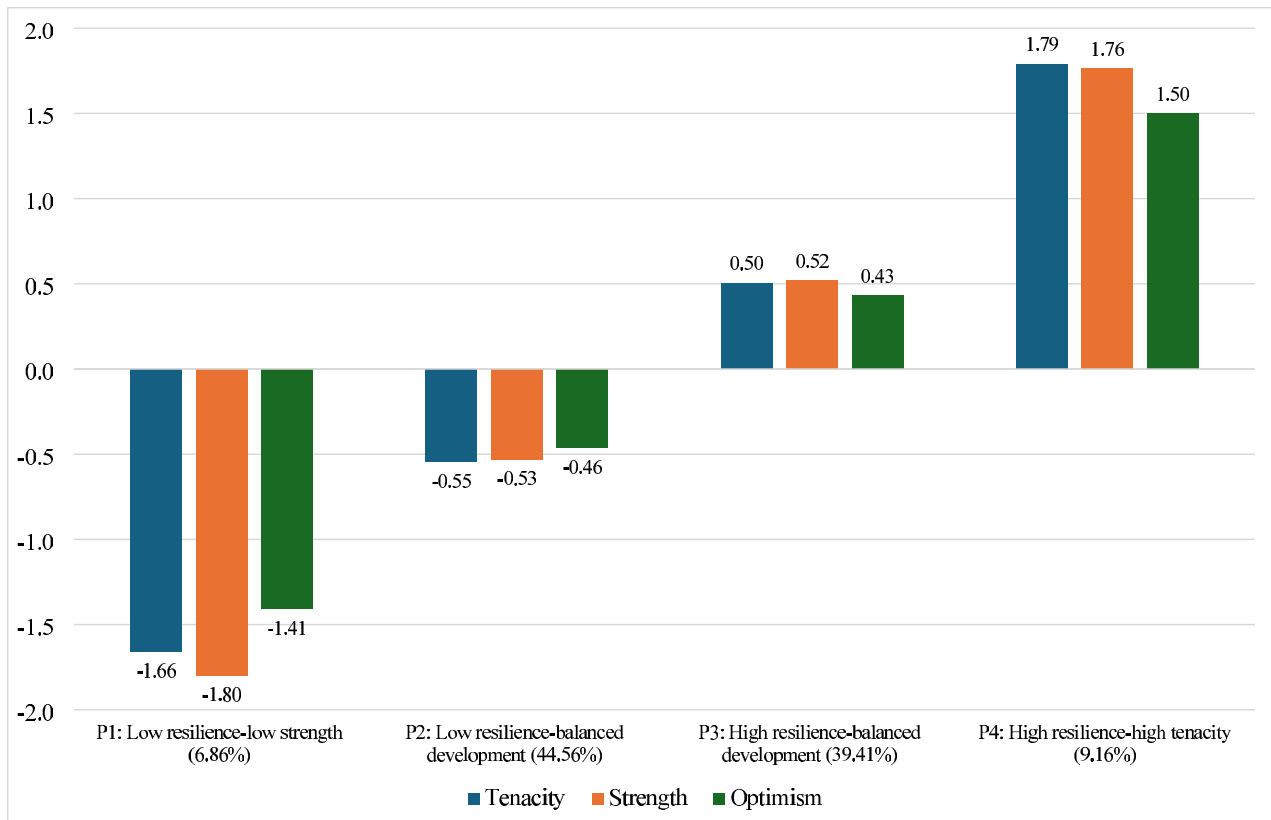


Fig. 1 Four-profile model of resilience in the present study

Table 3 Equality tests of mean scores on each spiritual coping strategies by resilience profiles

Spiritual coping strategies	Profile 1 (a)	Profile 2 (b)	Profile 3 (c)	Profile 4 (d)
Positive spiritual coping strategies	44.49 _{bcd}	54.91 _{acd}	63.42 _{abd}	71.75 _{abc}
Negative spiritual coping strategies	19.03 _{bcd}	14.82 _{ac}	12.98 _{ab}	13.49 _a

Subscripts denote profiles that differ significantly at $p < 0.01$; Profile 1, low resilience-low strength group; Profile 2, low resilience-balanced development group; Profile 3, high resilience-balanced development group; Profile 4, high resilience-high tenacity group

as low to high relative to the sample, reflect their relative standing within the study [41]. Profile 1 had the lowest scores in all dimensions, particularly in strength, and was labeled the low resilience-low strength group. Profile 2 had uniformly lower scores and was named the low resilience-balanced development group. Profile 3, with higher balanced scores, was the high resilience-balanced development group, while Profile 4, with the highest scores and standout tenacity, was the high resilience-high tenacity group.

Spiritual coping strategies by resilience

The Bolck-Croon-Hagenaars approach [46] was used to analyze spiritual coping strategies (positive and negative)

as outcomes of resilience profiles. The results showed that positive coping strategies exhibited a statistically significant increase in mean scores from Profile 1 to Profile 4. For negative coping strategies, mean scores decreased statistically from Profile 1 to Profile 3, with no statistically significant differences between Profiles 2 and 4 or Profiles 3 and 4. See Table 3.

Prediction of resilience profile membership by demographic information

Table 4 presents the results of the multinomial logistic regression examining demographic factors and resilience profile membership. Age and being an only child were not statistically significantly associated with profile membership. Female students were more likely to belong to Profiles 1 ($\beta = -1.01, p < 0.05$), 2 ($\beta = -1.02, p < 0.001$), and 3 ($\beta = -0.73, p < 0.01$) than Profile 4. Students with leadership experience were more likely to be in Profiles 3 ($\beta = 0.66, p < 0.001$) and 4 ($\beta = 0.74, p < 0.01$) than Profile 2. Urban students were more likely to belong to Profile 4 than Profile 1 ($\beta = 0.77, p < 0.05$).

Discussion

Using a person-centered approach [50], this study explored how different resilience profiles manifest among nursing students. It also examined how individuals

Table 4 Results of multinomial logistic regressions for the effects of predictors on resilience profiles

Variable	Profile 2 vs. 1 ^a			Profile 3 vs. 1 ^a			Profile 4 vs. 1 ^a		
	β	SE	OR	β	SE	OR	β	SE	OR
Gender	0.01	0.40	1.01	-0.28	0.38	0.76	-1.01*	0.42	0.36
Age	0.04	0.11	1.04	0.06	0.11	1.06	0.02	0.13	1.02
Whether the participant was an only child in their family	0.19	0.40	1.21	0.27	0.39	1.31	-0.01	0.45	0.99
Whether they had been a student leader during college	-0.09	0.33	0.92	0.57	0.31	1.78	0.65	0.36	1.92
Family residence	0.63	0.35	1.87	0.56	0.34	1.75	0.77*	0.39	2.15
	Profile 3 vs. 2 ^a			Profile 4 vs. 2 ^a			Profile 4 vs. 3 ^a		
	β	SE	OR	β	SE	OR	β	SE	OR
Gender	-0.29	0.20	0.75	-1.02***	0.25	0.36	-0.73**	0.26	0.48
Age	0.02	0.05	1.20	-0.02	0.09	0.99	-0.03	0.10	0.97
Whether the participant was an only child in their family	0.08	0.18	1.09	-0.20	0.28	0.82	-0.29	0.30	0.75
Whether they had been a student leader during college	0.66***	0.17	1.93	0.74**	0.25	2.09	0.08	0.25	1.08
Family residence	-0.07	0.16	0.94	0.14	0.24	1.15	0.21	0.25	1.23

Dummy coding (Gender: male=1 and female=2; Age= values; Whether the participant was an only child in their family: no=1 and yes=2; Whether had been a student leader during college: no=1 and yes=2; Family residence: rural=1 and urban=2); SE, standard error of the coefficient (Coef/ β); OR, odds ratio; Profile 1, low resilience-low strength group; Profile 2, low resilience-balanced development group; Profile 3, high resilience-balanced development group; Profile 4, high resilience-high tenacity group

^a Reference group

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

within these profiles utilize spiritual coping strategies and analyzed the relationships between demographic factors and the various resilience profiles. Four profiles of resilience were identified: low resilience-low strength (Profile 1), low resilience-balanced development (Profile 2), high resilience-balanced development (Profile 3), and high resilience-high tenacity (Profile 4). Spiritual coping strategies differed across resilience profiles. Gender, having been a student leader during college, and family residence were found to be predictors of resilience in different profiles.

Latent profiles of resilience

Four latent profiles of resilience were identified in our study. The majority of nursing students (44.56% of the sample) were classified into Profile 3, characterized as the high resilience-balanced development group. A large-scale study in China involving a similar demographic, which employed a variable-centered approach, found that scores for tenacity and optimism were similar and lower compared to those for strength [24]. This suggests that while variable-centered methods are effective for summarizing overall trends, they may fall short of capturing individual heterogeneity [51]. It also indicates that the previous variable-centered investigation [24] may not be precise enough to inform resilience-related interventions, as different dimensions require different intervention components [27, 28]. In contrast, person-centered methods, like the one used in our study, are particularly adept at revealing heterogeneity within groups [30]. Therefore, the findings of our study are important as they offer new evidence of nursing students' resilience levels by identifying diverse resilience profiles among them,

which can guide the design of more targeted interventions. Additionally, the results suggest potential heterogeneity in resilience among nursing students in other countries. Researchers worldwide can apply the same methodology in our study to uncover resilience profiles in nursing students within their own countries, enabling more precise intervention design.

Our study revealed an overall upward trend in three dimensions (tenacity, strength, and optimism) from the first to the fourth profile. Tenacity refers to an individual's equanimity, promptness, perseverance, and sense of control when encountering challenges. Strength is the capacity to recover from setbacks and past experiences. Optimism is the confidence that one can resist adverse events [27, 34]. In Profile 1 (low resilience-low strength group), scores on all three dimensions were very low, especially the strength dimension. This indicates students in this group may struggle significantly with resilience, especially in their ability to bounce back from challenges. This finding is consistent with a previous study that individuals with low resilience levels usually manifested on the strength dimension [52]. One reason may be that individuals with low resilience usually lack the resources to cope with adversity, which may impede their recovery from setbacks [15]. Thus, there is an urgent need to improve the resilience level, especially the strength dimension among this profile compared to the other three profiles.

In addition, Profile 4 (high resilience-high tenacity group), which included the second-largest number of participants (39.41% of the sample), had the highest scores in the tenacity dimension and the lowest scores in the optimism dimension. This finding means that these

students demonstrate a strong sense of control when facing challenges, but they lack confidence in their ability to resist adversity. It suggests that while they are self-determined, they may struggle with maintaining a positive outlook and believing in favorable outcomes. Individuals with high psychological resilience tend to deal with problems with a realistic and pragmatic attitude rather than simply being optimistic. This approach helps them cope with stress and challenges more effectively [53]. This may contribute to the lower scores in optimism among nursing students in this group. Given that optimism was a prominent area of weakness for nursing students in Profile 4, it is imperative to place increased emphasis on fostering optimism among this group.

Resilience profiles and spiritual coping strategies

An important observation from these profiles was that resilience significantly influenced subsequent spiritual coping strategies among nursing students, consistent with previous research on the relationship between resilience and coping strategies [18]. Our study adds to the existing knowledge base by revealing the relationships between different resilience profiles and spiritual coping strategies. Specifically, as scores in the three dimensions increased from the first to the fourth profile, there was a statistically significant increase in the positive spiritual coping strategies score. This finding aligns with the Matching Model [16], suggesting that individuals with higher levels of resilience are more likely to use positive spiritual coping strategies. One possible explanation for this outcome is that individuals with strong resilience may mobilize more resources to cope with difficulties, including spiritual resources [54]. In other words, nursing students with high resilience levels are likely to use spiritual resources effectively to manage stress, such as seeking spiritual support and finding meaning in challenges [55]. Thus, improving students' resilience may help them adopt more positive and constructive spiritual responses to challenges.

Moreover, our study found that improvements in resilience among nursing students positively influence the reduction of negative coping strategies. However, this influence was significant only among students with low levels of resilience (Profile 1 and Profile 2). This suggests that negative coping strategies may not be influenced by resilience improvement when nursing students' resilience reaches a high level (Profile 3). This may be because, at high resilience levels, nursing students might have become accustomed to specific spiritual coping strategies and believe these are sufficient to manage current challenges or stressors. Consequently, they may lack the motivation to change their spiritual coping strategies even as resilience levels continue to rise [56]. Therefore, among college nursing students, we should be cautious

when considering the reduction of negative spiritual coping strategies through the enhancement of resilience levels.

Demographic predictors of resilience for different profiles

Gender. The results revealed that female students were more likely to belong to Profiles 1 ($\beta = -1.01, p < 0.05$), 2 ($\beta = -1.02, p < 0.001$), and 3 ($\beta = -0.73, p < 0.01$) compared to Profile 4. This suggests that female students tended to show lower resilience than their male counterparts, not only in overall scores but also across all three dimensions. This may be because female college students usually experience higher levels of stress than their male counterparts [57, 58], which can negatively affect their resilience [59]. Our finding contrasts with previous variable-centered studies, which found no statistically significant difference in resilience between female and male nursing students [20, 21, 23, 24]. The person-centered approach used in our study allows for a more nuanced understanding [60] of gender differences in resilience, underscoring the significance of our findings. Meanwhile, this highlights the need for researchers worldwide to reconsider and assess the factors influencing resilience through a person-centered approach.

Whether having been a student leader during college. Students with leadership experience during college are more likely to be members of Profiles 3 ($\beta = 0.66, p < 0.001$) and 4 ($\beta = 0.74, p < 0.01$) compared to Profile 2. This means that students with leadership experience during college tended to show a higher level of resilience than those without such experience. Our finding is consistent with previous variable-centered studies [23, 24]. This may be because leadership roles often require individuals to navigate challenges, manage stress, and develop problem-solving skills, which can enhance their overall resilience [61]. Additionally, the experience of leading others and taking on responsibilities can build confidence and adaptive coping strategies, contributing to greater resilience in various situations [62]. The importance of leadership in clinical nursing is widely recognized globally [1]. However, our study emphasizes the significance of leadership, specifically among nursing students. Leadership is not solely demonstrated by individuals in formal positions; rather, it can be exhibited by anyone who seeks to influence others toward a shared goal [63]. Our research suggests that nursing students should engage more in collective activities to expand their leadership experience. This involvement may further equip them with greater resilience to cope with academic pressures and the challenges of future clinical work.

Family residence. Students who live in urban areas were more likely to belong to Profile 4 than Profile 1 ($\beta = 0.77, p < 0.05$), suggesting that they tend to exhibit higher resilience compared to their rural counterparts. This finding

contrasts with previous variable-centered studies, which found no statistically significant difference in resilience between urban and rural students [23, 24]. A possible explanation is that urban students have access to more educational resources, psychological support, and social opportunities, which enhance their ability to cope with challenges [64]. These results highlight the importance of considering within-group heterogeneity when designing resilience interventions, particularly in addressing the specific needs of rural students.

Limitations

First, the data were collected from a single college, which may limit the generalizability of the findings to other institutions. While the characteristics of the nursing students in this study were consistent with those of nursing students nationwide in China [24], differences in resilience and coping strategies across institutions may still affect the applicability of these findings. Therefore, caution is needed when generalizing these results to other educational settings. To improve external validity, future research should include participants from multiple colleges. Second, we cannot confirm whether participants discussed the questions with each other, which could potentially have influenced their responses. Nevertheless, we encouraged participants to base their answers on their own thoughts and feelings. Third, the questionnaire was designed with all questions set as mandatory. While this approach helps minimize missing data, it may also increase the risk of dropout and introduce response bias. Finally, since the questionnaire relied on participants' recollection of past events or experiences, there is a potential risk that their responses may not be entirely accurate. This could lead to inaccuracies in the reported data and affect the overall validity of the findings. Future studies should consider incorporating more objective measures or validating responses with additional data sources to mitigate the effects of recall bias.

Implications for research and education, and policy-making

Despite the limitations of our study, the findings have important implications for education, research, and policy-making. For nursing research and education, based on the four resilience profiles identified in this study, researchers and educators can develop targeted interventions to enhance students' resilience levels and better support them in coping with their stressors. Specifically, in designing resilience programs within the curriculum, the focus should be tailored according to the profiles of nursing students. For students in Profile 1, efforts should be concentrated on interventions targeting the strength dimension. For students in Profiles 2 and 3, attention should be equally distributed across all three dimensions.

For students in Profile 4, the emphasis should be placed on the optimism dimension. This targeted approach can help maximize the impact of limited resources, especially in resource-constrained educational settings. Our study also serves as a reminder for nursing researchers and educators worldwide, when assessing nursing students' resilience or designing educational interventions, it's important to consider their individual heterogeneity.

Future educational interventions aimed at enhancing positive spiritual coping strategies among nursing students could consider resilience as a primary intervention target. However, interventions that target negative spiritual coping strategies by enhancing resilience may be particularly effective for individuals with low resilience levels (students in Profiles 1 and 2). Additionally, we encourage nurse educators and researchers to explore potential explanations and gain a deeper understanding of how differences in gender, leadership experience, and family residence during college influence students across different resilience profiles. For example, interviewing students of different genders from various resilience profiles about how they develop their resilience could provide valuable insights.

Our research findings also have significant implications for policy-making. Firstly, our study underscores the urgency of enhancing resilience among nursing students in Profiles 1 and 2 to better equip them to cope with stress. Policymakers can allocate more financial support towards this endeavor, such as providing more funds to incentivize nursing educators to apply for transformation projects that explore the feasibility and effectiveness of integrating resilience education into nursing curricula. Secondly, policymakers can develop more detailed policies to guide nursing educators and researchers in specific strategies to enhance nursing students' resilience. This could include focusing on students in Profiles 1 and 2, addressing specific dimensions within each profile, and emphasizing the importance of targeting female students living in rural areas as well as those without leadership experience during college.

Conclusion

Our study confirmed the individual heterogeneity in resilience among nursing students. We identified four distinct resilience profiles associated with different coping strategies. Gender, family residence, and previous leadership experience during college were predictors of these profiles. Profile 1 has the lowest scores across all three dimensions, with the most significant weakness in the strength dimension. Profile 4 has the highest scores across all dimensions, yet shows the most noticeable weakness in the optimism dimension. This suggests that future research should focus more on nursing students in Profile 1 and the weaker dimensions across different

profiles to help them better cope with stressors. For future educational interventions aimed at enhancing positive spiritual coping strategies among nursing students, integrating resilience as a primary intervention component could be beneficial. Interventions targeting negative spiritual coping strategies by enhancing resilience may be particularly effective for individuals with low resilience levels (students in Profiles 1 and 2). The primary focus of future resilience research and education should be on female students living in rural areas and students without leadership experience during college.

Abbreviations

SCQ	Spiritual Coping Questionnaire
CD-RISC	Connor-Davidson Resilience Scale
BCH	Bolck-Croon-Hagenaars
R3STEP	Three-Step Approach for Auxiliary Variables
CMV	Common Method Variance
LPA	Latent profile analysis
MLR	Maximum Likelihood Robust
AIC	Akaike Information Criterion
BIC	Bayesian Information Criterion
SABIC	Sample-size adjusted Bayesian Information Criterion
aLMR	adjusted Lo-Mendell-Rubin likelihood ratio
BLRT	Bootstrap Likelihood Ratio Test

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12912-025-03510-1>.

Supplementary Material 1

Acknowledgements

We would like to thank all nursing students who joined our study.

Author contributions

S.H. and S.L. conceptualized the study and wrote the original draft. S.H. and Y.X. secured funding for the project. Q.Y. contributed to methodology and performed the formal analysis. T.Z., Y.X., D.X., and H.H. conducted the investigation. B.S., H.H., and X.L. reviewed and edited the manuscript, with X.L. providing supervision. All authors reviewed the manuscript and approved the final version.

Funding

This study was supported by the China Scholarship Council (No. Not applicable) and Central South University (2023ZZTS0836, 2023ZZTS0567). The funders had no role in the design and conduct of the study; collection, management, analysis, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Data availability

Databased: The de-identified dataset generated and analyzed during the current study is available in the Open Science Framework (OSF) repository, DOI: 10.17605/OSF.IO/PGU87.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The Ethics Review Committee of Changsha Medical University approved this study on May 10, 2024, prior to the commencement of data collection (No. X2024016). This study was conducted anonymously. Participants were fully informed about data confidentiality by participating study, and their participation was voluntary. Additionally, participants were informed of their right to withdraw from the study at

any time without providing a reason. Informed consent to participate was obtained from all of the participants in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Xiangya School of Nursing, Central South University, No. 172, Tongzipo Road, Changsha 410013, China

²Department of Nursing, Hunan Provincial Maternal and Child Health Care Hospital, Changsha, China

³Northern Jiangsu People's Hospital Affiliated to Yangzhou University, Yangzhou, China

⁴Department of Nursing Science, University of Turku, Turku, Finland

⁵School of Public Health, Kunming Medical University, Kunming, China

⁶Department of Emergency Intensive Care Unit, The Affiliated Hospital of Xuzhou Medical University, Xuzhou, China

⁷Department of Nursing, Hunan Cancer Hospital, No. 582, Xianjiahua Road, Changsha 410006, China

Received: 26 November 2024 / Accepted: 27 June 2025

Published online: 03 July 2025

References

- World Health Organization. The WHO Global Strategic Directions for Nursing and Midwifery (2021–2025) [Internet]. 2021. Available from: <http://file:///E:/Zotero/storage/FUAR65UQ/9789240033863.html>
- Alzayyat A, Al-Gamal E. A review of the literature regarding stress among nursing students during their clinical education. *Int Nurs Rev* [Internet]. 2014 [cited 2024 Jun 24];61(3):406–15. Available from: <https://onlinelibrary-wiley-com.ezproxy.utu.fi/doi/abs/https://doi.org/10.1111/inr.12114>
- Bartlett ML, Taylor H, Nelson JD. Comparison of Mental Health Characteristics and Stress Between Baccalaureate Nursing Students and Non-Nursing Students. *J Nurs Educ* [Internet]. 2016 Feb [cited 2024 May 10];55(2):87–90. Available from: <https://journals.healio.com/doi/https://doi.org/10.3928/0148-4834-20160114-05>
- Onieva-Zafra MD, Fernández-Muñoz JJ, Fernández-Martínez E, García-Sánchez FJ, Abreu-Sánchez A, Parra-Fernández ML. Anxiety, perceived stress, and coping strategies in nursing students: a cross-sectional, correlational, descriptive study. *BMC Med Educ* [Internet]. 2020 Oct 19 [cited 2024 Jun 24];20(1):370. Available from: <https://doi.org/10.1186/s12909-020-02294-z>
- Ching SSY, Cheung K, Hegney D, Rees CS. Stressors and coping of nursing students in clinical placement: A qualitative study contextualizing their resilience and burnout. *Nurse Educ Pract* [Internet]. 2020 [cited 2024 May 3];42:102690. Available from: <https://www.sciencedirect.com/science/article/pii/S1471595318302580>
- Pryjmachuk S, Richards DA. Predicting stress in pre-registration nursing students. *Br J Health Psychol* [Internet]. 2007 Feb [cited 2024 Jun 24];12(1):125–44. Available from: <https://bpspsychub.onlinelibrary.wiley.com/doi/https://doi.org/10.1348/135910706X98524>
- Felicilda-Reynaldo RFD, Cruz JP, Papatanasasiou IV, Helen Shaji JC, Kamau SM, Adams KA et al. Quality of Life and the Predictive Roles of Religiosity and Spiritual Coping Among Nursing Students: A Multi-country Study. *J Relig Health* [Internet]. 2019 Oct [cited 2024 Jun 12];58(5):1573–91. Available from: <http://link.springer.com/https://doi.org/10.1007/s10943-019-00771-4>
- Kurtgöz A, Koç Z. Nursing Students' Spiritual/Religious Coping Strategies Dealing With First Experience of Witnessing Death During Clinical Practices. *OMEGA - J Death Dying* [Internet]. 2023 Apr 28 [cited 2024 Jun 12];003022282311748. Available from: <http://journals.sagepub.com/doi/https://doi.org/10.1177/00302228231174803>
- Pargament KI. The psychology of religion and coping: Theory, research, practice [Internet]. Guilford press; 2001 [cited 2024 May 8]. Available from: <https://books.google.com/books?hl=zh-CN%26lr=%26id=Vn5XObcpcnd4C%26oi=fnd%26pg=PA1%26dq=The%26Bpsychology%26of%26B;religion%26and%26B;coping%26BTheory,%26Bresearch,%26Bpractice%26to%26ts=eUbx4O6Jfb%26sig=69f2jzRdtIsW9ogGP17rK9JBVk>

10. Stephenson E, DeLongis A. Coping Strategies. In: The Wiley Encyclopedia of Health Psychology [Internet]. John Wiley & Sons, Ltd; 2020 [cited 2024 Jul 13]. pp. 55–60. Available from: <https://onlinelibrary-wiley-com.ezproxy.utu.fi/doi/abs/https://doi.org/10.1002/9781119057840.ch50>
11. Feng J, Li Y, Sun Y, Wang L, Qi W, Wang KT et al. The Chinese spiritual coping scale: Development and initial psychometric evaluation. *J Relig Health* [Internet]. 2021 Aug 1 [cited 2025 Jun 22];60(1):458–74. Available from: <http://link.springer.com/https://doi.org/10.1007/s10943-019-00970-z>
12. Niu Y, McSherry W, Partridge M. Exploring the meaning of spirituality and spiritual care in Chinese contexts: A scoping review. *J Relig Health* [Internet]. 2022 Aug 1 [cited 2025 Jun 22];61(4):2643–62. Available from: <https://link.springer.com/article/https://doi.org/10.1007/s10943-021-01199-5>
13. Taylor H, Reyes H. Self-efficacy and resilience in baccalaureate nursing students. *Int J Nurs Educ Scholarsh* [Internet]. 2012 Feb 17 [cited 2025 Jun 22];9(1). Available from: <https://www.degruyterbrill.com/document/doi/https://doi.org/10.1515/1548-923X.2218/html>
14. Charzyńska E. Multidimensional approach toward spiritual coping: construction and validation of the spiritual coping questionnaire (SCQ). *J Relig Health*. 2015;54:1629–46.
15. Masten AS. Ordinary magic: Resilience processes in development. *Am Psychol* [Internet]. 2001 [cited 2024 May 4];56(3):227. Available from: <https://psycnet.apa.org/record/2001-00465-004>
16. Folkman S. Stress. Appraisal and Coping. In: Gellman MD, editor. *Encyclopedia of Behavioral Medicine* [Internet]. Cham: Springer International Publishing; 2020 [cited 2024 May 4]. pp. 2177–9. Available from: http://link.springer.com/https://doi.org/10.1007/978-3-030-39903-0_215
17. Hand MW, Evans J, Swenty C, White A, Chen C. An Examination of Factors Associated With Student Resiliency. *Nurse Educ* [Internet]. 2022 Jun [cited 2024 May 4];47(3):156. Available from: https://journals.lww.com/nurseeducatoronline/fulltext/2022/05000/an_examination_of_factors_associated_with_student.7.aspx
18. Li L, Hua R, Yang L. Coping styles play intermediary roles between resilience and clinical communication ability among nursing students in traditional Chinese Medical university: A structural equation model analysis. *Medicine (Baltimore)* [Internet]. 2021 [cited 2024 May 4];100(51):e28284. Available from: https://journals.lww.com/md-journal/fulltext/2021/12230/Coping_styles_play_intermediary_roles_between.88.aspx
19. Parviniannasab AM, Bijani M, Dehghani A. The mediating role of psychological capital in relations between spiritual well-being and mental health among nursing students. *BMC Psychol* [Internet]. 2022 Oct 2 [cited 2025 Jun 20];10(1):230. Available from: <https://bmcpublishing.biomedcentral.com/articles/https://doi.org/10.1186/s40359-022-00935-0>
20. Berdida DJE, Grande RAN. Quality of life and academic resilience of Filipino nursing students during the COVID-19 pandemic: a cross-sectional study. *Int J Nurs Educ Scholarsh* [Internet]. 2021 Jan 27 [cited 2024 May 4];18(1):20210115. Available from: <https://www.degruyter.com/document/doi/https://doi.org/10.1515/ijnes-2021-0115/html>
21. Grande RAN, Berdida DJE, Villagracia HN, Cornejo LTO, Villacorte LM, Borja MVF. Association Between Perceived Resilience and Mental Well-Being of Saudi Nursing Students During COVID-19 Pandemic: A Cross-Sectional Study. *J Holist Nurs* [Internet]. 2021 Dec 1 [cited 2024 May 4];39(4):314–24. Available from: <https://doi.org/10.1177/08980101211009063>
22. Lancaster R, Englund H, Anibas M, Berg CV. Self-Compassion and Resilience in a National Sample of Nursing Students Amid the COVID-19 Pandemic. *Nurs Educ Perspect* [Internet]. 2023 [cited 2024 May 4];44(1):43–5. Available from: https://journals.lww.com/neponline/fulltext/2023/01000/self_compassion_and_resilience_in_a_national.9.aspx
23. Lyu FF, Ramoo V, Wang YX. Career maturity, psychological resilience, and professional self-concept of nursing students in China: A nationwide cross-sectional study. *J Prof Nurs* [Internet]. 2022 [cited 2024 May 6];42:58–66. Available from: <https://www.sciencedirect.com/science/article/pii/S8755722322000837>
24. Zhou H, Wang Y, Cheng L. The mediating effect of self-directed learning in the relationship between caring and resilience among Chinese nursing students: A multi-center cross-sectional study. *Nurse Educ Today* [Internet]. 2022 Dec 1 [cited 2024 May 5];119:105598. Available from: <https://www.sciencedirect.com/science/article/pii/S0260691722003343>
25. Hwang E, Shin S. Characteristics of nursing students with high levels of academic resilience: A cross-sectional study. *Nurse Educ Today* [Internet]. 2018 Dec 1 [cited 2024 May 4];71:54–9. Available from: <https://www.sciencedirect.com/science/article/pii/S0260691718306348>
26. Lekan DA, Ward TD, Elliott AA. Resilience in Baccalaureate Nursing Students: An Exploration. *J Psychosoc Nurs Ment Health Serv* [Internet]. 2018 Jul [cited 2024 May 4];56(7):46–55. Available from: <https://journals.healio.com/doi/https://doi.org/10.3928/02793695-20180619-06>
27. Connor KM, Davidson JRT. Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety* [Internet]. 2003 Sep [cited 2024 Apr 28];18(2):76–82. Available from: <https://onlinelibrary.wiley.com/doi/https://doi.org/10.1002/da.10113>
28. Windle G, Bennett KM, Noyes J. A methodological review of resilience measurement scales. *Health Qual Life Outcomes* [Internet]. 2011 [cited 2024 Jun 24];9(1):8. Available from: <http://hqlo.biomedcentral.com/articles/https://doi.org/10.1186/1477-7525-9-8>
29. Laursen BP, Hoff E. Person-Centered and Variable-Centered Approaches to Longitudinal Data. *Merrill-Palmer Q* [Internet]. 2006 [cited 2024 May 3];52(3):377–89. Available from: <https://muse.jhu.edu/pub/27/article/202921>
30. Spurk D, Hirschi A, Wang M, Valero D, Kauffeld S. Latent profile analysis: A review and how to guide of its application within vocational behavior research. *J Vocat Behav* [Internet]. 2020 [cited 2024 May 3];120:103445. Available from: <https://www.sciencedirect.com/science/article/pii/S0001879120300701>
31. Vandenbroucke JP, Poole C, Schlesselman JJ, Egger M. Strengthening the reporting of observational studies in epidemiology (STROBE): explanation and elaboration. *PLoS Med*. 2007;4(10).
32. Tein JY, Coxse S, Cham H. Statistical Power to Detect the Correct Number of Classes in Latent Profile Analysis. *Struct Equ Model Multidiscip J* [Internet]. 2013 Oct [cited 2024 Jun 16];20(4):640–57. Available from: <http://www.tandfonline.com/doi/abs/https://doi.org/10.1080/10705511.2013.824781>
33. Chrétien A, Hayotte M, Vuillemin A, Longueville F, d'Arripe. Resilience profiles of elite athletes and their associations with health-related behaviors, well-being, and performance: A latent profile analysis. *Psychol Sport Exerc* [Internet]. 2024 [cited 2025 Jun 23];102:689. Available from: https://www.sciencedirect.com/science/article/pii/S1469029224001006?casa_token=lojyDqJOsLoAAAAA:niIuaeDzLWbuNSQBLRaW7S9ysQ3TNTTQjmhvEQ4L7Fvn8CuLWwyplRg2-ZkOEI67Drr-GO7zXE
34. Yu X, Zhang J. Factor analysis and psychometric evaluation of the Connor-Davidson Resilience Scale (CD-RISC) with Chinese people. *Soc Behav Personal Int J* [Internet]. 2007 [cited 2024 Apr 28];35(1):19–30. Available from: <https://www.ingentaconnect.com/content/sbp/sbp/2007/00000035/00000001/art00003>
35. Ding X, Zheng L, Liu Y, Zhang W, Wang N, Duan H et al. Parenting styles and psychological resilience: The mediating role of error monitoring. *Biol Psychol* [Internet]. 2023 May 1 [cited 2024 Apr 28];180:108587. Available from: <https://www.sciencedirect.com/science/article/pii/S0301051123001047>
36. Zhang X, Yue H, Hao X, Liu X, Bao H. Exploring the relationship between mental health literacy and psychological distress in adolescents: A moderated mediation model. *Prev Med Rep* [Internet]. 2023 Jun 1 [cited 2024 Apr 28];33:102199. Available from: <https://www.sciencedirect.com/science/article/pii/S2211335523000906>
37. Tao Y, Zhu X, Peng M, Wang C, Yu Y, Zhang L. Revision of the Chinese version of the Spiritual Coping Questionnaire and its reliability and validity in patients with advanced cancer. *J ET Nurs* [Internet]. 2021 [cited 2023 Apr 26];36(8):13–6. Available from: https://kns.cnki.net/kcms2/article/abstract?v=3uoqlhG8C44YLtIOAiTRKibYV5Vjs7iy_Rpms2pqwbFRRUtoUlmHQMm6294rHaFmBWAP_HISB-Jn9X4mfAJEazxDp7BYiW&uniplatform=NZKPT
38. Hu S, Chen W, Li M, Shen S, He S, Wang Q, et al. Validation of the Chinese version of the Spiritual Coping Scale among nursing students. *J Nurs Sci* 2023;38(15):14–17.
39. Ward MK, Meade AW. Dealing with Careless Responding in Survey Data: Prevention, Identification, and Recommended Best Practices. *Annu Rev Psychol* [Internet]. 2023 Jan 18 [cited 2024 Aug 4];74(Volume 74, 2023):577–96. Available from: <https://www.annualreviews.org/content/journals/10.1146/annurev-psych-040422-045007>
40. Tehseen S, Ramayah T, Sajilan S. Testing and Controlling for Common Method Variance: A Review of Available Methods. *J Manag Sci* [Internet]. 2017 Mar [cited 2023 Oct 19];4(2):142–68. Available from: <http://geistscience.com/papers/view/JMS1704202>
41. Nylund-Gibson K, Choi AY. Ten frequently asked questions about latent class analysis. *Transl Issues Psychol Sci* [Internet]. 2018 [cited 2024 Jun 25];4(4):440. Available from: <https://psycnet.apa.org/journals/tps/4/4/440/>
42. Yuan KH, Bentler PM. Three Likelihood-Based Methods for Mean and Covariance Structure Analysis with Nonnormal Missing Data. *Sociol Methodol*

- [Internet]. 2000 Aug [cited 2024 Apr 25];30(1):165–200. Available from: <http://journals.sagepub.com/doi/https://doi.org/10.1111/0081-1750.00078>
43. Geiser C. Data analysis with Mplus [Internet]. Guilford press; 2012 [cited 2024 Apr 25]. Available from: https://books.google.com/books?hl=zh-CN&lr=&id=Rd4yAAAQBAJ&oi=fnd&pg=PP1&dq=Data+analysis+with+Mplus&ots=nMh4CjHrfl&sig=oGtgzXe2yd9sAxXqFE_5eFUZXiw
 44. Morin AJ, Wang JC. A gentle introduction to mixture modeling using physical fitness performance data. In: John Wiley & Sons; 2016 [cited 2024 Apr 25]. Available from: <https://acuresearchbank.acu.edu.au/item/89944/online-supplements-for-a-gentle-introduction-to-mixture-modeling-using-physical-fitness-performance-data>
 45. Nylund KL, Asparouhov T, Muthén BO. Deciding on the Number of Classes in Latent Class Analysis and Growth Mixture Modeling: A Monte Carlo Simulation Study. *Struct Equ Model Multidiscip J* [Internet]. 2007 Oct 23 [cited 2024 Apr 25];14(4):535–69. Available from: <https://doi.org/10.1080/10705510701575396>
 46. Bakk Z, Vermunt JK. Robustness of Stepwise Latent Class Modeling With Continuous Distal Outcomes. *Struct Equ Model Multidiscip J* [Internet]. 2016 Jan 2 [cited 2024 Apr 25];23(1):20–31. Available from: <http://www.tandfonline.com/doi/full/https://doi.org/10.1080/10705511.2014.955104>
 47. Bakk Z, Tekle FB, Vermunt JK. Estimating the Association between Latent Class Membership and External Variables Using Bias-adjusted Three-step Approaches. *Sociol Methodol* [Internet]. 2013 Aug [cited 2024 Apr 25];43(1):272–311. Available from: <http://journals.sagepub.com/doi/https://doi.org/10.1177/0081175012470644>
 48. Shrestha N. Detecting multicollinearity in regression analysis. *Am J Appl Math Stat* [Internet]. 2020 [cited 2024 Apr 26];8(2):39–42. Available from: https://www.researchgate.net/profile/Noora-Shrestha/publication/342413955_Detecting_Multicollinearity_in_Regression_Analysis/links/5eff203345815505087a949/Detecting-Multicollinearity-in-Regression-Analysis.pdf
 49. Asparouhov T, Muthén B. Auxiliary Variables in Mixture Modeling: Three-Step Approaches Using *M plus*. *Struct Equ Model Multidiscip J* [Internet]. 2014 Jul 3 [cited 2024 Apr 25];21(3):329–41. Available from: <http://www.tandfonline.com/doi/abs/https://doi.org/10.1080/10705511.2014.915181>
 50. Mäkikangas A, Kinnunen U. The person-oriented approach to burnout: A systematic review. *Burn Res* [Internet]. 2016 Mar 1 [cited 2024 May 3];3(1):11–23. Available from: <https://www.sciencedirect.com/science/article/pii/S2213058615300127>
 51. Howard MC, Hoffman ME. Variable-Centered P-C. and Person-Specific Approaches: Where Theory Meets the Method. *Organ Res Methods* [Internet]. 2018 Oct [cited 2024 Aug 17];21(4):846–76. Available from: <http://journals.sagepub.com/doi/https://doi.org/10.1177/1094428117744021>
 52. Bonanno GA. Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events? *Am Psychol* [Internet]. 2004 [cited 2024 Jun 25];59(1):20. Available from: <https://psycnet.apa.org/fulltext/2004-10043-003.html>
 53. Southwick SM, Charney DS. The Science of Resilience: Implications for the Prevention and Treatment of Depression. *Science* [Internet]. 2012 Oct 5 [cited 2024 Jul 10];338(6103):79–82. Available from: <https://www.science.org/doi/https://doi.org/10.1126/science.1222942>
 54. Pargament KI, Smith BW, Koenig HG, Perez L. Patterns of positive and negative religious coping with major life stressors. *J Sci Study Relig* [Internet]. 1998 [cited 2024 Jun 27];7:10–24. Available from: <https://www.jstor.org/stable/1388152>
 55. Labrague LJ, McEnroe-Petitte DM, Gloe D, Thomas L, Papathanasiou IV, Tsaras K. A literature review on stress and coping strategies in nursing students. *J Ment Health* [Internet]. 2017 Sep 3 [cited 2024 Jun 24];26(5):471–80. Available from: <https://doi.org/10.1080/09638237.2016.1244721>
 56. Diener E, Lucas RE, Scollon CN. Beyond the Hedonic Treadmill: Revising the Adaptation Theory of Well-Being. In: Diener E, editor. *The Science of Well-Being* [Internet]. Dordrecht: Springer Netherlands; 2009 [cited 2024 May 8]. pp. 103–18. (Michalos AC, editor. *Social Indicators Research Series*; vol. 37). Available from: http://link.springer.com/https://doi.org/10.1007/978-90-481-2350-6_5
 57. Eisenbarth CA. Coping with stress: gender differences among college students. *Coll Stud J*. 2019;53(2):151–62.
 58. Graves BS, Hall ME, Dias-Karch C, Haischer MH, Apter C. Gender differences in perceived stress and coping among college students. *PLOS ONE* [Internet]. 2021 Aug 12 [cited 2024 Aug 18];16(8):e0255634. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0255634>
 59. Alatawi AO, Morsy NM, Sharif LS. Relation between resilience and stress as perceived by nursing students: a scoping review. *Evid-Based Nurs Res* [Internet]. 2022 [cited 2024 Aug 18];4(1):19–19. Available from: <https://www.ajol.info/index.php/ebnr/article/view/219525>
 60. Schmiege SJ, Meek P, Bryan AD, Petersen H. Latent variable mixture modeling: a flexible statistical approach for identifying and classifying heterogeneity. *Nurs Res* [Internet]. 2012 [cited 2024 Aug 17];61(3):204–12. Available from: https://journals.lww.com/nursingresearchonline/fulltext/2012/05000/Latent_Variable_Mixture_Modeling__A_Flexible.8.aspx
 61. Luthans F, Avolio BJ. Authentic leadership development. *Posit Organ Schol arsh* [Internet]. 2003 [cited 2024 Aug 18];241(258):1–26. Available from: <https://cerf.radiologie.fr/sites/cerf.radiologie.fr/files/Enseignement/DES/Modules-Base/Luthans%20%26%20Avolio%2C%202003.pdf>
 62. Jagger O, Lewith G. Building resilience through leadership. *InnovAiT Educ Inspir Gen Pract* [Internet]. 2016 Jun [cited 2024 Aug 18];9(6):347–54. Available from: <http://journals.sagepub.com/doi/10.1177/1755738016634382>
 63. Välimäki MA, Lantta T, Hipp K, Varpula J, Liu G, Tang Y, et al. Measured and perceived impacts of evidence-based leadership in nursing: a mixed-methods systematic review protocol. *BMJ Open*. 2021;11(10):e055356.
 64. Masten AS. Global Perspectives on Resilience in Children and Youth. *Child Dev* [Internet]. 2014 Jan [cited 2024 Aug 18];85(1):6–20. Available from: <https://srcd.onlinelibrary.wiley.com/doi/https://doi.org/10.1111/cdev.12205>

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.