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Latent Profile Analysis of mindful self-care and associations with mental health among nurses in China

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Latent Profile Analysis of mindful self-care and associations with mental health among nurses in China

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15 **Latent Profile Analysis of mindful self-care and associations with**
16 **mental health among nurses in China**

18 **Abstract**

19 **Background:** Despite the crucial role of mindfulness and self-care in nurses' physical
20 and mental health, as well as their professional well-being, the majority of nurses still
21 exhibit low levels of self-care. Moreover, there remains a lack of understanding
22 regarding the diverse subgroups of mindful self-care among nurses.

23 **Objectives:** To delve into the diverse groups of mindful self-care among nurses and to
24 investigate the correlation between these groups and their mental health.

25 **Methods:** Convenience sampling was adopted to select nurses from Guizhou Province,
26 China during August to September, 2023. The demographic characteristics
27 questionnaire, Chinese version of the Brief Mindful Self-Care Scale, Patient Health
28 Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder-7 (GAD-7), Perceived Stress
29 Scale (PSS) were used. A latent profile analysis (LPA) was performed on characteristics
30 of nurses' mindful self-care, and the correlations among latent profiles, demographic
31 characteristics, and mental wellbeing were identified by chi-square test, Spearman
32 correlation analysis, and non-parametric test.

33 **Results:** A total of 1001 nurses were included, and they were divided into four
34 heterogeneous subgroups, namely Inconsistent Mindful Self-Care Group (4.4%),
35 Balanced Development Group (43.4%), Moderate Mindful Self-Care Group (39.4%),
36 High Mindful Self-Care Group (12.9%). Results of single factor analysis showed that
37 the nurses' department and the average monthly income were the factors influencing
38 the potential profiles. Mindful self-care was negatively correlated to anxiety and
39 depression, but not correlated to perceived stress. There were significant differences
40 of perceived stress, anxiety, and depression across different mindful self-care groups.

41 **Conclusion:** This study employed latent profile analysis to identify four distinct
42 subgroups of hospital nurses based on their mindful self-care, revealing varying levels

of anxiety, depression, and perceived stress across groups, emphasizing the need for tailored mindful self-care strategies to promote nurses' well-being.

Keywords: nurse, mindfulness, self-care, latent profile analysis, cross-sectional study

Strengths and limitations of this study:

- The LPA approach was employed in this study to delve into the diverse subgroups of mindful self-care practices among Chinese nurses.
- While this study adopted a cross-sectional research design, it failed to explore the interaction mechanism between mental health and mindful self-care.
- The generalizability of our findings may be constrained due to the survey data being sourced from a single region, potentially limiting its wider applicability.

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54 **Introduction**

55 Nurses are recognized as a high-stress profession [1]. Sustained stress over a
56 prolonged period has numerous detrimental impacts on nurses, healthcare
57 organizations, and the patients they serve. Despite the fact that nurses worldwide
58 belong to a highly stressed group, there are significant differences among regions. A
59 systematic review and meta-analysis [2] revealed that that the Asian region exhibited
60 the lowest degrees of compassion satisfaction, contrasted with the highest rates of
61 compassion fatigue symptoms. Among them, Chinese nurses face a very worrying
62 situation [3, 4], nearly 43.83% Chinese nurses had depressive symptoms [5].

63 Nursing professionals can mitigate severe consequences such as burnout,
64 compassion fatigue and depression by adopting a regime of self-care management that
65 helps them attain psychophysical balance and spiritual wellness [6]. Self-care is
66 essential for nurses to optimize their performance and ensure they are operating at
67 their peak abilities [7]. Some authors have proposed that nurses' self-care is not only
68 beneficial but also a moral and ethical responsibility from a professional perspective
69 [7, 8]. However, nurses frequently neglect self-care and prioritize the wellbeing and
70 care of their patients [9, 10]. Nurses encounter numerous barriers to self-care, such as
71 shift work, hectic schedules, competing time demands, cost considerations, limited
72 resource availability, and work-related stress [11].

73 Self-care is crucial as it facilitates the maintenance of one's physical, emotional,
74 mental, spiritual, and social well-being [12]. As Martínez et al [13] stated, self-care is
75 the ability to care for oneself through awareness, self-control, and self-reliance in
76 order to achieve, maintain, or promote optimal health and well-being. Self-care
77 contains six domains: physical, professional, relational, emotional, psychological, and
78 spiritual [14]. Given the paramount significance of self-care, devoting attention to
79 nurses' self-care practices holds the key to safeguarding their professional well-being.
80 It is thus imperative that we proactively address this issue and provide effective
81 strategies to enhance nurses' self-care practices.

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Mindfulness enables nurses to concentrate more effectively on the functions of their bodies and minds [15]. A concept analysis [16] defined mindfulness as a transformative process, where one develops an increasing ability to experience being present with awareness, acceptance and attention. Mindfulness offers a promising strategy for managing chronic stress, holding significant implications for enhancing mind-body health and well-being, regardless of disease status [17]. Existed studies [18-20] have consistently demonstrated that mindfulness intervention is effective in alleviating stress and burnout among nurses, and simultaneously promoting their physical and mental well-being. Consequently, it is crucial for nurses to elevate their mindfulness to the utmost level [21].

Cook-Cottone et al [22] developed formulated the concept of mindful self-care by seamlessly integrating mindful awareness, active mindful practices, and mindful nurturing of every facet of oneself with traditional conceptions of self-care. Then mindful self-care was defined it as a continuous process that comprises two parts: a mindful awareness and assessment of one's internal needs and external demands, and a purposeful engagement in targeted self-care practices aimed at addressing these needs and demands in a way that fosters well-being and personal effectiveness [22, 23]. Mindfulness self-care can aid in identifying unrecognized self-care patterns and obstacles to implementing targeted self-care, while also guiding the development of intentional and focused self-care practices [12].

Previous studies [24, 25] have investigated the current status of mindful self-care and its influencing factors in the nurse population, and the results show that most nurses deal with low levels of mindful self-care. However, the present evidence could not reveal the heterogeneous subgroups of mindful self-care in the nurse population and their differences in different dimensions. Latent profile analysis (LPA) is a trustworthy statistical technique for classifying subgroups [26]. In addition, previous studies have lacked correlations between latent profiles of mindful self-care and mental health.

Therefore, the purpose of this study was to conduct a survey on the current status of mindfulness self-care among nurses and explore the heterogeneous groups and the correlation between mental health.

METHODS

Study design

In this study, a cross-sectional study was conducted through an online survey utilizing convenient sampling method. The study was designed and reported in alignment with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [27].

Sample size estimation

This study aimed to delve into the latent profiles of nurses' mindful self-care. Given that latent profile analysis (LPA) requires a sample size exceeding 500 [26, 28], the minimum sample size for this investigation was set at 500.

Participants

Participants in this study required to meet the following inclusion criteria. Inclusion criteria: (1) working as a nurse in a medical facility, (2) registered nurses, and (3) being willing to participate in this study. Exclusion criteria: nurses who were taking sick leave, or suffering from serious physical and psychological illnesses.

Measurements

The General Information Questionnaire

The general information questionnaire included demographic and sociological information such as age, gender, marital status, professional title, highest degree, department, job title, working years, number of night shifts per month, average monthly income, and hospital grade.

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Chinese version of the Brief Mindful Self-Care Scale

The scale was developed by Cook-Cottone et al [23] in 2018, then it was translated into Chinese and applied to the nurse population by Yang et al [29] in 2021. The scale has a total of 24 items and 6 dimensions, which are mindful relaxation, physical care, self-compassion and purpose, supportive relationships, and supportive structure, mindful awareness. A Likert 5-point scale is used with a total score of 24 to 120, with higher scores indicating higher levels of mindful self-care among nurses. The Cronbach's α coefficient for this scale is 0.92.

Perceived Stress Scale (PSS)

The scale was developed by Cohen et al. in 1983 [30]. The scale was translated into Chinese by Yang et al [31] in 2003. The scale consists of 10 items and is scored on a 5-point scale from "never" to "always", with a total score of 0-40, and higher scores indicate greater stress. The Cronbach's α coefficient of the Chinese version of the PSS-10 is 0.76-0.83, which has good reliability and validity [32].

Patient Health Questionnaire-9 (PHQ-9)

The questionnaire was developed by Kroenke et al [33] in 2001, then it was introduced into China in 2009 [34]. The questionnaire comprises nine items, each rated on a scale ranging from 0 (not at all) to 3 (almost every day). The total score ranges from 0 to 27, with the following classifications: 0 to 5 indicating no depression, 6 to 9 indicating mild depression, 10 to 14 indicating moderate depression, 15 to 19 indicating severe depression, and 20 to 27 indicating extremely severe depression. The internal consistency coefficient of PHQ-9 is 0.857.

Generalized Anxiety Disorder-7 (GAD-7)

The scale was developed by Spitzer et al [35] in 2006 to reflect an individual's psychosomatic activity in the past two weeks, and the Chinese version was translated by He et al [36] in 2010, with a Cronbach's α coefficient of 0.898. The GAD-7

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(Chinese version) scale is used to screen and assess generalized anxiety symptoms, with 7 items, using a scale of 0 (not at all) to 3 (almost every day) scale, with a total score range of 0 to 21, of which 0 to 5 is no anxiety, 6 to 9 is mild, 10 to 14 is moderate, and 15 to 21 is severe.

Data collection

The data collection was conducted during the period spanning from August 26, 2023 to September 18, 2023. The survey mainly collected data through a Chinese questionnaire survey network platform. The entire testing process followed the principles of anonymity and voluntariness. Before the test, the participants could read the instructions and precautions, and submitted questionnaire after completion. The link of questionnaire was directly distributed to nurses by WeChat.

Statistical analyses

The Mplus 7.4 program was employed to delineate distinct subgroups of mindful self-care. To assess model adequacy and establish the optimal number of categories, indicators such as Log likelihood (LL), Akaike information criterion (AIC), Bayesian information criterion (BIC), and Adjusted Bayesian Information Criteria (aBIC), Entropy, Lo-Mendell-Rubin (LMR) test and the Bootstrapped Likelihood Ratio Test (BLRT) were used. By pooling these indicators across all model fitting results in each category, we were able to select the model that best suited the data. For data analysis, the statistical software SPSS 26.0 was utilized. Categorical variables were characterized by assessing frequency and composition ratios, continuous variables were described using mean and standard deviation. If the variables do not meet the normality test, they should be represented using the median and quartiles. To compare categorical variables across different groups, the chi-square test was employed. For comparing variables among groups, non-parametric test, chi-square test and *Fisher's* exact probability method were utilized. Differences between the two groups were compared using post hoc tests. Statistical significance was defined as a p-value less

197 than 0.05.

198

199 **Ethical Considerations**

200 The Ethics Council of The Third Affiliated Hospital of Zunyi Medical
201 University, also known as The First People's Hospital of Zunyi, granted approval for
202 this study (2023-1-J02). All participants consented to the collection of data with full
203 knowledge and understanding. Prior to commencing the survey, participants were
204 informed about the study's primary objectives and rationale, enabling them to provide
205 informed consent. If any participant declined to participate, the questionnaire
206 collection process was promptly terminated. Furthermore, participants were assured
207 that the study results would be presented in aggregated form, ensuring their individual
208 anonymity.

209

210 **Patient and public involvement**

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

213

214 **Results**

215 **Participant characteristics**

216 The study participants were collected from Guizhou Province, China. A total of
217 1020 questionnaires were received, with 1001 being valid, resulting in an effective
218 recovery rate of 98.1%. Among them, 48 were males (4.8%) and 953 were females
219 (95.2%). The average age was 32.6 years old, ranging from 22 to 54. 31 people (3.1%)
220 were from first-level hospitals, 701 people (70.0%) were from second-level hospitals,
221 and 269 people (26.9%) were from third-level hospitals.

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223 **Latent class identification**

224 The results of latent profile analysis showed that both the LMR P value and BLRT
225 P value of Class 2, Class 3, and Class 4 were statistically significant ($P < 0.05$).

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226 Compared to Class 2 and Class 3, Class 4 had the highest Entropy value. Therefore, we
227 ultimately determined that Class 4 was the optimal profile analysis model, indicating
228 that classifying nurses' mindful self-care into four profiles was the best approach. The
229 results are shown in Table 1.

230 Based on the results of latent profile analysis, a score distribution chart of different
231 profiles across different dimensions was drawn. The results are presented in Figure 1.
232 Based on the trend of the profile distribution in the chart, we named Class 1 as
233 Inconsistent Mindful Self-Care Group (n=44, 4.4%), Class 2 as Balanced Development
234 Group (n=434, 43.4%), Class 3 as Moderate Mindful Self-Care Group (n=394, 39.4%),
235 Class 4 as High Mindful Self-Care Group (n=129, 12.9%).

236
237 **Single-factor analysis of the latent profiles of nurses' mindful self-care**

238 The distribution and characteristics of the basic information of the different
239 potential profiles are shown in Table 2. The results illustrated that the nurses'
240 department and the average monthly income were the factors influencing the potential
241 profiles ($P < 0.05$), and there was no statistically significant difference in the other
242 factors.

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Table 1 Table 1 Potential profile analysis indicators (N=1001)

Model	LL	AIC	BIC	aBIC	Entropy	LMR <i>P</i> value	BLRT <i>P</i> value	Category probability (%)
Class 1	-15893.553	31811.106	31870.011	31830.898	—	—	—	—
Class 2	-14886.130	29810.259	29903.526	29843.180	0.865	< 0.001	> 0.001	47.35/52.65
Class 3	-14500.995	29053.990	29181.618	29099.041	0.896	0.001	> 0.001	5.20/49.15/45.65
Class 4	-14131.351	28328.702	28490.691	28385.881	0.922	< 0.001	> 0.001	4.40/43.36/39.36/12.89
Class 5	-14070.715	28221.431	28417.781	28290.739	0.917	0.496	> 0.001	4.40/37.56/4.30/39.96/13.79

AIC Akaike information criterion, BIC Bayesian information criterion, aBIC Sample adjusted bayesian information criterion, LMR Lo-Mendell-Rubin Likelihood Ratio Test, BLRT Bootstrapped Likelihood Ratio Test.

Insert Figure 1 here **Figure 1** Latent profiles of mindful self-care

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Table 2 Demographic and characteristics by latent profile (N=1000)

Variables		Category	Class 1	Class 2	Class 3	Class 4	X ² /H	P
Age, median			31.5 (28.0, 37.0)	32.0 (29.0, 36.0)	31.5 (28.0, 35.0)	31.5 (28.0, 36.0)	2.067	0.559
(P25, P75)								
Gender	Female		43 (97.7%)	407 (93.8%)	380 (96.4%)	43 (95.3%)	3.407	0.317
	Male		1 (2.3%)	27 (6.2%)	14 (3.6%)	6 (4.7%)		
Marital status	Single		10 (22.7%)	70 (16.1%)	74 (18.8%)	40 (15.5%)	6.463	0.373
	Married		34 (77.3%)	354 (81.6%)	312 (79.2%)	233 (79.8%)		
	Others		0 (0%)	10 (2.3%)	8 (2.0%)	6 (4.7%)		
Professional title	Junior level		24 (54.5%)	257 (59.2%)	241 (61.2%)	40 (62.1%)	2.587 ^a	0.860
	Intermediate level		19 (43.2%)	154 (35.5%)	137 (34.8%)	55 (34.9%)		
	Senior level		1 (2.3%)	23 (5.3%)	16 (4.1%)	4 (3.1%)		
Highest Degree	Junior College and below		7 (15.9%)	61 (14.1%)	62 (15.7%)	55 (19.4%)	9.701	0.138
	Undergraduate and above		37 (84.1%)	373 (85.9%)	332 (84.3%)	244 (80.6%)		
Department	Internal Medicine		12 (27.3%)	90 (20.7%)	129 (32.7%)	44 (18.6%)	50.627 ^a	0.001
	Surgery		10 (22.7%)	94 (21.7%)	67 (17.0%)	40 (23.3%)		
	Obstetrics and Gynecology		11 (25.0%)	38 (8.8%)	33 (8.4%)	7 (5.4%)		
	Pediatrics		2 (4.5%)	32 (7.4%)	31 (7.9%)	6 (12.4%)		
	Emergency/ICU		0 (0%)	57 (13.1%)	47 (11.9%)	19 (14.7%)		
	Operating Room		2 (4.5%)	25 (5.8%)	10 (2.5%)	7 (5.4%)		
	Functional Assistance		1 (2.3%)	20 (4.6%)	16 (4.1%)	5 (3.9%)		
	Departments							
	Administrative and Logistics		0 (0%)	17 (3.9%)	7 (1.8%)	4 (3.1%)		
	Departments							
Others			6 (13.6%)	61 (14.1%)	54 (13.7%)	7 (13.2%)		

Job title	No	37 (84.1%)	348 (80.2%)	322 (81.7%)	37 (82.9%)	0.858	0.839
	Yes	7 (15.9%)	86 (19.8%)	72 (18.3%)	81 (17.1%)		
Working years	< 5	7 (15.9%)	77 (17.7%)	76 (19.3%)	75 (19.4%)	5.204	0.518
(years)	5~10	23 (52.3%)	209 (48.2%)	193 (49.0%)	191 (39.5%)		
	> 10	14 (31.8%)	148 (34.1%)	125 (31.7%)	123 (41.1%)		
Number of night	0	17 (38.6%)	154 (35.3%)	133 (33.8%)	17 (36.4%)	7.512	0.276
shifts per month	1~4	4 (9.1%)	75 (17.3%)	57 (14.5%)	8 (21.7%)		
	≥5	23 (52.3%)	205 (47.2%)	204 (51.8%)	44 (41.9%)		
Average monthly	≤3000	16 (36.4%)	47 (10.8%)	68 (17.3%)	18 (14.0%)	24.460	< 0.001
income (yuan)	3001~6000	23 (52.3%)	299 (68.9%)	256 (65.0%)	30 (69.8%)		
	> 6000	5 (11.4%)	88 (20.3%)	70 (17.8%)	11 (16.3%)		
Hospital grade	Primary level	1 (2.3%)	16 (3.7%)	12 (3.0%)	2 (1.6%)	3.396	0.749
	Secondary level	35 (79.5%)	298 (68.7%)	278 (70.6%)	30 (69.8%)		
	Tertiary level	8 (18.2%)	120 (27.6%)	104 (26.4%)	17 (28.7%)		

254 ^a Fisher's exact probability test

Correlation analysis between mindful self-care and mental health

Spearman's correlation was used to analyze the relationship between mindful self-care, perceived stress, anxiety, and depression, the results showed that mindful self-care was negatively correlated to anxiety and depression ($P < 0.05$). However, there was no correlation between mindful self-care and perceived stress ($P > 0.05$). There were positively correlation among perceived stress, anxiety, and depression ($P < 0.05$). The results were shown in Table 3.

Table 3 Correlation between mindful self-care and mental health

	Median (P25, P75)	1	2	3	4
1 Mindful self-care	80.00 (69.00, 91.00)	1			
2 PHQ-9	7.00 (3.00, 11.00)	-0.333**	1		
3 GAD-7	6.00 (1.00, 8.00)	-0.295**	0.826**	1	
4 PSS	20.00 (16.00, 22.00)	-0.030	0.498**	0.496**	1

** $P < 0.01$

Using the grouping of mindful self-care as the dependent variable and the scores of perceived stress, anxiety, and depression as the independent variables, a non-parametric test was conducted. The results are showed in Table 4. There were significant differences in nurses' scores of perceived stress, anxiety, and depression across different groups. There were differences in depression scores among different groups. When comparing multiple groups, it was revealed that Inconsistent Mindful Self-Care Group and Moderate Mindful Self-Care Group had higher level of depression than Balanced Development Group and High Mindful Self-Care Group, but there was no difference between Inconsistent Mindful Self-Care Group and Moderate Mindful Self-Care Group. The results of anxiety were similar to depression. Perceived stress was statistically different among the groups, and further two-by-two comparisons showed that, Balanced Development Group and Moderate Mindful Self-Care Group had a higher level than High Mindful Self-Care Group and Inconsistent Mindful Self-Care Group, and Inconsistent Mindful Self-Care Group had a highest level of perceived

280 stress.

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Table 4 Comparative analysis of mental health between different groups

	1 Inconsistent Mindful Self- Care Group	2 Balanced Development Group	3 Moderate Mindful Self- Care Group	4 High Mindful Self-Care Group	<i>H</i>	<i>P</i>	Post hoc
PHQ-9	9.0 (4.5, 16.0)	6.0 (2.0, 10.0)	9.0 (6.0, 13.0)	3.0 (0, 7.0)	107.327	< 0.001	3≈1 > 2 > 4
GAD-7	7.0 (0, 13.0)	4.0 (0, 7.0)	4.0 (0, 7.0)	7.0 (3.0, 10.0)	90.593	< 0.001	3≈1 > 2 > 4
PSS	17.0 (10.0, 16.0)	20.0 (16.0, 22.0)	20.0 (17.0, 22.0)	18.0 (13.0, 22.0)	11.585	0.009	3≈2 > 4 > 1

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Discussion

In this study, we employed LPA to investigate the diverse group of mindful self-care practices among nurses in hospitals. Based on cross-sectional data, we discovered four distinct subgroups: the Inconsistent Mindful Self-Care Group, the Balanced Development Group, the Moderate Mindful Self-Care Group, and the High Mindful Self-Care Group. To the best of our knowledge, this is the first study to explore the heterogeneous group of mindful self-care using the LPA method. We further used correlation analysis to confirm that there was a significant correlation among four subgroups, anxiety, depression, and perceived stress.

LPA results revealed nearly half of the nurses have a mindful self-care level below the average, and 39.4% of the nurses have a moderate level. A survey of oncology nurses in China showed an average mindful self-care score of 59.30 [37]. In another survey of emergency nurses, using the 36-item mindful self-care scale in the study, it was found that scores averaged 89.74, which was low overall [24]. In our findings, nurses' mindful self-care score of 80.00, which was higher than previous studies. The LPA results similarly revealed characteristic differences between groups. The two groups with high levels of LPA scored significantly higher on the dimensions of supportive relationships and supportive structures than on the other dimensions, and may have a stronger external self from the perspective of Attuned Representational Models of Self [23]. The natural development group scored more consistently on all dimensions. However, the inconsistent group scored significantly higher on physical care and self-compassion and purpose, which means a stronger internal self. This suggests that in future studies, priority should be given to considering the characteristics of the population and implementing effective interventions.

Our study also found that some characteristics of different profiles. More specifically, department and average monthly income were influencing factors of different groups. Workloads, atmospheres, and incomes can vary from unit to unit, which can greatly influence the level of mindful self-care among nurses. Previous study [37] have proved that educational level and health status are predictors of mindful self-

care, but our investigation failed to verify it, this may be related to the inclusion of the study population. In addition, another study [25] showed that gender is also an influencing factor for mindful self-care, but the large gap between the male and female ratios in this study also failed to validate this difference. This elevates the need to actively focus on key populations in future research to explore the factors influencing the population of nurses with low mindful self-care and provide targeted interventions.

Our study further proved the correlation between mindful and mental health. Anxiety and depression scores showed weak negative correlations with mindful self-care scores. Mental health literacy is positively correlated with mindful self-care [37]. However, perceived stress was not correlated with mindful self-care scores. This is inconsistent with previous studies. A study [38] has revealed that mindfulness can function as a protective factor, mitigating or even eliminating the negative impact of perceived stress among Chinese intensive care nurses. After careful analysis, we hypothesize that the observed phenomenon might stem from a direct correlation between the nurses' anxiety and depression levels and their mindful self-care practices. However, it's noteworthy that the nurses' perception of stress and their mindful self-care levels might interact and dynamically modulate the stress levels. The underlying mechanisms governing this interaction remain elusive and require further exploration through more rigorous research.

This study revealed that there is still much room for improvement in mindful self-care for nurses. Most importantly, nurses' awareness of self-care should be raised and mindfulness should be integrated into their daily work and life [12]. There have been many mindful self-care related interventions, such as mindfulness workshops [39], mindful self-compassion training [40], and mindfulness-based self-care and resiliency intervention [41], but these interventions have failed to use mindful self-care as a valid outcome indicator. In addition, some personalized and convenient interventions, such as digital health App [42] and fragmented interventions, should be provided according to the special characteristics of the nurses' group work.

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Limitations

This research encountered several notable limitations. Firstly, the methodology employed was a cross-sectional survey, and despite the substantial size of the sample, data collection relied on convenience sampling instead of random sampling. Secondly, the sample was exclusively drawn from Guizhou Province in China, resulting in a potential selection bias that hinders a comprehensive portrayal of the current state of mindfulness self-care among nurses throughout the country. Thirdly, since the present research was conducted exclusively with Chinese nurses, it remains uncertain whether the findings can be generalized to other cultural contexts. Therefore, there is a pressing need for further research with a larger, higher-quality sample size, and meticulously designed investigations.

Conclusion

This study used LPA to investigate mindful self-care practices among hospital nurses, revealing four distinct subgroups: the Inconsistent Mindful Self-Care Group, the Balanced Development Group, the Moderate Mindful Self-Care Group, and the High Mindful Self-Care Group. The four groups showed different levels of anxiety, depression, and perceived stress scores, highlight the importance of mindful self-care for nurses' mental well-being. In future studies, nursing managers and researchers should prioritize enhancing nurses' awareness of mindful self-care and develop some concise, accessible, and feasible intervention programs.

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None.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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Authors' contribution

YZF, ZYH participated in writing and revising the manuscript. WWW, LMD and YWP collected and analyzed the data. Jiang Hu designed the study, and participated in revising the manuscript. All authors have read and approved the manuscript.

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The authors have no conflicts of interest to declare.

Data availability statement

Data are available upon reasonable request. Data are available from the corresponding author and the first author on reasonable request.

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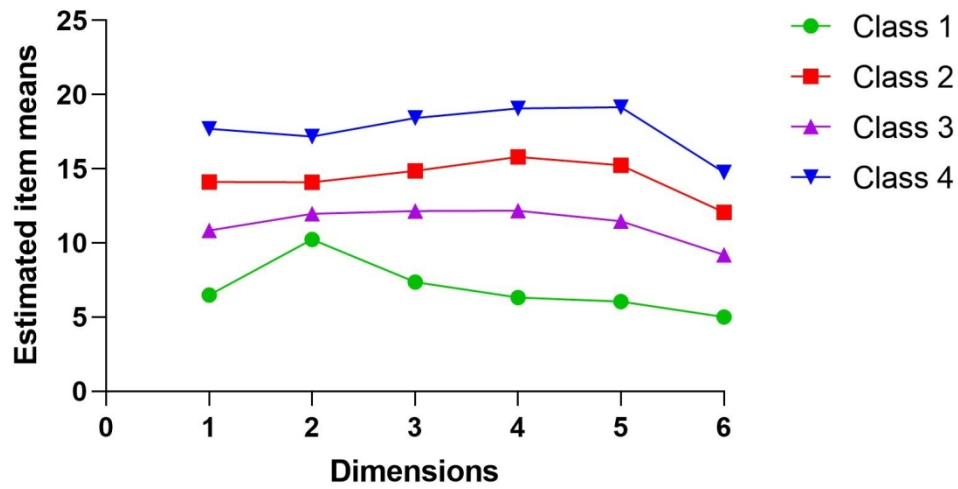
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Latent profiles of mindful self-care

136x74mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	NA
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	6-8
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8-9
		(b) Describe any methods used to examine subgroups and interactions	NA
		(c) Explain how missing data were addressed	NA
		(d) If applicable, describe analytical methods taking account of sampling strategy	NA
		(e) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	9-14
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA

		(b) Report category boundaries when continuous variables were categorized	10
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	16-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Latent profile analysis of mindful self-care and associations with mental health among nurses in China

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Latent profile analysis of mindful self-care and associations with mental health among nurses in China

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15 **Latent profile analysis of mindful self-care and associations with**
16 **mental health among nurses in China**

18 **Abstract**

19 **Background:** Despite the crucial role of mindfulness and self-care in nurses' physical
20 and mental health, as well as their professional well-being, most nurses exhibit low
21 levels of self-care. Moreover, there is a lack of understanding of the diverse subgroups
22 of mindful self-care among nurses.

23 **Objectives:** The present study delved into the diverse groups of mindful self-care
24 among nurses and investigated the correlation between these groups and their mental
25 health.

26 **Methods:** Convenience sampling was used to select nurses from Guizhou Province,
27 China, from August to September 2023. A total of 1020 nurses were investigated, and
28 1001 questionnaires were included, for an effective return rate of 98.1%. The
29 demographic characteristics questionnaire, Chinese version of the Brief Mindful Self-
30 Care Scale, Patient Health Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder-7
31 (GAD-7), and Perceived Stress Scale (PSS) were used. Latent profile analysis (LPA)
32 was performed on the characteristics of nurses' mindful self-care, and the correlations
33 between the latent profiles, demographic characteristics, and mental wellbeing were
34 identified using chi-squared tests, Spearman correlation analyses, and nonparametric
35 tests.

36 **Results:** A total of 1001 nurses were included, and they were divided into four
37 heterogeneous subgroups: the Inconsistent Mindful Self-Care Group (4.40%),
38 Balanced Development Group (43.36%), Moderate Mindful Self-Care Group
39 (39.36%), High Mindful Self-Care Group (12.89%). Results of single factor analysis
40 showed that the nurses' department and average monthly income were the factors
41 influencing the potential profiles. Mindful self-care negatively correlated with anxiety
42 and depression but was not correlated with perceived stress. There were significant
43 differences in perceived stress, anxiety, and depression between different mindful

self-care groups.

Conclusion: The present study used latent profile analysis to identify four distinct subgroups of hospital nurses based on their mindful self-care and revealed varying levels of anxiety, depression, and perceived stress between groups. These results emphasize the need for tailored mindful self-care strategies to promote nurses' well-being.

Keywords: nurse, mindfulness, self-care, latent profile analysis, cross-sectional study

Strengths and limitations of this study:

- The LPA approach was used in this study to delve into the diverse subgroups of mindful self-care practices among Chinese nurses.
- This study used confirmatory factor analysis (CFA) to ensure the validity of the measurement tools.
- This study provided evidence of the relationships between mindful self-care and anxiety, depression, and perceived stress.
- This study was limited by its cross-sectional research design.
- The generalizability of our findings may be limited due to the survey data being sourced from a single region, which may limit its wider applicability.

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62 **Introduction**

63 Nurses occupy an important position in the healthcare field and are the largest
64 group within the health care system. They often perform a variety of work roles,
65 which leads to diverse job demands, such as work overload, lack of formal rewards,
66 and work-life interference [1]. Due to the influence of multiple factors, including
67 individual, educational, organizational, managerial, and policy-making factors, the
68 shortage of nurses has become a continuous global challenge [2, 3]. It is estimated
69 that the demand for nursing will reach 12.9 million worldwide by 2035 [4]. Therefore,
70 paying attention to the physical and mental health of nurses and enhancing their
71 coping abilities is an important task in nursing management.

72 Nursing is recognized as a high-stress profession [5]. Prolonged sustained stress
73 has numerous detrimental impacts on nurses, health care organizations, and the
74 patients they serve. Although nurses are one of the occupations with the highest levels
75 of stress, there are significant differences between regions. A systematic review and
76 meta-analysis [6] revealed that the Asian region exhibited the lowest degree of
77 compassion satisfaction and the highest rates of compassion fatigue symptoms.
78 Chinese nurses face a very worrying situation [7, 8], and approximately 43.83% of
79 Chinese nurses experience depressive symptoms [9].

80 Nursing professionals can mitigate severe consequences, such as burnout,
81 compassion fatigue and depression, by adopting a regime of self-care management
82 that helps them attain psychophysical balance and spiritual wellness [10]. Self-care is
83 essential for nurses to optimize their performance and ensure that they are operating at
84 their peak abilities [11]. Some authors proposed that nurses' self-care is not only
85 beneficial but also a moral and ethical responsibility from a professional perspective
86 [11, 12]. Nurses frequently neglect self-care and prioritize the wellbeing and care of
87 their patients [13, 14]. A cross-sectional study revealed that more than half of nurses
88 did not engage in health-promoting self-care [15]. Nurses encounter numerous
89 barriers to self-care, such as shift work, hectic schedules, competing time demands,
90 cost considerations, limited resource availability, and work-related stress [16].

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Self-care is crucial because it facilitates the maintenance of one's physical, emotional, mental, spiritual, and social well-being [17]. Martínez et al. [18] stated that self-care is the ability to care for oneself through awareness, self-control, and self-reliance to achieve, maintain, or promote optimal health and well-being. Self-care contains six domains: physical, professional, relational, emotional, psychological, and spiritual [19]. Given the paramount significance of self-care, devoting attention to nurses' self-care practices is key safeguarding their professional well-being. Therefore, it is imperative to proactively address this issue and provide effective strategies to enhance nurses' self-care practices.

Mindfulness enables nurses to concentrate more effectively on the functions of their bodies and minds [20]. A concept analysis [21] defined mindfulness as a transformative process in which one develops an increasing ability to experience being present with awareness, acceptance and attention. Mindfulness offers a promising strategy for managing chronic stress, with significant implications for enhancing mind-body health and well-being, regardless of disease status [22]. Existing studies [23-25] have consistently demonstrated that mindfulness interventions effectively alleviated stress and burnout in nurses and simultaneously promoted their physical and mental well-being. Therefore, it is crucial for nurses to elevate their mindfulness to the utmost level [26].

Cook-Cottone et al. [27] conceptualized mindful self-care by skillfully integrating mindful awareness, active mindful practices, and mindful nurturing of every facet of oneself with traditional conceptions of self-care. Mindful self-care was defined as a continuous process comprised of two parts: mindful awareness and assessment of one's internal needs and external demands and purposeful engagement in targeted self-care practices aimed at addressing these needs and demands in a way that fosters well-being and personal effectiveness [27, 28]. Mindfulness self-care can aid in the identification of unrecognized self-care patterns and obstacles and the implementation of targeted self-care while guiding the development of intentional and focused self-care practices [17].

Previous studies [29, 30] investigated the current status of mindful self-care and its influencing factors in the nurse population, and the results showed that most nurses engaged in low levels of mindful self-care. However, the current evidence could not reveal the heterogeneous subgroups of mindful self-care in the nurse population or their differences in different dimensions.

Latent profile analysis (LPA) is a reliable statistical technique for the classification of subgroups [31]. LPA is a "person-centered" analysis method that is frequently used in current research. This method is based on the classification of mixture models that views the population distribution as a mixture of several homogeneous populations with the same distribution and uses maximum likelihood estimation to estimate the probabilities of latent classes and the parameters of the population distribution within the class. Considering the uncertainty of classification, this method ultimately assigns observations to the category with the maximum posterior probability. Previous studies lacked correlations between latent profiles of mindful self-care and mental health.

Therefore, the present study performed a survey of the current status of mindfulness self-care among nurses and explored the heterogeneity of groups and the correlation between anxiety, depression and perceived stress.

METHODS

Study design

A cross-sectional study was performed via an online survey using a convenient sampling method. The study was designed and reported in compliance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [32].

Sample size estimation

This study investigated the latent profiles of nurses' mindful self-care. Because the LPA requires a sample size that exceeds 500 [31, 33], the minimum sample size for this investigation was set at 500.

Participants

Participants were included in this study based on the following eligibility criteria: (1) working as a nurse in a medical facility, (2) registered as a nurse, and (3) willing to participate in this study. The exclusion criteria were nurses taking sick leave or who self-reported suffering from serious physical or psychological illnesses using the questionnaire.

Measurements

The general information questionnaire

The general information questionnaire included demographic and sociological information, such as age, gender, marital status, professional title, highest degree, department, job title, working years, number of night shifts per month, average monthly income, and hospital grade.

The Chinese version of the Brief Mindful Self-Care Scale

This scale was developed by Cook-Cottone et al. [28] in 2018. It was translated into Chinese and applied to the nurse population by Yang et al. [34] in 2021. The scale has a total of 24 items and 6 dimensions, which are mindful relaxation, physical care, self-compassion and purpose, supportive relationships, supportive structure, and mindful awareness. A 5-point Likert scale is used with a total score ranging from 24 to 120. Higher scores indicate higher levels of mindful self-care among nurses. The Cronbach's alpha coefficient for this scale is 0.92.

Perceived Stress Scale (PSS)

This scale was developed by Cohen et al. in 1983 [35]. Yang et al. [36] translated this scale into Chinese in 2003. The scale consists of 10 items that are scored on a 5-point scale from "never" to "always". The total score ranges from 0 to 40, and higher scores indicate greater stress. The Cronbach's α coefficient for the Chinese version of the PSS-10 is 0.76-0.83, which indicates good reliability and validity [37].

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Patient Health Questionnaire-9 (PHQ-9)

The questionnaire was developed by Kroenke et al. [38] in 2001 and subsequently introduced to China in 2009 [39]. The questionnaire is comprised of nine items, each rated on a scale from 0 (not at all) to 3 (almost every day). The total scores range from 0 to 27, with the following classifications: 0 to 5 indicating no depression, 6 to 9 indicating mild depression, 10 to 14 indicating moderate depression, 15 to 19 indicating severe depression, and 20 to 27 indicating extremely severe depression. The internal consistency coefficient of the PHQ-9 is 0.857.

Generalized Anxiety Disorder-7 (GAD-7) Scale

The scale was developed by Spitzer et al. [40] in 2006 to reflect an individual's psychosomatic activity in the past two weeks, and the Chinese version was translated by He et al. [41] in 2010. This scale has a Cronbach's alpha coefficient of 0.898. The GAD-7 (Chinese version) is used to screen and assess generalized anxiety symptoms using 7 items. The scale ranges from 0 (not at all) to 3 (almost every day). The total score ranges from 0 to 21, with 0 to 5 indicating no anxiety, 6 to 9 indicating mild anxiety, 10 to 14 indicating moderate anxiety, and 15 to 21 indicating severe anxiety.

Data collection

Data collection was performed from August 26, 2023 to September 18, 2023. The survey collected data mainly using a Chinese questionnaire survey network platform. The entire testing process followed the principles of anonymity and voluntariness. Before the test, the participants read the instructions and precautions and completed the questionnaire. The questionnaire was directly distributed to nurses via WeChat.

Statistical analyses

The omega coefficient was used to measure the internal consistency reliability of the scale. Omega coefficients greater than 0.7 indicate that the scale has a high level

of internal consistency reliability. The validity of the scale must be comprehensively assessed in combination with the fit indices. (1) Smaller χ^2 test values indicate smaller degrees of deviation and a greater fit of the measurement model. (2) Degrees of freedom (*df*). (3) χ^2 / df , smaller χ^2 / df values indicate a greater fit of the model, and a value between 1 and 5 indicates good model fit. (4) Root mean square error of approximation (RMSEA): an RMSEA less than 0.05 indicates a good model fit, and an RMSEA less than 0.08 indicates an acceptable model fit. (5) The comparative fit index (CFI), which ranges between 0 and 1; generally, a CFI greater than 0.9 indicates a good model fit. (6) For the Tucker–Lewis index (TLI), a TLI greater than 0.9 indicates an acceptable model, and a TLI greater than 0.95 indicates a better model fit. (7) The standardized root mean square residual (SRMR), which reflects the standardized overall residual of the assumed model, is used to determine whether the model parameter setting is ideal via residual analysis, and an SRMR between 0 and 1 and less than 0.08 indicates a good model fit. The Mplus 7.4 program was used to delineate distinct subgroups of mindful self-care. To assess model adequacy and establish the optimal number of categories, various indicators were used, such as the log likelihood (LL), Akaike information criterion (AIC), Bayesian information criterion (BIC), adjusted Bayesian information criterion (aBIC), entropy, Lo-Mendell-Rubin (LMR) test and bootstrapped likelihood ratio test (BLRT). By pooling these indicators across all model fitting results in each category, we selected the model that best suited the data. For data analysis, the statistical software SPSS 26.0 was used. Categorical variables were characterized by assessing frequency and composition ratios, and continuous variables were described using means and standard deviations. If the variables did not meet the normality test, they were represented using the median and quartiles. To compare categorical variables between different groups, the chi-squared test was used. For comparing variables between groups, nonparametric tests, chi-squared tests and *Fisher's* exact probability tests were used. Differences between the two groups were compared using post hoc tests. Cramér's V and Epsilon-squared (ϵ^2) were used to determine the effect size. Statistical significance was defined as a p value less than 0.05.

Ethical considerations

The Ethics Council of The Third Affiliated Hospital of Zunyi Medical University, also known as The First People's Hospital of Zunyi, granted approval for this study (2023-1-J02). All participants consented to the collection of data with full knowledge and understanding. Prior to commencing the survey, participants were informed about the study's primary objectives and rationale, which enabled them to provide informed consent. If any nurse declined to participate, the questionnaire collection process was promptly terminated. The instructions clearly assured participants that there would be no consequences for refusing to participate in the survey. Furthermore, participants were assured that the study results would be presented in aggregated form to ensure their individual anonymity.

Patient and public involvement

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

Results

Participant characteristics

The study participants were recruited from Guizhou Province, China. A total of 1020 questionnaires were returned, and 1001 questionnaires were valid, which resulted in an effective recovery rate of 98.1%. Among the 19 invalid questionnaires, 9 contained logical errors in basic information, and 10 had missing data. Among the included participants, 48 were males (4.8%), and 953 were females (95.2%). The average age was 32.6 years, and the range was 22 to 54 years. Thirty-one people (3.1%) were from first-level hospitals, 701 people (70.0%) were from second-level hospitals, and 269 people (26.9%) were from third-level hospitals.

Reliability and validity analysis

The omega coefficients of the scales ranged from 0.723 to 0.954, which indicated that

the scales were reliable. The fit indices of all scales were within the ideal range, which suggested that the scales had good validity. The results are presented in Table 1.

Table 1 Reliability and validity analysis of the scales

Variables	χ^2	df	χ^2/df	RMSEA	CFI	TLI	SRMR	omega
Mindful self-care	1143.558	232	4.929	0.063	0.946	0.936	0.038	0.946
PHQ-9	85.956	19	4.524	0.059	0.988	0.977	0.021	0.919
GAD-7	30.132	10	3.013	0.045	0.997	0.994	0.008	0.954
PSS	119.957	26	4.614	0.060	0.985	0.973	0.032	0.777

Latent class identification

The results of latent profile analysis showed that the LMR P value and BLRT P value of Class 2, Class 3, and Class 4 were statistically significant ($P<0.05$). Compared to Class 2 and Class 3, Class 4 had the highest entropy value. Therefore, we ultimately determined that Class 4 was the optimal profile analysis model, and it indicated that classifying nurses' mindful self-care into four profiles was the best approach. The results are shown in Table 2.

Based on the results of the latent profile analysis, a score distribution chart of different profiles between different dimensions was drawn. These results are presented in Figure 1. Based on the trend of the profile distribution in the chart, we named Class 1 the Inconsistent Mindful Self-Care Group (n=44, 4.40%), Class 2 the Balanced Development Group (n=434, 43.36%), Class 3 the Moderate Mindful Self-Care Group (n=394, 39.36%), and Class 4 the High Mindful Self-Care Group (n=129, 12.89%).

Single-factor analysis of the latent profiles of nurses' mindful self-care

The distribution and characteristics of the basic information of the different potential profiles are shown in Table 3. The results showed that the nurses' department and average monthly income were the factors influencing the potential profiles ($P<0.05$), and there was no statistically significant difference between the other factors. The results of the effect size analysis showed that the effect size was moderate or small.

Table 2 Potential profile analysis indicators (N=1001)

Model	LL	AIC	BIC	aBIC	Entropy	LMR <i>P</i> value	BLRT <i>P</i> value	Category probability (%)
Class 1	-15893.553	31811.106	31870.011	31830.898	—	—	—	—
Class 2	-14886.130	29810.259	29903.526	29843.180	0.865	<0.001	<0.001	47.35/52.65
Class 3	-14500.995	29053.990	29181.618	29099.041	0.896	0.001	<0.001	5.20/49.15/45.65
Class 4	-14131.351	28328.702	28490.691	28385.881	0.922	<0.001	<0.001	4.40/43.36/39.36/12.89
Class 5	-14070.715	28221.431	28417.781	28290.739	0.917	0.496	<0.001	4.40/37.56/4.30/39.96/13.79

AIC Akaike information criterion, BIC Bayesian information criterion, aBIC Sample adjusted Bayesian information criterion, LMR Lo-Mendell-Rubin Likelihood Ratio Test, BLRT Bootstrapped Likelihood Ratio Test.

Insert Figure 1 here **Figure 1** Latent profiles of mindful self-care

Table 3 Demographics and characteristics by latent profile (N=1000)

Variables	Category	Class 1	Class 2	Class 3	Class 4	X^2/H	P	V/ϵ^2
Age, median (P25, P75)		31.5 (28.0, 37.0)	32.0 (29.0, 36.0)	31.5 (28.0, 35.0)	33.0 (30.0, 36.0)	2.067	0.559	0.001
Gender	Female	43 (97.7%)	407 (93.8%)	380 (96.4%)	129 (93.3%)	3.407	0.317	0.062
	Male	1 (2.3%)	27 (6.2%)	14 (3.6%)	15 (11.7%)			
Marital status	Single	10 (22.7%)	70 (16.1%)	74 (18.8%)	25 (18.5%)	6.463	0.373	0.055
	Married	34 (77.3%)	354 (81.6%)	312 (79.2%)	100 (74.8%)			
	Others	0 (0%)	10 (2.3%)	8 (2.0%)	1 (0.7%)			
Professional title	Junior level	24 (54.5%)	257 (59.2%)	241 (61.2%)	88 (64.9%)	2.587 ^a	0.860	0.039
	Intermediate level	19 (43.2%)	154 (35.5%)	137 (34.8%)	44 (32.0%)			
	Senior level	1 (2.3%)	23 (5.3%)	16 (4.1%)	4 (3.0%)			
Highest Degree	Junior College and below	7 (15.9%)	61 (14.1%)	62 (15.7%)	23 (16.9%)	9.701	0.138	0.047
	Undergraduate and above	37 (84.1%)	373 (85.9%)	332 (84.3%)	100 (74.6%)			
Department	Internal Medicine	12 (27.3%)	90 (20.7%)	129 (32.7%)	24 (17.6%)	50.627 ^a	0.001	0.133
	Surgery	10 (22.7%)	94 (21.7%)	67 (17.0%)	30 (22.3%)			
	Obstetrics and Gynecology	11 (25.0%)	38 (8.8%)	33 (8.4%)	15 (11.2%)			
	Pediatrics	2 (4.5%)	32 (7.4%)	31 (7.9%)	1 (0.7%)			
	Emergency/ICU	0 (0%)	57 (13.1%)	47 (11.9%)	1 (0.7%)			
	Operating Room	2 (4.5%)	25 (5.8%)	10 (2.5%)	5 (3.7%)			
	Functional Assistance Departments	1 (2.3%)	20 (4.6%)	16 (4.1%)	3 (2.2%)			
	Administrative and Logistics Departments	0 (0%)	17 (3.9%)	7 (1.8%)	4 (3.0%)			
	Others	6 (13.6%)	61 (14.1%)	54 (13.7%)	17 (12.5%)			

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Job title	No	37 (84.1%)	348 (80.2%)	322 (81.7%)	10 (8.9%)	0.858	0.839	0.029
	Yes	7 (15.9%)	86 (19.8%)	72 (18.3%)	23 (17.0%)			
Working years (years)	<5	7 (15.9%)	77 (17.7%)	76 (19.3%)	23 (17.0%)	5.204	0.518	0.051
	5~10	23 (52.3%)	209 (48.2%)	193 (49.0%)	55 (40.9%)			
	>10	14 (31.8%)	148 (34.1%)	125 (31.7%)	55 (40.9%)			
Number of night shifts per month	0	17 (38.6%)	154 (35.3%)	133 (33.8%)	43 (31.4%)	7.512	0.276	0.061
	1~4	4 (9.1%)	75 (17.3%)	57 (14.5%)	28 (20.7%)			
	≥5	23 (52.3%)	205 (47.2%)	204 (51.8%)	54 (40.9%)			
Average monthly income (yuan)	≤3000	16 (36.4%)	47 (10.8%)	68 (17.3%)	18 (13.3%)	24.460	<0.001	0.111
	3001~6000	23 (52.3%)	299 (68.9%)	256 (65.0%)	90 (67.8%)			
	>6000	5 (11.4%)	88 (20.3%)	70 (17.8%)	23 (16.9%)			
Hospital grade	Primary level	1 (2.3%)	16 (3.7%)	12 (3.0%)	4 (3.0%)	3.396	0.749	0.044
	Secondary level	35 (79.5%)	298 (68.7%)	278 (70.6%)	99 (73.8%)			
	Tertiary level	8 (18.2%)	120 (27.6%)	104 (26.4%)	35 (26.7%)			

^a Fisher's exact probability test

Correlation analysis between mindful self-care and mental health

Spearman's correlation was used to analyze the relationships between mindful self-care, perceived stress, anxiety, and depression. The results showed that mindful self-care negatively correlated with anxiety and depression ($P < 0.05$). However, there was no correlation between mindful self-care and perceived stress ($P > 0.05$). There were positive correlations between perceived stress, anxiety, and depression ($P < 0.05$). The results are shown in Table 4.

Table 4 Correlations between mindful self-care and mental health

	Median (P25, P75)	1	2	3	4
1 Mindful self-care	80.00 (69.00, 91.00)	1			
2 PHQ-9	7.00 (3.00, 11.00)	-0.333**	1		
3 GAD-7	6.00 (1.00, 8.00)	-0.295**	0.826**	1	
4 PSS	20.00 (16.00, 22.00)	-0.030	0.498**	0.496**	1

** $P < 0.01$

Using the grouping of mindful self-care as the dependent variable and the scores of perceived stress, anxiety, and depression as the independent variables, a nonparametric test was performed. The results are shown in Table 5. There were significant differences in nurses' scores for perceived stress, anxiety, and depression between the different groups. There were differences in depression scores between the different groups. Comparison of multiple groups revealed that the Inconsistent Mindful Self-Care Group and Moderate Mindful Self-Care Group had higher levels of depression than the Balanced Development Group and High Mindful Self-Care Group, but there was no difference between the Inconsistent Mindful Self-Care Group and Moderate Mindful Self-Care Group. The results for anxiety were similar to depression. Perceived stress was statistically different between the groups, and further two-by-two comparisons showed that the Balanced Development Group and Moderate Mindful Self-Care Group had higher levels than the High Mindful Self-Care Group and Inconsistent Mindful Self-Care Group. The Inconsistent Mindful Self-Care Group had the highest level of perceived stress. The results of the effect size analysis showed that the comparison of anxiety and depression between the different groups revealed a

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334 medium effect, but the value of the effect size for the comparison of perceived stress
335 was small.

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337 Table 5 Comparative analysis of mental health between different groups

	1 Inconsistent Mindful Self- Care Group	2 Balanced Development Group	3 Moderate Mindful Self- Care Group	4 High Mindful Self-Care Group	<i>H</i>	<i>P</i>	Post hoc	ε ²
PHQ-9	9.0 (4.5, 16.0)	6.0 (2.0, 10.0)	9.0 (6.0, 13.0)	3.0 (0, 7.0)	107.327	<0.001	3≈1>2>4	0.10
GAD-7	7.0 (0, 13.0)	4.0 (0, 7.0)	4.0 (0, 7.0)	7.0 (3.0, 10.0)	90.593	<0.001	3≈1>2>4	0.08
BSS	17.0 (10.0, 16.0)	20.0 (16.0, 22.0)	20.0 (17.0, 22.0)	18.0 (13.0, 22.0)	11.585	0.009	3≈2>4>1	0.00

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Discussion

The present study used LPA to investigate diverse groups of mindful self-care practices among nurses in hospitals. Based on cross-sectional data, we identified four distinct subgroups: the Inconsistent Mindful Self-Care Group, the Balanced Development Group, the Moderate Mindful Self-Care Group, and the High Mindful Self-Care Group. To the best of our knowledge, this study is the first study to explore heterogeneous groups of mindful self-care using the LPA method. Compared to traditional person-centered analysis methods, such as cluster analysis, LPA is a more flexible and model-based classification method. Notably, LPA provides a variety of adaptability indices to determine the number of profiles more scientifically with a lower bias. We further used correlation analysis to confirm a significant correlation between four subgroups, anxiety, depression, and perceived stress.

The LPA results revealed that nearly half (43.36%) of the nurses had a relatively lower level of mindful self-care, and 39.36% of the nurses had a moderate level of mindful self-care. A survey of oncology nurses in China reported an average mindful self-care score of 59.30 [42]. In another survey of emergency nurses used the 36-item mindful self-care scale and found that scores averaged 89.74, which was low overall [29]. According to our findings, nurses' mindful self-care score was 80.00, which was higher than previous studies. Similarly, the LPA results revealed characteristic differences between the groups. The two groups with high LPA values scored significantly higher on the dimensions of supportive relationships and supportive structures than the other dimensions and may have a stronger external self from the perspective of Attuned Representational Models of Self [28]. The Natural Development Group scored more consistently on all dimensions. However, the Inconsistent Group scored significantly higher on physical care, self-compassion and purpose, which indicates a stronger internal self. These results suggest that future studies should prioritize the characteristics of the population and the implementation of effective interventions.

Our study also revealed several different profile characteristics. Specifically, department and average monthly income were influencing factors in different groups.

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The results showed that a larger proportion of nurses in the internal medicine department belonged to the medium- and high-scoring groups, which indicated that internal medicine nurses more frequently adopted mindful self-care practices. Potential reasons may be that nurses in internal medicine departments have relatively low workloads, and working in such an environment, where some chronic diseases are often caused by unhealthy lifestyles, may promote nurses' self-care behaviors. The present study included full-time nurses because there are no part-time nurses in China. There is a significant income disparity between different hospitals and departments, which is also one of the factors affecting mindful self-care. Nurses' capacity for health-promoting self-care is significantly influenced by a confluence of factors, including time constraints, excessive workloads, scarcity of resources and facilities, the draining effects of fatigue, and the demands of external commitments [15, 43]. A previous study [42] demonstrated that educational level and health status were predictors of mindful self-care, but our investigation did not support this finding, which may be related to the inclusion of the study population. Another study [30] showed that gender was also an influencing factor for mindful self-care, but the large gap between the male and female ratios in this study failed to validate this difference. Future research should actively focus on key populations to explore the factors influencing the population of nurses with low levels of mindful self-care to provide targeted interventions.

Our study further confirmed the correlation between mindfulness and mental health. Anxiety and depression scores showed weak negative correlations with mindful self-care scores. Although perceived stress was not correlated with the mindful self-care score, the perceived stress score differed between the four groups. Zhang et al. [42] showed that mental health literacy positively correlated with mindful self-care. Mindfulness can function as a protective factor to mitigate or even eliminate the negative impact of perceived stress [44]. This relationship may further explain the potential stress-buffering effects of mindful self-care. More research is needed to further validate the relationships between the variables related to mental health and mindful self-care.

The present study revealed that there is much room for improvement in mindful

self-care for nurses. Notably, nurses' awareness of self-care should increase, and mindfulness should be integrated into their daily work and life [17]. There have been many mindful self-care-related interventions, such as mindfulness workshops [45], mindful self-compassion training [46], and mindfulness-based self-care and resiliency interventions [47], but these interventions did not use mindful self-care as a valid outcome indicator. Some personalized and convenient interventions, such as digital health apps [48] and fragmented interventions, should be provided according to the special characteristics of the nurses.

Limitations

This research has several notable limitations. First, the methodology was a cross-sectional survey, and despite the substantial size of the sample, data collection relied on convenience sampling instead of random sampling. Second, the sample was exclusively drawn from Guizhou Province in China, which resulted in a potential selection bias that hindered a comprehensive portrayal of the current state of mindfulness self-care among nurses throughout the country. Third, because the present research was performed exclusively with Chinese nurses, whether the findings can be generalized to other cultural contexts is not certain. Therefore, there is a pressing need for further research with a larger and higher-quality sample size.

Conclusion

This study used LPA to investigate mindful self-care practices among hospital nurses and revealed four distinct subgroups: the Inconsistent Mindful Self-Care Group, the Balanced Development Group, the Moderate Mindful Self-Care Group, and the High Mindful Self-Care Group. The four groups showed different levels of anxiety, depression, and perceived stress, which highlights the importance of mindful self-care for nurses' mental well-being. Nursing managers and researchers should prioritize the enhancement of nurses' awareness of mindful self-care and the development of concise, accessible, and feasible intervention programs.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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Ethical considerations

The Ethics Committee of The Third Affiliated Hospital of Zunyi Medical University (The First People's Hospital of Zunyi) approved this study (2023-1-J02). Informed consent was obtained from all study participants prior to initiating the survey.

Authors' contributions

YZF and ZYH participated in writing and revising the manuscript. WWW, LMD and YWP collected and analyzed the data. JH designed the study and participated in revising the manuscript. All authors have read and approved the manuscript. JH acted as guarantor.

Data availability statement

The data are available upon reasonable request. The data are available from the corresponding author and the first author upon reasonable request.

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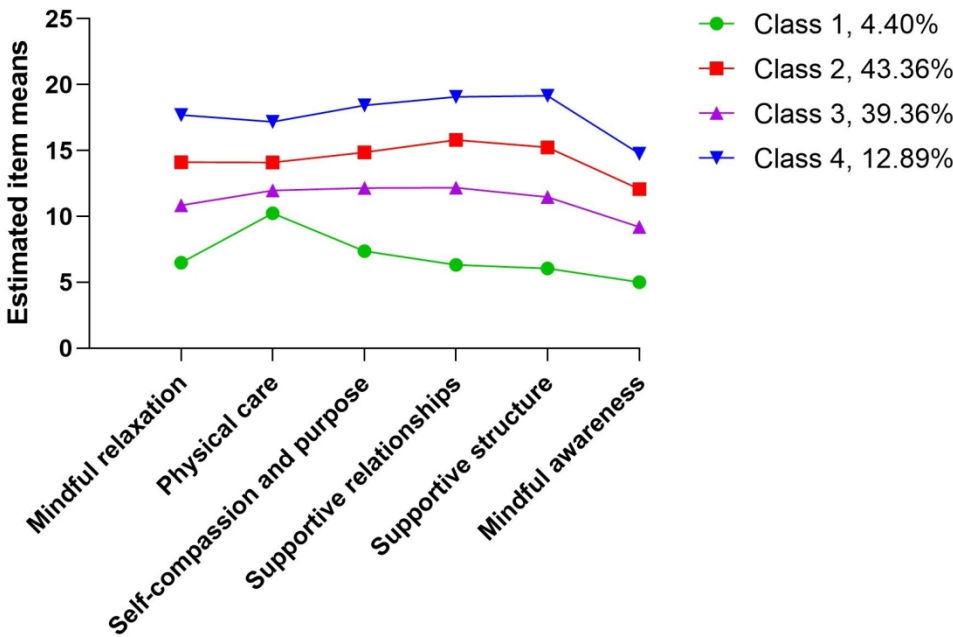
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Latent profiles of mindful self-care
153x105mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	NA
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	6-8
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8-9
		(b) Describe any methods used to examine subgroups and interactions	NA
		(c) Explain how missing data were addressed	NA
		(d) If applicable, describe analytical methods taking account of sampling strategy	NA
		(e) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	9-14
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA

		(b) Report category boundaries when continuous variables were categorized	10
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	16-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.