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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**

17

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

2

43   of anxiety, depression, and perceived stress across groups, emphasizing the need for

44   tailored mindful self-care strategies to promote nurses' well-being.

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

46

47   **Strengths and limitations of this study:**

48   ● The LPA approach was employed in this study to delve into the diverse subgroups

49   of mindful self-care practices among Chinese nurses.

50   ● While this study adopted a cross-sectional research design, it failed to explore the

51   interaction mechanism between mental health and mindful self-care.

52   ● The generalizability of our findings may be constrained due to the survey data

53   being sourced from a single region, potentially limiting its wider applicability.

3

Introduction

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

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

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

4

82   Mindfulness enables nurses to concentrate more effectively on the functions of

83   their bodies and minds [15]. A concept analysis [16] defined mindfulness as a

84   transformative process, where one develops an increasing ability to experience being

85   present with awareness, acceptance and attention. Mindfulness offers a promising

86   strategy for managing chronic stress, holding significant implications for enhancing

87   mind-body health and well-being, regardless of disease status [17]. Existed studies

88   [18-20] have consistently demonstrated that mindfulness intervention is effective in

89   alleviating stress and burnout among nurses, and simultaneously promoting their

90   physical and mental well-being. Consequently, it is crucial for nurses to elevate their

91   mindfulness to the utmost level [21].

92   Cook-Cottone et al [22] developed formulated the concept of mindful self-care

93   by seamlessly integrating mindful awareness, active mindful practices, and mindful

94   nurturing of every facet of oneself with traditional conceptions of self-care. Then

95   mindful self-care was defined it as a continuous process that comprises two parts: a

96   mindful awareness and assessment of one's internal needs and external demands, and

97   a purposeful engagement in targeted self-care practices aimed at addressing these

98   needs and demands in a way that fosters well-being and personal effectiveness [22,

99   23]. Mindfulness self-care can aid in identifying unrecognized self-care patterns and

100   obstacles to implementing targeted self-care, while also guiding the development of

101   intentional and focused self-care practices [12].

102   Previous studies [24, 25] have investigated the current status of mindful self-care

103   and its influencing factors in the nurse population, and the results show that most

104   nurses deal with low levels of mindful self-care. However, the present evidence could

105   not reveal the heterogeneous subgroups of mindful self-care in the nurse population

106   and their differences in different dimensions. Latent profile analysis (LPA) is a

107   trustworthy statistical technique for classifying subgroups [26]. In addition, previous

108   studies have lacked correlations between latent profiles of mindful self-care and

109   mental health.

5

110   Therefore, the purpose of this study was to conduct a survey on the current status

111 of mindfulness self-care among nurses and explore the heterogeneous groups and the

112 correlation between mental health.

113

114 **METHODS**

115 **Study design**

116   In this study, a cross-sectional study was conducted through an online survey

117 utilizing convenient sampling method. The study was designed and reported in

118 alignment with the Strengthening the Reporting of Observational Studies in

119 Epidemiology (STROBE) guidelines [27].

120

121 **Sample size estimation**

122   This study aimed to delve into the latent profiles of nurses' mindful self-care.

123 Given that latent profile analysis (LPA) requires a sample size exceeding 500 [26,

124 28], the minimum sample size for this investigation was set at 500.

125

126 **Participants**

127   Participants in this study required to meet the following inclusion criteria.

128 Inclusion criteria: (1) working as a nurse in a medical facility, (2) registered nurses,

129 and (3) being willing to participate in this study. Exclusion criteria: nurses who were

130 taking sick leave, or suffering from serious physical and psychological illnesses.

131

132 **Measurements**

133 **The General Information Questionnaire**

134   The general information questionnaire included demographic and sociological

135 information such as age, gender, marital status, professional title, highest degree,

136 department, job title, working years, number of night shifts per month, average

137 monthly income, and hospital grade.

138

6

139 **Chinese version of the Brief Mindful Self-Care Scale**

140 The scale was developed by Cook-Cottone et al [23] in 2018, then it was

141 translated into Chinese and applied to the nurse population by Yang et al [29] in 2021.

142 The scale has a total of 24 items and 6 dimensions, which are mindful relaxation,

143 physical care, self-compassion and purpose, supportive relationships, and supportive

144 structure, mindful awareness. A Likert 5-point scale is used with a total score of 24 to

145 120, with higher scores indicating higher levels of mindful self-care among nurses.

146 The Cronbach's α coefficient for this scale is 0.92.

147

148 **Perceived Stress Scale (PSS)**

149 The scale was developed by Cohen et al. in 1983 [30]. The scale was translated

150 into Chinese by Yang et al [31] in 2003. The scale consists of 10 items and is scored

151 on a 5-point scale from "never" to "always", with a total score of 0-40, and higher

152 scores indicate greater stress. The Cronbach's α coefficient of the Chinese version of

153 the PSS-10 is 0.76-0.83, which has good reliability and validity [32].

154

155 **Patient Health Questionnaire-9 (PHQ-9)**

156 The questionnaire was developed by Kroenke et al [33] in 2001, then it was

157 introduced into China in 2009 [34]. The questionnaire comprises nine items, each

158 rated on a scale ranging from 0 (not at all) to 3 (almost every day). The total score

159 ranges from 0 to 27, with the following classifications: 0 to 5 indicating no

160 depression, 6 to 9 indicating mild depression, 10 to 14 indicating moderate

161 depression, 15 to 19 indicating severe depression, and 20 to 27 indicating extremely

162 severe depression. The internal consistency coefficient of PHQ-9 is 0.857.

163

164 **Generalized Anxiety Disorder-7 (GAD-7)**

165 The scale was developed by Spitzer et al [35] in 2006 to reflect an individual's

166 psychosomatic activity in the past two weeks, and the Chinese version was translated

167 by He et al [36] in 2010, with a Cronbach's alpha coefficient of 0.898. The GAD-7

7

168 (Chinese version) scale is used to screen and assess generalized anxiety symptoms,

169 with 7 items, using a scale of 0 (not at all) to 3 (almost every day) scale, with a total

170 score range of 0 to 21, of which 0 to 5 is no anxiety, 6 to 9 is mild, 10 to 14 is

171 moderate, and 15 to 21 is severe.

172

173 **Data collection**

174   The data collection was conducted during the period spanning from August 26,

175 2023 to September 18, 2023. The survey mainly collected data through a Chinese

176 questionnaire survey network platform. The entire testing process followed the

177 principles of anonymity and voluntariness. Before the test, the participants could read

178 the instructions and precautions, and submitted questionnaire after completion. The

179 link of questionnaire was directly distributed to nurses by WeChat.

180

181 **Statistical analyses**

182   The Mplus 7.4 program was employed to delineate distinct subgroups of mindful

183 self-care. To assess model adequacy and establish the optimal number of categories,

184 indicators such as Log likelihood (LL), Akaike information criterion (AIC), Bayesian

185 information criterion (BIC), and Adjusted Bayesian Information Criteria (aBIC),

186 Entropy, Lo-Mendell-Rubin (LMR) test and the Bootstrapped Likelihood Ratio Test

187 (BLRT) were used. By pooling these indicators across all model fitting results in each

188 category, we were able to select the model that best suited the data. For data analysis,

189 the statistical software SPSS 26.0 was utilized. Categorical variables were

190 characterized by assessing frequency and composition ratios, continuous variables

191 were described using mean and standard deviation. If the variables do not meet the

192 normality test, they should be represented using the median and quartiles. To compare

193 categorical variables across different groups, the chi-square test was employed. For

194 comparing variables among groups, non-parametric test, chi-square test and *Fisher's*

195 exact probability method were utilized. Differences between the two groups were

196 compared using post hoc tests. Statistical significance was defined as a p-value less

8

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.

222

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 ($P < 0.05$).

9

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.

10

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

244

Model	LL	AIC	BIC	aBIC	Entropy	LMR *P* value	BLRT *P* 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

245

246 AIC Akaike information criterion, BIC Bayesian information criterion, aBIC Sample adjusted bayesian information criterion, LMR Lo-Mendell-Rubin Likelihood

247 Ratio Test, BLRT Bootstrapped Likelihood Ratio Test.

248

249

250 ***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=1006)

Variables	Category	Class 1	Class 2	Class 3	Class 4	X^2/H	P
Age, median (P25, P75)		31.5 (28.0, 37.0)	32.0 (29.0, 36.0)	31.5 (28.0, 35.0)	(28.0, 36.0)	2.067	0.559
Gender	Female	43 (97.7%)	407 (93.8%)	380 (96.4%)	123 (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%)	20 (15.5%)	6.463	0.373
	Married	34 (77.3%)	354 (81.6%)	312 (79.2%)	103 (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%)	80 (62.1%)	2.587[a]	0.860
	Intermediate level	19 (43.2%)	154 (35.5%)	137 (34.8%)	45 (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%)	25 (19.4%)	9.701	0.138
	Undergraduate and above	37 (84.1%)	373 (85.9%)	332 (84.3%)	104 (80.6%)		
Department	Internal Medicine	12 (27.3%)	90 (20.7%)	129 (32.7%)	24 (18.6%)	50.627[a]	0.001
	Surgery	10 (22.7%)	94 (21.7%)	67 (17.0%)	30 (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%)	16 (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 Departments	1 (2.3%)	20 (4.6%)	16 (4.1%)	5 (3.9%)		
	Administrative and Logistics Departments	0 (0%)	17 (3.9%)	7 (1.8%)	4 (3.1%)		
	Others	6 (13.6%)	61 (14.1%)	54 (13.7%)	17 (13.2%)		

12

Job title	No	37 (84.1%)	348 (80.2%)	322 (81.7%)	107 (82.9%)	0.858	0.839
	Yes	7 (15.9%)	86 (19.8%)	72 (18.3%)	22 (17.1%)		
Working years (years)	< 5	7 (15.9%)	77 (17.7%)	76 (19.3%)	25 (19.4%)	5.204	0.518
	5~10	23 (52.3%)	209 (48.2%)	193 (49.0%)	51 (39.5%)		
	> 10	14 (31.8%)	148 (34.1%)	125 (31.7%)	53 (41.1%)		
Number of night shifts per month	0	17 (38.6%)	154 (35.3%)	133 (33.8%)	47 (36.4%)	7.512	0.276
	1~4	4 (9.1%)	75 (17.3%)	57 (14.5%)	28 (21.7%)		
	≥5	23 (52.3%)	205 (47.2%)	204 (51.8%)	54 (41.9%)		
Average monthly income (yuan)	≤3000	16 (36.4%)	47 (10.8%)	68 (17.3%)	18 (14.0%)	24.460	< 0.001
	3001~6000	23 (52.3%)	299 (68.9%)	256 (65.0%)	90 (69.8%)		
	> 6000	5 (11.4%)	88 (20.3%)	70 (17.8%)	21 (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%)	90 (69.8%)		
	Tertiary level	8 (18.2%)	120 (27.6%)	104 (26.4%)	37 (28.7%)		

254   [a] *Fisher's* exact probability test

13

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

14

280   stress.

281

282   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	H	P	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

15

283 **Discussion**

284   In this study, we employed LPA to investigate the diverse group of mindful self-

285 care practices among nurses in hospitals. Based on cross-sectional data, we discovered

286 four distinct subgroups: the Inconsistent Mindful Self-Care Group, the Balanced

287 Development Group, the Moderate Mindful Self-Care Group, and the High Mindful

288 Self-Care Group. To the best of our knowledge, this is the first study to explore the

289 heterogeneous group of mindful self-care using the LPA method. We further used

290 correlation analysis to confirm that there was a significant correlation among four

291 subgroups, anxiety, depression, and perceived stress.

292   LPA results revealed nearly half of the nurses have a mindful self-care level below

293 the average, and 39.4% of the nurses have a moderate level. A survey of oncology

294 nurses in China showed an average mindful self-care score of 59.30 [37]. In another

295 survey of emergency nurses, using the 36-item mindful self-care scale in the study, it

296 was found that scores averaged 89.74, which was low overall [24]. In our findings,

297 nurses' mindful self-care score of 80.00, which was higher than previous studies. The

298 LPA results similarly revealed characteristic differences between groups. The two

299 groups with high levels of LPA scored significantly higher on the dimensions of

300 supportive relationships and supportive structures than on the other dimensions, and

301 may have a stronger external self from the perspective of Attuned Representational

302 Models of Self [23]. The natural development group scored more consistently on all

303 dimensions. However, the inconsistent group scored significantly higher on physical

304 care and self-compassion and purpose, which means a stronger internal self. This

305 suggests that in future studies, priority should be given to considering the characteristics

306 of the population and implementing effective interventions.

307   Our study also found that some characteristics of different profiles. More

308 specifically, department and average monthly income were influencing factors of

309 different groups. Workloads, atmospheres, and incomes can vary from unit to unit,

310 which can greatly influence the level of mindful self-care among nurses. Previous study

311 [37] have proved that educational level and health status are predictors of mindful self-

16

312 care, but our investigation failed to verify it, this may be related to the inclusion of the

313 study population. In addition, another study [25] showed that gender is also an

314 influencing factor for mindful self-care, but the large gap between the male and female

315 ratios in this study also failed to validate this difference. This elevates the need to

316 actively focus on key populations in future research to explore the factors influencing

317 the population of nurses with low mindful self-care and provide targeted interventions.

318   Our study further proved the correlation between mindful and mental health.

319 Anxiety and depression scores showed weak negative correlations with mindful self-

320 care scores. Mental health literacy is positively correlated with mindful self-care [37].

321 However, perceived stress was not correlated with mindful self-care scores. This is

322 inconsistent with previous studies. A study [38] has revealed that mindfulness can

323 function as a protective factor, mitigating or even eliminating the negative impact of

324 perceived stress among Chinese intensive care nurses. After careful analysis, we

325 hypothesize that the observed phenomenon might stem from a direct correlation

326 between the nurses' anxiety and depression levels and their mindful self-care practices.

327 However, it's noteworthy that the nurses' perception of stress and their mindful self-

328 care levels might interact and dynamically modulate the stress levels. The underlying

329 mechanisms governing this interaction remain elusive and require further exploration

330 through more rigorous research.

331   This study revealed that there is still much room for improvement in mindful self-

332 care for nurses. Most importantly, nurses' awareness of self-care should be raised and

333 mindfulness should be integrated into their daily work and life [12]. There have been

334 many mindful self-care related interventions, such as mindfulness workshops [39],

335 mindful self-compassion training [40], and mindfulness-based self-care and resiliency

336 intervention [41], but these interventions have failed to use mindful self-care as a valid

337 outcome indicator. In addition, some personalized and convenient interventions, such

338 as digital health App [42] and fragmented interventions, should be provided according

339 to the special characteristics of the nurses' group work.

340

17

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.

18

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364 None.

365

366 **CONFLICT OF INTEREST**

367 The authors have no conflicts of interest to declare.

368

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372

373 **Authors' contribution**

374 YZF, ZYH participated in writing and revising the manuscript. WWW, LMD and

375 YWP collected and analyzed the data. Jiang Hu designed the study, and participated

376 in revising the manuscript. All authors have read and approved the manuscript.

377

378 **CONFLICT OF INTEREST**

379 The authors have no conflicts of interest to declare.

380

381 **Data availability statement**

382 Data are available upon reasonable request. Data are available from the corresponding

383 author and the first author on reasonable request.

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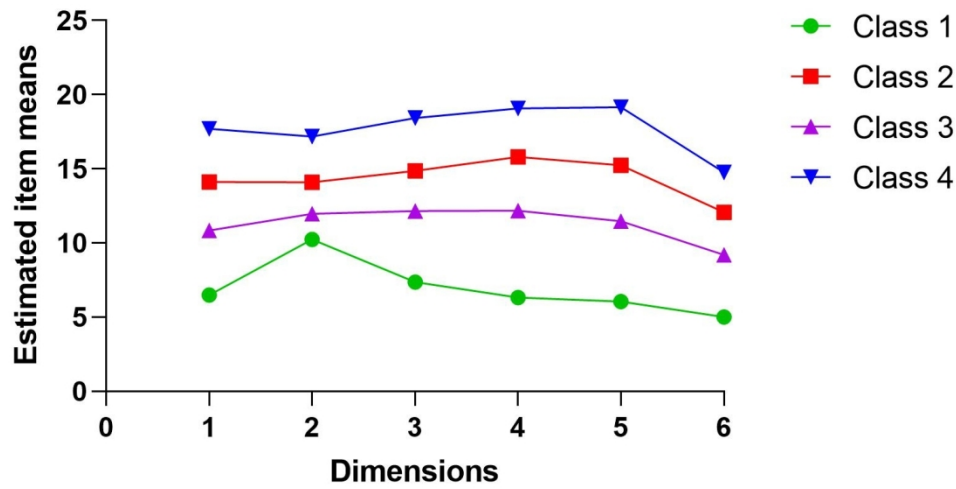
Latent profiles of mindful self-care

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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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1

Latent profile analysis of mindful self-care and associations with

mental health among nurses in China

4

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15 **Latent profile analysis of mindful self-care and associations with**

16 **mental health among nurses in China**

17

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

2

44 self-care groups.

45 **Conclusion:** The present study used latent profile analysis to identify four distinct

46 subgroups of hospital nurses based on their mindful self-care and revealed varying

47 levels of anxiety, depression, and perceived stress between groups. These results

48 emphasize the need for tailored mindful self-care strategies to promote nurses' well-

49 being.

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

51

52 **Strengths and limitations of this study:**

53 ● The LPA approach was sed in this study to delve into the diverse subgroups of

54 mindful self-care practices among Chinese nurses.

55 ● This study used confirmatory factor analysis (CFA) to ensure the validity of the

56 measurement tools.

57 ● This study provided evidence of the relationships between mindful self-care and

58 anxiety, depression, and perceived stress.

59 ● This study was limited by its cross-sectional research design.

60 ● The generalizability of our findings may be limited due to the survey data being

61 sourced from a single region, which may limit its wider applicability.

3

Introduction

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

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

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

4

91   Self-care is crucial because it facilitates the maintenance of one's physical,

92 emotional, mental, spiritual, and social well-being [17]. Martínez et al. [18] stated that

93 self-care is the ability to care for oneself through awareness, self-control, and self-

94 reliance to achieve, maintain, or promote optimal health and well-being. Self-care

95 contains six domains: physical, professional, relational, emotional, psychological, and

96 spiritual [19]. Given the paramount significance of self-care, devoting attention to

97 nurses' self-care practices is key safeguarding their professional well-being.

98 Therefore, it is imperative to proactively address this issue and provide effective

99 strategies to enhance nurses' self-care practices.

100   Mindfulness enables nurses to concentrate more effectively on the functions of

101 their bodies and minds [20]. A concept analysis [21] defined mindfulness as a

102 transformative process in which one develops an increasing ability to experience

103 being present with awareness, acceptance and attention. Mindfulness offers a

104 promising strategy for managing chronic stress, with significant implications for

105 enhancing mind-body health and well-being, regardless of disease status [22].

106 Existing studies [23-25] have consistently demonstrated that mindfulness

107 interventions effectively alleviated stress and burnout in nurses and simultaneously

108 promoted their physical and mental well-being. Therefore, it is crucial for nurses to

109 elevate their mindfulness to the utmost level [26].

110   Cook-Cottone et al. [27] conceptualized mindful self-care by skillfully

111 integrating mindful awareness, active mindful practices, and mindful nurturing of

112 every facet of oneself with traditional conceptions of self-care. Mindful self-care was

113 defined as a continuous process comprised of two parts: mindful awareness and

114 assessment of one's internal needs and external demands and purposeful engagement

115 in targeted self-care practices aimed at addressing these needs and demands in a way

116 that fosters well-being and personal effectiveness [27, 28]. Mindfulness self-care can

117 aid in the identification of unrecognized self-care patterns and obstacles and the

118 implementation of targeted self-care while guiding the development of intentional and

119 focused self-care practices [17].

5

120   Previous studies [29, 30] investigated the current status of mindful self-care and

121   its influencing factors in the nurse population, and the results showed that most nurses

122   engaged in low levels of mindful self-care. However, the current evidence could not

123   reveal the heterogeneous subgroups of mindful self-care in the nurse population or

124   their differences in different dimensions.

125   Latent profile analysis (LPA) is a reliable statistical technique for the

126   classification of subgroups [31]. LPA is a "person-centered" analysis method that is

127   frequently used in current research. This method is based on the classification of

128   mixture models that views the population distribution as a mixture of several

129   homogeneous populations with the same distribution and uses maximum likelihood

130   estimation to estimate the probabilities of latent classes and the parameters of the

131   population distribution within the class. Considering the uncertainty of classification,

132   this method ultimately assigns observations to the category with the maximum

133   posterior probability. Previous studies lacked correlations between latent profiles of

134   mindful self-care and mental health.

135   Therefore, the present study performed a survey of the current status of

136   mindfulness self-care among nurses and explored the heterogeneity of groups and the

137   correlation between anxiety, depression and perceived stress.

138

139   **METHODS**

140   **Study design**

141   A cross-sectional study was performed via an online survey using a convenient

142   sampling method. The study was designed and reported in compliance with the

143   Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)

144   guidelines [32].

145

146   **Sample size estimation**

147   This study investigated the latent profiles of nurses' mindful self-care. Because

148   the LPA requires a sample size that exceeds 500 [31, 33], the minimum sample size

149   for this investigation was set at 500.

6

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].

7

180

Patient Health Questionnaire-9 (PHQ-9)

181

182   The questionnaire was developed by Kroenke et al. [38] in 2001 and

183 subsequently introduced to China in 2009 [39]. The questionnaire is comprised of

184 nine items, each rated on a scale from 0 (not at all) to 3 (almost every day). The total

185 scores range from 0 to 27, with the following classifications: 0 to 5 indicating no

186 depression, 6 to 9 indicating mild depression, 10 to 14 indicating moderate

187 depression, 15 to 19 indicating severe depression, and 20 to 27 indicating extremely

188 severe depression. The internal consistency coefficient of the PHQ-9 is 0.857.

189

190   **Generalized Anxiety Disorder-7 (GAD-7) Scale**

191   The scale was developed by Spitzer et al. [40] in 2006 to reflect an individual's

192 psychosomatic activity in the past two weeks, and the Chinese version was translated

193 by He et al. [41] in 2010. This scale has a Cronbach's alpha coefficient of 0.898. The

194 GAD-7 (Chinese version) is used to screen and assess generalized anxiety symptoms

195 using 7 items. The scale ranges from 0 (not at all) to 3 (almost every day). The total

196 score ranges from 0 to 21, with 0 to 5 indicating no anxiety, 6 to 9 indicating mild

197 anxiety, 10 to 14 indicating moderate anxiety, and 15 to 21 indicating severe anxiety.

198

199   **Data collection**

200   Data collection was performed from August 26, 2023 to September 18, 2023.

201 The survey collected data mainly using a Chinese questionnaire survey network

202 platform. The entire testing process followed the principles of anonymity and

203 voluntariness. Before the test, the participants read the instructions and precautions

204 and completed the questionnaire. The questionnaire was directly distributed to nurses

205 via WeChat.

206

207   **Statistical analyses**

208   The omega coefficient was used to measure the internal consistency reliability of

209 the scale. Omega coefficients greater than 0.7 indicate that the scale has a high level

8

210   of internal consistency reliability. The validity of the scale must be comprehensively

211   assessed in combination with the fit indices. (1) Smaller χ^2 test values indicate smaller

212   degrees of deviation and a greater fit of the measurement model. (2) Degrees of

213   freedom (*df*). (3) χ^2 / df, smaller χ^2 / df values indicate a greater fit of the model, and a

214   value between 1 and 5 indicates good model fit. (4) Root mean square error of

215   approximation (RMSEA): an RMSEA less than 0.05 indicates a good model fit, and

216   an RMSEA less than 0.08 indicates an acceptable model fit. (5) The comparative fit

217   index (CFI), which ranges between 0 and 1; generally, a CFI greater than 0.9 indicates

218   a good model fit. (6) For the Tucker–Lewis index (TLI), a TLI greater than 0.9

219   indicates an acceptable model, and a TLI greater than 0.95 indicates a better model fit.

220   (7) The standardized root mean square residual (SRMR), which reflects the

221   standardized overall residual of the assumed model, is used to determine whether the

222   model parameter setting is ideal via residual analysis, and an SRMR between 0 and 1

223   and less than 0.08 indicates a good model fit. The Mplus 7.4 program was used to

224   delineate distinct subgroups of mindful self-care. To assess model adequacy and

225   establish the optimal number of categories, various indicators were used, such as the

226   log likelihood (LL), Akaike information criterion (AIC), Bayesian information

227   criterion (BIC), adjusted Bayesian information criterion (aBIC), entropy, Lo-Mendell-

228   Rubin (LMR) test and bootstrapped likelihood ratio test (BLRT). By pooling these

229   indicators across all model fitting results in each category, we selected the model that

230   best suited the data. For data analysis, the statistical software SPSS 26.0 was used.

231   Categorical variables were characterized by assessing frequency and composition

232   ratios, and continuous variables were described using means and standard deviations.

233   If the variables did not meet the normality test, they were represented using the

234   median and quartiles. To compare categorical variables between different groups, the

235   chi-squared test was used. For comparing variables between groups, nonparametric

236   tests, chi-squared tests and *Fisher's* exact probability tests were used. Differences

237   between the two groups were compared using post hoc tests. Cramér's V and Epsilon-

238   squared (ϵ^2) were used to determine the effect size. Statistical significance was

239   defined as a p value less than 0.05.

9

240

Ethical considerations

241

242   The Ethics Council of The Third Affiliated Hospital of Zunyi Medical

243   University, also known as The First People's Hospital of Zunyi, granted approval for

244   this study (2023-1-J02). All participants consented to the collection of data with full

245   knowledge and understanding. Prior to commencing the survey, participants were

246   informed about the study's primary objectives and rationale, which enabled them to

247   provide informed consent. If any nurse declined to participate, the questionnaire

248   collection process was promptly terminated. The instructions clearly assured

249   participants that there would be no consequences for refusing to participate in the

250   survey. Furthermore, participants were assured that the study results would be

251   presented in aggregated form to ensure their individual anonymity.

252

253   **Patient and public involvement**

254   Patients and/or the public were not involved in the design, conduct, reporting, or

255   dissemination of this research.

256

257   **Results**

258   **Participant characteristics**

259   The study participants were recruited from Guizhou Province, China. A total of

260   1020 questionnaires were returned, and 1001 questionnaires were valid, which resulted

261   in an effective recovery rate of 98.1%. Among the 19 invalid questionnaires, 9

262   contained logical errors in basic information, and 10 had missing data. Among the

263   included participants, 48 were males (4.8%), and 953 were females (95.2%). The

264   average age was 32.6 years, and the range was 22 to 54 years. Thirty-one people (3.1%)

265   were from first-level hospitals, 701 people (70.0%) were from second-level hospitals,

266   and 269 people (26.9%) were from third-level hospitals.

267

268   **Reliability and validity analysis**

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

10

270   the scales were reliable. The fit indices of all scales were within the ideal range, which

271   suggested that the scales had good validity. The results are presented in Table 1.

272

273   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

274

Latent class identification

276   The results of latent profile analysis showed that the LMR P value and BLRT P

277   value of Class 2, Class 3, and Class 4 were statistically significant ($P<0.05$). Compared

278   to Class 2 and Class 3, Class 4 had the highest entropy value. Therefore, we ultimately

279   determined that Class 4 was the optimal profile analysis model, and it indicated that

280   classifying nurses' mindful self-care into four profiles was the best approach. The

281   results are shown in Table 2.

282   Based on the results of the latent profile analysis, a score distribution chart of

283   different profiles between different dimensions was drawn. These results are presented

284   in Figure 1. Based on the trend of the profile distribution in the chart, we named Class

285   1 the Inconsistent Mindful Self-Care Group (n=44, 4.40%), Class 2 the Balanced

286   Development Group (n=434, 43.36%), Class 3 the Moderate Mindful Self-Care Group

287   (n=394, 39.36%), and Class 4 the High Mindful Self-Care Group (n=129, 12.89%).

288

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

290   The distribution and characteristics of the basic information of the different

291   potential profiles are shown in Table 3. The results showed that the nurses' department

292   and average monthly income were the factors influencing the potential profiles

293   ($P<0.05$), and there was no statistically significant difference between the other factors.

294   The results of the effect size analysis showed that the effect size was moderate or small.

11

295   Table 2 Potential profile analysis indicators (N=1001)

296

Model	LL	AIC	BIC	aBIC	Entropy	LMR P value	BLRT P 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

297

298   AIC Akaike information criterion, BIC Bayesian information criterion, aBIC Sample adjusted Bayesian information criterion, LMR Lo-Mendell-Rubin Likelihood

299   Ratio Test, BLRT Bootstrapped Likelihood Ratio Test.

300

301

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

303

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12

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Table 3 Demographics and characteristics by latent profile (N=100?)

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 (28.0, 36.0)	2.067	0.559	0.001
Gender	Female	43 (97.7%)	407 (93.8%)	380 (96.4%)	12x (95.3%)	3.407	0.317	0.062
	Male	1 (2.3%)	27 (6.2%)	14 (3.6%)	x (x%)			
Marital status	Single	10 (22.7%)	70 (16.1%)	74 (18.8%)	2x (x%)	6.463	0.373	0.055
	Married	34 (77.3%)	354 (81.6%)	312 (79.2%)	10x (x8%)			
	Others	0 (0%)	10 (2.3%)	8 (2.0%)	x (x%)			
Professional title	Junior level	24 (54.5%)	257 (59.2%)	241 (61.2%)	8x (x1%)	2.587[a]	0.860	0.039
	Intermediate level	19 (43.2%)	154 (35.5%)	137 (34.8%)	4x (x%)			
	Senior level	1 (2.3%)	23 (5.3%)	16 (4.1%)	x (3.x%)			
Highest Degree	Junior College and below	7 (15.9%)	61 (14.1%)	62 (15.7%)	2x (1x.4%)	9.701	0.138	0.047
	Undergraduate and above	37 (84.1%)	373 (85.9%)	332 (84.3%)	10x (8x.6%)			
Department	Internal Medicine	12 (27.3%)	90 (20.7%)	129 (32.7%)	2x (18.6%)	50.627[a]	0.001	0.133
	Surgery	10 (22.7%)	94 (21.7%)	67 (17.0%)	3x (2x.3%)			
	Obstetrics and Gynecology	11 (25.0%)	38 (8.8%)	33 (8.4%)	x (5.x%)			
	Pediatrics	2 (4.5%)	32 (7.4%)	31 (7.9%)	16 (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%)	x (x%)			
	Functional Assistance Departments	1 (2.3%)	20 (4.6%)	16 (4.1%)	x (3.x%)			
	Administrative and Logistics Departments	0 (0%)	17 (3.9%)	7 (1.8%)	4 (3.x%)			
	Others	6 (13.6%)	61 (14.1%)	54 (13.7%)	17 (13.2%)			

13

						χ^2	p	
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%)	2? (17.?%)			
Working years (years)	<5	7 (15.9%)	77 (17.7%)	76 (19.3%)	2? (1?.4%)	5.204	0.518	0.051
	5~10	23 (52.3%)	209 (48.2%)	193 (49.0%)	5? (?9.5%)			
	>10	14 (31.8%)	148 (34.1%)	125 (31.7%)	5? (3?.1%)			
Number of night shifts per month	0	17 (38.6%)	154 (35.3%)	133 (33.8%)	4? (?.4%)	7.512	0.276	0.061
	1~4	4 (9.1%)	75 (17.3%)	57 (14.5%)	2? (?.7%)			
	≥5	23 (52.3%)	205 (47.2%)	204 (51.8%)	54 (?.9%)			
Average monthly income (yuan)	≤3000	16 (36.4%)	47 (10.8%)	68 (17.3%)	18 (1?.0%)	24.460	<0.001	0.111
	3001~6000	23 (52.3%)	299 (68.9%)	256 (65.0%)	9? (?.8%)			
	>6000	5 (11.4%)	88 (20.3%)	70 (17.8%)	2? (1?.3%)			
Hospital grade	Primary level	1 (2.3%)	16 (3.7%)	12 (3.0%)	? (1.?%)	3.396	0.749	0.044
	Secondary level	35 (79.5%)	298 (68.7%)	278 (70.6%)	9? (69.8%)			
	Tertiary level	8 (18.2%)	120 (27.6%)	104 (26.4%)	3? (2?.7%)			

306   [a] *Fisher's* exact probability test

14

Correlation analysis between mindful self-care and mental health

307

308   Spearman's correlation was used to analyze the relationships between mindful self-

309   care, perceived stress, anxiety, and depression. The results showed that mindful self-

310   care negatively correlated with anxiety and depression (*P*<0.05). However, there was

311   no correlation between mindful self-care and perceived stress (*P*>0.05). There were

312   positive correlations between perceived stress, anxiety, and depression (*P*<0.05). The

313   results are shown in Table 4.

314

315   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

316   ** *P*<0.01

317

318   Using the grouping of mindful self-care as the dependent variable and the scores

319   of perceived stress, anxiety, and depression as the independent variables, a

320   nonparametric test was performed. The results are shown in Table 5. There were

321   significant differences in nurses' scores for perceived stress, anxiety, and depression

322   between the different groups. There were differences in depression scores between the

323   different groups. Comparison of multiple groups revealed that the Inconsistent Mindful

324   Self-Care Group and Moderate Mindful Self-Care Group had higher levels of

325   depression than the Balanced Development Group and High Mindful Self-Care Group,

326   but there was no difference between the Inconsistent Mindful Self-Care Group and

327   Moderate Mindful Self-Care Group. The results for anxiety were similar to depression.

328   Perceived stress was statistically different between the groups, and further two-by-two

329   comparisons showed that the Balanced Development Group and Moderate Mindful

330   Self-Care Group had higher levels than the High Mindful Self-Care Group and

331   Inconsistent Mindful Self-Care Group. The Inconsistent Mindful Self-Care Group had

332   the highest level of perceived stress. The results of the effect size analysis showed that

333   the comparison of anxiety and depression between the different groups revealed a

15

334   medium effect, but the value of the effect size for the comparison of perceived stress

335   was small.

336

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	H	P	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	0.105
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	0.088
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	0.009

Discussion

338   The present study used LPA to investigate diverse groups of mindful self-care

339   practices among nurses in hospitals. Based on cross-sectional data, we identified four

340   distinct subgroups: the Inconsistent Mindful Self-Care Group, the Balanced

341   Development Group, the Moderate Mindful Self-Care Group, and the High Mindful

342   Self-Care Group. To the best of our knowledge, this study is the first study to explore

343   heterogeneous groups of mindful self-care using the LPA method. Compared to

344   traditional person-centered analysis methods, such as cluster analysis, LPA is a more

345   flexible and model-based classification method. Notably, LPA provides a variety of

346   adaptability indices to determine the number of profiles more scientifically with a lower

347   bias. We further used correlation analysis to confirm a significant correlation between

348   four subgroups, anxiety, depression, and perceived stress.

349

350   The LPA results revealed that nearly half (43.36%) of the nurses had a relatively

351   lower level of mindful self-care, and 39.36% of the nurses had a moderate level of

352   mindful self-care. A survey of oncology nurses in China reported an average mindful

353   self-care score of 59.30 [42]. In another survey of emergency nurses used the 36-item

354   mindful self-care scale and found that scores averaged 89.74, which was low overall

355   [29]. According to our findings, nurses' mindful self-care score was 80.00, which was

356   higher than previous studies. Similarly, the LPA results revealed characteristic

357   differences between the groups. The two groups with high LPA values scored

358   significantly higher on the dimensions of supportive relationships and supportive

359   structures than the other dimensions and may have a stronger external self from the

360   perspective of Attuned Representational Models of Self [28]. The Natural Development

361   Group scored more consistently on all dimensions. However, the Inconsistent Group

362   scored significantly higher on physical care, self-compassion and purpose, which

363   indicates a stronger internal self. These results suggest that future studies should

364   prioritize the characteristics of the population and the implementation of effective

365   interventions.

366   Our study also revealed several different profile characteristics. Specifically,

367   department and average monthly income were influencing factors in different groups.

17

368   The results showed that a larger proportion of nurses in the internal medicine

369   department belonged to the medium- and high-scoring groups, which indicated that

370   internal medicine nurses more frequently adopted mindful self-care practices. Potential

371   reasons may be that nurses in internal medicine departments have relatively low

372   workloads, and working in such an environment, where some chronic diseases are often

373   caused by unhealthy lifestyles, may promote nurses' self-care behaviors. The present

374   study included full-time nurses because there are no part-time nurses in China. There

375   is a significant income disparity between different hospitals and departments, which is

376   also one of the factors affecting mindful self-care. Nurses' capacity for health-

377   promoting self-care is significantly influenced by a confluence of factors, including

378   time constraints, excessive workloads, scarcity of resources and facilities, the draining

379   effects of fatigue, and the demands of external commitments [15, 43]. A previous study

380   [42] demonstrated that educational level and health status were predictors of mindful

381   self-care, but our investigation did not support this finding, which may be related to the

382   inclusion of the study population. Another study [30] showed that gender was also an

383   influencing factor for mindful self-care, but the large gap between the male and female

384   ratios in this study failed to validate this difference. Future research should actively

385   focus on key populations to explore the factors influencing the population of nurses

386   with low levels of mindful self-care to provide targeted interventions.

387   Our study further confirmed the correlation between mindfulness and mental

388   health. Anxiety and depression scores showed weak negative correlations with mindful

389   self-care scores. Although perceived stress was not correlated with the mindful self-

390   care score, the perceived stress score differed between the four groups. Zhang et al. [42]

391   showed that mental health literacy positively correlated with mindful self-care.

392   Mindfulness can function as a protective factor to mitigate or even eliminate the

393   negative impact of perceived stress [44]. This relationship may further explain the

394   potential stress-buffering effects of mindful self-care. More research is needed to

395   further validate the relationships between the variables related to mental health and

396   mindful self-care.

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

18

398   self-care for nurses. Notably, nurses' awareness of self-care should increase, and

399   mindfulness should be integrated into their daily work and life [17]. There have been

400   many mindful self-care-related interventions, such as mindfulness workshops [45],

401   mindful self-compassion training [46], and mindfulness-based self-care and resiliency

402   interventions [47], but these interventions did not use mindful self-care as a valid

403   outcome indicator. Some personalized and convenient interventions, such as digital

404   health apps [48] and fragmented interventions, should be provided according to the

405   special characteristics of the nurses.

406

407   **Limitations**

408   This research has several notable limitations. First, the methodology was a cross-

409   sectional survey, and despite the substantial size of the sample, data collection relied

410   on convenience sampling instead of random sampling. Second, the sample was

411   exclusively drawn from Guizhou Province in China, which resulted in a potential

412   selection bias that hindered a comprehensive portrayal of the current state of

413   mindfulness self-care among nurses throughout the country. Third, because the present

414   research was performed exclusively with Chinese nurses, whether the findings can be

415   generalized to other cultural contexts is not certain. Therefore, there is a pressing need

416   for further research with a larger and higher-quality sample size.

417

418   **Conclusion**

419   This study used LPA to investigate mindful self-care practices among hospital

420   nurses and revealed four distinct subgroups: the Inconsistent Mindful Self-Care

421   Group, the Balanced Development Group, the Moderate Mindful Self-Care Group,

422   and the High Mindful Self-Care Group. The four groups showed different levels of

423   anxiety, depression, and perceived stress, which highlights the importance of mindful

424   self-care for nurses' mental well-being. Nursing managers and researchers should

425   prioritize the enhancement of nurses' awareness of mindful self-care and the

426   development of concise, accessible, and feasible intervention programs.

427

19

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430

431 **CONFLICT OF INTEREST**

432 The authors have no conflicts of interest to declare.

433

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437

438 **Ethical considerations**

439 The Ethics Committee of The Third Affiliated Hospital of Zunyi Medical University

440 (The First People's Hospital of Zunyi) approved this study (2023-1-J02). Informed

441 consent was obtained from all study participants prior to initiating the survey.

442

443 **Authors' contributions**

444 YZF and ZYH participated in writing and revising the manuscript. WWW, LMD and

445 YWP collected and analyzed the data. JH designed the study and participated in

446 revising the manuscript. All authors have read and approved the manuscript. JH acted

447 as guarantor.

448

449 **Data availability statement**

450 The data are available upon reasonable request. The data are available from the

451 corresponding author and the first author upon reasonable request.

452

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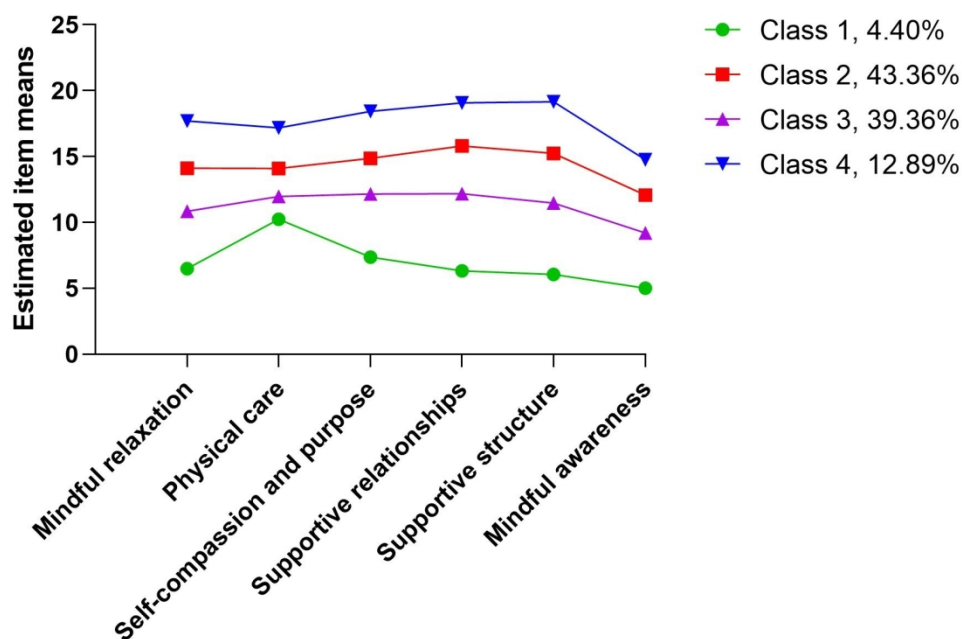
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26

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.