

Relationship Between Freshmen's Psychological Health and Family Economic Status in Chinese Universities: A Latent Profile Analysis

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Purpose: With the rapid social changes, psychological health problems among freshmen in universities have become increasingly serious. Many researchers have studied the psychological health status of college freshmen using quantitative methods. However, most researchers have studied the psychological health of college freshmen by treating variables as the central concept and analysis unit, which has limitations on the variable-centered research method. Therefore, this study aims to explore the impact of family economic status and demographic variables on the psychological health of college freshmen, as well as the potential types of psychological health among college freshmen.

Methods: Based on the SCL-90 and the self-evaluation of the family economic status of college freshmen, latent profile analysis (LPA) was used to analyze the psychological health of 1497 college freshmen selected through a whole-group sampling method. Freshmen completed the questionnaire from October 18 to October 20, 2022. Then, multinomial logistic regression analysis and variance analysis were conducted using SPSS 25.0 to analyze the impact of family economic status and demographic variables on different psychological health subtypes of college freshmen from a university in Eastern China.

Results: There is obvious heterogeneity in the psychological health of college freshmen, which can be divided into three groups: psychological health group (69.54%), psychological distress group (24.65%), and psychological risk group (5.81%). The latent categories of psychological health among college freshmen differ by gender and family economic status. The psychological health status of female students is significantly better than that of male students. In addition, the lower the self-evaluation of family economic status of college freshmen, the lower their psychological health level.

Conclusion: Three categories of mental health exist for college freshmen, with significant group heterogeneity. Gender and family economic status significantly influenced mental health outcomes with female students faring better. The study's significance lies in providing useful recommendations for educational administrators and developing targeted interventions for college freshmen. Given the practical realities of mental health education efforts, personalized strategies that utilize peer support, counseling, and psychological services can be adopted to assist freshmen in acclimating to university life and maintaining mental wellness. The findings suggest considering the role of family economic status and gender in promoting mental health and the need for further research to develop comprehensive and effective interventions.

Keywords: college freshmen, psychological health, family economic status, heterogeneity, latent profile analysis

Introduction

Psychological health has emerged as a pressing global social issue in recent times.¹⁻³ Notably, researchers from various parts of the world have directed their attention toward the mental well-being of college students.⁴⁻⁶ The most prevalent psychological issue faced by Chinese university students is anxiety and depression.⁷ In a study published in 2021, researchers found that the prevalence of anxiety and depression in China was 40.3% and 45.3%, respectively.⁸ Previous research has demonstrated associations between mental health issues in college students and deficits in interpersonal skills, elevated academic stress, and increased risk of suicidal ideation and behavior.⁹ These findings raise concerns

regarding the prevalence of psychological distress among university populations. College life, marked by a transition from late adolescence to early adulthood, exposes students to several psychological challenges and changes, rendering them vulnerable to mental health issues.^{10–12} Freshmen, in particular, are faced with unprecedented challenges such as role adaptation, interpersonal relationships, and changes in living environments. The ensuing stressors can exert significant pressure on their mental health and coping abilities.^{13–15}

Previous research has established that the mental health challenges facing college freshmen have grown increasingly severe with the changing societal landscape.^{16–18} The World Health Organization conducted a mental health survey on 13984 college freshmen in eight countries and found that approximately one-third of the participants exhibited problems of anxiety, depression, and other psychological issues.¹⁹ In a recent study conducted in the United States, 29.0% of college freshmen reported mild anxiety, 18.1% reported moderate anxiety, and 14.2% reported severe anxiety.²⁰ In a comparative study conducted in China, the mental health status of 13085 Chinese college freshmen was analyzed. The findings indicate a concerning trend, with the total score of SCL-90 (Symptom Checklist-90) showing a consistent increase among college freshmen.²¹ Furthermore, there is an alarming rise in the detection rate of mental health problems year by year.¹⁸

In the context of Chinese university education, researchers tend to examine the factors affecting college freshmen's mental health by categorizing them based on demographic and family characteristics. For instance, some researchers have found that college freshmen with left-behind experience (i.e., they have long separation time from their parents) have more mental health problems.²² Additionally, a study that classified parents' educational backgrounds revealed that the mother's educational level had a greater impact on college freshmen's mental health than the father's.²³ In another study, significant differences in multiple dimensions of mental health were observed across different majors of humanities, science, and arts among college freshmen.²⁴ Furthermore, studies have also briefly categorized and analyzed college freshmen's demographic information, such as gender, age, ethnicity, and whether they are the only children in the family. They reported no difference in the mental health of college freshmen from urban areas with regard to the attribute of being an only child.²⁵ In contrast, other attributes, such as ethnicities, show a significant difference in mental health among college freshmen.²⁶ However, some studies found that the risk of mental health problems among college freshmen was 2.23 times lower than that of college sophomores,²⁷ and there was no significant gender difference in mental health among college freshmen.²⁸ Balancing work and study is a common challenge faced by many university students today. A significant number of students choose to work part-time during term time or full-time during holidays to help fund their living and education expenses.^{29,30} However, part-time employment can negatively impact student well-being. Studies show the student population has lower levels of mental health compared to the general population.³¹

The analysis abovementioned indicates that several factors, including age, gender, major studied, and left-behind situation, may be associated with the mental health of college freshmen. However, previous studies on this topic have primarily utilized a variable-centered research approach, assuming college freshmen as a homogeneous group and comparing them with relevant norms. This approach may overlook the heterogeneity of the college freshmen population and may not provide a comprehensive understanding of their mental health characteristics. Moreover, relying solely on norms may not capture the true picture of college freshmen's mental health as it can be influenced by social development. To better understand the heterogeneity of mental health and related characteristics among college freshmen, it is proposed to adopt a person-centered approach that considers individual differences and takes into account the unique characteristics and experiences of each student. This approach offers a more accurate and nuanced understanding of their mental health status and can help identify specific subgroups of freshmen who are at a higher risk of mental health problems. By designing targeted interventions that address their unique needs, this approach can contribute to the development of effective prevention and intervention strategies.

The family economic status is understood as a crucial dimension in our research. The Family Stress Model suggests that when a family is in a poor economic state, parents may experience negative emotions due to economic pressure. This can trigger family conflicts and inappropriate parenting behaviors, which can ultimately impact their children's psychological health and behavioral development and lead to unfavorable consequences.³² Peltz et al³³ found that college students from low-income families are more likely to experience psychological problems such as anxiety, depression, and interpersonal sensitivity. In the sense of Peltz et al³³ we conducted an empirical study to incorporate the family economic

status into a person-oriented approach. In contrast to Sang and Fu³⁴ who argued that there were less influences on the mental health of college freshmen, our results showed that students with lower self-evaluations of their family's economic status exhibited lower levels of mental health.

To achieve our goals, we adopted the Latent Profiles Analysis (LPA), which is an extension of the Latent Class Analysis (LCA) that employs latent continuous variables.³⁵ By employing LPA, investigations of various problems or characteristic subtypes of mental health in college freshmen from a person-centered perspective are scarce under the context of Chinese education, with the exception of Xu and Kong's³⁶ identification of five subtypes of psychological problems. In our research, we employ exploratory latent profile analysis to examine the characteristics of psychological health problems among college freshmen. Drawing on survey data, the study explores the heterogeneity and related features of psychological health among college freshmen, and investigates the relationship between psychological health latent categories and family economic status and demographic variables. This study is expected to provide valuable references for evaluating psychological health and implementing targeted psychological interventions for college freshmen.

Method

Participants

A total of 1653 first-year full-time college students from a university in Zhejiang Province, China, were recruited for this study using a whole-group sampling method. The study was approved by the Human Research Ethics Review Board of the authors' university (Ethical Committee Number ZAFU2022/0915-1).

Research Design

The study employed a cross-sectional survey design to assess the psychological health and associated factors among college freshmen. Cross-sectional analysis aligns with prior research on mental health profiles and risks in university populations.^{37,38} Self-report measures were used to evaluate mental health symptoms and family economic status. An online survey collected data from a large sample of freshman students. Latent profile analysis first identified psychological health subgroups, followed by multinomial logistic regression examining predictors of profile membership. These methods enabled investigation of heterogeneity in freshman mental health.

Procedure for Data Collection

All participants were approached by a teacher from the university's mental health education center who was uniformly trained in explaining the purpose and procedures of the study. Informed consent was obtained from each student. Freshmen completed the questionnaire by scanning a WeChat QR code on their smartphones within 30 minutes. The data collection period spanned from October 18 to October 20, 2022.

The inclusion criteria of questionnaire data were: (1) newly enrolled full-time undergraduate students in 2022; (2) no history of medication consumption in the two weeks prior to scale testing; (3) willingness to participate in the study. The exclusion criteria of questionnaire data were: (1) being diagnosed with a mental disorder (This means that any participant who has been officially diagnosed with a mental disorder prior to taking the test is not included in the analysis. This is because their responses may be influenced by their mental health condition, which could skew the results); (2) answering the questionnaire too quickly (In order to get an accurate measure of someone's psychological state, it's important that they take their time to consider each question and answer carefully. If a participant rushes through the test and answers too quickly without much thought, then it may be an indication that they did not take the test seriously or were not fully engaged in the process);^{39,40} (3) exhibiting a clear pattern in their responses (If a participant's answers show a clear pattern or bias towards a certain kind of response (e.g., always choosing the same answer option, or only selecting "strongly agree" or "strongly disagree" for every question), then it may indicate that they were not giving genuine or honest responses. In this case, we can examine the distribution of answer options across all questions and exclude any participants who show an unusually high level of consistency or predictability in their responses).^{41,42}

After screening and excluding invalid data, 1497 valid questionnaires were included in the analysis, resulting in a questionnaire efficiency of 90.56%. Due to the form of using a QR code on their smartphones to answer questions, students must complete the previous question to enter the next one. Therefore, in this study, no data were missing for variables. The sample included 602 male freshmen and 895 female freshmen, with an average age of 18 years ($M = 18.24$, $SD = 0.58$) and an age range of 17 to 20 years. Of these participants, 1433 were from the Han majority, and 64 were from ethnic minorities, including the Zhuang, Yi, Tujia, and 12 other groups. The distribution of subjects is presented in Table 1.

Measures

Psychological State Evaluation

The Symptom Checklist-90 (SCL-90) developed by Derogatis et al⁴³ is adopted in our research. This scale has also been widely used in clinical assessment studies in many countries, particularly in the field of mental health.^{44,45} It was translated into Chinese by Dr. Zhengyu Wang⁴⁶ to reach a wide application in China. 34 out of 43 previous studies on changes in mental health status among college and high school students, teachers, and medical personnel in China utilized the SCL-90 scale.⁴⁷

The SCL-90 scale consists of 90 items that measure psychological symptoms and distress across 10 principal symptom dimensions, namely: (1) somatization (SOM); (2) obsessive-compulsive (OBS); (3) interpersonal sensitivity (INT); (4) depression (DEP); (5) anxiety (ANX); (6) hostility (HOS); (7) phobic anxiety (PHOB); (8) paranoid ideation (PAR); (9) psychoticism (PSY); (10) sleep difficulties (SLE). Participants were asked to rate each item on a 5-point scale ranging from 1 (not at all) to 5 (very strongly). If a student's total score exceeds 160, or if any of the standardized subscale scores exceed 2, the results of this scale are expected to indicate psychological symptoms present in that specific dimension.⁴⁸ The Cronbach's alpha for the total scale was 0.964, and Cronbach's alpha for the 10 subscales ranged from 0.958 to 0.963 for this sample. According to Tavakol et al⁴⁹ Cronbach's alpha values exceeding 0.90 may signify item redundancy, thereby impelling scale shortening. With a view to enhancing scale efficiency and based on preliminary item analysis revealing redundancy, a total of 79 out of 90 items were finally retained for the tool.

Self-Assessment of Family Economic Status

In addition, college freshmen were also asked to self-assess their family's financial status on a 3-point scale, with options of poor (1), medium (2), and good (3).

Statistical Analysis

Mplus 8.3 software⁵⁰ was used in this study to conduct a latent profile analysis of the mental health of college freshmen. Subsequently, SPSS 25.0 was employed to analyze the multinomial logistic regression and variance analysis.

Latent Profile Analysis (LPA)

Latent profile analysis (LPA) is a model-based method that classifies individuals into mutually exclusive latent categories based on their responses to observed variables.⁵¹ Using sample data, LPA can estimate the probability of each individual

Table 1 Distribution of Subjects

Variable	Variable Characteristics	Number of Students	Percentage (%)
Gender	Male	602	40.21
	Female	895	59.79
Ethnicity	The Han majority	1433	95.72
	Ethnic minorities	64	4.28
Age	17	58	3.87
	18	1073	71.68
	19	313	20.91
	20	53	3.54

belonging to a specific category and can differentiate subtypes based on the nature and degree of the observed variables.^{52,53} One of the main advantages of LPA is that it can ensure the maximum difference between different latent categories while minimizing the differences within the same category. Additionally, it can estimate the proportion of different subtypes in the population, making up for the unequal population that variable-centered research may fail to identify.^{54,55} The method starts with parameter estimation of a baseline model with all samples divided into a one-class model, gradually increasing the number of model classes, and parameter estimation of model fit. Finally, the advantages and disadvantages of the different models are compared based on the model fit information to determine the most reasonable classification model.

The LPA models were evaluated based on fit criteria, including the Akaike information criterion [AIC], Bayesian information criterion [BIC], sample-adjusted Bayesian information criterion [aBIC], Entropy, the Lo-Mendell-Rubin likelihood ratio test [LMR], and the bootstrapped likelihood ratio test [BLRT].⁵⁶ The AIC, BIC, and aBIC fit indicators have smaller results indicating better model fit. Entropy measures the quality of classification in LPA and takes values from 0 to 1. The closer the index is to 1, the more accurate the classification is. An index of less than 0.6 indicates that the individual classification error rate is as high as 20%, which is not acceptable.⁵⁷ LMR and BLRT were used to compare the fit differences between k profiles and a $k-1$ profile. If the corresponding p value for LMR and BLRT reached significant levels, it indicated that a model with k profiles was superior to a model with a $k-1$ profile.⁵⁶ When identifying the best model, not only AIC, BIC, entropy, and other model fitting indicators should be considered, but also the acceptability and simplicity of the model should be considered comprehensively.⁵³

Multinomial Logistic Regression

In line with the LPA, Multinomial Logistic Regression models were utilized to investigate the predictive impact of demographic variables and family economic status on the latent categories of mental health problems of Chinese college freshmen. The model encompassed demographic variables such as gender, and ethnicity, as well as family economic status as independent variables. The latent category outcomes were dependent variables in multiple logistic regression. Posterior probabilities within the model were employed to assign each participant their most probable profile. The odds ratios were utilized to indicate the expected increase or decrease in the probability of obtaining a positive score on a given variable in comparison to the reference or control group.

Results

Test for Common Method Deviation

As the research method was cross-sectional, self-assessment data of participants were collected at the same time, which may lead to the possibility of common method bias caused by factors such as the common characteristics of response items or participants' response bias.⁵⁸ To address this issue, the Harman single factor test was conducted to test for common method bias for all items in the questionnaire.⁵⁹ The results revealed that 11 factors had eigenvalues greater than 1, and the first factor accounted for 36.56% of the total variance, which was below the standard threshold value of 40%. These findings indicate that there was no significant common method bias in this study.

Latent Profile Analysis with Indicators of Mental Health in College Freshmen

By exploring 10 dimensions of mental health symptoms, including somatization, obsessive-compulsive behavior, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and sleep difficulties, the present study utilized latent profile analysis to identify distinct profiles of mental health in college freshmen. Latent profile models with solutions ranging from 1 to 4 profiles were tested. Table 2 displays the model fit information for the various latent profile solutions examined for mental health profiles in college freshmen.

After comparing the model fit indices, the 4-profile solution had the lowest values for AIC, BIC, and aBIC, indicating the best model fit. However, the 4-profile solution was rejected due to having a profile with less than 5% of the sample (4.61%), below the minimum threshold. Therefore, the 3-profile solution was selected as the optimal model balancing model fit, parsimony, and adequacy of profile sizes. As shown in Table 2, the 3-profile solution had relatively low AIC, BIC, and aBIC values. Furthermore, the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT) and the bootstrapped

Table 2 Fit Statistics for Latent Profile Analysis of Mental Health Among College Freshmen

Number of Profiles	Log (L)	AIC	BIC	aBIC	Entropy	LMR-LRT(p)	BLRT(p)	Proportions min (%)
1-Class	-11654.89	23349.77	23456.00	23392.46	n/a	n/a	n/a	n/a
2-Class	-6887.64	13837.28	14001.93	13903.45	0.98	0.00	0.00	18.77
3-Class	-4906.83	9897.65	10120.72	9987.30	0.97	0.00	0.00	5.81
4-Class	-4012.86	8131.72	8413.21	8244.85	0.95	0.01	0.00	4.61

Abbreviations: AIC, Akaike information criteria; BIC, Bayesian information criteria; aBIC, adjusted Bayesian information criteria; LMR-LRT, Lo-Mendell-Rubin likelihood ratio Test; BLRT, bootstrap likelihood ratio test.

likelihood ratio test (BLRT) were significant ($p < 0.01$) providing statistical evidence for the 3-profile model over more parsimonious models.

In the 3-profile solution model, the average probability of correct assignment for each profile ranged from 0.974 to 0.998. Additionally, the average misclassification probabilities ranged from 0.002 to 0.024, indicating low probabilities of profiles being incorrectly attributed. These results demonstrate the 3-profile model has high reliability and accuracy in classification. Table 3 presents a detailed summary of the 3-profile solution model results.

Analysis of the Characteristics of Each Latent Profile Model of Mental Health Among College Freshmen

The present study utilized latent profile analysis to identify and characterize three distinct subtypes of mental health among college freshmen, as shown in Figure 1, which displays the percentages of students in each subtype and their corresponding response probabilities on the 10 dimensions of mental health.

No overlap among the dimensions of the three subtypes is found in Figure 1. The overall patterns of response are consistent within each subtype. Specifically, all 10 dimensions of the first subtype, labeled the Health Group(C2), score significantly lower than those of the other subtypes, ranging from 1 to 1.5, which suggests that these students report minimal psychological problems and display high levels of mental health. This subtype comprises 1041 students, representing 69.54% of the total sample.

The second subtype, labeled the Distress Group(C1), exhibits middle-range scores from 1.5 to 2.5 on all 10 dimensions, except for the somatization dimension, which scores below 1.5. It indicates that these students experience some psychological problems, even though they occur infrequently, and their overall mental health level is intermediate. This subtype consists of 369 students, accounting for 24.65% of the total sample.

The third subtype, labeled the Risk Group(C3), reports the highest scores on eight of the 10 dimensions, with scores ranging from 2.5 to 3.5, except for the somatization dimension, which scores below 2.5. These findings suggest that students in this group experience a range of psychological problems and have the lowest level of mental health among the three subtypes. This subtype comprises 87 students, representing 5.81% of the total sample.

Taken together, these findings highlight the heterogeneity of mental health status among college freshmen and underscore the importance of tailored interventions for promoting mental health in this population.

Table 3 Average Latent Class Probabilities for Most Likely Latent Class Membership (Row) by Latent Profile (Column)

Class	C1 (%)	C2 (%)	C3 (%)
C1	0.974	0.024	0.002
C2	0.009	0.991	0.000
C3	0.002	0.000	0.998

Notes: C1 = Distress Group; C2 = Health Group; C3 = Risk Group.

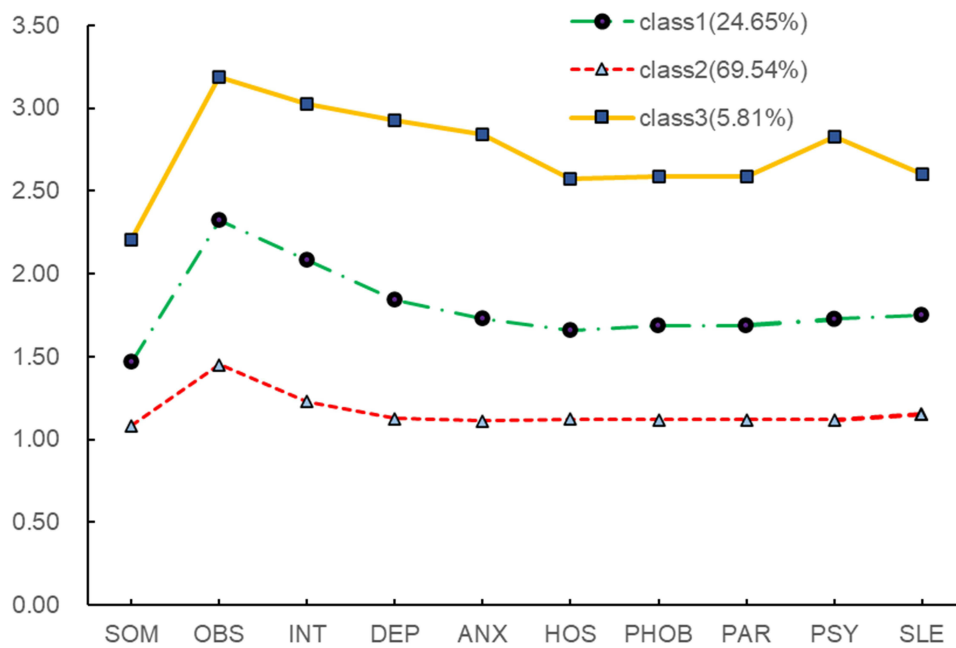


Figure 1 Latent profile indicator mean values for the three-profile solution.

Notes: class1 = Distress Group; class2 = Health Group; class3 = Risk Group.

Abbreviations: SOM, Somatization; OBS, Obsessive-compulsive; INT, Interpersonal sensitivity; DEP, Depression; ANX, Anxiety; HOS, Hostility; PHOB, Phobic anxiety; PAR, Paranoid ideation; PSY, Psychoticism; SLE, Sleep difficulties.

Multiple Comparisons of College Freshmen with Different Mental Health Latent Profiles

We conducted multiple comparisons of the three subtypes to assess the heterogeneity of mental health status among college freshmen across the identified latent profile models. The results of these comparisons are presented in Table 4.

Notably, students in the Distress Group exhibit significantly higher scores than those in the Health Group, but significantly lower scores than those in the Risk Group across all 10 dimensions of mental health. Furthermore, students in the Risk Group scored significantly higher on all 10 dimensions of mental health compared to students in the Health Group and the Distress Group.

Table 4 Comparison of Differences in College Freshmen Across Latent Profiles of Mental Health

	Distress Group (C1, n=369)	Health Group (C2, n=1041)	Risk Group (C3, n=87)	F Statistic	η^2	Post-Hoc Comparisons
SOM	1.47±0.37	1.08±0.14	2.20±0.55	983.86***	0.57	C2<C1<C3
OBS	2.33±0.40	1.45±0.39	3.19±0.50	1228.95***	0.62	C2<C1<C3
INT	2.08±0.40	1.23±0.39	3.03±0.50	1694.19***	0.69	C2<C1<C3
DEP	1.84±0.39	1.13±0.18	2.93±0.56	2278.96***	0.75	C2<C1<C3
ANX	1.73±0.37	1.11±0.16	2.84±0.59	2120.11***	0.74	C2<C1<C3
HOS	1.66±0.41	1.12±0.18	2.58±0.67	1248.60***	0.63	C2<C1<C3
PHOB	1.69±0.50	1.12±0.22	2.58±0.82	861.39***	0.54	C2<C1<C3
PAR	1.69±0.37	1.12±0.18	2.58±0.61	1457.06***	0.66	C2<C1<C3
PSY	1.73±0.44	1.12±0.19	2.83±0.60	1582.59***	0.68	C2<C1<C3
SLE	1.75±0.50	1.15±0.25	2.60±0.65	920.05***	0.55	C2<C1<C3

Notes: *** $p < 0.001$.

Abbreviations: SOM, Somatization; OBS, Obsessive-compulsive; INT, Interpersonal sensitivity; DEP, Depression; ANX, Anxiety; HOS, Hostility; PHOB, Phobic anxiety; PAR, Paranoid ideation; PSY, Psychoticism; SLE, Sleep difficulties.

The above findings support the efficacy of the latent classification approach in distinguishing between different mental health profiles among college freshmen. These results also suggest that targeted interventions may be needed to address the distinct mental health needs of each subtype, particularly among students in the Risk Group.

Analysis of Demographic Variables Associated with Different Latent Profiles of Mental Health Among College Freshmen

We sought to examine the demographic characteristics associated with different subtypes of mental health among college freshmen in light of the findings from the latent profile analysis. We conducted a multinomial logistic regression analysis, with the three subtype classifications from the latent profile analysis as the dependent variables, and with gender (with female as the reference category), ethnicity (with ethnic minority as the reference category), and family economic status (with self-evaluation of good economic status as the reference category) as independent variables. We obtained the odd ratio (*OR*) coefficient, which reflects the strength of the effect of different demographic variables on college freshmen's mental health subtypes. The results of the multinomial logistic regression analysis are presented in Table 5.

Compared to the Health Group (C2), the *OR* coefficient results indicated that gender and family economic status significantly influenced the distribution of mental health subtypes among college freshmen, while ethnicity did not. Specifically, male students were more likely to exhibit mental health problems than female students in both the Distress Group (C1) and the Risk Group (C3). Furthermore, students who self-evaluated their family economic status as poor or medium were more likely to display mental health problems than those who self-evaluated their family economic status as good, in both the Distress Group and the Risk Group.

Discussion

Latent Categorical Characteristics and Heterogeneity of College Freshmen's Mental Health

We utilized latent profile analysis to explore the distinct characteristics of mental health among college freshmen. Our results revealed three qualitatively different categories of mental health that correspond to college freshmen: the Health Group (C2), the Distress Group (C1), and the Risk Group (C3).

The Health Group (C2) accounted for the largest proportion of the total sample (69.54%). College freshmen in this group exhibited good mental health, although they may experience normal psychological fluctuations such as a bad mood with obvious triggers. However, the mean scores of all dimensions of mental health in this group were significantly lower than the other two categories.

The Distress Group (C1) accounted for the middle proportion of the total sample (24.65%). College freshmen in this group exhibited mental health problems that were between the Health Group and the Risk Group. They may experience physical discomfort, meaningless thoughts, impulses, and behaviors, and distressing emotions and states of mind, although these problems do not occur frequently.

Table 5 Results of the Multinomial Logistic Regression Predicting Latent Profile Membership

		Distress Group (C1)			Risk Group (C3)		
		<i>P</i>	<i>OR</i>	<i>CI</i> (95%)	<i>P</i>	<i>OR</i>	<i>CI</i> (95%)
Gender	Female	0.04	0.68	0.61–0.86	0.00	0.35	0.21–0.60
	Male		1.00			1.00	
Ethnicity	The Han majority	0.85	1.06	0.58–1.93	0.45	1.75	0.42–7.39
	Ethnic minorities		1.00			1.00	
Family economic situation	Poor	0.00	2.56	1.48–4.35	0.00	3.01	1.52–7.99
	Medium	0.00	2.02	1.03–3.02	0.00	2.13	1.21–3.88
	Good		1.00			1.00	

Abbreviations: *OR*, Odds Ratio; *CI*, Confidence Interval.

The Risk Group (C3) accounted for the least percentage of the total sample (5.81%). The college freshmen in this group exhibited adverse reactions on all dimensions of mental health and had major problems with mental health. They may experience physical discomfort, more obvious obsessive-compulsive symptoms, certain interpersonal discomfort, and low self-esteem. Previous studies^{60,61} have conducted latent profile analysis on a range of indicators related to psychological health among university students, such as depression, anxiety, and psychological behavior. The results indicated that students in the psychological health group had the highest proportion, while those in the psychological risk group had the lowest. The findings of our study validate these results and provide further support for the notion that the vast majority of university students enjoy good psychological health, with only a small minority experiencing challenges in this domain.

Post-hoc pairwise comparison results showed that the shape of each dimension level was consistent within each subtype in trend. Furthermore, the three subtypes of mental health differed significantly from each other, with the mean scores of mental health dimensions in the Risk Group being higher than those in the Distress Group, and the mental health dimensions in the Distress Group being significantly higher than those in the Health Group. These findings confirm the presence of a heterogeneous category of mental health among college freshmen.

To sum up, our LPA analysis identified three distinct categories of mental health among college freshmen, with varying degrees of problems and severity. These findings can inform the development of targeted interventions and support for college students' mental health needs.

Effects of Demographic Variables and Family Economic Status on Latent Classes of College Freshmen's Mental Health

Our study further investigated the possible effects of demographic variables and family economic status on the latent classes of college freshmen's mental health identified through LPA. The results indicate that mental health subtypes differ significantly by gender, but not by ethnicity. Females are found to have a lower risk of mental health problems than males, which is consistent with previous research as discussed in Song et al⁶² For a long time, the gender differences in the mental health of college students have been the focus of relevant research. Gender differences in the mental health of college students have long been a focus of relevant research. However, there is currently no consensus on the gender differences in the mental health of college freshmen. Some studies have found that female students are more likely to experience emotional and anxiety-related mental health problems than male students.^{63,64} However, other studies argue that there are no significant differences in psychological problems between male and female students⁶⁵ Similarly, a study by Gao et al⁶⁶ found no significant gender differences in the average levels of depression and stress among college freshmen. Our findings are inconsistent with the literature mentioned above. It is speculated that this finding is attributed to the fact that females mature earlier physiologically and psychologically than males and live a relatively simple life on campus, which could contribute to better mental health. In contrast, male students may carry excessive parental or social expectations and have difficulty seeking help or releasing their emotions, potentially leading to lower levels of mental health. Additionally, traditional gender self-concepts can impact attitudes and behaviors toward life experiences. Feminine traits have been characterized by loyalty, humility, and emotional expressiveness,⁶⁷ while masculine traits exhibit aggression and independence.⁶⁸ These traits can have implications for an individual's psychological health.

There are no differences found in the mental health subtypes of college freshmen based on ethnicity, which differs from previous studies as in Liu et al.⁶⁹ This may be attributed to several factors. First, the Chinese university's initiatives to foster an inclusive and integrated campus environment for students of all backgrounds could contribute to a greater sense of belonging and well-being among minority students. In addition, the increased representation and visibility of minority students on campus compared to previous generations may lead to stronger social support networks. Finally, the similar age and life stage of freshmen across ethnic groups, as they transition to university life, could outweigh any differences in experience. Our findings highlight the importance of continuing to promote inclusivity, integration, and mental health support for students of all ethnic backgrounds.

In terms of family economic status, the study finds that college freshmen from lower economic backgrounds have lower levels of mental health. This is consistent with previous research^{70,71} and can be explained by family investment

theory, which suggests that parents with higher socioeconomic status have more resources to provide high-quality material and emotional support, adopt positive parenting styles, and create a harmonious family environment that promotes positive emotions and good psychological health. In contrast, college freshmen from economically disadvantaged families may face higher economic stress during their growth process, which can increase their risk for mental health problems such as depression, anxiety, and interpersonal sensitivity.^{72,73} Moreover, students from families with lower economic status typically receive less family support, and their parents may experience behavioral or emotional problems due to their disadvantaged economic position, leading to increased conflict between family members.⁷⁴ Some parents may have low income and need to work long hours, leaving them with insufficient attention, caring, and understanding for their children, resulting in increased psychosocial distress among the children.⁷⁵

Implications for College Freshmen's Mental Health Education

The present study reveals that there exists significant heterogeneity within the mental health of college freshmen, and that different subtypes of mental health can be differentiated based on gender and family economic status. Our findings imply that a person-centered approach to exploring the characteristics of different subtypes of college freshmen can facilitate more accurate identification and differentiation of mental health subgroups, which can provide a scientific basis for personalized psychological counseling and intervention. Taking educators' stance, it is encouraged to focus on cultivating correct self-understanding, promoting subjective socioeconomic status and self-esteem, and positively affirming students to reduce the likelihood of psychological problems. Taking college freshmen's stance, the transition to college is a potentially stressful event, which may result in discomfort and psychological problems among them. Therefore, it is essential for universities and educators to collaborate to help students cope positively with stress and adapt to college life as soon as possible.

Limitations and Future Directions

This study has some limitations that should be addressed in future research. Firstly, the study sample consisted only of college freshmen from one university in eastern China. To enhance the coverage and representativeness of the sample, future studies could expand the scope to include participants from multiple universities in various cities. Secondly, while this study provides valuable insights into the mental health status of college freshmen, further investigation is required to generalize our findings to upper-year students to gain a more comprehensive understanding of mental health among all groups of college students. Thirdly, this study only examined the influence of demographics and family economic status on mental health classification among college freshmen, and future research should investigate other family factors such as family structure to identify additional factors that influence mental health classification and to develop targeted preventive measures and intervention programs for college freshmen with psychological problems.

Conclusion

In conclusion, this study contributes to our understanding of the relationship between the mental health of college freshmen and their families' economic status. Our empirical findings reveal significant heterogeneity in the mental health of college freshmen, which can be classified into three latent groups: Psychological Health Group, Psychological Distress Group, and Psychological Risk Group. Gender and family economic status were found to significantly influence the latent classifications of college freshmen's mental health, with female students exhibiting better mental health than their male counterparts. Moreover, students with lower self-evaluations of their family's economic status exhibited lower levels of mental health.

Freshmen in colleges and universities are a special group who have just transitioned from high school life to an entirely new university environment. In this process, some students may experience psychological health issues. If unaddressed, these problems may evolve into mental illnesses, severely impacting students' academics and well-being. Therefore, based on this study's conclusions and practical experience, we propose three intervention strategies: (1) For freshmen in the Psychological Health Group, we will facilitate in-depth peer support and daily assistance. First, we will fully engage classmates to integrate these students into academic and extracurricular activities, enhancing their social skills and alleviating loneliness and anxiety. Second, we will leverage peer support to guide students through any

emerging psychological confusion, such as via mutual aid groups and counseling to share experiences, garner support, and foster encouragement. These measures aim to maintain mental health. (2) For freshmen in the Psychological Distress Group, counselors will provide personalized counseling, assess symptoms, and collaborate on solutions. We will also engage peers to integrate these students into academic and extracurricular activities and guide them through emerging psychological issues. These aims to build confidence, resilience, and alleviate burden. (3) For freshmen in the Psychological Risk Group, counselors will immediately refer them for comprehensive psychological evaluation and prompt intervention by mental health professionals, with treatment at psychiatric facilities for severe cases and regular counseling for moderate cases. This aims to alleviate symptoms by early detection and intervention. In summary, these personalized strategies leverage peer support, counseling, and psychological services to help freshmen adapt to university life and maintain mental health. This was tested.

The significance of this study lies in its provision of a new perspective on mental health among college freshmen and its useful recommendations for colleges and educational administrators. These findings have important implications for the development of targeted interventions and preventative measures to promote the mental health and well-being of college freshmen. Effective interventions that cater to the unique needs and challenges of college freshmen can be developed by identifying the factors that affect their mental health.

In summary, this study has shed new light on the mental health of college freshmen and provided valuable insights for educators, policymakers, and mental health professionals. Our findings suggest that it is essential to consider the role of family economic status and gender in promoting the mental health and well-being of college freshmen. Future research in this area should continue to explore the complex relationships between these factors and mental health outcomes to develop more comprehensive and effective interventions.

Data Sharing Statement

The datasets in the study are available from the corresponding author on reasonable request. Please contact djqzafu@126.com.

Ethics Statement

This study was approved by the Ethics Board of the Mental Health Education Center at Zhejiang A&F University, China (Ethical Committee Number ZAFU2022/0915-1). Informed consent from participants was required in accordance with national legislation and institutional requirements.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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