International Journal of
Mental Health Promotion

Tech Science Press

http://doi.org/10.32604/ijmhp.2026.076721

ARTICLE

Anxiety and Depression among High School Students: Roles of Psychological Resilience and Subjective Well-Being

Guangdong Zhou[1,2], Qing Zhang[1] and Meishuo Yu[3,*]

[1]Faculty of Psychology, Tianjin Normal University, Tianjin, China
[2]Shanghai Key Laboratory of Mental Health and Psychological Crisis Intervention, School of Psychology and Cognitive Science, East China Normal University, Shanghai, China
[3]School of Psychology, Capital Normal University, Beijing, China
*Corresponding Author: Meishuo Yu. Email: yumeishuo0909@163.com

Received: 25 November 2025; Accepted: 12 January 2026; Published: 28 April 2026

ABSTRACT: Background: Adolescence is a critical period for mental health development, during which individuals may experience emotional challenges such as anxiety and depression. However, the patterns of how these symptoms develop and change over time in high school students, as well as the factors that influence these patterns, remain unclear. This study aims to identify distinct anxiety-depression symptom profiles and their transitions over time, while examining the roles of gender, subjective well-being, and psychological resilience in shaping these profiles. **Methods:** Two-wave longitudinal questionnaire data were collected from 913 high school students (57% female) in Shandong Province, China, between March and September 2022. Latent profile and latent transition analysis were used to examine anxiety-depression profiles and their transitions. Multinomial logistic regression was further conducted to examine the roles of gender, subjective well-being, and psychological resilience in predicting profile membership and transitions. **Results:** Four distinct anxiety-depression profiles were identified: normal (48%–52%), mild (20%–22%), moderate (24%–26%), and severe (4%). The normal group exhibited the greatest stability (70%), whereas the severe group showed the highest level of instability (30%). The overall level of anxiety and depression symptoms among females was higher than that of males, but males were more prone to severe anxiety and depression groups. Higher subjective well-being and psychological resilience were significantly associated with membership in lower symptom groups or transitions toward them. **Conclusion:** These findings highlight the importance of subjective well-being and psychological resilience as protective factors in the development of anxiety and depression symptoms among high school students. Interventions that target these psychological resources may help reduce the risk of more severe symptom trajectories during adolescence.

KEYWORDS: Anxiety; depression; psychological resilience; subjective well-being; latent profile analysis; latent transition analysis

1 Introduction

High school years represent a critical period in psychological development, during which anxiety and depression symptoms are particularly prevalent, especially among girls [1]. A meta-analysis by Yu et al. examining high school students in mainland China from 2010 to 2020 reported that depression had the highest prevalence among mental health problems, followed by anxiety [2]. The 2020 China National Mental Health Development Report also found that 24.6% of adolescents in China exhibited symptoms of depression [3]. Given the substantial mental health challenges faced by adolescents, there is a clear need to

better understand the development and dynamics of anxiety and depression symptoms, as well as to identify effective interventions. In this context, interventions grounded in positive psychology, such as enhancing subjective well-being and psychological resilience, have shown promise in mitigating these symptoms.

1.1 Co-Occurrence of Anxiety and Depression Symptoms

Anxiety and depression symptoms frequently co-occur, particularly among adolescents [4]. A longitudinal study by Long et al. demonstrated that the co-occurrence of anxiety and depression follows a cascading model, suggesting a bidirectional relationship in which the two symptoms influence each other over time [5]. This interrelationship may arise from shared psychological and biological vulnerability factors. For instance, individuals with anxiety often engage in avoidance behaviors that reduce positive life experiences, thereby increasing the risk of depression. Conversely, the low motivation and feelings of helplessness associated with depression can heighten anxiety, especially in new situations, thereby exacerbating the cycle of avoidance [6]. Additionally, anxiety and depression share overlapping physiological characteristics, such as heightened neuroticism and increased stress responses, including fluctuations in cortisol levels, further illustrating their interwoven nature [7].

1.2 Types of Anxiety and Depression Symptoms

Adolescents with anxiety and depression symptoms exhibit considerable heterogeneity, presenting with different combinations and severities of symptoms. Traditional diagnostic approaches, which classify anxiety and depression as separate entities, often do not fully reflect the complexity of their manifestation during adolescence. Researchers have proposed various classifications, including the co-occurrence of anxiety-related and depression-related disorders, as well as simultaneous symptoms of both [8]. However, these categorical approaches often fail to address the nuanced variations across individuals.

Latent profile analysis (LPA) has emerged as an effective person–centered statistical approach to better capture this heterogeneity. By estimating the likelihood of individuals belonging to distinct latent groups, LPA allows for a more comprehensive understanding of the varying risk levels within adolescent populations regarding anxiety and depression [9]. Previous studies using LPA have identified different profiles of anxiety and depression among adolescents, commonly characterized as low, moderate, and high symptom groups [10], and have further demonstrated that these profiles may vary across specific contexts, such as post–disaster environments [11].

1.3 Changes in Anxiety and Depression Symptoms

Cross-sectional studies provide valuable insights into the co-occurrence of anxiety and depression symptoms but fail to capture the dynamic changes individuals experience over time. In contrast, longitudinal studies track symptom changes across multiple time points, offering a deeper understanding of the dynamic associations and potential causal mechanisms.

Although previous longitudinal studies have demonstrated a robust bidirectional relationship between anxiety and depression symptoms [5], most studies adopt a variable-centered perspective, examining the impact of one symptom on the other in isolation. Such approaches may obscure heterogeneity in symptom severity and overlook individual–level transitions across different symptom states.

Latent transition analysis (LTA) not only benefits from the longitudinal design, allowing for the tracking of dynamic processes over time, but also adopts a person-centered approach, focusing on individual symptom transitions and state evolution across multiple time points [12]. Compared with traditional variable-centered

methods, LTA provides deeper insights into both the stability and variability of anxiety–depression symptom patterns.

Previous studies using latent transition analysis have categorized the subtypes of anxiety and depression symptoms and explored their transition patterns. The results show that adolescents in the high anxiety-depression group exhibit lower stability, meaning these individuals are more likely to experience fluctuations in symptoms and recovery, rather than remaining in a state of distress [13]. This finding further supports the dynamic nature of anxiety and depression symptoms, indicating that these symptoms are not irreversible but can change and improve over time.

1.4 Factors Influencing Anxiety and Depression Symptoms

Anxiety and depression symptoms in adolescents are influenced by various demographic and psychological factors, with gender differences being particularly significant. Studies have shown that adolescent girls generally exhibit higher levels of anxiety and depression symptoms [14]. A cross-sectional study further supports this, finding that high school girls are more likely than their boy counterparts to experience anxiety and depression [15]. Additionally, a longitudinal cohort study in Australia confirms that adolescent girls tend to experience more severe symptoms of anxiety and depression [16]. These findings suggest that gender plays a critical role in adolescent mental health, with girl adolescents being more susceptible to emotional distress and psychological challenges.

The development and fluctuation of these symptoms are not only linked to gender but also to individual psychological resources. Subjective well-being has been widely identified as a key protective factor, with higher levels associated with lower anxiety and depression symptoms among adolescents [17]. A significant negative correlation exists between anxiety and subjective well-being, which has been validated both in everyday contexts and during large-scale public health crises [18]. Similarly, depressive symptoms also show a significant negative correlation with subjective well-being [19]. Moreover, a meta-analysis demonstrated that enhancing students' subjective well-being can alleviate depressive symptoms [20]. According to the Broaden-and-Build Theory [21], positive emotions broaden individuals' thought-action repertoires and help them build lasting psychological resources. These resources protect individuals from anxiety and depression by promoting adaptive coping and emotional balance.

Psychological resilience refers to an individual's ability to maintain or quickly restore psychological functioning when facing adversity, stress, or trauma [22]. It serves as a crucial protective role in helping adolescents cope with stress and emotional challenges [23]. Research has shown a significant negative correlation between psychological resilience and symptoms of anxiety and depression [24]. Specifically, individuals with low psychological resilience are more vulnerable to mental health problems, while those with high resilience are better equipped to handle stress, especially when faced with life changes and uncertainties about the future [25]. In addition to alleviating emotional and life stress, psychological resilience has also been found to effectively reduce academic anxiety experienced by adolescents during their studies [26]. Therefore, psychological resilience, as a positive psychological resource, helps adolescents maintain mental health under multiple pressures.

Although existing research on adolescent anxiety and depression has established their high comorbidity, most studies have relied on variable-centered approaches, which limit the ability to capture individual-level heterogeneity in symptom configurations and their dynamic changes over time. This limitation is particularly evident during the high school period, a critical developmental stage characterized by the convergence of intensified academic pressure and elevated psychological risk, where longitudinal evidence regarding latent anxiety-depression symptom profiles and their transition patterns remains insufficient.

Moreover, although subjective well-being and psychological resilience are widely regarded as important protective psychological resources, there is still a lack of empirical evidence based on longitudinal, person-centered models clarifying whether and how these factors influence the stability and transitions of different symptom profiles.

Accordingly, the present study aims to identify latent anxiety-depression symptom profiles and examine their transition patterns over time among Chinese high school students using a person-centered, longitudinal approach. Specifically, this study seeks to (1) identify distinct latent profiles of anxiety-depression symptoms, (2) examine the stability and transitions of these profiles across two time points, and (3) investigate whether gender, subjective well-being, and psychological resilience predict profile membership and transitions. To achieve these aims, latent profile analysis and latent transition analysis were employed, thereby addressing existing gaps from both a methodological and developmental perspective.

2 Methods

2.1 Participants

The participants were students from a senior high school in Qufu, Shandong Province, China. A snowball sampling approach was used within the school setting. No formal a priori sample size estimation was conducted prior to the commencement of the study; instead, a large initial sample was recruited to maximize statistical power and to account for potential attrition.

The first wave of data collection was in March 2022 (T1), yielding a total of 1968 valid responses, including 867 males (44%) and 1101 females (56%). The second wave was in September 2022 (T2), with 3133 valid responses collected, including 1446 males (46%) and 1687 females (54%). Due to potential factors such as semester transitions and changes in class composition, attrition occurred between the two waves of longitudinal follow-up. In addition, responses with excessively short or excessively long completion times were excluded. Finally, a total of 913 students participated in both waves, including 397 males (43%) and 516 females (57%).

The survey was administered online using the questionnaire platform WJX.cn. Class teachers distributed the survey link to parents' WeChat groups during weekends. The survey instructions clearly explained the purpose of the study and the principles of confidentiality. Ethical approval was obtained from the Ethics Committee of Tianjin Normal University (No. APB20190313). All measurements involving adolescents were conducted after obtaining informed consent from the participants themselves and their guardians/parents.

2.2 Measures

2.2.1 Generalized Anxiety Disorder Scale-7

The 7-item GAD-7 measures students' anxiety symptoms on a 0–3 scale (0 = not at all, 3 = nearly every day), with higher scores indicating greater anxiety [27]. Severity is commonly categorized as: Minimal anxiety (0–4), Mild anxiety (5–9), Moderate anxiety (10–14), and Severe anxiety (15–21) [27]. The scale showed excellent reliability (Cronbach's α = 0.93 at T1 and T2).

2.2.2 Patient Health Questionnaire-9

The 9-item PHQ-9 assesses depressive symptoms using the same 0–3 scale, with higher scores indicating more severe symptoms [28]. Severity is commonly categorized as: Minimal (0–4), Mild (5–9), Moderate

(10–14), Moderately severe (15–19), and Severe (20–27) [28]. The study revealed that the scale had a Cronbach's α coefficient of 0.90 at both T1 and T2, suggesting strong reliability.

2.2.3 Oxford Happiness Questionnaire

The Oxford Happiness Questionnaire (OHQ), developed by Hills and Argyle, was used to assess students' subjective well-being [29]. It consists of 8 items rated on a six-point Likert scale from 1 (strongly agree) to 6 (strongly disagree), with higher total scores indicating greater happiness. In this study, the scale demonstrated good reliability (Cronbach's $\alpha = 0.78$).

2.2.4 Connor–Davidson Resilience Scale-10

The Connor–Davidson Resilience Scale-10 (CD-RISC-10), developed by Campbell-Sills and Stein, was used to measure students' psychological resilience [30]. It includes 10 items rated on a five-point Likert scale from 1 (never) to 5 (always), with higher total scores indicating greater resilience. The scale demonstrated excellent reliability, with a Cronbach's α coefficient of 0.96 in the present study.

2.3 Statistical Analysis

First, descriptive statistics, independent samples *t*-test, and Pearson correlation analysis were calculated using SPSS 24.0 (IBM Corp., Armonk, NY, USA).

The second step involved using Mplus 8.0 (Muthén & Muthén, Los Angeles, CA, USA) to conduct latent profile analysis to identify distinct anxiety-depression symptom groups. The latent profile model indexes include Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), adjusted Bayesian Information Criterion (aBIC), Entropy, Lo-Mendell-Rubin (LMR), and Bootstrap Likelihood Ratio Test (BLRT). The lower the AIC, BIC, and aBIC, the higher the fitting degree of the model [31]. Entropy represents the classification accuracy of the model. The closer the value is to 1, the better the accuracy is. An entropy value above 0.80 is generally considered indicative of good class separation [32]. In addition, if the *p*-values of LMR and BLRT are significant, it indicates that the *k* class model is superior to the *k*-1 class model.

After identifying the optimal profiles, analysis of variance (ANOVA) was performed to test for differences between profiles on external variables. Following these group comparisons, we conducted latent transition analysis using Mplus 8.0 to estimate transition probabilities between latent profiles across time points, in order to examine the stability and change of anxiety-depression symptom profiles over time. Higher probabilities along the diagonal indicate greater profile stability.

Finally, within the LTA framework, gender, subjective well-being, and psychological resilience were included as covariates to predict latent profile membership and transitions between profiles. The effects of covariates were reported as odds ratios (ORs), with ORs greater than 1 indicating an increased likelihood of belonging to or transitioning to a specific profile, and ORs less than 1 indicating a decreased likelihood, relative to the reference category.

The missing data were addressed via the maximum likelihood estimation (MLE) approach.

3 Results

3.1 Descriptive Statistics and Gender Differences

Independent samples *t*-test results (Table 1) revealed significant gender differences. Compared with males, females reported higher levels of anxiety ($t(911)_{T1} = -3.84$, $p < 0.001$; $t(911)_{T2} = -3.42$, $p = 0.001$) and depression symptoms ($t(911)_{T1} = -2.86$, $p = 0.004$; $t(911)_{T2} = -2.75$, $p = 0.006$) at both T1 and T2.

Additionally, males showed significantly higher scores in psychological resilience compared to females ($t(911) = 4.96$, $p < 0.001$).

Table 1: Descriptive statistics and gender difference of research variables.

Variables	Total (Mean ± SD)	Male (Mean ± SD)	Female (Mean ± SD)	*t*	*d*
T1 anxiety symptoms	3.36 ± 3.84	2.81 ± 3.75	3.79 ± 3.86	−3.84***	0.26
T1 depression symptoms	4.13 ± 4.47	3.65 ± 4.56	4.50 ± 4.36	−2.86**	0.19
T2 anxiety symptoms	3.32 ± 3.87	2.82 ± 3.84	3.70 ± 3.84	−3.42**	0.23
T2 depression symptoms	4.31 ± 4.61	3.83 ± 4.61	4.67 ± 4.58	−2.75**	0.18
subjective well–being	35.49 ± 7.10	35.45 ± 7.01	35.52 ± 7.18	−0.15	
psychological resilience	37.66 ± 8.47	39.23 ± 8.31	36.46 ± 8.40	4.96***	0.33

Note: **$p < 0.01$, ***$p < 0.001$.

3.2 Correlations between All Variables

The results of the correlation analysis are presented in Table 2. Anxiety and depression symptoms at T1 ($r = 0.78$, $p < 0.001$) and T2 ($r = 0.83$, $p < 0.001$) were significantly and positively correlated. Moreover, anxiety and depression symptoms at T1 were positively associated with those at T2 ($r = 0.41$, $p < 0.001$; $r = 0.45$, $p < 0.001$), indicating temporal stability. Subjective well-being ($r = -0.61$~-0.31, ps < 0.001) and psychological resilience ($r = -0.58$~-0.31, ps < 0.001) exhibited significant negative correlations with anxiety and depression symptoms at both T1 and T2.

Table 2: Correlation coefficients of all study variables.

Variable	1	2	3	4	5	6
1. T1 anxiety symptoms	-					
2. T1 depression symptoms	0.78***	-				
3. T2 anxiety symptoms	0.41***	0.39***	-			
4. T2 depression symptoms	0.41***	0.45***	0.83***	-		
5. subjective well-being	−0.31***	−0.38***	−0.56***	−0.61***	-	
6. psychological resilience	−0.31***	−0.36***	−0.54***	−0.58***	0.68***	-

Note: ***$p < 0.001$.

3.3 Prevalence Rates of Anxiety and Depression Symptoms

According to the scoring rules of the Generalized Anxiety Disorder 7-item scale (GAD-7) and the Patient Health Questionnaire (PHQ-9) [27,28], the prevalence rates of anxiety and depression symptoms at T1 by gender and for the overall sample are reported in Tables 3 and 4. At T1, the prevalence rates of anxiety were 26.7% in males (mild 21.4%, moderate 3.8%, severe 1.5%) and 37.2% in females (mild 31.2%, moderate 3.6%, severe 2.3%). The prevalence rates of depression were 34.3% in males (mild 25.4%, moderate 5.5%, moderately severe 2.3%, and severe 1.0%) and 43.2% in females (mild 31.4%, moderate 9.3%, moderately severe 1.9%, and severe 0.6%).

Table 3: Prevalence rate of anxiety symptoms at T1 time point.

Group	Normal	Mild Anxiety	Moderate Anxiety	Severe Anxiety
Male (n = 397)	291 (73.3%)	85 (21.4%)	15 (3.8%)	6 (1.5%)
Female (n = 516)	324 (62.8%)	161 (31.2%)	19 (3.6%)	12 (2.3%)
Total (N = 913)	615 (67.4%)	246 (26.9%)	34 (3.7%)	18 (2.0%)

Table 4: Prevalence rate of depression symptoms at T1 time point.

Group	Normal	Mild Depression	Moderate Depression	Moderately Severe Depression	Severe Depression
Male (n = 397)	261 (65.7%)	101 (25.4%)	22 (5.5%)	9 (2.3%)	4 (1.0%)
Female (n = 516)	293 (56.8%)	162 (31.4%)	48 (9.3%)	10 (1.9%)	3 (0.6%)
Total (N = 913)	554 (60.7%)	263 (28.8%)	70 (7.7%)	19 (2.1%)	7 (0.8%)

3.4 Latent Profile Analysis of Anxiety and Depression Symptoms

Using the GAD-7 and PHQ-9 items as indicators, latent profile analysis exploring 1 to 5 classes were conducted for T1 and T2 (Table 5). Although the three-class model showed the highest entropy, it was not selected because adolescents with mild and moderate symptom levels were combined into a single class, obscuring meaningful gradations in anxiety–depression severity. For the four-class model, the LMR and BLRT tests were marginal or non-significant; nevertheless, decreases in AIC, BIC, and aBIC values relative to the three-class solution indicated improved overall model fit. More importantly, the four-class model yielded clearly interpretable profiles (normal, low, moderate, and severe) and demonstrated a consistent profile structure across T1 and T2. In contrast, the five-class model further subdivided the severe symptom group; however, the two additional classes exhibited highly similar profile shapes, providing limited incremental interpretability. Therefore, considering the statistical fit, practical significance, and classification meaningfulness, the four-class model was selected as the optimal model. Table 6 shows the profile probabilities for Classes 1–4.

One-way ANOVAs were conducted to examine differences among the four latent profiles in anxiety–depression symptom levels at T1 and T2 [33]. Significant group differences were found at both time points (Table 7). At both T1 and T2, symptom scores increased progressively across profiles, with Class 1 showing the lowest levels, followed by Class 3 and Class 2, and Class 4 showing the highest levels. Post hoc analysis indicated the same ordered pattern at both time points (C4 > C2 > C3 > C1). Accordingly, Class 1 was labeled as the normal group, Class 3 as the low symptom group, Class 2 as the moderate symptom group, and Class 4 as the high symptom group. The item-level score patterns of each profile are illustrated in Figs. 1 and 2.

Table 5: Fit indices for one-to-five-profile models of latent profile analysis.

Time	Profile	AIC	BIC	aBIC	Entropy	LMR (*p*)	BLRT (*p*)
T1	1	29,113.40	29,267.54	29,165.91	N/A	N/A	N/A
	2	23,170.00	23,406.0	23,250.40	0.96	<0.001	<0.001
	3	20,952.03	21,269.94	21,060.33	0.97	0.02	0.02
	4	**20,171.85**	**20,571.64**	**20,308.04**	**0.94**	**0.08**	**0.08**
	5	19,820.27	20,301.95	19,984.36	0.94	0.58	0.58
T2	1	29,448.11	29,602.25	29,500.62	N/A	N/A	N/A
	2	23,307.42	23,543.44	23,387.82	0.96	<0.01	<0.01
	3	20,879.99	21,197.89	20,988.29	0.97	0.03	0.03
	4	**20,110.38**	**20,510.17**	**20,246.57**	**0.94**	**0.57**	**0.56**
	5	19,407.91	19,889.58	19,572.00	0.95	0.21	0.21

Note: Values in bold represent the profile chosen as optimal. Abbreviations: AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; aBIC, Adjusted Bayesian Information Criterion; LMR, Lo-Mendell-Rubin; BLRT, Bootstrap Likelihood Ratio Test; N/A, Not Applicable.

Table 6: Average latent class probabilities for most likely latent class membership.

Time	Class	Class 1	Class 2	Class 3	Class 4
T1	Class 1 (n = 442)	**0.98**	0	0.02	0
	Class 2 (n = 194)	0	**0.98**	0.02	0
	Class 3 (n = 241)	0.05	0.04	**0.91**	0
	Class 4 (n = 36)	0	<0.01	0	**0.99**
T2	Class 1 (n = 476)	**0.98**	0	0.02	0
	Class 2 (n = 185)	0	**0.96**	0.04	0
	Class 3 (n = 211)	0.03	0.03	**0.94**	0
	Class 4 (n = 41)	0	0.02	0	**0.98**

Note: Bold values indicate the highest average latent class probability for the most likely class membership.

Table 7: Descriptive statistics and group differences of each latent profile (Mean ± SD).

Time	Class 1	Class 2	Class 3	Class 4	*F*	Post-Hoc Analysis
T1	0.08 ± 0.10	1.01 ± 0.16	0.53 ± 0.15	1.89 ± 0.41	2847.41***	C4 > C2 > C3 > C1
T2	0.10 ± 0.11	1.02 ± 0.17	0.57 ± 0.13	1.92 ± 0.47	2507.36***	C4 > C2 > C3 > C1

Note: ***$p < 0.001$.

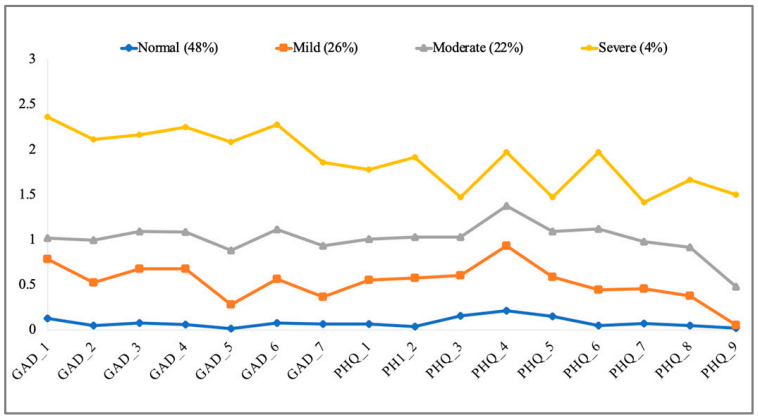

Figure 1: Each item score of the PHQ-9 and GAD-7 for the Four-class model profile plot at T1.

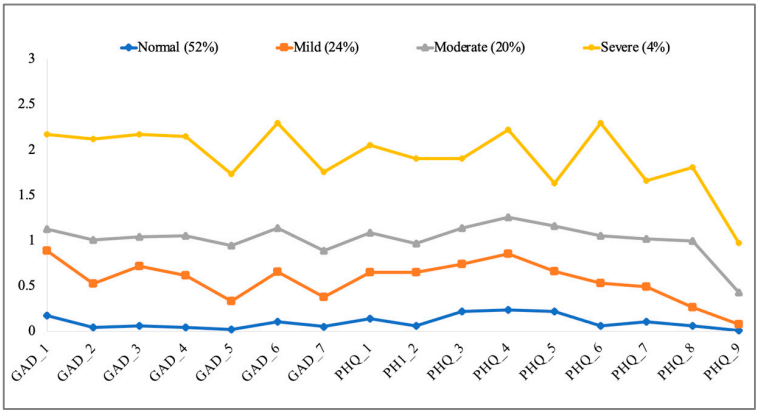

Figure 2: Each item score of the PHQ-9 and GAD-7 for the Four-class model profile plot at T2.

3.5 Latent Transition Analysis of Anxiety and Depression Symptoms

Using latent transition analysis, we compared the changes between the four latent anxiety and depression classes from T1 to T2, as shown in Table 8. In the transition matrix, the values on the diagonal represent the probability of individuals remaining stable in their original latent class from T1 to T2.

Specifically, the normal group presented the greatest degree of stability (70%), with 17% transitioning to mild anxiety, 11% transitioning to moderate anxiety, and 2% transitioning to severe anxiety-depression. The moderate group had 50% stability, with 26% moving to normal, 20% moving to mild, and 4% moving to severe. The mild group showed 44% stability, with 39% moving to normal, 15% to moderate, and 2% to severe. The severe group had the lowest stability (30%), with 43% transitioning to moderate, 17% to normal, and 11% to mild.

Table 8: The transition matrix from T1 to T2.

T1	T2			
	Normal	Mild	Moderate	Severe
Normal group	70%	17%	11%	2%
Mild anxiety-depression group	39%	44%	15%	2%
Moderate anxiety-depression group	26%	20%	50%	4%
Severe anxiety-depression group	17%	11%	43%	30%

3.6 Factors Influencing the Stability and Transition of Latent Profiles of Anxiety and Depression Symptoms

To examine the predictors of latent profile membership at T1, a multinomial logistic regression was conducted with gender, subjective well-being, and psychological resilience as covariates, with the normal group and girls used as reference categories (as shown in Table 9). ORs indicate the likelihood of belonging to a specific latent class relative to the reference group ($p < 0.05$ for significance). The results revealed that girls were more likely to belong to the mild anxiety-depression group; lower subjective well-being increased the likelihood of being in the mild or severe group; lower psychological resilience predicted mild group membership.

Table 9: The odds ratios (ORs) of latent profile probabilities at T1 under the influence of covariates.

Predictor	Mild		Moderate		Severe	
	OR	95% CI	OR	95% CI	OR	95% CI
Gender	0.56**	[0.38, 0.84]	0.80	[0.57, 1.13]	0.59	[0.27, 1.29]
Subjective well-being	0.94**	[0.90, 0.98]	0.97	[0.94, 1.00]	0.87***	[0.81, 0.93]
Psychological resilience	0.95**	[0.92, 0.98]	0.97	[0.95, 1.00]	0.96	[0.90, 1.02]

Note: $^{**}p < 0.01$, $^{***}p < 0.001$. $R^2 = 0.26$ (cox & Snell), 0.29 (Nagelkerke), 0.13 (McFadden); Model χ^2 (12) = 270.87, $p < 0.001$.

To explore changes over time, the effects of these covariates on transitions between classes from T1 to T2 were examined (as shown in Table 10). In this analysis, ORs represent the likelihood of transitioning to a different class relative to remaining in the same class. An OR less than 1 indicates greater profile stability, whereas an OR greater than 1 indicates a higher probability of transitioning to another class. Subjective well-being and psychological resilience significantly influenced profile stability and transitions, whereas gender was not a significant predictor. Higher subjective well-being or resilience increased the likelihood of remaining in the normal or mild groups and of transitioning from the moderate or severe groups to the normal group.

Table 10: The odds ratio (OR) of transition probability under the influence of covariates.

Predictor	T1	T2			
		Normal	Mild	Moderate	Severe
Gender	Normal	-	1.11	0.61	0.54
	Mild	1.36	-	0.65	0.61
	Moderate	1.54	0.82	-	2.58
	Severe	3.51	0.62	0.63	-
Subjective well-being	Normal	-	0.94*	0.82***	0.71***
	Mild	1.03	-	0.84***	0.69***
	Moderate	1.13**	1.14**	-	0.89
	Severe	1.26*	1.20	1.02	-
Psychological resilience	Normal	-	0.89***	0.88***	0.82**
	Mild	1.07**	-	0.99	1.10
	Moderate	1.08*	0.98	-	0.96
	Severe	1.20*	1.10	1.13	-

Note: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. Gender: Females composed the reference group.

4 Discussion

This study used latent profile analysis to classify the anxiety and depression symptoms among Chinese high school students, identifying four latent classes: normal, mild anxiety-depression, moderate anxiety-depression, and severe anxiety-depression. The normal group exhibited the highest stability from T1 to T2, while the severe anxiety-depression group showed the lowest stability. Gender, subjective well-being, and psychological resilience significantly predicted both class membership and transitions between classes. Specifically, girls reported higher levels of anxiety and depression than boys, and adolescents with higher subjective well-being and psychological resilience were more likely to belong to, or move into, lower-symptom groups.

4.1 Co-Occurrence of Anxiety and Depression Symptoms

In this study, the overall prevalence rate of anxiety symptoms was 32.6%, which is slightly higher than the 26.3% reported by Yu et al. [2]. The prevalence rate for depression symptoms was 39.3%, which is generally consistent with previous research [34]. Correlation analysis showed a positive relationship between anxiety and depression issues at both T1 and T2, consistent with earlier studies [5]. Latent profile analysis further revealed a consistent overall trend in the average scores of various items within the four latent classes of anxiety and depression symptoms, indicating that higher average scores on anxiety items are associated with higher average scores on depression items. This suggests that individuals with anxiety symptoms often also exhibit depression symptoms, and vice versa. These findings validate the strong co-occurrence of anxiety and depression issues among high school students, highlighting the need for integrated mental health support.

4.2 Gender Differences in Anxiety and Depression Symptoms

This study found significant gender differences in anxiety and depression symptoms at both T1 and T2, with girls scoring significantly higher than boys in both areas, consistent with previous research [14]. This difference may be associated with emotional, genetic, and cognitive factors [35]. However, although girls score higher than boys in anxiety and depression symptoms, boys had a higher detection rate in moderate anxiety and severe depression. This indicates that although boys have lower overall scores, there may be more extreme phenomena, while girls have higher scores but fewer extreme situations. Latent

profile analysis further confirms that although girls were more likely to belong to the mild anxiety and depression group, while no significant difference were found in the moderate and severe groups. This pattern is consistent with previous findings on anxiety in children and adolescents [36], but contradicts the general view on depression problems [14]. This may be due to the shared academic and social pressures faced by high school students, as well as the impact of the pandemic, which has led to gender differences becoming less significant [37,38].

Although significant gender differences were observed at baseline, gender did not significantly predict transitions between latent comorbid anxiety-depression profiles. This finding is partly consistent with prior latent transition analysis of depressive symptoms in adolescents [39]. Previous longitudinal studies focusing only on anxiety have suggested that girls experience slower symptom remission than boys [40]; however, the present study examined comorbid anxiety–depression profiles rather than single-symptom trajectories. The strong interrelationship between anxiety and depression may therefore alter how gender influences symptom development.

Several explanations may account for the nonsignificant effect of gender on transitions between comorbid anxiety-depression profiles. First, gender may not directly influence the transition process but may have an indirect impact through psychological resources, such as resilience. Second, data collection during the COVID-19 pandemic may have equalized environmental stressors, reducing gender-specific effects. Third, only two measurement occasions within a relatively short time span may have limited the ability to detect gender-related differences in long-term developmental trajectories. Overall, these results suggest that the influence of gender on changes in comorbid anxiety–depression profiles is shaped by complex psychological mechanisms and contextual conditions.

4.3 Latent Profiles of Anxiety and Depression Symptoms in High School Students and Their Stability and Transitions

Latent profile analysis identified four groups of anxiety and depression symptoms among high school students: normal, mild, moderate, and severe. While most prior studies used low, medium, and high classifications, the present study revealed a more fine-grained four-group structure with gradually increasing symptom severity, which is consistent with earlier findings [10,11,41].

From T1 to T2, the proportion of students in the normal group increased by 4%, whereas the proportion in the mild and moderate groups decreased by 2%; the proportion in the severe group was unchanged, suggesting an overall stability. The normal group had the highest stability (70%), while the severe group showed the lowest stability (30%), similar to previous results [13]. This indicates that adolescents with severe symptoms are more likely to transition to milder groups over time. Such transitions reflect a recovery-oriented developmental trajectory [42], in which psychological maturation promotes improvements in emotional regulation and stress management, leading to symptom alleviation [43]. These results align with the Positive Youth Development framework, which highlights adolescents' potential for growth and adjustment [44].

However, transitions from the severe group occurred primarily toward the moderate group rather than directly to mild or normal profiles, indicating that recovery tends to be gradual rather than abrupt. Therefore, mental health interventions should avoid overly rapid expectations and provide sustained support to promote stepwise symptom improvement.

4.4 Factors Influencing the Latent Categories and Transition Patterns of Anxiety and Depression Symptoms in High School Students

4.4.1 Subjective Well-Being

The present study found that subjective well-being played an important role in distinguishing latent profiles of anxiety and depression symptoms and predicting transitions between these profiles over time. At both T1 and T2, subjective well-being was negatively associated with anxiety and depression, indicating that adolescents with lower subjective well-being were more likely to belong to classes characterized by elevated symptoms.

In addition to its cross-sectional associations, subjective well-being also predicted longitudinal changes. Logistic regression analysis further showed that reduced subjective well-being increased the likelihood of being classified into moderate or high symptom groups. Adolescents with higher subjective well-being demonstrated a greater tendency to remain in or transition to lower symptom groups, suggesting that positive psychological resources may buffer against the escalation of emotional difficulties. These findings are consistent with previous studies showing that subjective well-being serves as a protective factor against internalizing problems among adolescents [18,19].

Overall, these results highlight the protective function of subjective well-being in the development of anxiety and depression symptoms. Interventions aimed at enhancing adolescents' subjective well-being, such as promoting positive affect, life satisfaction, gratitude, and meaning in life, may serve as effective strategies for preventing or reducing emotional problems in high school students.

4.4.2 Psychological Resilience

The results indicate that psychological resilience serves as a protective factor against anxiety and depression. Lower resilience was associated with a higher likelihood of being classified into the mild anxiety-depression group, consistent with prior research [45]. Individuals with lower resilience tended to report heightened levels of anxiety and depression [46].

In the longitudinal follow-up from T1 to T2, it was also observed that adolescents with high levels of resilience were more likely to maintain a stable psychological state or transition to the mild symptom group. This finding further supports the growing body of evidence from longitudinal studies, which suggests that resilience can serve as a buffer, preventing the exacerbation of anxiety and depression over time. For instance, Parlikar et al.'s 11-year follow-up study found that adolescents with low resilience were more likely to experience worsening anxiety and depression symptoms as time went on [47]. This underscores the long-term significance of fostering resilience in adolescents to reduce the likelihood of mental health deterioration.

Moreover, boys demonstrated significantly greater resilience than girls at both time points, which supports earlier findings that boys tend to show higher resilience in response to major life events. This difference in resilience may partly explain the observed gender disparities in anxiety and depression levels [48].

4.5 Limitations and Future Directions

4.5.1 Limitations

First, the participants were limited to students from a high school in Qufu, Shandong, which may restrict sample representativeness. Second, high dropout rates reduce the follow-up sample and leave some classes with insufficient sizes for classification. Third, only two surveys were conducted over a short period,

limiting the accuracy of conclusions on anxiety and depression characteristics. Finally, having only two waves restricted the observation of variable changes.

4.5.2 Future Directions

First, future studies should include students from different regions and school types to improve representativeness and generalizability. Second, a larger initial sample should be reserved to address attrition and ensure a sufficient size for each category, enhancing analysis reliability. Third, longitudinal designs with multiple surveys over longer periods are needed to capture trends and improve the accuracy of conclusions. Finally, adding more measurement waves can help observe variable changes, verify result stability, and explore causal relationships.

In addition to methodological improvements, future research should further explore how subjective well-being and psychological resilience can be translated into mental health interventions for adolescents. Based on the present findings, future intervention-oriented studies may examine whether school-based programs targeting positive emotional experiences, life satisfaction, stress management, and coping skills can effectively reduce anxiety and depression symptoms among high school students. Moreover, adopting longitudinal or randomized controlled designs would help evaluate the sustainability and effectiveness of such interventions across different educational contexts.

5 Conclusions

Based on a survey of 913 high school students, this study yielded the following conclusions. First, four latent profiles of anxiety and depression were identified: normal, mild, moderate, and severe. Second, over time, the normal group showed the highest stability, while the severe group was most likely to transition, mainly to the moderate group. Third, gender, subjective well-being, and psychological resilience significantly influenced the stability and transitions of symptom profiles. Girls were more likely to belong to higher symptom groups. Higher subjective well-being and resilience predicted membership in, or transitions toward, lower-symptom groups.

Acknowledgement: Not applicable.

Funding Statement: Supported by The Research Project of Shanghai Science and Technology Commission (20dz2260300) and The Fundamental Research Funds for the Central Universities.

Author Contributions: The authors confirm contribution to the paper as follows: conceptualization, Meishuo Yu and Guangdong Zhou; methodology, Meishuo Yu; formal analysis, Meishuo Yu and Qing Zhang; investigation, Meishuo Yu; writing—original draft preparation, Meishuo Yu and Qing Zhang; writing—review and editing, Qing Zhang and Guangdong Zhou; visualization, Meishuo Yu and Qing Zhang; supervision, Guangdong Zhou; project administration, Meishuo Yu; funding acquisition, Guangdong Zhou. All authors reviewed and approved the final version of the manuscript.

Availability of Data and Materials: The data that support the findings of this study are available from the corresponding author, [Meishuo Yu], upon reasonable request.

Ethics Approval: Ethical approval was obtained from the Ethics Committee of Tianjin Normal University (No. APB20190313). All measurements involving adolescents were conducted after obtaining informed consent from the participants themselves and their guardians/parents.

Conflicts of Interest: The authors declare no conflicts of interest.

Use of Artificial Intelligence: In the course of preparing this manuscript/study, the authors utilized ChatGPT 4 for grammar correction. The authors have carefully reviewed and revised the generated output, assuming full responsibility for the content of this publication.

References

1. Hankin BL. Development of sex differences in depressive and co-occurring anxious symptoms during adolescence: descriptive trajectories and potential explanations in a multiwave prospective study. J Clin Child Adolesc Psychol. 2009;38(4):460–72. [CrossRef].
2. Yu X, Zhang Y, Yu G. Prevalence of mental health problems among senior high school students in mainland of China from 2010 to 2020: a meta-analysis. Adv Psychol Sci. 2022;30(5):978–90. [CrossRef].
3. Fu X, Zhang L, Chen X, Chen Z. Report on national mental health development in China (2019–2020). Beijing, China: Social Sciences Academic Press; 2021. (In Chinese).
4. Su Z, Yang X, Hou J, Liu S, Wang Y, Chen Z. Gender differences in the co-occurrence of anxiety and depressive symptoms among early adolescents: a network approach. J Psychiatr Res. 2024;179:300–5. [CrossRef].
5. Long EE, Young JF, Hankin BL. Temporal dynamics and longitudinal co-occurrence of depression and different anxiety syndromes in youth: evidence for reciprocal patterns in a 3-year prospective study. J Affect Disord. 2018;234:20–7. [CrossRef].
6. Demyttenaere K, Heirman E. The blurred line between anxiety and depression: hesitations on comorbidity, thresholds and hierarchy. Int Rev Psychiatry. 2020;32(5–6):455–65. [CrossRef].
7. Ter Meulen WG, Draisma S, van Hemert AM, Schoevers RA, Kupka RW, Beekman ATF, et al. Depressive and anxiety disorders in concert—a synthesis of findings on comorbidity in the NESDA study. J Affect Disord. 2021;284:85–97. [CrossRef].
8. Cummings CM, Caporino NE, Kendall PC. Comorbidity of anxiety and depression in children and adolescents: 20 years after. Psychol Bull. 2014;140(3):816–45. [CrossRef].
9. Laursen B, Hoff E. Person-centered and variable-centered approaches to longitudinal data. Merrill Palmer Q. 2006;52(3):377–89. [CrossRef].
10. Dai Y, Zheng Y, Hu K, Chen J, Lu S, Li Q, et al. Heterogeneity in the co-occurrence of depression and anxiety among adolescents: results of latent profile analysis. J Affect Disord. 2024;357:77–84. [CrossRef].
11. Wang Y, Ge F, Zhang J, Zhang W. Heterogeneity in the co-occurrence of depression and anxiety symptoms among youth survivors: a longitudinal study using latent profile analysis. Early Interv Psychiatry. 2021;15(6):1612–25. [CrossRef].
12. Hickendorff M, Edelsbrunner PA, McMullen J, Schneider M, Trezise K. Informative tools for characterizing individual differences in learning: latent class, latent profile, and latent transition analysis. Learn Individ Differ. 2018;66:4–15. [CrossRef].
13. Wang X, Zhao W, Li J, Mo L, Jiang W, Peng M. Decoding the effects of varied peer victimization forms on depression and anxiety among Chinese adolescents: an exploration through latent transition analysis. Aggress Behav. 2024;50(2):e22144. [CrossRef].
14. Chen F, Zheng D, Liu J, Gong Y, Guan Z, Lou D. Depression and anxiety among adolescents during COVID-19: a cross-sectional study. Brain Behav Immun. 2020;88:36–8. [CrossRef].
15. Chen X, Qi H, Liu R, Feng Y, Li W, Xiang M, et al. Depression, anxiety and associated factors among Chinese adolescents during the COVID-19 outbreak: a comparison of two cross-sectional studies. Transl Psychiatry. 2021;11(1):148. [CrossRef].
16. Neelakantan L, Logan N, Raniti M, Morgan A, Lim MH, Reavley N. Baseline findings from study 1 of a longitudinal co-evaluation of the Live4Life adolescent mental health promotion model in regional Victoria, Australia. Ment Health Prev. 2025;40:200465. [CrossRef].
17. Chen X, Fan X, Cheung HY, Wu J. The subjective well-being of academically gifted students in the Chinese cultural context. Sch Psychol Int. 2018;39(3):291–311. [CrossRef].
18. Malone C, Wachholtz A. The relationship of anxiety and depression to subjective well-being in a mainland Chinese sample. J Relig Health. 2018;57(1):266–78. [CrossRef].

19. Hellfeldt K, López-Romero L, Andershed H. Cyberbullying and psychological well-being in young adolescence: the potential protective mediation effects of social support from family, friends, and teachers. Int J Environ Res Public Health. 2019;17(1):45. [CrossRef].
20. Tejada-Gallardo C, Blasco-Belled A, Torrelles-Nadal C, Alsinet C. Effects of school-based multicomponent positive psychology interventions on well-being and distress in adolescents: a systematic review and meta-analysis. J Youth Adolesc. 2020;49(10):1943–60. [CrossRef].
21. Fredrickson BL. What good are positive emotions? Rev Gen Psychol. 1998;2(3):300–19. [CrossRef].
22. Connor KM, Davidson JRT. Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC). Depress Anxiety. 2003;18(2):76–82. [CrossRef].
23. Yu Z, Liu W. The psychological resilience of teenagers in terms of their everyday emotional balance and the impact of emotion regulation strategies. Front Psychol. 2025;15:1381239. [CrossRef].
24. Ran L, Wang W, Ai M, Kong Y, Chen J, Kuang L. Psychological resilience, depression, anxiety, and somatization symptoms in response to COVID-19: a study of the general population in China at the peak of its epidemic. Soc Sci Med. 2020;262:113261. [CrossRef].
25. Janousch C, Anyan F, Morote R, Hjemdal O. Resilience patterns of Swiss adolescents before and during the COVID-19 pandemic: a latent transition analysis. Int J Adolesc Youth. 2022;27(1):294–314. [CrossRef].
26. Reis M, Noronha C, Tomé G, Carvalho M, Rodrigues NN, de Matos MG. Understanding academic evaluation anxiety in Portuguese adolescents: a psychosocial and educational perspective. Int J Ment Health Promot. 2025;27(10):1457–70. [CrossRef].
27. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med. 2006;166(10):1092–7. [CrossRef].
28. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606–13. [CrossRef].
29. Hills P, Argyle M. The Oxford happiness questionnaire: a compact scale for the measurement of psychological well-being. Pers Individ Differ. 2002;33(7):1073–82. [CrossRef].
30. Campbell-Sills L, Stein MB. Psychometric analysis and refinement of the Connor-Davidson resilience scale (CD-RISC): validation of a 10-item measure of resilience. J Trauma Stress. 2007;20(6):1019–28. [CrossRef].
31. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. Struct Equ Model A Multidiscip J. 2007;14(4):535–69. [CrossRef].
32. Lanza ST, Flaherty BP, Collins LM. Latent class and latent transition analysis. In: Handbook of psychology. Hoboken, NJ, USA: John Wiley & Sons, Inc.; 2003. p. 663–85. [CrossRef].
33. Huang W, Chen B, Hu C. The latent profile structure of negative emotion in female college students and its impact on eating behavior: the mediating role of physical exercise. Front Public Health. 2025;13:1663474. [CrossRef].
34. Bueno-Notivol J, Gracia-García P, Olaya B, Lasheras I, López-Antón R, Santabárbara J. Prevalence of depression during the COVID-19 outbreak: a meta-analysis of community-based studies. Int J Clin Health Psychol. 2021;21(1):100196. [CrossRef].
35. Essau CA, Lewinsohn PM, Seeley JR, Sasagawa S. Gender differences in the developmental course of depression. J Affect Disord. 2010;127(1–3):185–90. [CrossRef].
36. Ahmed MZ, Ahmed O, Zhou A, Sang H, Liu S, Ahmad A. Epidemic of COVID-19 in China and associated psychological problems. Asian J Psychiatr. 2020;51:102092. [CrossRef].
37. Golberstein E, Wen H, Miller BF. Coronavirus disease 2019 (COVID-19) and mental health for children and adolescents. JAMA Pediatr. 2020;174(9):819–20. [CrossRef].
38. Peng X, Liang S, Liu L, Cai C, Chen J, Huang A, et al. Prevalence and associated factors of depression, anxiety and suicidality among Chinese high school E-learning students during the COVID-19 lockdown. Curr Psychol. 2022;42(34):1–12. [CrossRef].
39. Dai Y, Shen L, Zhang S, Wu Z, Zhang J, Li Q, et al. Trajectories and influences of depression in adolescents: a latent profile transition analysis study. Stress Health. 2025;41(1):e3528. [CrossRef].
40. Spence SH, Lawrence D, Zubrick SR. Anxiety trajectories in adolescents and the impact of social support and peer victimization. Res Child Adolesc Psychopathol. 2022;50(6):795–807. [CrossRef].

41. Wan H, Huang W, Zhang W, Hu C. Exploring adolescents' social anxiety, physical activity, and core self-evaluation: a latent profile and mediation approach. Int J Ment Health Promot. 2025;27(10):1611–26. [CrossRef].
42. Moore SA, Dowdy E, Nylund-Gibson K, Furlong MJ. A latent transition analysis of the longitudinal stability of dual-factor mental health in adolescence. J Sch Psychol. 2019;73:56–73. [CrossRef].
43. Collishaw S, Hammerton G, Mahedy L, Sellers R, Owen MJ, Craddock N, et al. Mental health resilience in the adolescent offspring of parents with depression: a prospective longitudinal study. Lancet Psychiatry. 2016;3(1):49–57. [CrossRef].
44. Damon W. What is positive youth development? ANNALS Am Acad Political Soc Sci. 2004;591(1):13–24. [CrossRef].
45. Cui Z, Xue H, Liu H, Liu F, Feng S, Chen H, et al. A latent class analysis of depressive symptoms among rural Chinese adolescents and their association with psychological resilience. Prev Med Rep. 2024;38:102625. [CrossRef].
46. Setiawati Y, Wahyuhadi J, Joestandari F, Maramis MM, Atika A. Anxiety and resilience of healthcare workers during COVID-19 pandemic in Indonesia. J Multidiscip Healthc. 2021;14:1–8. [CrossRef].
47. Parlikar N, Strand LB, Kvaløy K, Espnes GA, Moksnes UK. The prospective association of adolescent loneliness and low resilience with anxiety and depression in young adulthood: the HUNT study. Soc Psychiatry Psychiatr Epidemiol. 2025;60(9):2223–35. [CrossRef].
48. Moksnes UK, Lazarewicz M. The association between stress, resilience, and emotional symptoms in Norwegian adolescents from 13 to 18 years old. J Health Psychol. 2019;24(8):1093–102. [CrossRef].