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Heterogeneity in school adjustment among adolescent victims of school bullying and its association with mental health

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Abstract: This study investigated latent profiles of school adjustment among adolescent victims of school bullying and examined differences in mental health levels and network structures across these profiles. Data were drawn from the "Database of Youth Health", including 829 victims of school bullying (461 boys; 368 girls). Latent profile analysis yielded heterogeneity in school adjustment, which could be divided into the well-adapted group (characterized by strong prosocial competence, low antisocial behavior) and the poorly-adapted group (marked by insufficient prosocial resources, prominent antisocial behaviors). The well-adapted group had significantly better mental health status than the poorly-adapted group as indicated by consistently lower scores across all ten psychopathological symptom dimensions of the Symptom Checklist-90 (SCL-90). Network analysis revealed that anxiety was a central node in both groups, as it was the node with the highest expected influence value and served as the core hub connecting school adjustment and mental health indicators in both networks. However, the well-adapted group also featured self-management skills and depression as core nodes, whereas the poorly-adapted group exhibited obsessive-compulsive symptoms and eating/sleeping problems as central nodes. These findings underscore the relevance of ecological systems theory and person-centered latent profile and network analytical approaches, and highlight the need for targeted intervention strategies based on school adjustment profiles to improve the mental health of adolescent victims of school bullying.

Keywords: Victimization of school bullying; school adaptation; mental health; latent profile analysis; network analysis

Introduction

School bullying has now emerged as a global public health issue. According to a global report on school bullying, approximately 32% of children and adolescents experience school bullying each year (United Nations Educational, Scientific & Cultural Organization, 2019). Bullying situations typically involve three roles: the bully, the victim, and the bystander, with the most severe impacts generally observed among victims (Ahmed et al., 2022). Bullying victimization refers to repeated exposure to aggressive behaviors—physical, verbal, psychological, or emotional—within the school context (Olweus, 1993). Previous studies have indicated that bullying victims are at a higher risk of social and emotional difficulties and are more likely to develop internalizing problems such as depression and anxiety (Dania et al., 2024). Student bullying risk profiles are less well documented although important for the design of preventive interventions. Therefore, the school adjustment profiles of students with school bullying and mental health outcomes warrants particular attention. This study focuses specifically on adolescents who have experienced school bullying and employs a person-centered methodology combining latent profile analysis and network analysis.

School adaptation and bullying risk

School adjustment refers to students' overall performance in coping with academic tasks, managing peer and teacher-student relationships, participating in group activities, and regulating emotions (Huang et al., 2023). Some scholars have found that bullying victims tend to experience a lower sense of security and hold skeptical and distrustful attitudes toward the external environment and others (Tsomokos & Slavich, 2024). School adjustment comprises three dimensions: academic, social, and personal adaptation (Ratelle & Duchesne, 2014). Based on this framework, several studies have identified potential variations in school adjustment across these dimensions. For example, Miao et al. (2021) classified the social adaptation of left-behind children into high, medium, and low adaptation groups, while Li et al. (2014) categorized their emotional and behavioral characteristics into well-adapted, impulsive behavior, and adaptation difficulty groups. Treating bullying-victimized adolescents as a homogeneous group in analyzing their school adjustment may lead to significant bias. Accordingly, this study employs latent profile analysis to identify distinct subtypes of school adjustment.

Adolescent school adjustment comprises two key dimensions: social competence and antisocial behavior (Merrell et al., 1993). Research indicates that strong social competence—such as positive relationships with parents, teachers, and peers—contributes to enhanced psychological well-being (Tomé et al., 2014). Supportive peer relationships help reduce negative emotions like loneliness and improve academic adjustment (Kiuru et al., 2024), while positive teacher-student relationships are associated with lower levels of internalizing problems such as depression and anxiety (Wang et al., 2024). In contrast, difficulties in coping with academic pressure and interpersonal challenges may lead to maladjustment. School adjustment is influenced by multiple factors, including individual characteristics and relationships with classmates and teachers. Therefore, positive school adjustment

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plays a crucial role in promoting adolescents' mental health.

In-school mental health, recent research has revealed that school adjustment plays a crucial role in the relationship between bullying victimization and adolescent mental health. Specifically, while exposure to bullying may lead to deteriorated psychological well-being, school adjustment can buffer its negative impact on mental health (Zhang et al., 2025).

Theoretical basis

According to ecological systems theory, individual development is embedded in a series of interconnected environmental systems, ranging from immediate microsystems (such as family and school) to broader exosystems and cultural contexts (Bronfenbrenner, 1979). From this theoretical perspective, schools, as the primary setting for adolescents' daily learning and life, constitute a crucial factor influencing their growth and development and, to some extent, shape their psychological well-being. Thus, school adjustment may serve as a key link connecting experiences of school bullying and mental health (Zhang et al., 2025).

The China context

In China, school bullying has emerged as a pervasive public health concern threatening adolescent development, with national and regional studies consistently documenting a high prevalence of bullying victimization. Specifically, Zhang and Wang (2022) reported that the incidence of school bullying among Chinese adolescents is as high as 53.5%, meaning more than half of the adolescent population has been exposed to bullying experiences in the school setting. Against this backdrop, school adjustment difficulties have become a prominent secondary adverse outcome among bullied adolescents, with national statistics indicating that approximately 18% to 35% of Chinese adolescents face varying degrees of school adjustment challenges (Wang, 2023). Grounded in Bronfenbrenner's (1979) ecological systems theory, schools serve as the core microsystem for adolescents' daily learning and socialization; thus, bullying victimization directly undermines this critical developmental context. Prior research has demonstrated that adolescent bullying victims often experience a reduced sense of security, hold distrustful attitudes toward peers and teachers, and subsequently encounter multifaceted school adjustment difficulties, including learning distraction, negative attitudes toward school, perceived campus unsafety, declining academic performance, and even school dropout (Tsomokos & Slavich, 2024; Juvonen et al., 2011).

These co-occurring issues of bullying victimization and school adjustment difficulties do not only impair adolescents' academic progression, but also exert profound and lasting detrimental effects on their psychological well-being (Mei et al., 2019). A large body of Chinese empirical research has linked school adjustment problems among bullied adolescents to a wide spectrum of mental health disorders, including internalizing symptoms such as anxiety, depression, and obsessive-compulsive symptoms, as well as externalizing problems such as impulsive and aggressive behaviors (Wang et al., 2024). Longitudinal evidence has further revealed that chronic school adjustment stress can trigger sustained physiological and psychological dysregulation, manifesting as somatization symptoms, sleep and appetite disturbances, and even severe psychiatric symptoms over time (Shalayiding et al., 2024; Castillo-Navarrete et al., 2024; Inostroza et al., 2024). Notably, most existing studies on bullying victimization in the Chinese context have treated adolescent victims as a homogeneous group, overlooking the significant heterogeneity in their school adjustment patterns and the corresponding differences in mental health symptom networks. This critical gap limits the development of culturally appropriate, personalized intervention strategies for Chinese adolescent bullying victims. The present study addresses this limitation by adopting latent profile analysis and network analysis to identify distinct school adjustment subgroups among Chinese adolescent bullying victims, clarify their differential mental health outcomes, and pinpoint core symptom targets for precise, tailored intervention.

Goals of the study

This study aims to explore the heterogeneity in school adjustment among bullying victims and examine differences in mental health—both at the variable and network levels—across distinct school adjustment subtypes. Specifically, this study aimed to systematically investigate the latent profiles of school adjustment among adolescent victims of school bullying, examine the association between these school adjustment profiles and mental health status, and identify the core symptoms within the school adjustment-mental health network across distinct subgroups. This study tested the following hypotheses:

H1: The school adjustment of adolescent victims of school bullying will present significant heterogeneity, which can be categorized into two distinct latent profiles based on multi-dimensional school adjustment indicators (social competence and antisocial behavior).

H2: The school adjustment profile of adolescent victims of school bullying are associated with their mental health statuses.

H3: The core symptoms within the school adjustment-mental health network of adolescent victims of school bullying will differ significantly across distinct school adjustment subgroups.

Methods

Sources of data

The data for this study were obtained from the "Database of Youth Health (DYH)" managed by the National Population Health Data Center (China), a longitudinal Database of Chinese adolescents' health. Access to DYH is restricted and not publicly available. A formal application must be submitted to the data custodian, and approval is required prior to data use. The research protocol of the present study has been submitted, and formal permission to use the DYH dataset has been granted. DYH comprises comprehensive data on the health and health-related behaviors of Chinese adolescents from several years of middle school and high school cohorts (Zhang et al.,

2022). Utilizing the population proportionate sampling (PPS) method, schools were randomly selected to be based on geographical, demographic, and socio-economic level in Shandong Province, China. Using data collected from 2020 to 2021, participants were included based on the following criteria: adolescents who responded "yes" to the bullying screening question—"In the past 12 months, have you been bullied at school?"—and provided complete responses to school adjustment and mental health questionnaires. The final sample consisted of 829 valid cases, including 461 boys (55.60%) and 368 girls (44.40%), with ages ranging from 15 to 18 years (M = 16.22, SD = 1.25). Because network analysis models do not allow for missing values and to improve data quality, we applied the following inclusion criteria: (1) no missing or incomplete data, and (2) no random responses (e.g., choosing the same answer for all questions). All samples met these criteria. Data collection was approved by the Institutional Review Board of Shandong University. All procedures were conducted in accordance with relevant guidelines and regulations, and informed consent was obtained from all participating students and their parents or legal guardians.

Measures

School adaptation

Adolescents' school adjustment was assessed using the School Social Behavior Scales, Second Edition (SSBS-2), developed by Merrell et al. (1993). The scale was originally designed as a teacher-report instrument. However, for the "Database of Youth Health," it was adapted into a self-report version for adolescents. This adaptation involved carefully rephrasing items from the third-person perspective to the first-person perspective while preserving the original item content. The Chinese version of the scale has been validated as suitable for Chinese adolescents (Han et al., 2006). The 65-item instrument comprises two subscales: social competence (including interpersonal skills, self-management skills, and academic skills) and Antisocial Behavior (including hostile-irritable, demanding-disruptive, and antisocial-aggressive factors) (Crowley & Merrell, 2003). In this study, Cronbach's α coefficients were 0.938 and 0.954 for the respective subscales.

Mental health

Adolescents' mental health was assessed using the Symptom Checklist-90 (SCL-90) (Derogatis & Cleary, 1977). This instrument employs a Likert 5-point rating scale, with a total score ranging from 90 to 450 across 90 items. It covers a broad range of psychopathological symptoms, including dimensions of sensation, emotion, cognition, consciousness, and behavior. Mental health measures mental health across 10 domains: somatization, obsessive-compulsiveness, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and sleep and appetite disturbances (Dong et al., 2023). A total score of 160 or a factor mean score of 2 is commonly used as the cut-off for positive screening, with higher scores indicating poorer mental health status. In the present study, the scale demonstrated excellent internal consistency, with a Cronbach's α coefficient of 0.990.

Procedure

This study involves human participants and was approved by Ethics Committee of Shandong University (20180517). The protocol has been performed with the ethical standards as laid down in the 1989 Declaration of Helsinki and its later amendments or comparable ethical standards. Written informed consent to participate in this study was provided by the participants and their parents and/or legal guardians.

Data analysis

Statistical analyses were performed using SPSS 26.0 for descriptive statistics, Mplus 8.3 for latent profile analysis (LPA), and RStudio 4.4.1 for network analysis.

To begin, LPA was conducted in Mplus 8.3 with the goal of detecting distinct school adjustment subtypes among adolescent victims of bullying. The dimension scores of school adjustment were standardized and used as indicators to build the latent profile models. Within each profile, variances and covariances were freely estimated, yet these parameters were held equal across profiles. Model selection was guided by both fit statistics and theoretical interpretability. Three categories of fit indices were examined (Peugh & Fan, 2013): (1) information criteria (AIC, BIC, aBIC), with smaller values indicating better fit; (2) likelihood ratio tests (LRT, BLRT), where a significant result suggests that a k-profile solution fits the data better than a (k–1)-profile solution; and (3) classification precision, as measured by Entropy, where values above 0.80 indicate over 90% classification accuracy. Beyond these quantitative indices, we ensured that each profile contained a sufficient number of participants, requiring that each profile represent at least 5% of the total sample (Yin et al., 2020). Subsequently, the BCH approach was applied to examine the predictive effect of latent class membership on mental health, and a chi-square test was used to compare gender distributions across the identified profiles.

Next, network analysis was carried out in RStudio 4.4.1 to construct separate network models for each subgroup, pinpoint central symptoms, and compare both global and local network properties between groups. The R packages qgraph and bootnet were used for network estimation, stability checking, and visualization. Each network consisted of 16 nodes covering all dimensions of school adjustment and mental health, and was estimated via a Gaussian Graphical Model (GGM). In a GGM, edges represent partial correlations between two nodes after adjusting for all other nodes in the network; edge thickness reflects the strength of association, with green lines denoting positive correlations and red lines denoting negative ones. To improve the robustness of the network, the graphical LASSO regularization technique was applied to remove spurious edges and retain only meaningful connections. The optimal model was determined by minimizing the Extended Bayesian Information Criterion (EBIC) (Foygel & Drton (2010)), with the EBIC tuning parameter gamma (γ) set at 0.5 to limit false positives. Core nodes were identified via the expected influence (EI)

centrality index: EI is the sum of all edge weights (both positive and negative) connected to a node, quantifying that node's overall influence in the network (Robinaugh et al., 2016).

To verify the accuracy and stability of the network models, the bootnet package was used to compute the correlation stability coefficient (CS-coefficient) for node EI and 95% bootstrapped confidence intervals for edge weights (Epskamp et al., 2018). A CS-coefficient of at least 0.25 was deemed acceptable, with values above 0.50 reflecting excellent stability of node centrality. Narrower bootstrapped CIs for edge weights indicated greater precision in estimating the strength of inter-node connections. Within each subgroup, the nodes with the highest EI values were designated as the network's core symptoms.

Finally, the R package NetworkComparisonTest (v2.2.2) was employed to run permutation tests (van Borkulo et al., 2023) that systematically compared global and local network characteristics between the well-adapted and poorly-adapted groups. Global invariance testing comprised two parts: network structure invariance, which examined whether any specific edge weights differed significantly between the two subgroup networks, and global strength invariance, which tested whether the sum of absolute edge weights (an index of overall network connectivity) significantly differed. Local invariance tests focused on comparing the expected influence of specific nodes and the weights of particular edges across the two networks.

Common method bias test

Using Harman single factor test (Podsakoff et al., 2003), all the variables involved were subjected to unrotated exploratory factor analysis, and the results showed that the variance explained by the first factor was 34.29%, which is below the critical value of 40% (Zhou & Long, 2004). This suggested that the data in the current study was unlikely to be significantly affected by common method bias.

Results

Descriptive statistics

Descriptive statistics (see Table 1) revealed that female victims of school bullying exhibited significantly lower levels of antisocial behavior than their male counterparts, as reflected in their lower scores on the Hostile-Irritable, Demanding-Disruptive, and Antisocial-Aggressive dimensions. Furthermore, no significant gender differences were found in overall mental health status.

Latent profile analysis

Using the mean scores of each dimension of the SSBS-2 as analytical indicators, the number of profiles was incrementally adjusted from 1 to 5. The results of the latent profile analysis are presented in Table 2. As the number of profiles increased, the information criteria (AIC, BIC, and aBIC) progressively decreased. The BLRT values for all models reached statistical significance. However, only the 2-profile model demonstrated a significant LMR-LRT value and the highest Entropy. Based on these findings, the 2-profile model was selected as the optimal model. The average posterior probabilities for the two profiles were 0.993 and 0.976, indicating good classification certainty.

Based on the scores across school adjustment dimensions, the two latent profiles were designated as follows: The first profile, labeled the "Well-Adapted Group," comprised 72.4% of the total sample (n = 599). This group demonstrated significantly higher scores on all three dimensions of the Prosocial Behavior subscale compared to the three dimensions of the Antisocial Behavior subscale. The second profile, labeled the "Poorly-Adapted Group," accounted for 27.6% of the sample (n = 230). No statistically significant differences were observed between the scores of the Prosocial Behavior and Antisocial Behavior subscales in this group. Furthermore, compared to the "Well-Adapted Group," this group exhibited lower scores on the Prosocial Behavior subscale and higher scores on the Antisocial Behavior subscale. The chi-square test revealed a significant difference in the distribution of gender across the identified latent profiles ($\chi^2 = 10.85$, $p < 0.001$), with the poorly-adapted group showing a significantly higher proportion of females (61.3%) compared to the well-adapted group (45.2%).

To examine whether the identified school adjustment profiles represented distinct subgroups, comparisons were conducted between the two latent classes. The results indicated statistically significant differences in all school adjustment dimension scores between the classes ($p < 0.001$). This confirms that the latent profile classification effectively differentiates the school adjustment capabilities of adolescent bullying victims and supports the validity of the identified subgroups. For details, see Figure 1 and Table 3. Thus, Hypothesis 1 was supported.

The association between school adjustment subgroups and mental health was analyzed using the BCH procedure. The results revealed statistically significant differences between the school adjustment subgroups across all mental health factors. Specifically, the Well-Adapted Group scored significantly lower than the Poorly-Adapted Group on all ten symptom dimensions of the Symptom Checklist-90 (SCL-90). For detailed results, see Table 4. Thus, Hypothesis 2 was supported.

Network analysis

Network estimation and accuracy

Partial correlation networks of school adjustment and mental health for the identified subgroups are presented in Figure 2. Each subgroup network comprised 16 nodes and 120 potential edges. The well-adapted group and the poorly-adapted group contained 70 and 58 non-zero edges, respectively, with both groups exhibiting an average edge weight of 0.06. The stability and accuracy of the estimated networks were assessed. The correlation stability coefficient (CS-coefficient) for expected influence was 0.75 for the well-adapted group and 0.51 for the poorly-adapted group. As both values exceed the recommended threshold of 0.50, the stability of the node centrality indices is considered good. Furthermore, the 95% bootstrapped confidence intervals for the edge weights were narrow for both groups, indicating satisfactory precision in the edge weight estimations.

Table 1. Results of descriptive statistics ($N = 829$ $M \pm SD$)

	Variable	Boys ($N = 461$)	Girls ($N = 368$)	t	Cohen's d	95%CI
School adaptation	SSBS1: Self-management Skills	3.32 ± 1.01	3.45 ± 0.93	−1.86	0.98	[−0.27, 0.01]
	SSBS2: Academic Skills	3.45 ± 1.06	3.48 ± 1.00	−2.57*	1.03	[−0.32, −0.04]
	SSBS3: Interpersonal Skills	3.21 ± 1.00	3.33 ± 0.95	−1.63	0.98	[−0.25, 0.02]
	SSBS4: Antisocial-Aggressive	1.81 ± 0.83	1.60 ± 0.70	3.95***	0.77	[0.14, 0.41]
	SSBS5: Demanding-Disruptive	1.80 ± 0.85	1.62 ± 0.73	3.29**	0.80	[0.09, 0.37]
	SSBS6: Hostile-Irritable	1.74 ± 0.84	1.53 ± 0.68	3.78***	0.77	[0.13, 0.40]
Mental health	SCL1: Somatization	1.75 ± 0.86	1.78 ± 0.82	−0.55	0.84	[−0.18, 0.10]
	SCL2: Obsessive-compulsive	1.94 ± 0.91	1.99 ± 0.87	−0.82	0.89	[−0.20, 0.08]
	SCL3: Interpersonal Sensitivity	1.90 ± 0.95	1.94 ± 0.89	−0.65	0.92	[−0.18, 0.09]
	SCL4: Depression	1.85 ± 0.95	1.94 ± 0.90	−1.34	0.93	[−0.23, 0.04]
	SCL5: Anxiety	1.83 ± 0.95	1.89 ± 0.90	−0.89	0.93	[−0.20, 0.08]
	SCL6: Hostility	1.80 ± 0.93	1.83 ± 0.91	−0.46	0.93	[−0.17, 0.11]
	SCL7: Phobic Anxiety	1.73 ± 0.92	1.81 ± 0.84	−1.43	0.89	[−0.24, 0.04]
	SCL8: Paranoid Ideation	1.82 ± 0.94	1.82 ± 0.84	0.11	0.90	[−0.13, 0.15]
	SCL9: Psychoticism	1.76 ± 0.86	1.81 ± 0.82	−0.77	0.84	[−0.19, 0.08]
	SCL10: Diet and Sleep	1.82 ± 0.91	1.82 ± 0.84	−0.01	0.88	[−0.14, 0.14]

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

Table 2. Fit statistics for latent profile analysis

Model	AIC	BIC	ABIC	Entropy	LMR (*p*)	BLRT (*p*)	Class probability (%)
1-profile	12,923.81	12,980.45	12,942.35				1
2-profile	10,365.09	10,454.78	10,394.44	0.963	0.000	0.000	72.4/27.6
3-profile	9200.39	9323.12	9240.55	0.934	0.081	0.000	25.4/58.2/16.4
4-profile	8523.21	8678.98	8574.18	0.956	0.093	0.000	13.0/59.2/26.4/1.4
5-profile	7844.23	8033.04	7906.01	0.931	0.067	0.000	7.6/29.5/36.7/24.8/1.4

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = adjusted Bayesian information criterion; LMR = Lo-Rubin adjusted likelihood radio test; BLRT = bootstrap likelihood ratio test.

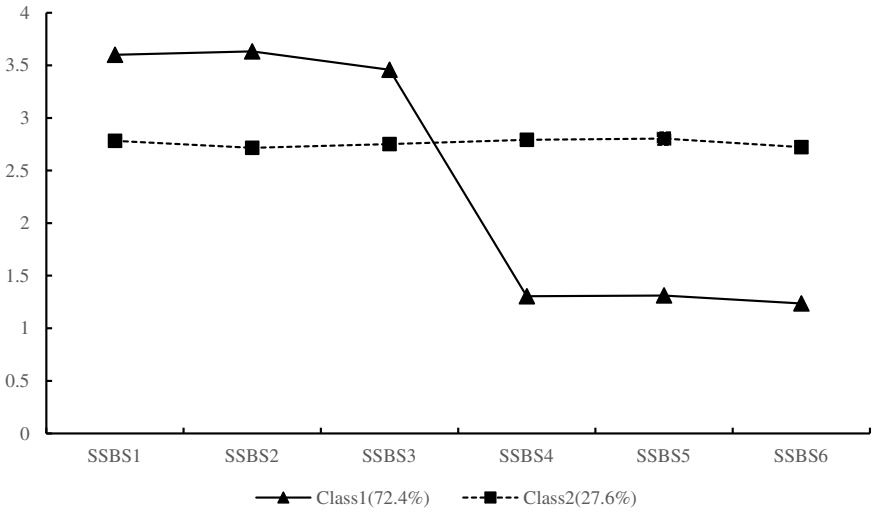

Figure 1. Latent profile analysis of school adaptation

Core symptoms

The expected influence (EI) values for each node across the subgroups are detailed in Table 5 and visualized in Figure 3. The results indicated that the core symptoms in the well-adapted group were, in order: SCL5 (Anxiety, EI = 1.30), SSBS1 (Self-Management Skills, EI = 1.10), and SCL4 (Depression, EI = 1.08). In the poorly-adapted group, the core symptoms were: SCL5 (Anxiety, EI = 1.11), SCL2 (Obsessive-Compulsive, EI = 1.00), and SCL10 (Eating/Sleeping Problems, EI = 1.07). While both subgroups shared anxiety (SCL5) as the node with the highest expected influence, they differed in their other central symptoms.

Network comparison

A global invariance test was conducted to compare the overall differences between the networks of the well-adapted and poorly-adapted groups. The test for

Table 3. Differences in school adaptation dimensions across latent profiles ($M \pm SD$)

Variable	C1 well-adapted group ($n = 599$)	C2 poorly-adapted group ($n = 230$)	t	Cohen's d	95%CI
SSBS1: Self-management Skills	3.60 ± 0.98	2.78 ± 0.70	11.59***	0.91	[0.74, 1.06]
SSBS2: Academic Skills	3.64 ± 1.00	2.71 ± 0.79	12.59***	0.95	[0.97, 1.34]
SSBS3: Interpersonal Skills	3.46 ± 1.00	2.75 ± 0.69	9.79***	0.93	[0.60, 0.92]
SSBS4: Antisocial-Aggressive	1.30 ± 0.30	2.78 ± 0.60	−47.32***	0.41	[−3.90, −3.44]
SSBS5: Demanding-Disruptive	1.31 ± 0.34	2.80 ± 0.63	−43.78***	0.44	[−3.62, −3.17]
SSBS6: Hostile-Irritable	1.23 ± 0.28	2.72 ± 0.62	−47.38***	0.40	[−3.91, −3.44]

Note. ***$p < 0.001$.

Table 4. Comparison of mental health scores across latent profile

Variable[c]	C1 well-adapted group ($n = 599$)	C2 poorly-adapted group ($n = 230$)	X^2	p	Post hoc tests
SCL1: Somatization	1.60 (0.03)	2.19 (0.06)	72.73	<0.001	C2 > C1
SCL2: Obsessive-compulsive	1.85 (0.04)	2.27 (0.06)	32.69	<0.001	C2 > C1
SCL3: Interpersonal Sensitivity	1.79 (0.04)	2.25 (0.07)	38.44	<0.001	C2 > C1
SCL4: Depression	1.76 (0.04)	2.24 (0.06)	41.94	<0.001	C2 > C1
SCL5: Anxiety	1.71 (0.04)	2.25 (0.07)	53.35	<0.001	C2 > C1
SCL6: Hostility	1.65 (0.03)	2.24 (0.07)	57.46	<0.001	C2 > C1
SCL7: Phobic Anxiety	1.60 (0.03)	2.20 (0.07)	66.26	<0.001	C2 > C1
SCL8: Paranoid Ideation	1.67 (0.03)	2.22 (0.07)	56.11	<0.001	C2 > C1
SCL9: Psychoticism	1.62 (0.03)	2.20 (0.06)	68.78	<0.001	C2 > C1
SCL10: Diet and Sleep	1.68 (0.03)	2.19 (0.07)	47.91	<0.001	C2 > C1

Note. [c]Means and standard errors of variable c across profiles.

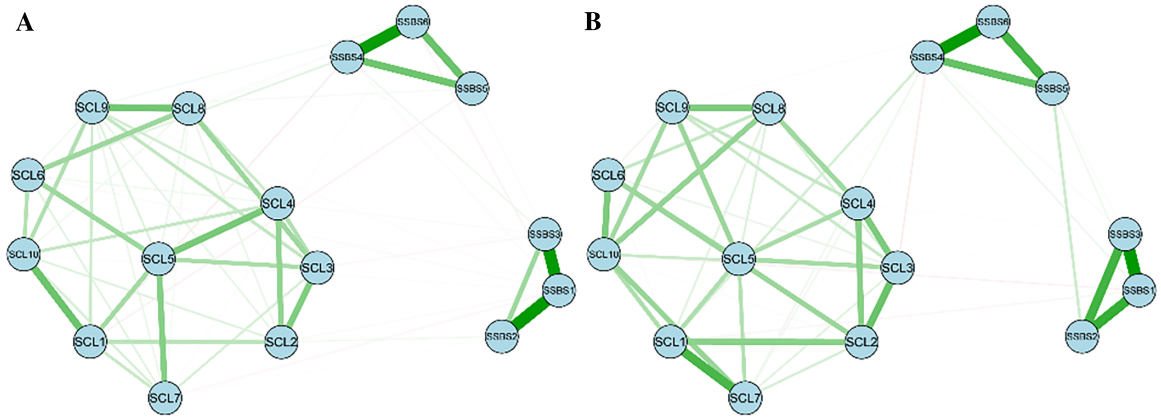

Figure 2. Networks of well-adapted group (A) and poorly-adapted group (B). *Note*. For panel A and B, green lines represent positive correlations, and red lines represent negative correlations. Thicker edges represent stronger associations.

network structure invariance revealed no significant difference between the two groups (M = 0.28, $p = 0.11$), indicating that the network structures are similar across subgroups. Furthermore, the test for global strength invariance showed no significant difference in the overall connectivity between the networks (GS_well-adapted = 4.78, GS_poorly-adapted = 4.85; S = 0.07, $p = 0.27$). These results suggest that the pattern of interactions between school adjustment and mental health dimensions is broadly similar across the different latent profiles.

A local invariance test was performed to compare differences in node expected influence and edge weights between the subgroup networks. The centrality invariance test revealed significant differences in the expected influence of nodes across subgroups. Specifically, the expected influence of node SCL2 (Obsessive-Compulsive) was significantly stronger in the poorly-adapted group compared to the well-adapted group ($p < 0.001$). The edge weight invariance test indicated that several specific edge weights differed significantly between the two subgroups. Specifically, four edges showed statistically significant differences. Further analysis identified that, compared to the well-adapted group, the poorly-adapted group exhibited significantly stronger positive associations for the following edges: SCL1–SCL7 (E = 0.27, $p < 0.05$), SCL2–SCL6 (E = 0.20, $p < 0.05$), SCL3–SCL10 (E = 0.09, $p < 0.05$), and SCL8–SCL10 (E = 0.19, $p < 0.05$). Thus, Hypothesis 3 was supported.

Table 5. Centrality index of well-adapted group and poorly-adapted group

Item	Expected influence	
	C1 well-adapted group (n = 599)	**C2 poorly-adapted group (n = 230)**
SSBS1: Self-management Skills	1.10	0.91
SSBS2: Academic Skills	0.81	0.86
SSBS3: Interpersonal Skills	0.82	0.91
SSBS4: Antisocial-Aggressive	0.95	0.91
SSBS5: Demanding-Disruptive	0.65	0.80
SSBS6: Hostile-Irritable	0.93	0.88
SCL1: Somatization	0.83	1.02
SCL2: Obsessive-compulsive	0.89	1.10
SCL3: Interpersonal Sensitivity	1.05	1.03
SCL4: Depression	1.08	0.97
SCL5: Anxiety	1.30	1.11
SCL6: Hostility	0.79	0.79
SCL7: Phobic Anxiety	0.65	0.88
SCL8: Paranoid Ideation	1.02	0.93
SCL9: Psychoticism	1.06	0.86
SCL10: Diet and Sleep	0.96	1.07

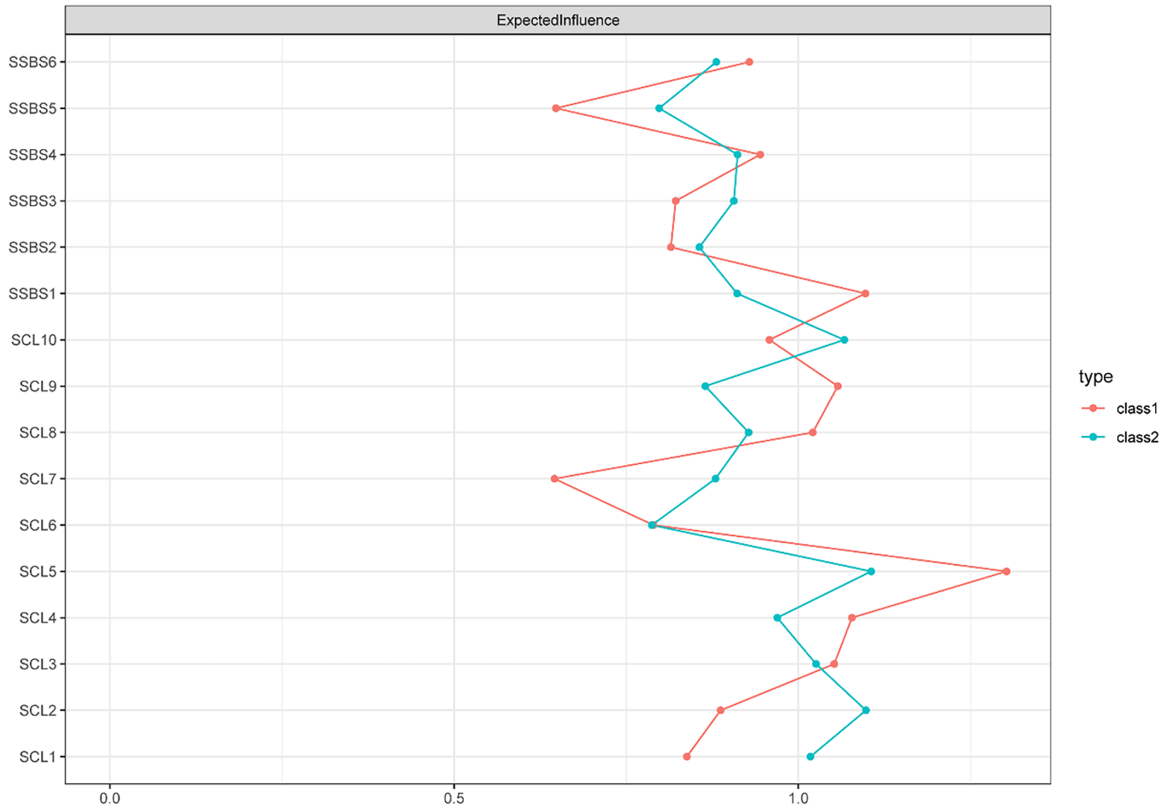

Figure 3. Results diagram of expected influence of well-adapted group (class1) and poorly-adapted group (class2). *Note*. The expected influence is defined as the sum of the values of all edges extending from a given node. The larger the value, the greater the degree of influence.

Discussion

This study revealed significant heterogeneity in school adjustment among adolescent bullying victims, identifying two distinct subgroups: a well-adapted group and a poorly-adapted group. Compared to the poorly-adapted group, the well-adapted group demonstrated significantly higher scores across all three dimensions of the Prosocial Behavior subscale and lower scores on the three dimensions of the Antisocial Behavior subscale. Their prosocial behavior scores were also significantly higher than their antisocial behavior scores, indicating stronger overall school adjustment. From the lens of ecological systems theory (Bronfenbrenner, 1979), this group effectively buffered the developmental harm of bullying—a noxious environmental stimulus within the school microsystem—by establishing adaptive, positive proximal interactions with

their school environment: for these adolescents, effective self-management skills which act as a core capacity to regulate behavioral interactions within the microsystem may help regulate behaviors and reduce the escalation of bullying-related conflicts (Tomé et al., 2014). Strengths in academic skills which support competence in the core developmental task of the school microsystem: academic progress can mitigate the negative impact of bullying on academic performance and help maintain a sense of school belonging a key protective resource within the school microsystem (Li et al., 2020). Furthermore, interpersonal skills which enable the formation of supportive relational ties within the microsystem facilitate the formation of positive peer relationships (Aprilianata et al., 2025), thereby alleviating the social trauma associated with bullying and further reinforcing the protective effects of positive proximal interactions within the school environment (Tomé et al., 2014).

In contrast, the poorly-adapted group showed no significant difference between their prosocial and antisocial behavior scores, reflecting a dual challenge characterized by insufficient positive resources and prominent negative behaviors. This pattern may represent a "counterattack" strategy in response to bullying (Ostrov et al., 2019)—where bullying, as a chronic negative stimulus within the school microsystem, erodes this group's capacity to establish adaptive proximal interactions with the school environment, leading them to adopt aggressive or disruptive behaviors to cope with feelings of helplessness, which unfortunately exacerbates interpersonal conflicts in school. This maladaptive pattern of proximal interaction, in turn, further degrades their developmental environment within the school microsystem, driving increased peer rejection and negative evaluations from teachers.

This study found that bullying victims in the well-adapted group exhibited significantly better mental health than those in the poorly-adapted group, supporting Hypothesis 2. Specifically, the well-adapted group reported significantly lower levels of depression and anxiety. Through adaptive proximal interactions with the school microsystem, this group has accumulated robust protective resources: their strong self-management skills likely help them regulate negative emotions (Yazdani Sarijeh et al., 2023), while their academic and interpersonal competencies may enhance self-worth and reduce cognitive biases such as self-blame following bullying experiences (Li et al., 2020). These microsystem-level protective factors collectively mitigate the development of internalizing symptoms. In contrast, the poorly-adapted group not only showed more severe emotional problems but also reported higher levels of somatization and eating/sleep disturbances. This pattern may reflect a psycho-physiological linkage resulting from chronic adaptation stress: persistent peer rejection and academic setbacks which act as a chronic microsystem stressor can trigger sustained anxiety, which may subsequently dysregulate neuroendocrine functions, manifesting as physical symptoms including headaches, chest tightness, and sleep disorders (Shalayiding et al., 2024; Castillo-Navarrete et al., 2024).

Network analysis provided support for Hypothesis 3. In the school adjustment-mental health networks of both subgroups, anxiety emerged as a central node. This indicates that, regardless of school adjustment level, anxiety serves as a core hub in the mental health networks of adolescent bullying victims. Anxiety is a state of alertness and worry towards potential threats. For victims of bullying, this threat is real and persistent. The strong association between bullying victimization and anxiety has been well-documented (Zhu et al., 2022; Ji & Liu, 2022), and anxiety readily triggers other mental health issues such as depression (Jia & Guo, 2026). Mechanistically, the "unpredictable threat" inherent in bullying (e.g., the fear of being targeted again) may persistently activate an individual's anxiety system, creating spreading effects that influence other dimensions like depression and compulsivity through the network (Gorrese, 2016).

However, network comparisons also revealed distinct features specific to each subgroup. Besides anxiety, the well-adapted group's network featured self-management skills and depression as central nodes, whereas the poorly-adapted group's network centered on obsessive-compulsive symptoms and eating/sleep disturbances. For adolescents with better school adjustment, robust self-management skills may enhance coping self-efficacy (e.g., the belief "I can control my emotions and behaviors"), thereby reducing the likelihood of depressive symptoms following victimization (Caldarella & Merrell, 1997). Conversely, those with poorer adjustment demonstrated prominent somatic symptoms after being bullied. They might engage in repetitive behaviors to alleviate bullying-induced stress (Newman et al., 2011), but these often impair daily functioning and provoke peer misunderstanding, further intensifying social conflicts. Their eating and sleep disturbances represent a "physiological externalization" of prolonged psychological stress (Evans et al., 2017), indicating that their psychological imbalance has extended to fundamental physiological functions.

Implications for research, theory and practice

This study offers important research, theory and practical implications. First, methodologically, the latent profile analysis results confirm significant heterogeneity in school adjustment among adolescent bullying victims, with distinct subgroups exhibiting varying mental health statuses. While no significant differences were found in global network structure or overall strength between subgroups, significant variations in local node centrality and edge weights provide targeted, symptom-level evidence for intervention. Anxiety emerged as a central node in both groups' networks, suggesting that interventions for all bullying victims should prioritize alleviating anxiety to block its spreading effects on other psychological dimensions.

Second, from a theoretical perspective, the present study extends ecological systems theory (Bronfenbrenner, 1979) and empirically validates its core tenet: as the central microsystem for adolescent development, the school context is where proximal processes between the individual and their environment serve as the critical determinant of developmental outcomes under risk exposure. The findings reveal that the heterogeneity in school adjustment among

adolescent victims of school bullying essentially mirrors differences in patterns of proximal processes formed in response to bullying risk within the school microsystem. Specifically, well-adapted adolescents can establish adaptive, positive interactions through robust self-management, academic, and interpersonal skills to effectively buffer the deleterious effects of bullying victimization; in contrast, poorly-adapted adolescents adopt maladaptive "counter-attack" interaction strategies that tend to exacerbate interpersonal conflict, thereby trapping themselves in persistent adjustment difficulties. This finding provides novel, context-specific empirical support for the theory within the school bullying research framework, and further refines and advances its explanatory power regarding the heterogeneous adaptation processes of adolescents navigating adverse risk environments.

Third, for practice implications, anti-bullying interventions should avoid a one-size-fits-all approach and prioritize support for those displaying prominent anti-social behaviors to prevent the escalation of their adjustment difficulties. Furthermore, since the well-adapted group's network also featured self-management skills and depression as central nodes, interventions for this subgroup should focus on enhancing self-management competencies—such as emotion regulation and problem-solving—while monitoring early signs of depression, including persistent low mood and loss of interest. For the poorly-adapted group, whose central nodes included obsessive-compulsive symptoms and eating/sleep disturbances, interventions should integrate cognitive-behavioral approaches (e.g., exposure therapy for compulsive symptoms) with lifestyle guidance (e.g., sleep hygiene education).

Limitations and future recommendations

This study, notwithstanding its contributions to informing psychological interventions for adolescent victims of school bullying, has several limitations. First, the use of cross-sectional data precludes definitive conclusions regarding the dynamic relationship between school adjustment and mental health. Future research should employ longitudinal designs to better examine the developmental trajectories of school adjustment and their long-term interplay with mental health outcomes in this population. Second, the reliance on self-reported data may introduce biases such as common-method variance or social desirability effects. Subsequent studies could strengthen findings by incorporating multi-method assessments, including objective measures or observational data, to complement self-reports.

Conclusion

Employing latent profile analysis and network analysis, this study systematically examined the heterogeneity in school adjustment among adolescent victims of school bullying and its relationship with mental health. Overall, the findings indicate that school adjustment capacity influences the mental health status of adolescents who have experienced school bullying. First, school adjustment in this population is characterized by significant heterogeneity, which can be categorized into two distinct latent classes—well-adapted and poorly-adapted groups. Second, these adaptation classes differ significantly in their levels of mental health. Furthermore, differences were also observed in the central symptoms of the mental health networks and in specific edge weights between the two groups. Furthermore, distinct school adjustment subgroups manifest different psychological symptoms following bullying victimization. Consequently, psychological interventions for these adolescents should not adopt a uniform approach, but rather develop precise, targeted strategies tailored to the specific characteristics of each subgroup.

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Availability of Data and Materials: The data that support the findings of this study are available from the Database of Youth Health (https://www.ncmi.cn/phda/dataDetails.do?id=CSTR:17970.11.A0031.202107.209.V1.0.) but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Database of Youth Health. The other materials are available from the corresponding author on reasonable request.

Ethics Approval: The original DYH project was approved by the Ethics Committee of Shandong University (20180517), in accordance with the principles of the Declaration of Helsinki. Since this study used only de-identified data, institutional review board approval was waived. Permission to access and use the DYH database for this study was obtained from the data custodian. In the original data collection, written informed consent was obtained from all participating students and their parents or legal guardians after they were assured of confidentiality and that their responses would be used solely for academic purposes.

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

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