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Cluster analysis of family resilience in adolescents with emotional disorders: a cross-sectional study

Jun Shen^{1†}, Shuang Zhou^{2†}, Miao Du¹, Biyun Xia^{3,4*} and Ying Jiang^{1*}

Abstract

Objectives This study evaluated the current state of family resilience in adolescents diagnosed with emotional disorders, incorporating perspectives from both the patients and their primary caregivers.

Method A cross-sectional study design was employed, involving 281 adolescent aged 12 to 18 years diagnosed with emotional disorders and their primary caregivers, recruited from a psychiatric specialty hospital in China between December 2023 and July 2024. Both groups completed standardized assessments of family resilience and family functioning. K-means cluster analysis was conducted using Python 3.12.4 software, and statistical analyses were conducted with SPSS 25.0.

Results Five distinct clusters of family resilience were identified based on scores from both patients and primary caregivers, including Dual Adversity (18.50%), Caregiver-Empowered (10.32%), Balanced and Coordinated (46.26%), Patient-Strength (11.39%), and Divergent-Challenge (13.52%). Significant differences were observed across clusters in family functioning, socioeconomic factors (such as medical payment methods, monthly household income, caregiver employment status), family relationship quality (including parent-child relationship, marital relationship, and parenting style), and disease-related characteristics (such as distress and self-discontinuation of psychiatric medication). Primary caregivers reported higher levels of family resilience and functioning than adolescents. Additionally, family resilience and family functioning showed significant positive correlations in both adolescents ($r=0.668, p<0.001$) and caregivers ($r=0.405, p<0.001$).

Conclusions This study, through a dual patient-caregiver perspective and cluster analysis, highlights the diversity and complexity of family resilience in adolescents with emotional disorders. The findings identified five distinct cluster patterns, underscoring the strong association between family resilience and family functioning. Based on the characteristic differences among these clusters, clinical practitioners can formulate tailored family-based intervention

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strategies aimed at enhancing overall family resilience and optimizing family functioning, thereby improving treatment outcomes and quality of life for adolescents with emotional disorders.

Keywords Adolescent, Cluster analysis, Emotional disorders, Family function, Family resilience

Introduction

Emotional disorders encompass a range of mental health conditions characterized by persistent negative emotional states, including anxiety, fear, depression, and obsession [1]. These disorders account for nearly 40% of all mental health conditions among adolescents aged 10 to 19 worldwide, making them the most prevalent mental health issues in this age group [2, 3]. In China, recent data indicate that depression and anxiety affect 28.6% and 26.9% of adolescents, respectively, with 20.6% showing symptoms of both [4, 5]. These disorders are chronic and prone to relapse, with recurrence rates ranging from 39 to 72% [6], which not only impairs adolescents' current academic performance and social functioning but also poses long-term risks to their mental health [7, 8].

The onset of emotional disorders in adolescents is closely linked to family dynamics. A nurturing family environment fosters the mental well-being of adolescents, whereas dysfunctional family relationships can elevate the risk of emotional difficulties in young people [9]. As primary caregivers, parents' understanding and attitudes toward emotional disorders directly influence adolescents' treatment adherence and recovery outcomes. Conversely, adolescents' emotional distress can also impact the mental health of their parents, creating a bidirectional interactive cycle [10–12].

Recent studies have found that although families of adolescents with emotional disorders often face significant challenges, some are able to adapt effectively, demonstrating stronger family cohesion and resilience [13]. The concept of family resilience was initially proposed by McCubbin and later expanded by Walsh, emphasizing the family's collective ability to adapt and thrive in the face of adversity [14–16]. Research has shown that family resilience can mitigate the negative behavioral impacts of chronic illness in children, reduce the likelihood of internalizing symptoms in adolescents, and enhance adolescent psychological resilience by improving family communication and emotional interactions [17–19].

However, the components and coping strategies of family resilience may vary across different cultural contexts. Unlike the emphasis on individualism in Western cultures, Chinese collectivist culture centers on the family and emphasizes interdependence among family members [20]. Positive family relationships and interpersonal harmony are regarded as fundamental characteristics of a happy family [21], which may help explain why Chinese families, when facing challenges, tend to rely more on immediate or extended family for emotional and

practical support rather than seeking external resources to cope with crises [22]. Empirical studies support the real impact of these cultural differences. Yu et al. [23] found that even after controlling for individual resilience, family resilience continued to exert a significant protective effect on depressive symptoms within the Chinese cultural context, highlighting the central role of the family as an emotional support system. A cross-cultural comparative study by Chow et al. further confirmed that although the underlying structure of the family resilience assessment scale remained stable across Chinese and American samples, items related to religious and spiritual support had lower factor loadings in the Chinese sample, reflecting cultural differences in the use of external support resources [24]. Therefore, identifying and understanding the distinct types and characteristics of family resilience within the Chinese cultural context is essential for developing personalized intervention strategies tailored to the unique features of Chinese families.

Previous studies have identified multiple factors influencing family resilience in families of children with chronic illnesses and individuals with mental health disorders. These include sociodemographic characteristics—such as method of medical payment, caregiver relationship, caregiver age, monthly household income, caregiver employment status, parental education level, place of residence, family structure, parenting style, and family communication patterns [25–30], as well as clinical characteristics of the patient, such as time since diagnosis, symptom severity, self-harming behavior, and treatment adherence [31–33]. However, compared with chronic physical illnesses, adolescent emotional disorders present unique challenges. First, the concealed and subjective nature of emotional disorders often makes it difficult for families to recognize and understand the severity of symptoms, increasing uncertainty in the coping process. Second, social stigma and prejudice toward mental illness may deter families from seeking help [10]. Therefore, families of adolescents with emotional disorders must not only manage the illness itself but also navigate complex emotional dynamics, social stigma, and potential disruptions in family functioning. Moreover, research has shown that adolescents with depression may face different challenges at different stages of the illness, and family resilience may fluctuate over time [34, 35]. with substantial variability in resilience and functioning across families [36]. Thus, the specific factors influencing family resilience in the context of adolescent emotional disorders warrant further investigation. More importantly,

family resilience is a complex systemic construct involving interactions among multiple family members [37]. However, existing studies often rely on data from a single family member, which may not fully capture the family's overall resilience. Zhang et al. [38] pointed out that perceptions of family resilience may differ between patients and primary caregivers within the same household. Therefore, assessment methods that include multiple family members and account for perceptual differences are essential for a comprehensive understanding of family resilience.

Cluster analysis is an effective method to address this issue. This approach can naturally group families based on the characteristics of their members, identifying family types with similar coping patterns [39–41]. In recent years, the integration of dual-perspective designs and cluster analysis has been widely applied in family research. For example, Cummings et al. [42] used cluster analysis to identify different types of family emotion regulation and found these types were significantly associated with key outcome variables, such as communication patterns between caregivers and adolescents. Similarly, Zhang et al. [38] identified three distinct resilience trajectories based on discrepancies in family resilience perceptions between patients and caregivers, and suggested that different family types require tailored intervention strategies. These studies demonstrate that cluster analysis is helpful in identifying heterogeneous patterns within families and provides a foundation for developing personalized intervention strategies.

In light of this, the present study employed a dual perspective, incorporating inputs from both patients and their primary caregivers, utilizing the K-means clustering method. The objectives were to investigate the state of family resilience among adolescents with emotional disorders within the Chinese cultural context, identify family clusters associated with resilience, and explore the link between these clusters and family functioning. This research aims to provide theoretical insights that can guide the development of family-centered, targeted intervention strategies, tailored to the unique characteristics and needs of each cluster.

Methods

Design

A cross-sectional design was employed for the survey.

Sample

Currently, no established consensus exists from calculating sample size in K-means clustering studies. Sample size estimation in this study was based on a method proposed by Im et al., which determines the minimum sample size using the formula 2^k , where k represents the number of variables [43]. The Family Resilience

Assessment Scale (Chinese Version) (FRAS-C) includes three subscales. Family resilience was assessed separately for both patients and their primary caregivers, resulting in a total of six variables (3 subscales \times 2 groups) for cluster analysis. Thus, the minimum required sample size was 64 participants ($k = 6$, sample size = $2^6 = 64$).

To ensure a more thorough exploration of patient characteristics and to enhance the statistical power of the analysis, a larger sample size was targeted. In the final study, 281 patient-caregiver pairs were included. The participant selection process is detailed in Additional File 1.

Participants and procedure

Between December 2023 and July 2024, a total of 281 adolescents diagnosed with emotional disorders and their primary caregivers (either father or mother) were recruited from the outpatient departments of child and adolescent psychiatry at a tertiary psychiatric specialty hospital in Shanghai, China. Participants were selected using a convenience sampling method. To minimize selection bias associated with convenience sampling, all eligible participants were consecutively enrolled during the recruitment period to avoid researcher selection bias. Clear and objective inclusion and exclusion criteria were also established.

The inclusion criteria for adolescent patients were: (1) aged 12–18 years with a diagnosis of emotional disorders specific to childhood onset or other behavioral and emotional disorders typically manifesting in childhood or adolescence, as defined by the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) F93/F98; (2) ≥ 6 years of education; (3) stable clinical condition, clear consciousness, and the ability to independently complete questionnaires; (4) provision of informed consent by both the patient and their guardian. Exclusion criteria included: (1) intellectual developmental disorders; (2) comorbid psychiatric disorders; (3) severe physical illnesses; (4) first-time inpatient treatment or initial diagnosis. For primary caregivers, inclusion criteria were: (1) being the patient's father or mother; (2) living with the patient; (3) assuming primary caregiving responsibilities. Exclusion criteria for caregivers were: (1) presence of severe illnesses or psychiatric disorders in other family members.

To minimize potential investigator bias, three surveyors received standardized training prior to the study. The training included the study's objectives, the use of standardized questionnaire instructions, and consistent protocols for addressing participant questions. All surveyors were registered nurses. Quality control during data collection was overseen by the project lead. To minimize the burden on participants, only one parent from each family was included in the study. The investigators informed all participants of the study's purpose, procedures, potential

risks and benefits, and their right to withdraw at any time using standardized, uniform instructions. Written informed consent was obtained from both the adolescent patients and their caregivers, with caregivers also consenting on behalf of their child. To reduce potential bias, adolescents and caregivers were seated separately in a quiet room, completing their questionnaires independently without any communication or interference. Researchers were available to answer any questions related to the questionnaires but did not provide suggestive guidance. Upon completion, the questionnaires were immediately collected and reviewed for completeness. Missing responses were addressed on-site by inviting participants to fill in any gaps. Missing responses above 10%, or questionnaires exhibiting patterned responses, or those where only one participant (either the patient or caregiver) completed the survey were excluded. The completion of the questionnaires took approximately 15 min.

Measures

Sociodemographic and clinical characteristics

The questionnaire gathered extensive sociodemographic and clinical information from both adolescent patients and their primary caregivers. For adolescent patients, data collected included age, sex, education level, number of siblings, type of medical insurance, duration since diagnosis, history of self-injurious behavior, current disease-related distress, and the perceived quality of the parent-child relationship.

Data collected for primary caregivers included the caregiver's relationship to the patient, age, education level, employment status, family residence (urban/rural), family structure, monthly household income per capita, parenting style, perceived quality of the parent-child relationship, and perceived quality of the spousal relationship.

Family resilience

Family resilience was evaluated using the FRAS-C. This scale. Originally developed by Sixbey based on Walsh's family resilience model, the scale was subsequently culturally adapted into Chinese by Li et al. [15, 44, 45]. This scale demonstrated good internal consistency among Chinese pediatric patients and their families [46]. The FRAS-C consists of 32 items distributed across three dimensions: Family Communication and Problem Solving (FCPS), Utilizing Social Resources (USR), and Maintaining a Positive Outlook (MPO). Responses are rated on a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree), with total scores ranging from 32 to 128. Higher scores signify stronger family resilience. In this study, the Cronbach's α coefficient ranged from 0.947 to 0.975, indicating excellent internal consistency for both adults and adolescents.

Family functioning

Family functioning was assessed using the Family Concern Index Questionnaire (APGAR) [47]. This scale is concise and quick to complete, and it has been widely used among Chinese adolescents and patient caregivers [48, 49]. This 5-item questionnaire evaluates subjective satisfaction with family functioning across five dimensions: Adaptability, Partnership, Growth, Affection, and Resolve. Each item is rated on a 3-point scale (0 = hardly ever, 1 = some of the time, 2 = almost always). Total scores range from 0 to 10, with higher scores indicating better family functioning. In this study, the Cronbach's α coefficient ranged from 0.849 to 0.911, demonstrating good internal consistency for both adults and adolescents.

Statistical analysis

Statistical analyses were performed using SPSS 25.0 and Python 3.12.4. The Python clustering analysis primarily utilized the scikit-learn library, with cluster validation conducted by calculating the silhouette coefficient and Davies-Bouldin index using the sklearn.metrics module. Visualization was carried out using the matplotlib and scipy libraries.

To investigate the resilience characteristics of families with adolescents experiencing different emotional disorders, this study employed K-means clustering analysis to identify family groups with similar patterns of family resilience. K-means is an unsupervised machine learning algorithm that effectively partitions cases into a predetermined number (K) of clusters by maximizing inter-cluster differences while minimizing intra-cluster variance. The clustering results have clear boundaries and present intuitive outcomes, facilitating the identification and interpretation of family types naturally formed by multidimensional data [50]. This method is suitable for clustering large sample sizes with continuous variables and has been applied in studies of family resilience [38]. Although K-means is sensitive to outliers and assumes spherical clusters, these limitations can be effectively mitigated through data preprocessing and multiple validation approaches.

To account for scale differences across dimensions on the clustering results, the data were standardized using Z-scores. Several methods were employed to determine the optimal number of clusters. First, Hierarchical Clustering was performed using Ward's method, which minimizes within-cluster variance, with squared Euclidean distance to compute inter-sample distances. This process generated a dendrogram (Fig. 1), suggesting that 4 to 5 clusters might be appropriate. Next, the Elbow Method was applied, which involves plotting the Within-Cluster Sum of Squares (WCSS) as the number of clusters (K) increases (Fig. 2). The curve demonstrated a plateau at K=5, indicating an inflection point where the rate of

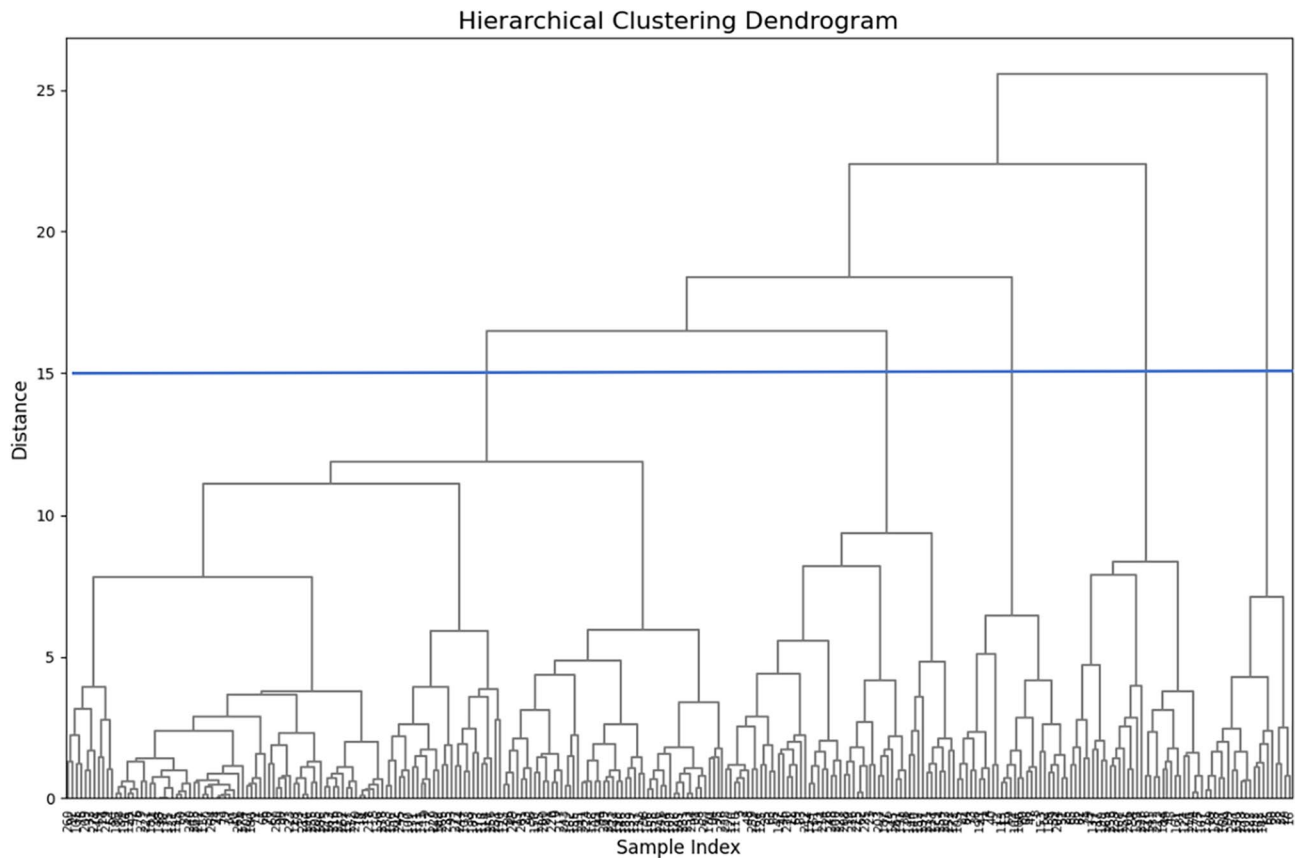


Fig. 1 Hierarchical clustering dendrogram

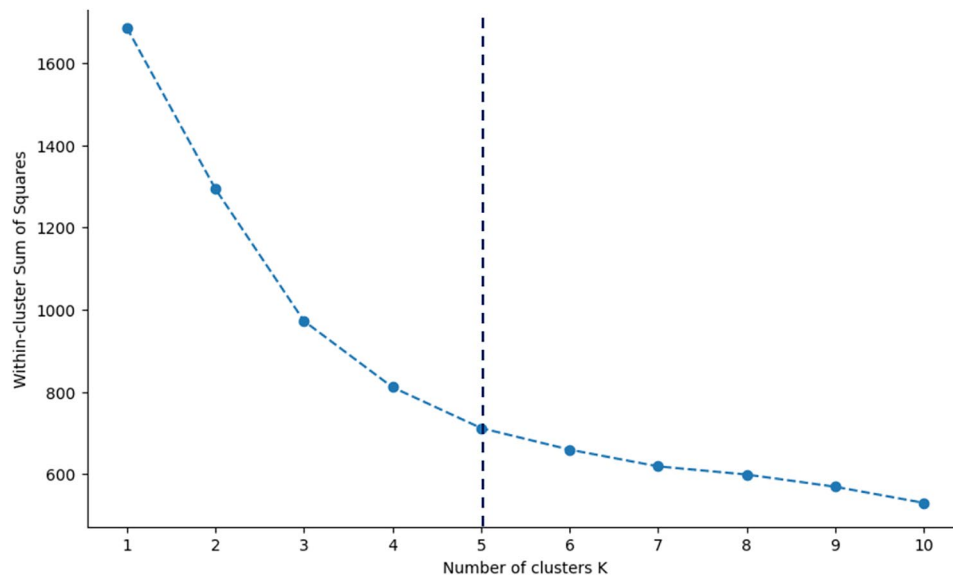


Fig. 2 Optimal number of clusters

decrease in WCSS slowed significantly, suggesting $K=5$ as the optimal number of clusters [51]. Finally, Cluster Validation Indices were calculated, including the Davies-Bouldin Index (DBI) and Silhouette Coefficient. For $K=4$, the DBI was 1.532 and the Silhouette Coefficient was

0.211, whereas for $K=5$, the DBI was 1.289 and the Silhouette Coefficient was 0.256, indicating superior model quality at $K=5$ [52].

Considering statistical validity, interpretability, and clinical relevance, $K=5$ was ultimately selected as the

optimal number of clusters. K-means clustering was subsequently performed using the default parameter settings (Lloyd's algorithm) to finalize the clustering process.

Descriptive statistics were used to summarize participants' sociodemographic characteristics, with continuous variables reported as means and standard deviations, and categorical variables as frequencies (percentages). Normality of continuous variables was assessed using Q-Q plots and P-P plots, which indicated that the data approximated a normal distribution. Independent samples t-tests were performed to compare family resilience and family functioning scores between the perspectives of patients and caregivers. One-way ANOVA with Bonferroni post-hoc tests was used to evaluate differences in FRAS-C total scores, its three subscales, and APGAR scores across the five clusters for both patients and caregivers. Chi-square tests were used to examine overall differences in sociodemographic characteristics among the different family resilience subgroups, followed by pairwise post hoc comparisons with Bonferroni correction. For structurally missing data resulting from divorce or bereavement (i.e., missing values for the spousal relationship variable), no imputation was performed. Analyses related to spousal relationship quality across subgroups were conducted only on the relevant participant subsample. In addition, through on-site quality control measures, no other types of missing data occurred in this study.

Pearson correlation analysis was conducted to explore the relationship between family resilience and family functioning. Statistical significance was considered at $p < 0.05$ (two-tailed) for all tests.

Results

Demographic and clinical characteristics

Table 1 presents the demographic and clinical characteristics of the 281 patient-caregiver dyads. The adolescent patients had a mean age of 14.74 years ($SD = 1.77$), with the majority being female (72.6%). The caregivers, with a mean age of 43.12 years (ranging from 32 to 61 years), were predominantly mothers (75.40%). The time since diagnosis varied from 1 to 84 months, with a median of 7 months.

A majority of adolescents lived in urban or suburban areas (87.2%, $n = 245$), with most coming from nuclear families (56.6%, $n = 159$). The dominant parenting style was found to be indulgent (44.1%, $n = 124$). Of the patients, 84.3% reported experiencing distress related to their condition, which included symptoms such as frequent urges to cry, perceived disease progression, sleep disturbances, refusal to attend school, and difficulties with communication and social interactions.

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Table 2 presents the scores for the FRAS-C total scale, its dimensions, and the APGAR scale. Independent samples t-tests indicated that patients reported significantly lower scores on the FRAS-C, its subscales, and the APGAR scale compared to caregivers, with these differences being statistically significant ($P < 0.05$).

Cluster analysis

Clustering was performed using the three FRAS-C dimensions: Family Communication and Problem Solving, Utilizing Social Resources, and Maintaining a Positive Outlook, from both the patient and primary caregiver perspectives. Table 3 presents the final cluster centers, while Fig. 3 illustrates the characteristics of each cluster. One-way ANOVA revealed significant differences among the five clusters in all three family resilience dimensions, total FRAS-C scores, and the discrepancy between patient and caregiver total FRAS-C scores ($p < 0.001$, Table 4). Based on these characteristics, five family types were identified: "Dual Adversity", "Caregiver-Empowered", "Balanced and Coordinated", "Patient-Strength", and "Divergent-Challenge".

Cluster 1: Dual adversity families (18.51%, $n = 52$)

This family type exhibited low scores on all dimensions of family resilience for both patients and primary caregivers. Caregivers' scores were the lowest among all five groups, with minimal variation between patient and caregiver scores. These families demonstrated generally low levels of family resilience, with both patients and caregivers sharing similar perceptions, likely due to facing common challenges and stressors. This pattern is consistent with Walsh's family resilience theory, which suggests that when families face overwhelming stress and lack sufficient coping resources, both patients and caregivers may experience a diminished capacity for resilience [15].

Cluster 2: Caregiver-empowered families (10.32%, $n = 29$)

In this family type, primary caregivers ranked highest in all dimensions of family resilience, while patients ranked second. Caregivers scored significantly higher than patients in all dimensions ($p < 0.001$), suggesting that family resilience was primarily driven by caregivers. According to the Dual-Process Model of Disease Management [53], this pattern reflects how caregivers' positive coping states are transmitted to adolescents through interactive processes, embodying the synergistic effect of family coping.

Table 1 Sample demographics and clinical characteristics of the study population and differences among the 5 clusters (281 dyads)

Patient variables	Total (n = 281)	Cluster 1 (n = 52)	Cluster 2 (n = 29)	Cluster 3 (n = 130)	Cluster 4 (n = 32)	Cluster 5 (n = 38)	Statistic	p-value
General characteristics of patients								
Age (years), M ± SD	14.74 ± 1.77	14.54 ± 1.90	14.86 ± 1.87	14.85 ± 1.76	14.75 ± 1.93	14.50 ± 1.37	0.510*	0.728
Gender, n(%)							5.657#	0.226
Male	77(27.40)	20(38.50)	6(20.70)	33(25.40)	6(18.80)	12(31.60)		
Female	204(72.60)	32(61.50)	23(79.30)	97(74.60)	26(81.30)	26(68.40)		
Education, n(%)							2.174#	0.704
Middle school and below	189(67.30)	35 (67.30)	20 (69.00)	83 (63.80)	22 (68.80)	29 (76.30)		
High school	92(32.70)	17 (32.70)	9 (31.00)	47 (36.20)	10 (31.30)	9 (23.70)		
Number of children, n(%)							8.219#	0.084
One	144(51.20)	24(46.20)	18(62.10)	59(45.40)	17(53.10)	26(68.40)		
More than one	137(48.80)	28(53.80)	11(37.90)	71(54.60)	15(46.90)	12(31.60)		
Payment type for medical expenses, n(%)							10.820#	0.029
Self-financed	89(31.70)	22(42.30) ^a	3(10.30) ^b	43(33.10) ^{a, b}	7(21.90) ^{a, b}	14(36.80) ^{a, b}		
Medical insurance	192(68.30)	30(57.70) ^a	26(89.70) ^b	87(66.90) ^{a, b}	25(78.10) ^{a, b}	24(63.20) ^{a, b}		
Time since diagnosis ^d , n(%)							15.843 ^c	0.172
1-6 month	137(48.80)	25 (48.10)	16 (55.20)	63 (48.50)	18 (56.30)	15 (39.50)		
7-18 month	94(33.50)	21 (40.40)	8 (27.60)	46 (35.40)	10 (31.30)	9 (23.70)		
19-36 month	30(10.70)	4 (7.70)	3 (10.30)	11 (8.50)	1 (3.10)	11(28.90)		
> 36 month	20(7.10)	2 (3.80)	2 (6.90)	10 (7.70)	3 (9.40)	3 (7.90)		
Self-injurious behavior, n(%)							1.738#	0.784
No	89(31.70)	20(38.50)	8(27.60)	39(30.00)	11(34.40)	11(28.90)		
Yes	192(68.30)	32(61.50)	21(72.40)	91(70.00)	21(65.50)	27(71.10)		
History of psychiatric medication self-discontinuation, n(%)							11.406#	0.022
No	153(54.40)	25(48.10) ^{a, b}	17(58.60) ^{a, b}	73(56.20) ^{a, b}	24(75.00) ^b	14(36.80) ^a		
Yes	128(45.60)	27(51.90) ^{a, b}	12(41.40) ^{a, b}	57(43.80) ^{a, b}	8(25.00) ^b	24(63.20) ^a		
Current presence of disease-related distress, n(%)							47.235#	<0.001
No	44(15.70)	3(5.80) ^a	5(17.20) ^a	15(11.50) ^a	18(56.30) ^b	3(7.90) ^a		
Yes	237(84.30)	49(94.20) ^a	24(82.80) ^a	115(88.50) ^a	14(43.80) ^b	35(92.10) ^a		
Perceived parent-child relationship, n(%)							82.211#	<0.001
Poor	31(11.10)	1(1.90) ^a	1(3.40) ^a	9(6.90) ^a	2(6.30) ^a	18(47.40) ^b		
Average	105(37.40)	30(57.70) ^a	10(34.50) ^{a, b}	47(36.20) ^{a, b}	4(12.50) ^b	14(36.80) ^{a, b}		
Perfect	145(51.60)	21(40.40) ^{a, b}	18(62.10) ^{b, c}	74(56.90) ^{b, c}	26(81.30) ^c	6(15.80) ^a		
General characteristics of Caregiver								
Relationship, n(%)							2.700#	0.609
Mother	212(75.40)	43(82.70)	20(69.00)	97(74.60)	25(78.10)	27(71.10)		
Father	69(24.60)	9(17.30)	9(31.00)	33(25.40)	7(21.90)	11(28.90)		
Age (years), M ± SD	43.12 ± 4.92	43.75 ± 5.47	42.34 ± 4.64	42.81 ± 4.76	43.09 ± 5.61	43.95 ± 4.3	0.789*	0.533
Education, n(%)							13.808#	0.087
Middle school and below	85(30.20)	17(32.70)	4(13.80)	41(31.50)	7(21.90)	16(42.10)		
High school	42(14.90)	5(9.60)	5(17.20)	23(17.70)	2(6.30)	7(18.40)		
Bachelor or above	154(54.80)	30(57.70)	20(69.00)	66(50.80)	23(71.90)	15(39.50)		
Employment, n(%)							17.558 [‡]	0.020
Full-time or Part-time	172(61.20)	31 (59.60) ^{a, b}	10(34.50) ^b	84 (64.60) ^a	19 (59.40) ^{a, b}	28 (73.70) ^a		
Self-employed	84(29.90)	13 (25.00) ^{a, b}	16(55.20) ^b	38 (29.20) ^{a, b}	11 (34.40) ^{a, b}	6 (15.80) ^a		
Unemployed	25(8.90)	8 (15.40) ^a	3 (10.30) ^a	8 (6.20) ^a	2 (6.30) ^a	4 (10.50) ^a		
Family location, n(%)							3.027 [‡]	0.553
Urban areas	245(87.20)	46 (88.50)	28 (96.60)	110 (84.60)	28 (87.50)	33 (86.80)		
Rural areas	36(12.80)	6 (11.50)	1 (3.40)	20 (15.40)	4 (12.50)	5 (13.20)		
Family types, n(%)							12.289 [‡]	0.402
Core family	159(56.60)	31 (59.60)	14 (48.30)	77 (59.20)	20 (62.50)	17 (44.70)		
Extended family	77(27.40)	9 (17.30)	8 (27.60)	38 (29.20)	8 (25.00)	14 (36.80)		
Stepparent family	22(7.80)	5 (9.60)	3 (10.30)	8 (6.20)	3 (9.40)	3 (7.90)		

Table 1 (continued)

Patient variables	Total (n = 281)	Cluster 1 (n = 52)	Cluster 2 (n = 29)	Cluster 3 (n = 130)	Cluster 4 (n = 32)	Cluster5 (n = 38)	Statistic	p-value
Single-parent family	23(8.20)	7 (13.50)	4 (13.80)	7 (5.40)	1 (3.10)	4 (10.50)		
Per capita monthly household income(yuan) ^e ,n(%)							23.126 [#]	0.003
≤4000	81(28.80)	22(42.30) ^a	7(24.10) ^{a,b}	32(24.60) ^{a,b}	4(12.50) ^b	16(42.10) ^{a,b}		
4001~8000	97(34.50)	10(19.20) ^a	6(20.70) ^{a,b}	51(39.20) ^{a,b}	16(50.00) ^b	14(36.80) ^{a,b}		
>8000	103(36.70)	20(38.50) ^{a,b}	16(55.20) ^b	47(36.20) ^{a,b}	12(37.50) ^{a,b}	8(21.10) ^a		
Parenting Style, n(%)							27.371 [#]	0.007
Authoritarian	53(18.90)	14(26.90) ^a	7(24.10) ^a	23(17.70) ^a	6(18.80) ^a	3(7.90) ^a		
Neglectful	38(13.50)	12(23.10) ^{a,b}	1(3.40) ^{a,b}	13(10.00) ^b	1(3.10) ^b	11(28.90) ^a		
Permissive	124(44.10)	20(38.50) ^a	12(41.40) ^a	58(44.60) ^a	18(56.30) ^a	16(42.10) ^a		
Authoritative	66(23.50)	6(11.50) ^a	9(31.00) ^a	36(27.70) ^a	7(21.90) ^a	8(21.10) ^a		
Perceived parent-child relationship, n(%)							20.622 ^{&}	0.006
Poor	24(8.50)	4(7.70) ^a	0(0.00) ^a	13(10.00) ^a	1(3.10) ^a	6(15.80) ^a		
Average	91(32.40)	24(46.20) ^a	3(10.30) ^b	42(32.30) ^{a,b}	9(28.10) ^{a,b}	13(34.20) ^{a,b}		
Good	166(59.10)	24(46.20) ^a	26(89.70) ^b	75(57.70) ^a	22(68.80) ^{a,b}	19(50.00) ^a		
Perceived spousal relationship (total n = 254),n(%)							23.772 ^{&}	0.001
Poor	12(4.70)	2(4.30) ^{a,b}	1(4.00) ^{a,b}	3(2.50) ^b	1(3.60) ^{a,b}	5(15.20) ^a		
Average	72(28.30)	21(44.70) ^a	1(4.00) ^b	32(26.40) ^{a,b}	7(25.00) ^{a,b}	11(33.30) ^{a,b}		
Good	170(66.90)	24(51.10) ^a	23(92.00) ^b	86(71.10) ^{a,b}	20(71.40) ^{a,b}	17(51.50) ^a		

^{a,b,c}Proportions in the same row with different superscript letters indicate significant differences between groups ($p < 0.05$, Bonferroni-adjusted)

^dTime since diagnosis was used to measure the duration of the disease, calculated from the date of formal diagnosis to the date of the survey

^e4000 Chinese Yuan ≈ 562.688 US dollar; and the national per capita disposable annual income of Chinese residents in 2023 was 39,218 Chinese Yuan (https://www.stats.gov.cn/sj/zxfb/202401/t20240116_1946622.html)

*One-Way ANOVA

[#]Pearson chi-square test

[&]Fisher's exact test

Table 2 Comparison of FRAS-C and APGAR scores between patients and caregivers (N = 281 dyads)

Dimension	patient	Caregiver	t	p-value
FRAS -C	86.98 ± 18.05	95.31 ± 9.71	-6.821	< 0.001
FCPS	62.18 ± 13.45	68.33 ± 7.08	-6.785	< 0.001
USR	7.68 ± 1.97	8.52 ± 1.28	-5.990	< 0.001
MPO	17.11 ± 3.78	18.46 ± 2.25	-5.122	< 0.001
APGAR	5.36 ± 2.73	5.86 ± 2.45	-2.297	0.022

FRAS-C The Family Resilience Assessment Scale (Chinese Version), FCPS Family Communication and Problem Solving, USR Utilizing Social Resources, MPO Maintaining a Positive Outlook, APGAR Family Concern Index Questionnaire

Cluster 3: Balanced and coordinated families (46.26%, n = 130)

A moderate family resilience across all dimensions was demonstrated by both patients and primary caregivers. Patients ranked third or fourth, while caregivers ranked

second or third, with minimal differences between them. These families displayed stable and moderate resilience levels. This balanced pattern reflects Patterson et al.'s view of family resilience as an inherent attribute of family functioning, specifically referring to the ability to maintain internal stability and equilibrium within the family despite significant adversity [54].

Cluster 4: Patient-strength families (11.39%, n = 32)

In this family type, patients ranked first in all family resilience dimensions, while caregivers ranked second in maintaining a positive outlook, third in family communication and problem solving, and fourth in utilizing social resources. Patients scored significantly higher than caregivers across all dimensions ($p < 0.001$), suggesting that patients perceived higher levels of family resilience. This

Table 3 Final cluster centre(standardization)

Dimension		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
FCPS	Patient	-0.063646	0.358867	0.001951	1.617993	-1.555973
	Caregiver	-0.024719	0.266008	-0.054028	1.351563	-1.122506
USR	Patient	0.164293	0.372548	0.038005	1.451992	-1.861882
	Caregiver	-0.825109	2.098354	-0.00597	-0.016372	-0.438069
MPO	Patient	-1.132672	1.588795	0.19877	-0.189442	-0.183001
	Caregiver	-0.784439	2.083175	-0.04181	0.047596	-0.413395

FCPS Family Communication and Problem Solving, USR Utilizing Social Resources, MPO Maintaining a Positive Outlook

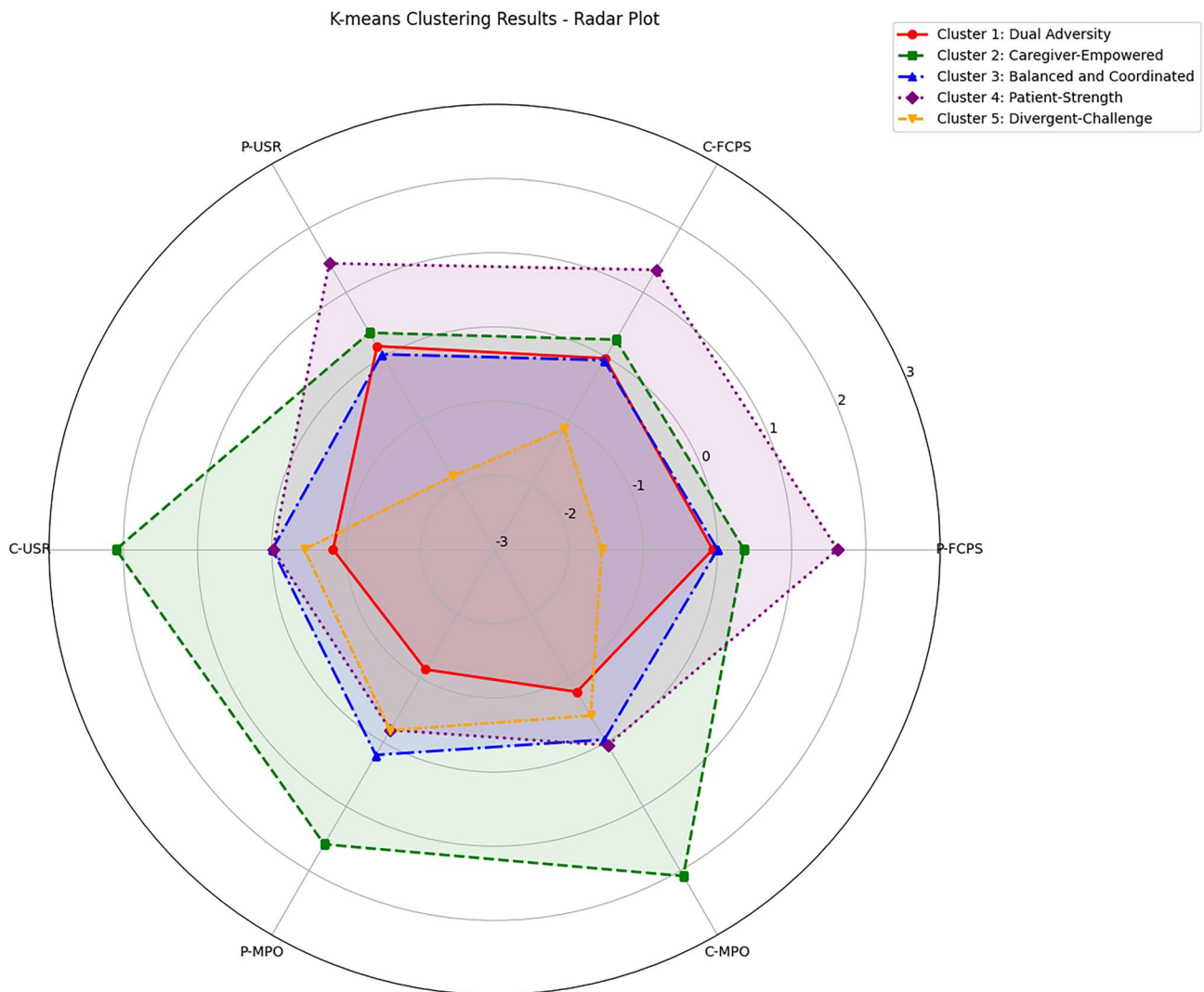


Fig. 3 Radar Chart Illustrating Cluster Characteristics of Family Resilience in Adolescents with Emotional Disorders P-FCPS: the Patient-reported Family Communication and Problem Solving dimension score; C-FCPS: the Caregiver-reported Family Communication and Problem Solving dimension score; P-USR: the Patient-reported Utilizing Social Resources; C-USR: the Caregiver-reported Utilizing Social Resources; P-MPO: the Patient-reported Maintaining a Positive Outlook; C-MPO: the Caregiver-reported Maintaining a Positive Outlook

pattern is consistent with the theory of posttraumatic growth [55], which posits that individuals may develop adaptive capacities that exceed their previous levels of functioning after experiencing significant challenges.

Cluster 5: Divergent-challenge families (13.52%, $n = 38$)

In this family type, patients ranked lowest in all family resilience dimensions, while caregivers ranked third or fourth. Caregivers scored significantly higher than patients across all dimensions ($p < 0.001$), showing the greatest discrepancy among all clusters. These families exhibited low resilience, with a notable gap in resilience perception between patients and caregivers. According to family systems theory [56], this low resilience and marked perceptual divergence may reflect communication barriers and uncoordinated coping strategies within

the family, suggesting possible dysfunction in the family system [57].

Cluster-based differences in characteristics and family functioning

Analysis of the five clusters revealed significant differences in several key areas ($p < 0.05$, Table 1), including patients' method of medical payment, current disease-related distress, perceived parent-child relationship, and history of self-discontinuation of psychiatric medication. Caregivers also showed significant differences in employment status, average monthly household income per capita, parenting style, and perceived quality of both parent-child and marital relationships. However, no significant differences were found in relation to patients' sex, age, education level, only-child status, time since

Table 4 Descriptions and ANOVA analysis of FRAS-C and APGAR scores in the five clusters (N = 281 dyads)

Variables	Cluster 1 (n = 52)		Cluster 2 (n = 29)		Cluster 3 (n = 130)		Cluster 4 (n = 32)		Cluster 5 (n = 38)		F	P	
	M ± SD	Rank	M ± SD	Rank	M ± SD	Rank	M ± SD	Rank	M ± SD	Rank			
FCPS	Patient	61.33 ± 7.56	4c	67.00 ± 11.03	2b	62.21 ± 7.94	3c	83.91 ± 6.58	1a	41.29 ± 8.18	5d	165.632	<0.001
	Caregiver	62.5 ± 5.73	5c	83.17 ± 5.61	1a	68.29 ± 2.96	2b	68.22 ± 4.56	3b,c	65.24 ± 5.70	4c	159.384	<0.001
USR	Patient	7.63 ± 1.70	3b	8.21 ± 1.72	2b	7.58 ± 1.36	4b	10.34 ± 1.49	1a	5.47 ± 1.86	5c	122.437	<0.001
	Caregiver	7.08 ± 0.97	5c	10.55 ± 1.21	1a	8.78 ± 0.61	2b	8.28 ± 1.20	4b	8.29 ± 0.98	3b	106.303	<0.001
MPO	Patient	17.73 ± 1.99	3b	18.52 ± 2.13	2b	17.25 ± 1.78	4b	22.59 ± 1.50	1a	10.08 ± 2.75	5c	43.595	<0.001
	Caregiver	16.69 ± 1.63	5c	23.14 ± 0.99	1a	18.36 ± 1.25	3b	18.56 ± 1.61	2b	17.53 ± 1.98	4b,c	76.208	<0.001
Total score	Patient	86.69 ± 9.08	4c	93.72 ± 14.02	2b	87.04 ± 9.05	3c	116.84 ± 8.54	1a	56.84 ± 10.79	5d	185.490	<0.001
	Caregiver	86.27 ± 6.34	5d	116.86 ± 6.58	1a	95.43 ± 3.46	2b	95.06 ± 5.54	3b,c	91.05 ± 7.75	4c	97.63	<0.001
Difference Score	Patient-Caregiver	0.42 ± 10.83	5e	-23.14 ± 14.40	2b	-8.39 ± 9.73	4d	21.78 ± 10.69	3c	-34.21 ± 13.17	1a	131.724	<0.001
	APGAR	4.73 ± 2.16	4c	6.21 ± 2.02	2b	5.52 ± 2.53	3c,b	8.78 ± 0.87	1a	2.18 ± 1.41	5d	43.297	<0.001
	Caregiver	4.5 ± 2.55	5c	8.07 ± 1.36	1a	6.09 ± 2.27	2b	5.81 ± 2.56	3b,c	5.32 ± 2.12	4b,c	12.451	<0.001

FRAS-C The Family Resilience Assessment Scale (Chinese Version), FCPS Family Communication and Problem Solving, USR Utilizing Social Resources, MPO Maintaining a Positive Outlook, APGAR Family Concern Index Questionnaire, M Mean, SD standard deviation

Values were ranked from the highest to the lowest. Differences in post hoc analysis were represented by the following order: a > b > c > d > e, P < 0.05

diagnosis, self-harm behaviors, or in caregivers' relationship to the patient, age, education level, family residence area, or family type.

Family functioning, assessed through APGAR scores, varied significantly across the clusters ($p < 0.001$, Table 4). Clusters 1 and 5 showed lower family functioning, with patients and caregivers in these groups consistently ranking in the lowest two positions. In contrast, Clusters 2 and 4 demonstrated higher family functioning, with both patients and caregivers ranking in the top three. Cluster 3 demonstrated moderate family functioning, with rankings for both patients and caregivers falling in the middle range. These patterns in family functioning were closely aligned with the family resilience cluster scores.

To further examine the connection between family resilience and family functioning, Pearson correlation analysis was performed. The results indicated significant positive correlations between self-reported family resilience and family functioning for both adolescents ($r = 0.668$, $p < 0.001$) and primary caregivers ($r = 0.405$, $p < 0.001$).

Discussion

This study utilized K-means cluster analysis to identify five distinct family resilience groups. The results reveal the following key points: (1) patients and caregivers report significantly different levels of family resilience; (2) the five family groups exhibit varied levels of family functioning; (3) a positive correlation exists between family resilience and family functioning; and (4) socioeconomic factors (such as medical payment method, monthly household income per capita, and caregiver employment status), family relationship quality (including parent-child and marital relationships, as well as parenting style), and disease-related factors (such as disease distress and history of self-discontinuation of psychiatric medication) all play a role in shaping family resilience clusters.

Differences in patient-caregiver perspectives

Significant differences were observed between adolescents with emotional disorders and their caregivers regarding reported levels of family resilience and family functioning, underscoring the importance of obtaining assessments from multiple family members. In this study, adolescent patients (mean score = 86.98 ± 18.05) reported lower family resilience scores than primary caregivers (mean score = 95.31 ± 9.71). Both scores were lower than the family resilience levels of parents of children with dwarfism (mean score = 99.29 ± 8.53) in previous research [58].

The unique nature of mental and psychological illnesses can disrupt children's social, learning, and interpersonal abilities, often leading to alienation or conflict within families [59]. In contrast to physical illnesses,

the stigma surrounding mental health conditions may prompt families to hide the illness, reduce social interactions, and limit access to external support [60]. This social isolation not only negatively impacts overall family functioning but may also worsen the psychological burden on caregivers, contributing to relatively lower levels of family resilience [11].

Furthermore, emotional disorders directly impact patients' psychological well-being and cognitive processes, potentially resulting in more negative perceptions of the family environment and support available to them [61]. In contrast, caregivers often have access to more abundant social resources, both within and outside the family, receiving greater emotional and material support, which may enhance their ability to cope with stress [62]. This may explain why caregivers in this study reported higher family resilience levels compared to patients, which contrasts with findings from research on other chronic disease [63].

Additionally, this study identified a significant positive correlation between family resilience and family functioning, which is consistent with previous research [64]. This underscores the potential importance of enhancing family resilience to improve family functioning. Since all families have the potential to bolster their resilience, the timely identification and strengthening of resilience in families of adolescents with emotional disorders is essential for improving their overall family functioning [65].

Cluster characteristics and implications

Based on the FRAS-C scores reported by adolescents with emotional disorders and their primary caregivers from a specialized hospital sample in this study, five distinct family resilience clusters were identified: Dual Adversity, Caregiver-Empowered, Balanced and Coordinated, Patient-Strength, and Divergent-Challenge families.

The Balanced and Coordinated family type was the most prevalent in our study (46.26%), with moderate levels of both family resilience and family functioning scores within the cluster groups. This finding reflects the situation of many families dealing with adolescent emotional disorders and is in line with Walsh's perspective, which suggests that resilient families can balance stability and change [16]. However, as Malik points out, while this balance supports stable family functioning, it may also restrict a family's flexibility and adaptability when confronted with new challenges [66]. Therefore, Balanced and Coordinated families may need to enhance their adaptive capabilities. Within this group, patients demonstrated relatively low scores in utilizing social resources and maintaining a positive attitude, ranking fourth among all clusters. These deficiencies may serve as critical barriers to enhancing family resilience. To

address these challenges, healthcare professionals can offer adolescents social skills training and peer support groups, while also working to identify and strengthen positive family beliefs, fostering confidence in managing the illness [67]. Through resource exploration activities and role-exchange exercises, healthcare providers can encourage family members to better understand each other's needs, enhance the entire family system's ability to utilize resources, and thereby effectively improve overall family resilience levels [68].

In addition to the predominant Balanced and Coordinated family type, this study identified two other family types with high levels of family resilience: Caregiver-Empowered (10.32%) and Patient-Strength (11.39%) families. Although these groups represent relatively small proportions, they indicate that despite the challenges associated with adolescent emotional disorders, families may still cultivate high levels of resilience. Caregiver-Empowered families exhibited high levels of family resilience and functioning from the caregiver's perspective. This group demonstrated significant socio-economic advantages, including the highest rate of medical insurance coverage (89.7%) and a high proportion of high-income households (above 8000 yuan, 55.2%). This finding is consistent with previous research, which suggests a positive correlation between family economic status and resilience [69]. Adequate economic resources not only strengthen a family's ability to manage risks but may also enhance psychological resilience by reducing financial stress [70]. Interestingly, this family type had the highest proportion of self-employed individuals (55.2%), indicating that occupational flexibility may enable caregivers to better balance work and family responsibilities.

Furthermore, these families excelled in relationship quality, with the highest proportions of caregivers reporting good parent-child relationships (89.7%) and good marital relationships (92.0%). This aligns with research done by Park et al., which emphasizes the critical role of family communication skills in the adaptation process [62]. Notably, although families in this group had relatively favorable economic conditions and social resources, the proportion of adolescents with emotional disorders who had a history of self-injury was the highest (72.40%). This may be a key trigger prompting parents to become highly involved and take a leading role in the family resilience process. Previous studies have shown that a child's self-injurious behavior often heightens parental vigilance and support efforts [71, 72]. Adaptive parental responses and coping abilities can strengthen emotional bonds within the family, improve parent-child relationships, and enhance overall family cohesion. During the critical developmental stage of adolescent identity formation, such parent-led protective coping may lead adolescents with emotional disorders to rely more heavily

on parental support and resource access. To maintain and enhance the existing strengths of these families, it is recommended that healthcare professionals implement regular assessment mechanisms. Based on these assessments, timely and targeted interventions should be provided, such as offering respite services and stress management training for caregivers exhibiting signs of burnout [73]. At the same time, it is essential to gradually guide parents to shift from an overly protective role toward fostering adolescents' self-management abilities. This can be achieved through family psychoeducation, training in coping strategies for self-injurious behaviors, and other supportive interventions, which help adolescents build a sense of self-efficacy and promote more balanced interactions among family members.

Patient-Strength families demonstrate stronger family resilience and functioning from the patient's perspective, which may reflect adolescents' positive adaptation and high self-efficacy in managing their illness. The lower rate of self-discontinuation of medication (25%) in this family type indicates higher treatment adherence, consistent with findings of Zhang et al., which emphasize the impact of both parents' and patients' understanding of the illness on future treatment decisions [34]. The high proportion of patients without disease-related distress (56.3%) further supports the positive correlation between disease stability, self-management ability, and family resilience [36].

Regarding parenting styles, research suggests that authoritative parenting fosters greater family cohesion and more balanced family functioning, as opposed to neglectful parenting [74]. Qiu et al. observed that parents of children with chronic illnesses generally exhibit lower family resilience and authoritative parenting levels compared to parents of healthy children, with authoritative parenting fully mediating the relationship between family resilience and psychosocial adaptation in children with chronic illnesses [30]. Despite the high levels of family resilience observed in Patient-Strength families, primary caregivers still exhibit notable gaps in family communication, problem-solving, and the effective utilization of social resources. Within the Chinese cultural context, where families are predominantly child-centered, parents often adapt their behaviors to shield their children from additional stress. This may involve suppressing negative emotions or outwardly displaying positive coping mechanisms [65–76]. As a result, children may perceive stronger family resilience, while parents experience greater stress and report lower levels of family resilience than the patients themselves [63]. Therefore, we recommend that healthcare professionals offer caregivers safe avenues for emotional expression, teach effective stress management techniques, and assist them in prioritizing their own needs while caring for patients. Additionally, caregiver

skill training should emphasize the identification and utilization of social resources, alongside encouraging patient independence while continuing to offer support.

While Caregiver-Empowered and Patient-Strength families demonstrated high resilience, our study also identified two family types facing significant challenges: Dual Adversity and Divergent-Challenge families. In Dual Adversity families, both patients and caregivers reported low levels of family resilience, with minimal differences, potentially indicating a general dysfunction within the family system. This family type exhibited several unfavorable characteristics: a high proportion of patients experiencing current disease-related distress (94.2%), a high rate of self-paid medical care (42.3%), a significant proportion of low-income families (≤ 4000 yuan, 42.3%), and the highest rates among the five groups of caregivers reporting average parent-child relationships (46.2%) and average marital relationships (44.7%). These features highlight the severe challenges these families face across various dimensions, including economic, health, and relationship quality. According to the Family Adjustment and Adaptation Response (FAAR) model, these families may be struggling to transition from the adjustment phase to the adaptation phase [77]. They may need to reassess their values, beliefs, goals, and role distributions, which could require more fundamental changes, including modifications to family structure, communication patterns, and resource allocation. For these families, it was recommended to implement comprehensive intervention strategies that help family members reframe and approach stressful events with a positive, optimistic perspective. This approach should focus on building positive therapeutic alliances, identifying internal family strengths and resources, and enhancing family self-efficacy. Additionally, it should improve interaction patterns among family members and empower parents to take a leadership role in solving family problems [78]. These strategies are intended to foster positive family adaptation and strengthen overall family resilience.

Divergent-Challenge families are characterized by low family resilience scores reported by both caregivers and patients, with significant discrepancies between the two. This inconsistency may lead to an imbalance in family dynamics, weakened family functioning, and an increased risk of communication barriers and conflicts. Research indicates that in this group, there is a high proportion of patients perceiving poor parent-child relationships (47.4%), caregivers perceiving poor marital relationships (15.2%), and a high prevalence of neglectful parenting styles (28.9%).

To enhance family adaptability, it is essential to promote effective interpersonal skills, including communication, conflict management, emotional guidance, and problem-solving, within the spousal relationship,

parent-child system, and sibling subsystems [79]. Therefore, for these families, it was recommended to build strong therapeutic relationships to foster a sense of understanding and safety among family members. It is also important to enhance the parent-child relationship, encourage consistency in parenting and decision-making, and support parents in adopting democratic and authoritative parenting styles. Furthermore, assisting family members in identifying and transforming ineffective problem-solving approaches, while teaching new coping strategies such as improving communication skills, can significantly benefit the family dynamics [80].

It is worth mentioning that this study was conducted in China, a country with a traditional culture that places a strong emphasis on collectivism. In this setting, family resilience is often shaped by values such as family harmony, filial piety, and collectivism. These cultural factors may influence patterns of family communication, decision-making processes, and the ways in which resources are mobilized, ultimately giving rise to culturally specific expressions of family resilience. When facing prolonged family adversity, Chinese families tend to focus on continuous adjustment, acceptance, and adaptation, striving to coexist peacefully with adversity [81]. This contrasts with the family resilience model commonly emphasized in Western cultures, where resilience is often rooted in religious beliefs, individual traits, and external resources, and families are expected not only to recover to their pre-crisis state but also to emerge stronger than before [82]. Although our study did not find significant differences in the distribution of the five family resilience types based on the proportion of only children or family structure, the unique familial and cultural context in China may still have a profound impact on the findings. For decades, Chinese society implemented a one-child policy, and although a three-child policy is now in place, the deeply rooted “child-centered” parenting style continues to shape family dynamics. This is particularly evident in families with children experiencing illness, where resources tend to be highly concentrated on the affected child. While such a focus may foster resilience by mobilizing collective family efforts, it can also intensify the caregiving burden and strain family functioning. The prevalent cultural expectations for high academic achievement and success in Chinese society may also influence the family resilience of adolescents with emotional disorders. In caregiver-empowered and patient-strength-based families, these cultural values may motivate families to invest substantial resources in supporting the adolescent’s recovery. However, in dually vulnerable families, such expectations may exacerbate feelings of frustration and inadequacy due to perceived failure to meet societal standards. Additionally, the stigma surrounding mental illness in Chinese culture,

where psychiatric conditions are often attributed to family failings, such as poor upbringing, and seen as a threat to the family’s reputation, can lead to heightened experiences of shame [83]. The traditional belief that “family shame should not be made public” may further discourage families from seeking external support, thereby limiting access to beneficial resources and services. Taken together, family values, parent-child relationship dynamics, social support systems, and cultural beliefs about mental illness may significantly shape how family resilience is expressed and how effective related interventions are. Future research should consider conducting cross-cultural comparisons to better understand the moderating role of cultural factors in family resilience.

Strengths and limitations

This study utilized K-means cluster analysis to identify five distinct family resilience clusters, offering a fresh perspective on the diversity of family resilience in families of adolescents with emotional disorders. A significant strength lies in inclusion of dual perspectives from both patients and their primary caregivers, enabling a more holistic assessment of family resilience. Conducted within a Chinese cultural context, this research contributes valuable data to the cross-cultural application of family resilience theory.

However, several limitations should be noted. First, the K-means clustering method employed in this study assumes spherical cluster distributions and is sensitive to outliers and initial centroid selection, which may affect the stability and accuracy of the clustering results. Although data standardization and multiple validation methods were applied to mitigate these issues, and the method performed well with the continuous variables and sample size in this study, the clustering results should be interpreted with caution. Second, participants were recruited from specific medical institutions, consisting of outpatients diagnosed with Childhood Emotional Disorder (CED) or other behavioral and emotional disorders, with onset typically occurring in childhood and adolescence, and their primary caregivers. In China, due to the atypical or complex nature of symptoms in these patients—often not meeting the diagnostic criteria for other affective psychiatric disorders—these diagnoses are frequently used as provisional or transitional diagnoses for patients with early-onset symptoms, particularly when the condition does not yet meet the criteria for other established psychiatric disorders. Moreover, Chinese parents tend to accept a CED diagnosis rather than diagnoses related to more stigmatized mental disorders, such as depression. Consequently, caution should be exercised when generalizing the clustering results.

Additionally, all participants were recruited from a single institution. The selected tertiary psychiatric hospital

is the largest and most comprehensive specialized facility in the region, with a wide range of diagnoses and a broad patient base; therefore, to some extent, it can reflect the characteristics of patients with mood disorders in the area. However, data collection from a single center may limit the external validity and generalizability of the findings. The cross-sectional design of this study limits our understanding of how family resilience changes over time. Family resilience is not a static trait but dynamically adjusts along with the course of the adolescent's emotional disorder, treatment progress, family adaptation processes, and developmental stages. Cross-sectional data cannot capture changes in family adaptation patterns in the face of ongoing emotional challenges, nor can it determine whether different family types transform over time. Therefore, the five family clusters identified in this study may reflect only a state at a specific time point rather than stable family characteristics. The study primarily relied on self-reported data from patients and caregivers, which may be influenced by social desirability bias or recall bias. Lastly, other factors beyond the demographic variables explored in this study could also affect family resilience in patients. The aim of this study was to provide an overview of family resilience, rather than to comprehensively investigate resilience-related strategies.

To address these limitations, future research could utilize multi-center, longitudinal designs, broaden the sample to encompass participants from various regions and with different diagnostic criteria, and integrate qualitative methods. Furthermore, future research could explore latent profile analysis or model-based clustering methods to validate and supplement the findings of this study. These approaches have different strengths in handling complex data structures and may provide additional perspectives on the classification of family resilience.

While this study was conducted in specific urban medical institutions in China, its findings offer valuable insights into family resilience among adolescents with emotional disorders. Notably, the five family clusters identified in this study may represent different patterns or states of family coping with adolescent emotional disorders, providing an important framework for understanding the diversity of family resilience. This framework may also have reference value for other countries and regions with similar cultural values or healthcare systems. Future research could examine the applicability of these clusters in various geographical to verify cross-cultural stability and cultural contexts and develop tailored care strategies for families and adolescents within each resilience cluster.

Conclusion

This study highlights the association between family resilience and family functioning in adolescents with emotional disorders, highlighting a shared need for

improvement as perceived by both patients and their primary caregivers. Adolescents reported lower resilience levels than their caregivers, indicating differences in perspective. Based on the three dimensions of family resilience reported by patients and their caregivers, five distinct family resilience clusters were identified. The study reveals that influencing factors shaping these clusters include patient's medical payment method, current disease-related distress, perceived parent-child relationship, history of self-discontinuation of psychiatric medication, along with the caregiver's employment status, household income, parenting style, and perceived quality of parent-child and marital relationships. These findings can assist healthcare professionals in designing targeted interventions to strengthen both family resilience and functioning in adolescents with emotional disorders.

Relevance to clinical practice

Emotional disorders are among the most prevalent mental health issues in adolescents, with families serving as the primary support system for these individuals and playing a pivotal role in their recovery. This study demonstrates that family resilience is linked to family functioning in adolescents with emotional disorders, highlighting the need to address not only the individual symptoms but also the family dynamics during treatment. By identifying five distinct resilience clusters among families of adolescents with emotional disorders, it is recommended that clinicians develop targeted and differentiated family intervention strategies based on family type to improve treatment outcomes and enhance the quality of life of adolescents facing emotional disorders. For families experiencing dual adversity, comprehensive systemic interventions are suggested, including reevaluation of values and role divisions, establishment of positive therapeutic alliances, and exploration of internal strengths and resources. For families facing divergent challenges, focus should be placed on improving communication patterns, strengthening the parent-child subsystem, and enhancing caregivers' ability to recognize patients' needs. For caregiver-empowered and patient-advantaged families with higher resilience levels, it is recommended to maintain existing resources while monitoring new adaptive difficulties. Balanced and coordinated families may consider further developing their adaptive capacities and increasing awareness of resource utilization. In clinical practice, regular assessment of family type changes and dynamic adjustment of intervention strategies are advised to achieve optimal treatment effects.

Supplementary Information

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Supplementary Material 1.

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Clinical trial number

Not applicable.

Authors' contributions

Conception and design of the research: Ying Jiang, Jun Shen
Acquisition of data: Jun Shen, Shuang Zhou, Miao Du
Analysis and interpretation of the data: Shuang Zhou, Miao Du
Statistical analysis: Shuang Zhou, Miao Du
Obtaining financing: Jun Shen
Writing of the manuscript: Jun Shen, Biyun Xia
Critical revision of the manuscript for intellectual content: Ying Jiang, Jun Shen, Shuang Zhou, Biyun Xia
All authors read and approved the final draft.

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Data availability

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted with approval from the Ethics Committee of Shanghai University of Medicine & Health Sciences (No.2023-WX-310109198408014564). This study was conducted in accordance with the declaration of Helsinki. Written informed consent was obtained from all participants. Informed consent to participate was obtained from the parents or legal guardians of any participant under the age of 16.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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