

Resilience, life events, and socioeconomic status in adolescent depression: a matched case-control study examining stress moderation and socioeconomic influences

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Abstract. Background: Low resilience, high stress, and low Socioeconomic Status (SES) are known risk factors for adolescent depression, but their joint effects remain poorly understood. This matched case-control study examined how life events and SES together influence the resilience–depression link in clinically depressed adolescents. Methods: A total of 360 depressed adolescents (aged 11-18) were recruited from outpatient clinics and matched 1:1 by age and sex with 360 healthy controls. Participants completed the Resilience Scale for Chinese Adolescents (RSCA), the Patient Health Questionnaire-9 (PHQ-9), the Generalized Anxiety Disorder-7 (GAD-7), the Adolescent Self-Rating Life Events Checklist (ASLEC), and a family SES index. Conditional logistic regression and hierarchical multiple regression with interaction terms were used to analyze associations, moderation by life events, and the role of SES. Results: Depressed adolescents had significantly lower RSCA ($d_z = 1.28$) and SES ($d_z = 0.62$) and higher ASLEC ($d_z = 1.52$) than controls. In conditional models, each SD increase in resilience reduced depression odds by 77% (OR = 0.23) and each SD increase in life events increased odds 3.1-fold (OR = 3.12), after controlling for SES. Within the depressed group, resilience was negatively associated with PHQ-9 ($r = -0.47$). Life events moderated this association (interaction $\beta = 0.17$, $p = 0.003$), with resilience less protective under high stress. This moderation effect was significant only in females. SES did not moderate the resilience–depression link but had an independent protective effect on symptoms ($\beta = -0.12$, $p = 0.01$). Including SES as a covariate did not attenuate the life events moderation. Conclusions: Life events, but not SES, moderate the resilience–depression relationship in clinical adolescents, with resilience being less protective under high stress, especially in girls. Low SES independently predicts more severe symptoms but does not alter the stress-resilience dynamic. Comprehensive treatment should address individual resilience, stress reduction, and socioeconomic disadvantage.

Keywords: resilience, depression, life events, socioeconomic status, adolescents

1. Introduction: background

Adolescent depression is a major public health problem, with a sharp rise in incidence during the secondary school years [1]. In China, up to 40% of adolescents report clinically significant depressive symptoms [2], and

depression is a leading cause of disability and suicide in this age group [3]. Understanding the interplay between protective and risk factors is crucial for designing effective interventions.

Psychological resilience—the capacity for positive adaptation despite adversity—consistently predicts lower depressive symptoms in adolescents [4, 5]. In Chinese youth, resilience is a multidimensional construct encompassing goal concentration, emotion regulation, positive cognition, family support, and interpersonal assistance [6]. Cross-sectional studies report moderate negative correlations between resilience and depression in community samples [7], but studies in clinical populations are scarce. Clinical depression likely involves more profound resilience deficits and may alter the dynamics between resilience and environmental influences.

Stressful life events are robustly associated with adolescent depression [8]. The diathesis-stress model posits that psychopathology emerges when vulnerabilities interact with environmental stressors [9]. Within this framework, resilience may buffer stress, but high stress could also overwhelm resilience resources. Some studies support the buffering hypothesis [10], while others find that resilience's protective effect diminishes under severe stress [11]. Few studies have examined this moderation in clinically depressed adolescents or considered whether it differs by gender. Adolescent girls experience more interpersonal stress and are more emotionally reactive, which may make their resilience more susceptible to stress [12].

Socioeconomic Status (SES) is another critical factor. Low family SES is associated with higher rates of adolescent depression [13], and it can shape both exposure to stressors and access to protective resources [14]. Low SES may also be confounded with lower resilience, as economic hardship can strain family support and limit opportunities for building coping skills. However, whether SES interacts with resilience in the context of stress to influence depression remains unknown. If resilience is less protective among low-SES adolescents, this would have important implications for intervention targeting.

To address these gaps, this matched case-control study had three aims: (1) to compare resilience, life events, and SES between depressed adolescents and matched healthy controls; (2) to examine whether life events moderate the resilience-depression link, controlling for SES; and (3) to test whether this moderation differs by gender and whether SES further moderates the resilience-depression relationship.

2. Method

2.1. Study design and participants

A 1:1 matched case-control design was used. Participants were enrolled from January 2023 to March 2024 at three child and adolescent psychiatric outpatient departments and four public secondary schools in Chengdu, Sichuan Province, China.

2.1.1. Cases

Depressed adolescents were consecutively recruited. Inclusion criteria: age 11-18 years; DSM-5 diagnosis of Major Depressive Disorder (MDD) or Persistent Depressive Disorder (PDD), confirmed by a child psychiatrist using the Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL) [15]; living with at least one parent. Exclusion criteria: psychotic disorders, bipolar disorder, autism spectrum disorder, intellectual disability, substance use disorder. Among 412 eligible patients, 376 consented, and 360 provided complete data (87.4% valid response rate).

2.1.2. Controls

Healthy controls were recruited from the same local schools. They were screened with PHQ-9 (< 5) and GAD-7 (< 5) and confirmed free of psychiatric diagnoses by clinical interview. Each case was individually matched

to one control by age (± 6 months) and sex. The closest available match was selected.

The final sample comprised 360 matched pairs (720 individuals), with 162 male pairs and 198 female pairs. Mean age was 15.20 years ($SD = 1.81$) for cases and 15.25 years ($SD = 1.78$) for controls (paired $t = 0.56$, $p = 0.648$).

2.2. Measures

Resilience Scale for Chinese Adolescents (RSCA): The 27-item RSCA [6] assesses five factors: goal concentration, emotion regulation, positive cognition, family support, and interpersonal assistance. Items are rated 1-5; higher scores indicate greater resilience. Cronbach's α was 0.93 for the total scale and 0.76-0.88 for factors.

Patient Health Questionnaire-9 (PHQ-9): Depressive symptom severity over two weeks was assessed with the PHQ-9 [16], Cronbach's $\alpha = 0.90$.

Generalized Anxiety Disorder-7 (GAD-7): Anxiety symptoms were measured with the GAD-7 [17], Cronbach's $\alpha = 0.91$.

Adolescent Self-Rating Life Events Checklist (ASLEC): The ASLEC [18] is a 27-item measure of the frequency and perceived impact of stressful life events in the past 12 months across interpersonal, academic, family, and personal domains. Each item is rated 1–5; the total score reflects cumulative stress burden, Cronbach's $\alpha = 0.92$.

Family Socioeconomic Status (SES): SES was assessed using three indicators: father's education, mother's education (both on a 6-point scale from 1 = primary school or less to 6 = postgraduate), and monthly household income (on an 8-point scale from 1 = less 3,000 yuan to 8 = more 30,000 yuan). The three items were standardized and averaged to create a composite SES index. Higher scores indicate higher SES. Cronbach's α for the three-item composite was 0.81.

2.3. Procedure

For cases, assessments occurred on the day of the diagnostic interview after consent. Controls completed questionnaires at school. Written informed consent was obtained from parents, and written assent from all adolescents. Participation was voluntary, and participants were informed of their right to withdraw at any time without any consequences to their clinical care or academic standing. The study was approved by the Ethics Committee of Southwest Rehabilitation Hospital (approval number: SWH-2022-041) and adhered to the Declaration of Helsinki.

2.4. Statistical analysis

SPSS 26.0 was used. Paired-samples t -tests compared cases and controls on RSCA, PHQ-9, GAD-7, ASLEC, and SES; Cohen's d_z quantified effect sizes [19]. Conditional logistic regression assessed the associations of resilience, life events, and SES with depression status, with models adjusted for each variable and all combined.

Within the depressed group, Pearson correlations were calculated. Hierarchical multiple regression predicted PHQ-9. Step 1 included RSCA and ASLEC (mean-centered); Step 2 added SES as a covariate; Step 3 added the RSCA $\times$ ASLEC interaction; Step 4 added RSCA $\times$ SES and ASLEC $\times$ SES interactions to test SES moderation. Simple slopes were probed at ± 1 Standard Deviation (SD) of the moderator [20]. Gender-stratified models examined sex differences. All tests were two-tailed ($\alpha = 0.05$).

3. Results

3.1. Sample characteristics and case-control comparisons

The depressed group had high PHQ-9 ($M = 18.48$, $SD = 5.18$) and GAD-7 ($M = 13.62$, $SD = 4.95$); controls had minimal symptoms (PHQ-9: $M = 2.12$, $SD = 1.52$; GAD-7: $M = 1.94$, $SD = 1.40$; both $p < 0.001$).

Table 1 shows paired comparisons. Depressed adolescents scored significantly lower on total RSCA ($d_z = 1.28$) and all factors, with emotion regulation most impaired ($d_z = 1.35$). ASLEC was substantially higher ($d_z = 1.52$). SES was also significantly lower in cases ($d_z = 0.62$). Girls in the depressed group had particularly low SES ($M = -0.31$ vs. controls $M = 0.28$, $d_z = 0.71$), while the gap in boys was smaller ($d_z = 0.51$).

Table 1. Paired comparisons on RSCA, ASLEC, and SES

Variable	Cases ($n = 360$)	Controls ($n = 360$)	t	p	d_z
RSCA total	2.86 ± 0.71	3.81 ± 0.58	-19.05	< 0.001	1.28
Goal concentration	2.70 ± 0.87	3.60 ± 0.79	-13.85	< 0.001	0.98
Emotion regulation	2.42 ± 0.82	3.57 ± 0.76	-19.72	< 0.001	1.35
Positive cognition	2.89 ± 0.92	3.88 ± 0.82	-14.65	< 0.001	1.06
Family support	2.80 ± 0.90	3.88 ± 0.70	-17.45	< 0.001	1.18
Interpersonal assistance	3.10 ± 0.85	3.84 ± 0.68	-12.35	< 0.001	0.78
ASLEC total	2.94 ± 0.72	1.96 ± 0.57	22.14	< 0.001	1.52
SES (z-score)	-0.25 ± 0.88	0.28 ± 0.82	-9.08	< 0.001	0.62

3.2. Conditional logistic regression

As shown in Table 2, RSCA and ASLEC were strongly associated with depression status. Adding SES to the model slightly attenuated the ORs, but all three variables remained significant. Each SD increase in resilience reduced depression odds by 77% ($OR = 0.23$), each SD increase in ASLEC increased odds 3.1-fold ($OR = 3.12$), and each SD increase in SES reduced odds by 32% ($OR = 0.68$).

Table 2. Conditional logistic regression for depression status

Predictor (per SD)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
RSCA total	0.21 (0.15–0.29)***	—	0.23 (0.17–0.32)***
ASLEC total	—	3.56 (2.63–4.83)***	3.12 (2.31–4.21)***
SES	—	—	0.68 (0.55–0.84)***

Note: *** indicates statistical significance at the 1% level. Model 3 includes all three variables. OR = Odds Ratio, CI = Confidence Interval.

3.3. Correlations and moderation in the clinical sample

In the depressed group, RSCA was negatively correlated with PHQ-9 ($r = -0.47$, $p < 0.001$), ASLEC ($r = -0.33$, $p < 0.001$), and positively with SES ($r = 0.25$, $p < 0.001$). SES was negatively correlated with PHQ-9 ($r = -0.26$, $p < 0.001$) and ASLEC ($r = -0.19$, $p < 0.001$).

Hierarchical regression (Table 3) revealed that in Step 1, RSCA and ASLEC explained 30.8% of PHQ-9 variance. Adding SES (Step 2) increased R^2 to 32.5% ($\Delta R^2 = 0.017$, $p = 0.001$), with SES independently

predicting lower symptoms ($\beta = -0.12$). The RSCA $\times$ ASLEC interaction (Step 3) was significant ($\beta = 0.17$, $p = 0.003$, $\Delta R^2 = 0.022$), showing life events moderated the resilience–depression link. The RSCA $\times$ SES and ASLEC $\times$ SES interactions (Step 4) were not significant ($p = 0.352$ and 0.478), indicating SES did not moderate these relationships.

Table 3. Hierarchical regression predicting PHQ-9 in depressed adolescents ($n = 360$)

Step/Predictor	B	SE	β	t	p	R^2 (ΔR^2)
Step 1						0.308
RSCA	-0.38	0.05	-0.38	-7.60	< 0.001	
ASLEC	0.32	0.05	0.32	6.40	< 0.001	
Step 2						0.325 (0.017)
SES	-0.12	0.05	-0.12	-2.40	0.017	
Step 3						0.347 (0.022)
RSCA $\times$ ASLEC	0.17	0.05	0.17	3.40	0.003	
Step 4						0.352 (0.005)
RSCA $\times$ SES	0.04	0.05	0.04	0.93	0.352	
ASLEC $\times$ SES	-0.03	0.05	-0.03	-0.71	0.478	

Note: All continuous variables mean-centered. SES entered as a covariate and tested as moderator.

Simple slope analysis: at low ASLEC (-1 SD), RSCA was strongly associated with lower PHQ-9 ($b = -0.44$, $p < 0.001$); at high ASLEC ($+1$ SD), the association weakened ($b = -0.20$, $p = 0.012$).

3.4. Gender-stratified moderation

The RSCA $\times$ ASLEC interaction was significant only in females ($\beta = 0.24$, $p = 0.002$), with $R^2 = 0.365$. In males, the interaction was not significant ($\beta = 0.06$, $p = 0.481$), $R^2 = 0.272$. SES contributed significantly in both genders (females $\beta = -0.13$; males $\beta = -0.11$) but did not interact with resilience or life events in either group.

4. Discussion

his study confirms that depressed adolescents experience marked deficits in resilience, elevated life stress, and lower SES compared to matched healthy controls. Importantly, life events—but not SES—moderated the resilience–depression link, with resilience less protective under high stress. This moderation was specific to girls, while low SES independently contributed to more severe symptoms without altering the stress–resilience dynamic.

4.1. Resilience and stress in adolescent depression

The large resilience deficits observed (d_z up to 1.35 for emotion regulation) align with models positing that depression undermines the very cognitive and interpersonal capacities that constitute resilience [21, 22]. The strong link between ASLEC and depression supports the stress-generation hypothesis [23]—depressed adolescents both experience more stress and may perceive even ordinary events as more threatening. Our conditional models show that resilience and stress independently predict depression status, underscoring the need for dual-focused interventions.

4.2. Life events moderate the resilience–depression association

The significant $RSCA \times ASLEC$ interaction extends prior work by demonstrating that resilience's protective function is conditional on stress level in a clinical sample. Under low stress, resilient youth show substantially fewer symptoms, consistent with the buffering model [10]. Under high stress, this advantage shrinks, supporting the view that cumulative stress can overwhelm personal resources [11]. For clinicians, this means that resilience-building alone may be insufficient for adolescents facing severe or chronic adversity; stress reduction interventions—such as family therapy, academic accommodations, or trauma-focused treatment—are equally critical [24].

4.3. Gender-specific vulnerability

The moderation effect was significant only in girls. Adolescent girls face more interpersonal stress [12] and are more prone to co-rumination and emotional reactivity [25]. Under high stress, these tendencies may erode the benefits of resilience, leaving girls more symptomatic despite personal strengths. Girls' resilience may also be more relationally embedded [26], making it more vulnerable to social stress. For boys, resilience appears more stable across stress levels, perhaps because male-typed coping strategies (e.g., problem-solving, distraction) are less disrupted by interpersonal turmoil [27]. These findings support gender-sensitive interventions: depressed girls may particularly benefit from interpersonal psychotherapy that targets stress reactivity and social coping [28], while boys may gain more from behavioral activation and problem-solving training.

4.4. The independent role of SES

Low SES was more common among depressed adolescents and independently predicted more severe symptoms, consistent with the social gradient in adolescent mental health [13]. However, SES did not moderate the resilience-depression or stress-depression relationships. This suggests that while economic disadvantage increases symptom burden, it does not fundamentally change how resilience and stress interact to influence depression. One possible explanation is that the resilience-stress dynamic operates through proximal psychosocial processes (e.g., coping, social support) that are less directly shaped by SES in this clinical sample. Another possibility is that the relatively narrow range of SES in our urban clinical sample limited statistical power to detect interactions.

Practically, this finding implies that resilience interventions can be effective across SES levels, but addressing the socioeconomic context—through family support, social welfare linkage, or school-based financial assistance—may independently boost treatment outcomes. Comprehensive adolescent depression care should thus incorporate attention to social determinants of health.

4.5. Limitations

The cross-sectional design prevents causal inference. Longitudinal studies are needed to clarify temporal relationships among SES, stress, resilience, and depression. All measures were self-report; future studies should incorporate objective SES indicators (e.g., income records), clinician-rated resilience, and multiple informants. The sample was limited to one urban area in China, limiting generalizability. Unmeasured confounders, such as parental psychopathology, could bias results. Finally, the narrow SES range in a clinical sample may have reduced sensitivity to detect SES interactions.

5. Conclusion

Life events moderate the association between resilience and depressive symptoms in clinically depressed adolescents, with resilience becoming less protective under high stress, particularly in girls. Low SES independently predicts more severe depression but does not alter the stress-resilience dynamic. Effective treatment of adolescent depression requires a multi-pronged approach that enhances individual resilience, reduces environmental stressors, and addresses socioeconomic disadvantage.

Author contributions

XH conceptualized and designed the study, supervised data collection, conducted the statistical analyses, drafted the manuscript, and critically revised the manuscript. LZ recruited participants, collected data, and assisted with statistical analyses and manuscript drafting. BZ recruited participants, collected data, and critically revised the manuscript. All authors read and approved the final manuscript.

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Ethics approval and consent to participate

This study was approved by the Ethics Committee of Southwest Rehabilitation Hospital (approval number: SWH-2022-041). All procedures were conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from parents or legal guardians of all participants, and written assent was obtained from all adolescent participants. Participation was voluntary, and participants were informed of their right to withdraw at any time without any consequences to their clinical care or academic standing.

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