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Association of Resilience with Adverse Childhood Experiences and Risk- Taking Behavior among Adolescents: a cross-sectional study

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Abstract

Background

Adolescence is a developmental phase marked by vulnerability to negative risk-taking behaviour (RTB). Adverse childhood experiences (ACEs) elevate these risks. Resilience, defined as the ability to adapt positively in adversity, may buffer these effects.

Methods

A cross-sectional study was conducted among 103 adolescents (10–19 years) in Sullia, Karnataka, selected by simple random sampling from school and college registers. Data were collected through a validated proforma incorporating sociodemographic details, RTB assessment (Cronbach's α = 0.938), the Brief Resilience Scale (BRS; α = 0.716), and the ACE-10 questionnaire (α = 0.810). Complete data were available for all participants. Chi-square tests and binary logistic regression were used for analysis.

Results

Of 130 students approached, 103 (79.2%) met eligibility criteria and were enrolled. Resilience levels were normal in 41.7%, low in 37.9%, and high in 20.4% of participants. More than half (55.3%) reported clinically significant ACEs. Logistic regression showed that negative RTB (OR = 53.3; 95% CI: 6.34–448.08) and ACEs (OR = 9.41; 95% CI: 3.14–28.19) were significantly associated with lower resilience, while female gender (OR = 22.23; 95% CI: 3.43–144.30) and lower income (OR = 0.02; 95% CI: 0.004–0.116) were associated with higher resilience.

Conclusions

Negative RTB and ACEs were linked to lower resilience, whereas gender and income showed unexpected patterns. As a single-district, cross-sectional study, causality and generalisability are limited. Future multi-centric longitudinal studies are required to validate and extend these findings. Targeted interventions addressing harmful behaviours and early adversity are recommended.

Background

Adolescence is a crucial transitional phase between childhood and adulthood, marked by significant physical, emotional, and cognitive changes. This period is characterised by neurocognitive development and socio-emotional growth, influenced by physiological changes during puberty and external social, cultural, and environmental factors [1].

Adolescents often engage in heightened risk-taking behaviour (RTB) due to anatomical and physiological changes in the brain and body [2]. Such behaviours include tendencies toward violence, sustaining injuries, engaging in hazardous activities, and substance abuse [3]. RTB is defined as actions with uncertain outcomes that can impact an individual's well-being [4] and is categorised into positive risks (socially acceptable actions with minimal adverse consequences) and negative risks (socially inappropriate behaviours with potentially severe negative outcomes) [5, 6]. High impulsivity is associated with aggression, substance use, and poor decision-making [7]. The prefrontal cortex, responsible for executive functions such as decision-making, impulse control, and planning, matures later than the limbic system, which governs emotions and reward processing [8].

Adverse childhood experiences (ACEs) are traumatic or stressful events occurring before age 18 (e.g., bullying, neglect, abuse, parental separation, sexual abuse) [13]. These experiences disrupt brain development and can lead to long-term mental health challenges, poor academic performance, increased aggression, and higher rates of depression and suicidal ideation [14]. A longitudinal Indian study found that adolescents who experienced bullying were twice as likely to engage in high-risk behaviours [9]. Studies in India have demonstrated that Social and Emotional Learning (SEL)-based school interventions significantly reduce aggression, impulsivity, and substance use while enhancing academic performance and social skills [11].

Resilience—the capacity to cope effectively with stress and adversity—plays a crucial role in reducing risky behaviours among adolescents. It is viewed as a dynamic process of positive adaptation rather than a fixed trait [15]. According to resilience theory, highly resilient adolescents show better self-regulation, planning, and adaptability in stressful situations, lowering their engagement in risky activities [16]. For those who have experienced ACEs, resilience mitigates the impact of childhood trauma and reduces the likelihood of developing depression [16]. Higher resilience is also linked to lower inflammatory markers and improved overall well-being, buffering long-term health risks associated with ACEs [17].

Resilience levels vary between urban and rural adolescents due to differences in socioeconomic status, educational opportunities, and community support [18]. Educational institutions foster resilience through mental health education, socio-emotional learning, and stress-management curricula [19]. Cultural values and traditional practices—such as storytelling, rituals, and communal activities—bolster resilience in Indian children and adolescents [20]. Engagement in physical activity and play is fundamental to resilience development [21], and balanced nutrition supports mental health outcomes [22].

Despite the well-established impact of ACEs, RTB, and impulsivity on adolescent mental health, there is limited research exploring their interconnected relationship with resilience, particularly in the Indian context. Understanding this complex interplay is crucial for designing effective preventive and intervention strategies. This study aimed to: (1) assess the prevalence of RTB and ACEs among adolescents aged 10–19 years in Sullia, Karnataka; and (2) examine the association between RTB, ACEs, and resilience in this population.

Methods

Study design, setting and participants

A cross-sectional study was conducted over three months (July–September 2024) across schools and colleges in Sullia, Dakshina Kannada district of Karnataka, India. The study population comprised students from one higher primary school, one Pre-University College (PUC), and one undergraduate degree college, aged between 10 and 19 years.

Participants were selected using simple random sampling from class registers; random numbers were generated using a dedicated random number application. Inclusion criteria were: students aged 10–19 years enrolled at the study institutions and willing to participate. Exclusion criteria were: students with a diagnosed psychiatric disorder and those who declined to participate.

The sample size was calculated using the formula $Z^2p(1 - p)/d^2$, based on a risk-taking behaviour prevalence of 7.2% [23], with a Z value of 1.96 and a 5% margin of error, yielding a minimum of 103 participants.

Informed consent was obtained from adult participants (≥ 18 years) and from parents/guardians of minors, with written assent from minor participants.

Variables and potential confounders

The primary outcome was resilience, operationalised using the Brief Resilience Scale (BRS) and categorised as low (mean score < 3.0), normal (3.0–4.30), or high (> 4.30) based on established scale norms. The primary exposures of interest were risk-taking behaviour (RTB) and adverse childhood experiences (ACEs). RTB was categorised as low (< 40th percentile of the sample distribution), normal (40th–60th percentile), or high (> 60th percentile). ACE scores were categorised as normal (score 0–3) or clinically significant (score ≥ 4), based on published ACE literature thresholds [13, 25].

Potential confounders considered a priori were age, sex, educational level, residential area (rural/urban), and family income. These were included in the regression models as covariates. Unmeasured potential confounders include peer influence, parental mental health, and access to community support services.

Data collection instruments

Data were collected using a predesigned semi-structured proforma validated by three subject-matter experts prior to the study, with a pilot study conducted to assess reliability. Complete data were available for all 103 participants; no missing data were encountered. The proforma comprised four sections:

Section 1 — Sociodemographic details: age, sex, educational level, residential area, and family income category (classified by Modified Kuppuswamy scale).

Section 2 — Risk-Taking Behaviour Assessment: a researcher-developed scale evaluating psychological risk (items 11–20; behaviour and thoughts related to societal, parental, and moral disapproval) and physical risk (items 21–30; comfort with and orientation toward physical danger). Responses used a 5-point scale (1 = 'Like me' to 5 = 'Not like me'). Total scores range from 30 to 150. Internal consistency was Cronbach's α = 0.938.

Section 3 — Brief Resilience Scale (BRS): a validated six-item instrument measuring ability to recover from stress, rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Mean scores categorised as low (< 3.0), normal (3.0–4.30), or high (> 4.30). Higher scores indicate greater resilience (Cronbach's α = 0.716).

Section 4 — ACE-10 Questionnaire: a 10-item instrument examining exposure to childhood adversities including physical, emotional, and sexual abuse, neglect, and family dysfunction, each answered Yes/No. Total scores range from 0 to 10; scores ≥ 4 were classified as clinically significant based on established literature thresholds [13, 25]. Internal consistency was Cronbach's α = 0.810.

Statistical analysis

Data were entered into Microsoft Office Excel 2007 and analysed using IBM SPSS version 21. Descriptive statistics were used to summarise sociodemographic characteristics and scale distributions. Chi-square tests assessed associations between resilience categories and sociodemographic variables, RTB, and ACEs. Binary logistic regression was performed with resilience (low vs. normal/high) as the dependent variable to identify independent predictors; all sociodemographic variables with $p < 0.05$ on univariable analysis were entered into the multivariable model. A p-value of < 0.05 was considered statistically significant.

Several steps were taken to minimise bias. Random sampling from class registers reduced selection bias. The proforma was administered under standardised conditions by trained research assistants in a private classroom setting to reduce social desirability bias. The BRS and ACE-10 are validated instruments with established reliability. Recall bias for ACE items was addressed by using a simple Yes/No format with clear behavioural descriptors. Complete data were available for all 103 participants, so no imputation was required.

No subgroup analyses, interaction analyses, or sensitivity analyses were pre-specified or conducted for this study.

Results

Participant flow

A total of 130 students were identified from class registers across the three study institutions. Of these, 18 were absent on the day of data collection and 9 declined to participate, yielding a final sample of 103

participants (response rate 79.2%). No students were excluded for psychiatric diagnoses during the data collection period. Complete data were obtained for all 103 enrolled participants (Fig. 1).

[Fig. 1: Participant flow diagram — 130 identified → 18 absent, 9 declined → 103 enrolled & analysed]

Sociodemographic characteristics

Among the 103 participants, the majority were aged 10–13 years (47.6%), and most had completed primary education (41.7%). Gender distribution was nearly equal, with slightly more females (50.5%) than males (49.5%). A significant proportion resided in rural areas (72.8%), and the largest income group belonged to the upper middle-income category (41.7%) (Table 1). No missing data were recorded for any variable.

Table 1
Sociodemographic characteristics of participants (n = 103)

Characteristic	Category	n	%
Age group (years)	10–13	49	47.6
	14–16	28	27.2
	17–19	26	25.2
Sex	Female	52	50.5
	Male	51	49.5
Residence	Rural	75	72.8
	Urban	28	27.2
Education	Primary (5th–7th std)	43	41.7
	Secondary (8th–10th std)	32	31.1
	PUC / Degree	28	27.2
Family income	Lower income	18	17.5
	Lower middle income	20	19.4
	Upper middle income	43	41.7
	Upper income	22	21.4

std standard; PUC Pre-University College. No missing data for any variable.

Distribution of resilience, RTB, and ACEs

RTB distribution was relatively balanced: 35.9% of participants showed low levels (score < 40th percentile), 30.1% demonstrated normal levels (40th–60th percentile), and 34.0% exhibited high levels (> 60th percentile). Resilience was predominantly normal (41.7%; BRS mean 3.0–4.30), while 37.9% had low resilience (BRS mean < 3.0) and 20.4% demonstrated high resilience (BRS mean > 4.30). More than half of participants (55.3%) reported clinically significant ACEs (score ≥ 4) (Table 2).

Table 2
Distribution of risk-taking behaviour, resilience, and adverse childhood experiences (n = 103)

Variable	Category	n	%
Risk-taking behaviour	Low (< 40th percentile)	37	35.9
	Normal (40th–60th percentile)	31	30.1
	High (> 60th percentile)	35	34.0
Resilience (BRS mean score)	Low (< 3.0)	39	37.9
	Normal (3.0–4.30)	43	41.7
	High (> 4.30)	21	20.4
Adverse childhood experiences	Normal (ACE score 0–3)	46	44.7
	Clinically significant (ACE score ≥ 4)	57	55.3

BRS Brief Resilience Scale; ACE Adverse Childhood Experience. Category boundaries defined in Methods.

Association between resilience and sociodemographic variables

Statistically significant associations were observed between resilience and educational attainment, family income, gender, RTB, and ACEs (all $p < 0.05$) (Table 3). Participants with higher education demonstrated greater resilience compared to those with PUC or secondary education ($p = 0.009$). Lower-income participants exhibited the highest resilience levels, with none falling in the low-resilience category, whereas those in upper-middle-income households predominantly showed low resilience ($p < 0.001$). Female participants demonstrated significantly higher resilience than males ($p < 0.001$). High negative RTB was strongly associated with low resilience ($p < 0.001$), as was the presence of clinically significant ACEs ($p < 0.001$).

Table 3
Association between resilience and key variables (chi-square test)

Variable	Category	Low resilience n (%)	Normal/High resilience n (%)	p-value
Gender	Male	32 (62.7%)	19 (37.3%)	< 0.001
	Female	7 (13.5%)	45 (86.5%)	
RTB	Low/Normal	5 (7.4%)	63 (92.6%)	< 0.001
	High	34 (97.1%)	1 (2.9%)	
ACEs	Normal	4 (8.7%)	42 (91.3%)	< 0.001
	Clinically significant	35 (61.4%)	22 (38.6%)	
Income	Lower income	0 (0%)	18 (100%)	< 0.001
	Upper-middle income	30 (69.8%)	13 (30.2%)	

RTB risk-taking behaviour; ACEs adverse childhood experiences. p < 0.05 considered statistically significant.

Logistic regression analysis

In univariable logistic regression, education showed an odds ratio of 4.24 (95% CI: 0.843–21.35; p = 0.08), which was not statistically significant. Income was a significant predictor (OR = 0.02; 95% CI: 0.004–0.116; p < 0.01), indicating lower-income participants were significantly more likely to demonstrate higher resilience. Female gender was strongly associated with higher resilience (OR = 22.23; 95% CI: 3.428–144.295; p < 0.01) (Table 4).

Table 4
Logistic regression: sociodemographic predictors of resilience (univariable analysis)

Variable	OR	95% CI	p-value
Education (higher vs. lower)	4.24	0.843–21.350	0.08
Income (lower vs. upper middle)	0.02	0.004–0.116	< 0.01
Gender (female vs. male)	22.23	3.428–144.295	< 0.01

OR odds ratio; CI confidence interval. Reference categories: lower education, upper-middle income, male gender.

Multivariable logistic regression confirmed that both RTB and ACEs were significantly associated with lower resilience. Participants with high RTB were 53.3 times more likely to exhibit low resilience (OR = 53.299; 95% CI: 6.340–448.083; p < 0.001), and those with significant ACEs were 9.41 times more likely to have low resilience (OR = 9.410; 95% CI: 3.142–28.186; p < 0.001) (Table 5).

Table 5
Logistic regression: RTB and ACEs as predictors of low resilience (multivariable analysis)

Variable	OR	95% CI	p-value
Risk-taking behaviour (high vs. low/normal)	53.299	6.340–448.083	< 0.001
ACEs (significant vs. normal)	9.410	3.142–28.186	< 0.001

OR odds ratio; CI confidence interval; ACEs adverse childhood experiences; RTB risk-taking behaviour.

No additional subgroup, interaction, or sensitivity analyses were conducted.

Discussion

This study investigated the relationship between resilience, adverse childhood experiences, and risk-taking behaviour among 103 adolescents in Sullia, Karnataka. The key findings were: (1) high negative RTB was strongly associated with lower resilience (OR = 53.3); (2) clinically significant ACEs were independently associated with lower resilience (OR = 9.41); and (3) unexpectedly, female gender and lower family income were associated with higher resilience.

RTB was broadly distributed across the sample, consistent with the natural developmental trajectory described by Steinberg et al. [2, 5, 6], wherein adolescence is marked by heightened experimentation and boundary testing. The relatively high proportion of participants with low resilience (37.9%) likely reflects the elevated prevalence of ACEs (55.3%), consistent with Masten et al., who highlight that resilience varies substantially based on exposure to environmental and psychosocial challenges [16, 24]. The disruption of coping mechanisms by early adversities aligns with findings by Felitti et al. [13].

Higher educational attainment was associated with greater resilience ($p = 0.009$), reinforcing the role of education in equipping adolescents with problem-solving and emotional regulation strategies [19, 24]. The counterintuitive finding that lower-income participants exhibited higher resilience ($p < 0.001$) may be explained by theories from Werner and Smith [26], who propose that adversity in resource-depleted environments fosters resourcefulness, adaptability, and reliance on social networks. Conversely, upper-middle-income participants predominantly exhibited lower resilience, potentially attributable to academic pressure, familial expectations, and the relative individualism associated with higher-income settings [12].

Female participants demonstrated significantly higher resilience than males (OR = 22.23; 95% CI: 3.428–144.295; $p < 0.001$), consistent with Nolen-Hoeksema and Aldao [27], who attribute this to socialisation processes promoting emotional expression, support-seeking behaviour, and adaptive coping strategies. Regional studies from Dakshina Kannada similarly highlight the linkage between psychological well-being, life skills, and academic performance [28, 29].

The strong association between high RTB and low resilience (OR = 53.299; 95% CI: 6.340–448.083; $p < 0.001$) underscores the impact of impulsiveness and sensation-seeking on emotional regulation [2]. The

wide confidence interval for this estimate, while statistically significant, reflects the modest sample size and warrants cautious interpretation. The association between significant ACEs and low resilience (OR = 9.410; 95% CI: 3.142–28.186; $p < 0.001$) aligns with Felitti et al. and Anda et al. [13, 31], who describe how early adversities disrupt neurodevelopmental processes, impairing coping mechanisms and increasing vulnerability to stress. These findings collectively emphasise the importance of school- and community-based interventions incorporating trauma-informed care, social-emotional learning, and structured resilience-building programmes.

Limitations

This study has several limitations. First, the cross-sectional design precludes causal inference; the direction of associations between RTB, ACEs, and resilience cannot be established from these data. Second, the sample was modest (n = 103) and drawn from a single district in Karnataka, limiting generalisability to other geographic, cultural, or socioeconomic settings. Third, self-reported data are subject to recall bias and potential underreporting of sensitive ACE items, likely leading to an underestimate of ACE prevalence. Fourth, the wide confidence interval for the RTB odds ratio (6.34–448.08) is a direct consequence of the small sample and high OR; this estimate should be interpreted cautiously and confirmed in larger studies. Fifth, unmeasured confounders—including peer influence, parental mental health, and access to support services—may have biased associations in an unpredictable direction. Future longitudinal, multi-centric studies with larger samples are recommended to confirm and extend these findings.

Conclusions

High negative RTB and clinically significant ACEs were strongly associated with lower resilience among adolescents in this sample, underscoring their disruptive impact on emotional regulation and coping. Unexpectedly, female gender and lower family income were associated with higher resilience, suggesting that socio-cultural factors and adaptive coping in resource-constrained settings play important roles. These findings emphasise the need for school- and community-based interventions that integrate trauma-informed care, reduce harmful behaviour, and build emotional regulation skills. Future longitudinal, multi-centric studies with larger and more representative samples are warranted to establish causal pathways and inform comprehensive strategies for promoting adolescent resilience and mental well-being.

Abbreviations

ACE
Adverse Childhood Experience
BRS
Brief Resilience Scale
CI

Confidence Interval
IEC
Institutional Ethics Committee
OR
Odds Ratio
PUC
Pre-University College
RTB
Risk-Taking Behaviour
SEL
Social and Emotional Learning
SPSS
Statistical Package for the Social Sciences

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Ethics Committee of K.V.G. Medical College & Hospital, Kurunjibag, Sullia, Dakshina Kannada, Karnataka, India (Approval No. KVGMCIEC202486; date of approval: 17 September 2024), and was conducted in accordance with ethical standards of the Declaration of Helsinki (1964) and its later amendments. Written informed consent was obtained from all adult participants (≥ 18 years). For minor participants (aged < 18 years), written informed consent was obtained from parents or guardians, and written assent was obtained from the participants themselves.

Consent for publication

Not applicable. This manuscript does not contain data from any individual person.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

YGR contributed to the study design, literature search, data acquisition, data analysis, statistical analysis, manuscript preparation, editing, and review. ASB contributed to the study design, data analysis, statistical analysis, and manuscript preparation, editing, and review. AA contributed to manuscript preparation, editing, and review. RR contributed to the study design and manuscript editing, and review. BA contributed to manuscript editing and review. DPV contributed to data analysis and manuscript preparation, editing, and review. All authors read and approved the final manuscript.

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Data Availability

The datasets generated and/or analysed during the current study are not publicly available due to participant privacy and confidentiality but are available from the corresponding author on reasonable request.

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