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RESEARCH

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Mechanisms linking household income trajectories to adolescent mental well-being: A longitudinal study

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ABSTRACT

Objectives: Using four waves of data from the China Family Panel Study, this study examined the impact of household income trajectories on two key dimensions of adolescent mental well-being (i.e., depressive symptoms and happiness) and explored the mediating mechanisms.

Background: Substantial evidence links socioeconomic status (SES) to adolescent mental health, yet few studies have examined how longitudinal SES trajectories shape mental well-being and the mechanisms underlying these relationships.

Method: Using group-based trajectory modeling, we analyzed a nationally representative sample of 3,491 Chinese families with adolescents aged 10 to 19, identifying five distinct income trajectories.

Results: Adolescents from stable lower middle-income and decreasing-income groups demonstrated more depressive symptoms compared with their counterparts in the stable high-income group. These associations were primarily mediated by maternal mental well-being and family material investment pathways. Additionally, adolescents in the stable low-income group exhibited lower happiness levels than the stable high-income group, with maternal mental well-being partly mediating this association.

Conclusion: Both stable lower income and downward income mobility are significant predictors of poorer adolescent mental health outcomes, mediated through distinct pathways such as family stress and family material investment.

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Implications: Our results underscore the critical role of SES trajectories in shaping developmental contexts that influence adolescent mental well-being.

KEYWORDS

adolescent, family investment, family stress, income trajectories, mental well-being

Adolescence is increasingly recognized as a crucial stage for identifying early signs of mental distress because of the significant biological and psychosocial changes during this developmental stage (Viner et al., 2012). Approximately half of lifetime mental health disorders begin before age 18 years, with the highest incidence occurring around 14.5 years of age (Solmi et al., 2022). Poor mental well-being during adolescence can significantly impede the development of human capital later in life, often exerting a stronger impact than physical health (Hale et al., 2015; McLeod et al., 2016). This highlights the global health imperative of understanding the factors that influence adolescent mental well-being. In this context, the current study focuses on how household income trajectories shape adolescent mental well-being and the mechanisms underlying this relationship.

SOCIOECONOMIC STATUS TRAJECTORIES AND ADOLESCENT MENTAL WELL-BEING

Disparities in adolescent mental well-being associated with household socioeconomic status (SES) have garnered considerable research attention, as such disparities are often regarded as unfair and avoidable (Braveman, 2006). Multiple studies have indicated that adolescents from low-SES families have poorer mental well-being compared with their peers from high-SES families (Kinge et al., 2021; Reiss, 2013). SES has frequently been treated as a static measure, however, typically assessed at a single timepoint. This "snapshot" approach disregards the dynamic nature of SES, such as fluctuations in household income over time, which can significantly influence mental health outcomes (Thomson et al., 2022). Research on adults suggests that ignoring these temporal changes in household income and other SES dynamics may understate the role of SES in health disparities (Do, 2009).

To better understand the long-term effects of SES on mental well-being, two theoretical models have been proposed: the accumulation model and the social mobility model. The accumulation model suggests that prolonged exposure to disadvantaged SES intensifies its negative health effects (de Vocht et al., 2015). For instance, Noonan et al. (2018) found that frequent exposure to poverty over multiple years increased the risk of mental health issues among adolescents. The social mobility model highlights the impact of SES changes, with upward and downward mobility significantly affecting mental well-being (Hallqvist et al., 2004). For instance, adolescents experiencing downward mobility often exhibit greater behavioral problems compared with those with stable SES (D. W. Lee et al., 2019). Despite these insights, most of these studies have assessed either SES accumulation or mobility independently, neglecting their combined effects (Page et al., 2014; Pinchoff et al., 2021).

Recent research has employed person-centered, data-driven methods to identify income trajectories—such as upward mobility, downward mobility, and stable income patterns over time—and their associations with adolescent health outcomes (Björkenstam et al., 2017; Hoyt et al., 2019; Pryor et al., 2019; Treanor & Troncoso, 2022). By capturing both the accumulative socioeconomic experiences and the mobility across income levels, these studies enhanced our understanding of how long-term SES patterns affect adolescent mental well-being. Many of

these studies yielded inconsistent findings, however. Some indicated that adolescents from stable low-income families had poorer mental health compared with those from stable high-income families (Björkenstam et al., 2017; Hoyt et al., 2019), whereas others suggested that only decreasing income negatively impacted mental health (Pryor et al., 2019). Moreover, a recent study found that adolescents whose families moved out of poverty experienced the highest levels of conduct and emotional problems (Treanor & Troncoso, 2022). These mixed results warrant further investigation into SES trajectories and their long-term effects on adolescent mental well-being.

MECHANISMS LINKING SOCIOECONOMIC STATUS TRAJECTORIES TO ADOLESCENT MENTAL WELL-BEING

Two prominent theories, the family stress model and the family investment model, provide valuable frameworks for understanding how SES shapes adolescent mental well-being (T. K. Lee et al., 2013; Yang et al., 2023). The family stress model posits that economic hardship impacts adolescent adjustment through its impact on parental emotional states (Conger et al., 2002). Specifically, lower SES creates economic stress, which negatively affects parental emotional well-being (Nagy et al., 2022). This, in turn, results in a less supportive family atmosphere (Simons et al., 2016), ultimately leading to poorer mental well-being among adolescents. Notably, maternal well-being has been shown to play a particularly central role in family stress model. Empirical studies indicates that, relative to paternal mental well-being, maternal mental well-being is a stronger predictor of mental health outcomes in both sons and daughters (Fitzsimons et al., 2017). In addition, evidence from low-income families suggests that women's financial stress is more likely than men's to precipitate adverse psychological conditions, partly due to their greater reliance on emotion-focused coping strategies (Ponnet, 2014). The family investment model argues that lower SES limits parents' ability to provide resources critical for child development. These include both material investments, such as housing, education, and health care, and immaterial investments, such as time and attention (Conger et al., 2021; Mayer, 2002). Both types of investments play a critical role in shaping adolescent mental well-being (Carlsson et al., 2014; Khin et al., 2024). Together, the family stress and family investment models provide important perspectives for understanding the relationship between static family SES and adolescent mental well-being (Noonan et al., 2018; Yang et al., 2023).

Despite the theoretical relevance of these mechanisms to cross-sectional analyses, empirical studies on how longitudinal household SES trajectories influence adolescent mental well-being remain scarce (Pryor et al., 2019). Evidence suggests that fluctuations in household income can significantly affect both parental mental states and family investments. For instance, the loss of household income is associated with higher levels of parental depression and reduced parental supervision of adolescents' regular meals (Pinchoff et al., 2021). Empirically testing these mechanisms within the context of family SES trajectories and their impact on adolescent mental well-being can help formulate effective intervention. Such efforts could guide policies, such as parental mental health resources and financial support programs, to mitigate the effects of economic instability and improve adolescent outcomes.

THE CURRENT STUDY

This study uses nationally representative longitudinal data from China to achieve three objectives. First, we identify distinct patterns of SES trajectories from 2012 to 2018, based on household income quintiles. The relative income hypothesis, also known as psychosocial hypothesis, suggests that an individual's mental well-being is more susceptible to relative income, which is

linked to social comparison, than to absolute income (Tsui, 2014). Using person-centered, data-driven modeling, we capture trends of the stability and change of household relative income over time. Second, we examine whether these income trajectories were significantly associated with adolescents' mental well-being. Drawing on the accumulation model and the social mobility model, we hypothesize that mental well-being varies among adolescents depending on their income trajectory. Third, we investigate the mechanisms linking income trajectories to adolescent mental well-being. We hypothesize that these effects operate through two pathways: family stress and family investment. Supplemental Figure A1 (in the online supplemental material) presents our research framework.

METHODS

Data and participants

We used publicly available data from the China Family Panel Studies (CFPS), a biennial longitudinal survey conducted by the Institute of Social Science Survey at Peking University. The CFPS is nationally representative and captures socioeconomic developments in China through multistage probability sampling (Y. Xie & Hu, 2014). Initiated in 2010 with approximately 15,000 households across 25 regions, the CFPS achieved an 80% response rate, with subsequent waves in 2012, 2014, 2016, 2018, and 2020.

We analyzed four waves of data from 2012 to 2018, collected before the COVID-19 pandemic. The 2010 data were excluded due to inconsistencies in the income measurement with other waves. Our study population comprised adolescents aged 10 to 19 years in 2018. We extracted individual information for adolescents aged 10 through 19 from the 2018 dataset and matched these records with their corresponding household information across waves using family identifiers ($n = 4{,}217$). Samples with incomplete income information were excluded ($n = 726$), resulting in a final sample of 3,491 adolescents. The majority of these adolescents lived with two parents (91.81%).

Measures

Household income quintile

Household income was measured as per capita net income, including wages, business income, property income, public transfers, and private transfers or gifts. Income quintiles were created, with the first quintile representing the lowest and the fifth quintile the highest. To minimize bias, income rankings were calculated using the full CFPS household sample for each wave (Zeng & Zhu, 2022).

Adolescent mental well-being

As indicators of mental well-being, we analyzed depressive symptoms and happiness. Adolescent depressive symptoms were measured using the eight-item Centre for Epidemiological Studies Depression Scale (CES-D8), a widely used measure of the severity of adolescent depressive symptoms over the previous 2 weeks (Van de Velde et al., 2009). The CES-D8 consists of eight items scored from 0 (*rarely*) to 3 (*most or all of the time*): "*I feel depressed*," "I *find everything is an effort*," "*I can't sleep well*," "*I feel happy*," "*I feel lonely*," "*I enjoy life*," "*I feel sad*," and "*I feel like life can't go on*." Among them, "*I feel happy*" and "*I enjoy life*" are reverse-scored.

Summed scores ranged from 0 to 24, with higher scores indicating more depressive symptoms. The Cronbach's alpha in this study was 0.721. In addition, adolescent happiness was assessed through a self-reported question, "How happy do you feel?" The answers ranged from 0 to 10, with 10 indicating the highest level of happiness.

Maternal mental well-being

Similar to adolescents' report of depressive symptoms, mothers reported their own depressive symptoms through the CES-D8 scale. The measure also demonstrated adequate reliability among mothers (Cronbach's $\alpha = 0.775$). Additionally, maternal happiness was measured through the same question, "How happy do you feel?," with a higher score indicating a higher level of happiness.

Family investment

Family investment includes material and immaterial aspects. Following Conger and his colleagues (2021), material investment was measured through three indicators: household book possession, environmental living conditions, and adolescent health insurance coverage. Household book possession is widely recognized as a proxy for families' direct material investment in children's learning, as it reflects the extent of educational resources available in the home environment (Chen & Yeung, 2025). It was assessed by the total number of books available at home based on household representative reports. Environmental living conditions were evaluated through standardized observational assessments conducted by trained interviewers, who scored household cleanliness and tidiness on a 1 to 7 scale. Health insurance coverage was measured dichotomously (1 = *covered*, 0 = *not covered*), with data collected via parental reports for adolescents aged 15 and younger and self-reports for those older than 15 years. In China, individuals without health insurance must pay the full cost of formal health care services out of pocket. Although this does not result in denial of treatment, the heavy financial burden greatly reduces service utilization, especially for children. Limited medical subsidies exist but cover only a very small subset of impoverished households. Prior studies have shown that health insurance coverage in China is strongly associated with children's use of formal health care services, as it helps reduce direct medical costs (Liu & Zhao, 2014). To ensure consistency across measures, household book possession and environmental living condition were dichotomized at the sample median (household book possession: 20 books; environmental living condition: a score of 5). Thus, the cutoff for household book possession and environmental living conditions reflects the midpoint distribution of our study sample, rather than an arbitrary threshold. The family material investment index was constructed as the simple average across each material investment variable's standardized *z*-score, meaning that its values have no direct intuitive interpretation. To describe its distribution, the mean and variance are reported in Table 1. Second, family immaterial investment was gauged by a single item, the frequency of family dinners, which is an important indicator of parental time spent with children (Fulkerson et al., 2006). Respondents answered the question "How often do you have dinner with your family every week?" on a scale of 1 to 7, with a mean 5.23 ($SD = 2.58$) in our sample. Overall, higher scores indicate higher levels of both family material and immaterial investment.

Covariates

Covariates included the characteristics of adolescents and their households at baseline that might explain differences in adolescent health across income trajectories. Baseline characteristics included

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TABLE 1 Adolescent characteristics and mental well-being by household income trajectory groups ($N = 3,491$).

	Total *n* (%) or *M* ± *SD*	Stable high-income group ($n = 275$) *n* (%) or *M* ± *SD*	Stable middle-income group ($n = 1,532$) *n* (%) or *M* ± *SD*	Stable lower middle-income group ($n = 1,265$) *n* (%) or *M* ± *SD*	Stable low-income group ($n = 216$) *n* (%) or *M* ± *SD*	Decreasing-income group ($n = 203$) *n* (%) or *M* ± *SD*	*p* value
Age	8.34 ± 2.89	8.27 ± 2.80	8.37 ± 2.91	8.34 ± 2.91	8.20 ± 2.73	8.29 ± 2.93	.93
Sex							.53
Male	1,845 (52.85)	151 (54.91)	826 (53.92)	660 (52.17)	108 (50.00)	100 (49.26)	
Female	1,646 (47.15)	124 (45.09)	706 (46.08)	605 (47.83)	108 (50.00)	103 (50.74)	
Mother's age at child's birth	26.64 ± 4.97	26.16 ± 3.79	26.77 ± 4.80	26.64 ± 5.20	26.54 ± 5.93	26.33 ± 5.08	.34
Residential area							<.001
Rural	2,300 (65.88)	80 (29.09)	867 (56.59)	1000 (79.05)	199 (92.13)	154 (75.86)	
Urban	1,191 (34.12)	195 (70.91)	665 (43.41)	265 (20.95)	17 (7.87)	49 (24.14)	
Parental education attainment							<.001
Less than high school	2,613 (74.85)	101 (36.73)	1,042 (68.02)	1,105 (87.35)	197 (91.20)	168 (82.76)	
High school	599 (17.16)	77 (28.00)	338 (22.06)	135 (10.67)	15 (6.94)	34 (16.75)	
College and above	279 (7.99)	97 (35.27)	152 (9.92)	25 (1.98)	4 (1.85)	1 (0.49)	
Maternal depressive symptoms	6.14 ± 4.03	5.36 ± 3.67	5.64 ± 3.70	6.73 ± 4.35	6.47 ± 4.31	6.84 ± 3.82	<.001
Maternal happiness	7.26 ± 2.29	7.66 ± 1.85	7.41 ± 2.12	7.06 ± 2.46	6.99 ± 2.56	7.16 ± 2.53	<.001
Family material investment	0.03 ± 0.58	0.22 ± 0.54	0.11 ± 0.57	−0.07 ± 0.59	−0.14 ± 0.59	−0.11 ± 0.56	<.001
Family immaterial investment	5.23 ± 2.58	5.51 ± 2.40	5.38 ± 2.51	5.10 ± 2.62	4.78 ± 2.84	5.07 ± 2.59	<.001
Adolescent depressive symptoms	4.20 ± 3.18	3.74 ± 3.12	3.96 ± 2.99	4.48 ± 3.32	4.37 ± 3.04	4.73 ± 3.75	<.001
Adolescent happiness	8.02 ± 2.01	8.13 ± 2.00	8.16 ± 1.87	7.93 ± 2.09	7.56 ± 2.28	7.87 ± 2.14	<.001

Note: Chi-square tests were used for categorical variables, and analysis of variance *F* tests were applied for continuous variables.

adolescents' age, sex (1 = *male*, 0 = *female*), mother's age at child's birth, residential area (1 = *urban*, 0 = *rural*), and parental educational attainment (Björkenstam et al., 2017; Zhang & Han, 2021). Parental educational attainment was measured by the highest level of education for both parents, categorized as less than high school (9 years of compulsory education or less), high school (10–12 years of education), and college and above (more than 12 years of education).

STATISTICAL ANALYSIS

We conducted attrition analyses for covariates to examine whether there was any systematic bias in the missing data. The results of Little's missing completely at random (MCAR) test indicated that missing data were indeed missing at random (MAR) (χ^2 = 135.49, *df* = 147, p = .742). Therefore, we performed multiple imputation using chained equations to address missing data for covariates (n = 10).

To identify the patterns of household income trajectories from 2012 to 2018, we employed a group-based trajectory model (GBTM), which is a specialized application of mixture modeling for identifying discrete subgroups of individuals exhibiting similar progressions during the observation period for a particular set of repeated measures (Nagin & Odgers, 2010). It has the advantage of reducing the heterogeneity of income trajectories within each income group and maximizing between-group differences (Song et al., 2022). To identify the trajectory groups that best fit the data, we fitted between one and six trajectory groups using a censored normal distribution. The trajectory shape of each group was determined in a stepwise procedure, with the fitting begins with the highest order function (cubic) of time and further reduced the degree of order function (quadratic, linear, and intercept) one by one until the order function is significant.

We then selected the best model based on the Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample-size adjusted Bayesian information criterion (SSA-BIC). Smaller AIC, BIC, and SSA-BIC values indicate a better model fit (Nagin, 2005). We further assessed the adequacy of the selected model by examining the sufficient sample sizes in each identified trajectory group, the average posterior probabilities of assignment (AvePP), and the odds of correct classification (OCC) based on the posterior probabilities of group membership. Each subgroup constituted more than 5% of the total sample, while AvePP greater than 0.70 and OCC greater than five suggested good model fitness (Nagin, 2005). A visual inspection of the five trajectory groups showed the second smallest BIC, SSA-BIC, and AIC. Moreover, most participants within the five trajectory groups had a high probability of belonging to a specific group, which indicates optimal classification of individuals while allowing for a reasonable number of trajectory groups. Supplemental Table A3 presents the fit statistics for our GBTM.

After identifying the income trajectories, we assessed their associations with adolescent mental well-being. First, we conducted a bivariate analysis using chi-square tests for categorical variables and analysis of variance F tests for continuous variables to examine the distribution of each variable across the income trajectory groups. Next, we employed four nested ordinary least squares regression models to investigate the relationship between income trajectories and adolescent mental well-being (crude model in Model 1 and adjusted model in Model 2), as well as the potential mediating roles of family stress (Model 3) and family investment (Model 4). To further quantify these mediating effects, we applied structural equation modeling (SEM) to formally test the indirect effects and estimate the proportion of the total effect mediated by family stress and family investment.

To examine the robustness of our results, we conducted a full information maximum likelihood estimation, which accounts for missing data patterns under the assumption of MAR,

thereby retaining all available information (Armitage et al., 2023). All analyses were conducted in Stata (version 15.0), with $p < .05$ considered statistically significant.

RESULTS

Group-based trajectories of household income among Chinese adolescents

We identified five distinct household income trajectories from 2012 to 2018 (Figure 1). The stable high-income group (7.88%, $n = 275$) had the highest levels of income across waves, with an average income quintile ranging between the fourth and fifth quintile. Participants in the stable middle-income trajectory formed the largest group, representing 43.88% of the sample ($n = 1{,}532$). This group was characterized by a consistent moderate level of household income, remaining in the middle-income bracket close to the third quintile. The stable lower middle-income group constituted 36.24% of the sample ($n = 1{,}265$), with an average income around the second quintile. The stable low-income group (6.19%, $n = 216$) had the lowest levels of income across waves, with an average income below the second quintile. In addition, 203 participants (5.81%) were in the decreasing-income group, whose average income quintile decreased from near the fifth quintile in 2012 to below the second quintile in 2016, though it showed a slight rise in 2018.

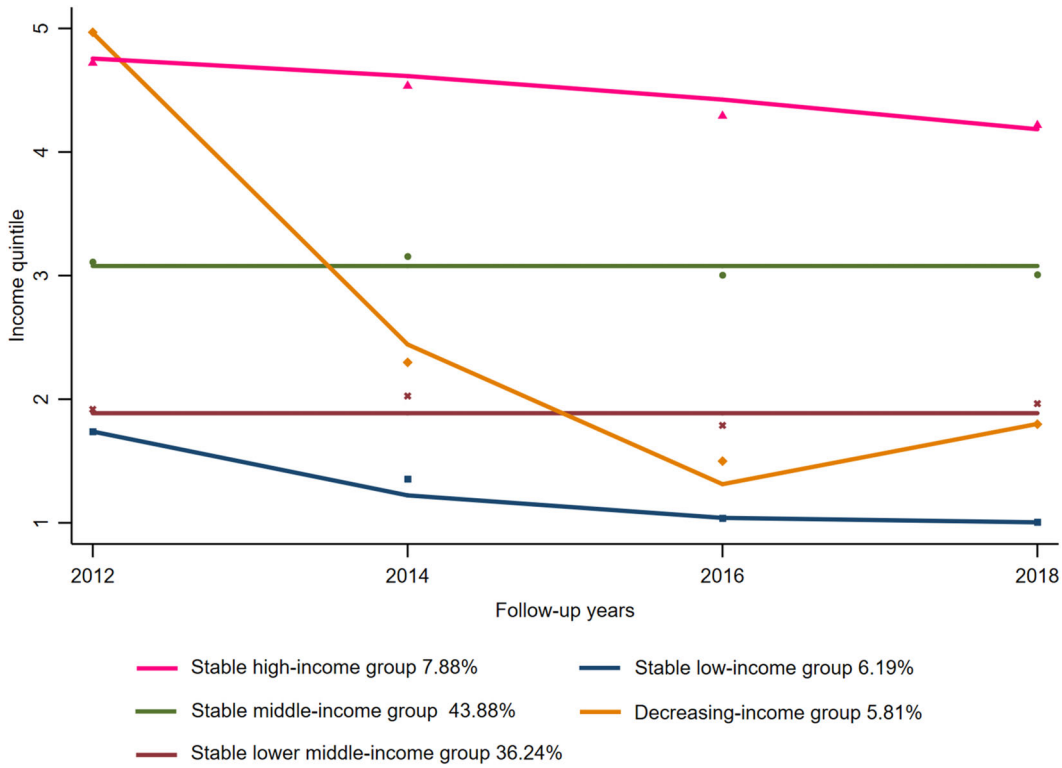

FIGURE 1 Estimated trajectory groups of household income across four waves (2012–2018). *Note*. Income quintile represents the relative rank in the full China Family Panel Studies sample for each wave, with the first quintile representing the lowest income group and the fifth quintile representing the highest. [Color figure can be viewed at wileyonlinelibrary.com]

Participant characteristics by household income trajectories

Table 1 presents the results of a bivariate analysis of sample characteristics and household income trajectories. Participants' age, sex, and mother's age at childbirth did not differ significantly across the trajectory groups. Significant group differences were found in residential areas and parental education attainment, however. On average, participants were born when their mothers were 26.64 years old. Among the different groups, mothers in the stable middle-income group were the oldest at the time of their children's births. Most of the participants (65.88%) resided in rural areas, and 34.12% were living in urban areas. Notably, the proportion of rural participants decreased as the cumulative income levels increased. Finally, participants whose parents had higher educational attainment tended to be classified into higher household income trajectories.

The five income trajectory groups differed significantly in both family stress and family investment variables. The stable high-income group exhibited the most favorable outcomes in all dimensions of family stress (maternal depressive symptoms: $M = 5.36$, $SD = 3.67$; maternal happiness: $M = 7.66$, $SD = 1.85$) and family investment (material: $M = 0.22$, $SD = 0.54$; immaterial: $M = 5.51$, $SD = 2.40$). In contrast, the stable low-income and the decreasing-income groups performed worse in these dimensions. Specifically, the stable low-income group demonstrated the lowest levels of maternal happiness ($M = 6.99$, $SD = 2.56$) and family investment (material: $M = -0.14$, $SD = 0.59$; immaterial: $M = 4.78$, $SD = 2.84$). The decreasing-income group displayed the highest level of maternal depressive symptoms ($M = 6.84$, $SD = 3.82$).

Household income trajectories and adolescent mental well-being

Table 2 presents the associations between household income trajectories and adolescents' mental well-being. In depressive symptoms analyses, Model 1a showed that adolescents from the stable low-income, stable lower middle-income, and decreasing-income groups displayed more severe depressive symptoms, with effect sizes ranging from 0.047 to 0.111 *SD*. After adjusting for adolescents and families' baseline characteristics (Model 2a), most associations showed slight attenuation compared with the unadjusted estimates, with the stable low-income group no longer exhibiting significantly more severe depressive symptoms. Specifically, compared with the stable high-income group, the stable lower middle-income ($\beta = 0.081$, $p < .05$) and the decreasing-income ($\beta = 0.058$, $p < .05$) groups exhibited higher levels of depressive symptoms, while the stable middle-income group showed no significant difference ($\beta = 0.011$, $p = .77$).

Regarding happiness, adolescents from the stable low-income group ($\beta = -0.068$, $p < .01$) exhibited significantly lower happiness compared with their counterparts from the stable high-income families in the crude model (Model 1b). This effect remained robust after controlling for baseline individual and family characteristics ($\beta = -0.061$, $p < .05$; Model 2b). No significant differences were observed in happiness between the other three groups and the stable high-income group.

The mediating role of family stress

The difference in the coefficients between Model 2 and Model 3 allowed us to assess the mediating effect of family stress. As shown in Model 3 of Table 2, poorer maternal mental well-being was significantly associated with worse adolescent mental well-being. The inclusion of maternal mental well-being attenuated the strength of the associations between income trajectories and adolescent mental well-being, suggesting a mediating effect. For adolescent depressive

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TABLE 2 Multiple regression analyses of household income trajectories and adolescent mental well-being.

	DS	Happiness	DS	Happiness	DS	Happiness	DS	Happiness
	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)
	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b	Model 4a	Model 4b
Household income trajectories (ref. stable high-income group)								
Stable middle-income group	0.033	0.006	0.011	0.016	0.007	0.024	0.010	0.017
	(0.208)	(0.133)	(0.214)	(0.138)	(0.210)	(0.137)	(0.212)	(0.138)
Stable lower middle-income group	0.111**	−0.049	0.081*	−0.035	0.058	−0.009	0.074*	−0.030
	(0.216)	(0.138)	(0.232)	(0.150)	(0.227)	(0.149)	(0.230)	(0.151)
Stable low-income group	0.047*	−0.068**	0.032	−0.061*	0.023	−0.049	0.027	−0.058*
	(0.289)	(0.204)	(0.307)	(0.214)	(0.304)	(0.213)	(0.305)	(0.214)
Decreasing-income group	0.072**	−0.031	0.058*	−0.026	0.046	−0.014	0.053*	−0.023
	(0.336)	(0.200)	(0.344)	(0.206)	(0.343)	(0.205)	(0.344)	(0.207)
Family stress								
Maternal depressive symptoms					0.118***	−0.073***		
					(0.015)	(0.010)		
Maternal happiness					−0.046*	0.111***		
					(0.026)	(0.017)		
Family investment								
Family material investment							−0.039*	0.032
							(0.010)	(0.063)
Family immaterial investment							−0.068***	0.028
							(0.023)	(0.014)
Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	3,281	3,290	3,281	3,290	3,281	3,290	3,281	3,290
(Pseudo) R^2	0.01	0.01	0.03	0.02	0.05	0.04	0.04	0.02

Note: Robust standard errors in parentheses. β = standardized regression coefficients; ref. = reference group. Social demographic controls include adolescents' age, sex, residential area, mother's age at child's birth, and parental education attainment. DS = depressive symptoms.
*$p < .05$.**$p < .01$.***$p < .001$.

TABLE 3 Standardized path coefficients for household income trajectories' effects on adolescent mental well-being.

		Indirect effects	Total effects	% Explained
Outcome: adolescent depressive symptoms				
Stable lower middle-income group	Family stress	0.023*** (0.039)	0.081* (0.232)	28.4
	Family investment	0.007* (0.022)		8.6
Decreasing-income group	Family stress	0.012** (0.048)	0.058* (0.343)	20.7
	Family investment	0.005* (0.031)		8.6
Outcome: adolescent happiness				
Stable low-income group	Family stress	−0.012** (0.033)	−0.061* (0.213)	19.7
	Family investment	−0.004 (0.016)		

Note: Robust standard errors in parentheses. The stable high-income served as the reference group. All models were adjusted for adolescents' age, sex, mother's age at child's birth, residential area, and parental education attainment at baseline.
*$p < .05$.**$p < .01$.***$p < .001$.

symptoms, the coefficients for the stable lower middle-income and decreasing-income groups decreased by 28.4% and 20.7% from Model 2a to Model 3a, respectively, and were no longer statistically significant. A similar attenuation was observed for adolescent happiness, with the standardized coefficient decreasing from −0.061 ($p < .05$) in Model 2b to −0.049 ($p < .05$) in Model 3b. Specifically, 19.7% of the association between the stable low-income group and adolescent mental well-being diminished after including maternal mental well-being in the model.

Table 3 and Supplemental Figure A2 present the results of the SEM, illustrating the mediating effects of maternal mental well-being. The indirect effects of stable lower middle-income and decreasing-income groups on adolescent depressive symptoms through maternal mental well-being were 0.023 ($p < .001$) and 0.012 ($p < .01$), representing 28.4% and 20.7% of the total effects, respectively. Similarly, the indirect effect of stable low-income group on adolescent happiness through maternal mental well-being was −0.012 ($p < .01$), accounting for 19.7% of the total effects.

The mediating role of family investment

Model 4 showed that higher levels of family investment were significantly associated with reduced adolescent depressive symptoms (family material investment: $\beta = -0.039$, $p < .05$; family immaterial investment: $\beta = -0.068$, $p < .001$). Conversely, no significant relationship was observed between family investment and adolescent happiness (family material investment: $\beta = 0.032$, $p = .08$; family immaterial investment: $\beta = 0.028$, $p = .14$). When the family investment variable was added in Model 2, the coefficients between income trajectories (i.e., stable lower middle-income and decreasing-income groups) and adolescent depressive symptoms showed a slight attenuation, suggesting a partial mediating effect. The association between the stable low-income group and adolescent happiness remained unchanged, however, indicating no evidence of a mediating effect for happiness.

The SEM results in Table 3 and Supplemental Figure A1 further supported these findings. The indirect effects of the stable lower middle-income and decreasing-income groups on adolescent depressive symptoms through family investment were 0.007 ($p < .05$) and 0.005 ($p < .05$), respectively, accounting for 8.6% of the total effects. Moreover, this mediation effect was mainly ascribed to material investment, as immaterial investment did not exhibit significant variation across income trajectories. Nevertheless, no statistically significant indirect effects were observed for the stable low-income group and adolescent happiness. Overall, the results in Table 3 were consistent with those presented in Table 2.

Results of sensitivity analysis

The sensitivity analysis, conducted using full information maximum likelihood estimation, is detailed in Supplemental Table A4. The results were largely consistent with those of the main analysis, confirming the robustness of our results.

DISCUSSION

Using a nationally representative sample of 3,491 adolescents from China, this study identified five distinct household income trajectories from 2012 to 2018. By exploring how long-term processes of SES stratification and mobility during early life shape mental well-being in adolescence, this study contributes to the understanding of health inequalities among adolescents, particularly in the context of developing countries.

Income trajectories and economic rigidity

By employing a data-driven, person-centered approach to measure income trajectories, this study conceptualizes SES as a dynamic process that incorporates timing, stability, and change. Our findings reveal that most Chinese adolescents experienced stable income levels during the study period, with 43.88% in the stable middle-income group and 36.24% in the stable lower middle-income group. Only 7.88% and 6.19% belonged to the stable high-income and low-income groups, respectively. A smaller proportion (5.81%) experienced downward income mobility, transitioning from high to low income. Unlike previous studies (Hoyt et al., 2019; Pryor et al., 2019) that identified upward mobility trajectories in other countries, we did not observe upward mobility in this study.

Household income trajectories and adolescent mental well-being

The results suggest the significant role of SES trajectories in shaping adolescent mental well-being. Regarding depressive symptoms, disparities emerged among adolescents in different stable income groups. Adolescents in the stable lower middle-income group, averaging near the second income quintile, showed significantly higher depressive symptoms compared with their peers in the stable high-income group. However, those in the stable low-income group, averaging near the first income quintile, reported depressive symptoms comparable to the stable high-income group. This aligns with cross-sectional research showing that adolescents from lower middle-income households exhibited higher depressive symptoms than those from high-income families, while those from low-income households showed no significant difference (Patalay & Fitzsimons, 2018). One possible explanation is the "near-poor" hypothesis, which suggests that families slightly above the poverty line face greater economic insecurity due to the lack of targeted policy support than those already in poverty (Han & Zhang, 2022). Adolescents in these families may endure more stress, as chronic near-poverty is linked to an external locus of control and negative self-concept (Zhang & Han, 2021). Downward mobility also significantly impacted adolescent depressive symptoms. Adolescents from families that experienced a decline in income, often from higher initial SES, reported increased depressive symptoms, consistent with the social mobility model (Hallqvist et al., 2004). These results align with previous studies showing that economic shock, such as reduced family income, increases adolescent psychological risks (Björkenstam et al., 2017; Pryor et al., 2019).

For happiness, adolescents from chronically low-income households—those with the lowest income levels across all timepoints—reported significantly lower happiness than their peers in the stable high-income group. This pattern was not observed in other groups with relatively higher income levels, however. These results support Kahneman and Deaton's (2010) perspective that while income increases beyond a certain threshold may not enhance happiness, persistent low income is strongly correlated with reduced happiness. Additionally, no significant association was observed between downward mobility and happiness, echoing conclusion from a recent Chinese study (Q.-W. Xie et al., 2024).

Overall, long-term economic hardship, such as stable low income and downward mobility, was associated with poorer adolescent mental well-being. Notably, depressive symptoms appear more strongly associated with stable lower middle-income and downward mobility, whereas the lack of happiness seems more closely tied to stable low income. The results support the view that negative (e.g., depressive symptoms) and positive (e.g., happiness) dimensions of mental well-being are distinct constructs (Patalay & Fitzsimons, 2018; Q.-W. Xie et al., 2024). Therefore, studying negative and positive dimensions of mental well-being separately, rather than treating them as opposing ends of a single spectrum, is essential for developing a nuanced understanding of adolescent well-being across socioeconomic contexts.

Mediating mechanisms: Family stress and family investment

Our findings revealed distinct mechanisms underlying the association between household income trajectories and adolescent mental well-being. First, the relationship between household income trajectories—particularly the stable lower middle-income trajectory—and depressive symptoms appears to be predominantly mediated by family stress and material investment pathways rather than direct effects. Economic hardship, such as lower income or decreasing income, is strongly associated with increased maternal stress and poorer maternal mental well-being (Pinchoff et al., 2021). Within the Chinese context, where mothers often serve as primary caregivers, compromised maternal mental well-being can disrupt the family dynamic and directly affect adolescents' emotional development (Simons et al., 2016). Additionally, lower income and downward mobility can lead to underinvestment in children, which has been shown to exacerbate depressive symptoms (Di Maio & Nisticò, 2019; Zhang & Han, 2021).

Second, maternal mental well-being, a key component of the family stress framework, also mediated the link between household income trajectories and adolescent happiness. Family material investment did not mediate the association between income trajectories and happiness, however, as no significant association was found between family material investment and happiness. This suggests that insecure material investments, such as limited access to housing, cultural resources, and health care are more closely tied to depressive symptoms but have minimal direct impact on happiness.

Overall, our research found that households with children in China showed notable economic rigidity and frequently positioned at the lower end of income distribution. This pattern reflects the country's relatively weak child welfare system and limited family-supportive labor market policies. Belonging to chronically lower income groups or experiencing downward income mobility was associated with poorer adolescent mental well-being, with the family stress process serving as a key transmission pathway. In other words, the developmental context shaped by household income trajectories through family dynamics, especially family stress process, is critical to mental well-being in adolescence and may exert a stronger influence than income trajectories alone.

Over the past 3 decades, China has experienced rapid economic growth alongside a widening income gap (Zhou & Song, 2016). Within this context, adults in chronically lower income households, as well as those undergoing downward mobility, are more likely to face

unfavorable social comparisons that foster dissatisfaction and frustration (Ishida et al., 2014). These psychosocial stressors, in turn, undermine children's mental well-being. The cascading effects of economic hardship on family dynamics highlight the particular challenges of safeguarding adolescent mental well-being amid widening inequality in the context of China's rapid economic transformation.

Implications for policy and practice

The current study offers several important insights for improving adolescents' mental well-being. First, our findings reveal that Chinese families with children often cluster at the lower end of the income distribution, with strong income rigidity. This economic stagnation significantly affects adolescent mental well-being, which will in turn influence their future life opportunities and overall adult health outcomes (Hale et al., 2015; McLeod et al., 2016). To address this problem, policies should aim to improve the economic conditions of families with children by enhancing public welfare systems (e.g., tax credit, childcare subsidy) and family-friendly employment policies, while preventing prolonged periods of income instability. Families that experience significant income losses require special policy attention to mitigate the negative effects of economic shocks on adolescent mental well-being, particularly depressive symptoms.

Second, our analysis underscores the interconnectedness between the mental well-being of mothers, who are usually the primary caregivers in Chinese families, and the mental well-being of their children. Interventions targeting maternal mental well-being are essential to improve children's mental well-being and prevent cascading negative effects through family dynamics. Furthermore, our study highlights the importance of addressing insufficient family material foundations due to economic hardship, which contribute significantly to adolescent depressive symptoms. Targeted material interventions, such as enhancing access to better housing, education, and health care for disadvantaged families, are crucial for mitigating mental health challenges associated with stable lower income and income shocks.

Last, our results highlight distinct patterns and mechanisms between household income trajectories and adolescent depressive symptoms and happiness, affirming that these two dimensions of mental well-being are separate constructs. Therefore, reducing depressive symptoms should not be equated with increasing happiness. Intervention strategies must be tailored to address these specific objectives independently, ensuring that each aspect of mental well-being is effectively supported.

Limitations

First, the GBTM assumes probabilistic rather than deterministic group assignments. This means individuals are not assigned to a single trajectory group but instead have varying probabilities of belonging to different groups (Song et al., 2022). As such, the income groups we identified are latent and cannot be directly observed in the real world (Nagin & Tremblay, 2005). Caution is needed when generalizing our findings to other samples, particularly those experiencing different patterns of income fluctuations over time. In addition, our analysis relied solely on the trajectories of relative income (i.e., income quintiles), which reflect the stability and change of a household's resource position compared with others. This focus may help explain why the mediating effect of the family stress mechanism appeared stronger in our findings. However, compared with relative income trajectories, absolute income trajectories might better capture the trend of whether a household actually lacks essential resources. Future research could therefore further examine whether absolute income trajectories exert distinct effects on adolescents' mental well-being. Furthermore, our study focused on 6-year income trajectories, which may

bias results toward the prevalence of stable incomes. Future research should incorporate longer term data to identify extended income trajectories and explore their effects on health outcomes across the lifespan.

Second, although the core mechanism of the family stress model was partially captured through indicators of mothers' mental well-being, parental relationship quality—another key component of the model—was not examined in our study because the available measures were not compatible with our sample. Paternal mental well-being, also a critical element of the framework, was likewise excluded due to substantial missing data. Future research should incorporate additional variables, such as marital status, parental relationship quality, and paternal mental well-being, to provide a more comprehensive test of the family stress model. Moreover, due to data constraints, we relied on a single item to measure household immaterial investments, which may account for the nonsignificant relationship observed between immaterial investments and adolescent happiness. Future studies should employ more comprehensive measures of both material and immaterial investments to provide a more accurate estimation.

Finally, family stress, family investment, and adolescent mental well-being variables were measured in the same wave (2018). This was necessitated by the potential psychological disruptions caused by the COVID-19 pandemic after 2020, which precluded us from using lagged measurements of adolescent mental well-being. Consequently, the potentially bidirectional relationship between maternal and adolescent mental well-being limits our ability to determine causality. Future studies with more waves available can further explore the dynamic relationships between family income, parental mental health, and adolescent mental well-being over time. Moreover, our results may underestimate the impact of income trajectories on adolescent depressive symptoms because we excluded participants with incomplete income information, who exhibited higher levels of depressive symptoms (see supplemental material).

Conclusions

This study, based on a representative sample from China, assesses how family income trajectories shape adolescents' mental well-being. Our findings highlight that poorer mental well-being in adolescents, including increased depressive symptoms and reduced happiness, may result from chronic lower income and downward mobility, with distinct patterns evident for each dimension of mental well-being. Importantly, the developmental context shaped by household income trajectories through family dynamics, especially family stress process, plays an even greater role in adolescent mental well-being than income trajectories alone. While our analysis is based on data from 2012–2018, the insights remain highly relevant in the post-pandemic era, as families worldwide grapple with the ongoing challenges of global economic downturn, including income declines and prolonged financial insecurity. Our results underscore the importance of adopting a family systems perspective in policies and interventions to mitigate the cascading effects of economic hardship on adolescents through family dynamics.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in China Family Panel Studies at https://opendata.pku.edu.cn/.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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