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How School-Family-Community Collaboration Shapes Left-Behind Children's Mental Health: An Ecological Systems Approach in Chongqing, China

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Abstract: Amid rapid urbanisation, the number of left-behind children nationwide has reached 66.93 million, and prolonged parent-child separation exposes this group to significant mental health risks. Drawing on ecological systems theory, these risks arise from the functional weakening and collaborative rupture of multiple systems, family, school, and community, yet existing research lacks both mechanistic modeling of the triad as an integrated system and quantitative comparisons of their relative contributions. Using left-behind children in Chongqing as the study population, this research conducted a large-sample survey using the Symptom Checklist-90 (SCL-90) and conducted empirical analyses using multiple regression and Shapley value decomposition. The findings reveal the following: First, family emotional support lies at the core of the protective structure, with guardian care alone explaining 52.27% of the model variance, far exceeding the contributions of school (4.74%) and community (7.92%) factors. Second, the quality of emotional bonds, rather than the form of care is key to psychological well-being: there was no significant difference based on whether care was provided by grandparents, but those with caregivers who showed a high level of concern had significantly better mental health (128.77 vs. 182.22, $p < 0.001$), indicating that “whether one is truly cared for” is far more decisive than “who provides the care.” Third, school-based mental health education and community-based organisational care exert compensatory and synergistic effects, together accounting for approximately 12.7% of the variance. The study suggests a shift from fragmented services toward ecological governance, with efforts focused on enhancing family emotional responsiveness, strengthening the school as the primary front, promoting proactive community care and building a “school-family-community” integrated support ecosystem.

Keywords: Left-behind children, mental health, ecological systems theory, school-family-community collaboration, Shapley value.

Introduction

Research Problem

Left-behind children represent a distinct population emerging from China’s rapid urbanisation, rooted in the large-scale cross-regional labour migration shaped by the urban-rural dual structure. According to the report *What the 2020 Census Can Tell Us About Children in China: Facts and Figures*, jointly released by the National Bureau of Statistics of China, UNICEF China and UNFPA China, the number of left-behind children nationwide reached 66.93 million in 2020, accounting for a substantial proportion of the total child population. Among them, approximately 41.77 million were rural left-behind children, representing 62.4% of all left-behind children and 37.9% of the total rural child population. In other words, nearly four out of ten rural children are left behind (National Bureau of Statistics of China et al., 2023). Behind these figures lies a systemic absence of emotional and custodial care, placing this group at heightened psychosocial risk during critical developmental

stages. Prolonged parent-child separation, with its associated decline in emotional availability and weakened daily supervision, readily precipitates internalising problems such as depression and anxiety, and without timely support, these difficulties may persist and accumulate, adversely affecting long-term development (Fellmeth et al., 2018; Graham & Jordan, 2011). Meta-analytic evidence consistently confirms that left-behind children experience significantly elevated emotional and behavioural problems compared with their non-left-behind counterparts (Wang & Mesman, 2015; Zhao et al., 2014; Tang et al., 2018; Lu et al., 2016).

Bronfenbrenner's ecological systems theory provides a crucial framework for understanding these risks. The theory posits that child development occurs within nested, dynamically interacting environmental systems—the microsystem (e.g., family, school), the mesosystem (linkages between microsystems), the exosystem (e.g., community organisations), and the macrosystem (broader sociocultural contexts) (Bronfenbrenner, 1979). This perspective was later refined into the bioecological model, which emphasises the powerful role of proximal processes—the reciprocal interactions between a developing individual and the persons, objects, and symbols in their immediate environment—over time (Bronfenbrenner & Morris, 2006). Parental absence directly weakens the core functions of the family microsystem, and this impact may be further amplified by weakened mesosystem connections or insufficient exosystem resources. Consequently, the mental health risks of left-behind children do not stem from the failure of a single system but rather from the interaction of a weakened microsystem (diminished family emotional warmth and daily supervision), a fractured mesosystem (inadequate home-school communication and coordination), and an insufficient exosystem (limited community resource access) (Fellmeth et al., 2018). Despite growing academic attention, three important limitations persist in the existing literature. First, most analyses continue to treat family, school and community factors as isolated variables or, at most, focus on dyadic linkages, while empirical studies that conceptualise school-family-community (SFC) collaboration as an integrated mesosystem and proceed to model its operational mechanisms remain notably scarce (Fazel et al., 2014; Sanders, 2001). Second, there is a dearth of research evidence that can quantitatively compare the relative contributions of family, school and community subsystems to left-behind children's mental health, which constrains evidence-based decisions on resource allocation and intervention prioritisation. Third, a substantial proportion of existing studies remain at the descriptive level, with relatively few drawing on large-sample data and multivariate models to produce actionable and generalizable quantitative evidence. These gaps call for a systematic, multisystem investigation to inform integrated prevention and intervention efforts.

Research Focus

This study focuses on the mental health of left-behind children in Chongqing, China, and adopts an ecological systems perspective to examine the roles of family, school and community support systems. Rather than treating these settings as independent variables, the study conceptualises them as interconnected subsystems within the mesosystem and aims to empirically

model their effects on left-behind children's psychological well-being. A large-sample survey using the Symptom Checklist-90 (SCL-90) was administered to capture the mental health status of this population, and the subsequent statistical analyses-including difference tests, multiple regression, and Shapley value decomposition-were designed to disentangle the unique and shared influences of family emotional support, school-based mental health education, and community-based care. This analytical approach enables an examination of both the direct effects of each subsystem and their relative contributions within an integrated ecological model.

Research Aim

This study aims to systematically investigate the current status and characteristics of left-behind children's mental health and to empirically test the effects of family, school and community factors on psychological outcomes. Building on the results of multiple regression and Shapley value decomposition, it further seeks to clarify the relative contributions of these three subsystems and to propose a multidimensional "school-family-community" collaborative intervention strategy that is tailored to the Chinese context, thereby providing theoretical support and evidence-based grounds for policy formulation and practice interventions.

Research Questions

Based on the identified research gaps and the study's ecological orientation, the following formal research questions are posed:

RQ1: How do family emotional support (including guardian care and emotional bonds), school-based mental health education, and community-based organisational care respectively affect the mental health of left-behind children?

RQ2: What are the relative contributions of family, school and community subsystems to variations in left-behind children's mental health and which subsystem plays the most critical protective role?

RQ3: How can an integrated "school-family-community" collaborative intervention framework be designed, based on the empirical findings, to effectively compensate for systemic weaknesses and enhance the mental health of left-behind children?

Materials and Methods

Theoretical Basis and Analytical Framework

This study adopts the ecological systems theory proposed by Bronfenbrenner (1979) and its subsequent bioecological elaboration (Bronfenbrenner & Morris, 2006) as its overarching analytical framework. The theory situates individual development within a series of nested environmental

systems, primarily including the microsystem, mesosystem, exosystem, and macrosystem. Specifically, the microsystem refers to the activities and interactional environments in which individuals directly engage (e.g., family, school); the exosystem comprises social contexts that affect individuals indirectly, even though they do not participate directly (e.g., grassroots community organisations); and the mesosystem denotes the linkages and interactions among different microsystems. Drawing on this framework, the present study conceptualizes left-behind children's mental health as the product of interactions among multiple ecological systems: the emotional care provided by guardians in the family microsystem, mental health education in the school microsystem, grassroots organizational support in the community exosystemic, as well as the synergistic effects across these systems (i.e., the mesosystem) jointly constitute the ecological network that influences children's psychological adaptation. Accordingly, the survey instruments and data analysis strategy were designed to systematically evaluate the independent effects and relative contributions of ecological factors at various levels, so as to assess their impact on left-behind children's mental health.

Participants

According to the definition of "left-behind children" provided in What the 2020 Census Can Tell Us About Children in China: Facts and Figures, jointly released by the National Bureau of Statistics of China, UNICEF China and UNFPA China, left-behind children refer to children aged 0-17 years who have one or both parents migrating across township (subdistrict) boundaries for six months or more and who remain in their place of origin, unable to live together with both parents (National Bureau of Statistics of China et al., 2023). The participants of this urban-rural left-behind children's mental health survey were children aged 0-17.

Survey Implementation and Quality Control

After the initial draft of the questionnaire was compiled, in order to ensure the reliability and validity of the subsequent data, the research team conducted a pilot survey in early April 2024 at a secondary school in Chengkou County, Chongqing, to test and refine the questionnaire items. The formal survey was implemented once the items were confirmed to be clear and appropriate. From April to May 2024, using a stratified sampling approach, the research team selected 5,640 children from 20 districts and counties in Chongqing for the formal survey. In parallel, semi-structured interviews, designed in advance, were conducted to supplement information not fully captured by the questionnaire.

To obtain an accurate picture of the mental health of urban and rural left-behind children in Chongqing and to ensure data quality, all investigators received standardised training prior to the formal survey. After the electronic questionnaires were collected, designated inspectors checked the completeness, response duration, and response validity of each questionnaire. Invalid questionnaires were excluded, and data were cleaned in Excel.

Questionnaire Design

Basic Information Section

In designing the basic information section, multiple factors influencing left-behind children's mental health were fully considered. The questionnaire collected information on children's basic demographics, family circumstances, and the Symptom Checklist-90 (SCL-90), with data obtained through student self-reports. This approach enables a more comprehensive and in-depth exploration of the factors affecting left-behind children's mental health, providing rich and valuable data for subsequent analyses.

Symptom Checklist-90 (SCL-90)

The Symptom Checklist-90 (SCL-90) consists of 90 items covering 10 dimensions: somatisation, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and diet/sleep disturbances. Items are scored on a 5-point scale (1 = not at all, 5 = extremely severe). Higher scores on each dimension and the total score indicate more severe symptom levels. In the present study, the Cronbach's alpha coefficient of the scale was 0.992 (Derogatis, 1994; Derogatis & Cleary, 1977).

Statistical Methods

This study employed questionnaire and interview data, processed with SPSS 27.0 and STATA 16.0, to empirically analyse the mental health status, problems, and underlying factors of urban and rural left-behind children in Chongqing. First, the reliability and validity of the symptom checklist were tested. Second, descriptive statistics were used to present the overall characteristics of mental health status. Independent-sample t-tests and analysis of variance (ANOVA) were conducted to examine differences in mental health across demographic characteristics, family factors, school support, and community-level variables. Finally, ordinary least squares (OLS) regression analysis was performed to identify specific factors influencing left-behind children's mental health. A significance level of $p < 0.05$ was adopted as the criterion for statistical significance throughout all analyses.

Results

Reliability and Validity Tests

Reliability

Internal consistency of the SCL-90 was assessed using Cronbach's alpha. The overall alpha was 0.992 (> 0.70), indicating excellent reliability. All subscales met or exceeded common thresholds. Details are reported in Table 1.

Table 1*Reliability of the SCL-90*

Dimension	Items	Cronbach's α
Somatisation	12	0.954
Obsessive-compulsive	10	0.927
Interpersonal sensitivity	9	0.932
Depression	13	0.956
Anxiety	10	0.947
Hostility	6	0.912
Phobic anxiety	7	0.910
Paranoid ideation	6	0.894
Psychoticism	10	0.934
Diet and sleep-related symptoms	7	0.897
Total scale	90	0.992

Validity

Convergent validity was examined using confirmatory factor analysis (CFA) with 10 factors and 90 items. Average Variance Extracted (AVE) and Composite Reliability (CR) were calculated. All AVE values exceeded 0.50, and all CR values were above 0.70, indicating satisfactory convergent validity (Table 2).

Table 2*AVE and CR of the CFA model*

Dimension	AVE	CR
Somatisation	0.639	0.955
Obsessive-compulsive	0.562	0.927
Interpersonal sensitivity	0.616	0.935
Depression	0.641	0.958
Anxiety	0.653	0.949
Hostility	0.653	0.919
Phobic anxiety	0.596	0.911
Paranoid ideation	0.592	0.896
Psychoticism	0.596	0.936
Diet and sleep-related symptoms	0.558	0.897

Descriptive Statistics

A total of 5,640 electronic questionnaires were returned. After data screening, 5,154 were valid, yielding an effective response rate of 91.38%. Among valid cases, 2,092 were left-behind children (40.5%), and 3,062 were non-left-behind children (59.5%). Basic demographic characteristics are shown in Table 3.

Table 3

Descriptive statistics of basic demographics

Variable	Category	Frequency	Percentage (%)
Left-behind status	Yes	2,092	40.5
	No	3,062	59.5
Gender	Male	2,550	49.5
	Female	2,604	50.5
Age	0-6 years	120	2.33
	7-12 years	2,285	44.33
	13-17 years	2,749	53.34
Household registration	Rural	3,950	76.6
	Urban	1,204	23.4
Intergenerational caregiving	Yes	1,027	19.9
	No	4,127	80.1
Number of co-residing household members	< 3	391	7.59
	3	1,085	21.05
	4	1,706	33.1
	5	953	18.49
	6	728	14.12
	> 6	291	5.65

Group Differences

Overall Differences Between LBC and Non-LBC

Independent-samples t-tests showed that the mean total SCL-90 score for LBC (144.8) was significantly higher than that for non-LBC (132.5), $t = 7.023$, $p < 0.001$. Across all 10 SCL-90 dimensions, LBC scored significantly higher (all $p < 0.001$), with larger differences observed in obsessive-compulsive symptoms, depression, and anxiety. This pattern is consistent with previous meta-analytic evidence highlighting elevated emotional and behavioural problems among left-behind children (Wang & Mesman, 2015).

Table 4*Differences in mental health between LBC and non-LBC*

Variable	LBC(n=2,092)	Non-LBC(n=3,062)	t	p
Somatisation	1.45±0.67	1.35±0.57	5.583	<0.001
Obsessive-compulsive	1.80±0.80	1.65±0.72	6.680	<0.001
Interpersonal sensitivity	1.68±0.80	1.53±0.70	6.945	<0.001
Depression	1.66±0.81	1.51±0.71	7.203	<0.001
Anxiety	1.59±0.77	1.45±0.66	6.758	<0.001
Hostility	1.67±0.83	1.53±0.72	6.491	<0.001
Phobic anxiety	1.56±0.77	1.42±0.65	6.932	<0.001
Paranoid ideation	1.58±0.74	1.46±0.65	6.145	<0.001
Psychoticism	1.52±0.71	1.40±0.62	6.528	<0.001
Diet and sleep-related symptoms	1.59±0.76	1.46±0.65	6.687	<0.001
Total SCL-90 score	144.8±64.9	132.5±56.4	7.023	<0.001

Differences by Duration of Parental Absence

Significant differences were observed across duration groups for the total score and all 10 dimensions (all $p < 0.001$). A monotonic pattern was evident: longer duration was associated with higher total scores (Table 5).

Table 5*Mental health differences by duration of parental absence*

Variable	0 duration (n=3,062)	0.5-1 year (n=1,765)	1-2 years (n=141)	2-3 years (n=27)	≥3 years (n=159)	F	p
Somatisation	1.35±0.57	1.44±0.65	1.42±0.58	1.53±0.67	1.63±0.83	11.96	<0.001
Obsessive-compulsive	1.65±0.72	1.78±0.79	1.83±0.74	1.99±0.92	2.01±0.95	16.41	<0.001
Interpersonal sensitivity	1.53±0.70	1.66±0.78	1.68±0.72	1.81±0.99	1.90±0.97	16.68	<0.001
Depression	1.51±0.70	1.64±0.79	1.66±0.72	1.80±0.90	1.88±0.99	17.81	<0.001
Anxiety	1.45±0.66	1.56±0.75	1.60±0.72	1.74±0.83	1.80±0.94	16.61	<0.001
Hostility	1.53±0.72	1.66±0.83	1.63±0.71	1.67±0.82	1.86±0.96	13.82	<0.001
Phobic anxiety	1.42±0.65	1.54±0.75	1.56±0.68	1.66±0.84	1.75±0.96	16.05	<0.001
Paranoid ideation	1.46±0.65	1.57±0.73	1.51±0.61	1.70±0.90	1.74±0.85	12.77	<0.001
Psychoticism	1.39±0.61	1.50±0.70	1.51±0.63	1.55±0.79	1.74±0.90	16.38	<0.001
Diet and sleep-related symptoms	1.46±0.65	1.57±0.74	1.61±0.72	1.77±0.78	1.76±0.92	14.94	<0.001
Total SCL-90 score	132.49±56.43	143.03±67.72	144.16±57.17	155.11±68.76	162.81±79.90	17.21	<0.001

Individual Differences by Gender, Age, and Household Registration

Significant differences were found by gender, age, and household registration. Female LBC had higher total scores than male LBC (153.3 vs. 136.1, $p < 0.001$). Total scores increased with age ($0-6 < 7-12 < 13-17$; $p < 0.001$). Rural LBC also scored higher than urban LBC (146.12 vs. 136.85, $p = 0.012$). These results indicate that female, older, and rural LBC show higher symptom levels.

Table 6

Differences by individual characteristics (LBC only)

Variable	Group	Total SCL-90 score	t / F	p
Gender	Male (n=1,037)	136.1±59.2	-6.089	<0.001
	Female (n=1,055)	153.3±69.1		
Age	0-6 years (n=46)	115.33±46.98	68.39	<0.001
	7-12 years (n=923)	128.17±52.81		
	13-17 years (n=1,123)	159.61±70.65		
Household registration	Rural	146.12±65.88	-2.510	0.012
	Urban	136.85±58.45		

Differences by Key Ecological Factors

At the family level, intergenerational caregiving showed no significant difference in total SCL-90 scores ($p > 0.05$). The number of co-residing household members was associated with a significant, though modest, difference ($F = 2.79$, $p = 0.016$). In contrast, caregiver concern and parental concern were strongly associated with the total score: children reporting greater concern had substantially lower total scores (128.77 vs 182.22; 129.80 vs 182.43; both $p < 0.001$), with differences exceeding 50 points.

At the school level, LBC in schools that offered mental health education activities had significantly lower total scores than those in schools without such activities (142.42 vs. 172.77, $t = -4.681$, $p < 0.001$). Moreover, higher activity frequency was associated with progressively lower total scores ($F = 13.0$, $p < 0.001$), indicating a graded trend.

At the community level, LBC who had received attention from civil affairs/community/residential/village committees had significantly lower total scores than those who had not (134.81 vs. 155.42, $t = -7.315$, $p < 0.001$). Higher frequency of such attention was also associated with lower total scores ($F = 16.6$, $p < 0.001$), showing a consistent gradient.

Table 7*Differences in LBC mental health by ecological factors*

Variable	Group	Total score	SCL-90	t / F	P
Intergenerational caregiving	Yes (n=820)	144.7±66.4		0.063	0.949
	No (n=1272)	144.8±63.9			
	<3 (n=229)	155.42±73.21		2.79	0.016
	3 (n=467)	149.73±69.39			
Number of co-residing members	4 (n=605)	142.33±62.00			
	5 (n=372)	142.22±61.40			
	6 (n=280)	137.66±60.01			
	>6 (n=139)	142.27±63.80			
Caregiver concern	High (n=1466)	128.77±52.13		-16.118	<0.001
	Low (n=626)	182.22±75.66			
Parental concern	High (n=1497)	129.80±52.45		-15.328	<0.001
	Low (n=595)	182.43±76.94			
School mental health education	Yes (n=1930)	142.42±62.89		-4.681	<0.001
	No (n=162)	172.77±80.50			
	Never (n=162)	172.77±80.50		13.0	<0.001
Frequency of school activities	Once a year (n=252)	152.90±69.87			
	Once per semester (n=868)	144.92±62.99			
	Every two months (n=117)	146.97±62.97			
	Once a month (n=693)	134.70±59.24			
Community/civil affairs attention	Yes (n=1081)	134.81±59.99		-7.315	<0.001
	No (n=1011)	155.42±68.23			
	Never (n=1011)	155.42±68.23		16.6	<0.001
Frequency of community attention	Once a year (n=508)	141.74±63.66			
	Once per semester (n=235)	126.71±51.94			
	Every two months (n=81)	134.12±60.43			
	Once a month (n=257)	128.74±57.96			

Multivariate Regression and Contribution of Factors

Baseline Regression

To assess the net effects of ecological factors on LBC mental health, multivariate linear regression models were estimated (Table 8). After controlling for individual and family characteristics, the full model (Column 3) shows that: caregiver concern ($\beta = -18.619$, $p < 0.001$), school mental health education activities ($\beta = -17.993$, $p < 0.01$), and community/civil affairs attention ($\beta = -12.432$, $p < 0.001$) are all significantly negatively associated with the total score, indicating that higher support is linked to lower symptom levels. In addition, being female, older age, and longer left-behind duration are associated with higher total scores, whereas larger household size is associated with lower scores.

Table 8

Baseline regression results

Variables	(1)	(2)	(3)
Caregiver concern (X1)	-18.968***(-11.48)	-22.150***(-13.54)	-18.619***(-11.21)
School mental health activities (X2)	-18.720***(-3.17)	-17.393***(-2.91)	-17.993***(-3.10)
Community attention (X3)	-12.151***(-4.63)	-11.053***(-4.10)	-12.432***(-4.72)
Gender	-14.257***(-5.57)		-14.337***(-5.62)
Age	4.179*** (9.09)		4.163*** (9.08)
Household registration	-1.118(-0.31)		-1.740(-0.49)
Intergenerational care		-4.146(-1.50)	-2.429(-0.90)
Left-behind duration		4.108*** (2.29)	4.480** (2.55)
Household size		-1.689* (-1.84)	-1.625* (-1.81)
_cons	196.961*** (17.89)	257.399*** (26.52)	257.399*** (26.52)
R ²	0.1992	0.1601	0.2044
N	2,092	2,092	2,092

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$; t-values in parentheses.

Shapley Value Decomposition

To quantify relative importance, Shapley value decomposition was conducted (Grömping, 2007). Caregiver concern contributed the most to the total R^2 (52.27%), followed by age (23.52%). School activities and community attention contributed 4.74% and 7.92%, respectively (Table 9).

Table 9*Shapley value decomposition*

Variable	Shapley value	Contribution (%)
Caregiver concern (X1)	0.10686	52.27
School mental health activities (X2)	0.00968	4.74
Community attention (X3)	0.01620	7.92
Gender	0.01458	7.13
Age	0.04809	23.52
Household registration	0.00130	0.64
Intergenerational care	0.00025	0.12
Left-behind duration	0.00469	1.36
Household size	0.00278	2.30
Total	0.20442	100

Robustness Check

To test robustness, core explanatory variables were replaced with analogous continuous measures (e.g., “whether cared for” replaced by “frequency of care”). Results (Table 10) are consistent with the baseline: higher frequencies of family, school, and community support are associated with lower total scores.

Table 10*Robustness check results*

Variable	Coefficient
Parental concern frequency (X1)	-17.296***(-10.27)
School activity frequency (X2)	-3.150***(-2.74)
Community attention frequency (X3)	-3.507***(-3.56)
Controls	YES
_cons	186.752*** (16.39)
R ²	0.1838
N	2,092

Note: *** $p < 0.001$; t-values in parentheses.

Discussion

The Central Role of Family Emotional Support

This study first reveals an overall inadequacy of family emotional support. Many guardians and parents pay limited attention to the mental health of left-behind children, and the absence of emotional responsiveness leads to weakened parent-child bonds and heightened loneliness. Regression results indicate that guardian care is the strongest negative predictor of mental health problems, which is in line with research emphasising the critical role of parent-child communication for left-behind children's psychological well-being (Wen & Lin, 2012; Su et al., 2013). Shapley value decomposition further demonstrates that this single variable accounts for 52.27% of the model variance, a contribution far exceeding that of external variables such as school and community factors, as well as the cumulative effect of risk factors such as age and duration of parental absence. These findings suggest that "whether one is truly cared for" is far more decisive for left-behind children's psychological adjustment than "who is physically present as the caregiver." Emotional bond quality, rather than the form of co-residence, constitutes the core of the psychological protection mechanism.

This finding is highly consistent with attachment theory. Bowlby (1969) posited that a secure and stable emotional bond between the child and the primary caregiver serves as the foundation for emotion regulation and social adaptation. When parental companionship is chronically absent, the extent to which a guardian can provide consistent emotional responsiveness essentially determines the degree to which secure attachment can be substituted and compensated (Bowlby, 1969). The present study confirms that it is the quality of emotional responsiveness, rather than the form of co-residence, that plays the key protective role. The underlying mechanisms may include the following: high-quality interaction satisfies children's needs for love and belonging, alleviating the anxiety and loneliness brought about by separation; simultaneously, as an external resource, it nourishes psychological resilience and enhances children's capacity to adapt in the face of adversity (Masten, 2001; Luthar et al., 2000). Moreover, resilience is increasingly understood not merely as an individual trait but as a process shaped by social-ecological interactions (Ungar, 2011). Accordingly, future research and practice should shift the emphasis from the "completeness" of family structure to the "emotional quality" of family interaction, and promote the transformation of guardians from mere physical caregivers into key supporters capable of providing sustained emotional nurturance.

The Compensatory and Synergistic Roles of School and Community

This study reveals a clearly stratified protective structure: family emotional support occupies the core, yet institutional interventions from schools and communities remain indispensable. Regression analysis and Shapley value decomposition show that both school-based mental health education activities and community-organised care are significantly associated with better mental health outcomes among left-behind children, together accounting for approximately 12.7% of the model variance. This quantitative pattern clearly indicates that the role of schools and communities is not to substitute for family functioning but rather to compensate, reinforce, and create synergy when family functioning is insufficient or absent.

As the most critical arena for institutional socialisation of left-behind children, schools provide a structured support system. The data show that children in schools that implement mental health education activities score significantly lower on mental health problems than those in schools without such activities (142.42 vs 172.77), and that the higher the frequency of activities, the lower the problem scores, revealing a distinct gradient of protective effect. The underlying mechanisms involve at least two pathways: first, mental health literacy education reduces stigma and enhances children's emotional regulation skills and help-seeking awareness (Jorm, 2012); second, institutionalized caring practices and positive, stable teacher-student interactions construct a predictable and supportive microenvironment within the school, consistent with the documented benefits of school-based social and emotional learning programs (Durlak et al., 2011). As Gilligan (1998) noted, schools serve a significant protective environmental function for disadvantaged children, and systematic mental health promotion in schools can meaningfully reduce psychological distress (Weare & Nind, 2011). However, this study also finds notable weaknesses in school-based mental health education: constrained by the exam-oriented culture, activities remain generally infrequent and uneven in professionalism, and considerable gaps persist in teachers' emotional engagement and in systematic psychological service capacities. This implies that the potential protective role of schools is far from being fully realised. Accordingly, mental health education should be substantively integrated into the core governance of basic education, with systematic efforts to advance curriculum development and the allocation of professional teaching personnel, thereby genuinely consolidating the school's position as a primary channel for promoting the psychological well-being of left-behind children.

Community care, delivered through civil affairs bureaus, neighbourhood committees, and village committees, is also closely associated with the psychological adjustment of left-behind children. On the one hand, organisational care can enhance children's sense of psychological security and perceived social support; on the other, community engagement can link resources such as volunteers, cultural activities, and material assistance, helping to expand children's support networks. This process aligns with the "stress-buffering effect" explanatory pathway of social support theory (Cohen & Wills, 1985; Thoits, 2011). The beneficial effects of community-based organisational care are also consistent with broader evidence on neighbourhood social capital and collective efficacy on child development (Leventhal & Brooks-Gunn, 2000; Barrera, 1986). The findings of the present study support this view and further suggest that grassroots community organisations should play a more proactive role in mental health services for left-behind children, moving from passive response to routinised care provision.

Taken together, the above findings point to the necessity of constructing a synergistic mechanism between schools and communities. Within this mechanism, schools are well positioned to assume the functions of daily identification and primary intervention, while communities should leverage their strengths in resource integration and sustained support. Ideally, when family emotional support is adequate, schools and communities exert a reinforcing effect; when family support is weak, they promptly activate a compensatory function. This dynamic linkage model is highly consistent with the core proposition of Bronfenbrenner's ecological systems theory, namely

that the substantive connections among microsystems—the quality of the mesosystem—exert an independent and significant influence on individual development (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006). Therefore, activating and institutionalising synergy between schools and communities constitutes a crucial pathway to rebuilding the protective network for left-behind children under conditions in which family functioning is temporarily weakened.

Building a Multidimensional School-Family-Community Collaborative Strategy for Left-behind Children's Mental Health

The mental health problems of left-behind children are rooted in a compounded predicament of deficient family functioning, insufficient school support, and fractured social collaboration. To resolve this predicament, it is necessary to move beyond a “solo-operation” model and build an integrated support ecosystem with schools as the hub, families as the foundation, and communities as the support base, as articulated in school-family-community partnership frameworks (Epstein, 2011). Based on the core findings of this study, this can be systematically advanced along the following three dimensions.

(1) Building an institutionalised emotional provision system centred on emotional responsiveness.

The family is the starting point for emotional development, yet the emotional functioning of left-behind children's families is generally weak. Systematic home-school communication and community guidance should be employed to effectively enhance guardians' mental health literacy and emotional responsiveness. At the school level, institutionalised arrangements such as “surrogate parents” and “regular heart-to-heart talk days” can establish stable teacher-student emotional bonds, effectively compensating for the temporary absence of parent-child attachment. At the community level, parent-child activities should be actively organised, and professional social work services should be introduced to expand children's diverse social support networks. Through tripartite collaboration, fragmented and haphazard care can be transformed into sustained, predictable emotional support, thereby building the first line of defence for the psychological protection of left-behind children.

(2) Building a tiered and collaborative psychological service capacity system oriented toward capacity building.

The professionalism and sustainability of psychological services for left-behind children fundamentally depend on the capacity reserves and collaborative effectiveness of the school, family, and community at different levels. At the foundational capacity level, efforts should focus on enhancing the “identification-response” capabilities regarding mental health among family members and community frontline workers. For guardians and migrant parents, the emphasis should be on helping them recognise early signals of common psychological distress such as anxiety and depression, and on equipping them with basic responsive skills such as listening and empathy—this is the starting point of emotional support. For community grid workers, child officers, and frontline social workers, systematic training in preliminary screening of psychological problems and

psychological first aid should be provided, enabling them to have the front-end response capacity of “detection-initial comfort-referral.”

At the professional capacity level, the core task is to strengthen the specialised provision of school-based psychological services. As the formal system with the most extensive daily coverage, schools should take the lead in ensuring a full complement of dedicated psychological teachers and establishing a regular training mechanism to enhance the mental health literacy of all teachers. At the same time, in addition to relying on regional psychological counselling centres or professional medical institutions, a collaborative network of “professional institutions + schools + volunteers” should be established, and the depth of specialisation of school psychological services should be continuously enhanced through fixed-point supervision, case discussions, and on-site mentoring. Moreover, at the societal level, capacity building itself should be institutionalized—by incorporating it into government procurement of services, establishing a tiered certification system, and sustaining financial investment—so as to push psychological services for left-behind children from “someone is doing it” to “professionals are doing it,” and eventually realize a leap in capacity from “able to do” to “skilled at doing.”

(3) Improving the cross-sectoral collaborative governance mechanism with institutional integration as the lever.

The prominent obstacles currently facing service provision lie in the decentralisation of responsibilities, information silos, and policy disconnects. Government-led efforts should be strengthened to establish a cross-sectoral collaborative framework involving education, civil affairs, health, women’s federations, and other relevant departments, clarifying the rights and responsibilities of each party and setting up a regularised joint working group. Relying on the national information management system for left-behind children, multi-source data from schools, families, and communities should be integrated to build a foundational database for dynamic monitoring and precise policy implementation. On this basis, the service model should shift from post-hoc remedy to a “prevention-intervention-development” full-cycle management approach, ensuring that care and support run throughout the entire developmental process of left-behind children.

In summary, mental health support for left-behind children should not be undertaken by any single entity; rather, a collaborative system featuring shared goals, shared responsibilities, and shared resources should be formed, achieving a transformation from “passive relief” to “active empowerment,” so that left-behind children can grow up healthily in an environment filled with care and support.

Conclusion

Adopting an empirical analysis approach and grounded in the framework of ecological systems theory, this study systematically examined the mental health status and influencing factors among left-behind children in Chongqing, and demonstrated the mechanisms and differential contributions of the tripartite collaborative protection involving family, school, and community. By confirming the

significant protective effects of guardian emotional care, school-based mental health education, and community organisational care on left-behind children's mental health, this study provides both theoretical foundations and practical insights for psychological intervention research on left-behind children.

At the theoretical level, this study moves beyond previous analytical paradigms that focused solely on single-system or dual-system interactions, and models the "school-family-community" triad as an integrated ecological system. The findings reveal that family emotional support alone accounts for 52.27% of the explained variance in mental health, far exceeding the contributions of school factors (4.74%) and community factors (7.92%). This highlights the foundational role of the quality of the family's emotional bond in the psychological protection mechanism. At the same time, systematic interventions by schools and communities play a critical compensatory role, validating the synergistic effect of overlapping protection across multiple layers of ecological resources. These findings deepen the understanding of the psychological development mechanisms of left-behind children, and suggest that future theoretical construction should pay greater attention to the hierarchical and complementary nature of the functions of various subsystems within the ecological system.

At the practical level, this study offers concrete recommendations for education and social work practitioners. To more effectively promote the mental health development of left-behind children, intervention strategies should shift from "fragmented services" to "ecological governance": at the family level, efforts should focus on enhancing guardians' emotional responsiveness rather than simply altering the form of care; at the school level, mental health education should be regularized and professionalized, fulfilling the school's role as the main front for daily monitoring and front-line intervention; at the community level, the proactive care and resource integration functions of grassroots organizations should be strengthened. Schools, families, and communities should develop tiered, classified collaborative intervention strategies tailored to children's specific characteristics, such as the duration of parental absence, gender, and age. Future research could adopt longitudinal tracking designs to explore the developmental trajectories of mental health and the dynamic evolution of protective factors, and conduct comparative studies across multiple regions and institutions to examine the applicability boundaries and differential mechanisms of various collaborative models.

Ethics approval and informed consent statement

This study did not require formal ethical approval from an institutional review board. All procedures were carried out in accordance with the Declaration of Helsinki. Prior to data collection, the survey's purpose and procedures were fully explained to the participants, and written informed consent was obtained from the legal guardians of all left-behind children involved.

Limitations

Several limitations of this study should be acknowledged. First, the cross-sectional design precludes causal inference; the observed associations between family, school, and community

factors and left-behind children's mental health cannot be interpreted as causal relationships. Second, the reliance on self-report measures—primarily the SCL-90—introduces the possibility of common-method bias, and the SCL-90 may not be developmentally appropriate for children at the lower end of the age spectrum, particularly those in the 0–6 age band, which limits the accuracy of mental health assessment for younger participants. Third, the sample was drawn exclusively from Chongqing, a single province-level municipality, which constrains the generalizability of the findings to other regions with different socioeconomic and cultural profiles. These limitations should be carefully considered when interpreting the results.

Suggestions for Future Research

Future studies should adopt longitudinal designs to examine the causal pathways through which school-family-community collaboration influences left-behind children's mental health over time. Multi-informant approaches—integrating reports from teachers, caregivers, and community workers—are recommended to reduce common-method bias and capture a more comprehensive picture of children's functioning. In addition, using child-appropriate instruments (e.g., the Strengths and Difficulties Questionnaire; Goodman, 1997) for younger age groups would improve measurement validity. Expanding the sampling frame to multiple provinces with varying levels of economic development and migration patterns would enhance external validity. Finally, intervention research is needed to test whether an integrated SFC collaborative model, as outlined in this study, can produce measurable improvements in left-behind children's mental health outcomes.

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Conflict of Interest

None.

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