

Mediating Effect of the Parent–Child Relationship on the Association Between Maternal Nurturance and Early Child Development: A Longitudinal Study During the COVID-19 Pandemic

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Background: Research on the specific pathways from maternal nurturance to early child development remains limited. Grounded in transactional theory, this study is the first to examine these pathways through the parent–child relationship.

Methods: This longitudinal study involved mothers of children aged 1–3 years. Data on sociodemographic characteristics, Comprehensive General Parenting Questionnaire, and Child-Parent Relationship Scale were collected at Time 1, when children were 1 year old. At Time 2, when children were 3 years old, Caregiver-Reported Early Development Instruments were measured. Structural equation modeling (SEM) was used to explore direct and indirect pathways from maternal nurturance to early child development.

Results: A total of 1145 mother-child dyads participated, with children averaging 32 months (SD = 6.4) and mothers averaging 28.7 years (SD = 4.0). Maternal nurturance had significant direct ($\beta = 0.271$), indirect ($\beta = 0.065$), and total ($\beta = 0.336$) effects on early child development. Direct effects accounted for 80.7% of the total effects, while indirect effects accounted for 19.3%. Maternal nurturance indirectly predicted higher early child development through increased parent–child closeness ($\beta = 0.048$), explaining 14.3% of the total effects. Maternal nurturance indirectly promoted early child development through reduced parent–child conflict ($\beta = 0.017$), explaining 5.1% of the total effects.

Conclusion: The novelty of this study lies in its demonstration of the mediating role of the parent–child relationship in the effect of maternal nurturance on early child development. This longitudinal study provides insights for governments agencies, policymakers, and healthcare workers to develop intervention programs that enhance maternal nurturance through the parent–child relationship to promote early child development.

Keywords: maternal nurturance, early child development, parent–child relationship

Introduction

Child development is a maturational and interactive process, marked by the gradual acquisition of perceptual, motor, cognitive, language, socio-emotional, and self-regulation skills.¹ The first 1000 days are particularly critical, as they represent a formative period that shapes long-term outcomes.² Development in the first three years of life is deeply intertwined with the brain's sensitivity to external stimuli,³ drawing global attention to this critical window.⁴ Human capital is built through intergenerational and interactive processes, significantly influences child development during time-dependent crucial periods.⁵ For children aged 1–3 years, early child development encompasses cognitive, language, motor, and socioemotional growth, forming the foundation for adult health and well-being.⁶ In upper- and middle-income

countries (UMICs), 219 million children under the age of 5 are at risk of not reaching their developmental potential.⁷ Addressing early child development disparities is essential for reducing global inequities and fostering sustainable development worldwide.⁸

Nurturing care adopts a life course perspective, proactively supporting optimal child development by mitigating adversities, enhancing resilience, and promoting children's wellbeing.⁹ Nurturing care integrates the determinants of human capital formation, emphasizing the continuing provision of healthcare, nutrition, and education within a responsive care framework supported by family-centered policies and services.¹⁰ Nurturing care targets critical developmental periods that are particularly vulnerable to adversity but also responsive to interventions that promote equity, resilience, and human capital.¹¹ Nurturing care significantly influences early child health and development,¹² helping to buffer the effects of adversity.¹³ A randomised trial among Romanian children indicated that nurturing care could particularly alleviate the negative impacts of early adversity.¹⁴ Maternal nurturance is characterised by a family environment that is responsive to a child's health and nutritional needs, emotionally supportive, developmentally stimulating, and protection against adversities.¹⁵ Through continuous learning, active participation, relationship building, and navigating challenges, maternal nurturance enables children to develop the foundational elements of human capital.¹⁶ This process goes beyond academic achievement, helping children regulate emotions and behaviours, assume responsibilities, and build self-efficacy.¹⁷ Maternal nurturance plays a pivotal role in shaping children's acquisition of developmental competencies, contributing to their academic, behavioural, socio-emotional, and economic successes.¹⁸

The Nurturing Care Framework underscores the importance of responsive caregiving in enabling children to reach their full developmental potential during early childhood.¹⁹ Maternal nurturance refers to the degree to which mothers sensitively address their children's needs, support their autonomy, engage in meaningful interactions, encourage healthy behaviors, and express affection and care.²⁰ Maternal nurturance not only enhances childhood safety but also boosts children's confidence in social interactions, setting them on a positive developmental path and helping them achieve their early developmental potential.²¹ Research indicated that cumulative exposure to maternal nurturance during early childhood is associated with improvements in language, cognitive abilities, and socioemotional development.^{22,23} Maternal nurturance includes effective communication, acknowledgment of children's actions and behaviors, and the provision of a warm, supportive environment.²⁴ A study elucidated that maternal nurturance influences the relationship between family functioning and children's self-esteem.²⁵

The transactional theory of development suggests that cognitive, language, motor, and socioemotional development in early childhood is cumulatively enhanced through dynamic interactions between mothers and young children.²⁶ The theory emphasizes a reciprocally adjusting mechanism, where maternal nurturance supports active exploration and engagement with the environment by children, potentially influencing both the parent-child relationship²⁷ and early child development.²² The parent-child relationship, a significant and distinctive bond formed through interactions between parents and children, encompasses both parent-child closeness and conflict.²⁸ Parent-child closeness refers to the level of warmth, affection and open communication, while parent-child conflict pertains to the degree of negativity and behavioral opposition.²⁹ The parent-child relationship is a prominent proximal process in individual development, with direct implications for early childhood physical, social, and emotional well-being.²⁸ Children who experience higher levels of parent-child closeness are more likely to perceive maternal educational involvement as emotional support, which may be associated with increased motivation to engage in expected activities, thereby fostering socioemotional development during early childhood.³⁰ Conversely, elevated levels of parent-child conflict may hinder positive communication, impede the acquisition of essential knowledge and competencies, and pose significant challenges to early child development.³¹ The parent-child relationship influenced children's self-esteem and mental health,³² while parent-child conflict negatively affected children's prosocial behavior and mental health.³³ Children's emotional difficulties and parent-child closeness remained relatively stable over time, suggesting that developing close parent-child relationships during childhood is crucial for mitigating subsequent emotional difficulties.³⁴

Conceptual Framework and Hypotheses

Most studies investigating the relationship between maternal nurturance and child development focused on children older than three years in high-income countries (HICs).^{35,36} Notably, only one longitudinal study demonstrated that maternal

nurturance indirectly contributed to child development at 54 months through the mediation of parent–child attachment.³⁶ This highlights a critical gap in understanding the pathways from maternal nurturance to early child development, particularly in the context of UMICs. The impact of maternal nurturance on early child developmental potential may be influenced by sociocultural factors.³⁷ Inadequate support for maternal nurturance during the crucial period of rapid brain development, learning, and the establishment of the parent–child relationship can hinder optimal development.¹ Despite the importance of issue, there is a noticeable lack of research exploring the specific pathways from maternal nurturance to early child development in UMICs. This study employs structural equation modeling (SEM), a statistical approach that allows for the estimation of both direct and indirect pathways involving multiple variables through regression analysis, facilitates the decomposition of effects that traverse a chain of influence.³⁸

To the best of our knowledge, this is the first longitudinal study in China to explore both direct and indirect pathways from maternal nurturance to early child development, mediated by the parent–child relationship using SEM. Building on the transactional theory and an extensive literature review, this longitudinal study proposes a conceptual framework and hypotheses (Figure 1): (1) a direct pathway from maternal nurturance to early child development; (2) an indirect pathway from maternal nurturance to early child development mediated by parent–child closeness; and (3) an indirect pathway from maternal nurturance to early child development mediated by parent–child conflict. This study aims to provide valuable insights for intervention programs designed to enhance maternal nurturance by strengthening the parent–child relationship, thereby promoting early child development in an UMIC.

Methods

Participants and Procedure

This longitudinal study was conducted in eastern China from March 1, 2020, to March 31, 2022. Mothers who were the primary caregivers for children aged 1–3 years were recruited through purposive sampling. The inclusion criteria were as follows: (1) mothers with at least one child between the ages of 1 and 3 years; (2) mothers aged 18 years or older; and (3) children born full-term with a birth weight between 2500 and 4000 grams. Exclusion criteria included mothers with diagnosed mental disorders that impair cognitive function and children with developmental disabilities or delays.

A pilot study involving eleven mothers was conducted to improve the clarity and consistency of the questionnaires. No modifications were necessary for the questionnaires, and the data collected from the pilot study were incorporated into the final sample for subsequent analysis.

Measures

Sociodemographic Characteristics

Data collection occurred at two distinct time points: (1) maternal nurturance and parent–child relationship measures were assessed at Time 1 when the children were aged 1 year,³⁶ and (2) early child development was assessed at Time 2 when the children were aged 3 years.³⁹ The interval between these two time points was two years.

Sociodemographic data collected included child age and sex (female, male), maternal age, educational level (middle school or below, high school, college/university or above), employment status (unemployed, employed), area of residence (urban, rural), family status (single-parent household, two-parent households), and family monthly income (< 5000, 5000–10,000, > 10,000 CNY).

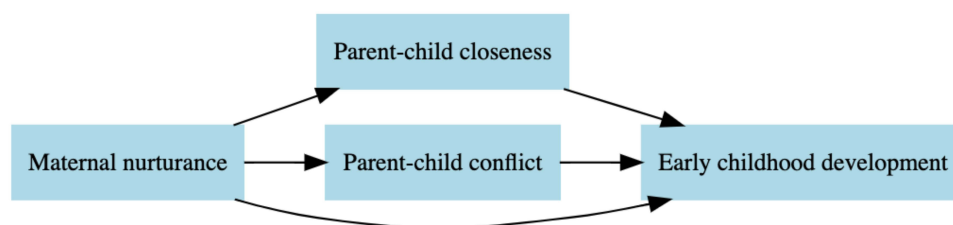


Figure 1 Conceptual Framework and Hypotheses.

Confirmatory Factor Analyses

Confirmatory factor analyses (CFA) were conducted for each measurement scale to assess construct validity. Multiple goodness-of-fit indices were examined for acceptable model fit, including Chi-square to Degrees of Freedom (χ^2/df) < 3, Root Mean Square Error of Approximate (RMSEA), Standardized Root Mean Square Residual (SRMR) ≤ 0.06 , Comparative Fit Index (CFI), Tucker-Lewis index (TLI), and Goodness of Fit Index (GFI) ≥ 0.90 .⁴⁰

Maternal Nurturance

Maternal nurturance was assessed using the 18 items from the subscale of the Comprehensive General Parenting Questionnaire (CGPQ) when the child was 1 year old. The CGPQ includes four domains: autonomy support, social rewarding, responsiveness, and involvement.²⁰ Each item was rated on a 5-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree), with higher average scores indicating a higher level of maternal nurturance. The CGPQ demonstrated acceptable reliability (Cronbach's alpha = 0.916) and construct validity (χ^2/df = 2.780, RMSEA = 0.059, SRMR = 0.041, CFI = 0.937, GFI = 0.928, TLI = 0.926) in this study.

Parent–Child Relationship

The parent–child relationship was assessed using the short form of the Child-Parent Relationship Scale (CPRS) when the child was 1 year old. This scale comprises 15 items and two subscales: parent–child closeness and parent–child conflict.⁴¹ Each item was rated on a 5-point Likert scale, ranging from 1 (Definitely does not apply) to 5 (Definitely applies). Higher average scores reflected greater levels of parent–child closeness or conflict. The Cronbach's alpha values for parent–child closeness and parent–child conflict were 0.71 and 0.76,⁴² respectively, indicating validation of the CPRS in Chinese children aged 2–3 years. In this study, the CGPQ demonstrated acceptable reliability (Cronbach's alpha = 0.797) and construct validity (χ^2/df = 2.777, RMSEA = 0.059, SRMR = 0.053, CFI = 0.948, GFI = 0.942, TLI = 0.938).

Early Child Development

Early child development was assessed using the Caregiver-Reported Early Development Instruments short form (CREDI) when the child was 3 years old. The CREDI provides a single, overall score capturing developmental progress across cognitive, language, motor, and socioemotional domains, encompassing 20 items.⁴³ Each item's raw score was coded as 0 (No) and 1 (Yes). The total raw scores were then converted into age-specific standardized scores, with higher scores indicating enhanced early child development. The CREDI demonstrated acceptable reliability and validity among Chinese children.⁴⁴ In this study, the CREDI demonstrated acceptable reliability (Cronbach's alpha = 0.804) and construct validity (χ^2/df = 1.114, RMSEA = 0.010, SRMR = 0.023, CFI = 0.992, GFI = 0.992, TLI = 0.991).

Data Analyses

Statistical analyses were conducted using Stata 15.0 software (Stata Corporation, College Station, TX, USA), AMOS 23.0 software (IBM Corporation, Armonk, NY, USA), and R version 4.1.1 (R Foundation for Statistical Computing, Vienna, Austria). The data were thoroughly checked for errors, and no missing values were identified. Categorical variables were presented as frequencies and percentages, while continuous variables were described using means and standard deviation. Univariate analysis employed *t*-tests and analysis of variance for appropriate comparisons. Pearson's correlation analysis was used to assess the associations among sociodemographic characteristics, maternal nurturance, parent–child closeness, parent–child conflict, and early child development.

The structural equation modeling (SEM) approach was employed to examine the direct and indirect pathways from maternal nurturance to early child development through the parent–child relationship, utilizing maximum likelihood estimation. Sociodemographic characteristics were included as potential covariates in the SEM if they were significantly associated with the mediator (parent–child relationship), predictor variable (maternal nurturance), or outcome variable (early child development). Bias-corrected 95% confidence intervals (BC 95% CI) were used to assess the significance of effects from maternal nurturance to early child development.⁴⁵ Total effects were calculated as the sum of direct and indirect effects, expressed mathematically as $c = c' + ab$, where c represents the total effect, c' denotes the direct effect, and ab signifies the indirect effect.⁴⁶ Multiple indices were

examined for acceptable model fit, including the $\chi^2/df < 3$, RMSEA, SRMR ≤ 0.06 , CFI, TFI, and GFI ≥ 0.90 .⁴⁰ The ratio of indirect effect to total effects was calculated as $100 \times (\text{indirect effect} / \text{total effects})$. A p -value < 0.05 indicated statistical significance. Given the empirical estimates for mediation models, this study included 486 participants, exceeding the required sample size for small-to-medium paths with a power of 0.80.⁴⁷

Ethical Approval

Potential participants were recruited through word of mouth and flyers distributed during child vaccination visits. All mothers were approached to participate, and those expressing interest received an information sheet detailing the study's objectives, procedures, expected outcomes, benefits, and risks. Written informed consent was obtained from all participating mothers, who were explicitly informed of their right to withdraw from the study at any point. To ensure data protection, all collected data were anonymized. Researchers were available to assist participants with any questions related to the study and to ensure the completeness of the questionnaires. This study adhered strictly to the principles outlined in the Declaration of Helsinki and received ethical approval from the Affiliated Hospital of Xuzhou Medical University Ethics Committee (ID: XYFY2021-KL070-01).

Results

Sociodemographic Characteristics

Table 1 illustrates the sociodemographic differences in early child development. A total of 1250 mother-child dyads participated at Time 1, mean age of children was 19 months (SD = 3.8), and 1145 (91.6%) continuing to participate in the

Table 1 Sociodemographic Differences in Early Childhood Development (N = 1145)

Variables	N (%) / Mean \pm SD	Early Childhood Development (Mean \pm SD)	t/F	P
Child				
Age (months)	32 \pm 6.4	—	—	—
Sex			1.562	0.119
Boy	574 (50.1)	57.1 \pm 3.3		
Girl	571 (49.9)	56.8 \pm 3.2		
Mothers				
Age (years)	28.7 \pm 4.0			
Educational level			84.427	< 0.001
Middle school or below	247 (21.6)	58.1 \pm 3.1		
High school	359 (31.4)	55.3 \pm 3.7		
College/university or above	539 (47.1)	57.6 \pm 2.4		
Employment status			3.664	< 0.001
Unemployed	497 (43.4)	57.4 \pm 2.8		
Employed	648 (56.6)	56.7 \pm 3.5		
Area of residence			−0.009	0.993
Urban	643 (56.2)	57.0 \pm 2.9		
Rural	502 (43.8)	57.0 \pm 3.6		
Relationship status			0.670	0.503
Single-parent household	93 (8.1)	56.8 \pm 3.3		
2-parent households	1052 (91.9)	57.0 \pm 3.2		
Family monthly income (CNY)			0.176	0.838
<5000	279 (24.4)	56.9 \pm 3.7		
5000–10,000	417 (36.4)	57.0 \pm 3.3		
>10,000	449 (39.2)	57.0 \pm 2.9		

Notes: CNY = 0.141 USD; SD, standard deviation.

follow-up measures at Time 2, mean age of children was 32 months ($SD = 6.2$). Among the 1145 mother-child dyads, 574 (50.1%) were boys. The mothers' mean age was 28.7 years ($SD = 4.0$), with 539 (47.1%) reporting a college/university degree or higher. Additionally, 497 (43.4%) were unemployed, 643 (56.2%) resided in urban areas, 1052 (91.9%) were in two-parent households, and 449 (39.2%) reported a family monthly income exceeding 10,000 CNY. Significant differences in early child development scores were observed based on mothers' education level and employment status.

Pearson's Correlation Analyses

Table 2 displays the results of Pearson's correlation analyses examining the associations among early child development, maternal nurturance, the parent-child relationship, and sociodemographic characteristics. Early child development was positively correlated with maternal nurturance ($r = 0.34$), parent-child closeness ($r = 0.25$), and childhood age ($r = 0.07$), and negatively correlated with parent-child conflict ($r = -0.18$) and maternal employment status ($r = -0.11$). Parent-child closeness was positively correlated with area of residence ($r = 0.06$), and negatively correlated with parent-child conflict ($r = -0.22$), and childhood age ($r = -0.09$). Childhood age, maternal employment status, and area of residence were included as covariates in the SEM approach.

Structural Equation Modeling Analyses

Pathways from Maternal Nurturance to Early Child Development

The standardized direct, indirect, and total effects of maternal nurturance on early child development through the parent-child relationship are presented in Figure 2 and Table 3. Maternal nurturance exhibited significant direct ($\beta = 0.271$), indirect ($\beta = 0.065$), and total ($\beta = 0.336$) effects on early child development; 80.7% of the total effects were direct, while 19.3% were indirect. Higher levels of maternal nurturance indirectly predicted greater early child development through increased parent-child closeness ($\beta = 0.048$), explaining 14.3% of the total effects. Maternal nurturance indirectly promoted early child development through the mediation of reduced parent-child conflict ($\beta = 0.017$), explaining 5.1% of the total effects. The SEM approach indicated an acceptable model fit, with $\chi^2/df = 1.004$, RMSEA = 0.002, SRMR = 0.017, CFI = 1.000, and GFI = 0.997.

Discussion

The process of early child developmental, while sharing universal characteristics, exhibits variations as children acquire skills tailored to their specific cultural contexts. This is the first longitudinal study to confirm the pathways from maternal nurturance to early child development through the parent-child relationship in China. Consistent with the proposed conceptual framework and hypotheses, this study highlights that maternal nurturance not only directly impacts early child development but also exerts indirect effects by fostering greater parent-child closeness and reducing parent-child conflict. These findings provide valuable insights for designing intervention programs and policies aimed at promoting early child development through enhanced maternal nurturance within the parent-child relationship.⁹

The study's results underscore that higher levels of maternal nurturance significantly and directly promote early child development, in alignment with previous cross-sectional study.⁴⁷ A study conducted in Brazil demonstrated that elevated maternal nurturance was associated with enhanced developmental outcomes among 66-month-old children.⁴⁸ In the United States, higher maternal nurturance, characterized by prompt and responsive responses to children's needs, was found to enhance cognitive development in children under three years of age.⁴⁹ Chinese mothers who reported higher levels of maternal nurturance showed associations with reduced childhood overweight and obesity through the mediation of children's eating behaviors and early temperament.³⁸ Maternal nurturance marked by responsiveness to children's needs and responsive engagement, encourages social interactions and sensitive responses, thereby facilitating early childhood language development.⁵⁰ Children with higher levels of maternal nurturance are more likely to be motivated and enthusiastic about exploring their environments, ultimately enhancing their learning abilities and achieving their developmental potential.⁵⁰

This study highlights an indirect pathway through which maternal nurturance influences early child development by fostering greater parent-child closeness. Elevated maternal nurturance contributes to the establishment of parent-child

Table 2 Descriptive Statistics and Correlations of Sociodemographic Characteristics, Parent–Child Relationship, Maternal Nurturance, and Early Child Development

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Maternal nurturance	4.24	0.54	1.00	–	–	–	–	–	–	–	–	–	–	–
2. Parent–child closeness	4.13	0.68	0.36*	1.00	–	–	–	–	–	–	–	–	–	–
3. Parent–child conflict	2.70	0.74	–0.16*	–0.22*	1.00	–	–	–	–	–	–	–	–	–
4. Early childhood development	56.99	3.24	0.34*	0.25*	–0.18*	1.00	–	–	–	–	–	–	–	–
5. Child age	–	–	–0.01	–0.09*	< 0.001	0.07**	1.00	–	–	–	–	–	–	–
6. Child sex	–	–	< 0.001	0.03	0.03	–0.05	0.01	1.00	–	–	–	–	–	–
7. Maternal age	–	–	0.02	–0.03	–0.01	–0.01	–0.02	–0.02	1.00	–	–	–	–	–
8. Area of residence	–	–	0.03	0.06*	–0.04	< 0.001	< 0.001	0.04	0.02	1.00	–	–	–	–
9. Maternal educational level	–	–	< 0.001	–0.03	0.01	0.02	0.04	–0.01	0.08*	0.14*	1.00	–	–	–
10. Maternal employment status	–	–	–0.04	0.04	0.01	–0.11*	0.03	< 0.001	0.06	–0.03	0.06**	1.00	–	–
11. Maternal relationship status	–	–	–0.01	–0.03	0.01	0.02	0.01	–0.03	–0.04	–0.01	0.05	–0.02	1.00	–
12. Family monthly income	–	–	< 0.001	0.01	0.03	0.02	–0.01	0.03	–0.03	0.07**	0.20*	< 0.001	0.02	1.00

Notes: SD, Standardized deviation; * $p < 0.01$, ** $p < 0.05$.

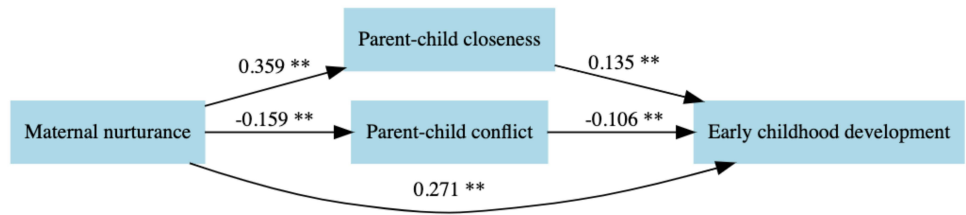


Figure 2 Pathways from Maternal Nurturance to Early Child Development Mediated by the Parent–Child Relationship. ***p* < 0.05.

closeness, which in turn instills in children the confidence to explore and learn, thereby promoting the realization of their developmental potential.³⁶ Maternal nurturance, characterized by responsive caregiving and support for autonomy, was consistently associated with higher levels of parent–child closeness.⁵¹ Children who experience greater parent–child closeness are more likely to engage in frequent social learning processes, providing an environment conducive to promoting early child development.⁵² The benefits of greater parent–child closeness extend to children’s participation in harmonious activities and the acquisition of emerging knowledge, further contributing to their developmental progress.³⁰

This study reveals another pathway in which greater maternal nurturance positively influences early child development by reducing parent–child conflict. A longitudinal study in the US identified a significant association between higher levels of mother–child conflict and increased externalizing problems in children aged two to four years, suggesting a negative impact on early childhood socioemotional development.³¹ Elevated parent–child conflict can evoke negative emotions in children and potentially interfere with the cognitive processes essential for self-control, thereby hindering early childhood cognitive development.⁵³ A study in the UK found that lower levels of parent–child conflict at age three were associated with more positive feelings and better learning at age five, indicating a beneficial influence on early child development.⁵⁴

Interventions for Early Child Development from a Life Course Perspective

A holistic conceptualization of human capital encompasses not only health and wellbeing but also developmental potential, which is essential for fulfilling individual capabilities.² Ensuring that children reach their full developmental potential requires nurturing care interventions.⁵⁵ Nurturing care supported by an evidence-based dynamic framework, plays a crucial role in shaping intervention policies aimed at ensuring that young children attain their maximum developmental potential.⁵⁶ This care is facilitated through a stable environment and behaviors that promote learning, coupled with an emotionally supportive and responsive parent–child relationship.⁵⁷ Programs that promote maternal nurturance supportive and responsive parent–child relationships and reduce abusive parenting practices, particularly in UMICs.⁵⁸ Healthcare workers can play a pivotal role by implementing family-based interventions that strengthen maternal nurturance through the parent–child relationship, thereby contributing to early child development.⁵⁹ Interventions targeting maternal nurturance that focus on enhancing problem-solving skills and promoting a responsive parent–child relationship may positively impact early child development by increasing parent–child closeness.¹⁹ The

Table 3 Standardized Direct, Indirect, and Total Effects from Maternal Nurturance to Early Childhood Development

Effects	Pathways	β	SE	P	BC 95% CI
Direct effects	Maternal nurturance → Parent–child closeness	0.359	0.031	0.001	0.298 to 0.417
	Maternal nurturance → Parent–child conflict	−0.159	0.027	0.001	−0.209 to −0.103
	Parent–child closeness → Early childhood development	0.135	0.034	0.001	0.069 to 0.201
	Parent–child conflict → Early childhood development	−0.106	0.033	0.003	−0.171 to −0.037
	Maternal nurturance → Early childhood development	0.271	0.034	0.001	0.200 to 0.334
Indirect effects	Maternal nurturance → Parent–child closeness → Early childhood development	0.048	0.014	0.001	0.024 to 0.076
	Maternal nurturance → Parent–child conflict → Early childhood development	0.017	0.006	0.002	0.006 to 0.030
Total effects	Maternal nurturance → Early childhood development	0.336	0.033	0.001	0.271 to 0.399

Notes: SE, standard error; BC 95% CI, bias-corrected 95% confidence interval.

elements of nurturing care include a responsive parent–child relationship and learning opportunities that support early child development, encompassing the cultivation of resilience, self-esteem, socioemotional skills, and wellbeing.⁶⁰

In many countries, early child development services receive financial and technical support through multisectoral cooperation; however, these services face challenges such as fragmentation, limited regulatory guidelines, insufficient attention to quality standards, and minimal coordination.⁶¹ Health and nutrition sectors regularly provide coordinated early child development services, emphasizing that promoting early child development and maternal nurturance are equally important from a life course perspective.⁶² However, the limitations of health and nutrition services beyond the early years may result in a two to three years service gap before preschool.⁶³ While substantial investment has been made in early child development, some countries do not adequately provide maternal nurturance support.¹ Integrating early child development with health and nutrition sectors requires the consideration of feasible and scalable strategies, including maternal nurturance training for early child development.⁶⁴ Child care programs in UMICs have shown positive but modest effects on early child development, though the impact of quality on child development varies.⁷

Effective maternal nurturance intervention programs have been implemented in UMICs, enhancing early learning capabilities, improving parents' ability to manage child behaviours, promoting socioemotional development, and reducing instances of abuse and neglect.¹⁵ An enabling environment is crucial in supporting families as primary providers of maternal nurturance; thus, the implementation of family-friendly intervention systems is essential.¹² The adoption of universal, high-quality intervention programs that reach all children, especially those living in extreme poverty, has the potential to enhance equity.²¹ Family-based early child development programs implemented by healthcare workers within communities support maternal nurturance linked to children's cognitive and socioemotional development.⁶⁵ Implementation research is crucial for scaling evidence-based programs, involving stakeholders, identifying core interventions, and focusing on quality assurance and cost-effectiveness.²¹

Longitudinal studies indicate that interventions for children exposed to adverse conditions result in favorable outcomes on adult educational achievement and reductions in social inhibition,⁶⁶ and they contribute to positive development in subsequent generations.⁶⁷ The need for early child development services arises from the substantial global burden faced by UMICs, where many children fail to reach their developmental potential. Investment in early child development is on the rise, driven by progress in health, nutrition, and social protection programs focused on survival, nutritional adequacy, and poverty reduction.¹ However, the translation of policy heuristics based on existing evidence reveals fragmented and uncoordinated implementation of early child development programs.

Strength and Limitations

This is the first longitudinal study to identify parent–child closeness and parent–child conflict as mediators in the pathways from maternal nurturance to early child development in China. The longitudinal design employed allows for a prospective examination of the causal associations between maternal nurturance, the parent–child relationship, and early child development, contributing valuable insights to existing theoretical frameworks. This study expanded the application of the CPRS to measure the parent–child relationship in children under two years of age, a period that poses measurement challenges. Given favorable conditions, this study will continue to track the developmental trajectory of these children until the age of five. The study utilized maternal reports for data collection, a common approach in early child development studies when child self-report is not feasible.⁴⁷ Data collection for this study occurred during the COVID-19 pandemic, which may limit the generalizability of the findings. The study highlighted the absence of a comprehensive intervention policy for early child development within childcare services in China.

Conclusions

The dynamic nature of early child development not only influence the life course but also has the potential to mitigate adverse outcomes. Maternal nurturance emerges as a significant positive predictor of early child development, with the mediating role of the parent–child relationship providing valuable insights for early interventions. Maternal nurturance exhibited significant direct, indirect, and total effects on early child development, higher levels of maternal nurturance indirectly predicted greater early child development through increased parent–child closeness and reduced parent–child conflict. This longitudinal study could help governments, policymakers, and healthcare workers in establishing optimal intervention programs aimed at enhancing maternal nurturance by fostering greater parent–child closeness and reducing parent–child, thereby promoting early child development.

Abbreviations

AGFI, adjusted goodness-of-fit index; CFA, confirmatory factor analyses; CFI, comparative fit index; CI, confidence interval; CPRS, caregiver-reported early development; CGPQ, comprehensive general parenting questionnaire; CREDI, caregiver-reported early development instruments; GFI, goodness of fit index; UMIC, upper- and middle-income country; RMSEA, root-mean-square error of approximation; SEM, structural equation modeling; SRMR, standardised root-mean-square residual; TFI: Tucker-Lewis index.

Data Sharing Statement

The datasets generated and analyzed during the current study are not publicly available due to original consent but are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the Declaration of Helsinki. Human participant approval was obtained from the Affiliated Hospital of Xuzhou Medical University Ethics Committee (ID: XYFY2021-KL070-01)). Informed consent was obtained from all participants before data collection.

Consent for Publication

Informed written consent was obtained from all participants. This manuscript does not contain details, images, or videos of any participants; only aggregate data were used.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interest.

References

1. Pelletier D, Neuman MJ. Advancing the nutrition and early childhood development agenda: indicators and guidance. *Ann N Y Acad Sci*. 2014;1308:232–244.
2. Collaborators GB. Measuring universal health coverage based on an index of effective coverage of health services in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020;396(10258):1250–1284.

3. Engle PL, Black MM, Behrman JR, et al. Strategies to avoid the loss of developmental potential in more than 200 million children in the developing world. *Lancet*. 2007;369(9557):p.229–42. doi:10.1016/S0140-6736(07)60112-3
4. Lake A, Chan M. Putting science into practice for early child development. *Lancet*. 2015;385(9980):1816–1817. doi:10.1016/S0140-6736(14)61680-9
5. Bhutta ZA, Boerma T, Black MM, et al. Optimising child and adolescent health and development in the post-pandemic world. *Lancet*. 2022;399(10337):1759–1761. doi:10.1016/S0140-6736(21)02789-6
6. Sameroff AJ. *The Transactional Model of Development: How Children and Contexts Shape Each Other*. New York: NY: Wiley; 2009.
7. Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B Developmental potential in the first 5 years for children in developing countries. *Lancet*. 2007;369(9555):60–70. doi:10.1016/S0140-6736(07)60032-4
8. Zhang X, Jiang X, Sha M, et al. Life-course pathways from childhood socioeconomic status to type 2 diabetes in mid-late Chinese adulthood. *Sci Rep*. 2021;11(1):13051. doi:10.1038/s41598-021-91768-1
9. Evans GW, Li D, Whipple SS. Cumulative risk and child development. *Psychol Bull*. 2013;139(6):1342–1396. doi:10.1037/a0031808
10. Black MM, Behrman JR, Daelmans B, et al. The principles of nurturing care promote human capital and mitigate adversities from preconception through adolescence. *BMJ Glob Health*. 2021;6(4):e004436.
11. Zhang X, Rosenthal DM, Benton L, Lakhanpaul M Cultural influences on complementary feeding beliefs amongst new Chinese immigrant mothers in England: a mixed methods study. *Int J Environ Res Public Health*. 2020;17(15):5468.
12. Singla DR, Kumbakumba E, Aboud FE. Effects of a parenting intervention to address maternal psychological wellbeing and child development and growth in rural Uganda: a community-based, cluster randomised trial. *Lancet Glob Health*. 2015;3(8):e458–e469. doi:10.1016/S2214-109X(15)00099-6
13. Luby J, Belden A, Botteron K, et al. The effects of poverty on childhood brain development: the mediating effect of caregiving and stressful life events. *JAMA Pediatr*. 2013;167(12):1135–1142. doi:10.1001/jamapediatrics.2013.3139
14. McLaughlin KA, Sheridan MA, Tibu F, et al. Causal effects of the early caregiving environment on development of stress response systems in children. *Proc Natl Acad Sci U S A*. 2015;112(18):5637–5642. doi:10.1073/pnas.1423363112
15. Zhang X, et al. Sequential mediation of early temperament and eating behaviors in the pathways from feeding practices to childhood overweight and obesity. *Front Public Health*. 2023;11:1122645
16. Trude ACB, Richter LM, Behrman JR, et al. Effects of responsive caregiving and learning opportunities during pre-school ages on the association of early adversities and adolescent human capital: an analysis of birth cohorts in two middle-income countries. *Lancet Child Adolesc Health*. 2021;5(1):37–46. doi:10.1016/S2352-4642(20)30309-6
17. Ross DA, Hinton R, Melles-Brewer M, et al. Adolescent Well-Being: a Definition and Conceptual Framework. *J Adolesc Health*. 2020;67(4):472–476. doi:10.1016/j.jadohealth.2020.06.042
18. Zhang X, Benton L. The association of acculturation and complementary infant and young child feeding practices among new Chinese immigrant mothers in England: a mixed methods study. *Int J Environ Res Public Health*. 2019;16(18):3282.
19. World Health Organization, United Nations Children's Fund, and World Bank Group. *Nurturing Care for Early Childhood Development: A Framework for Helping Children Survive and Thrive to Transform Health and Human Potential*. Geneva: World Health Organization; 2018.
20. van der Horst K, Sleddens EFC, Aguilera AI. Parenting styles, feeding styles and food-related parenting practices in relation to toddlers' eating styles: a cluster-analytic approach. *PLoS One*. 2017;12(5):e0178149. doi:10.1371/journal.pone.0178149
21. Richter LM, Daelmans B, Lombardi J, et al. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet*. 2017;389(10064):103–118. doi:10.1016/S0140-6736(16)31698-1
22. Gaidhane A, Telrandhe S, Holding P, et al. Effectiveness of family-centered program for enhancing competencies of responsive parenting among caregivers for early childhood development in rural India. *Acta Psychol*. 2022;229:103669. doi:10.1016/j.actpsy.2022.103669
23. Kohl PL, Gyimah EA, Diaz J, et al. Grandi byen-supporting child growth and development through integrated, responsive parenting, nutrition and hygiene: study protocol for a randomized controlled trial. *BMC Pediatr*. 2022;22(1):54. doi:10.1186/s12887-021-03089-x
24. Neppl TK, Wedmore H, Senia JM, et al. Couple interaction and child social competence: the role of parenting and attachment. *Soc Dev*. 2019;28(2):347–363. doi:10.1111/sode.12339
25. Shaheen Z, Akhtar T, Khan MWS. Family functioning and behavioral problems among left-behind adolescent: self-esteem as a mediator and mother nurturance as a moderator. *Child Youth Services Rev*. 2023;155:107179. doi:10.1016/j.childyouth.2023.107179
26. Sameroff AJ, Fiese BH. *Transactional Regulation: The Developmental Ecology of Early Intervention in Handbook of Early Childhood Intervention*. Shonkoff JP, Meisels SJ, Editors.. Cambridge, UK: Cambridge University Press; 2000:135–159.
27. Liu QH, Ompok CS. The influence of parenting styles on child-parent relationship among Chinese and Bumiputera in sabah. *Malaysian J Social Scie Hum*. 2022;7(9):e001762.
28. Mihalec-Adkins B. Parent-Child Relationships. In: Zeigler-Hill V, Shackelford TK, editors. *Encyclopedia of Personality and Individual Differences*. Cham: Springer; 2020:3433–3435—.
29. Yan J, Schoppe-Sullivan SJ, Feng X. Trajectories of mother-child and father-child relationships across middle childhood and associations with depressive symptoms. *Dev Psychopathol*. 2019;31(4):1381–1393. doi:10.1017/S0954579418000809
30. Liu H, Qiu Y, Luo L. Exploring family educational involvement and social skills in Chinese preschoolers: the moderating role of parent-child relationship. *Front Psychol*. 2022;13:911421. doi:10.3389/fpsyg.2022.911421
31. Weaver CM, Shaw DS, Crossan JL, et al. Parent-child conflict and early childhood adjustment in two-parent low-income families: parallel developmental processes. *Child Psychiatry Hum Dev*. 2015;46(1):94–107. doi:10.1007/s10578-014-0455-5
32. Shaheen Z, Akhtar T, Khan MWS. Migrant fathers and mental health concern: perceived paternal attachment, self-esteem, maternal nurturance, and mental health problems among left-behind adolescents. *Social Work in Mental Health*. 2024;22(2):283–311. doi:10.1080/15332985.2023.2287398
33. Katsantonis I, McLellan R. The role of parent-child interactions in the association between mental health and prosocial behavior: evidence from early childhood to late adolescence. *Int J Behav Dev*. 2024;48(1):59–70. doi:10.1177/01650254231202444
34. Katsantonis IG, Symonds JE, McLellan R. Longitudinal relations between child emotional difficulties and parent-child closeness: a stability and malleability analysis using the STARTS model. *Child Adolesc Psychiatr Ment Health*. 2024;18(1):85. doi:10.1186/s13034-024-00777-1
35. Levickis P, Eadie P, Mensah F, McKean C, Bavin EL, Reilly S Associations between responsive parental behaviours in infancy and toddlerhood, and language outcomes at age 7 years in a population-based sample. *Int J Lang Commun Disord*. 2023;58:1098–1112—.

36. Birmingham RS, Bub KL, Vaughn BE. Parenting in infancy and self-regulation in preschool: an investigation of the role of attachment history. *Attach Hum Dev*. 2017;19(2):107–129. doi:10.1080/14616734.2016.1259335
37. Havighurst SS, Choy R, Ulker A et al. A preliminary evaluation of the cultural appropriateness of the tuning in to kids parenting program in Germany, Turkey. *Iran and China Int J Environ Res Public Health*. 2022;19(16):10321.
38. Zhang X, Dai S, Jiang X, et al. The pathways from disadvantaged socioeconomic status in childhood to edentulism in mid-to-late adulthood over the life-course. *Int J Equity Health*. 2023;22(1):150. doi:10.1186/s12939-023-01865-y
39. Jeong J, Franchett EE, Ramos de Oliveira CV, et al. Parenting interventions to promote early child development in the first three years of life: a global systematic review and meta-analysis. *PLoS Med*. 2021;18(5):e1003602. doi:10.1371/journal.pmed.1003602
40. Kline RB. *Principles and Practice of Structural Equation Modeling*. 4th ed. New York (NY): The Guilford Press; 2016.
41. Driscoll K, Pianta RC. Mothers' and fathers' perceptions of conflict and closeness in parent-child relationships during early childhood. *J Early Child Infant Psych*. 2011;7:1–24.
42. Zhang X, Chen H. Reciprocal influences between parents' perceptions of mother-child and father-child relationships: a short-term longitudinal study in Chinese preschoolers. *J Genet Psychol*. 2010;171(1):22–34. doi:10.1080/00221320903300387
43. McCoy DC, Seiden J, Waldman M, et al. Measuring early childhood development: considerations and evidence regarding the caregiver reported early development instruments. *Ann N Y Acad Sci*. 2021;1492(1):3–10. doi:10.1111/nyas.14598
44. Li Y, Tang L, Bai Y, et al. Reliability and validity of the caregiver reported early development instruments (CREDI) in impoverished regions of China. *BMC Pediatr*. 2020;20(1):475. doi:10.1186/s12887-020-02367-4
45. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods*. 2008;40(3):879–891. doi:10.3758/BRM.40.3.879
46. VanderWeele TJ. Mediation analysis: a practitioner's guide. *Annu Rev Public Health*. 2016;37:17–32. doi:10.1146/annurev-publhealth-032315-021402
47. Russell AL, Hentschel E, Fulcher I, et al. Caregiver parenting practices, dietary diversity knowledge, and association with early childhood development outcomes among children aged 18–29 months in Zanzibar, Tanzania: a cross-sectional survey. *BMC Public Health*. 2022;22(1):762. doi:10.1186/s12889-022-13009-y
48. Rocha HAL, Correia LL, Leite ÁJet al. Positive parenting behaviors and child development in ceara, brazil: a population-based study. *Children*. 2022;9(8).
49. Ward KP, Lee SJ. Mothers' and fathers' parenting stress, responsiveness, and child wellbeing among low-income families. *Child Youth Serv Rev*. 2020;116:105218. doi:10.1016/j.childyouth.2020.105218
50. Madigan S, Prime H, Graham SA, et al. Parenting behavior and child language: a meta-analysis. *Pediatrics*. 2019;144(4):e20183556. doi:10.1542/peds.2018-3556
51. O'Neill MC, Badovinac S, Pillai Riddell R, et al. The longitudinal and concurrent relationship between caregiver sensitivity and preschool attachment: a systematic review and meta-analysis. *PLoS One*. 2021;16(1):e0245061. doi:10.1371/journal.pone.0245061
52. Mo X, Wang Z, Shao J, Gros-Louis JJ. Parent-child attachment and good behavior habits among Chinese children: chain mediation effect of parental involvement and psychological Suzhi. *PLoS One*. 2021;16(1):e0241586. doi:10.1371/journal.pone.0241586
53. Pessoa L. How do emotion and motivation direct executive control? *Trends Cognit Sci*. 2009;13(4):160–166. doi:10.1016/j.tics.2009.01.006
54. Ng-Knight T, Schoon I. Self-control in early childhood: individual differences in sensitivity to early parenting. *J Pers*. 2021;89(3):500–513. doi:10.1111/jopy.12595
55. Britto PR, Lye SJ, Proulx K, et al. Nurturing care: promoting early childhood development. *Lancet*. 2017;389(10064):91–102. doi:10.1016/S0140-6736(16)31390-3
56. Black MM, Walker SP, Fernald LCH, et al. Early childhood development coming of age: science through the life course. *Lancet*. 2017;389(10064):77–90. doi:10.1016/S0140-6736(16)31389-7
57. Yousafzai AK, Aboud FE, Nores M, et al. Reporting guidelines for implementation research on nurturing care interventions designed to promote early childhood development. *Ann N Y Acad Sci*. 2018;1419(1):26–37. doi:10.1111/nyas.13648
58. Knerr W, Gardner F, Cluver L. Improving positive parenting skills and reducing harsh and abusive parenting in low- and middle-income countries: a systematic review. *Prev Sci*. 2013;14(4):352–363. doi:10.1007/s11121-012-0314-1
59. Berlinski S, Schady N. The early years: child well-being and the role of public policy. In: *MacMillan*. New York: Springer Nature; 2015.
60. Vaivada T, Lassi ZS, Irfan O, et al. What can work and how? An overview of evidence-based interventions and delivery strategies to support health and human development from before conception to 20 years. *Lancet*. 2022;399(10337):1810–1829. doi:10.1016/S0140-6736(21)02725-2
61. Zhang X, Chen S. Association of childhood socioeconomic status with edentulism among Chinese in mid-late adulthood. *BMC Oral Health*. 2019;19(1):292. doi:10.1186/s12903-019-0968-1
62. Black MM, Perez-Escamilla R, Rao SF. Integrating nutrition and child development interventions: scientific basis, evidence of impact, and implementation considerations. *Adv Nutr*. 2015;6(6):852–859. doi:10.3945/an.115.010348
63. Yousafzai AK, Rasheed MA, Rizvi A, et al. Effect of integrated responsive stimulation and nutrition interventions in the lady health worker programme in Pakistan on child development, growth, and health outcomes: a cluster-randomised factorial effectiveness trial. *Lancet*. 2014;384(9950):1282–1293. doi:10.1016/S0140-6736(14)60455-4
64. Phuka J, Maleta K, Thomas M, et al. A job analysis of community health workers in the context of integrated nutrition and early child development. *Ann N Y Acad Sci*. 2014;1308:183–191. doi:10.1111/nyas.12338
65. Walker SP, Wachs TD, Grantham-McGregor S, et al. Inequality in early childhood: risk and protective factors for early child development. *Lancet*. 2011;378(9799):1325–1338. doi:10.1016/S0140-6736(11)60555-2
66. Walker SP, Chang SM, Vera-Hernández M, et al. Early childhood stimulation benefits adult competence and reduces violent behavior. *Pediatrics*. 2011;127(5):849–857. doi:10.1542/peds.2010-2231
67. Behrman JR, Calderon MC, Preston SH, et al. Nutritional supplementation in girls influences the growth of their children: prospective study in Guatemala. *Am J Clin Nutr*. 2009;90(5):1372–1379. doi:10.3945/ajcn.2009.27524

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