

POPULATION STUDY ARTICLE



Maternal cognitive and affective empathy related to preschoolers' emotional-behavioral problems: moderation of maternal depression

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BACKGROUND: Low maternal cognitive empathy and higher affective empathy have been linked to increased emotional-behavioral problems (EBPs) in young children, but it remains unclear whether the associations are distinct according to maternal depression. This study aims to explore the moderating role of maternal depression in the association between maternal empathy and EBPs in preschoolers.

METHODS: Cross-sectional and representative data were from 19,965 Chinese preschoolers. Maternal cognitive and affective empathy and depression were evaluated with Questionnaire of Cognitive and Affective Empathy and World Health Organization Five Well-Being Index, respectively. The Strengths and Difficulties Questionnaire was used to assess child EBPs.

RESULTS: Lower maternal cognitive empathy was associated with increased child EBPs (aOR: 0.97, 95% CI: 0.96–0.97) with moderation of maternal depression ($p = 0.002$), and was slightly stronger in mothers at low risk for depression (aOR: 0.96, 95% CI: 0.95–0.97). Higher maternal affective empathy was associated with increased child EBPs (aOR: 1.03, 95% CI: 1.02–1.04), without significant moderation ($p = 0.79$).

CONCLUSIONS: Lower maternal cognitive empathy and higher affective empathy were associated with more EBPs in preschoolers. Maternal depression moderated only the cognitive empathy-EBPs association. Tailored strategies targeting maternal empathy according to various depression levels should be considered in clinical practices.

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IMPACT:

- We found lower maternal cognitive empathy and higher maternal affective empathy were associated with more emotional-behavioral problems (EBPs) in a large-scale and representative sample of preschoolers in Shanghai.
- We demonstrated the moderating role of maternal depression in the association between maternal cognitive empathy and EBPs in preschoolers, with the association being slightly stronger in mothers at low risk for depression than in mothers with depressive symptoms.
- The study highlights that, aside from maternal depression, promoting interventions on inappropriate maternal empathy may confer significant benefits on the psychological well-being of preschool children.

INTRODUCTION

Children's emotional-behavioral problems (EBPs) merit keen attention due to their high prevalence and wide range of detrimental outcomes that span childhood to later life.^{1–3} These problems often emerge as early as the start of preschool, a critical transition period from a family-predominant environment to a richer social world. The first critical step to prevent and intervene

in EBPs in preschoolers is to determine the most proximal and amendable factors. Bronfenbrenner's socioecological framework⁴ posits that children's socio-economic status, family environment, and parental factors form the microsystem with the most significant impact on their emotional-behavioral development.^{5–7} According to prior empirical studies informed by Bronfenbrenner's framework,^{8,9} maternal depression has been identified as a priority

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predisposing children to EBPs. However, it remains unclear how maternal depression could moderate the association of other maternal psychological traits, cognitive and affective empathy in particular, with preschoolers' EBPs.^{10,11} Addressing this research gap will inform tailored and integrated strategies to improve mental health of children with mothers at either low or high risk for depression.

Maternal empathy is recognized as an important psychological trait associated with child EBPs, with a notable difference between cognitive and affective components.^{12,13} Cognitive empathy reflects maternal ability to understand social situations, emotions and feelings of their children, and thus facilitates attuned parenting. Affective empathy refers to the ability to be sensitive to and vicariously experience children's emotion, which can result in maternal distress when the mother becomes overwhelmed by a child's distress.^{14,15} Maternal cognitive and affective empathy may be differently associated with child's EBPs, according to maternal depression status. For example, in children having mothers with a clinical diagnosis of depression,¹⁶ a previous study showed that higher maternal affective empathy but not cognitive empathy was associated with increased child's EBPs. However, in community children whose mothers were at low risk for depression, lower maternal cognitive empathy¹⁷ and higher affective empathy have been linked to more child EBPs.¹⁸ Thus, higher maternal affective empathy served as a consistent risky factor for child EBPs. Furthermore, both cross-sectional and longitudinal evidence suggested the moderating roles of maternal depression in the association of maternal parenting with child emotional expression, stress reactivity, and social competence.^{19–21} However, it is unclear whether the moderating role of maternal depression holds for maternal empathy and child EBPs.

Therefore, using cross-sectional data from a large-scale and representative sample of preschoolers in Shanghai, China, this study aimed to explore the moderating role of maternal depression in the association of maternal cognitive and affective empathy with child EBPs. Based on aforementioned evidence,^{16–18} we hypothesized that lower cognitive empathy and higher affective empathy of mothers would both be associated with increased child EBPs, with the associations being slightly stronger in mothers at low risk for depression than those in mothers with depressive symptoms.

METHOD

Study design and participants

This study used cross-sectional data collected in June 2020, as a part of the Shanghai Children's Health, Education and Lifestyle Evaluation-Preschool (SCHEDULE-P) study.²² Briefly, a representative sample of children newly enrolled in Shanghai kindergartens in September 2019 was selected using a stratified random sampling design. All 16 districts in Shanghai were set as primary sampling units, and we defined nine secondary sampling units (SSU) based on the kindergarten's ownership (public or private) and quality level (from highest to lowest is demonstration, first, second, and third level). In each SSU, one or two kindergartens were randomly selected, and all the newly enrolled children were invited to this survey. Finally, 25,354 children in 213 kindergartens were sampled. All parents gave informed consent on participating in this survey. We used cross-sectional data from the follow-up survey in June 2020, including 23,958 children (95.4% of the baseline participants; Fig. 1). We further excluded 713 samples deemed as careless responses, since they responded with the same answer towards all items of the questionnaire on maternal empathy.²³ In the end, 19,965 (83.3% of participants in the follow-up visit; Fig. 1) children and their caregivers were included for the final analysis. The included sample ($N = 19,965$), compared with those who were excluded ($n = 3993$), was less likely to have low maternal education, low household income per year, maternal depressive symptoms, and divorced status (Table S1). The study was approved by the Institutional Review Board of the Shanghai Children's Medical Center, School of Medicine, Shanghai Jiao Tong University (SCMCIRB-K2016022-01).

Measures

Maternal cognitive and affective empathy. Maternal empathy was evaluated with the Questionnaire of Cognitive and Affective Empathy (QCAE).¹² The QCAE is a measurement for trait empathy, consisting of 31 items. Participants are required to assess their agreement with a series of descriptions about feelings without specific time reference on a 4-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). This instrument defines cognitive empathy as the ability to construct a working model of the emotional state of others and is indexed by summing scores on the Perspective Taking (11 items) and Online Simulation (9 items) subscales (scores ranging from 20 to 80). Affective empathy is defined as the ability to be sensitive to and vicariously experience the feelings of others and indexed by summing scores on the Emotion Contagion (4 items), Proximal Responsivity (3 items) and Peripheral Responsivity (4 items) subscales (range from 11 to 44). A higher score indicates higher empathy. We used raw scores of cognitive empathy and affective empathy for main analyses. The QCAE possesses good internal consistency, test-retest reliability, convergent validity, and acceptable criterion validity.²⁴ In the current sample, the Cronbach's α is 0.92 for cognitive empathy, and 0.75 for affective empathy.

Emotional-behavioral problems. The 25-item Strengths and Difficulties Questionnaire (SDQ) was developed to screen EBPs among children and adolescents during the past 6 months.²⁵ Parents rate each item according to the children's behavior in the last 6 months on a 3-point Likert scale (not true = 0, somewhat true = 1, and certainly true = 2). The total difficulties score can be computed by adding up the 20 items for full subscales of emotional problems, conduct problems, hyperactivity, and peer problems (0–40), with higher scores indicating more EBPs. The total difficulties score was categorized into normal (0–14), borderline (15–16), and clinical (≥ 17) groups. In this study, the children in clinical group were identified as with EBPs. We also used the combination of borderline and clinical groups as a broader definition of EBPs for sensitivity analyses. The Chinese version of SDQ had good convergent and discriminant validity, with validated cutoff values for children aged 3–16 years in China.^{26,27} For the current sample, the Cronbach's α is 0.76.

Maternal depression. The widely used World Health Organization Five Well-Being Index (WHO-5) is a short, generic rating scale that measures subjective well-being over the past 2 weeks and has adequate validity as a screening tool for depression in primary care.^{28,29} Five items are rated on a 6-point Likert scale that ranges from "at no time" (0) to "all the time" (5), resulting in a maximum score of 25. A total score < 13 indicates poor well-being and warrants clinical evaluation for potential depression,³⁰ which was used to distinguish mothers with depressive symptoms from those at low risk for depression, and explore the moderating role of maternal depression in the association of maternal cognitive and affective empathy with child EBPs in our study. The raw score of WHO-5 was also treated as a confounder in regression models. For the current sample, the Cronbach's α is 0.82.

Confounding variables. Potential confounders for the association between maternal empathy and EBPs were identified using a directed acyclic graph (DAG) using DAGitty online software.^{31,32} We included children's age, sex, maternal socioeconomic statuses (maternal education level and household annual income), parents' marital status and child empathy to build DAG.^{5–7,33,34} The Bivariate correlation matrix was also provided in supplemental material (Table S2). According to the developed DAG (Fig. S1), child empathy was considered as mediator between maternal empathy and child EBPs.^{35,36} Thus, we excluded child empathy from the minimally sufficient adjustment set to measure the total effect, instead of direct effect between our key variables in the multivariate regression models.³¹ Among those variables, maternal education was divided into junior high school and below, high school and junior college, undergraduate, master's and above, and unknown and refused, while household annual income was categorized as $< 100,000$ CNY, 100,000–300,000 CNY, $> 300,000$ CNY, and unknown and refused. Parents' marital status was recognized as divorced or not.

Statistical analysis. Descriptive statistics were employed to characterize the sample with respect to percentages and means with standard deviations across child EBPs. Differences in categorical variables were assessed using the Chi-square test, and continuous variables were analyzed with the t-test. We did a 3-step statistical analysis to explore the association between maternal cognitive/affective empathy and child's EBPs. Firstly, logistic regression was used to examine the association between maternal cognitive/affective empathy and child EBPs,

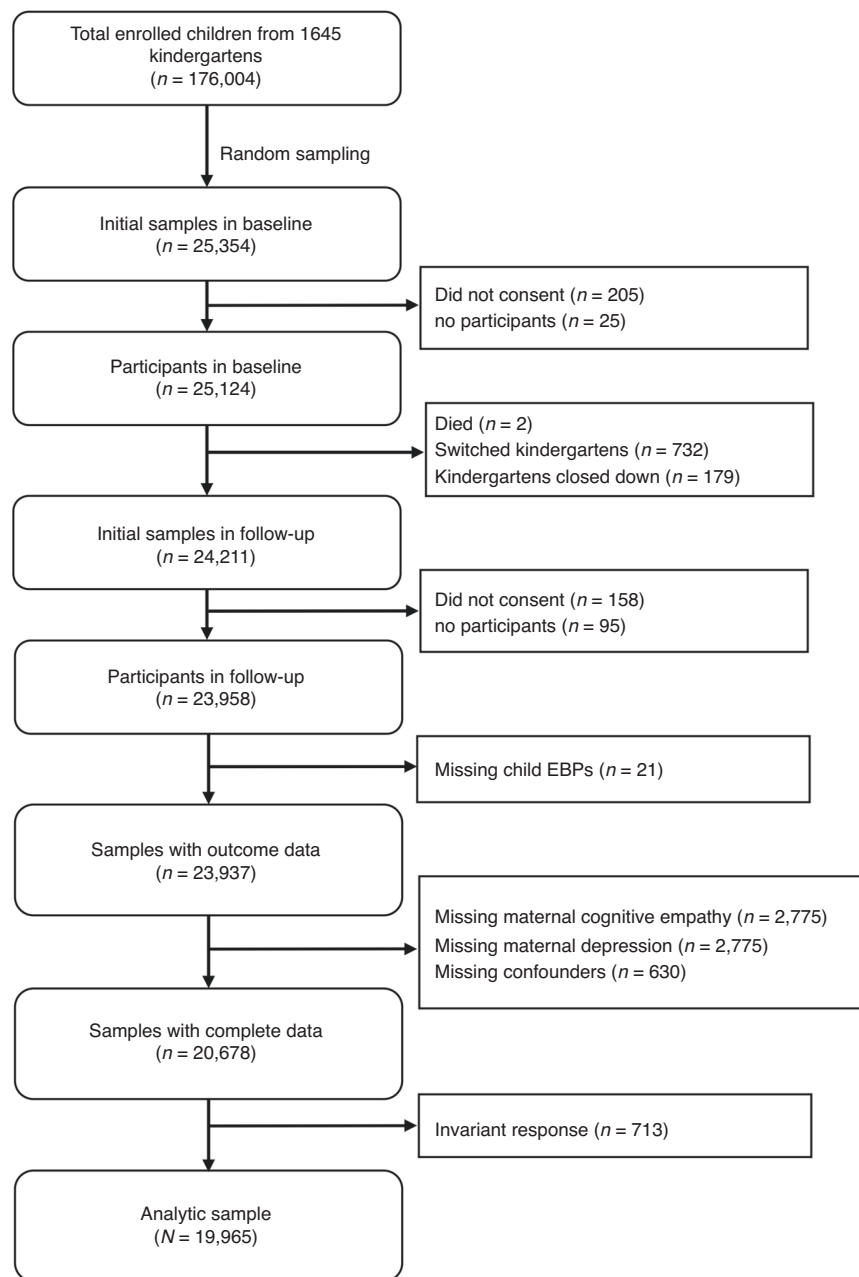


Fig. 1 Participant profile. Flow chart of participants from total enrolled children to analytic sample.

respectively. Adjusted models were generated with children's age, sex, maternal education level, household annual income, parents' marital status, and WHO-5 raw score. Secondly, to examine the moderating role of maternal empathy in the association of maternal cognitive/affective empathy with child's EBPs, we included an interaction term (maternal cognitive/affective empathy \times dichotomized maternal depression) in the logistic models. ΔR^2 after adding the interaction term was used to assess the effect size of moderation.³⁷ Thirdly, the unadjusted and adjusted regression models were replicated within maternal depression strata, dichotomized by the WHO-5. A 2-tailed Bonferroni-corrected threshold of 0.017 (0.05/3) was used to indicate regression significance. Several sensitivity analyses were used to evaluate the robustness of our findings. To minimize the effect of missing data, we performed multiple imputations on maternal cognitive and affective empathy, depression, and confounders for the sample who had completed the SDQ ($n = 23,937$). To address the representability of our sample, we weighted the sample by selection probability and sex ratio. To rule out potential bias from varied data sources, we adjusted the logistic model, including the role of respondent (mother, father, grandparents, or others). To examine the association

between maternal empathy and more general EBPs, we used a broader definition (a borderline group also identified as children with EBPs) and raw scores of SDQ total difficulties as outcomes (Details in Supplementary Materials). All analyses were conducted using Stata v16 (StataCorp LP, College Station, Texas) from September 2021 to December 2022. The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

RESULTS

Study sample

The results were drawn from the complete-case dataset ($N = 19,965$; Fig. 1). The mean age of the children was 4.3 ± 0.3 years. Of the children, 51.3% were boys, and 34.1% were from a high-income family (household annual income $>300,000$ CNY). In terms of maternal education, 64.0% had at least an undergraduate degree. The prevalence of EBPs in preschoolers was 10.2% ($n = 2,037$), remaining 76.8% normal and 13.0% borderline in

Table 1. Demographic characteristics of the participants ($N = 19,965$).

Characteristics	Total $N = 19,965$	Children without EBPs $n = 17,928$	Children with EBPs ^a $n = 2037$	Range	Skewness/ Kurtosis	t/χ^2
Age, y, mean (SD)	4.3 (0.3)	4.3 (0.3)	4.3 (0.3)	3.8/4.8	-0.11/5.00	1.47
Sex, n (%)						
Boys	10,232 (51.3)	9060 (50.5)	1172 (57.5)			35.88**
Maternal education, n (%)						
Junior high school and below	1014 (5.1)	838 (4.7)	176 (8.6)			171.61**
High school and junior college	6033 (30.2)	5266 (29.4)	767 (37.7)			
Undergraduate	10,008 (50.1)	9090 (50.7)	918 (45.1)			
Master's and above	2778 (13.9)	2619 (14.6)	159 (7.8)			
Unknown and refused	132 (0.7)	115 (0.6)	17 (0.8)			
Household income per year, n (%)						
<100,000 CNY	1682 (8.4)	1383 (7.7)	299 (14.7)			181.65**
100,000–300,000 CNY	8297 (41.6)	7378 (41.2)	919 (45.1)			
>300,000 CNY	6810 (34.1)	6323 (35.3)	487 (23.9)			
Unknown and refused	3176 (15.9)	2844 (15.9)	332 (16.3)			
Marital status, n (%)						
Divorced	631 (3.2)	523 (3.0)	139 (4.5)			23.95**
WHO-5 maternal depression, mean (SD)	16.7 (4.2)	16.9 (4.1)	15.3 (4.6)	0/25	-0.67/3.58	16.17**
Mothers at low risk for depression ^b , n (%)	16,966 (85.0)	15,458 (86.2)	1508 (74.0)			213.01**
Maternal cognitive empathy, mean (SD)	61.2 (8.2)	61.5 (8.1)	58.4 (8.7)	20/80	-0.52/3.85	15.99**
Maternal affective empathy, mean (SD)	29.2 (4.6)	29.2 (4.6)	29.9 (4.5)	11/44	-0.12/3.56	-6.36**

EBPs emotional and behavioral problems, WHO-5 World Health Organization Five Well-Being Index.

^aChild with EBPs was defined as having the Strengths and Difficulties Questionnaire (SDQ) total difficulties score ≥ 17 .

^bMothers at low risk for depression were defined as having the WHO-5 Well-Being score ≥ 13 .

** $P < 0.01$.

SDQ categories. Children with EBPs had higher level of maternal cognitive empathy, but lower level of maternal affective empathy. More children without EBPs had mothers at low risk for depression (86.2% vs 74.0%). Maternal cognitive empathy ranged from 20 to 80, and 11 to 44 for affective empathy. Both maternal empathy variables were slightly left-skewed with higher peaks and heavier tails (Skewness/Kurtosis: cognitive empathy -0.52/3.85; affective empathy -0.12/3.56) (Table 1).

Association between maternal cognitive and affective empathy and child EBPs

As shown in Table 2 and Fig. 2, adjusted by children's age, sex, maternal education, household annual income, parents' marital status and WHO-5 raw score, higher maternal cognitive empathy was associated with lower risk for child EBPs (aOR: 0.97, 95% CI: 0.96–0.97). The association was significantly moderated by maternal depression ($p = 0.002$), and was slightly stronger in mothers at low risk for depression (aOR: 0.96, 95% CI: 0.95–0.97) than that in mothers with depressive symptoms (aOR: 0.98, 95% CI: 0.97–0.99). The effect size of moderation was relatively small ($\Delta R^2 = 0.07$). Higher maternal affective empathy was associated with higher risk for child EBPs (aOR: 1.03, 95% CI: 1.02–1.04), without significant moderation effect of maternal depression ($p = 0.79$).

Sensitivity analysis

The results for the association between maternal cognitive empathy and child EBPs, and moderation of maternal depression

were substantively the same after multiple imputation or inclusion of the respondent in the logistic model. When weighted by sampling probability and sex ratio, the association was not significant in mothers with depressive symptoms. Using a broader definition of child EBPs or considering the raw score of SDQ total difficulties as an outcome, the association between maternal cognitive empathy and child EBPs remained significant, without noting significant moderation of maternal depression (Fig. S2). For maternal affective empathy, all results were robust notwithstanding the weighting of the sample by sampling probability and sex ratio, resulting in a non-significant association in mothers with depressive symptoms (Fig. S3).

DISCUSSION

Lower maternal cognitive empathy was associated with increased risk for EBPs in preschoolers. More importantly, we found that the association was moderated by maternal depression, and was slightly stronger in mothers at low risk for depression than in mothers with depressive symptoms. We also found that higher maternal affective empathy was associated with more EBPs in preschoolers, but not moderated by maternal depression. Furthermore, a series of sensitivity analyses endorsed the robustness of our findings.

Similar to previous research conducted with mothers at high risk for mental health problems,^{16,38} our study showed a reduced association between maternal cognitive empathy and EBPs in preschoolers in mothers with depressive symptoms, compared to

Table 2. Logistic regression between maternal empathy score and child EBPs.

	<i>n</i>	Total difficulties			
		Unadjusted		Adjusted ^a	
Maternal cognitive empathy		OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Whole population	19,965	0.96 (0.95–0.96)	<0.001	0.97 (0.96–0.97)	<0.001
Mothers at low risk for depression ^b	16,966	0.95 (0.95–0.96)	<0.001	0.96 (0.95–0.97)	<0.001
Mothers with depressive symptoms ^c	2999	0.98 (0.97–0.99)	<0.001	0.98 (0.97–0.99)	0.005
<i>p</i> value for interaction			0.001		0.002
Maternal affective empathy					
Whole population	19,965	1.03 (1.02–1.04)	<0.001	1.03 (1.02–1.04)	<0.001
Mothers at low risk for depression ^b	16,966	1.03 (1.02–1.04)	<0.001	1.03 (1.01–1.04)	<0.001
Mothers with depressive symptoms ^c	2999	1.03 (1.00–1.05)	0.02	1.03 (1.01–1.05)	0.01
<i>p</i> value for interaction			0.89		0.79

Significant at a Bonferroni-corrected threshold ($p < 0.017$).

EBPs emotional and behavioral problems.

^aAdjusted model includes children's age, sex, maternal education, household income, parents' marital status, and raw score of World Health Organization Five Well-Being Index (WHO-5).

^bMothers at low risk for depression were defined as having a WHO-5 Well-Being score ≥ 13 .

^cMothers with depressive symptoms were defined as having a WHO-5 Well-Being score < 13 .

those at low risk for depression. While the underlying mechanism warrants further investigation, it may reside in a period of low mood and loss of interest among mothers with depressive symptoms. This state of “emotional disinvolvement” can cause maternal cognitive empathy, the ability to “see things from the child's point of view”, to become dysfunctional, thereby weakening the effect of maternal cognitive empathy in mothers with depressive symptoms.³⁹ Even when depressed mothers have the appropriate ability to understand the reasons behind their children's emotions, they still have difficulties providing appropriate parenting behaviors that align with their understanding.⁴⁰

In mothers at low risk for depression, our study represents one of the first to reveal that lower maternal cognitive empathy was associated with higher risk for EBPs in preschoolers. Children of mothers with the lowest quantile of cognitive empathy had nearly two-fold increase in EBPs compared to those with the highest quantile (Fig. S4 and Table S3). Those mothers and children are less likely to be identified as potentially having difficulties since these mothers seem to be in positive well-being. Our results highlight that particular attention should be paid to preschoolers whose mothers have lower cognitive empathy to reduce their EBPs, even when their mothers are at low risk for depression. One of the potential mechanisms between maternal cognitive empathy and child EBPs is parenting behavior. Mothers with adequate cognitive empathy are able to recognize and respond to their children's needs in a more responsive and supportive way (positive parenting).^{41–43} In contrast, mothers who lack cognitive empathy may struggle to understand their children's perspectives when the children are not complying with their requests, which may result in hostility and overcontrol parenting behavior (negative parenting), even if they are at low risk for depression.^{35,44} Those different parenting patterns may impact early childhood social-emotional development, including parent-child attachment.⁴⁵ An alternative explanation for these results is the limited use of emotion words by mothers when labeling children's action or affect. According to the constructionist view of emotional development, mothers play a crucial role in children's emotional development by continuous descriptions of their emotions.⁴⁶ The use of emotion words helps children to learn context-dependent emotional conception for perceiving and expressing emotions, thereby reducing their risk for EBPs.⁴⁷ While mothers with low cognitive empathy may struggle to fulfill this role.^{48,49}

Furthermore, maternal cognitive empathy plays a role in not only mother-child interactions, but also family functioning. The existing literature has shown that a couple's empathic ability and a partner's perceived empathic concern are closely related to family functioning.^{50,51} Therefore, mothers' low level of cognitive empathy also may affect children's EBPs via problematic family dynamics (e.g., more family conflicts and fewer effective coping strategies). Genetic effects also may serve as a mechanism. Twin studies have found that approximately one-third of cognitive empathy variance is heritable.^{52,53} It has been well recognized that maternal psychological trait, cognitive empathy in particular is a primary and proximal contributor to child mental health according to the socioecological framework.⁴ However, theoretical and empirical evidence also supports the reciprocal relationship between maternal psychological trait and child EBPs.^{54,55} We are more interested in how maternal cognitive empathy can influence EBPs of preschoolers. Maternal cognitive empathy is considered as a more stable trait than the parenting behaviors and is less susceptible to the influence from the child's behaviors, suggesting a more enduring and potentially influential role in the developmental process. Therefore, low levels of maternal cognitive empathy could be a potential target for reducing EBPs in young children.

Our results also indicated that higher maternal affective empathy was associated with more child EBPs, whether in mothers at low risk for depression or mothers with depressive symptoms. Children of mothers with the highest quantile of affective empathy in our sample had a 19 to 38 percent higher risk for EBPs compared to those with the lowest quantile (Fig. S4 and Table S4). This finding was in accordance with previous research in community sample and clinical high-risk sample.^{16,18} The affective empathy measured by the QCAE highlights negative emotion responses to unpleasant and neutral stimuli (e.g., I get very upset when I see someone cry; I am inclined to get nervous when others around me seem to be nervous).⁵⁶ Therefore, it is possible that maternal affective empathy is positively associated with their negative emotions elicited by children's distress, which may lead to less support from mothers and more EBPs in children.⁵⁷ Furthermore, these negative parenting behaviors could impede the acquisition of valuable emotional regulation strategies, resulting in more child EBPs.⁵⁸ Taking the above findings together, the current study indicates that the moderating role of maternal depression is distinct in the associations of maternal cognitive and

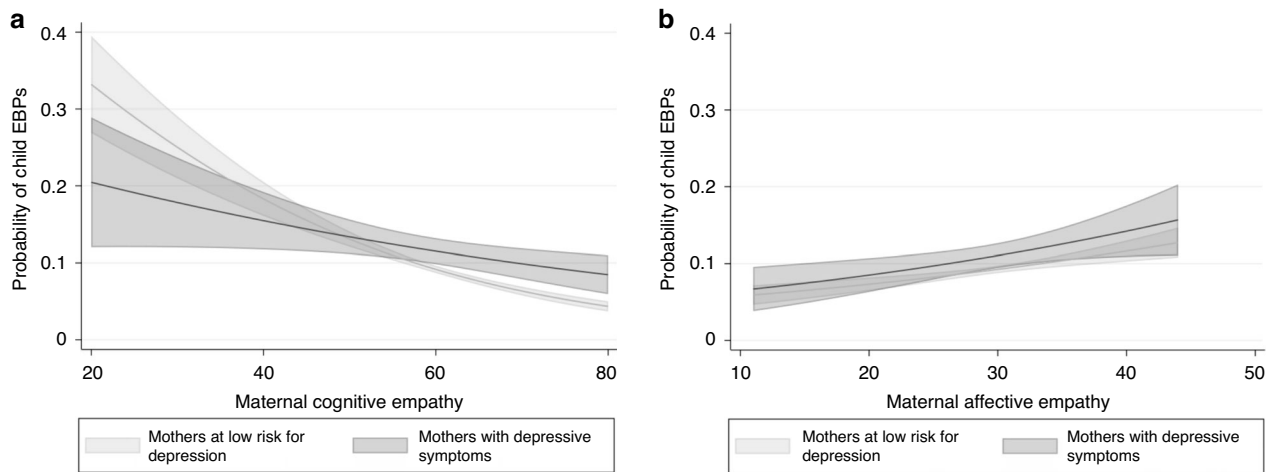


Fig. 2 Moderation effects of maternal depression on the association between maternal cognitive/affective empathy and child EBPs. **a** The association between maternal cognitive empathy and child EBPs was slightly stronger in mothers at low risk for depression. **b** The association between maternal affective empathy and child EBPs was not significantly moderated by maternal depression. EBPs emotional and behavioral problems.

affective empathy with child EBPs. The disparity may be attributed to the fact that cognitive empathy, a top-down procedure requiring cognitive efforts, differs from affective empathy and operates as an automatic bottom-up process.⁵⁹ Depressive symptoms may disturb the responsive parenting behavior motivated by high cognitive empathy. However, those symptoms may not affect the increased negative emotions elicited by children's distress due to higher affective empathy.⁶⁰

To be noted that, our study did not intend to negate the well-recognized significance of maternal depression in pediatric clinical practice. Instead, it focused on the broader community population, particularly the majority of mothers at low risk for depression. Maternal psychological traits (either depression or empathy) distribute as continuum, wherein some individuals may not manifest symptoms of mental health problems but could still increase children's risk of EBPs. Thus, the coverage of maternal cognitive empathy advocacy, such as teaching them to recognize children's emotion cues, in a population-wide health promotion strategy could be worthy of consideration.

Several limitations should be considered to interpret our findings. First, due to the population-based nature of the study, our data were collected via an online, self-reported questionnaire. Mothers' subjective bias may under- or overestimate their empathy and children's EBPs in the same direction and, thus, enhance the association. Besides, the same respondents providing information for all the key variables may inflate the association. However, the questionnaires we used were all validated in Chinese population, which ensure the validity to assess the key variables in our study. Concerning the respondent effect, we have conducted another regression model adjusting the role of respondent and duplicated the results (Figs. S2 and S3). Second, the cross-sectional design restricted the exploration of causal effect. Maternal cognitive empathy could be elevated during satisfying interactions with a well-behaved child. In addition, mothers could express less cognitive empathy and higher affective empathy when they become frustrated and overwhelmed in dealing with difficult children. The bidirectional association between these variables warrants a cohort or intervention study. Third, we did not measure maternal mental health problems (e.g., anxiety, bipolar disorder, schizophrenia) other than depression. Thus, the low risk mothers in our study may not be entirely at low risk for a mental health disorder. Future studies could control for additional maternal mental health risks and clarify the association between maternal empathy and child EBPs, and moderating role of

maternal depression in the general population. Fourth, the SCHEDULE-P study is representative of the preschool population of Shanghai, one of China's most developed cities. As in most cohort studies, attrition may have occurred over time, so as our studies, leading to potential selection bias. The overall high socioeconomic status and selection bias of the included dataset may limit generalization to other populations in low socioeconomic groups and also in other age stages.

CONCLUSION

Our study revealed that lower maternal cognitive empathy was associated with increased child EBPs, with the association slightly stronger in mothers at low risk of depression than that in mother with depressive symptoms. Conversely, higher maternal affective empathy was associated with increased child EBPs, independent of maternal depression. These findings indicate that inappropriate maternal cognitive and affective empathy may disturb child emotional and behavioral adjustment, even for mothers at low risk for depression. Therefore, tailored and integrated strategies targeting inappropriate maternal cognitive and affective empathy according to different risks of maternal depression should be considered in clinical practices and public health initiatives to reduce EBPs in young children.

DATA AVAILABILITY

The datasets generated during and/or analyzed during the current study are not publicly available due to shared ownership of Shanghai Municipal Education Commission but are available from the corresponding author on reasonable requests.

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AUTHOR CONTRIBUTIONS

Zichen Zhang conceptualized the study; contributed to the data collection, design, and conduct of data analysis; and drafted the initial manuscript. Yujiao Deng contributed to the conduct of data analysis and drafted and revised the manuscript. Tingyu Rong, Yiding Gui, Yunting Zhang, Jin Zhao, Wenjie Shan, and Qi Zhu contributed to the data collection and revision of the draft. Guanghai Wang

supervised the data collection, conceptualized and designed the study, and critically reviewed and revised the manuscript. Fan Jiang coordinated and supervised the data collection, conceptualized and designed the study, and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

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COMPETING INTERESTS

The authors declare no competing interests.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study received approval from the institutional review board of the Shanghai Children's Medical Center, Shanghai Jiao Tong University (SCMCIRB-K2016022-01).

Parents of the involved children signed the informed consent before participating in the study.

ADDITIONAL INFORMATION

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