
Title	Maternal anxiety, parenting stress, and preschoolers' behavior problems: The role of child self-regulation
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Abstract

Objective: Maternal anxiety is a well-known risk factor for early childhood behavior problems. In this study we explore (1) whether parenting stress mediates this relation, and also (2) whether child factors, namely self-regulation, modify the influence of maternal well-being on child externalizing and internalizing problems at 4 years of age. **Method:** Mothers taking part in the Growing Up in Singapore Towards Healthy Outcomes (GUSTO) cohort completed the Spielberger State-Trait Anxiety Inventory when their children were 24 months of age. At 42 months children performed a self-regulation task ($n=391$) and mothers completed the Parenting Stress Index (PSI). When children were 48 months, both parents completed the Child Behavior Checklist. **Results:** As predicted, parenting stress mediated the relation between maternal trait anxiety and child externalizing and internalizing problems. This mediating effect was further moderated by child self-regulation. The indirect effect of maternal trait anxiety through parenting stress on child externalizing problems was stronger among children with low self-regulation. **Conclusion:** Parenting stress is an additional pathway connecting maternal trait anxiety and children's externalizing and internalizing behavior problems. The risk for child externalizing problems conveyed by elevated maternal trait anxiety and parenting stress may be buffered by better self-regulation in four-year-olds. These results suggest that interventions that include decreasing parenting stress and enhancing child self-regulation may be important to limiting the transgenerational impact of maternal trait anxiety. **Keywords:** maternal trait anxiety, behavior regulation, externalizing problems, parenting stress, inhibitory control.

Elevated subclinical parent- or teacher-reported internalizing or externalizing problems are frequently reported in childhood as early as three years of age¹ and may precede an actual psychiatric diagnosis later in childhood or pre-adolescence². Maternal anxiety constitutes a prominent risk factor for both externalizing and internalizing problems³, perhaps, in part, due to influences on aspects of parenting. As an example, inconsistent or overprotective parenting, has been found to mediate the relation between maternal anxiety symptoms and child externalizing and internalizing problems^{3,4}. Anxious mothers also tend to feel less competent in their parenting role⁴. From a family-systems approach, however, maternal anxious disposition, or “trait” anxiety, may negatively impact the family system. Mothers with anxious personality traits tend to appraise ambiguous child-referent information as threatening, or catastrophizing in hypothetical worry scenarios involving their children⁵, thus magnifying the risk for dysfunctional interactions and parenting stress³.

Parenting stress is a form of distress specifically relevant to the parental role, usually described as parents’ negative experience stemming from the disparity between the perceived burden of being a parent and the available parenting resources⁶. Parenting stress may occur in relation to child characteristics, such as difficult temperament, which are perceived by the parent as a source of stress. It may also occur in relation to parent-related factors, such as lack of spousal support. Parents high in parenting stress may perceive their child as very demanding or “difficult” to handle or their child’s behavior as negative or hostile⁷, or provide less assistance to their children in regulating their own emotions⁸, further contributing to the development of insecure mother-child attachment and, eventually, child maladjustment. They may also employ harsh discipline practices characterized by aggression and physical maltreatment, display hostility, or neglect monitoring their children to prevent problem behaviors⁹. In light of such

research, parenting stress may be considered a proxy for the global tone of the parent-child relationship, even though it most directly queries parents' perceptions¹⁰. Among other negative correlates^{11,12} (e.g. disease severity in children with medical conditions, harsh discipline practices), increased parenting stress itself has been associated with higher numbers of offspring internalizing^{11,13} and externalizing¹¹ problems during the preschool years. In fact, recent longitudinal findings show that the course of parenting stress over time relates to the course of child behavior problems¹⁴. Although maternal trait anxiety has previously been associated with increased parenting stress, whether parenting stress plays a mediating role in the relation between maternal anxious disposition and child behavior problems remains largely unexplored.

Moreover, although associations between parenting stress and child behavioral outcomes are well documented, among children with behavior problems only 20% of the variance can be attributed to parenting stress¹³. As such, it is possible that child factors may serve to intensify or buffer the association between parenting stress and children's outcomes, perhaps especially under conditions of high parenting stress. This notion is also in agreement with prevailing theories on the development of childhood behavioral problems that underscore the interplay between child risk factors and the caregiving environment¹⁵. In addition, such an examination may be informative to policy makers and clinicians as they determine which type of intervention may best help to reduce child behavior problems.

Self-regulation is a term describing the process we use to modulate emotions and behaviors in order to respond appropriately to environmental events, and to maintain optimal levels of emotional, motivational and cognitive arousal within an ever-changing environment¹⁶. Inefficient self-regulation may amplify children's psychological and emotional maladjustment especially within an unfavorable caregiving environment. Accumulating evidence supports the moderating

effects of child self-regulation in the relation between the caregiving environment and offspring behavior problems. Both higher maternal depression¹⁷ and lower warm parenting¹⁸ have been associated with higher teacher-reported externalizing problems in early and middle childhood among children with poor attentional and behavioral control but not among their counterparts with average or high levels of control. Similarly, children with low attentional control exhibited elevated internalizing problems if their mother suffered from clinical depression diagnosed during childhood¹⁹ or when their cumulative caregiving risk index (including history of maternal mental disorders)²⁰ was high.

In addition, emerging evidence suggests that child-targeted, curriculum-based interventions aiming at improving child self-regulation elicit concomitant improvements in children's social skills and behavior problems²¹. Therefore, child self-regulation is an important area for study, as it may be important to both the identification of risk, as well as serving as a target for interventions leading to secondary improvements in other domains of a child's life.

Given the scarcity of studies investigating potential mechanisms that underlie the association between maternal trait anxiety and child behavior problems during the preschool years, in this study, we investigated whether a comparatively adverse caregiving environment, as indicated by elevated parenting stress, might serve as the linking mechanism. We hypothesized that besides a direct effect of maternal trait anxiety on child externalizing and internalizing problems there would also be an indirect effect, conveyed through maternal parenting stress. In other words, we asked whether the effect of trait anxiety (the predictor variable) upon child behavioral problems (the outcome variable) was partially due to a path involving maternal parenting stress (the mediator)²². In addition, as child self-regulation has been found to mitigate the influence of an adverse caregiving environment on offspring behavior problems, we also

predicted that the relation between maternal variables and child behavior problems would partially depend (or be moderated by) child self-regulation. We investigated the two hypotheses simultaneously through a moderated mediation model, which encompasses both the proposed mediational path between maternal anxiety, parenting stress, and child problems, as well as the moderating influence of child self-regulation upon this path.

We focused on 4-year-olds for two reasons. First, despite starting early in infancy and continuing until early adulthood, marked improvements in executive functioning development emerge between the ages of 3 and 6 years with larger changes occurring between 3 and 4 years²³. During these years brain regions, such as the prefrontal cortex, involved in self-regulation performance, exhibit increased activity and evidence of cognitive and behavioral control is present²⁴. Furthermore, in Singapore children usually start kindergarten at the age of 4. Therefore, understanding the potential influence of individual differences prior to school age may be a relevant consideration for programs aimed at increasing school readiness.

METHODS

Participants

We used data from mother-infant dyads who participated in the prospective pregnancy cohort study, Growing Up in Singapore Toward Healthy Outcomes (GUSTO)²⁵. GUSTO pregnant women above 18 years of age were recruited during the first trimester of pregnancy from the Kangkar Kerbau Women's and Children's Hospital and the National University Hospital in Singapore between June 2009 and September 2010. Demographic data were extracted from survey questionnaires conducted as part of a scheduled appointment during pregnancy.

At 42 months of age, a subset of GUSTO toddlers ($n=448$) attended a roughly 3-hour long neurodevelopment testing visit. Out of these, 409 were eligible to participate in the present study after applying inclusion criteria (i.e., last recorded Apgar score of ≥ 8 ; birth weight ≥ 2000 g and ≤ 4000 g, adjusted for gestational age; no preeclampsia at birth; aged 42 months ± 60 days at the time of testing). Data from another 18 children were excluded as outliers (above or below 3SDs from the mean in at least one continuous variable). Thus, we focused on 391 (207 male) GUSTO naturally-conceived children born from singleton pregnancies.

During the neurodevelopment visit, self-regulation was assessed through an experimental task as part of the standard testing protocol. This task was almost always administered after a parent-child separation-reunion session and before an observed emotion regulation assessment. Toddlers took planned and requested breaks, and frequently switched rooms to minimize fatigue, fussiness, or boredom. During the same visit, maternal self-reports of parenting stress were collected.

At 24 months of age maternal trait anxiety was assessed during a home visit. At 48 months child behavior problems were assessed by both maternal and paternal reports; these reports were collected by the experimenters during a home visit but were mailed to the parents in advance of the home visit.

This study was approved by both the National Health Care Group Domain Specific Review Board (reference D/09/021) and the SingHealth Centralized Institutional Review Board (reference 2009/280/D). All mothers provided informed written consent on behalf of themselves and their children before their participation and were reimbursed at the end of each visit.

Measures

Maternal trait anxiety was assessed using the Trait-anxiety subscale of Spielberger State-Trait Anxiety Inventory (STAI) Form Y²⁶. The STAI is a well-validated measure of anxiety. Its Trait-anxiety subscale assesses anxiety as a stable personality trait. Scores on the Trait-anxiety subscale range from 20 (no anxiety) to 80 and were used as continuous in all analyses. The Cronbach's alpha for Trait Anxiety in our cohort was 0.93.

Parenting stress was assessed through the Parenting Stress Index²⁷ (PSI). The PSI consists of 120 statements, of which 101 focus on parenting stress and the remaining 19 focus on stressful life events outside of the parent-child relationship. As noted above, the parenting stress-related statements describe stress stemming from perceived child qualities or behaviors that make it difficult for parents to fulfill their parenting role, or from parents' own characteristics, such as how competent they feel in the parenting role, and whether they perceive their parenting partner as supportive. The total PSI score, based on the 101 parenting stress-related statements only, was used in all analyses as a continuous variable; it ranged from 101 to 505. Cronbach's alpha, based on usable data for this measure from our entire cohort sample ($n=429$), was 0.95.

An aspect of children's self-regulation was assessed through a behavioral inhibitory control task, the Snack Delay task²⁸ and a similarly developed Sticker Delay task. The two versions of the task, Snack and Sticker, were administered sequentially in counterbalanced order among participants. In the food-related version the stimuli were colorful chocolates (or colorful cereals in case of allergy or if mother objected to sugar). In the emotion-related version, the Sticker Delay, stimuli were colorful stickers with emoticons demonstrating different emotions. Sticker Delay involved sticking each sticker on a sticker template in order to experience a rewarding action with every stimulus. Depending on the task version, the child was first given a snack or a sticker in order to prime interest in the game. After eating the chocolate or pasting the sticker on the template,

the child was instructed to place both hands flat on a mat while the experimenter placed one chocolate or sticker under a transparent plastic cup. Then, the child was instructed to wait for the experimenter to ring a bell before retrieving the chocolate or sticker.

Two practice trials were conducted followed by four separate test trials with delay intervals of 10s, 20s, 30s, and 15s. During the first half of each test trial the experimenter did not hold the bell. During the second half of the test trial the experimenter picked up the bell, but did not ring it. The bell was only pressed when the delay interval for that trial had passed. The average duration of the experiment among participants was 19 minutes. The experiment was video-recorded and scored by one of three independent raters according to the protocol created by Kochanska and colleagues²⁸. The measure of inhibitory control is the child's ability to resist reaching out for the bell or the stimulus. This behavior was scored per trial and scores ranged from 1 to 7; up to 2 additional points could be given if the child maintained both hands on the mat throughout the task. The final score ranged from 1 to 9 with 9 indicating the highest inhibitory control. An average score across all four trials was calculated per task version. These two average scores were further averaged to produce one self-regulation score which was used as a continuous variable in all analyses. Intra-class correlations coefficients on 57 videos were 0.96 for the Snack Delay and 0.93 for the Sticker Delay.

Children's behavioral problems were measured through maternal and parental reports using the Child Behavior Checklist (CBCL) 1.5-5 years²⁹. The CBCL is a standardized assessment of toddlers' behavioral problems composed of 99 items. The global dimension of internalizing problems includes concepts such as anxiety and affective difficulties. The global dimension of externalizing problems incorporates negative or disruptive behavior in relation to other people and the social environment, such as aggression and attention deficit. Consistency

between mothers' and fathers' responses was assessed through intra-class correlations (ICC). The ICC coefficients were .59 and .68 for internalizing and externalizing problems, respectively, indicating good agreement for externalizing problems but only fair agreement for internalizing problems. Therefore, we analyzed maternal and paternal reports separately. Within the present sample 15% (internalizing) and 6% (externalizing) of participants had a T-score of 60 (i.e. the cut-off for borderline clinical range) or above, based on maternal reports. These percentages were higher for T-scores based on paternal reports with 20% (internalizing) and 8% (externalizing) of participants scoring a T-score of 60 or above. Cronbach's alphas in our cohort were as follows: internalizing problems: $\alpha=.88$ (maternal) and $\alpha=.90$ (paternal); externalizing problems: $\alpha=.91$ (maternal) and $\alpha=.91$ (paternal). In our analysis we include raw scores instead of T-scores for research as recommended in the manual.

Plan of analyses

All analyses were conducted using SPSS and AMOS, version 25. First, we examined all variables for completeness using missing value analysis. Out of 391 participants 153 had complete datasets, 68 had only one missing value in a variable of interest, and the remaining 170 had two or more missing values in variables of interest. Still, no variable had more than 30% of missing data. As Little's MCAR test was significant [$\chi^2(140)=213.48, p=.00$], indicating lack of missingness-completely-at-random, we assumed missingness-at-random and we proceeded with data imputation through full-information maximum likelihood. Two imputed datasets were created, for maternal and paternal reports respectively. Afterwards, we used path analysis to examine the mediating effect of maternal PSI scores in the association between maternal STAI scores and child CBCL scores and, also, whether child self-regulation scores moderated the indirect effect of maternal STAI scores on child CBCL scores through maternal PSI. The self-

regulation moderation was assessed by including the main effect of child self-regulation scores, and an interaction term between PSI and self-regulation scores in each model. In order to increase statistical power, bias-corrected bootstrapping (2000 resamples) was used. Both models were controlled for maternal education (as an index of SES) and birth order (due to significant correlations with PSI). When a moderation effect was significant, post-hoc mediation models were performed through multivariable linear regressions to assess the indirect effect of maternal PSI scores for separate groups of participants based on their self-regulation scores. Participants were grouped based on whether they achieved an average self-regulation score of above or below 8 (i.e. almost perfect performance vs. all other participants) due to the high mean score on this task. Model fit was evaluated using multiple fit indices, namely the χ^2/df ratio wherein ratios of less than 2.5 or 3 indicate a good fit, the comparative fit index (CFI), wherein values above .95 indicate a good fit, and the root-mean square error of approximation (RMSEA) wherein values below 0.5 indicate a good fit, and values between 0.6 and 0.8 indicate acceptable fit.

RESULTS

Table 1 includes descriptive statistics of demographic information, maternal trait anxiety and parenting stress, and child self-regulation. Table 2 includes bivariate correlations between all main variables based on the initial dataset with missing values, as well as the imputed datasets. Of note, the correlations between child self-regulation and both maternal trait anxiety and parenting stress were not significant. Children in our sample exhibited significantly a higher number of externalizing than internalizing problems based on raw scores [maternal reports: $t(390)=-7.70, p=.00$; paternal reports: $t(390)=-6.70, p=.00$]. This is despite the fact that more participants had internalizing, rather than externalizing, T-scores at or above the clinical cut-off. This discrepancy stems from differences in the conversion of raw scores into T-scores²⁹ as a

given raw score is equivalent of a higher internalizing T-score when compared to its equivalent externalizing T-score.

[Insert Table 1 here]

[Insert Table 2 here]

The model assessing the mediating effect of maternal PSI total scores in the relation between maternal STAI scores and maternally reported child externalizing and internalizing problems (Figure 1a) explained 23% and 27% of the variance of externalizing and internalizing problems, respectively, and yielded a good fit: $\chi^2/df=2.31$, CFI=.99, and RMSEA=.06. The corresponding model based on paternal reports (Figure 1b) explained 14% of externalizing and 14% of internalizing problems, and also yielded a good fit: $\chi^2/df=2.58$, CFI=.99, and RMSEA=.06.

Despite differences in the magnitude of the effects, a similar pattern of results emerged for maternal versus paternal reports for both child problem dimensions. In both models examining child externalizing problems, both the total and indirect effects of maternal STAI scores through maternal PSI scores were significant, suggesting that high parenting stress mediates the positive association between maternal trait anxiety and externalizing problems; the direct effect of STAI was not significant. In addition, a main effect of child self-regulation scores was found suggesting higher externalizing problems associated with lower self-regulation. Finally, the moderating effect of child self-regulation on the indirect effect of STAI scores on child externalizing problems through maternal PSI scores was also significant (Table 3). Although post-hoc mediation models within both the low- and high-self-regulation groups showed a significant indirect effect in both low (maternal reports: $b=0.38$, $SE=0.07$, $p=.00$;

paternal reports: $b=0.30$, $SE=0.07$, $p=.00$) and high (maternal reports: $b=0.19$, $SE=0.05$, $p=.00$; paternal reports: $b=0.10$, $SE=0.04$, $p=.01$) self-regulation groups, there was a significant difference in the indirect-effect slopes between the two groups [maternal reports: $t(387)=2.21$, $p=.03$; paternal reports: $t(387)=2.48$, $p=.01$]. This difference indicates that the indirect effect of maternal trait anxiety on child externalizing problems through parenting stress was significantly larger for the low self-regulation group when compared to the high self-regulation one.

For models examining both maternally and paternally reported child internalizing problems the total, direct and indirect effects of maternal STAI scores through maternal PSI scores were significant, suggesting that high parenting stress mediates the positive association between maternal trait anxiety and internalizing problems. No main effect of child self-regulation or its moderating effect on the indirect effect of STAI scores on child internalizing scores through maternal PSI total scores was found (Table 3).

[Insert Figure 1 here]

[Insert Table 3 here]

DISCUSSION

In the present study we examined whether maternal parenting stress mediates the association between maternal trait anxiety and child externalizing and internalizing problems at 4 years of age, while also considering the moderating role of child self-regulation. We found that higher levels of maternal trait anxiety were associated with increases in parenting stress which, in turn, correlated to higher internalizing and externalizing problems in preschoolers, as reported by both mothers and fathers. The similarity in the pattern of these associations between maternal

and paternal reports of child internalizing and externalizing problems underlines their robustness irrespective of potential reporter biases.

Our mediational findings are in keeping with previous work demonstrating that maternal trait anxiety can lead to elevated child anxiety² and suggest that parenting stress, a proxy for the tone of the parent-child relationship and its functioning, may constitute one way in which maternal trait anxiety contributes to the development of child internalizing and externalizing problems.

As described in the introduction, mothers with anxious personality traits may misinterpret child-related information⁵, thus experiencing increased parenting stress. Parents who experience high parenting stress may be less supportive during distressing situations when they need to teach their children how to manage their emotions⁸, or perceive their child or the parenting role as very demanding. They may also employ aggressive discipline styles or exhibit amplified reactions to child misbehaving⁹. These impeding maternal thought processes and behaviors combined may impact on the quality of mother-child interactions and developing attachment patterns, making children more prone to developing maladaptive self-soothing strategies (e.g., aggression or emotional numbing), ultimately leading to externalizing and internalizing problems. As neither parental sensitivity or support, nor discipline were directly measured in the present study, future studies should investigate these as additional potential explanatory mechanisms.

A reduction in the quality of mother-child interactions may be particularly consequential for children with comparative difficulties in self-regulation. Within the current study we observed a direct negative association between self-regulation and externalizing problems. Of

note, we also observed that the indirect effect of maternal trait anxiety on child externalizing problems through parenting stress was higher in children with comparatively low self-regulation. These findings are in line with past work demonstrating that better child self-regulation attenuates the risk for behavior problems conveyed by maternal anxiety and parenting stress or other unfavorable caregiving environments^{17,18}. Such attenuation may occur as children with relatively better self-regulation may show increased control over pre-potent responses in stressful situations and, thus, may be better equipped to regulate their attention and emotional states. This may protect them from developing externalizing problems. These results have important implications for future research especially with regards to the reduction of parenting stress and an enhancement in children's self-regulation.

One interesting aspect of our findings is that self-regulation only moderated the mediating effect of parenting stress between maternal trait anxiety and child *externalizing* problems but did not moderate this relation involving internalizing problems. In the present sample children were rated by their parents as exhibiting more externalizing than internalizing problems. It is thus possible that the moderating effect is not specific to externalizing problems per se; rather, in our sample children's internalizing problems may not have been varied enough for such a moderating effect to emerge. Furthermore, the existing evidence regarding links between self-regulation and the development of internalizing problems is less cohesive, and other factors, such as age of assessment and stability of these constructs across time, may further obfuscate the picture. For example, Dennis and colleagues³⁰ reported a negative association between self-regulation and internalizing problems at 4 years of age but not at 5 or 6 years, perhaps due to marked increases in self-regulation between 4 and 6 years. These findings suggest that the specific age of assessment may matter and that there may be bidirectional associations across

development. Assessing internalizing problems in preschoolers may also pose certain challenges as preschoolers are limited in their ability to express such problems, sometimes even manifesting internalizing problems as externalizing behaviors (e.g., being oppositional or throwing tantrums), and parents may struggle in identifying them appropriately. A final alternate possibility concerns the manner in which self-regulation was operationalized and the differential nature of internalizing and externalizing problems. Despite the fact that the sticker-delay task included a variety of emotionally-valenced emoticons, overall the average score for Snack-Sticker Delay task, used in this study, may be most conceptually linked to aspects of self-regulation that allow for regulation in response to external rewards. Externalizing problems, such as poor attention, increased impulsivity, and even aggression may reflect difficulties managing responses to appetitive and aversive real-world stimuli in the environment³¹. Children who have difficulties self-regulating their responses to environmental cues may therefore need greater parental support to prevent externalizing behavior. These children may also be more apt to display negative behavior when the caregiving environment regularly includes unpredictable and/or aversive stimuli³¹. On the contrary, internalizing problems may reflect alterations in emotional experience, and perhaps the ability to regulate internal mental life. Thus, had we employed a different test of self-regulation, for example one involving error monitoring, or disengagement, specifically from negative emotions, we may have observed a similar moderation of self-regulation in the prediction of internalizing problems.

In the present study we found associations between maternal anxiety, parenting stress, and preschoolers' internalizing and externalizing outcomes. Nevertheless, despite our longitudinal design and the fact that maternal anxiety and parenting stress did not correlate significantly with child self-regulation, child behavior may also contribute to changes in maternal anxiety and

parenting stress levels. Such transactional relations between parenting stress and child internalizing and externalizing problems between 4 and 10 years of age¹⁴. Future studies should take into consideration potential modifications of parenting stress by the continuous interaction between mothers and children across development.

With regards to maternal anxiety, bidirectional effects between maternal psychological distress, including state anxiety, and child internalizing and externalizing problems have also been documented during the preschool years³². In the present study, however, we focused on trait anxiety, which tends to be relatively stable during the first postpartum years³³ and comparatively unlikely to be influenced by child behaviors. Rather it is possible that trait-anxiety may moderate potential reciprocal effects between maternal psychological distress and child problems; future investigations should consider working towards elucidating these more intricate relations between aspects of maternal anxiety, and child internalizing and externalizing problems.

Generalization of our findings is subject to additional limitations. First, the average performance on self-regulation in our sample was high; thus, it may be difficult to compare our results to those observed in studies with participants who have more extreme self-regulation difficulties. Yet, finding significant moderation effects despite such elevated performance emphasizes the significance of self-regulation in relation to child behavior, and suggests that even small variation in performance, as likely evident in typical populations, does matter. Second, within the current preschool-aged sample, child internalizing and externalizing behaviors were highly correlated. As such, the specific nature of the problems, i.e. externalizing versus internalizing, may further be dependent on other factors, such as genetic influences³⁴ or child temperament³¹. Although comparable correlations have been reported in other early childhood samples³⁴ these two symptom dimensions include problems, quite different in nature,

which may co-occur²⁹. However, future investigations with older children may wish to examine the influence of maternal trait anxiety and parenting stress on more discrete aspects of problematic behavior or psychopathology. Finally, as it is possible that parenting stress is highly associated with maternal anxiety traits, it is important to investigate whether it also leads to changes in parenting which further impact on behavior problems.

In conclusion, our results indicate that parenting stress is an additional pathway connecting maternal trait anxiety and children's externalizing and internalizing behavior problems. In addition, we found that the risk for child externalizing problems conveyed by elevated maternal trait anxiety and parenting stress may be buffered by high self-regulation in four-year-olds. This work may suggest that programs aimed at reducing offspring internalizing and externalizing problems should involve a dyadic focus. These may include psychoeducation and techniques to reduce parents' anxiety and parenting stress, enhance caregiver sensitivity, and strengthen children's neurocognitive skills and self-regulation to help them cope with the caregiving environment.

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Table 1. Descriptive statistics for the main variables for the total sample before and after imputation of missing values.

Factor	Before imputation	After imputation – maternal reports (<i>n</i> =391)	After imputation – paternal reports (<i>n</i> =391)
Categorical			
<i>Mothers</i>			
Education			
Primary education	16	16	16
Secondary education	104	105	105
Vocational training	136	141	141
University	121	121	121
Postgraduate qualification	8	8	8
Missing	6	NA	NA
Ethnicity			
Chinese	217	217	217
Malay	120	120	120
Indian	54	54	54
<i>Toddlers</i>			
Birth order			
1 st	171	171	171
2 nd	118	118	118
3 rd	68	68	68
4 th	27	27	27
5 th	7	7	7
Continuous			
	M (SD)	M (SD)	M (SD)
<i>Mothers</i>			
STAI Trait score	35.91 (9.74)	36.26 (8.71)	36.24 (8.72)
	<i>n</i> =285		
PSI total score	236.09 (38.44)	236.60 (37.87)	236.46 (37.82)

n=373

Toddlers

Self-regulation scores	7.97 (0.91)	7.96 (0.85)	7.97 (0.85)
	<i>n</i> =341		
Externalizing problems based on maternal reports			
Raw scores	10.96 (7.73)	11.23 (6.63)	NA
T-scores	47.30 (10.30)	48.00 (9.00)	
	<i>n</i> =270		
Externalizing problems based on paternal reports			
Raw scores	11.75 (7.63)	NA	12.07 (6.63)
T-scores	48.50 (10.00)		49.10 (8.80)
	<i>n</i> =281		
Internalizing problems based on maternal reports			
Raw scores	8.90 (6.53)	9.34 (5.64)	NA
T-scores	50.20 (10.60)	51.60 (9.40)	
	<i>n</i> =270		
Internalizing problems based on paternal reports			
Raw scores	9.93 (7.62)	NA	10.30 (6.61)
T-scores	51.60 (11.00)		52.90 (9.90)
	<i>n</i> =281		

Table 2. Bivariate correlations between main variables based on the initial dataset with missing values and the two imputed datasets (for maternal and paternal reports).

Initial database with missing values								
Variables	2.	3.	4.	5.	6.	7.	8.	9.
1. Birth order	-.34**	.07	-.15**	-.04	-.12	-.05	-.06	.01
2. Maternal education	1	-.20**	-.11*	.08	.04	-.16*	-.09	-.21**
3. Maternal STAI Trait score		1	.49***	-.02	.16*	.32***	.09	.17*
4. Maternal PSI total score			1	-.09	.41***	.41***	.26***	.23***
5. Child self-regulation score				1	-.08	-.02	-.14*	-.09
6. Externalizing problems based on maternal reports					1	.69***	.52***	.26***
7. Internalizing problems based on maternal reports						1	.31***	.43***
8. Externalizing problems based on paternal reports							1	.68***
9. Internalizing problems based on paternal reports								1
Imputed dataset based on maternal reports								
Variables	2.	3.	4.	5.	6.	7.		
1. Birth order	-.34***	.11*	-.15**	-.04	-.11*	-.02		
2. Maternal education	1	-.23***	-.12*	.09	.00	-.22**		

3. Maternal STAI Trait score	1	.55***	-.04	.23***	.38***
4. Maternal PSI total score		1	-.08	.47***	.47***
5. Child self-regulation score			1	-.10*	-.05
6. Externalizing problems				1	.70***
7. Internalizing problems					1

Imputed dataset based on paternal reports

Variables	2.	3.	4.	5.	6.	7.
1. Birth order	-.34***	.11*	-.15**	-.04	-.06	.01
2. Maternal education	1	-.24***	-.13*	.09	-.15	-.27**
3. Maternal STAI Trait score		1	.55***	-.04	.14**	.20***
4. Maternal PSI total score			1	-.08	.32***	.29***
5. Child self-regulation score				1	-.17**	-.11*
6. Externalizing problems					1	.69***
7. Internalizing problems						1

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3. Direct and indirect effects and confidence intervals of the path model on child externalizing and internalizing problems.

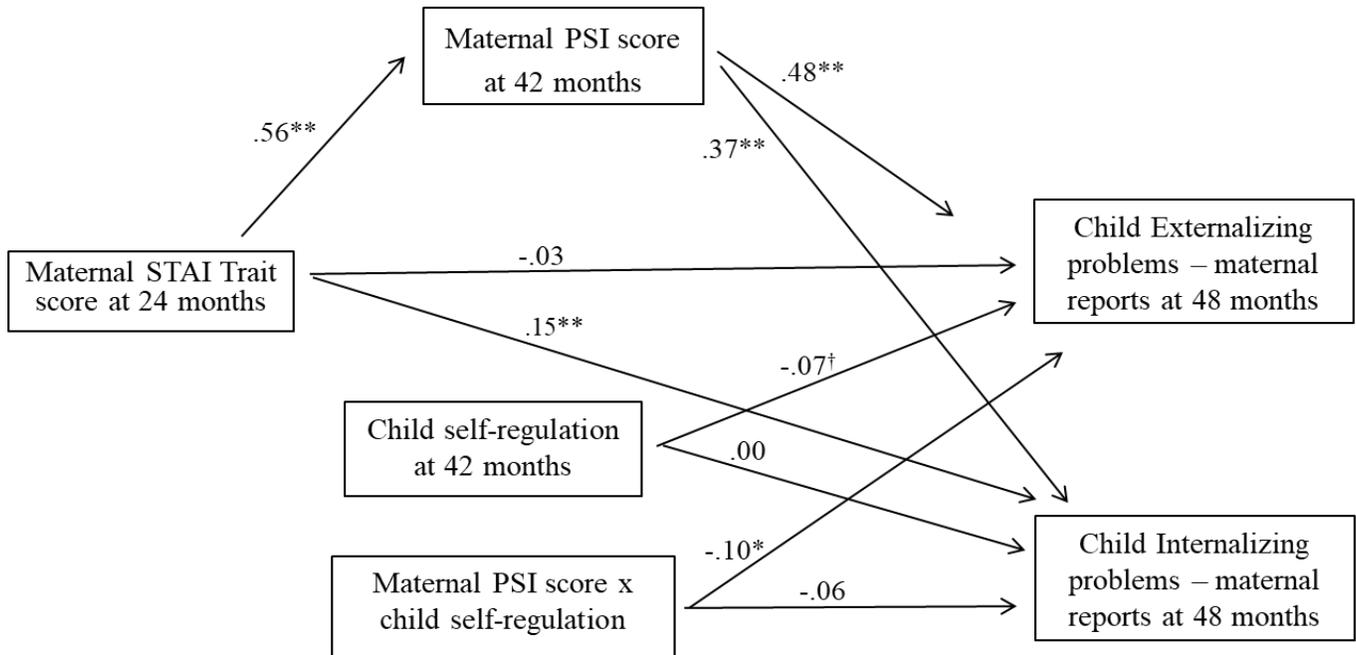
Path	<i>Standardized direct effect</i>	<i>Standardized indirect effect</i>	<i>p value</i>	<i>Bias-corrected bootstrap 95% confidence interval</i>
Based on maternal reports				
Maternal STAI Trait score (24 months) → Maternal PSI total score (42 months)	0.56	-	.00	0.47 – 0.62
Maternal PSI total score (42 months) → Child externalizing score (48 months)	0.48	-	.00	0.38 – 0.58
Maternal PSI total score (42 months) → Child internalizing score (48 months)	0.37	-	.00	0.25 – 0.46
Maternal STAI Trait score (24 months) → Maternal PSI total score (42 months) → Child externalizing score (48 months)	-	0.27	.00	0.20 – 0.34
Maternal STAI Trait score (24 months) → Maternal PSI total score (42 months) → Child internalizing score (48 months)	-	0.20	.00	0.13 – 0.27
Child self-regulation (42 months) → Child externalizing score (48 months)	-0.07	-	.08	-0.17 – 0.00
Child self-regulation (42 months) → Child internalizing score (48 months)	0.00	-	.91	-0.10 – 0.08
Interaction between maternal PSI total score and child self-regulation (42 months) → Child externalizing score (48 months)	-0.10	-	.03	-0.18 – -0.01
Interaction between maternal PSI total score and child self-regulation (42 months) → Child internalizing score (48 months)	-0.06	-	.23	-0.15 – 0.04
Based on paternal reports				

Maternal STAI Trait score (24 months) → Maternal PSI total score (42 months)	0.56	-	.00	0.47 – 0.62
Maternal PSI total score (42 months) → Child externalizing score (48 months)	0.32	-	.00	0.21 – 0.44
Maternal PSI total score (42 months) → Child internalizing score (48 months)	0.23	-	.00	0.11 – 0.35
Maternal STAI Trait score (24 months) → Maternal PSI total score (42 months) → Child externalizing score (48 months)	-	0.18	.00	0.11 – 0.26
Maternal STAI Trait score (24 months) → Maternal PSI total score (42 months) → Child internalizing score (48 months)	-	0.13	.00	0.06 – 0.20
Child self-regulation (42 months) → Child externalizing score (48 months)	-0.14	-	.00	-0.23 – -0.05
Child self-regulation (42 months) → Child internalizing score (48 months)	-0.08	-	.12	-0.17 – 0.02
Interaction between maternal PSI total score and child self-regulation (42 months) → Child externalizing score (48 months)	-0.11	-	.06	-0.20 – 0.00
Interaction between maternal PSI total score and child self-regulation (42 months) → Child internalizing score (48 months)	0.00	-	.90	-0.11 – 0.15

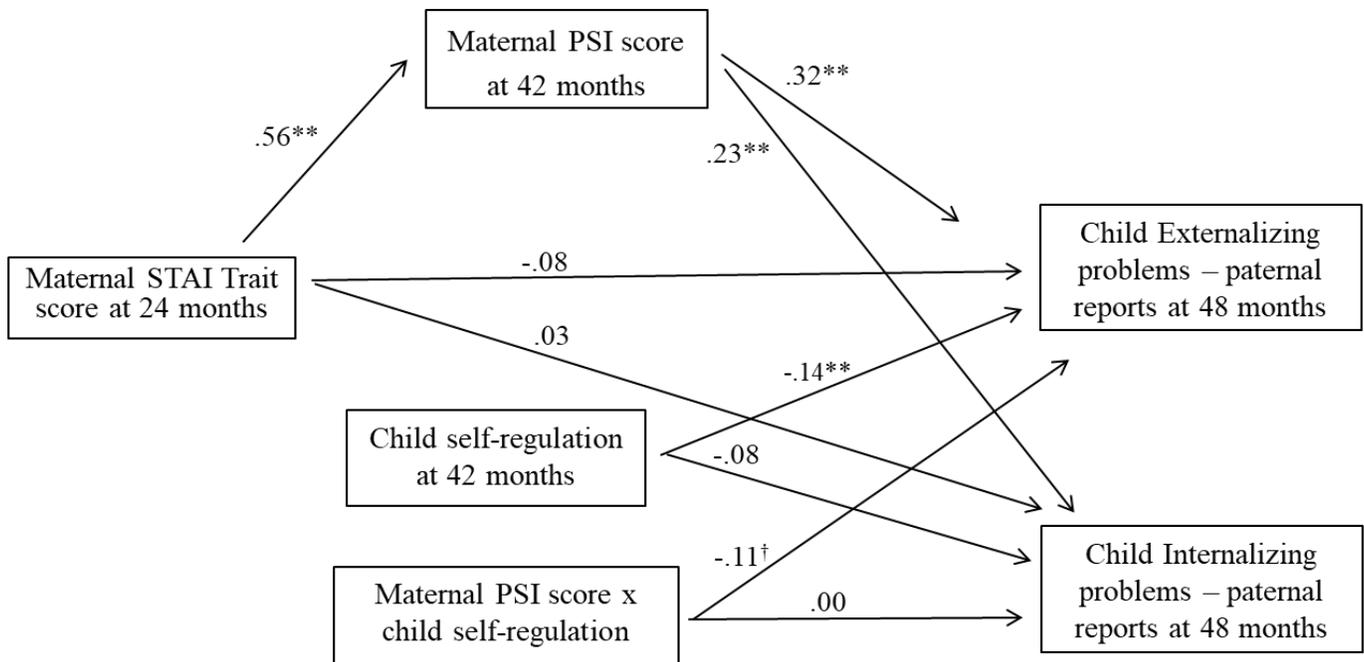
Note. *p* values in bold font are significant; *p* values in italic font are near-significant.

Figure 1: Path-analysis final models for hypothesis testing with standardized beta coefficients based on maternal and paternal reports separately.

a. Maternal reports



b. Paternal reports



† $p < 0.09$, * $p < 0.05$, ** $p < 0.01$.

Note. The path from the maternal STAI score to the child externalizing and internalizing problems represents the direct effect, i.e. the effect of maternal STAI score on child externalizing and internalizing problems after controlling it for the maternal PSI score.