Parental Meta-Emotion Philosophy and Adolescent Problem Behaviors: The Moderating Role of the Vagus Nerve

Authors: He Xiaoli, Yuan Xiaolong, Hu Ming, Zhou Lichun, He Xiaoli

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Abstract

This study explored the relationship between parental meta-emotion philosophy and adolescent problem behaviors, as well as the influence of adolescents' vagal nerve function on this relationship. Using the "mental arithmetic task paradigm" and questionnaire methods, 224 adolescents and their parents were assessed. The results revealed: (1) Maternal emotion coaching philosophy negatively predicted adolescents' internalizing and externalizing problem behaviors, maternal emotion dysregulation philosophy positively predicted adolescents' internalizing and externalizing problem behaviors, and maternal emotion non-interference philosophy positively predicted adolescents' externalizing problem behaviors; paternal emotion coaching philosophy negatively predicted adolescents' internalizing problem behaviors, and paternal emotion dysregulation philosophy positively predicted adolescents' externalizing problem behaviors. (2) When adolescents' vagal tone was low, maternal emotion non-interference philosophy positively predicted adolescents' externalizing problem behaviors; when adolescents' vagal suppression was low, maternal emotion dysregulation philosophy positively predicted adolescents' internalizing and externalizing problem behaviors, and paternal emotion dysregulation philosophy positively predicted adolescents' externalizing problem behaviors. In summary, parental meta-emotion philosophy can predict adolescent problem behaviors, and there are differences in how parental meta-emotion philosophy influences adolescent problem behaviors. Simultaneously, vagal nerve function exerts a certain moderating effect on the relationship between parental meta-emotion philosophy and adolescent problem behaviors.

Full Text

The Association Between Parental Meta-Emotion Philosophy and Adolescent Problem Behaviors: The Moderating Role of Vagal Function

HE Xiaoli[1], **YUAN Xiaolong**[2], **HU Ming**[3], **ZHOU Lichen**[1] [1] School of Education, Ningxia University, Yinchuan 750021, China
[2] Shandong Zibo No. 6 High School, Zibo 255300, China
[3] Ningxia Hospital of Traditional Chinese Medicine, Yinchuan 750021, China

Abstract

This study examined the relationship between parental meta-emotion philosophy and adolescent problem behaviors, as well as the influence of adolescents' vagal function on this relationship. Using a mental arithmetic task paradigm and questionnaire methods, 224 adolescents and their parents were assessed. The results revealed: (1) Maternal emotion coaching negatively predicted adolescents' internalizing and externalizing problem behaviors, maternal emotion dysregulation positively predicted both types of problems, and maternal non-involvement positively predicted externalizing problems. Paternal emotion coaching negatively predicted internalizing problems, while paternal emotion dysregulation positively predicted externalizing problems. (2) When adolescents exhibited low vagal tone, maternal non-involvement positively predicted externalizing problems. When adolescents showed low vagal suppression, maternal emotion dysregulation positively predicted both internalizing and externalizing problems, and paternal emotion dysregulation positively predicted externalizing problems. In summary, parental meta-emotion philosophy predicts adolescent problem behaviors, with differential effects for mothers and fathers. Additionally, vagal function moderates the relationship between parental meta-emotion philosophy and adolescent problem behaviors.

Keywords: parental meta-emotion philosophy; vagal function; adolescent problem behavior

Introduction

As adolescents' environments become increasingly complex, emotional and behavior problems have garnered sustained attention. Examining adolescent problem behaviors through the lens of parental emotional socialization has become a prominent research focus. Various aspects of parental emotional socialization —including emotional responsiveness, emotional discussion, and emotional expression—exert differential influences on adolescent problem behaviors (Chaplin, Cole, & Zahn-Waxler, 2005; Li, He, Yu, & Liu, 2010). However, the relationship between parental meta-emotion philosophy—a crucial factor influencing parental emotional socialization—and adolescent problem behaviors requires further investigation (Hu, Liang, Zhang, & Deng, 2017).

Parental meta-emotion philosophy refers to parents'cognitions and feelings about their own and their children' s emotions, encompassing four distinct types: emotion coaching, emotion dismissing, non-involvement, and emotion dysregulation (Hu, Xu, & Ye, 2002). The relationships between these different philosophies and adolescent problem behaviors vary considerably. When parents endorse high levels of emotion coaching, children demonstrate superior emotion regulation abilities, effective problem-solving skills, positive peer relationships, and fewer health problems (Gottman, Katz, & Hooven, 1996). Conversely, emotion dismissing philosophy adversely affects children' s emotion regulation and contributes to increased internalizing and externalizing problems (Lunkenheimer, Shields, & Cortina, 2007). For instance, maternal emotion dismissing indirectly influences adolescent depression through parenting attitudes and adolescents' own emotion regulation capacities. Furthermore, parental guidance regarding children' s negative emotions may serve as a protective factor buffering the detrimental effects of dismissing philosophy on problem behaviors. Therefore, the relationships among emotion coaching, emotion dismissing, and problem behaviors warrant continued investigation.

Emotion dysregulation and non-involvement philosophies represent meta-emotion philosophies unique to Eastern cultural contexts (Hu et al., 2002). Research indicates that paternal emotion dysregulation significantly correlates positively with children' s externalizing problems and negatively with social competence (Heng, 2014). Maternal non-involvement philosophy positively predicts later anger-aggression and anxiety-withdrawal behaviors in children (Liang, 2009; Liang, Zhang, Chen, & Zhang, 2012; Liang, Hu, Zhang, Deng, & Xia, 2016). However, the effects of parental non-involvement and dysregulation philosophies on problem behaviors from childhood through adolescence remain unclear. Additionally, Qiu (2005) found that, except for maternal emotion coaching, all other maternal meta-emotion philosophies showed significant positive correlations with adolescent depression. Liang et al. (2012) discovered that paternal emotion coaching and dysregulation influence emotional expression and indirectly affect children' s social competence. Thus, investigating the relationships between different types of parental meta-emotion philosophies and adolescent problem behaviors—particularly internalizing and externalizing problems—within Eastern cultural contexts holds significant implications for promoting adolescents' emotion regulation and social competence.

Adolescents' physiological factors constitute internal mechanisms underlying problem behavior development. The autonomic nervous system, as a crucial physiological regulatory system, contributes to maladaptive social functioning when dysfunctional (Raine, 2002). Polyvagal theory posits that the vagus nerve, as a primary component of the autonomic nervous system, relates to individuals' social behaviors (Porges, 2007). Perry et al. (2014) found that higher vagal tone and vagal suppression at age three negatively predicted later externalizing problems, demonstrating the importance of early physiological regulation for subsequent development. Neuhaus, Bernier, and Beauchaine (2014) reported that high vagal tone associated with better social functioning and fewer inter-

nalizing problems. These findings suggest that high vagal tone and substantial vagal withdrawal during tasks represent relatively adaptive responses negatively related to problem behaviors. However, some studies have failed to find correlations between vagal tone and problem behaviors (Utendale, Nuselovici, Saint-Pierre, Hubert, Chochol, & Hastings, 2014), and debates persist regarding the relationship between vagal suppression and problem behaviors (Hinnant & El-Sheikh, 2009; Utendale et al., 2014; Shanahan, Calkins, Keane, Kelleher, & Suffness, 2014). Some researchers propose that only optimal levels of vagal tone and vagal suppression promote positive behavioral outcomes (Kogan et al., 2014). The complexity of the relationship between vagal function and problem behaviors varies across participant characteristics and research methodologies. Moreover, vagal function as a risk factor may require interaction with other factors to produce problem behaviors (El-Sheikh, 2005; Hastings & De, 2008). The role of vagal function in the relationship between parental meta-emotion philosophy and problem behaviors requires further verification.

Existing research has confirmed the moderating role of vagal function between parental factors and individual adjustment. Katz and Gottman (1995) found that for children with low vagal tone, marital conflict positively predicted externalizing problems, whereas no significant relationship existed for children with high vagal tone, indicating that higher vagal tone buffers the adverse effects of marital conflict. Van der Graaff et al. (2016) reported that for girls with low vagal tone, poor parent-adolescent relationship quality predicted more externalizing problems, whereas relationship quality did not predict externalizing problems for girls with high vagal tone. These findings suggest that high vagal tone and vagal suppression represent effective physiological regulation and protective effects for individuals exposed to high-risk parental factors. Therefore, examining the moderating role of vagal function in the relationship between parental meta-emotion philosophy and adolescent problem behaviors represents a central focus of this study.

In summary, this study investigates the relationships among parental meta-emotion philosophy, vagal function, and adolescent problem behaviors, proposing the following hypotheses: (1) Parental meta-emotion philosophy significantly predicts adolescent problem behaviors. (2) Adolescents' vagal function predicts internalizing and externalizing problems. (3) Adolescents' vagal function moderates the relationship between parental meta-emotion philosophy and adolescent problem behaviors.

Method

Participants

A total of 277 parent-adolescent dyads from grades 7-9 at a middle school in Yinchuan were randomly selected to participate voluntarily. Due to incomplete questionnaires and invalid physiological data, the final sample comprised 224 dyads from single-child families, including 116 boys and 108 girls. Adolescents

ranged from 12 to 14 years old (M = 12.84, SD = 0.76). Maternal education included 91 with junior high school or below, 70 with high school, and 63 with university or higher; paternal education included 84 with junior high school or below, 68 with high school, and 72 with university or higher. Participants were instructed to avoid tea and caffeinated beverages on the day of testing, refrain from strenuous exercise before the experiment, and all were right-handed with normal vision, no congenital physiological defects, and no cold symptoms.

Measures and Apparatus

Measurement Instruments Parental Meta-Emotion Philosophy. The Parental Meta-Emotion Philosophy Scale (PMEPS) developed by Taiwanese scholars Ye, Zheng, and Yang (2005) was used to assess parental meta-emotion philosophy. This 42-item scale comprises four subscales: emotion coaching (15 items), non-involvement (12 items), emotion dismissing (7 items), and emotion dysregulation (8 items), rated on a 6-point Likert scale from 1 (completely disagree) to 6 (completely agree), completed separately by mothers and fathers. The scale has demonstrated good reliability and validity in Chinese samples (Liang et al., 2011, 2012, 2016). In the present study, Cronbach' s α for the maternal total scale was 0.72, with subscale α values of 0.86, 0.76, 0.65, and 0.84 for emotion coaching, non-involvement, dismissing, and dysregulation, respectively. For the paternal scale, total α was 0.73, with subscale α values of 0.81, 0.77, 0.67, and 0.79.

Adolescent Problem Behaviors. The Youth Self-Report (YSR) developed by Achenbach and Edelbrock (1987) was used to assess adolescent problem behaviors. This 112-item scale includes eight subscales: anxious/depressed, withdrawn, somatic complaints, social problems, thought problems, attention problems, delinquent behavior, and aggressive behavior, rated on a 3-point scale based on the past six months (0 = not true, 1 = somewhat true, 2 = very true). The scale demonstrates good reliability and validity for assessing problem behaviors in 12-18-year-olds (Liu et al., 1997). The anxious/depressed, withdrawn, and somatic complaints subscales combine to form internalizing problems, while delinquent behavior and aggressive behavior form externalizing problems. This study used 53 items from these five subscales to measure internalizing and externalizing problems, with Cronbach' s α values of 0.78 and 0.72, respectively.

Apparatus A Biopac MP150 (16-channel) physiological polygraph recorded heart rate and respiration. The system consists of a main unit, amplifiers, and transducers. This experiment utilized ECG100C cardiac amplifiers and RSP100C respiratory amplifiers, two LEAD100S shielded cables, one LEAD100D unshielded cable, one TSD201 respiratory belt, and disposable medical electrodes. A Dell desktop computer presented experimental stimuli, while a Dell laptop running AcqKnowledge 4.3 software recorded physiological waveforms.

Procedure

Physiological Measurement Physiological data were collected in an unused classroom at a middle school in Yinchuan, partitioned into an experimenter control room and participant testing room. The testing room contained a chair and a Dell desktop computer positioned 1m in front of the chair for stimulus presentation, while the control room housed the Dell laptop connected to the physiological recorder.

Upon arrival, participants sat naturally while the experimenter attached physiological sensors. After the experimenter returned to the control room, participants acclimated for 1 minute before the formal experiment began. The experiment comprised two phases: (1) Baseline phase: 12 neutral images from the Chinese Affective Picture System (Bai, Ma, Huang, & Luo, 2005) were presented automatically via PowerPoint while baseline data were collected for 180 seconds; (2) Task phase: A mental arithmetic task requiring continuous subtraction was administered while task data were collected for 180 seconds. The mental arithmetic task was adapted from the Trier Social Stress Test (TSST) and consisted of three sets of four-digit minus two-digit problems, balanced across two PowerPoint presentation versions (A/B) differing only in subtraction problem order. The entire experiment lasted approximately 9 minutes.

Questionnaire Administration Following physiological measurement, adolescents completed the YSR immediately. During a parent-teacher conference (approximately one week after physiological data collection), experimenters distributed two copies of the PMEPS to parents, explaining instructions. One copy was completed on-site by attending parents, while the other was taken home for completion by the absent parent and returned by the student the following day.

Data Analysis

AcqKnowledge 4.3 software conducted offline physiological data analysis. Respiratory sinus arrhythmia (RSA) refers to rhythmic heart rate fluctuations associated with respiratory cycles. Simultaneous respiration and heart rate data were collected, and RSA was calculated using the built-in peak-to-valley method, which computes interbeat interval (IBI, in milliseconds) changes per respiratory cycle. Initial RSA values were natural log-transformed ($\ln[ms^2]$), then averaged across the baseline (180s) and task (180s) periods. Vagal suppression was calculated as baseline RSA minus task RSA. The study examined baseline RSA (baseline vagal tone) and RSA suppression (vagal suppression) as indicators of vagal function. Physiological and questionnaire data were imported into SPSS 20.0 for statistical analysis.

Results

Differences in Vagal Activity Across Experimental Phases

A paired-samples t-test examined differences in vagal activity across experimental phases. Results appear in Table 1 .

Table 1 Differences in Vagal Activity Across Experimental Phases (M±SD)

Vagal Activity	RSA (ln[ms^2])
Baseline	8.04$±1.03||Task|7.69±$1.12
t	8.57***

Note: $p < 0.05$, $\boldsymbol{p < 0.01}$, p < 0.001; RSA: respiratory sinus arrhythmia

Table 1 shows that RSA levels during the task phase were significantly lower than during baseline, indicating significant vagal suppression under task conditions.

Correlations Among Parental Meta-Emotion Philosophy, Vagal Function, and Problem Behaviors

Correlations among study variables appear in Table 2 .

Table 2 Correlations Among Parental Meta-Emotion Philosophy, Vagal Function, and Problem Behaviors

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Maternal Emotion Coaching	65.46	12.80	1												
2. Maternal Non-involvement	37.00	8.95	-0.17*	1											
3. Maternal Emotion Dysregulation	24.49	5.31	-0.31***	0.24**	1										

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
4. Paternal Emotion Coaching	62.36	10.96	0.47***	-0.25***	-0.30***	1									
5. Paternal Non-involvement	36.53	8.86	-0.22**	0.58***	0.21***	1									
6. Paternal Emotion Dysregulation	24.78	5.51	-0.20**	0.20***	0.46***	0.23***	1								
7. Baseline RSA	8.04	1.03	0.32***	-0.25***	-0.33***	0.29***	0.22***	-0.16*	1						
8. RSA Suppression	0.35	0.51	0.21**	-0.20**	-0.22**	0.13*	0.19***	-0.15*	0.51***	1					
9. Internalizing Problems	8.23	4.53	-0.33***	0.25***	0.37***	-0.30***	0.21***	0.29***	-0.22***	-0.15*	1				
10. Externalizing Problems	12.25	6.34	-0.31***	0.33***	0.47***	-0.25***	0.21***	0.38***	-0.23***	-0.15*	0.46***	1			

Note: $p < 0.05$, ***p < 0.01,*** p < 0.001; RSA Suppression = Baseline RSA - Task RSA

Table 2 shows that maternal emotion coaching correlated negatively with internalizing and externalizing problems, maternal non-involvement correlated positively with externalizing problems, and maternal emotion dysregulation corre-

lated positively with both problem types. Paternal emotion coaching correlated negatively with internalizing problems, while paternal emotion dysregulation correlated positively with externalizing problems. Both baseline RSA and RSA suppression correlated negatively with externalizing problems.

Maternal Meta-Emotion Philosophy, Baseline Vagal Tone, and Adolescent Problem Behaviors

Multiple linear regression analyses examined internalizing and externalizing problems as dependent variables, with maternal emotion coaching and emotion dysregulation as independent variables, baseline RSA as a moderator, and gender and age as control variables. Results appear in Table 3 .

Table 3 Regression Analysis of Maternal Meta-Emotion Philosophy, Baseline Vagal Tone, and Adolescent Problem Behaviors

Step	Predictor	Internalizing Problems		Externalizing Problems	
		β	$R^2/\Delta R^2$	β	$R^2/\Delta R^2$
Step 1	Gender	-2.31*	0.05	2.01*	0.04
Step 2	Emotion Coaching	-2.37*	0.15***	-2.34*	0.18***
	Non-involvement			1.98*	
	Emotion Dysregulation	2.89**		2.02*	
	Baseline RSA	5.38***		5.65***	
Step 3	Emotion Coaching × Baseline RSA	3.84***	0.01	-2.87**	0.03**
	Non-involvement × Baseline RSA			-2.26*	
	Emotion Dysregulation × Baseline RSA			2.02*	

Note: $p < 0.05$, $\boldsymbol{p < 0.01}$, $p < 0.001$

For internalizing problems, maternal emotion coaching and emotion dysregulation showed significant regression coefficients, indicating that maternal emotion coaching negatively predicted and maternal emotion dysregulation positively predicted adolescent internalizing problems. However, the interaction terms were not significant. For externalizing problems, maternal emotion coaching, non-involvement, emotion dysregulation, and baseline RSA showed significant coefficients, indicating that maternal emotion coaching and baseline RSA negatively predicted externalizing problems, while non-involvement and emotion dysregulation positively predicted them. The interaction between maternal non-involvement and baseline RSA was significant, suggesting that baseline RSA moderates the relationship between maternal non-involvement and adolescent externalizing problems. To clarify this moderation effect, baseline RSA was split into high and low groups ($±$1 SD) for simple slopes analysis, presented in Figure 1 [Figure 1: see original paper].

Figure 1 Moderating Effect of Baseline RSA on the Relationship Between Maternal Non-involvement and Externalizing Problems

Figure 1 shows that when adolescents had low vagal tone, maternal non-involvement significantly positively predicted externalizing problems ($\beta = 1.73$, $p < 0.001$). When adolescents had high vagal tone, this relationship was not significant ($\beta = 0.11$, $p = 0.788$).

Paternal Meta-Emotion Philosophy, Baseline Vagal Tone, and Adolescent Problem Behaviors

Multiple linear regression analyses examined paternal emotion coaching and emotion dysregulation as predictors, with baseline RSA as a moderator. Results appear in Table 4 .

Table 4 Regression Analysis of Paternal Meta-Emotion Philosophy, Baseline Vagal Tone, and Adolescent Problem Behaviors

Step	Predictor	Internalizing Problems		Externalizing Problems	
		β	$R^2/\Delta R^2$		$R^2/\Delta R^2$
Step 1	Gender	-2.31*	0.05	2.01*	0.04
Step 2	Emotion Coaching	-2.09*	0.08**		
	Emotion Dysregulation			2.80**	0.12***
	Baseline RSA	2.51*		4.53**	

Step	Predictor	Internalizing Problems	Externalizing Problems	
Step 3	Emotion Coaching × Baseline RSA	0.05	0.00-2.11*	0.02*
	Emotion Dysregulation × Baseline RSA		0.08	

Note: $p < 0.05$, $\boldsymbol{p < 0.01}$, $p < 0.001$

For internalizing problems, paternal emotion coaching significantly negatively predicted problems, but the interaction with baseline RSA was not significant. For externalizing problems, paternal emotion dysregulation significantly positively predicted problems, though its interaction with baseline RSA was not significant.

Maternal Meta-Emotion Philosophy, Vagal Suppression, and Adolescent Problem Behaviors

Multiple linear regression analyses examined maternal emotion coaching and emotion dysregulation as predictors, with RSA suppression as a moderator. Results appear in Table 5 .

Table 5 Regression Analysis of Maternal Meta-Emotion Philosophy, Vagal Suppression, and Adolescent Problem Behaviors

Step	Predictor	Internalizing Problems		Externalizing Problems	
		β	$R^2/\Delta R^2$		$R^2/\Delta R^2$
Step 1	Gender	-2.31*	0.05	2.01*	0.04
Step 2	Emotion Coaching	-2.30*	0.15***	-1.98*	0.18***
	Non-involvement			2.03*	
	Emotion Dysregulation	2.98**		2.27*	
	RSA Suppression	5.49***		5.58***	

Step	Predictor	Internalizing Problems	Externalizing Problems	
Step 3	Emotion Coaching × RSA Suppression		0.01-2.79**	0.04***
	Non-involvement × RSA Suppression			
	Emotion Dysregulation × RSA Suppression	-2.85**	-3.44***	

Note: $p < 0.05$, ***p < 0.01,*** $p < 0.001$

For internalizing problems, the interaction between maternal emotion dysregulation and RSA suppression was significant, indicating that vagal suppression moderates this relationship. For externalizing problems, RSA suppression negatively predicted problems, and the interaction between maternal emotion dysregulation and RSA suppression was significant. Simple slopes analysis, conducted after splitting RSA suppression into high and low groups ($±$1 SD), appears in Figures 2 [Figure 2: see original paper] and 3 [Figure 3: see original paper].

Figure 2 Moderating Effect of Vagal Suppression on the Relationship Between Maternal Emotion Dysregulation and Internalizing Problems

Figure 2 shows that when adolescents had low vagal suppression, maternal emotion dysregulation significantly positively predicted internalizing problems (β = 2.69, $p < 0.001$). When adolescents had high vagal suppression, this relationship was not significant (β = -0.09, $p = 0.894$).

Figure 3 Moderating Effect of Vagal Suppression on the Relationship Between Maternal Emotion Dysregulation and Externalizing Problems

Figure 3 shows that when adolescents had low vagal suppression, maternal emotion dysregulation significantly positively predicted externalizing problems (β = 1.95, $p < 0.001$). When adolescents had high vagal suppression, this relationship was not significant (β = -0.30, $p = 0.510$).

Paternal Meta-Emotion Philosophy, Vagal Suppression, and Adolescent Problem Behaviors

Multiple linear regression analyses examined paternal predictors with RSA suppression as a moderator. Results appear in Table 6 .

Table 6 Regression Analysis of Paternal Meta-Emotion Philosophy, Vagal Suppression, and Adolescent Problem Behaviors

Step	Predictor	Internalizing Problems		Externalizing Problems	
		β	$R^2/\Delta R^2$		$R^2/\Delta R^2$
Step 1	Gender	-2.31*	0.05	2.01*	0.04
Step 2	Emotion Coaching	-2.12*	0.08**		
	Emotion Dysregulation			3.30**	0.12***
	RSA Suppression	2.62*		5.33***	
Step 3	Emotion Coaching × RSA Suppression		0.00	-2.73**	0.02*
	Emotion Dysregulation × RSA Suppression			-2.44*	

Note: $p < 0.05$, $\boldsymbol{p < 0.01}$, $p < 0.001$

For internalizing problems, the interaction between paternal emotion coaching and RSA suppression was not significant. For externalizing problems, the interaction between paternal emotion dysregulation and RSA suppression was significant, indicating that vagal suppression moderates this relationship. Simple slopes analysis appears in Figure 4 [Figure 4: see original paper].

Figure 4 Moderating Effect of Vagal Suppression on the Relationship Between Paternal Emotion Dysregulation and Externalizing Problems

Figure 4 shows that when adolescents had low vagal suppression, paternal emotion dysregulation significantly positively predicted externalizing problems ($\beta = 1.62$, $p < 0.001$). When adolescents had high vagal suppression, this relationship was not significant ($\beta = 0.21$, $p = 0.628$).

Discussion

Relationship Between Parental Meta-Emotion Philosophy and Adolescent Problem Behaviors

Research demonstrates that when parents endorse high levels of emotion coaching, children exhibit effective emotion regulation, problem-solving skills, prosocial behavior, and fewer health problems (Gottman et al., 1996; Katz & Windecker-Nelson, 2004; Ye et al., 2005). Paternal emotion coaching correlates positively with children' s emotion regulation, prosocial behavior, and social competence (Stover, 2003). When fathers respect and attend to children' s negative emotions while providing guidance, children develop superior emotional and behavioral regulation capacities, thereby inhibiting problem behaviors (Grossman, Kindler, & Strasser, 2003; Parke, 2002). The current findings indicate that maternal emotion coaching significantly negatively predicted both internalizing and externalizing problems, whereas paternal emotion coaching significantly negatively predicted only internalizing problems. Combined with previous research, this suggests that mothers with high emotion coaching may more sensitively detect and respect children' s negative emotional reactions, thereby influencing problem behavior development, while paternal emotion coaching may exert more unique effects on adolescent behavioral development.

Emotion dysregulation represents a maladaptive parental meta-emotion philosophy that negatively impacts adolescent social competence development (Liang et al., 2012), with maternal emotion dysregulation significantly correlating with children' s anger-aggression and anxiety-withdrawal behaviors (Liang et al., 2016). This study found that maternal emotion dysregulation significantly positively predicted both internalizing and externalizing problems, while paternal emotion dysregulation significantly positively predicted only externalizing problems. This indicates that when parents endorse high emotion dysregulation, they become highly sensitive yet reactive to children' s negative emotions, often displaying dysregulated responses and inappropriate behaviors. Under such conditions, children' s negative emotions receive inadequate guidance and concern, leaving them unable to understand the origins of their emotions or develop effective coping strategies, thereby precipitating emotional and behavioral problems.

Non-involvement philosophy represents a meta-emotion philosophy unique to Chinese parents, with complex and context-dependent effects on development. Adolescence constitutes a critical period for emotional development, characterized by emotional instability and immature regulation capacities, necessitating parental support for effective emotion management. This study found that maternal non-involvement significantly positively predicted externalizing problems, whereas paternal non-involvement showed no significant relationship with problem behaviors. These findings diverge somewhat from previous research, possibly reflecting the Eastern cultural context where mothers assume primary caregiving responsibilities while fathers spend less time with children.

Interestingly, this study found no significant relationship between parental emo-

tion dismissing philosophy and adolescent problem behaviors, contrasting with Western research (Lagacé-Séguin & Coplan, 2005; Lunkenheimer et al., 2007). Parents high in emotion dismissing often deny children' s negative emotional experiences, demand rapid elimination of these emotions, and may even punish emotional expression. This philosophy impairs normal emotional expression and adversely affects problem-solving, social competence, and emotional capacities (Gottman, Katz, & Hooven, 1997). However, Western cultures emphasize individual expression and emotional display (Soto, Perez, Kim, Lee, & Minnick, 2011), whereas Chinese culture emphasizes harmony and collective welfare over individual feelings. Chinese parents encourage emotional restraint and believe that controlling personal emotions facilitates social integration (Chen & French, 2008; Hu et al., 2002). Consequently, emotion dismissing philosophy may align with Chinese cultural values and thus not necessarily impair individual adjustment.

Relationship Between Vagal Function and Problem Behaviors

This study found that both vagal tone and vagal suppression significantly negatively predicted adolescent externalizing problems, such that higher vagal tone and greater vagal suppression associated with fewer externalizing problems, consistent with previous research (Graziano & Derefinko, 2013; Perry et al., 2014). Individuals with relatively high vagal suppression exhibit rapid vagal recovery (Brosschot & Thayer, 1998; Porges, 2007), facilitating the development of attentional control, executive function, emotion regulation, and behavioral regulation (Gottman & Katz, 2002; Marcovitch et al., 2010; Zhang, Wang, You, Lü, & Luo, 2015), thereby positively influencing problem behaviors (Calkins & Fox, 2002; Eisenberg et al., 2009; Gilliom & Shaw, 2004).

This study found no relationship between vagal function and internalizing problems, suggesting that the relationship between vagal function and problem behaviors, particularly internalizing problems, may be moderated by multiple factors.

Moderating Role of Vagal Function

Vagal tone significantly moderated the relationship between maternal non-involvement and adolescent externalizing problems. Simple slopes analysis revealed that when adolescents had low vagal tone, higher maternal non-involvement predicted more externalizing problems, whereas this relationship was not significant for adolescents with high vagal tone. High vagal tone represents effective physiological regulation that not only directly influences emotional and behavioral regulation but also serves a protective function against family risk factors (Van der Graaff et al., 2016). Mothers high in non-involvement show limited attention to children' s negative emotions. When children lack adequate self-regulation capacities to manage their emotions effectively, maternal non-involvement may exert detrimental effects, precipitating problem behaviors. The association between parental emotional socialization

and adjustment outcomes is stronger for children with low vagal tone, indicating that parents exert greater influence on low vagal tone individuals (Hastings et al., 2008).

Vagal suppression moderated the relationship between maternal emotion dysregulation and both internalizing and externalizing problems, as well as the relationship between paternal emotion dysregulation and externalizing problems. Simple slopes analysis indicated that when adolescents had low vagal suppression, maternal emotion dysregulation significantly predicted both problem types, whereas this relationship was not significant for adolescents with high vagal suppression. Similarly, when adolescents had low vagal suppression, paternal emotion dysregulation significantly predicted externalizing problems, but not for those with high vagal suppression. Research demonstrates that high vagal suppression protects individual adjustment under family risk conditions (McLaughlin, Alves, & Sheridan, 2014; Perry et al., 2012). Thus, high vagal suppression buffers the effects of parental emotion dysregulation, serving a protective function for development.

Conclusions

(1) Parental meta-emotion philosophy predicts adolescent problem behaviors: maternal emotion coaching negatively predicts both internalizing and externalizing problems; maternal emotion dysregulation positively predicts both problem types; maternal non-involvement positively predicts externalizing problems; paternal emotion coaching negatively predicts internalizing problems; and paternal emotion dysregulation positively predicts externalizing problems. (2) The effects of parental meta-emotion philosophy on adolescent problem behaviors are moderated by vagal function: when adolescents have low vagal tone, greater maternal non-involvement predicts more externalizing problems; when adolescents have low vagal suppression, greater maternal emotion dysregulation predicts more internalizing and externalizing problems, and greater paternal emotion dysregulation predicts more externalizing problems.

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Appendices

Parental Meta-Emotion Philosophy Scale

Instructions: Your age: ( ) Your occupation: ( ) Your relationship to the child: Father Mother Your education: Elementary school or below Junior high school High school University Graduate school or above Child' s primary caregiver: Parents Grandparents (paternal) Grandparents (maternal)

When your child becomes angry or sad, how do you react and interact with them? The following statements describe various parenting attitudes. There are no right or wrong answers. Please indicate the number that best reflects your actual situation. The numbers represent the degree of agreement with each statement. Please respond based on your actual circumstances. Choose only one answer per question. Please ensure you do not skip questions or misalign your responses.

12. I constantly remind myself to pay attention to my child' s angry or sad emotional reactions.
13. I believe that not interfering with my child' s angry or sad emotions is the proper behavior for a parent.
14. I think my child' s anger or sadness can be viewed as a beneficial life experience.
15. I remind myself that I must fully understand the reasons for my child' s anger or sadness before reacting.
16. I believe that when my child is angry or sad, it doesn' t really matter what I do.
17. When my child is angry or sad, I discuss the reasons for their anger or sadness with them.
18. I believe that children inevitably get angry or sad, so there' s no need to take it too seriously.
19. I do not intervene when my child is angry.
20. I often regret how I handle my child' s anger or sadness.

21. I can understand my child better through their experiences of anger or sadness.
22. I feel that when my child gets angry or sad, they are just taking things too seriously.
23. I teach my child to think about other things to distract them from their anger or sadness.
24. I believe there' s nothing noteworthy about my child' s anger or sadness because they are still young.
25. I believe children must face angry or sad events themselves, and I cannot help.
26. When my child is angry or sad, I can understand what they are angry or sad about.

Achenbach Youth Self-Report

Instructions: The following statements describe yourself. Please indicate your experiences over the past six months. If you clearly or frequently exhibit this behavior, select 2; if you mildly or sometimes exhibit this behavior, select 1; if you never exhibit this behavior, select 0. Please do not overthink your responses. Mark your selection with a "√" in the box.

Scale: 0 = Not true 1 = Sometimes true 2 = Often true

1. I act immature for my age
2. I have allergy symptoms
3. I argue frequently
4. I have asthma
5. I act like the opposite sex
6. I like animals
7. I brag or boast
8. I cannot concentrate or sustain attention
9. I cannot stop thinking about certain things
10. I am restless or overactive
11. I am overly dependent on adults
12. I feel lonely
13. I feel confused or muddled
14. I cry or scream often
15. I am quite honest
16. I am harsh toward others
17. I daydream or space out often
18. I intentionally hurt myself or attempted suicide
19. I need constant attention from others
20. I destroy my own belongings
21. I destroy others' belongings

22. I disobey my parents
23. I disobey at school
24. I refuse to eat properly
25. I don’ t get along with other youth
26. I don’ t feel guilty after misbehaving
27. I am jealous of others
28. I am willing to help others when they need it
29. I am afraid of certain animals, situations, or places (excluding school)
30. I am afraid of going to school
31. I am afraid of having bad thoughts or doing bad things
32. I feel I must be perfect
33. I feel no one likes me
34. I feel others are deliberately teasing me
35. I feel worthless or have low self-esteem
36. I frequently get physically injured or have accidents
37. I fight frequently
38. I am often teased by others
39. I associate with troublemaking children
40. I hear sounds that aren’ t really there
41. I act impulsively without thinking
42. I prefer to be alone
43. I lie or cheat
44. I bite my nails
45. I am nervous, easily excited, or tense
46. I have tense movements or body tics
47. I have nightmares
48. I am disliked by other children
49. I do certain things better than other children
50. I am excessively fearful or worried
51. I feel dizzy
52. I feel excessive guilt
53. I eat too much
54. I feel overly tired
55. I am overweight
56. Unexplained physical symptoms:

    a. Pain (excluding headaches)
    b. Nausea
    c. Eye problems
    d. Rashes or other skin conditions
    e. Stomach pain

57. I physically attack others
58. I pick my nose, skin, or other body parts
59. I can be very friendly
60. I like to try new things
61. I have poor schoolwork

62. I am uncoordinated or clumsy
63. I prefer to be with older children
64. I prefer to be with younger children
65. I refuse to talk to people
66. I repeat certain actions over and over
67. I run away from home
68. I scream frequently
69. I keep secrets and don' t share things
70. I see things that aren' t really there
71. I easily feel embarrassed or unnatural
72. I set fires
73. I am good at hands-on activities
74. I often show off or act silly
75. I am very shy
76. I sleep less than most children
77. I sleep more than most children (day and/or night) - specify how much more
78. I have a rich imagination
79. I have speech problems (e.g., stuttering)
80. I stand up for my rights
81. I steal at home
82. I steal outside the home
83. I collect things I don' t need (excluding hobbies like stamp collecting)
84. I do things that others find strange (not mentioned elsewhere)
85. I have strange ideas (not mentioned elsewhere)
86. I am very stubborn
87. My emotions change suddenly
88. I enjoy being with others
89. I am suspicious
90. I curse or use foul language
91. I have thought about suicide
92. I like to make others laugh
93. I talk too much
94. I often tease others
95. I have a bad temper
96. I think about sex too much
97. I threaten to hurt others
98. I like to help others
99. I demand excessive neatness and cleanliness
100. I sleep poorly
101. I skip school or cut classes
102. I lack energy
103. I feel gloomy, sad, or depressed
104. I am noisier than other children
105. I drink alcohol or use addictive drugs
106. I try to treat people fairly

107. I enjoy listening to jokes
108. I like to take things as they come
109. I try to help others within my ability
110. I wish I were the opposite sex
111. I avoid close relationships with others
112. I am full of worries

Please write about any problems with your feelings, behaviors, and interests not mentioned above:

Author Contribution Statement

HE Xiaoli and YUAN Xiaolong: Conceptualized the study and designed the research protocol;
YUAN Xiaolong, HU Ming, and ZHOU Lichen: Conducted the experiment;
YUAN Xiaolong and HU Ming: Collected, cleaned, and analyzed the data;
YUAN Xiaolong and HE Xiaoli: Drafted the manuscript;
HE Xiaoli, HU Ming, and ZHOU Lichen: Revised the manuscript;
HE Xiaoli and HU Ming: Revised the final version.

Co-first authors: HE Xiaoli, YUAN Xiaolong
Second author: HU Ming
Third author: ZHOU Lichen

Note: Figure translations are in progress. See original paper for figures.