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Maternal Worry Socialization and Toddler Inhibited Temperament: Transactional Associations and Stability across Time

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Abstract
Caregiver socialization of child emotions has consequences for both typical development and anxiety risk, with caregivers' non-supportive responses to *worry* perhaps especially salient to children's anxiety development. Children, in turn, impact the caregiving environment they receive through their temperament. We investigated transactional relations between maternal non-supportive responses to child worry (mother-reported) and two differently-measured child inhibited temperament indices (i.e., mother-perceived child inhibition to novelty, laboratory-observed child dysregulated fear) in a sample of 136 predominantly non-Hispanic, White mother-toddler dyads. Worry socialization and mother-reported inhibition to novelty were measured at each of three time points (toddler age 2, 3, 4 years), and dysregulated fear was measured at ages 2 and 3. Constructs showed stability across time, with effect sizes ranging from medium to large. Child inhibited temperament measures positively correlated within time point at ages 2 and 3, and laboratory-observed child dysregulated fear predicted mothers' later perceptions of their children's inhibition to novelty. At toddler age 2, mothers of children showing more dysregulated fear reported responding more non-supportively to worry. However, when controlling for one another, *more* mother-perceived child inhibition to novelty and *less* laboratory-observed child dysregulated fear at age 3 predicted mothers' greater non-supportive worry responses at child age 4. There was an indirect effect across time, such that children's greater laboratory-observed dysregulated fear predicted their mothers' heightened perceptions of inhibited temperament, which in turn predicted mothers' greater non-supportive worry responses. Findings lend support to anxiety-relevant construct stability in toddlerhood, as well as child-elicited, rather than parent-elicited, associations across time.

Keywords Emotion socialization · Worry socialization · Inhibited temperament · Dysregulated fear · Cross-lagged path analysis

Introduction

Caregiver-child interactions are essential to normative child development processes and may also foster child psychopathology risk (Berg-Nielsen et al., 2002). Parents' socialization of children's worry, in particular, may have germane implications for children's anxiety development. Studies devoted to parenting, child development, and psychopathology risk tend to favor examination of how caregivers influence their children's behaviors, socioemotional competencies, and psychological adjustment. Increasingly, however, theory (Dadds & Roth, 2001; Sameroff, 2010) and research (Yan et al., 2018) alike have pointed to the variety of ways in which children, in turn, impact the caregiving environment that they receive. Much of this recent research has focused on *child temperament* as a source of influence. The current study builds upon this foundation and provides an innovative contribution to the child anxiety risk literature by testing a novel model of transactional relations between anxiety-relevant child temperament indices (mother-perceived and laboratory-observed) and maternal worry socialization responses in a sample of mother-toddler dyads across time.

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Child Inhibited Temperament: Inhibition to Novelty and Dysregulated Fear

Inhibited temperament reflects the degree to which children are wary, withdrawn, and fearful when encountering unfamiliar individuals or situations (Kagan et al., 1984). Some level of behavioral inhibition and reticence may be expected when toddlers encounter new contexts; however, children higher in inhibited temperament may become wary more easily, intensely, or consistently than other children (Kagan et al., 1984). This over-arching temperamental index is conceptualized as a biologically-based characteristic observable early in infancy and moderately stable across childhood (Fox et al., 2005; Kagan et al., 1984). Child inhibited temperament heightens anxiety risk, particularly when compounded with certain caregiving environment and contextual factors (Murray et al., 2009). It is robustly predictive of various child anxiety diagnoses (e.g., especially Social Anxiety Disorder) both concurrently and longitudinally (Chronis-Tuscano et al., 2009; Rapee & Coplan, 2010). Children who show higher wariness and reticence towards novel stimuli have heightened risk of developing clinical anxiety, relative to children who readily approach such situations (Murray et al., 2009; Rapee & Coplan, 2010). There are numerous ways to measure inhibited temperament, and we presently use two distinct methods. First, we examine maternal report of child *inhibition to novelty*, characterizing mothers' perceptions of their child's shyness and hesitance when exposed to new people and situations. Second, we use laboratory observations of child *dysregulated fear*. Dysregulated fear denotes a mismatch between situational threat and fear, such that children considered elevated in dysregulated fear show high distress and withdrawal in putatively low-threat contexts (Buss, 2011; Buss et al., 2013). These children seem to represent ~ 15–19% of sampled children (Buss, 2011) and tend to be fearful of new and uncertain, though largely unthreatening, situations, in contrast to peers who may enjoy and engage with such contexts (Buss et al., 2013). Young children's dysregulated fear may be particularly salient to anxiety risk, with some suggestion that it is predictive of elevated generalized and social anxiety symptoms over time, above and beyond traditional inhibited temperament measures (Buss, 2011; Buss et al., 2013, 2021).

Caregiver Emotion Socialization: Non-Supportive Responses to Child Worry

Emotion socialization encompasses the processes by which socialization agents, such as caregivers, impart their values, beliefs, and practices about emotion expressivity and emotion regulation, to others, such as children (Eisenberg et al., 1998; Raval & Walker, 2019). Caregiver socialization of children's emotions is early-emerging (Spinrad et al., 2007) and multifaceted (Morris et al., 2007). Environmentally, caregivers shape their children's emotional development through the overall family emotional climate, caregiver-driven broad discussions about emotions, and in-the-moment responses to emotions expressed by children (Eisenberg et al., 1998). Direct emotion responses, our current focus, occur from infancy onward, with repertoires of caregiver emotion response styles showing stability in toddlerhood (Premo & Kiel, 2014). The use and consequences of caregivers' responses to emotion vary according to the culture in which they are embedded (Raval & Walker, 2019); designations of "supportive" versus "non-supportive" responses have been derived from samples characterized as primarily non-Hispanic White and middle-class, similar to the current sample. On the one hand, caregivers' *supportive* responses to negative emotions may involve comforting their children, encouraging their emotion displays, and helping them problem-solve (Fabes et al., 2002). On the other hand, caregivers may respond to negative emotions with *non-supportive* reactions (Fabes et al., 2002; O'Neal & Magai, 2005), which are of specific focus in the current study. Specifically, caregivers may *punish* emotion displays by scolding their children, reacting harshly (e.g., sending them to their room), or taking away/threatening to take away a privilege (Fabes et al., 2002). Reactions that involve the caregiver *minimizing* the emotion or labelling it as an overreaction (e.g., saying "Oh, it isn't worth crying over, get over it!"), as well as those during which the caregiver themselves becomes *distressed* or upset by the expressed emotion, also fall within the non-supportive emotion socialization domain (Fabes et al., 2002). In predominantly White samples, caregivers' non-supportive responses to children's emotions broadly relate to children's concurrent and later internalizing psychopathology, with non-supportive responses especially emergent for clinically anxious children (Hudson et al., 2008; Hurrell et al., 2015) and contributing to worsened anxiety and depression symptoms (Eisenberg et al., 1999; Luebbe et al., 2011). These findings provide robust evidence that socialization of negative emotions plays a role in child anxiety risk.

Presently, we focus on mothers' responses to toddlers' worry displays. Worry is both a central feature of child clinical anxiety (Kertz & Woodruff-Borden, 2011; Weems et al., 2000) and common in daily experiences of typically developing children (Muris et al., 1998). In fact, up to 30% of children may experience excessive worry, despite not meeting clinical thresholds for anxiety diagnoses (Bell-Dolan et al., 1990). In toddlerhood, worries may correspond to a variety of situations, such as meeting new peers or going to the doctor. Given that (a) children reporting more frequent and

varied worries tend to be more anxious (Muris et al., 1998; Weems et al., 2000) and (b) anxiety symptoms that emerge in toddlerhood are predictive of later anxiety symptoms (Mian et al., 2011), worry in toddlerhood may be a promising focus for elucidating child anxiety risk. As such, the current work relates both inhibition to novelty and dysregulated fear to caregivers' responses to child *worry*. Indeed, functionalist emotion theory highlights how discrete emotions address different goals and elicit unique reactions from others (Campos et al., 1994). Along these lines, a few studies have isolated effects of caregivers' *worry* responses. O'Neal & Magai (2005), for instance, found that parents' non-supportive responses to worry related to adolescents' greater internalizing and externalizing problems. Thus, we derive initial support for the importance of non-supportive worry socialization from the overarching emotion socialization literature, functionalist theory, and limited, though promising, work on worry socialization specifically.

Transactions between Inhibited Temperament and Non-supportive Worry Socialization

Toddler inhibited temperament indices and maternal non-supportive worry socialization responses are likely reciprocally related to one another across time. Emotion socialization, broadly, is well-established as a predictor of children's outcomes, including anxiety and its temperamental correlates (Eisenberg et al., 1998; Morris et al., 2007). We assert that worry socialization may predict change in anxiety risk, whether measured through maternal perceptions of inhibition to novelty or laboratory observations of dysregulated fear.

The literature also offers evidence for child-elicited effects on mothers' emotion socialization. Having a toddler who shows excessive inhibition, withdrawal, and fear in new situations may prime mothers' non-supportive responses to worry. These children may be prone to expressing more fears and worries, thereby potentially providing more opportunities for worry socialization, relative to other children. Moreover, temperamentally inhibited children may elicit more *non-supportive* socialization responses, specifically. Caregivers of anxious children are often tasked with providing frequent reassurance and help to their child, the act of which can become demanding and taxing over time (Dadds & Roth, 2001). Mothers' frustrations with their child's unremitting, multifaceted worries may preempt more punitive, minimizing, and distressed responses. Indeed, some research has substantiated these links. In one study, anxious toddlers had mothers who provided consistently anxious, concerned (i.e., *distressed*) responses to their child's withdrawal (Hastings et al., 2018). In another, mothers were more prone to child-focused worry when their child was temperamentally inhibited (Bryan & Dix, 2009). Pertinently, we recently examined predictors of mothers' worry socialization responses one year later in this sample (Kiel et al., 2020). We found that toddler dysregulated fear positively predicted mothers' minimizing responses to worry, even after accounting for concurrent anger socialization, earlier worry socialization, maternal anxiety, and toddler shyness. However, neither dysregulated fear, nor shyness, predicted mothers' punishing or distressed responses. Notably, toddler shyness did not predict mothers' non-supportive emotion socialization when accounting for the other maternal and child factors. Collectively, precedent from this work and broader literature suggests that child inhibited temperament may indeed contribute to mothers' non-supportive worry socialization practices. Of note, the current study's contribution is unique from the recent study using the same sample in that it broadly examines non-supportive worry socialization, focuses on maternal perceptions of inhibition to novelty rather than shyness (using a different questionnaire), and tests for bidirectional transactional relations between mothers and toddlers, rather than only testing predictors of mothers' worry socialization practices.

In addition to unidirectional parent-to-child and child-to-parent effects, developmental and anxiety-specific theories focused on parent-child interactions suggest bidirectional effects between parents and children. The unified theory of development (Sameroff, 2010) posits that children and parents engage in dynamic and reciprocally influential behavioral interactions across many domains of development. Theory of an anxious-coercive cycle that occurs between anxiety-prone children and their parents delineates a transactional process in which child anxiety and anxiety-relevant parenting reinforce one another across time (Dadds & Roth, 2001). Beyond parent-child interactions themselves, it is also possible that genetic predispositions shared between parents and their children, as well as non-parenting shared environmental factors (e.g., socioeconomic status [SES]), contribute to parent-child behaviors (Deater-Deckard & O'Connor, 2000; Paschall & Mastergeorge, 2016).

Moreover, the current work derives support from theoretical models of (a) affective processes in parenting (Dix, 1991) and (b) parenting-related emotions in parenting (Leerkes & Augustine, 2005). Dix's (1991) model of affective processes in parenting highlights how, during an emotion-activating event, a child's behavior leads to a parent's cognitive appraisal, which then manifests in parental engagement with child. The model by Leerkes & Augustine (2005) proposes a cycle in which a child engages in a behavior, the child's behaviors are noticed and interpreted by the parent, the parent clarifies their goals, and the parent

generates, chooses, and engages in a response, which then feeds back into the child's behavior. Each step of the process is informed by numerous factors, including child and parental characteristics. In this way, the Dix (1991) and Leerkes & Augustine (2005) models demarcate a prospective and dynamic sequence of events in parent-child interactions that involve parent emotion and cognition. Based on these theories, we would expect that a child's behavior would predict a parent response through the filter of the parent's perception of the child's behavior. Pertinent to the current study, a mother's perceptions of her child's temperamental characteristics likely partially derive from her child's behaviors (e.g., akin to those observed in the laboratory) and subsequently inform her emotion-relevant behaviors (e.g., responses to worry). Thus, we expected that observed inhibited temperament (here, dysregulated fear) would predict worry socialization through the mechanism of mothers' perceptions of inhibited temperament (i.e., inhibition to novelty).

The Current Study

Given that caregivers and children exert reciprocal influence on one another's behavioral tendencies and functioning, studies on child-caregiver transactional relations across time are critically needed to capture interdependent developmental processes. Such foci are particularly important considering the dual roles of child inhibited temperamental indices and caregiver emotion socialization in predicting children's psychopathology risk. Further, this study prioritized elucidating the unique contributions of mother-perceived versus laboratory-observed child inhibited temperament indices to maternal behaviors to identify whether children's behaviors or mothers' perceptions of said behaviors were more influential in shaping mothers' own caregiving behaviors. The current study applied this transactional framework to assess several anxiety-relevant mother- and child-level constructs in early childhood (3 time points across ages 2–4 years). Specifically, we aimed to characterize relations among mothers' non-supportive responses to child worry, mothers' perceptions of their child's inhibition to novelty, and laboratory observations of child dysregulated fear. We measured mothers' non-supportive worry socialization and perceptions of their child's inhibition to novelty when children were ages 2 years (Time 1 [T1]), 3 years (Time 2 [T2]), and 4 years (Time 3 [T3]). Laboratory observations of child dysregulated fear occurred at T1 and T2, but not T3, given the field's understanding of dysregulated fear as a construct of toddlerhood (Buss, 2011) and our incorporation of this theoretical basis into the larger study. We hypothesized that dysregulated fear, inhibition to novelty, and worry socialization would show stability across time (*Hypothesis 1*) and be positively correlated with one another within time points (*Hypothesis 2*). We also hypothesized bidirectional positive correlations across time, with mothers' worry socialization predicting children's dysregulated fear and inhibition to novelty (*parent-driven effects*, *Hypothesis 3*) and children's dysregulated fear and inhibition to novelty predicting mothers' worry socialization (*child-driven effects*, *Hypothesis 4*), controlling for stability. Finally, we hypothesized that there would be an indirect effect, such that laboratory-observed child dysregulated fear would predict emotion socialization through mother-perceived child inhibited temperament (*Hypothesis 5*). We tested our primary model with mothers' overall non-supportive worry socialization; however, exploratory analyses differentiating among the three types of non-supportive responses (i.e., punitive, minimizing, and distress reactions) are presented in the Supplementary Information.

Method

Participants

The sample comprised 136 mothers and their toddlers who participated at age 2, 3, and 4 years old (41.2% [56] girls). We recruited families from the midwestern United States (U.S.), as part of a larger study and prior to the COVID-19 pandemic. With respect to ethnicity, mothers and toddlers were, respectively, 96.3%/94.1% non-Hispanic/Latinx and 2.2%/4.4% Hispanic/Latinx, with 1.5% of mothers declining to respond. Mothers and toddlers were, respectively, 93.4%/83.8% White, 2.2%/1.5% Asian or Pacific Islander, 1.5%/2.2% Black, and 0.7%/0.0% Native American, with 0.7%/9.6% holding multiple racial identities, 0.7/1.5% identifying as a non-listed race, and 1.5% declining to respond. Families were diverse in SES, with 26.9% of families reporting an annual family income of <$40,000 (*Mean* = $51,000–60,000, *Range* = <$15,000 to >$100,000). Mothers, on average, had 15.65 years of education (*Range* = 9th grade to PhD) and 36.1% of the sample reported having an Associate degree or less.

We recruited families from birth announcements and community offices/programs (e.g., pediatricians' offices, WIC program, farmers' markets). In the larger study, families enrolled in the first or second of the three time points. Children were 24–30 months of age at T1 (M_{age} = 26.78, *SD* = 1.98), 36–42 months at T2 (M_{age} = 39.17, *SD* = 2.86), and 48–54 months at T3 (M_{age} = 51.97, *SD* = 3.61). At T1, T2, and T3, mothers' average ages were, respectively, 32.59 (*SD* = 5.19), 34.03 (*SD* = 5.09), and 34.97 (*SD* = 5.17) years. Inclusion in the current study required participation in at

least two of the three time points, with 41.9% and 58.1% of the included sample having data for two or three time points, respectively. We used a modified accelerated longitudinal design, akin to a planned wave-missing design (Little & Rhemtulla, 2013), to allow for planned missingness to be handled using contemporary statistical approaches. This design resulted in a relatively large sample of families who provided data across a longitudinal period, with 122 (89.71%) families enrolling at T1 and 14 (10.29%) enrolling at T2. Of the sample, 89.0% of the 136 families had data for T1, 94.1% had data for T2, and 75% had data for T3.

Procedure

We obtained institutional research board approval from Miami University's Institutional Review Board for the larger study. Mothers completed mailed consent forms and questionnaires, before participating with their child in an in-person laboratory visit (1.5–3 h, depending on time point). At the time of enrollment (T1 or T2), the questionnaire packet included demographic information questions. Per time point, mothers completed questions about worry socialization and perceptions of their child's inhibited temperament. At T1 and T2 only, mother-child dyads participated in two laboratory tasks relevant to the current study. These laboratory episodes were derived from previous work (Buss, 2011; Buss & Goldsmith, 2000; Nachmias et al., 1996) and coded to provide a measure of observed child dysregulated fear. The 5-min "clown" episode involved a research assistant (RA) dressed up like a clown who interacted with the child and mother. Specifically, she introduced herself, invited the child to play with three toys (i.e., bubbles, beach balls, musical instruments) for 1 min each, and asked the child to help clean up before saying goodbye. In the 4-min "puppet show" episode, an RA sat behind a curtained, wooden stage, controlling two plush animal puppets. The puppets (controlled by the RA) introduced themselves, invited the child to play two 1-min games (i.e., catch, magnetic fishing), and gave the child a sticker. When the puppet show ended, the RA emerged from behind the stage and invited the child to control the puppets. During both tasks, mothers were instructed to behave as they typically would, and tasks were video-recorded for behavioral coding. At all time points, mothers received $50 compensation and a small toy (worth <$5) for their child after their laboratory visit.

Measures

Maternal Worry Socialization (T1, T2, T3)

Mothers responded to the 82-item Coping with Toddlers' Negative Emotions Scale (CTNES; Spinrad et al., 2004) at T1 and T2, as well as the 72-item Coping with Children's Negative Emotions Scale (CCNES; Fabes et al., 1990; Fabes et al., 2002) at T3. The CTNES and CCNES assessed the likelihood that mothers engaged in various responses to their child's negative emotion displays. For both measures, mothers were presented with 12 hypothetical scenarios in which their child expressed a negative emotion. We currently focus on vignettes assessing responses to *worry*, specifically.[1] We identified four and six worry-specific vignettes in the CTNES and CCNES, respectively (see Table S1 in Supplementary Information for list), with mothers rating their likelihood (1 = *Very Unlikely* to 7 = *Very Likely*) of engaging in seven different responses per vignette. For the current study, we focused on three non-supportive response subscales, *Punishing Reactions*, *Minimizing Reactions*, and *Distress Reactions*.

The worry-specific *Punitive Reactions* subscale (T1 $\alpha = 0.67$, T2 $\alpha = 0.62$, T3 $\alpha = 0.74$) encompassed mothers' likelihood of responding to a child's worry by punishing them, scolding them, or threatening the loss of a privilege. The worry-specific *Minimizing Reactions* subscale (T1 $\alpha = 0.73$, T2 $\alpha = 0.68$, T3 $\alpha = 0.76$) denoted mothers' tendencies to minimize or devalue their child's worry. The worry-specific *Distress Reactions* subscale (T1 $\alpha = 0.84$, T2 $\alpha = 0.84$, T3 $\alpha = 0.61$) comprised mothers' tendencies to be very upset by their child's worry. See Table S2 for descriptive statistics of the worry socialization variables per response type. We created an overall non-supportive worry response composite (12 items for CTNES, 18 items for CCNES, T1 $\alpha = 0.75$, T2 $\alpha = 0.79$, T3 $\alpha = 0.84$) per time point by averaging worry-specific *Punitive Reactions*, *Minimizing Reactions*, and *Distress Reactions* subscales together (T1 $rs = 0.09$–0.25, T1 *Mean* $r = .18$, T1 $ps = 0.007$–0.361; T2 $rs = 0.23$–0.38, T2 *Mean* $r = .32$, T2 $ps = \leq 0.001$–0.017; T3 $rs = 0.39$–0.62, T3 *Mean* $r = .52$, T3 $ps \leq 0.001$). We used this method in a recent paper (Kiel et al., 2020) to derive worry-specific socialization vignettes. More broadly, CTNES and CCNES composite creation is consistent with past research (e.g., Gudmundson & Leerkes, 2012; Hurrell et al., 2015; Morelen et al., 2016), and both measures show acceptable

[1] Of note, we identified vignettes that shared common elements of child-expressed worry, fear, and/or temperamental shyness/behavioral inhibition. To retain linguistic conciseness and congruency to Kiel et al., 2020, we refer to these vignettes as "worry-specific," though we acknowledge that this labeling may be imperfect and that these situations also likely often incorporate the other aforementioned elements.

to excellent test-retest and internal reliability and construct validity with respect to emotion-relevant parenting indices (Fabes et al., 2002; Spinrad et al., 2004).

Mother-Perceived Child Inhibited Temperament (T1, T2, T3)

Mothers completed the 5-item *Inhibition to Novelty* subscale (T1 α = 0.81, T2 α = 0.80, T3 α = 0.86) of the 126-item Infant-Toddler Social and Emotional Assessment (ITSEA; Carter et al., 2003) to assess their child's inhibition or wariness towards novelty. Using a 3-point scale (0 = *Not true/Rarely* to 2 = *Very true/Often*), mothers identified how well/often the statements described their child in the past month. The mean of items yielded the final measure. The ITSEA has shown acceptable to excellent test-retest and internal reliability in past studies, as well as construct validity with respect to toddler psychological problems (Carter et al., 2003).

Laboratory-Observed Child Dysregulated Fear (T1, T2)

Using coding definitions established in past research (Kiel & Buss, 2011), an RA team, led by a graduate student, coded the "clown" and "puppet show" episodes to provide a measure of laboratory-observed child dysregulated fear. Per episode, child distress/negative affect (T1 ICCs = 0.82 – 1.00, T2 ICCs = 0.97 – 1.00) was scored on a 5-point scale, encompassing the extent of negative facial expressions and distress vocalizations (1 = *none* to 5 = *distress lasting entire episode, very intense, or resulting in episode termination*). Shyness/withdrawal (T1 ICCs = 0.90–0.93, T2 ICCs = 0.94 – 1.00) was scored on a separate 5-point scale, representing the degree to which each child was reticent towards, withdrew from, or avoided stimulus interactions (1 = *none* to 5 = *high shyness, frequent freezing, avoidant/resistant entire episode*). Following precedent for the measurement of dysregulated fear (Buss, 2011), the distress/negative affect and shyness/withdrawal scores of each episode (4 scores total; T1 across-episode *r*s = 0.37–0.42, *p*s < 0.001; T2 across-episode *r*s = 0.32–0.54, *p*s < 0.001) were averaged together to yield a measure of laboratory-observed dysregulated fear.[2]

Data Analytic Strategy

We conducted a priori power and sensitivity analyses (see Supplementary Information), before examining data missingness patterns and descriptives, as well as bivariate correlations among primary variables. We assessed relations between demographic variables (e.g., child sex, child and

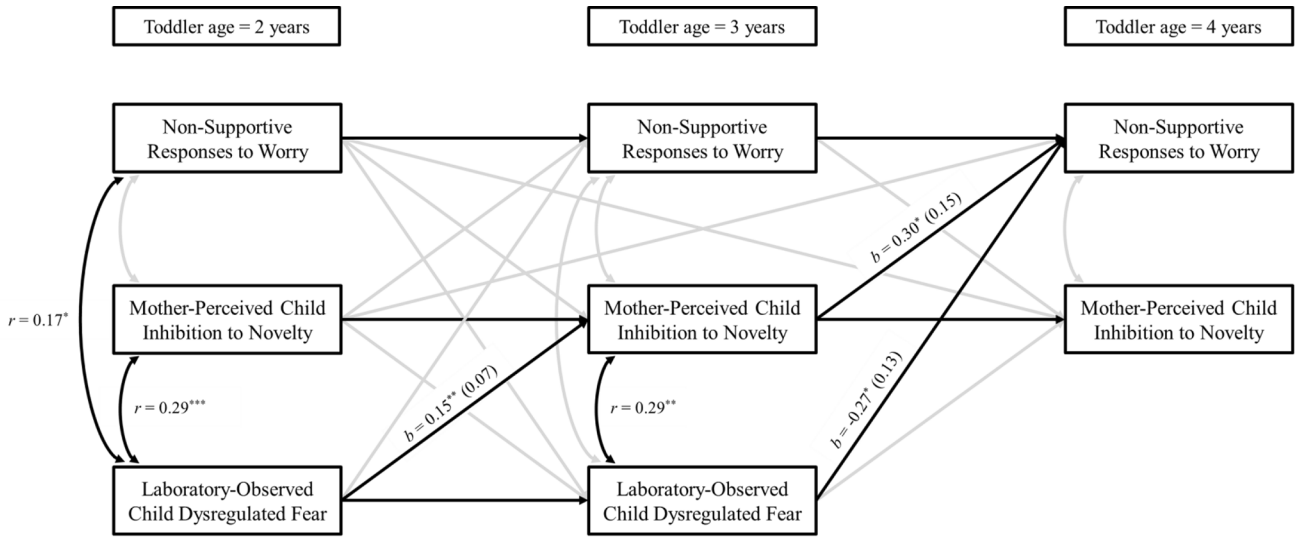

Fig. 1 Primary Path Analysis Model. *Note.* Figure shows the primary path analysis model with transactional relations modeled between mothers' non-supportive responses to child worry, mother-perceived child inhibition to novelty, and laboratory-observed child dysregulated fear. For within time point associations, bivariate correlation coefficients are shown. For across time-point associations, unstandardized path coefficients are shown with standard error estimates in parentheses. Gray lines represent non-significant paths and solid black lines represent statistically significant paths. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

[2] We z-scored dysregulated fear scores and used a 1 *SD* above the mean cut-off to identify that 15.79% (*N* = 18 of 114 participants with dysregulated fear data) and 20.16% (*N* = 25 of 124 participants) of the sample at T1 and T2, respectively, met or exceeded dysregulated fear cutoffs proposed by Buss (2011), suggesting that children with high dysregulated fear scores were well-represented in the sample.

mother age, family SES [i.e., composite of z-scored average of T1-T3 family income and z-scored maternal education]) and dependent variables to determine covariates, as recommended (Miller & Chapman, 2001). For our main analysis, we ran a cross-lagged path analysis model in Mplus v.7.3 (Muthén & Muthén, 2012), using full information maximum likelihood (FIML) estimation to handle missing data (Enders & Bandalos, 2001; Graham, 2009). The model simultaneously estimated stability in constructs, within-time correlations, parent-to-child effects, child-to-parent effects, and indirect effects. That is, T1 and T2 variables were modeled to predict their later measurements at T2 or T3. We tested within-time correlations among non-supportive worry socialization, mother-perceived child inhibition to novelty, laboratory-observed child dysregulated fear at T1 and T2, as well as between non-supportive worry socialization and mother-perceived child inhibition to novelty at T3. Parent-to-child effects included T1 (or T2) non-supportive worry socialization predicting T2 (or T3) child temperament indices. Child-to-parent effects were opposite in direction; T1 and T2 child temperament indices predicted T2 and T3 non-supportive worry socialization. Finally, we tested our hypothesized indirect effect: T1 laboratory-observed child dysregulated fear predicting T3 non-supportive worry socialization through T2 mother-perceived child inhibition to novelty.

Minimally acceptable model fit was identified as non-significant χ^2 values, RMSEA and SRMR values ≤ 0.08, CFI values ≥ 0.90, and TLI values ≥ 0.95. AIC and sample-size adjusted BIC (SABIC) are reported. Confidence intervals (CIs) for indirect effects were estimated using 10,000 bootstrapped samples. For brevity, only statistically significant pathways ($p \leq .05$) and indirect effects (CIs not containing 0) are reported in text. See Table 1; Fig. 1 for the primary model unstandardized path coefficients and standard errors, as well as Figures S1-S3 in the Supplementary Information for supplementary model information and discussion.

Results

Preliminary Analyses

Missing Data

The study design was similar to planned missingness and accelerated longitudinal designs (Graham, 2009), such that not all participants had three time points of data due to rolling recruitment, yet a relatively large sample size was retained. Taken together, 19.12% of final primary variable values were missing, including 3.86% missingness attributable to families starting at T2 and 2.21% missingness due to families participating in T1 and T3, but not T2. Twenty-five participants (18.4%) did not have T1 CTNES, mostly due to beginning the study at a later time point, but also in part because some mothers filled out some, but not all, questionnaires. At T2 and T3, 27 (19.9%) and 42 families (30.9%), respectively, did not have CTNES/CCNES scores and at T1, T2, and T3, 22 (16.2%), 24 (17.6%), and 34 (25%) of families, respectively, did not have the ITSEA, also largely due to attrition and partially-incomplete questionnaire packets. Laboratory-observed dysregulated fear was measured only at T1 and T2, with 16.7% ($N = 22$) and 8.8% ($N = 12$) data missing, mostly due to attrition, as well as some families moving away and completing questionnaire packets, but not laboratory visits. Families who completed two versus three study time points did not significantly differ on any T1 variables, nor did they differ on any demographic characteristics. Little's missing completely at random (MCAR) test suggested that the pattern of missingness did not deviate from a MCAR pattern ($\chi^2[139] = 152.30$, $p = .208$). Missing values were handled by using FIML estimation.

Descriptive Statistics and Bivariate Associations

Variable descriptive statistics and bivariate correlations are presented in Table 1. Scatterplot matrices of bivariate correlations among primary variables are available in Figure S1 of the Supplementary Information. All variables showed reasonable adherence to a normal distribution (|skew| < 2.00, |kurtosis| < 4.00). At a bivariate level and before handling missing data, constructs showed high stability across time ($\beta s = 0.41$–0.68, all $ps \leq 0.001$). Laboratory-observed child dysregulated fear and maternal non-supportive worry socialization were associated in the expected (positive) direction at T1. Inhibition to novelty and dysregulated fear were strongly associated at T2 and between T1 and T2. T2 dysregulated fear related to T3 inhibition to novelty. One across-time parent-to-child association was present, with T1 non-supportive worry socialization correlating with T2 inhibition to novelty. Regarding child-to-parent relations, T1 dysregulated fear was positively associated with T2 non-supportive worry responses.

Child biological sex and age were not related to any primary dependent variable (all $ps > 0.05$), so they were not considered further in analyses. Given the negative associations from family SES and maternal age at child birth to T2 non-supportive worry socialization, we included family SES and maternal age as covariates regressed on T2 non-supportive worry socialization in the primary model. However, model results were highly similar with the inclusion of family SES and maternal age, both of which did not significantly relate to any constructs within the larger model.

Table 1 Descriptive Statistics and Correlations among Primary Variables

Variable	*Mean (SD)*	*Range*	1	2	3	4	5	6	7	8	9	10
1. Child biological sex	—	—	—	.27**	.11	.00	−.22*	.09	.00	−.09	.18	−.02
2. Family SES	0.00 (1.00)	-1.77–1.27		—	−.28**	−.01	.004	−.22*	−.10	.02	−.08	.09
3. T1 maternal non-supportive WS	2.80 (0.85)	1.25–5.00			—	.19	.21*	.70***	.24*	.07	.40***	.09
4. T1 mother-perceived child inhibition to novelty	0.85 (0.51)	0.00–2.00				—	.31***	.11	.62***	.25*	−.05	.51***
5. T1 lab-observed child dysregulated fear	1.81 (0.59)	1.00–4.00					—	.21*	.38***	.45***	−.03	.18
6. T2 maternal non-supportive WS	2.70 (0.94)	1.00–5.08						—	.19	.04	.43***	.07
7. T2 mother-perceived child inhibition to novelty	0.83 (0.49)	0.00–2.00							—	.39***	.17	.68***
8. T2 lab-observed child dysregulated fear	1.64 (0.60)	1.00–3.75								—	−.12	.40***
9. T3 maternal non-supportive WS	1.78 (0.64)	1.00–4.12									—	.06
10. T3 mother-perceived child inhibition to novelty	0.85 (0.55)	0.00–2.00										—

Note. T1 = Time 1, T2 = Time 2, T3 = Time 3. WS = worry socialization. Means, standard deviations, ranges, and correlations computed with available data prior to handling missing data. Family SES comprised a mean of (a) z-scored average family income (across T1, T2, T3) and (b) z-scored maternal education. Child age per time point and maternal age at child birth were also correlated with primary dependent variables to determine covariates. No statistically significant relations emerged (all $ps > .05$), except for maternal age relating to T2 non-supportive worry socialization ($r = -.22$, $p = .023$). *N*s for correlations ranged from 74 to 136. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Thus, they were dropped to remain parsimonious, and we now present results without family SES and maternal age in the model.

Primary Analyses

The primary path analysis model is presented in Fig. 1. This model had very close fit, $\chi^2(6) = 5.34$, $p = .501$; AIC = 1499.30, SABIC = 1489.77; RMSEA = 0.00 (90% CI [0.00, 0.11]); SRMR = 0.03; CFI = 1.00, TLI = 1.00. Stability paths were statistically significant (all $ps \leq 0.001$) and positive (βs = 0.41–0.68), suggesting medium to large stability in constructs, per conventional guidelines (Adachi & Willoughby, 2015). There were two concurrent positive associations at T1: namely, mothers' non-supportive worry responses related to laboratory-observed child dysregulated fear ($r = .17$, $p = .040$), and mother-perceived child inhibition to novelty was associated with laboratory-observed child dysregulated fear ($r = .29$, $p = .001$). Concurrently at T2, mothers' perceptions of child inhibition to novelty remained correlated with laboratory observations of their child dysregulated fear ($r = .29$, $p = .008$). Three across-time associations emerged. First, greater T1 laboratory-observed child dysregulated fear predicted greater T2 mother-perceived child inhibition to novelty ($b = 0.15$, $SE = 0.07$, $p = .019$). Second, mothers' greater perceptions of their child's inhibition to novelty at T2 positively related to their greater T3 non-supportive worry responses ($b = 0.30$, $SE = 0.15$, $p = .043$). Third, laboratory observations of more child dysregulated fear at T2 predicted *less* non-supportive worry socialization at T3 (b = -0.27, $SE = 0.13$, $p = .041$). Moreover, a significant indirect effect emerged ($ab = 0.05$, $SE = 0.03$, 95% CI [0.01, 0.14]), such that greater T1 laboratory-observed child dysregulated fear predicted more mother-perceived child inhibition to novelty at T2, which in turn was associated with mothers' greater T3 non-supportive responses to worry displays.

Supplementary Analyses

Given our recent work indicating that specific types of maternal non-supportive worry socialization responses (i.e., punitive, minimizing, distress responses) may uniquely relate to child inhibited temperament (Kiel et al., 2020), we ran three supplementary path analysis models in which we replaced overall non-supportive worry socialization with each of the three non-supportive response types (see Supplementary Information Figures S1-S3 and Supplement Discussion). Overall, model paths functioned relatively similarly across strategy types, with associations in

Table 2 Path Coefficients for Primary Model with Non-Supportive Worry Responses

Variable	*b* (*SE*)	β	*t*	*p*	95% CI (*b*)
DV = T2 Non-supportive worry responses (R^2 = .47)					
T1 Non-supportive worry responses	0.74 (0.09)	0.68	8.39	< .001	[0.56, 0.91]
T1 Mother-perceived child inhibition to novelty	-0.04 (0.15)	-0.02	-0.24	.811	[-0.35, 0.26]
T1 Laboratory-observed child dysregulated fear	0.09 (0.14)	0.05	0.63	.531	[-0.18, 0.35]
DV = T2 Mother-perceived child inhibition to novelty (R^2 = .44)					
T1 Non-supportive worry responses	0.07 (0.05)	0.11	1.35	.176	[-0.03, 0.16]
T1 Mother-perceived child inhibition to novelty	0.54 (0.08)	0.56	6.43	< .001	[0.36, 0.70]
T1 Laboratory-observed child dysregulated fear	0.15 (0.07)	0.18	2.35	.019	[0.03, 0.28]
DV = T2 Laboratory-observed child dysregulated fear (R^2 = .21)					
T1 Non-supportive worry responses	0.00 (0.07)	0.00	0.00	.998	[-0.14, 0.13]
T1 Mother-perceived child inhibition to novelty	0.15 (0.12)	0.13	1.24	.215	[-0.09, 0.38]
T1 Laboratory-observed child dysregulated fear	0.41 (0.10)	0.41	4.07	< .001	[0.22, 0.62]
DV = T3 Non-supportive worry responses (R^2 = .27)					
T2 Non-supportive worry responses	0.29 (0.09)	0.42	3.24	.001	[0.12, 0.47]
T2 Mother-perceived child inhibition to novelty	0.30 (0.15)	0.23	2.03	.043	[0.03, 0.61]
T2 Laboratory-observed child dysregulated fear	-0.27 (0.13)	-0.25	-2.04	.041	[-0.53, 0.00]
DV = T3 Mother-perceived child inhibition to novelty (R^2 = .46)					
T2 Non-supportive worry responses	-0.03 (0.05)	-0.05	-0.54	.587	[-0.12, 0.07]
T2 Mother-perceived child inhibition to novelty	0.72 (0.09)	0.65	7.95	< .001	[0.54, 0.90]
T2 Laboratory-observed child dysregulated fear	0.06 (0.09)	0.07	0.74	.457	[-0.10, 0.24]

Note. Time 1 = T1, Time 2 = T2, Time 3 = T3. Correlations modeled included those between T1 non-supportive worry responses and T1 mother-perceived child inhibition to novelty (r = .15, p = .122), T1 non-supportive worry responses and T1 laboratory-observed child dysregulated fear (r = .17, p = .040), T1 mother-perceived child inhibition to novelty and T1 laboratory-observed child dysregulated fear (r = .29, p = .001), T2 non-supportive worry responses and T2 mother-perceived child inhibition to novelty (r = .10, p = .305), T2 non-supportive worry responses and T2 laboratory-observed child dysregulated fear (r = .02, p = .824), T2 mother-perceived child inhibition to novelty and T2 laboratory-observed child dysregulated fear (r = .29, p = .008), and T3 non-supportive worry responses and T3 mother-perceived child inhibition to novelty (r = – .04, p = .726).

the punitive response model closest to those in the main model. Construct stability, as well as the association from T1 child dysregulated fear to T2 child inhibition to novelty, remained in all supplementary models. Across supplementary models, there was some variation in within-time correlations among primary variables at T1. The relation between T2 child inhibition and T3 non-supportive worry responses was statistically significant in the punitive responses model, yet non-significant in the minimizing and distress responses models. These findings are discussed at greater length in the Supplementary Information.

Discussion

Contemporary theories suggest that transactional interactions between child and parent characteristics occur during child anxiety development. Little work has studied relations during toddlerhood, a time during which (a) child inhibited temperament may be malleable and open to environmental influence and (b) caregivers may develop patterns of responding to child worry. The current study tested bidirectional relations between child inhibited temperament indices and maternal non-supportive responses to worry across toddlerhood. Our longitudinal design incorporated repeated assessments and accounted for construct stability, allowing for robust tests of predictive relations as well as examination of whether dysregulated fear predicts maternal worry socialization through mothers' perceptions of toddler inhibition to novelty.

The medium to large effect sizes for stability of our constructs, in support of our first hypothesis, were consistent with previous studies. Our estimates were consistent with previous studies showing that inhibited temperament is moderately stable (Fox et al., 2005). Our finding of stability in the medium to large range of effect size for maternal socialization of worry was consistent with previous studies of broader emotion socialization (Hastings et al., 2019; Premo & Kiel, 2014) and contributes to the knowledge base for worry socialization, in particular. Specifically, socialization of worry, as a construct, persists across early childhood, but is not so stable as to prevent change attributable to other constructs. We interpret these results to evidence some stylistic stability in emotion-related parenting practices, while practices are continually honed and adapted alongside child developmental stages and characteristics.

The study provided only weak support for parent-driven effects (Hypothesis 3), apparent mostly in bivariate correlations. Our path model provided the most stringent test of parent-driven effects because it controlled for stability in constructs. No paths predicting toddler inhibited temperament from maternal socialization of worry emerged. This

was surprising given fundamental theoretical assumptions that caregiver emotion socialization influences child outcomes (Eisenberg et al., 1998; Raval & Walker, 2019). However, developmental models of emotion socialization suggest that socialization predicts child emotion regulation and adjustment outcomes, while temperament functions as a moderator or antecedent of these effects, despite incorporating aspects of regulation and being environmentally-influenced (Goldsmith et al., 1987; Shiner et al., 2012). Perhaps parent-driven effects emerge for the *consequences* of child inhibited temperament, such as psychopathology (e.g., anxiety disorder symptoms) or the emotion regulation strategies children develop either because of, or to adapt to, their temperamental tendencies. It is also possible that parent-driven effects are stronger later in development, with child-driven effects primarily shaping parent-child interactions in early childhood.

We found stronger evidence for child-elicited effects of maternal worry socialization (Hypothesis 4). Mothers who perceived their toddlers as shy and withdrawn when faced with new people and situations seemed to then engage in higher-than-expected levels (based on controlling for previous values) of non-supportive responses to toddlers' worries. This could reflect mothers losing patience with their toddlers' anxious tendencies or reacting with (and modeling) their own dysregulated response, possibly indicating patterns of negative interactions that have been linked to internalizing problems in toddlerhood (Luebbe et al., 2011) and clinically significant anxiety diagnoses in middle childhood (Hudson et al., 2008; Hurrell et al., 2015). Alternatively, results may reflect that mothers intentionally respond in a manner that they believe will help their toddlers disengage from their worries. Indeed, mothers' punitive responses to their children's expressions of negative emotions, generally, have been found to buffer the association between inhibited temperament and social anxiety symptoms (Trent et al., 2021). It is beyond the scope of the current study to conclude whether the increased non-supportive responses to child worry predicted by mothers' perceptions of inhibited temperament lead to increased or decreased risk for anxiety over time. Moreover, there remain important questions about the role of genetics, gene-environment interactions, and non-parenting shared environmental factors in relations between child inhibited temperament and maternal emotion socialization practices. However, given that many studies have focused on caregivers' responses to children's negative emotions, broadly, this study provides a foundation for continued investigation into the antecedents and consequences of worry socialization, in particular.

Unexpectedly, toddler dysregulated fear at age 3 and caregiver non-supportive worry responses at child age 4 were negatively associated. Given their non-significant bivariate correlation seen in preliminary analyses, and the positive correlation between dysregulated fear and mother-perceived inhibition to novelty at child age 3, this appears to be a suppression effect. In the larger model, the path from age 3 dysregulated fear to worry socialization at child age 4 accounted for (i.e., was left after removing) shared variance between dysregulated fear and inhibition to novelty, as well as stability between age 3 and 4 worry socialization. Thus, what made dysregulated fear unique from mothers' perceptions of inhibition to novelty predicted lower non-supportive worry socialization than expected based on mothers' previous levels. Variance in dysregulated fear unique from mothers' perceptions of their toddlers' inhibited temperament may have represented (a) aspects of toddlers' behavior mothers do not perceive as shyness or inhibition, (b) variance in toddlers' non-compliance with lab procedures, and/or (c) mothers' under-/over-estimation of inhibited temperament, any of which may have predicted mothers' lower-than-expected non-supportive responses. Alternatively, and building on anxious-coercive cycle models of anxiety risk (Dadds & Roth, 2001), perhaps mothers are motivated to respond to aspects of child inhibited temperament with protective or concerned, rather than precisely non-supportive, behaviors, such as problem-solving the situation for their child. Although it goes beyond the data of this study to precisely conclude what this unique variance represents, the informant discrepancies literature suggests that non-shared variance between different measures assessing a construct may relate meaningfully to individual differences in children's psychopathology risk (e.g., De Los Reyes & Kazdin, 2005). Presently, it seems to be meaningful in relation to parenting outcomes as well. Therefore, we would encourage continued investigation into the shared and non-shared aspects of laboratory observation and parent report of inhibited temperament in relation to multiple aspects of the dynamic parent-child relationship.

Finally, we found support for our final hypothesis that maternal perceptions of inhibition to novelty would mediate the relation between observed dysregulated fear and non-supportive worry socialization. This indirect effect is consistent with affective models of parenting (Dix, 1991; Leerkes & Augustine, 2005), which suggest that mothers' perceptions and interpretations of children's affectively-valenced behavior are crucial to subsequent parenting responses. Our results suggest that observed inhibited temperament (via dysregulated fear) predicts mothers' heightened perceptions of inhibition, which then predict more non-supportive worry responses. Importantly, this indirect effect existed above and beyond stability in maternal perceptions of inhibition to novelty and non-supportive worry socialization, as well as the more proximal direct association between dysregulated fear and worry socialization. Although debate

exists surrounding the utility of parent-report of children's temperament, parents' perceptions likely serve to shape their parenting, independent of what may be observed by putatively objective assessments. Alternatively, it could also be that (a) laboratory-observed dysregulated fear related to later maternal reports due to detection of continuity in inhibition and/or (b) linkages between later mother report measures signify shared method variance or shared parent-child temperament.

Limitations and Future Directions

As is typical with multi-wave, longitudinal studies of families, missing data was a limitation, though we did use FIML as a contemporary best practice for handling missing data. Measure-wise, we ideally would have assessed dysregulated fear at a third time point. The absence of age 4 child dysregulated fear likely made it more difficult to discern parent-driven effects on child outcomes beyond concurrent effects from age 2 to age 3 or in relation to mother-reported inhibited temperament. We used surveys to assess mothers' emotion socialization and child temperament perceptions, likely introducing some shared method variance, and the field would benefit from development of reworked methods of assessment (e.g., during real-time dyad interactions). We also did not assess the role of meaningfully distinct contexts of worry socialization, a promising future research direction. For instance, perhaps mothers endorse different motivations for socialization responses depending on child age or if their children express more anticipatory versus in-the-moment worry. Emotion socialization methods can also vary by caregiver, frequency of exposure, and culmination of socializer messages received. The lower-than-ideal alphas for worry socialization scales indicate that measure development specifically focused on worry socialization may benefit future work. We also recognize that our labeling of our item set as "worry socialization" imperfectly captures the variance in emotions and behaviors socialized (e.g., worry, fear, shyness) in each vignette. Future studies should examine other caregivers' responses and child outcomes associated with receiving discrepant or predominantly non-supportive messages from multiple caregivers, as well as greater nuance in conceptualizations of "non-supportive" responses (e.g., "minimizing" responses that may serve to adaptively dampen child negative affect). Additionally, because parent responses to child emotions likely depend on the type of discrete emotion being expressed (O'Neal & Magai, 2005), it is critical to simultaneously document the emergence of socialization of other (often overlapping) emotions, many of which likely carry important implications for psychopathology risk. As such, we should endeavor to incorporate our understanding of the blended, nuanced, and developmentally-bound nature of emotions into emotion socialization measurement.[3]

Finally, although our sample was diverse in SES, it was predominantly White, racially, and results should be considered within the cultural norms surrounding this population. Cultural values of White, middle class parents in the U.S. tend to be characterized by individualism and independence, often leading to socialization of emotion as an experience of the individual self (Raval & Walker, 2019). Parents with non-White identities may place greater emphasis on interdependence within family relationships and relational experiences of emotions (Raval & Walker, 2019). As such, parents with non-White identities may use different socialization strategies that do not always fall within definitions from theory developed with White samples and by White researchers. Their children may experience different outcomes of parent strategies because what have been termed "non-supportive" strategies may differ in quality (e.g., expressed with goals for their children's positive development versus being parent-centered) or perceived normativeness (Raval & Walker, 2019). Parenting strategies shaped by cultural values of interdependence offer strengths and sources of resilience to children by promoting connection and social harmony. Parents with minoritized identities also often socialize emotions within a context of pervasive, systemic racism and may be socializing their children's racial and ethnic identity alongside their emotion expression, for adaptive socioemotional outcomes when encountering bias and discrimination from the majority White culture (Dunbar et al., 2017).

Conclusions and Implications

In sum, this study advances our understanding of transactional relations between child temperament and parent emotion socialization by applying an anxiety risk-relevant framework to assess child inhibited temperament (both mother-perceived and laboratory-observed) and maternal non-supportive socialization of worry across three years in toddlerhood. Results indicated construct stability, meaningful and nuanced associations within and across time-points, and the presence of an indirect relation between laboratory-observed child inhibited temperament and maternal non-supportive worry responses through mothers' perceptions of their child's inhibited temperament. Future work should further delineate the transactional, nuanced nature of these relations across child development, with a particular focus on child-elicited effects.

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Data Availability The authors are not making a dataset publicly available as consent was not specifically sought from participants to do so. However, de-identified data will be distributed upon reasonable request.

Compliance with Ethical Standards

Conflict of interest/Competing Interests The authors declare that they have no conflicts of interest.

Ethics approval All study procedures were approved by the Miami University Institutional Review Board (protocol #s 00248r, 01026r) and adhere to the principles of the 1964 Helsinki Declaration.

Consent to participate Researchers obtained informed consent from legal guardians.

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