MATERNAL ANXIETY AND PHYSIOLOGICAL REACTIVITY AS MECHANISMS TO EXPLAIN OVERPROTECTIVE FIRST-TIME PARENTING BEHAVIORS

by Anne E. Kalomiris

This study sought to determine if the experience of first-time motherhood is distinct from multiparous mothers and if this motivates overprotective parenting behaviors. Temperamental fearfulness, or inhibition, of the child was also investigated for its impact. Mothers and their 24-month-old toddlers participated in a variety of novelty tasks designed to elicit parenting behaviors and children’s typical fear reactions. Mothers also completed a battery of questionnaires. Results suggest that first-time mothers experienced more anxiety and this was associated with increased overprotective parenting behaviors. First-time mothers also demonstrated greater physiological (i.e., cortisol) reactivity while watching their first-born children interact with novel stimuli. The role of increased cortisol secretion in relation to overprotective parenting behaviors was dependent on the child’s level of inhibition. Together, this suggests that first-time motherhood is a unique experience that can result in distinctions in parenting and is influenced by multiple maternal factors and their first-born child’s temperament.
MATERNAL ANXIETY AND PHYSIOLOGICAL REACTIVITY AS MECHANISMS TO EXPLAIN OVERPROTECTIVE FIRST-TIME PARENTING BEHAVIORS

A Thesis

Submitted to the
Faculty of Miami University of Ohio
in partial fulfillment of
the requirements for the degree of
Master of the Arts
Department of Psychology
by
Anne E. Kalomiris
Miami University
Oxford, Ohio
2015

Advisor: Elizabeth J. Kiel, Ph.D.
Reader: Aaron M. Luebbe, Ph.D.
Reader: Margaret O’Dougherty Wright, Ph.D.
# Table of Contents

List of Tables ........................................................................................................ iv
List of Figures ......................................................................................................... v
Introduction ........................................................................................................... 1
  Parenting and Birth Order ................................................................................... 1
  Parenting and Physiological Reactivity ............................................................... 3
  Child Temperament and Parenting ...................................................................... 5
  The Current Study ............................................................................................... 6
Method .................................................................................................................... 7
  Participants ......................................................................................................... 7
  Procedure .......................................................................................................... 7
  Measures ............................................................................................................ 8
Results .................................................................................................................... 11
  Cortisol Transformation and Imputation ............................................................ 11
  Data Reduction .................................................................................................. 12
  New Friends Vignettes (NFV) for Age 3 ............................................................ 12
  Preliminary Analyses ......................................................................................... 13
  First-Time Motherhood and Reported Overprotective Parenting Behaviors ..... 13
  First-Time Motherhood and Observed Overprotective Parenting Behaviors ..... 15
Discussion .............................................................................................................. 17
  The Indirect Effect of Worry on Parenting in First-Time Mothers .................... 18
  The Indirect Effect of Cortisol Reactivity on Parenting in First-Time Mothers .... 19
  Limitations ......................................................................................................... 22
  Conclusion ......................................................................................................... 22
References .............................................................................................................. 23
Table 1 ................................................................................................................. 29
Table 2 ................................................................................................................. 30
Table 3 ................................................................................................................. 31
Table 4 ................................................................................................................. 32
Table 5 ................................................................................................................. 33
Table 6 ............................................................................................................................. 34
Figure 1 .......................................................................................................................... 35
Figure 2 .......................................................................................................................... 36
List of Tables

Table 1 .................................................................................................................. 29
Table 2 .................................................................................................................. 30
Table 3 .................................................................................................................. 31
Table 4 .................................................................................................................. 32
Table 5 .................................................................................................................. 33
Table 6 .................................................................................................................. 34
List of Figures

Figure 1 .................................................................................................35
Figure 2 .................................................................................................36
Introduction

Individual differences in parents’ responses to their children can result from an interaction among a host of variables such as the temperament of the child, the personality of the parent, or the context of the interaction. Investigations conducted to elucidate the impact parenting can have on child development often focus on these multiple variables. Research consistently reveals that more fearful and inhibited children receive more protective and intrusive parenting than less timid children (Barrett, Fox, & Farrell, 2005; Rubin, Coplan, & Bowker, 2009; Rubin, Hastings, Stewart, Henderson, & Chen, 1997). This has motivated new questions about why and for which parents this occurs. There is a small but increasing literature suggesting that these parenting behaviors are accompanied by distinct patterns of physiological stress reactivity in the mother (Hill-Soderlund et al., 2008; Kiel & Buss, 2013; Martorell & Bugental, 2006; Mills-Koonce et al., 2009; Moore et al., 2009; Thompson & Trevathan, 2008). Further, although various child characteristics can affect parenting, it remains unclear to what extent parenting differs based on the child’s birth order. This is important to consider because if first-born children do receive different parenting than their later-born siblings, this may set first-borns on a different developmental trajectory in regards to psychological outcomes. Although the literature is mixed regarding distinct personality characteristics based on birth order (Jefferson, Herbst, & McCrae, 1998), research supports the notion that mothers respond differently to their first-borns (Arcus, 2001; Cohen & Beckwith, 1977; Hilton, 1967; Price, 2008), possibly due to the increased stress and anxiety associated with being a first-time parent (Gameiro, Moura-Ramos, Canavarro, 2009; Giakoumaki, Vasilaki, Lili, Skourolia, & Liosis, 2009; Hung, 2004; Paul, Downs, Schaefer, Beiler, & Weisman, 2013; Staehelin, Kurth, Schindler, Schmid, Stutz, 2013; Zanardo et al., 2009). The proposed research seeks to determine if the novel experience of first-time motherhood manifests in higher levels of physiological reactivity and anxiety, and then contributes to differences in parenting behaviors, and whether components of this pathway are impacted by the child’s temperament.

Parenting and Birth Order

The experience of being a first-time parent is undoubtedly stressful. It requires mothers to adjust to new roles and reallocate their attention to care for the new infant (Gjerdingen & Center, 2005; Hanna, Edgecombe, Jackson, & Newman, 2002). This stress may be a factor that places first-time mothers at an increased risk of developing mental health problems (e.g., postpartum
depression, generalized anxiety disorder) in the several months following the birth of their first-child (Munk-Olsen, Laursen, Pedersen, Mos, & Mortensen, 2006; Wenzel, Haugen, Jackson, & Robinson, 2003). Further, it appears that the novelty of first-time motherhood may arouse more anxiety in the prenatal period and the few months following the birth of the first-child (Fleming, Steiner, & Corter, 1997; Gameiro et al., 2009; Giakoumaki et al., 2009; Hung, 2004; Paul et al., 2013; Staehelin et al., 2013; Zanardo et al., 2009). Primiparous, or first-time, mothers also report feeling less capable and effective as caregivers, perhaps reflecting an underlying uncertainty and anxiety about their transition to becoming a mother (Flemming et al., 1997; Fish & Stifter, 1993). It is likely that this rise in anxiety and stress associated with becoming a first-time mother persists throughout the first-born’s life as new parenting experiences are frequently encountered. However, the finding that primiparous mothers are more anxious is not unanimous (DiPietro, Costigan, & Sipsma, 2008; Figueiredo & Conde, 2011; Skari et al., 2002), and sometimes no distinctions in anxiety levels are found (Krieg, 2007). Given knowledge that maternal anxiety uniquely and adversely relates to their infants’ neurological development (Kikkert, Middelburg, & Hadders-Algra, 2010), it is important to determine if first-time mothers are more anxious and worried. It will also be important to determine if this increased anxiety can explain why first-time may mothers demonstrate distinctions from more experienced mothers in parenting.

Although the specific impact of elevated maternal anxiety on first-born children remains relatively unknown, it is likely that this maternal state affects parenting. In support of this notion, there is literature suggesting that parenting differs based on the child’s birth order. Research by Price (2008) contends that first-born children not only spend more time with their parents throughout their lives, but also spend nearly 20-30 minutes more per day with both parents during childhood. Older research on birth-order effects on parenting also suggest that first-time mothers spend more time engaged in social interaction with their infants (Cohen & Beckwith, 1977; Jacobs and Moss, 1976; Lewis & Kreitzberg, 1979). It is possible that extra time devoted to the first-born child is due to fewer competing distractions. When only one child is present to capture attention, mothers are able to focus more on and attend more readily to the stressors in the child’s life. Such speculation is supported by the fact that mothers spend double the amount of time setting limits and restrictions for their first-born children when compared to limit-setting behaviors for second-born children (Arcus, 2001). Perhaps these behaviors are the result of anxious first-time mothers interpreting more threat than multiparous or non-anxious mothers.
from ambiguous situations involving their child (Challacombe, Feldman, Lehtonen, Craske, & Stein, 2007). Although there are undoubtedly positive aspects of this increased time and attention, first-time mothers may be more highly involved with their children and thus more prone to parenting that is characterized by overprotection, a type of overcontrol.

Overprotective parenting is a comprehensive term used to describe parenting characterized by overly restrictive, supportive, and warm behaviors when children are presented with new situations and is thought to foster dependency by limiting independent coping (Chorpita & Barlow, 1998; Rubin, Burgess, & Hastings, 2002). Although this parenting style seems as though it may protect children from negative events, protective parenting and other similar parenting styles (i.e., oversolicitous parenting; Rubin et al., 1997) can lead to a host of maladaptive outcomes for the child, including an increased propensity to develop internalizing problems (Edwards, Rapee, & Kennedy, 2010; McShane & Hastings, 2009; Rubin et al., 1997). This is because such parenting may prevent the child from exploring novel situations and significantly impede the development of the child’s independent coping (Rubin et al., 1997). Additionally, overprotective parenting is not sensitive to the child’s needs in the situation and jeopardizes the child’s sense of mastery over their environment as they learn to rely on their caregiver or engage in avoidance tactics in times of challenge and stress (Chorpita & Barlow, 1998).

Interestingly, overprotective parenting and less sensitive responding are more commonly displayed among anxious mothers (Bögels & Melick, 2004; Nicol-Harper, Harvey, & Stein, 2007). Given knowledge that first-time mothers may perceive greater threat in innocuous situations and often report more anxiety (Challacombe et al., 2007), perhaps this motivates distinct parenting behaviors with first-born children. Further, it may be that the increased amount of time and attention given to first-borns fosters a more overprotective parenting style. If this is the case, research suggests that these children may not develop the skills necessary to cultivate autonomy, placing them at an increased risk for anxiety and other internalizing disorders. To more comprehensively understand if and how the child’s birth order influences parenting, a mediational model examining the relation between first-time motherhood and overprotective parenting behaviors through maternal anxiety therefore is required.

Parenting and Physiological Reactivity
The bulk of the previously reviewed literature suggesting that parenting may differ based on the child’s birth order relies on questionnaire and behavioral measures. Differences in physiological assessments based on maternal parity may reveal another mechanism through which different parenting behaviors emerge. General studies on stress reactivity suggest that psychological stress activates the hypothalamic-pituitary-adrenocortical (HPA) axis, which then catalyzes a hormonal cascade and results in the release of the glucocorticoid, cortisol (Gunnar & Quevedo, 2007). The cortisol response can be measured via salivary assessments as a biological marker of stress. HPA-axis activity mobilizes the body to prepare for the release of its energy stores to use in times of stress. This response can prove useful, but hyperactivity of the HPA-axis, and thus repetitive surges in cortisol, presents a host of deleterious consequences on neurological systems and immune functioning (McEwen, 1998). Elevations in cortisol reactivity from laboratory paradigms prove difficult to elicit but are most pronounced when the presenting stressor is more novel to the individual (Gunnar, 2001; Kirschbaum & Hellhammer, 1989) and when the individual perceives the situation to be social-evaluative in nature (Dickerson & Kemeny, 2004). These findings, coupled with an understanding that first-time mothers undoubtedly experience more uncertainty and stress due to the novelty of first-time parenting, suggest that regulation of the HPA-axis is important to consider.

Although parity’s influence on maternal diurnal cortisol has been recently examined (Conde & Figueiredo, 2014), a paucity of research exists determining if first-time mothers demonstrate increased physiological reactivity. Such limited investigations have used stressors unrelated to the mother’s child or parenting, specifically, to elicit a cortisol response, like the Trier Social Stress task or a video of an unrelated child in danger (Federenko et al., 2006; Tu, Lupien, & Walker, 2006). Perhaps this is why they failed to find any notable differences based on parity alone. Additionally, no investigations of parity’s influence on HPA-axis activity have been conducted with mothers of toddlers, specifically. It is important to understand the influence of cortisol reactivity on parenting within this developmental period because the caregiver context is a salient environmental influence for toddlers during a time when such children are developing independent coping skills. It remains unclear if first-time mothers would display differences in cortisol reactivity in a stressful situation directly related to parenting their toddler. Perhaps watching their children interact with novel and potentially distressing stimuli while having their parenting observed by experimenters is salient enough to produce notable differences in the
maternal cortisol response. The current study aims to determine if first-time mothers experience a greater physiological response when observing their first-borns interact with novelty and if this physiological hyperactivity motivates overprotective parenting behaviors. Understanding how overprotective parenting emerges in this period may facilitate parenting interventions for preschool-aged children, which is an ideal time for early intervention to improve psychological trajectories of children (Rapee, Kennedy, Ingram, Edwards, & Sweeney, 2005).

To date, there is no research concluding that hyperactivity of the HPA-axis is common in first-time mothers, but an emerging body of literature proposes that different maternal parenting behaviors are associated with different patterns of physiological reactivity. Recently, Kiel and Buss (2013) demonstrated that mothers display more cortisol reactivity and intrusive parenting with more inhibited toddlers. Additionally, it appears that mothers with greater cortisol reactivity are harsher with their difficult tempered toddlers (Martorell & Bugenthal, 2006) whereas mothers with lower cortisol levels demonstrate fewer negative intrusive behaviors with these children (Mills-Koonce et al., 2009).

From the literature, it appears as though a decreased ability to physiologically regulate internal reactions to stress is related to parenting behaviors. Perhaps the novelty of raising a first-born child makes first-time mothers more vulnerable to experiencing stressors that they are not yet skilled at physiologically regulating. It still remains unclear if maternal physiological reactivity varies in relation to the child’s birth order and if it motivates overprotective parenting behaviors. However, previous research has not consistently found parenting behaviors to differ based on the child’s birth order alone (Donovan, Leavitt, & Taylor, 2005; Fish & Stifter, 1993; Kaitz, Chriki, Bear-Scarf, Nir, & Eidelman, 2000) suggesting that other factors should also be considered.

Child Temperament and Parenting

The literature reviewed above suggests that first-time mothers’ increased anxiety and physiological reactivity may relate to overprotective parenting behaviors, but these relations may also be affected by the child’s temperament. Specifically, the literature suggests that temperamentally inhibited children solicit over-control and overprotection from their parents (Dadds & Roth, 2001; Kiel & Buss, 2011, 2012). Temperamental inhibition, or fearful temperament, is characterized by patterns of fearful, hesitant, and avoidant behavior (Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984). Theory from Dadds and Roth (2001) suggests
that the relationship between parenting behavior and childhood inhibition may be cyclical. When inhibited children seek parental support and attention during stressful situations and the parent intervenes, the resultant decrease in the child’s distress reinforces their reliance on their parents and prevents the development of coping skills for use with future stressors. Indeed, many investigations have found that overly controlling and protective parenting occurs with greater frequency among inhibited children (Kiel & Buss, 2012; Park, Belsky, Putnam, Crnic, 1997; Rubin et al., 1997).

It is not only that inhibited first-borns are eliciting more controlling parenting from their mothers but perhaps first-time mothers may be especially likely to respond with overprotection when their children are high in inhibition. Potentially, parenting a more inhibited and distressed toddler produces more anxiety in the mother, which can lead to more over-protective and controlling parenting (Bögels & Melick, 2004). Clearly, further examination is needed to determine how inhibition in first-born children impacts the mother and the parenting that the child receives.

The Current Study

The current study seeks to contribute to the existing literature by investigating four hypotheses about how the novelty of first-time motherhood results in distinct emotional and physiological processes that can affect parenting. First, it is expected that first-time mothers will display and report engaging in parenting behaviors that are more overprotective in nature. Again, overprotection is defined by the time spent engaging in restrictive, controlling, and overly supportive behaviors. Secondly, first-time mothers will have a different subjective experience while parenting. It is expected the first-time mothers will report more anxiety and will display greater cortisol elevations when witnessing their toddlers engage in novel and potentially distressing situations. However, a positive relationship between self-reported anxiety and physiological assessments is not expected given literature to suggest that these measures often do not correlate (Gunnar, 2001; Harville, Savitz, Dole, Herring, & Thorp, 2009; Voegtline et al., 2013). Thirdly, the mothers’ subjective experiences will predict the relation between first-time motherhood and both self-reported and observed parenting behaviors. Finally, the strength of the effects of being a first-time mother and the affective and physiological experience on overprotective parenting behavior will be moderated by the child’s temperament. It is expected that these pathways will be particularly strong for inhibited toddlers. Taken together, the results
from this investigation have the potential to provide information about the experience of first-time parenting and suggest processes by which differences in parenting emerge.

Method

Participants

Participants were recruited with letters mailed in response to birth announcements in local newspapers and from meetings at a Women, Infants, and Children (WIC) program in the Midwestern region of the United States. A total of 117 mother-child dyads participated, but only 87 mothers provided viable saliva samples at the time points of interest. An additional four dyads were excluded because the mothers were in their third trimester of pregnancy, bringing the total number of mother-child dyads included in the analysis of the physiological data to 83. Forty-five of the 117 mothers participated with their oldest child (29 of those first-time mothers provided saliva samples). The mothers ranged in age from 20.29 to 46.09 years, with an average age of 33.73. Most mothers reported living with the toddler’s biological father (n = 110, 94% of entire sample). The toddlers ranged in age from 23.97 to 27.00 months, with an average age of 24.71 months at the time of the visit. Mothers represented a range of socioeconomic statuses but were on average middle-class, as measured by the Hollingshead Index (Range = 17.00-66.00, M=49.02). The mother-child dyads’ ethnicities are detailed as follows: 87% of mothers and 79% of toddlers were European American, 3% of mothers and 9% of toddlers were African American, 5% of mothers and 8% of toddlers were Asian American, 1% of mothers and 1% of toddlers were American Indian, 0% of mothers and 2% of toddlers were biracial, 1% of mothers and 6% of toddlers were Hispanic/Latino, and 2% of mothers and 1% of toddlers identified as “other.”

Procedure

Mother-child dyads participated in a 1 1/2 hour-long laboratory visit consisting of a series of activities (i.e., episodes) to assess both parenting behaviors and toddler temperament. The mothers were also asked to complete questionnaires about their typical parenting behaviors, their tendency to worry and feel anxious, their toddler’s temperament, and demographic information.

The laboratory episodes aimed to elicit individual differences in toddlers’ distress reactions to novel situations. First, toddlers were observed during the Risk Room paradigm where they spent 3 minutes in a room with their mothers and novel objects (i.e., trampoline, tunnel, balance beam, scary box, gorilla mask). After the 3 minutes elapsed, a female experimenter entered the room and invited the toddler to jump on the trampoline, crawl through the tunnel,
walk across the balance beam, put her or his hand in the scary box, and touch the gorilla mask. Although present, mothers were instructed to minimize engagement for the duration of this episode. This episode yielded observations for the assessment of fearful temperament.

Later in the visit, the dyads participated in a series of episodes in which the mothers were instructed to behave naturally. This allowed for the observation of how mothers typically interacted with their toddlers. Toddlers were invited to play various games with a friendly clown during a 5-minute period. Then, the dyads watched a 3-minute puppet show where the toddler interacted with two puppets. Finally, dyads sat in a room with a large, stuffed spider that was controlled from behind a two-way mirror that approached the mother and toddler twice. The toddler was then invited to touch the spider by the experimenter. The spider episode typically elicits the most distress in both the mother and child, compared to other episodes (Buss, 2011; Kiel & Buss, 2012). Again, the mother was instructed to behave “however seems natural” to her during these episodes. These episodes followed a script and occurred in the same order for all participants. Together, the clown, puppet show, and spider episodes were used as observational measures of parenting behaviors.

Saliva samples were collected from the mothers twice during the laboratory visit (after acclimating to the laboratory but before any procedures, and again approximately 20 minutes after the Spider episode). Mothers were asked to saturate the end of a cotton roll with saliva before placing it in a Salivette tube (Sarstedt, INC) for storage. The Salivette tubes were sealed and stored at -50°C until being shipped on dry ice to Biochemisches Labor in Trier, Germany. Each sample was double assayed after being centrifuged at 2000 g for 10 minutes. Assays were performed with 100 µl of saliva using a competitive solid phase time-resolved fluorescence immunoassay with fluromeric end point detection (DELFIA). The sensitivity of the assays ranged from .30-100 nmol/L. Average variation coefficients from intra-assays ranged from 4.0%-6.7% and the average variation coefficient from inter-assays ranged from 7.1%-9.0%.

Approximately 1 year after the laboratory visit, mothers were invited to participate in a follow-up assessment that involved completing mailed-home questionnaires. If they expressed interest in participating, they were sent a new consent form, the battery of questionnaires, and a prestamped, preaddressed envelope to mail the materials back to the laboratory.

Measures
Maternal demographics. A general demographic questionnaire was administered and data regarding the family’s composition was collected. Results from these questions were coded as 0 = not a first-time mother or 1 = first-time mother. This demographic questionnaire also asked if the child was living with one or both biological parents. Although this does not directly assess marital status, this will be used as a proxy measure to assess for the presence of a partner in the home. Results from these questions were coded as 0 = not living with biological father or 1 = living with biological father.

Self-reported general anxiety. The Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) is a 16-item questionnaire used to measure the severity of an individual’s worry (e.g., “I worry all the time”). It demonstrates good test-retest reliability and internal consistency (α = .93; Meyer et al., 1990). The questions are answered on a 5-point scale (1 = not at all typical to 5 = very typical) and a mean score was calculated for analyses (α = .93 in the current study). Although this measure is not a direct assessment of anxiety, worry has been theorized to be the hallmark symptom of all anxiety disorders (Barlow, 1988). As such, it represents an index of symptoms of anxiety in mothers and this was investigated as it relates to overprotective parenting behaviors.

Maternal physiological assessments. A baseline saliva sample was collected after a short acclimation period and prior to beginning any laboratory tasks. A post-visit sample was collected 20-minutes after the spider episode. The 20-minute delay after the spider episode allowed for the assessment of the peak cortisol response after the most intense stressor (Gunnar & Quevedo, 2007). Additionally, mothers were sent home with supplies to take an additional saliva sample later that day and were asked to send this sample back to the laboratory in a provided preaddressed, prestamped envelope. This home sample was used in the imputation of missing pre-visit or post-visit samples.

Overprotective parenting behaviors. Parenting behaviors were assessed using the following measures. Separate variables for reported and observed parenting behaviors were used in analyses.

New Friends Vignettes (NFV). This questionnaire is a parent-report measure of mothers’ engagement in various parenting behaviors (McShane & Hastings, 2009). The questionnaire asks the mother to report how they would respond to hypothetical situations in which her child behaves in a shy manner in front of other adults and children. For the purposes of this study, the
Overprotection subscale (α_{two-years} = .79, α_{three-years} = .82) of the questionnaire was used. Parents indicated how likely they are to say overprotective statements (e.g. “You’re okay, Mommy is right here with you”) or behave protectively (e.g., “I would pick up my child and give them a nice hug”) in response to their child’s hypothetical shy behavior on a 0 (not at all) to 2 (very likely) scale. Given that the NFV was completed at age 2 and during the follow-up assessment at age 3, it also provided an assessment of change in overprotective parenting over time.

**Observed parenting behaviors.** Parenting behaviors were observed during the episodes in which the mother was instructed to interact naturally with her child (i.e., spider, clown, puppet). This observational method provided a measure of parenting behavior distinct from the maternal-report data obtained from the questionnaire measure. Trained coders recorded mothers’ comforting (i.e., physically affectionate behaviors) and protective behaviors (i.e., shielding child from stimulus) from these episodes. Each behavior was coded on a 0 (no display) to 3 (extreme display) scale. The maternal behaviors were also recorded as being either solicited or unsolicited from the child. Inter-rater reliability was calculated from every ten-second epoch across all episodes and was satisfactory for both comforting (ICC = .92) and protective behavior (ICC = .91). Due to previous research suggesting that protective parenting behaviors are different depending on the level of threat in the episode, only those behaviors from low-threat episodes (i.e., clown and puppet show) were considered for the current overprotective parenting behavior variable (Buss, 2011; Kiel & Buss, 2012). This is because parenting in low-threat situations is likely more representative of everyday parenting behaviors. An average of solicited comforting and protective behaviors from the clown and puppet show was created.

**Toddler temperament.** The toddler’s temperament was assessed from the following measures. Data reduction techniques were used to aggregate this data into a composite of temperament during preliminary analyses.

**Observed toddler temperament.** The toddler’s temperament was observed during the Risk Room procedure. A series of behaviors were coded. Attempts made by the toddler to be held by her or his mother, approach towards the mother, and tentativeness displayed during play were all coded on a 0 to 3 scale, with 0 = no displays of the behaviors and 3 = extreme displays of the behaviors. These behaviors were coded for every 10-second epoch of the Risk Room episode, and scores for each behavior were then averaged across the episode to yield a single score for each behavior (ICC = 0.78-0.98, α=.84). Compliance with the experimenter’s request to touch
the five novel objects in the room was scored from 0 to 5, indicating the number of objects the child interacted with when prompted. Finally, the latency to touch a toy during play was coded as the number of seconds from the beginning of the episode to when the child purposefully touched a toy. Compliance was then reverse coded and all variables were standardized and averaged together (\(Range = -1.30 \text{ – } 3.52, \text{ skew} = 1.27\)) to form a composite of observed toddler temperament.

**Toddler Behavior Assessment Questionnaire (TBAQ).** Mothers completed the TBAQ to provide a maternal-report measure of toddler temperament to supplement the observational data from the Risk Room. The TBAQ is a 110 item measure that assesses a variety of temperament domains. The Social Fear subscale is an appropriate measure of toddlers’ inhibition and withdrawal tendencies in novel social situations (Goldsmith, 1996). Across the 10 items of the subscale, mothers reported how often their child engages in particular shyness-related behaviors (e.g., *How often does your child show distress or cry when approached by a stranger*) on a 7-point scale, with 1 = *never* to 7 = *always*. The items demonstrated strong internal consistency in the current study (\(\alpha = .82\)). An average score of the mother’s responses to these items was reasonably spread and demonstrated excellent normality (\(M = 3.70, SD = 1.05, \text{ Range} = 1.50 \text{ – } 6.60, \text{ skew} = .163\)). This was used to create the temperament composite.

**Results**

**Cortisol Transformation and Imputation**

Out of the total 117 participants, 63.25% (\(n=74\)) provided a baseline saliva sample, 59.83% (\(n=70\)) provided a saliva sample after the stressor, and 70.94% (\(n=83\)) of mothers provided at least one of those samples. No cortisol values were lower than the minimum sensitivity of the assay (.30). Outliers were defined as being greater than 3 standard deviations from the mean, and these samples were truncated to the greatest value within 3 standard deviations of the mean. Although the cortisol variables only demonstrated minimal skew (>|1|), both values were log transformed prior to any analyses due to conventions in the literature (Dettling, Gunnar, & Donzella, 1999). Both previsit and postvisit cortisol values were related to the time of the laboratory visit (\(r[74] = -.484, p < .001\) and \(r[70] = -.435, p < .001\), respectively) and previsit cortisol values were related to maternal use of asthma medication (\(n = 2; r[74] = .220, p < .05\)). Cortisol values were unrelated to maternal use of any other medications including birth control and pain relievers.
Multiple imputation techniques were used to replace missing cortisol values for mothers who had at least one cortisol value, either the previsit or postvisit sample. Consistent with recommendations from Graham (2009), all variables related to those variables being imputed were included in the algorithm. This included the previsit, postvisit, and home visit cortisol samples as well as the time of day of the visit and whether or not the mother was taking asthma medication. An average of values from the ten imputations was calculated to give final measures of previsit and postvisit cortisol (Graham, Olchowski, & Gilreath, 2007).

Postvisit saliva values were regressed on previsit saliva samples. The time of day of the visit and whether the mother took asthma medication were included as covariates in the equation. Residuals between the predicted and actual post-visit values were calculated to provide a continuous measure of HPA-axis reactivity. That is, positive residuals indicate relatively more HPA-axis reactivity and negative residuals indicate relatively less HPA-axis reactivity in response to the experimental procedure.

**Data Reduction**

A principal components analysis was used to aggregate the maternal-reported and observed toddler temperament variables into one temperament composite. Both variables loaded on to one component that accounted for 65.15% of the variance in the assessments. This component was used as the index of temperament and it is influenced by both observation and maternal report.

**New Friends Vignettes (NFV) Imputation for Age 3**

Because only 75 (64.10%) of the total 117 participants completed the NFV at age 3, multiple imputation techniques were used to replace the missing data. Variables related to the age 3 assessment of the NFV or its missingness included the NFV overprotection scale at age 2, being a first-time mother, maternal cortisol reactivity, the PSWQ, the temperament composite, and SES. Consistent with recommendations by Graham (2009), these variables were included in the imputation algorithm. Twenty imputations were completed and then an average of values from those twenty imputations was calculated to provide a maternal-report measure of overprotective parenting at age 3 (Graham et al., 2007). Only imputations for those participants who completed the NFV at age 2 were included (n = 107).

In order to measure change over the NFV assessments, the age 3 overprotection scale of the NFV was regressed on the age 2 variable. SES was also included as an independent predictor
in the regression. The residuals between the actual and predicted values provide an assessment of change in overprotection from age 2 to age 3.

**Preliminary Analyses**

**Bivariate relations and group differences.** Tables 1 and 2 list the descriptive statistics and relations among the constructs of interest. All variables demonstrated reasonable normality, except the observed overprotective parenting variable had slight skew (skew = 2.85). A series of transformations (square root, log10, natural log) were attempted but the skew statistic could not be lowered below 2.00. All analyses were conducted with the transformed and untransformed variables but no differences emerged. Given this, and the fact that the skew was not very high, analyses using the untransformed variable are reported.

The bivariate correlation between maternal worry and cortisol reactivity was not significant (Table 2). Given that anxiety levels from self-reported assessments do not necessarily correlate with physiological reactivity, this finding was not surprising (Harville et al., 2009; Voegtline et al., 2013). This highlighted the importance of investigating how these variables uniquely relate to first-time parenting behaviors.

**Covariates.** There was no significant impact of maternal age, child’s gender, or martial status on any of the dependent variables. Because no relations were evident, these variables were not considered in subsequent analyses. Socioeconomic status (SES) was significantly and positively related to observed overprotective parenting behaviors, so it was included as a covariate in the analyses including observed overprotective parenting as a dependent variable.

**First-time Motherhood and Reported Overprotective Parenting Behaviors**

A series of analyses were conducted but no distinctions emerged between predictors’ relationships to the age 2 and age 3 maternal-report of overprotective parenting. Change in overprotective parenting did not significantly relate to any of the proposed predictors. Given this pattern, only age 2 maternal-report of overprotection will be investigated as it relates to first-time motherhood, maternal worry, cortisol reactivity, and child temperament.

The total effect of first-time motherhood on reported overprotective parenting behavior was first examined. Hypothesized pathways of mediation models were investigated using multiple linear regression. References to path names follow traditional Baron & Kenny (1986) terminology. Self-reported parenting behaviors were regressed on first-time motherhood, but the effect was not significant for the age 2 assessment ($b = 0.04$, SE = 0.07, $t[105] = 0.58$, $p = .565$)
Recent empirical findings suggest that this C path need not be significant for indirect effects to emerge (Hayes, 2013; Shrout & Bolger, 2002). Because of this, maternal worry and cortisol reactivity were investigated as an indirect means by which first-time motherhood related to reported overprotective parenting behaviors.

**Maternal worry and self-reported overprotective parenting.** As is evident from the group difference in Table 1, first-time mothers reported significantly more worry than mothers of later-born children. To determine if worry indirectly linked first-time motherhood with overprotective parenting, worry was first regressed on first-time motherhood and a significant effect was found (A path; $b = 0.34, SE = 0.15, t[89] = 2.33, p = .022$). When controlling for first-time motherhood, worry also significantly related to increased self-reported overprotective parenting behaviors at age 2 (B path; $b = 0.11, SE = 0.05, t[88] = 2.14, p = .036$).

The indirect effect was tested using the PROCESS macro in SPSS (Hayes, 2013). A test of the model revealed that worry indirectly relates first-time motherhood and increased self-reported overprotective parenting behavior (Table 3; indirect effect = 0.04, $SE = 0.03$, 95% CI[0.001, 0.112]).

**Maternal cortisol reactivity and self-reported overprotective parenting.** First-time motherhood related to increased cortisol reactivity ($b = 0.08, SE = 0.03, t[80] = 2.34, p = .022$). However, when controlling for first-time motherhood, cortisol reactivity did not relate to self-reported overprotective parenting behaviors ($b = 0.07, SE = 0.28, t[71] = 0.24, p = .810$). Because the B path in this proposed model was not significant, a test of the indirect effect of cortisol on first-time motherhood and self-reported overprotective parenting behavior was not investigated further.

**Maternal self-reported overprotective parenting and child temperament.** Temperament was then investigated to determine if it moderated any pathway of the model. The C path was first tested to determine if temperament moderated the relation between first-time motherhood and reported overprotective parenting behaviors. A cross-product of temperament and the dummy-coded first-time motherhood variable was calculated to produce an interaction term. The temperament variable was already centered at its mean from the principal components analysis. The relation between first-time motherhood and self-reported overprotective parenting behaviors was not moderated by the child’s temperament at age 2 ($b = -0.02, SE = 0.07, t[103] = -0.23, p = 0.819$).
It was also important to consider how temperament moderated the A and B paths. Temperament did not moderate the relation between first-time motherhood and maternal worry \((b = -0.00, SE = 0.15, t[87] = -0.01, p = .994)\) or the relationship between maternal worry and self-reported overprotective parenting behaviors at age 2 \((b = -0.04, SE = 0.05, t[87] = -0.67, p = .502)\). Although temperament did moderate the relation between first-time motherhood and maternal cortisol reactivity \((b = -0.08, SE = 0.03, t[74] = -2.49, p = .015)\) it did not moderate the relation between cortisol reactivity and reported overprotection \((b = 0.07, SE = 0.22, t[70] = 0.31, p = .758)\) so cortisol reactivity was not investigated for its indirect effect on first-time motherhood and reported overprotection. Temperament was therefore not included in any tests of the indirect effect to explain the relationship between first-time motherhood and reported overprotective parenting behaviors.

**First-time Motherhood and Observed Overprotective Parenting Behaviors**

The total effect of first-time motherhood on observed overprotective parenting behaviors was first examined. Due to the significant bivariate correlation between observed overprotective parenting behaviors and SES (Table 2), SES was included as a covariate when analyzing all paths. A significant relation between first-time motherhood and observed overprotective parenting did not emerge \((b = -0.00, SE = 0.02, t[114] = -0.20, p = .839)\). Although the relation between first-time motherhood and observed overprotective parenting is non-significant, a test of the indirect effect of worry and cortisol reactivity on this relationship may yield significant findings (Hayes, 2013).

**Worry and first-time mothers’ observed overprotective parenting behaviors.** As reviewed above, worry is more common among first-time mothers. However, when controlling for first-time motherhood and SES, worry did not significantly relate to observed overprotective parenting behaviors \((b = 0.02, SE = 0.01, t[87] = 1.15, p = .253)\). Because this B path was not significant, worry was not investigated as it indirectly links first-time motherhood and observed overprotective parenting.

**Cortisol reactivity and first-time mothers’ observed overprotective parenting behaviors.** First-time mothers demonstrated increased cortisol reactivity while controlling for SES (A path; \(b = 0.09, SE = 0.03, t[79] = 2.52, p = .014)\). When controlling for both first-time motherhood and SES, cortisol reactivity also related to less observed overprotective parenting behaviors (B path; \(b = -0.17, SE = 0.08, t[78] = -2.20, p = .031)\). Further, being a first-time
mother and maternal cortisol reactivity accounted for a significant proportion of the variance in observed protection (Table 4). A test of the indirect effect using the PROCESS Macro was also significant (Table 4; indirect effect = -0.01, SE = 0.01, 95% CI[-0.041, -0.001]) suggesting that greater maternal cortisol reactivity indirectly related first-time motherhood and decreased observed overprotective parenting behavior.

**Cortisol reactivity and first-time mothers’ observed overprotective parenting behaviors including temperament.** Temperament significantly moderated the relation between first-time motherhood and observed overprotective parenting behavior (Figure 1; $b = 0.05$, $SE = 0.02$, $t[106] = 2.94$, $p = .004$). In order to probe this interaction further, the variable was re-centered by subtracting or adding one standard deviation from the temperament variable. The cross-products of these re-centered variables were calculated with first-time motherhood. The results from probing revealed that first-time mothers tended to engage in less overprotective parenting when children had low levels of fearful temperament, but this did not reach significance (-1 SD; $b = -0.04$, $SE = 0.22$, $\beta = -0.18$, $t = -1.63$, $p = .11$, 95% CI [-0.08, 0.01], $sr^2 = .017$). No significant differences were observed in the parenting behaviors of children at mean levels of fearful temperament ($b = 0.01$, $SE = 0.02$, $\beta = 0.54$, $t = 0.67$, $p = .504$, 95% CI [-0.02, 0.04], $sr^2 = .003$). However, first-time mothers of highly fearful children displayed significantly more overprotective behaviors than mothers of later-born children (+1 SD; $b = 0.06$, $SE = 0.02$, $\beta = 0.29$, $t = 2.51$, $p = .014$, 95% CI [0.01, 0.10], $sr^2 = .041$).

A test of temperament’s influence on the A path suggested that temperament also moderated the relation between first-time motherhood and cortisol reactivity (Figure 2). The results from probing revealed that first-time motherhood significantly predicted increased cortisol reactivity when children were at low levels of fearful temperament (-1 SD; $b = 0.16$, $SE = 0.05$, $\beta = 0.51$, $t = 3.42$, $p = .001$, 95% CI [0.07, 0.25], $sr^2 = .136$) or mean levels of fearful temperament ($b = 0.08$, $SE = 0.03$, $\beta = 0.267$, $t = 2.41$, $p = .019$, 95% CI [0.01, 0.15], $sr^2 = .068$). First-time mothers of highly fearful children did not display significant differences in cortisol reactivity (+1 SD; $b = 0.00$, $SE = 0.05$, $\beta = 0.01$, $t = 0.06$, $p = .995$, 95% CI [-0.09, 0.09], $sr^2 = .000$).

Temperament did not moderate the relation between cortisol reactivity and observed overprotective parenting ($b = 0.03$, $SE = 0.02$, $t[72] = 1.76$, $p = .082$) so it was not included as a
moderator of the B path in a test of the indirect effect of cortisol reactivity on first-time motherhood and observed overprotection.

A test of the indirect effect through cortisol reactivity with temperament moderating both the A and C paths was non-significant ($b = -0.01, SE = 0.01, 95\% CI[-0.025, 0.008]$). This was not surprising because the A path’s moderation was significant for only low levels of inhibition whereas the C path’s moderation was contingent on high levels of inhibition. Because the moderations indicated that these two paths are unique to different populations of children, the indirect effects were also examined with temperament moderating the A path and C path individually. Cortisol reactivity significantly linked first-time motherhood and observed overprotection when temperament moderated the A path only, such that lower levels of fearful temperament predicted increased cortisol reactivity in first-time mothers and less overprotective parenting (Table 5; indirect effect = -0.01, $SE = 0.01, 95\% CI[-0.044, -0.001]$). However, the indirect effect of cortisol reactivity was not significant when temperament moderated the C path only (Table 6; indirect effect = -0.01, $SE = 0.01, 95\% CI[-0.025, 0.001]$).

**Discussion**

The primary aim of this study was to identify if and why mothers behave differently while parenting their first-born versus later-born children. It was surprising given the existing literature (Arcus, 2001; Price, 2008) that the direct relation between first-time motherhood and overprotective parenting behaviors did not emerge. However, this study also predicted that first-time mothers would report more anxiety in general and have distinct physiological activity while parenting when compared to later mothers. This hypothesis was supported: first-time mothers reported more worry and displayed more evidence of physiological stress when compared to mothers with multiple children. Perhaps most intriguing is that first-time motherhood indirectly related to subsequent distinctions in parenting. That is, when mothers experienced greater worry or cortisol reactivity when raising their first-born children, they engaged in more or less overprotective parenting, respectively. This was further influenced by the child’s level of inhibition. Increased worry, physiological reactivity, and toddler temperament are therefore crucial in explaining why different parenting behaviors emerge in first-time mothers.

It is important to acknowledge that this study’s assessments of self-reported worry and cortisol reactivity were unrelated. This was not surprising given that self-report measures and physiological reactivity are often found to be uncorrelated (Gunnar, 2001; Harville et al., 2009;
Voegtline et al., 2013). Finding significant indirect effects with these parameters revealed that each assessment of a first-time mother’s experience uniquely related to parenting. This speaks to the importance of examining self-report and physiological assessments independently because they are clearly tapping into different components of the experience of first-time motherhood.

**The Indirect Effect of Worry on Parenting in First-time Mothers**

Given contradictory findings in the extant literature regarding if first-time mothers are more anxious (DiPietro et al., 2008; Figueirendo & Conde, 2011; Fleming et al., 1997; Gameiro et al., 2009; Giakoumaki et al., 2009; Hung, 2004; Paul et al., 2013; Skari et al., 2002; Staehelin et al., 2013; Zanardo et al., 2009), finding that first-time mothers reported more worry provides support for the claim that they may also experience more anxiety. Pervasive worry is a hallmark symptom of the entire spectrum of anxiety disorders (Barlow, 1988), so this offers a more nuanced understanding of the experience of first-time motherhood. Perhaps maternal worry is one aspect of anxiety to focus on in understanding the unique experience of first-time mothers whereas other symptoms of anxiety (e.g., behavioral avoidance) may not differ based on parity. This may explain why previous studies have not found increased levels of anxiety in first-time mothers (DiPietro et al., 2008; Figueirendo & Conde, 2011; Skari et al., 2002). It is conceivable that multiparous mothers are also anxious as they transition to raising more than one child. Although increased worry appears unique to first-time mothers, the experience of multiparous mothers likely differs in ways not addressed by this study and future investigations should determine what aspects of anxiety best characterize primiparous and multiparous mothers.

Although this study’s assessment of worry was general and nonspecific to motherhood, it would be interesting and informative to understand if first-time mothers worry more about certain things specifically, like parenting or their toddlers. Such an understanding would provide more information about the supports necessary for first-time mothers. Regardless, this adds to the existing literature by suggesting that worry is a symptom of interest when understanding how the experience of first-time mothers differs from later mothers.

First-time mothers who reported more worry also reported engaging in more overprotective parenting behaviors. This finding was stable across the self-reported age 2 and age 3 assessments but did not relate to change over the year. Perhaps this indicates that overprotective parenting behaviors are stable in this time period and suggests that future investigations should focus on changes in parenting with children under 2-years-old and over 3-
years-old. It is interesting that this relation only emerged for self-reported overprotective parenting behaviors. Potentially, this can be explained by shared variance common among self-report measures. Regardless, this study is the first to demonstrate an association between the unique experience of first-time motherhood and how this indirectly relates to changes in parenting. This elaborates on previous findings that anxious mothers respond in less sensitive ways to their infants (Nicol-Harper et al., 2007). Although protection may seem advantageous and sensitive, overprotection reflects a pattern of insensitive responding where the maternal behavior is not dependent upon the child’s actual needs in that circumstance. In these situations, caregivers make themselves present and shield the child from stimuli and situations that are potentially distressing, but also offer opportunities for growth in coping skills (Rubin et al., 2002; Chorpita & Barlow, 1998). It is also known that first-time, anxious mothers perceive greater threat in ambiguous situations (Challacombe et al., 2007). This study extends this to demonstrate how this perception may influence the first-time mother’s approach to parenting. Given how influential overprotective parenting behaviors are to child development (Chorpita & Barlow, 1998), finding that worry motivates overprotection in first-time mothers provides a novel contribution to inform future interventions.

Given multiple findings regarding how child temperament can affect parenting (Kiel & Buss, 2012; Park et al., 1997; Rubin et al., 1997), it was surprising that the associations between first-time motherhood and self-reported overprotection, first-time motherhood and worry, and worry and overprotective parenting were not impacted by the child’s level of inhibition. Perhaps this study’s assessment of worry and parenting did not adequately tap into the context in which mothers would also be cognizant of the child’s temperament. Additionally, the hypothetical scenarios from the self-reported overprotective parenting measure may not have resonated with parents regarding situations in which their children would demonstrate inhibition. It is clear that future investigations are warranted to understand how temperament uniquely impacts first-time mothers’ reported parenting behaviors.

**The Indirect Effect of Cortisol Reactivity on Parenting in First-time Mothers**

In addition to the self-report measures discussed above, first-time mothers also demonstrated greater cortisol reactivity than multiparous mothers when watching their children interact with novel and potential distressing situations. This contributes novel and exciting information to the field, as this is the first study to find increased HPA-axis reactivity in first-
time mothers. Previous investigations are limited and have not found distinctions in this physiological parameter based on parity alone (Federenko et al., 2006; Tu et al., 2006). Given the challenges in creating a laboratory stressor potent enough to elicit a cortisol response (Dickerson & Kemeny, 2004), this suggests that this study’s assessment of maternal cortisol reactivity while observing their child in new situations was effective in producing meaningful variation in physiological stress in first-time mothers. It is also conceivable that mothers perceived the laboratory visit to be more social-evaluative in nature and that this is what produced the stress response (Dickerson & Kemeny, 2004). This explanation seems particularly plausible for first-time mothers who rate being more uncertain of their parenting than later mothers (Fish & Stifter, 1993; Flemming et al., 1997). Future investigations should be conducted to determine the source of the stress producing the cortisol response first-time mothers. In either case, this study provides a paradigm through which primiparous mothers displayed increased HPA-axis reactivity when interacting with their children. This paradigm should be replicated in future investigations to determine if HPA-axis activity is the only physiological parameter linked to first-time motherhood. Specifically, cardiovascular activity should be examined due to research suggesting it is linked to parenting behavior. Research on cardiovascular responses during experimental laboratory paradigms suggest that mothers who are better able to regulate their cardiovascular responses in the face of stress display less negative intrusive behaviors with their children (Mills-Koonce et al., 2009). This suggests that cardiovascular reactivity may also be important to consider in understanding first-time mothers’ physiological experience and parenting behaviors.

Interestingly, greater cortisol reactivity in first-time mothers related to less observed overprotective parenting behaviors. However, physiological reactivity only motivated changes in observed parenting behaviors. This is not surprising and suggests that physiological reactivity motivates behaviors within the context in which the reactivity is observed. Although cortisol reactivity’s relation to overprotective parenting behaviors was contrary to the original hypothesis, perhaps cortisol reactivity influences different parenting behaviors. The extant literature has demonstrated a repeated association between increased cortisol reactivity and intrusive parenting behaviors (Kiel & Buss, 2013; Martorell & Bugental, 2006; Mills-Koonce et al., 2009). Intrusion pushes the child toward a stimulus whereas protection shields a child from it. Perhaps both types of parenting behaviors cannot feasibly occur simultaneously and, possibly, cortisol reactivity uniquely motivates intrusive parenting behaviors, which may prevent the
mother from engaging in overprotection. Although the relation between increased cortisol reactivity and intrusive parenting behaviors in first-time mothers is beyond the scope of this study, future investigations should test a mediational model examining how these are related.

Although a significant indirect effect of cortisol reactivity on first-time motherhood and overprotection was observed, considering how the child’s temperament impacted these relationships provided additional clarification. Mothers of highly inhibited children engaged in more overprotective parenting behaviors. It is possible that these behaviors were primarily driven by the child soliciting this parenting from their mothers, but finding that first-time mothers are more prone to engage in these behaviors with their fearful children is quite interesting. Further, for highly inhibited children, physiological reactivity was not a mechanism by which first-time mothers engaged in more overprotective parenting. Perhaps the experience of having an inhibited child as a first-time mother trumps this internal physiological experience and more directly explains the protective behavior. This suggests that first-time mothers may be prone to engage in parenting behavior that is less than ideal for their inhibited children, which is a potent risk factor for the development of future anxiety spectrum problems (Edwards et al., 2010; McShane & Hastings, 2009; Rubin et al., 1997, Rubin et al., 2002). Further, discovering that first-time mothers are particularly more protective of their inhibited toddlers provides possible targets for intervention during a developmental period when interventions are quite effective (Rapee et al., 2005).

The association between first-time motherhood and cortisol reactivity was moderated by the child’s level of inhibition but in a direction contrary to this study’s hypothesis. The original hypothesis was that mothers of fearful children would find the novelty episodes more distressing due to their child’s fear displays and so mothers would show greater physiological reactivity. However, only first-time mothers of children with low or average levels of inhibition displayed increased cortisol reactivity, whereas mothers of children high in fearful temperament showed virtually no difference from multiparous mothers in their cortisol reactivity. Potentially, those highly inhibited children required more attention from their mothers and this served to distract mothers from their own subjective experience during the laboratory episode. First-time mothers may increase their focus on helping to regulate their highly inhibited children in stressful situations, whereas mothers of less inhibited children are not primed to be ready to come to the rescue and so these mothers may be more aware of the evaluative nature of being recorded.
during the laboratory visit. Interestingly, cortisol reactivity in this context indirectly links first-time motherhood and less overprotective parenting behaviors. As such, it seems that cortisol reactivity serves to explain the link between first-time motherhood and parenting specifically for those children who are not high in inhibition.

**Limitations**

The above results should be considered with an understanding of the study’s limitations. Firstly, the participant sample was largely homogeneous and does not adequately represent the ethnic composition of the United States. The participants were also mostly middle class. The parent-child relationship varies significantly across cultures and so future studies should focus on recruiting more diverse populations. Given the time intensity of collecting longitudinal data and attrition, it would also be informative to examine the relations with a greater number of participants because findings may emerge as significant. In addition, the current study’s assessment of a mother’s subjective experience is not exhaustive but rather represents specific components (worry, HPA-axis activity) of first-time motherhood. Additional investigations are required to determine if parity influences any other experience of motherhood and how this relates to different parenting behaviors. It would also be interesting to identify any protective factors (e.g., spousal support) that may influence the experience of first-time motherhood. Finally, the study’s focus on mothers precluded the investigation of differences in the experience of first-time fatherhood. It is likely that fathers also experience uncertainty and anxiety regarding their transition to parenthood and how this can impact their parenting behaviors should be also be examined.

**Conclusion**

In summary, this study contributes to the existing literature by demonstrating that first-time mothers experience greater worry and physiological reactivity. In turn, these subjective experiences serve to uniquely motivate overprotective parenting behaviors, albeit in different directions. These pathways should also be considered in the context of the child’s level of inhibition because this can impact maternal behavior and physiological reactivity. The dynamic interaction between first-time mothers’ affective and physiological experience and their child’s temperament may inform interventions that seek to optimize children’s developmental trajectories.
References


<table>
<thead>
<tr>
<th></th>
<th>First-time mother</th>
<th>Not a first-time mother</th>
<th>t-value</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>General worry</td>
<td>3.04</td>
<td>0.72</td>
<td>2.70</td>
<td>0.69</td>
<td>-2.33</td>
</tr>
<tr>
<td>Cortisol</td>
<td>0.05</td>
<td>.16</td>
<td>-0.03</td>
<td>0.14</td>
<td>-2.34</td>
</tr>
<tr>
<td>Self-report overprotection (age 2)</td>
<td>1.16</td>
<td>0.35</td>
<td>1.12</td>
<td>0.34</td>
<td>-0.58</td>
</tr>
<tr>
<td>Self-report overprotection (age 3)</td>
<td>1.03</td>
<td>0.36</td>
<td>1.10</td>
<td>0.33</td>
<td>1.03</td>
</tr>
<tr>
<td>Observed overprotective parenting</td>
<td>0.06</td>
<td>0.11</td>
<td>0.05</td>
<td>0.10</td>
<td>-0.20</td>
</tr>
<tr>
<td>Temperament</td>
<td>-0.06</td>
<td>1.14</td>
<td>0.04</td>
<td>0.90</td>
<td>0.48</td>
</tr>
<tr>
<td>SES</td>
<td>51.89</td>
<td>10.68</td>
<td>48.40</td>
<td>12.54</td>
<td>-1.55</td>
</tr>
<tr>
<td>Toddler gender</td>
<td>0.49</td>
<td>0.51</td>
<td>0.44</td>
<td>0.50</td>
<td>-0.47</td>
</tr>
<tr>
<td>Maternal age</td>
<td>31.50</td>
<td>5.16</td>
<td>34.71</td>
<td>4.53</td>
<td>3.53</td>
</tr>
<tr>
<td>Marital status</td>
<td>0.98</td>
<td>0.15</td>
<td>0.92</td>
<td>0.28</td>
<td>-1.36</td>
</tr>
</tbody>
</table>

*Note.* Cortisol reactivity represents the unstandardized residual from a regression equation in which baseline cortisol secretion predicted post-visit cortisol secretion. Temperament is a composite of observed and maternal-reported inhibition.
Table 2

Descriptive Statistics and Bivariate Correlations Among the Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. General worry</td>
<td>2.85</td>
<td>0.71</td>
<td>1.25 – 4.31</td>
<td>-.06</td>
<td>.23*</td>
<td>.22*</td>
<td>.14</td>
<td>.22*</td>
<td>.10</td>
<td>.10</td>
<td>-.08</td>
<td>.12</td>
</tr>
<tr>
<td>2. Cortisol reactivity</td>
<td>0.00</td>
<td>0.15</td>
<td>-0.36 – 0.53</td>
<td>--</td>
<td>.05</td>
<td>-.03</td>
<td>-.24*</td>
<td>-.02</td>
<td>-.09</td>
<td>.01</td>
<td>-.14</td>
<td>.14</td>
</tr>
<tr>
<td>3. Self-report overprotection (age 2)</td>
<td>1.14</td>
<td>0.34</td>
<td>0.33 – 1.83</td>
<td>--</td>
<td>.72***</td>
<td>.22*</td>
<td>.28**</td>
<td>-.08</td>
<td>.00</td>
<td>.04</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>4. Self-report overprotection (age 3)</td>
<td>1.07</td>
<td>0.34</td>
<td>0.17 – 1.83</td>
<td>--</td>
<td>.20*</td>
<td>.45***</td>
<td>.03</td>
<td>.00</td>
<td>.11</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Observed overprotective parenting</td>
<td>0.05</td>
<td>0.11</td>
<td>0.00 – 0.58</td>
<td>--</td>
<td>.42***</td>
<td>.26**</td>
<td>.17</td>
<td>.11</td>
<td>.06</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Temperament</td>
<td>0.00</td>
<td>1.00</td>
<td>-1.60 – 3.19</td>
<td>--</td>
<td>-.10</td>
<td>.09</td>
<td>.08</td>
<td>-.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. SES</td>
<td>49.74</td>
<td>11.93</td>
<td>17.00 – 66.00</td>
<td>--</td>
<td>.01</td>
<td>.30**</td>
<td>.32***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Toddler gender</td>
<td>.46</td>
<td>0.50</td>
<td>0.00 – 1.00</td>
<td>--</td>
<td>.05</td>
<td>-.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Maternal age</td>
<td>33.47</td>
<td>4.99</td>
<td>20.27 – 49.56</td>
<td>--</td>
<td></td>
<td>.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Marital status</td>
<td>0.94</td>
<td>0.23</td>
<td>0.00 – 1.00</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Cortisol reactivity represents the unstandardized residual from a regression equation in which baseline cortisol secretion predicted post-visit cortisol secretion. Temperament is a composite of observed and maternal-reported inhibition. *p < .05, ** p < .01, *** p <.001.
Table 3

*Multiple Regression Predicting Self-Reported Overprotective Parenting from Worry and First-Time Motherhood (FTM)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$b$ (SE)</th>
<th>$\beta$</th>
<th>$t$-value</th>
<th>$p$-value</th>
<th>95% CI</th>
<th>$sr^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1 (DV: Worry)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>2.70 (0.10)</td>
<td>--</td>
<td>27.59</td>
<td>.000</td>
<td>2.50, 2.89</td>
<td>--</td>
</tr>
<tr>
<td>FTM</td>
<td>.34 (0.15)</td>
<td>.24</td>
<td>2.33</td>
<td>.022</td>
<td>0.05, 0.64</td>
<td>.057</td>
</tr>
<tr>
<td>Model 2 (DV: Overprotection)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>.80 (0.15)</td>
<td>--</td>
<td>5.32</td>
<td>.000</td>
<td>0.50, 1.10</td>
<td>--</td>
</tr>
<tr>
<td>FTM</td>
<td>0.00 (0.08)</td>
<td>0.00</td>
<td>0.01</td>
<td>.991</td>
<td>-0.15, 0.15</td>
<td>.000</td>
</tr>
<tr>
<td>Worry</td>
<td>0.11 (0.05)</td>
<td>0.23</td>
<td>2.14</td>
<td>.036</td>
<td>0.01, 0.22</td>
<td>.049</td>
</tr>
</tbody>
</table>

*Note.* The regression was significant for Model 1 ($R^2 = .06, F[1,89] = 5.41, p = .022$) but was only marginally significant for Model 2 ($R^2 = .05, F[2,88] = 2.43, p = .094$). CI = confidence interval. $sr^2$ = squared semi-partial correlation.
Table 4

*Multiple Regression Predicting Observed Overprotective Parenting from Cortisol Reactivity and First-Time Motherhood (FTM)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$b$ (SE)</th>
<th>β</th>
<th>$t$-value</th>
<th>$p$-value</th>
<th>95% CI</th>
<th>$sr^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1 (DV: Cortisol)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.05 (0.06)</td>
<td>--</td>
<td>0.74</td>
<td>.462</td>
<td>-0.08, 0.17</td>
<td>--</td>
</tr>
<tr>
<td>SES</td>
<td>-0.00 (0.00)</td>
<td>-.14</td>
<td>-1.24</td>
<td>.218</td>
<td>-0.00, 0.00</td>
<td>.018</td>
</tr>
<tr>
<td>FTM</td>
<td>0.09 (0.03)</td>
<td>.28</td>
<td>2.52</td>
<td>.014</td>
<td>0.02, 0.15</td>
<td>.073</td>
</tr>
<tr>
<td><strong>Model 2 (DV: Overprotection)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.06 (0.04)</td>
<td>--</td>
<td>-1.28</td>
<td>.204</td>
<td>-0.14, 0.03</td>
<td>--</td>
</tr>
<tr>
<td>SES</td>
<td>0.00 (0.00)</td>
<td>.25</td>
<td>2.34</td>
<td>.022</td>
<td>0.00, 0.00</td>
<td>.061</td>
</tr>
<tr>
<td>FTM</td>
<td>0.02 (0.03)</td>
<td>.08</td>
<td>0.74</td>
<td>.463</td>
<td>-0.03, 0.07</td>
<td>.006</td>
</tr>
<tr>
<td>Cortisol reactivity</td>
<td>-0.17 (0.08)</td>
<td>-.24</td>
<td>-2.20</td>
<td>.031</td>
<td>-0.33, -0.02</td>
<td>.053</td>
</tr>
</tbody>
</table>

*Note.* The regression was significant for both Model 1 ($R^2 = .082$, $F[2,79] = 3.52$, $p = .034$) and Model 2 ($R^2 = .136$, $F[3,78] = 4.11$, $p = .009$). CI = confidence interval. $sr^2 = \text{squared semi-partial correlation.}$
Table 5

*Multiple Regression Predicting Observed Overprotective Parenting from Cortisol Reactivity and First-Time Motherhood (FTM) and Temperament Moderating the A Path*

<table>
<thead>
<tr>
<th>Variable</th>
<th>b (SE)</th>
<th>β</th>
<th>t-value</th>
<th>p-value</th>
<th>95% CI</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1 (DV: Cortisol)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.00 (0.07)</td>
<td>--</td>
<td>0.04</td>
<td>.967</td>
<td>-0.13, 0.14</td>
<td>--</td>
</tr>
<tr>
<td>SES</td>
<td>-0.00 (0.00)</td>
<td>-.05</td>
<td>-0.48</td>
<td>.635</td>
<td>-0.00, 0.00</td>
<td>.003</td>
</tr>
<tr>
<td>FTM</td>
<td>0.08 (0.03)</td>
<td>.27</td>
<td>2.44</td>
<td>.017</td>
<td>0.02, 0.15</td>
<td>.070</td>
</tr>
<tr>
<td>Temperament</td>
<td>0.04 (0.02)</td>
<td>.25</td>
<td>1.55</td>
<td>.126</td>
<td>-0.01, 0.08</td>
<td>.028</td>
</tr>
<tr>
<td>FTM x Temperament</td>
<td>-0.08 (0.03)</td>
<td>-.38</td>
<td>-2.35</td>
<td>.022</td>
<td>-0.14, -0.01</td>
<td>.065</td>
</tr>
<tr>
<td><strong>Model 2 (DV: Overprotection)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.05 (0.04)</td>
<td>--</td>
<td>-1.22</td>
<td>.226</td>
<td>-0.13, 0.33</td>
<td>--</td>
</tr>
<tr>
<td>SES</td>
<td>0.00 (0.00)</td>
<td>.24</td>
<td>2.19</td>
<td>.032</td>
<td>0.00, 0.00</td>
<td>.057</td>
</tr>
<tr>
<td>FTM</td>
<td>0.02 (0.02)</td>
<td>.12</td>
<td>1.09</td>
<td>.280</td>
<td>-0.02, 0.07</td>
<td>.014</td>
</tr>
<tr>
<td>Cortisol reactivity</td>
<td>-0.13 (0.07)</td>
<td>-.20</td>
<td>-1.79</td>
<td>.077</td>
<td>-0.27, 0.01</td>
<td>.038</td>
</tr>
</tbody>
</table>

*Note.* The regression was significant for both Model 1 (R² = .139, F[4, 73] = 2.96, p = .025) and Model 2 (R² = .117, F[3, 74] = 3.28, p = .026). CI = confidence interval. sr² = squared semi-partial correlation.
### Table 6

*Multiple Regression Predicting Observed Overprotective Parenting from Cortisol Reactivity and First-Time Motherhood (FTM) and Temperament Moderating the C Path*

<table>
<thead>
<tr>
<th>Variable</th>
<th>b (SE)</th>
<th>β</th>
<th>t-value</th>
<th>p-value</th>
<th>95% CI</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1 (DV: Cortisol)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.03 (0.07)</td>
<td>--</td>
<td>0.43</td>
<td>.670</td>
<td>-0.11, 0.17</td>
<td>--</td>
</tr>
<tr>
<td>SES</td>
<td>-0.00 (0.00)</td>
<td>-.10</td>
<td>-0.88</td>
<td>.384</td>
<td>0.00, 0.00</td>
<td>0.009</td>
</tr>
<tr>
<td>FTM</td>
<td>0.08 (0.04)</td>
<td>.27</td>
<td>2.38</td>
<td>.020</td>
<td>0.01, 0.15</td>
<td>0.070</td>
</tr>
<tr>
<td><strong>Model 2 (DV: Overprotection)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.05 (0.04)</td>
<td>--</td>
<td>-1.36</td>
<td>.179</td>
<td>-0.13, 0.24</td>
<td>--</td>
</tr>
<tr>
<td>SES</td>
<td>0.00 (0.00)</td>
<td>.24</td>
<td>2.47</td>
<td>.016</td>
<td>0.00, 0.00</td>
<td>0.056</td>
</tr>
<tr>
<td>FTM</td>
<td>0.02 (0.02)</td>
<td>.10</td>
<td>0.96</td>
<td>.340</td>
<td>-0.02, 0.06</td>
<td>0.008</td>
</tr>
<tr>
<td>Temperament</td>
<td>0.02 (0.01)</td>
<td>.25</td>
<td>1.71</td>
<td>.091</td>
<td>0.00, 0.05</td>
<td>0.027</td>
</tr>
<tr>
<td>FTM X Temperament</td>
<td>0.03 (0.02)</td>
<td>.26</td>
<td>1.76</td>
<td>.082</td>
<td>-0.00, 0.07</td>
<td>0.029</td>
</tr>
<tr>
<td>Cortisol reactivity</td>
<td>-0.09 (0.07)</td>
<td>-.14</td>
<td>-1.37</td>
<td>.177</td>
<td>-0.22, 0.04</td>
<td>0.017</td>
</tr>
</tbody>
</table>

*Note.* The regression was marginally significant for Model 1 ($R^2 = .074, F[2, 75] = 2.98, p = .057$) and significant for Model 2 ($R^2 = .337, F[5, 72] = 7.33, p = .000$). CI = confidence interval. sr² = squared semi-partial correlation.
Interaction between first-time motherhood and fearful temperament (FT) from as assessed from observation and maternal report. First-time motherhood significantly predicted greater overprotective parenting at high levels (+1 SD) of FT.

*p < .05.
Interaction between first-time motherhood and fearful temperament (FT) from as assessed from observation and maternal report. First-time motherhood significantly predicted maternal cortisol reactivity at mean levels and low levels (-1 SD) of FT. 

*p < .05, **p < .01.

Figure 2.