BROWN, NICOLE E., M.S. Predicting Children's Emotion Regulation Behaviors from Maternal Emotion Socialization and Vagal Suppression. (2010)
Directed by Dr. Susan Calkins. 53 pp.

The relation between early maternal emotion socialization and children's emotion regulation behaviors were examined across a short-term longitudinal study. Participants were 196 children with data collected at age 3.5 and 4.5-years-old. It was hypothesized that children's vagal suppression at age 4.5 would partially mediate the association between maternal emotion socialization and children's emotion regulation behaviors. To assess maternal emotion socialization mothers completed the Coping with Children's Negative Emotions (CCNES) questionnaire and a supportive and non-supportive aggregate were created. To assess children's emotion regulation behaviors mothers completed the Emotion Regulation Checklist (ERC) and trained research assistants coded a laboratory frustration task for observed emotion regulation behaviors. Results indicate that emotion socialization did not predict vagal suppression or emotion regulation behaviors. Further, vagal suppression was not associated with emotion regulation behaviors. Thus, a mediation effect was not present. Results are discussed in terms of directions for future research.

PREDICTING CHILDREN'S EMOTION REGULATION BEHAVIORS FROM MATERNAL EMOTION SOCIALIZATION AND VAGAL SUPPRESSION

by

Nicole E. Brown

A Thesis Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Science

Greensboro
2010

Approved by

Susan Calkins
Committee Chair

To my mom, who has always been my best friend and loudest cheerleader. Thank you for your endless encouragement, support, and love.

APPROVAL PAGE

This thesis has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair Susan Calkins

Committee Members Marion O'Brien

Esther Leerkes

April 19th, 2010
Date of Acceptance by Committee

April 19th, 2010
Date of Final Oral Examination

ACKNOWLEDGEMENTS

I would like to extend my thanks to my advisor Dr. Susan Calkins, my committee members, Dr. Esther Leerkes and Dr. Marion O'Brien, and everyone at the Family Research Center.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION

During the last two decades, researchers have linked children's lack of adaptive emotion regulation skills to deficits in other developmental domains such as the presence of externalizing and internalizing behavior problems (Calkins, 1994; Hill, Degnan, Calkins, & Keane, 2006), social competence (Mendez, Fantuzzo, & Cicchetti, 2002; Spinrad et al., 2006), and school readiness (Denham et al., 2003; Denham, 2006). It is now known that the preschool period is a critical time for children's emotional development such that socioemotional skills of preschoolers' predict later school adjustment and maladjustment (Denham et al., 2003; Rubin, Coplan, Fox, & Calkins, 2995). Therefore, children's acquisition of adaptive emotion regulation behaviors is crucial to early childhood development.

Emotion regulation processes are defined as "behaviors, skills, and strategies, whether conscious or unconscious, automatic or effortful, that allow children to modulate, inhibit, or enhance emotional expressions and experiences" (Calkins & Hill, 2007, p. 229). Due to the multidimentionality of emotion regulation, researchers assert that in order to understand the development of emotion regulation intrinsic and extrinsic child factors must be examined (Calkins & Fox, 2003). Intrinsic factors are individual differences that are thought of as innate to a child such as physiological functioning; extrinsic factors are external influences such as parental emotion socialization. It has

been proposed that individual differences in emotion regulation stem from both biological and environmental factors that enable children to better cope with heightened emotional arousal (Posner & Rothbart, 2000; Calkins & Howse, 2004). Even though a substantial amount of evidence suggests that intrinsic and extrinsic factors contribute separately to the development of emotion regulation, few studies have used both intrinsic and extrinsic factors to explain the processes through which children's emotion regulation develops. Thus, this study examines children's physiological functioning as a mechanism through which maternal emotion socialization affects children's emotion regulation behaviors.

Physiology and Emotion Regulation Behaviors

Individual differences in the degree of emotional arousal have been thought to play a role in the display and development of emotion regulation behaviors such that the degree and intensity of emotional arousal influences which emotion regulation skills and behaviors children develop and employ (Calkins & Hill, 2007). Thus, the construct of emotion regulation in young children is often examined through observed emotion regulation strategies such as self-soothing, self-distraction, and help-seeking behaviors (Supplee, Skuban, Shaw, & Prout, 2009; Stansbury & Sigman, 2000). Additionally, emotion regulation processes have been found to be fundamentally linked to central physiological processes as early as infancy (Thompson, Lewis, & Calkins, 2008). For example, Rothbart et al. (2000) suggests infants' behavioral and physiological responses to sensory stimuli of different qualities may underlie their initial observed reactivity.

Emotion regulation theories that are composed of biological and physiological aspects of regulation assume that advanced and adaptive emotion regulation behaviors are a result of the maturation of different biological systems across childhood (Calkins and Hill, 2007). One way researchers have examined biological and physiological development of emotion regulation is through neurophysiology. For example, Quirk and Beer (2006) posit that the prefrontal cortex may have an inverse relationship with amygdala activity. Studies have found left amygdala activity to decrease and prefrontal activity to increase when participants are asked to re-appraise negative emotional stimuli (e.g., frightening pictures) (Ochsner et al., 2004; Phan et al., 2005). Moreover, tendencies of approach and avoidance behaviors that have been found to be specialized in the frontal lobes of the brain may influence which behaviors children employ when in emotionally charged situations; maturation of the frontal cortex allows for more advanced and sophisticated regulation behaviors (Fox, 1994).

In addition to examining neurophysiological systems, research investigating the physiological and biological components of emotion regulation has also examined maturation of the parasympathetic nervous system. Maturation that occurs in the parasympathetic nervous system is thought to play an important role in individuals' ability to regulate their state, activity, and emotion (Calkins, Graziano, & Keane, 2007). Porges (1995) introduced the polyvagal theory and identified an index of the functional status of the parasympathetic nervous system, which reflects the vagal control of the heart, as a measurable organismic variable that accounts for differences in the development of emotional expression and regulation.

The polyvagal theory involves the two subsystems of the autonomic nervous system (ANS): the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The primary job of the ANS is to maintain the body's homeostasis; therefore, the two subsystems have complimentary functions. The SNS promotes metabolic output to deal with environmental challenges and is responsible for accelerated heart beats and dilated pupils. The function of the PNS is to conserve the body's energy, rest vital organs, constrict pupils, and slow the heart (Porges, 1994). One common way of measuring parasympathetic influences on heart rate is to measure the variability in heart rate that occurs at the frequency of breathing (respiratory sinus arrhythmia [RSA]) (Calkins, Graziano, & Keane, 2007). Porges (1995) developed a method that measures vagal tone (i.e., the amplitude and period of the oscillations associated with inhalation and exhalation), which is thought to reflect the parasympathetic influence on heart rate by way of the vagus nerve. Specifically, the myelinated vagus nerve sends input to the heart and causes changes in cardiac activity that allow the body to transition between sustaining metabolic processes and generating responses to the environment (Porges, 2007).

According to Porges' (2007) theory, physiological states are associated with different classes of behavior including social engagement and appropriation of emotion. That is, a physiological state characterized by vagal withdrawal would support fight and flight behaviors, and a physiological state characterized by increased vagal influence would support positive social engagement (Porges, 2007). The vagus nerve serves as a vagal brake that can inhibit or disinhibit vagal tone and quickly mobilize or calm an

individual. When the vagus nerve inhibits the sympathetic nervous system's influence on the heart through increased influence, it dampens the activity of the hypothalamic-pituitary adrenal axis and consequently allows individuals to quickly engage and disengage with objects and other individuals, promotes self-soothing behaviors, and facilitates relaxed states which in turn increase individual's emotion regulation capabilities (Porges, 1985). If the vagus nerve is unable to regulate vagal tone, then optimal social engagement will be reduced (Porges, 2007).

The vagal system has two primary roles: physiological homeostasis and regulation of cardiac output. Thus, studies of children's RSA functioning have primarily examined resting RSA and decreases in RSA as predictors of emotion regulation. Resting measures of RSA are stable and increase with age; therefore, it is useful in identifying individual differences and typical arousal levels (Calkins, 1997; Calkins & Keane, 2004). Research suggests a relationship between individuals with low resting RSA and greater externalizing behavior problems, difficult temperament, poor attention, and negativity in young children (Calkins & Howse, 2004; Huffman et al., 1998; Degnan, Calkins, Keane, Hill-Soderlund, 2008). High resting RSA in young boys is associated with parent and teacher reports of emotion regulation and sociability and is correlated with greater emotional expressivity in preschool children (Eisenberg et al., 1995; Cole, Zhan-Waxler, Fox, Usher, & Welsh, 1996). Furthermore, in a study examining physiological reactions to stressful parent-child interactions, Gottman and Katz (2002) found that resting RSA at age 4.5 was predictive of children's emotion regulation at age 8 and that children with a higher resting RSA recovered from stressful situations faster than children with lower

resting RSA. Richards and Cameron (1989) have linked high resting RSA in newborns with positive developmental outcomes; thus, resting RSA is both predictive and stable.

In addition to resting RSA, the vagus nerve's ability to regulate metabolic output in emotionally and behaviorally challenging environmental situations can be assessed by examining the decrease in RSA (vagal suppression). Vagal suppression is the change in vagal tone from a baseline resting measure to a task measure and allows children to engage and disengage when needed. Vagal suppression has also been found to be stable and predictive of later functioning. In a longitudinal study El-Sheikh (2005) found that children's vagal suppression during a challenging problem-solving task remained stable over two years. Stability of vagal suppression is crucial in order to identify pathways and processes that may lead to individual differences in children's physiological capabilities as well as their regulation behaviors.

Current research supports the hypothesis that lower levels of vagal suppression appear to be risk factors for poor emotional health and emotion regulation abilities. Calkins and Keane (2004) found that children who displayed high and stable suppression across the preschool period were less emotionally negative and demonstrated fewer behavior problems and better social skills than other children. Vagal suppression is also associated with optimal emotion regulation behaviors. Calkins and Dedmon (2000) found that high-risk children consistently displayed lower vagal suppression during challenging tasks in addition to displaying more dysregulated emotion behaviors such as intense anger and aggression. Further, in a sample of 41 2 and 3-year-olds Calkins (1996) found

that children with greater suppression engaged in more positive coping strategies during a task designed to elicit negative affect. It is possible that when children are unable to physiologically regulate and the vagas nerve is unable to effectively dampen the activity of the hypothalamic-pituitary-adrenal axis during emotionally charged situations, children are unable to engage in self-soothing and utilize adaptive regulation behaviors.

Parental Emotion Socialization and Emotion Regualtion

Although physiology plays a role in children's ability to regulate their behavior in emotion eliciting situations, external factors also influence children's development. The central external factor that has been the focus of a vast amount of research is the quality of the interactions between children and their caregivers. Caregiver support and flexible responding is critical in the development of infants' emotion regulation behaviors because infants are not able to regulate their own emotional states without caregiver assistance (Calkins and Fox, 2002; Sroufe, 2000). By the end of the first year infants can signal to caregivers when they are frightened, interested, or angry; however it is the caregiver's responsibility to appropriately understand and react to these signals (Calkins & Hill, 2007). As caregivers learn to read infant signals they are able to control the amount of stress and arousal an infant experiences and can slowly increase the exposure to emotionally charged situations in a positive way that provides children with emotion regulation training (Sroufe, 2000).

By the time children enter preschool or kindergarten, it is paramount that they learn to interact in environments that are unfamiliar and that they develop social connections with people outside of their home. Children must rely less on the emotional

support and coaching of their parents and independently interact in social settings in an appropriate manner. However, in order to demonstrate emotional competence in social interactions, parents must actively socialize their children to understand the cultural norms of emotional behavior and appropriate strategies for regulating those emotions (Sroufe, 1996). The socialization of emotion is a multifaceted, complex process that facilitates emotional development and aids children in the understanding, expression, and regulation of emotion (Eisenberg, Cumberland, & Spinrad, 1998). Parents serve as models for children, demonstrating appropriate expression, display, and reactions to emotion. For example, parents can re-direct their children's attention teaching the child self-initiated redirection in emotionally-charged situations.

Parent socialization practices may also hinder the development of children's emotion regulation abilities. Parental reactions to their children's emotions may influence subsequent emotional responses and affect children's use of emotional resources when they are acting independently (Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997; Denham, 1995). For example, if children's emotions are ignored and they are left to cry in frustration after a parent removes a desired toy, children may be unable to independently generate a more appropriate way to deal with a similar situation in a classroom setting (Calkins & Hill, 2007). Therefore, many differences in children's regulatory behaviors in emotionally charged situations may be explained by differences in parental emotion socialization practices.

Maternal encouragement and support has been found to be critical to children's emotional development and social interactions (Strayer & Roberts, 2004; Denham &

Kochanoff, 2002). Less accepting parental responses to emotion have been linked to children's emotional difficulties and psychopathology (O'Neal & Magai, 2005), and children are sadder and more fearful when parents ignore their emotions (Denhan, 2007). Furthermore, parents who respond in an angry way have been found to have children with more emotional behavior problems (Denham et al., 2002).

Behavioral regulation of emotion has also been linked to discussion of emotions within the family, although less frequently. For example, parents who used more frequent and sophisticated language about emotions had children who were better able regulate their emotions during negative emotion eliciting situations (Denham, Cook, & Zoller, 1992). Emotion-related discussions between children and parents may help children link expressions, situations, and words into an emotion-related conceptual system which in turn influences children's emotion regulation skills and behaviors (Bullock & Russel, 1986; Malateesta & Haviland, 1985).

The investigation of the socialization of negative emotions is particularly important because the task of coping with negative affect, such as anger, sadness, or fear, is more developmentally difficult for children than coping with positive affect such as excitement or happiness (Ramsden & Hubbard, 2002). Empirical research has suggested that parental emotion-socialization practices that include non-supportive and punitive reactions to negative emotional displays (e.g. anger and sadness) are associated with negative emotional outcomes for children. Eisenberg, Fabes, and Murphy (1996) proposed that negative reactions to children's displays of negative emotions are likely to intensify and prolong children's arousal in emotion-eliciting situations, increasing the

likelihood of disregulated behavior. For example, in a study of preschoolers, parental punitive reactions to children's negative emotions were associated with avoidant (i.e., avoiding rather than coping to an emotionally arousing situation) and inappropriate emotion regulation strategies (Eisenberg, Fabes, Carlo, & Troyer, 1992).

Eisenberg, Fabes, Schaller, and Carlo (1991) have hypothesized that parental response to negative emotions increases children's personal distress, which they argue reflects children's empathetic over arousal. Eisenberg and colleagues found that boys exposed to negative parental reactions to their negative emotions seemed prone to experience personal distress rather than sympathy, and displayed more inappropriate regulation strategies when confronted with other children's distress. In preschool and kindergarten, children exposed to punitive reactions to emotions seek revenge or run from real life situations that involve anger and are not able to express their own emotions (Eisenberg & Fabes, 1994). Given these findings, it is clear that parent emotion-socialization practices affect children's behavioral regulation abilities; however, the mechanisms through which parental emotion socialization affect emotion regulation are not completely understood. It is possible that parents facilitate the development of their children's physiological regulation by encouraging and demonstrating appropriate emotional reactions and teaching children useful regulation techniques in a supportive environment, which in turn allows children to behaviorally regulate themselves in emotionally charged situations.

Physiology and Parental Emotion Socialization

Animal studies have provided some insight into the ways in which parents can affect the development of their children's physiological functioning. It has been suggested that caregivers affect infants' physiological regulation through the environment they provide rather than through heredity (Propper & Moore, 2006). For example, rats that display high levels of maternal grooming have offspring that display more advanced physiological functions (Champange & Meany, 2001). Furthermore, Calatayud, Coubard, and Belzung (2004) demonstrated that early caregiving plays a crucial role in early development when they examined emotional reactivity of mice raised by a biological mother or a foster mother. Findings revealed that emotional reactivity is induced by maternal behavior rather than transmitted by genetic factors.

Currently, there is little research investigating the effects of caregivers' behaviors on children's physiological processes involved in the regulation of emotion. Preliminary evidence suggests that caregiver effects are present as early as the prenatal period of development. For example, increased amounts of stress hormones during pregnancy may alter the fetus's hypothamic-pituitary-adrenal axis (HPA), which is primarily responsible for the activation of the stress response system, a system that is highly influential during emotionally charged situations (for reviews see Weinstock, 1997; Stansbury and Gunnar, 1994). Furthermore, caregiver touch has also been found to influence infants' stress response systems and the HPA axis (Jahromi, Putnam, & Stifter, 2004).

Specific to parasympathetic nervous system functioning, Calkins, Graziano, Berdan, Keane, and Degnan (2008) found that maternal–child relationship quality

predicted the degree of children's vagal regulation at 5-years-old even after controlling for behavior problems and vagal regulation at age 2, such that children with poorer maternal–child relationships displayed significantly poorer vagal regulation. Similarly, it has been found that infants who were part of mother–child dyads that displayed low levels of synchrony also displayed less vagal suppression (Calkins & Moore, 2004). Finally, in a study examining the gene–environment contributions to the development of vagal reactivity, Propper et al. (2008) found that infants who were at genetic risk for poor physiological regulation had vagal suppression similar to those not at genetic risk when they were exposed to sensitive parenting over a period of 6 to 9 months. Therefore, although the research examining parental effects on biological processes is small, it does support that parents play a role in their children's biological and physiological development.

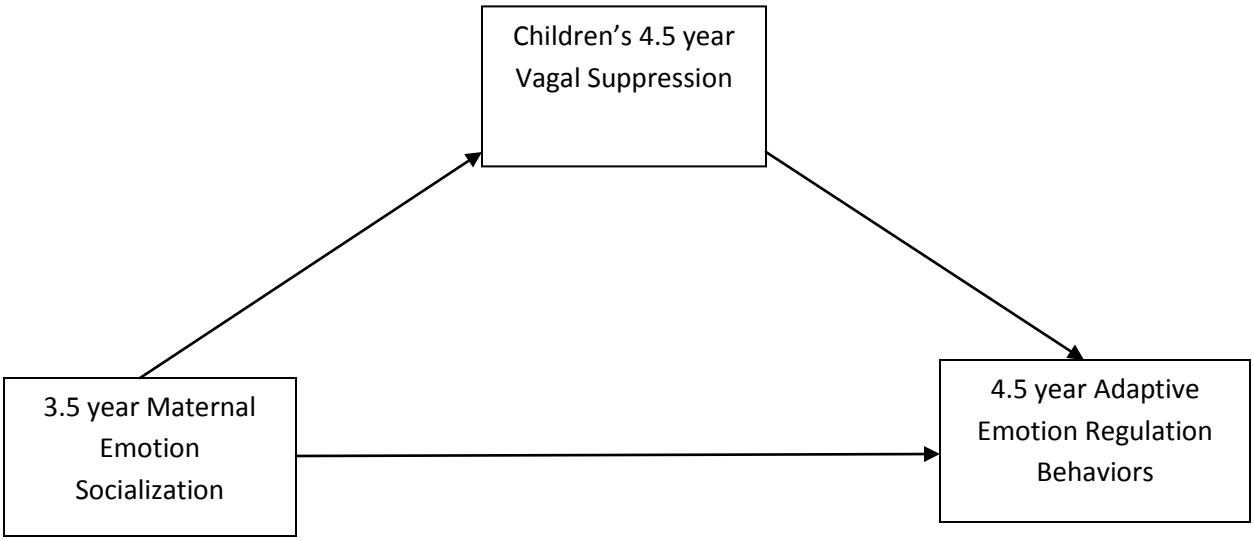
Previous research investigating the effect of direct parenting practices that can be present during parent–child interactions, such as maternal emotion socialization, on child functioning and developmental outcomes is small and has yielded mixed findings. For example, Kennedy and colleagues (2004) found no link between parental socialization and vagal regulation, and Calkins, Smith, Gill, and Johnson (1998) found that positive maternal support was uncorrelated with any physiological or emotional measures. In contrast, Hastings and Nuselovici, et al. (2008) found maternal negative control of emotions to be associated negatively with greater vagal suppression. Consequently, to further examine this relationship the current study investigates whether direct maternal emotion socialization affects the physiological skills that are found to be present in the

development of emotion regulation and predictive of emotion regulation behaviors. It is possible that physiological functioning, as indexed by cardiac vagal suppression, serves as a mechanism through which maternal emotion socialization affects emotion regulation; that is, mothers' who provide a supportive environment for their children to express negative emotions might better facilitate the development of physiological regulation, which in turn allows children to engage in adaptive regulation behaviors.

Mediating Role of Vagal Suppression

To date, only one study has investigated the possible mediating role of vagal suppression in the association between maternal socialization and behavioral regulation. In a short-term longitudinal study, Hastings and Nuselovici, et al. (2008) examined the relations between vagal suppression and emotion regulation, parental socialization and vagal regulation, and whether vagal regulation mediated associations between parental socialization and preschoolers' emotion regulation. Structural equation modeling showed that vagal regulation mediated associations between maternal negative control and children's emotional adjustment. That is, maternal control did not predict externalizing problems or self-regulation after vagal suppression was accounted for. Researchers were unable to find an association between mother's supportive parenting and vagal regulation. One possible explanation for this null finding is that parent scores were computed for restrictive over-control and parent's general supportive ideas about emotion not reactions to children's emotion. Therefore, this study builds on the current research by investigating the effect maternal reactions to negative emotions has on vagal regulation and subsequently emotion regulation behaviors (see Figure 1).

Figure 1. Vagal suppression as a mediator in the relation between maternal emotion socialization and children's reported and observed emotion regulation behaviors.



According to Baron and Kenny (1986) in order to test for mediation several requirements must be met. First, maternal emotion socialization must be correlated with maternal report of emotion regulation behaviors and observed emotion regulation behaviors. Then, in order to establish there is an effect to be mediated a simple linear regression must show maternal emotion socialization as a significant predictor of observed and parent report of emotion regulation behaviors. Second, maternal emotion socialization must be correlated with vagal suppression and a linear regression must reveal maternal emotion socialization as a significant predictor of children's vagal suppression. Third, a linear regression must show that vagal suppression significantly predicts maternal report of emotion regulation behaviors and observed regulation

behaviors. Finally, a regression equation must reveal that maternal emotion socialization drops to a non-significant predictor of maternal report of emotion regulation behaviors and observed emotion regulation behaviors when vagal suppression is added to the model.

Research Questions/Hypotheses

Considering the links found between emotion socialization practices, emotion regulation behaviors, and vagal suppression, it is appropriate to conclude that a mediating effect of vagal suppression may be present. Research questions and hypotheses to explain this relation are laid out in accordance to the meditational steps provided by Baron and Kenny (1986).

1.) What is the relation between maternal emotion socialization and changes in children's emotion regulation behaviors from age 3.5 to age 4.5?

Hypothesis: Supportive maternal emotion socialization practices at age 3.5 will be associated positively with changes in children's reported and observed adaptive emotion regulation behaviors from age 3.5 to 4.5-years-old. Conversely, non-supportive maternal emotion socialization practices at age 3.5 will be associated negatively with changes in children's reported and observed adaptive emotion regulation behaviors from age 3.5 to age 4.5-years-old.

2.) What is the relation between maternal emotion socialization at age 3.5 and children's physiological regulation at age 4.5?

Hypothesis: Supportive maternal emotion socialization at age 3.5 will be associated positively with children's vagal suppression at age 4.5. Conversely, non-

supportive maternal emotion socialization practices at age 3.5 will be associated negatively with children's vagal suppression at age 4.5.

3.) What is the relation between children's physiological regulation and children's emotion regulation behaviors?

Hypothesis: Children's vagal suppression at age 4.5 will be associated positively to changes in adaptive emotion regulation behaviors from age 3.5 to age 4.5.

4.) Does physiological regulation partially mediate the association between maternal emotion socialization at year 3.5 and changes in children's observed and reported adaptive emotion regulations behaviors from age 3.5 to age 4.5 years-old?

Hypothesis: Supportive maternal emotion socialization at age 3.5 will drop from a significant to non-significant predictor of children's reported and observed adaptive emotion regulation behaviors when children's vagal suppression at age 4.5-years-old is added to the model. Additionally, non-supportive maternal emotion socialization at age 3.5 will drop from a significant to a non-significant predictor of children's reported and observed adaptive emotion regulation behaviors when children's vagal suppression at age 4.5-years-old is added to the mode

CHAPTER II

METHODS

Recruitment and Attrition

The current study utilized data from children participating in an ongoing longitudinal study, the School Transitions and Academic Readiness (STAR) project. The STAR project's goal is to understand the way in which cognitive and emotional skills work in conjunction with each other to affect children's performance in kindergarten. Children were recruited from day care centers throughout Guilford County and efforts were made to recruit an equal number of male and female participants from economically and racially diverse backgrounds. Assessments were conducted at the Family Research Center on the University of North Carolina at Greensboro campus. The sample consisted of 263 3.5 year old children (M=41.79, SD=2.41) and their mothers. Of the 263 children, two were accompanied by their fathers and three by their grandmothers. Mothers in the sample were an average of 33 years old (SD=5.91). Approximately 51% had a 4-yr college degree or had completed higher levels of education; 74% of the respondents were married and living with their partner; and 79% were working outside of the home. The mean annual income (n=259) was $55,983 (SD= $32,434), ranging from $2400-$120,000 (Median= $54,000). Fifty-two percent of the children were female; 58% of the children were European American, 35% African American, and 7% of other races.

Of the 263 children who were seen at 3.5 years, 244 returned for the 4.5 year visit. Families lost to attrition included those who could not be located, who declined participation, and who did not respond to phone and letter requests to participate. Mothers of participating children at the 4.5 year visit were on average older (t[259]=2.36, p<.05), more likely to be white (χ^2 [1, *N*=262]=5.06, *p*<.05), and more well educated than mothers of non participating families (t [259]=2.46, *p*<.05).

Participants

The current sample was drawn from the larger study and participants included those children who (a) had available heart rate data at age 4.5, (b) had at least one completed emotion regulation behavior measure (parent reported or observed), and (c) had mother report of parental emotion socialization. This resulted in 196 participants. The demographics of the current sample are similar to those collected at the 3.5 and 4.5 year time points. Of the 196 participants, 98 are female (50%) and 98 are male (50%); approximately 61% were white and 39% were non-white. Additionally, 54% of the participating mothers had a 4-year college degree or higher. Finally, 31% of families had income-to-needs ratios less than 2.0, indicating low income, 57% had ratios of 2.0 to 5.0, indicating middle income, and 12% had ratios greater than 5.0, indicating high income.

TABLE 1. Descriptive Information of Study Demographic Variables

	%	*M* (*SD*)
Child Sex (Female)	50	
Child Race (Non-white)	39	
Maternal Education		
High school degree or less	11	
Attended college	34	
4yr degree	27	
Greater than a 4yr degree	28	
Income to Needs Ratio		2.94 (1.72)
<2	36	
2-5	54	
>5	10	

Measures

Emotion Regulation Behaviors. Emotion regulation behaviors were assessed when children were 3.5 and 4.5-years-old through maternal report and laboratory tasks designed to assess emotion regulation behaviors and emotional reactivity.

Maternal report of emotion regulation behaviors. At both time points mothers completed the Emotion Regulation Checklist (ERC; Shields and Cicchetti, 1997) which assesses parents'perceptions of their children's emotion regulation and emotionality. The ERC is composed of 24 items rated on a 4-point Likert scale that indicate the frequency

of emotion related behaviors from 1 (never) to 4 (always). This measure yields two subscales, negativity/lability and emotion regulation. The negativity subscale refers to children's tendency to become distressed and includes items such as "*is easily frustrated*" and "*is impulsive*." The regulation subscale is comprised of questions such as "can say when he/she is angry" and "can wait for something when asked to do so" and refers to children's ability to modulate emotional arousal. Higher scores on each subscale indicate greater intensity. The sum score of the emotion regulation subscale was used as an index of mother report of children's adaptive emotion regulation behaviors because it focuses on children's control of emotional responses. The items used to create this variable had internal reliability of 0.60 and .56 for 3.5 year and 4.5 year respectively.

Observed emotion regulation behaviors. Emotion regulation was also assessed through The *Impossibly Perfect Green Circle*s (Green Circles; GC) laboratory task adapted from Goldsmith and Reilly (1993). GC is an observational task that is coded to obtain indices of global emotion regulation and global frustration in addition to specific regulation behaviors. During the Green Circles task children are given a sheet of white paper and a green marker. In a neutral tone, an experimenter repeatedly (for 3.5 minutes) asks the child to draw a perfect green circle and gently criticizes previous circles drawn. Critiques do not provide the child with enough information to fix the problem, but they are specific (e.g, too small or too bumpy). Finally, when the task is over the children receive positive comments and the experimenter acknowledges that the last circle is perfect.

The Green Circles task is videotaped and regulation behaviors are coded from videotapes to index the child's ability to use regulation behaviors of approach, withdrawal, and distraction. The measure yields four scores: *Help-Seeking Score*, a measure of a child's help-seeking behavior; *Distraction Score*, a measure of the extent to which the child engaged in distraction as a regulatory strategy, *Physical Negative Score*, a measure of negative behaviors such as slapping a hand on the table or flipping the paper over; and *Verbal Negative Score*, a measure of negative verbal expressions such as "I don't want to do this anymore" or "this is hard." The videos were coded for the frequency of the given behaviors in 30-second intervals; these were summed to obtain a help-seeking, distraction, physical negative and verbal negative score for the entire duration of the task. Thus, the total score for each behavior is the amount of seconds the child engaged in that particular strategy for the entire 3.5 minute task. The help-seeking and distraction scores were significantly correlated. Thus, a composite score was computed by combining the help-seeking score and the distraction score as an index of children's observed adaptive emotion regulation behaviors. Help-seeking and distraction were combined because they were correlated and can be thought of as more adaptive regulation behaviors than being physically or verbally negative.

To establish reliability approximately 22% of the videotapes from the 3.5 year visit (N=54) and 20% of the videotapes from the 4.5 year visit (N=56) were coded by two coders. The Pearson correlation between the two rater's codes for the 3.5 year help-seeking score and the distraction score are .95 ($p<.01$) and .82 ($p<.01$) respectively. The

Pearson correlation between the two rater's codes for the 4.5 year help-seeking score and the distraction score are .92 (p<.01) and .89 (p<.01) respectively.

Vagal Suppression. Physiological activity was collected to assess physiological regulation and reactivity. To assess vagal tone, baseline EKG was recorded while children watched a 5-minute video and EKG recording was continued during the Green Circles task. Two electrodes were placed on children's chests and bellies and connected to a preamplifier, the output of which was processed through a vagal tone monitor (Series 2000 Mini-Logger, Mini Mitter Co., Inc. Bend, OR) for R-wave detection. A data file containing the interbeat intervals (IBIs) was transferred to a laptop computer for later artifact editing (e.g, child movement) and analysis. Using the software program MXEDIT (Delta Biometrics, Inc, Bethesda, MD) the data files were analyzed to derive vagal tone. The tasks included in the current analysis include the baseline task and the Green Circles task described above. Green Circles vagal suppression is calculated based on a difference score of mean vagal tone in the task from the mean baseline score. A positive score indicates greater suppression which is indicative of greater physiological regulation.

Maternal emotion socialization. Mothers completed the Coping with Children's Negative Emotions (CCNES) questionnaire designed to assess the ways in which they respond to their children during emotionally charged situations. Each response is rated on a 7-point scale ranging from 1 (very unlikely) to 7 (highly likely). This measure yields 6 subscales: distress reactions, punitive responses, minimization reactions, expressive encouragement, emotion focused reactions, and problem focused reactions (Fabes, Poulin, Eisenberg, & Madden-Derdich, 2002). The distress reactions subscale indicates

whether the mother becomes distressed herself when her child experiences a negative emotion. The punitive response subscale represents the degree to which mothers use verbal or physical punishment to control their children's negative emotions. The minimization subscale reflects the degree to which mothers discount the seriousness of their children's emotions. In contrast, the expressive encouragement subscale reflects the degree to which mothers accept their children's negative emotional displays. Finally, the problem focused and emotion focused subscale reflect the extent to which mothers help their children solve their problems, and which strategies they use to cope with the emotions (e.g., distraction or comfort). Higher scores in each subscale indicate more frequent use of that particular response. Following previous research, two aggregates, supportive and non-supportive, were calculated (Denham & Kochanoff, 2002). Non-supportive reactions include the minimizing, punitive, and distress reaction scales, while supportive reactions include the encouraging, emotion-focused, and problem-focused reaction scales. Alphas for supportive and non-supportive aggregates are reported at .80 and .64 respectively. The CCNES has demonstrated adequate test-retest reliability and construct and predictive validity (Fabes, Poulin, Eisenberg, & Madden-Derdich, 2002).

CHAPTER III

RESULTS

Missing Data

There were 3 cases in the analytic sample missing some portion of the data. One participant had missing data on maternal report of highest education completed and 2 participants were missing data on the 4.5 year adaptive emotion regulation behaviors composite score. The total percent of missing data for the Coping with Children's Negative Emotions (CCNES) questionnaire and the Emotion Regulation Checklist (ERC) was less than 5% for both the 3.5 and the 4.5 year data collection time points. Because the proportion of missing values was small, single imputation was used. Missing data were imputed using the NORM software (Schafer, 1997) which utilizes an Expectation-Maximization (EM) algorithm to replace missing values.

Analyses

Preliminary analyses included examining the frequencies and distributions of all study variables. Descriptive information of the study demographic variables can be found in Table 1. The means, standard deviations, and ranges of the 3.5 and 4.5 year study variables can be seen in Table 3 and Table 4 respectively. The correlations between the demographic variables and the study variable revealed that maternal education and family income-to-needs ratio were not correlated with any of the study variables. However, t-tests revealed that 3.5 year supportive maternal emotion socialization was higher for

white children (M = 6.1, SD = .59) than for nonwhite children (M = 5.8, SD = .72), t(194) = -3.05, p = .03 and females had a higher mother report of emotion regulation behaviors (M = 28.13, SD = 2.27) than males (M = 27.40, SD = 2.48), t(194) = 2.13, p = .04. Therefore, these two demographics were used as control variables for all analyses. As can be seen in Table 2, 3.5 year supportive maternal emotion socialization was correlated with 4.5 year parent report of emotion regulation behaviors and 3.5 year non-supportive maternal emotion socialization.

TABLE 2 . Pearson Correlations Among Study Variables

	2	3	4	5
1. 3.5 yr Supportive Emotion Socialization	-.18*	.16*	-.03	-.07
2. 3.5 yr Non-supportive Emotion Socialization		-.09	.07	.01
3. 4.5 yr Emotion Regulation SS (Parent Report)			.05	-.04
4. 4.5 yr Adaptive Emotion Regulation (Observed)				.03
5. 4.5 yr Vagal Suppression				

* $p < .05$. ** $p < .01$.

TABLE 3. Descriptive Information of 3yr Study Variables

	M	SD	Range	N	Skewness
Maternal Report of Emotion Regulation Behaviors					
Emotion Regulation Sum Score	27.19	2.59	17 - 32	196	-.51
Observed Emotion Regulation Behaviors					
Help-Seeking Behaviors	1.53	3.10	0-27	196	4.60
Distraction Behaviors	9.01	6.45	0-27	196	.80
Adaptive Emotion Regulation Composite	10.79	7.64	0 - 39	196	.94
Maternal Emotion Socialization					
Supportive	5.98	.68	2.82 – 7.0	196	-.62
Non-supportive	2.24	.51	1.36-4.15	196	.79

TABLE 4. Descriptive Information of 4yr Study Variables.

	M	SD	Range	N	Skewness
Maternal Report of Emotion Regulation Behaviors					
Emotion Regulation Sum Score	27.69	2.44	21 - 32	196	-.20
Observed Emotion Regulation Behaviors					
Help-seeking Score	1.06	1.60	0 - 10	194	2.34
Distraction Score	3.84	3.16	0 - 15	194	.18
Adaptive Emotion Regulation Composite	4.90	4.00	0 – 19	194	.18
Physiological Emotion Regulation					
Baseline Vagal Tone	6.62	1.06	3.96 - 9.23	196	-.19
Task Vagal Tone	7.49	1.43	3.91 -10.91	196	.01
Vagal Suppression	.90	.66	-.72 – 2.58	196	-.03

Due to the previously described relationships between emotion socialization, vagal suppression, and emotion regulation behaviors, four meditational models were tested. The first two models used children's 4.5 year vagal suppression as a mechanism through which supportive maternal emotion socialization practices at age 3.5 effected both maternal report of emotion regulation behaviors and observed emotion regulation behaviors at age 4.5. Maternal report of adaptive emotion regulation behaviors and observed adaptive emotion regulation behaviors were separated into two models to provide a clearer picture of children's general adaptive regulation behaviors as reported by the mother, and researcher observed adaptive behaviors during a task specifically designed to elicit frustration. The second two models investigated the effect of non-supportive emotion socialization by examining children's vagal suppression as a mechanism through which non-supportive emotion socialization affects maternal report of adaptive emotion regulation behaviors and observed adaptive emotion regulation behaviors. In order to test the role early maternal emotion socialization has on later developmental outcomes, longitudinal analyses are necessary. Thus, for all analyses 3.5 year maternal emotion socialization (i.e., supportive and non-supportive) was used to predict 4.5 year vagal suppression and emotion regulation behaviors (i.e., observed and parent report). In addition, because the best predictor of emotion regulation is prior emotion regulation, the dependent variable of interest in the longitudinal analyses is the change in emotion regulation from age 3.5 to age 4.5. Therefore, previous observed and maternal report of emotion regulation behaviors were used as controls in all analyses to

ensure that the predicted variable was emotion regulation behaviors at age 4.5 that cannot be explained by earlier behavioral regulation.

What is the relationship between maternal emotion socialization and adaptive emotion regulation behaviors?

According to Baron and Kenny (1986) for a meditational effect to be present the independent variable must predict the dependent variable in all 4 models. That is, both supportive and non-supportive maternal emotion socialization must predict parent report of adaptive emotion regulation behaviors and observed adaptive emotion regulation behaviors. A linear regression was used to address whether supportive maternal emotion socialization predicted the two dependent variables (observed and parent report of emotion regulation behaviors). Contrary to what was hypothesized, after controlling for 3.5 year reported emotion regulation behaviors supportive maternal emotion socialization did not predict maternal report of adaptive emotion regulation behaviors ($\beta = .09$, $p = .20$), or observed adaptive emotion regulation behaviors ($\beta = .03$, $p = .71$). Next, a linear regression was used to examine the effect non-supportive parenting had on adaptive emotion regulation behaviors. Also contrary to what was expected, non-supportive emotion socialization did not predict maternal report of adaptive emotion regulation behaviors ($\beta = .06$, $p = .37$), or observed adaptive emotion regulation behaviors ($\beta = .05$, $p = .45$). Therefore, the first criterion for mediation was not met.

What is the relationship between maternal emotion socialization and children's vagal suppression?

The next criterion Baron and Kenny (1986) list for mediation is that the independent variable (i.e., maternal emotion socialization) must predict the mediator (i.e., vagal suppression). A linear regression revealed that contrary to what was hypothesized, neither supportive maternal emotion socialization ($\beta = -.06$, $p = .45$), or non-supportive emotion socialization ($\beta = -.05$, $p = .55$), predicted children's vagal suppression. Therefore, the second criterion for mediation was not met.

What is the relationship between children's vagal suppression and adaptive emotion regulation behaviors?

The third criterion listed in order for a mediation effect to be present is the mediator (i.e., vagal suppression) must predict the dependent variables (adaptive observed and reported emotion regulation behaviors). Contrary to expectations, after controlling for previous emotion regulation behaviors children's vagal suppression did not predict maternal report of adaptive emotion regulation behaviors ($\beta = -.02$, $p = .74$), or observed adaptive emotion regulation behaviors ($\beta = .05$, $p = .54$). Thus, the third criterion for mediation was not met.

Does vagal suppression mediate the relation between maternal emotion socialization and children's adaptive emotion regulation behaviors?

Given that none of the criteria for mediation were met, it is clear that contrary to what was hypothesized there was no mediation effect of vagal suppression in any of the four tested models (see Table 5 – Table 8).

TABLE 5. Multiple Regression Predicting Changes in Maternal Report of Adaptive Emotion Regulation Behaviors from Children's Vagal Suppression and Report of Maternal Supportive Emotion Socialization at age 3.5 (N= 196)

	Model 1			Model 2			Model 3		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Child Gender	-.19	.30	-.04	-.21	.30	-.04	-.21	.31	-.04
Child Race	.26	.30	.05	.35	.31	.07	.34	.31	.07
3.5 yr Maternal Report of ER	.48	.06	.52**	.48	.06	.50**	.48	.06	.50**
3.5 yr Supportive ES				.25	.23	.07	.24	.23	.07
4.5 yr Vagal Suppression							-.04	.23	-.01
ΔR^2		.28			.004			.000	
F for change in R^2		25.25**			1.56			.037	

* $p < .05$. ** $p < .01$.
Emotion Regulation (ER)
Emotion Socialization (ES)

TABLE 6. Multiple Regression Predicting Change in Observed Adaptive Emotion Regulation Behaviors from Children's Vagal Suppression and Maternal Report of Supportive Emotion Socialization Practices at age 3.5 (N=194)

	Model 1			Model 2			Model 3		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Child Gender	.16	.56	.02	.16	.56	.02	.16	.56	.02
Child Race	-.05	.57	-.01	-.08	.59	-.01	-.06	.59	-.01
3.5 yr Observed ER	.14	.04	.27**	.14	.04	.27**	.14	.04	.27**
3.5 yr Supportive ES				-.09	.42	-.02	-.07	.42	-.01
4.5 yr Vagal Suppression							.25	.43	.04
ΔR^2		.073			.000			.002	
F for change in R^2		5.00**			.042			.340	

* $p < .05$. ** $p < .01$.
Emotion Regulation (ER)
Emotion Socialization (ES)

TABLE 7. Multiple Regression Predicting Changes in Maternal Report of Adaptive Emotion Regulation Behaviors from Children's Vagal Suppression and Report of Maternal Non-supportive Emotion Socialization at age 3.5 (N= 196)

	Model 1			Model 2			Model 3		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Child Gender	-.19	.30	-.04	-.19	.30	-.04	-.19	.30	-.04
Child Race	.27	.30	.05	.27	.31	.05	.27	.31	.05
3.5 yr Mother Report of ER	.49	.06	.52**	.50	.06	.52**	.50	.06	.52**
3.5 yr Non-supportive ES				.06	.30	.01	.06	.30	.01
4.5 yr Vagal Suppression							-.06	.23	-.02
ΔR^2		.28			.000			.000	
F for change in R^2		2.25**			.04			.07	

* $p < .05$. ** $p < .01$.
Emotion Regulation (ER)
Emotion Socialization (ES

TABLE 8. Multiple Regression Predicting Change in Observed Adaptive Emotion Regulation Behaviors from Children's Vagal Suppression and Maternal Report of Non-supportive Emotion Socialization Practices at age 3.5 (N=194)

	Model 1			Model 2			Model 3		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Child Gender	.16	.56	.02	.17	.56	.02	.17	.56	.02
Child Race	-.05	.57	-.01	-.05	.57	-.01	-.03	.07	.00
3.5 yr Observed ER	.14	.04	.27**	.14	.04	.27**	.14	.04	.27**
3.5 yr Non-supportive ES				.52	.54	.07	.52	.54	.07
4.5 yr Vagal Suppression							.25	.43	.04
ΔR^2		.073			.005			.002	
F for change in R^2		5.00**			.932			.36	

* $p < .05$. ** $p < .01$.
Emotion Regulation (ER)
Emotion Socialization (ES

CHAPTER IV

DISCUSSION

The present study aimed to investigate the relation between supportive maternal emotion socialization and children's emotion regulation behaviors, which has been found to be important for children's school readiness and social interactions. Because emotion regulation is critical to the development of children's socioemotional competence, it is important to understand the way in which mother's can help to facilitate its development. The mediating role of vagal suppression, an indicator of physiological regulation, was tested in order to further examine the relation between emotion socialization and children's regulation behaviors. It was proposed that one way mother's can facilitate more adaptive emotion regulation skills is through providing emotionally supportive environments that foster children's physiological regulation. The findings presented provide extended information on the way in which parenting predicts children's physiological development and how physiological skills predict observed behaviors.

The first question the current study asked was whether maternal emotion socialization was related to observed and reported adaptive emotion regulation behaviors. It was predicted that supportive and non-supportive maternal emotion socialization when children were 3.5-years-old would predict changes in emotion regulation from 3.5 to 4.5-years-old. That is, children with mothers who responded to their children's negative

emotions in a supportive way when they were 3.5-years-old would develop and display more adaptive emotion regulation behaviors, and children with mothers who responded in a non-supportive way would develop fewer regulation behaviors across a year's time. Contrary to expectations, supportive and non-supportive parenting at age 3.5 did not predict changes in children's emotion regulation behaviors from age 3.5 to age 4.5.

It is unclear as to why there was not a significant association between emotion socialization and emotion regulation behaviors as previous studies have found (O'Neal & Magai, 2005, Denham, 2007). Emotion socialization was measured by maternal report of how likely they would react in supportive or non-supportive ways to children's different negative emotions in various contexts. Therefore, it may be that mothers need to do more than simply respond to negative emotions in a positive way in order to create an environment that facilitates more adaptive regulation behaviors; the discussion of emotions and mother's own expression of emotions might also be important factors that contribute to children's emotional development.

The second question addressed in the current study involved the relation between maternal emotion socialization and children's physiological regulation. Contrary to what was expected, neither supportive emotion socialization nor non-supportive emotion socialization predicted greater vagal suppression. Not much research has been conducted regarding parenting effects on biological systems; however, empirical work that has examined parenting and vagal suppression reported mixed findings. Researchers have reported no association between supportive parenting and vagal suppression (Calkins,

Smith, Gill, & Johnson, 1998; Kennedy et al., 2004); however, Hastings et al, (2008) reported finding a positive linear relationship. Further investigation of this relationship is needed in order solve the discrepancies in the current research and to provide a clearer picture of the ways in which parenting affects children's physiological functioning.

One possible explanation could be that supportive parenting practices in general facilitate greater physiological development (Propper & Moore, 2006) and that supportive parenting in response to negative emotions is just a piece of the puzzle. In addition, baseline vagal tone was not examined here. As previously stated, research has shown a relationship between lower-resting baseline vagal tone and less than optimal developmental outcomes (e.g., difficult temperament, behavior problems, poor attention, and negativity) and higher-resting vagal tone with more optimal developmental outcomes (Calkins & Howse, 2004; Huffman et al., 1998; Degnan, Calkins, Keane, Hill-Soderlund, 2008). For example, a study conducted by Porter (2003) found that infants that spent more time in a communicative sequence with their mothers during free play, which allowed for a range of emotional experiences, had higher baseline vagal tone than infants in dyads in which one partner's attention was not being reciprocated. Thus, supportive parenting may have a bigger effect on baseline vagal tone rather than vagal suppression.

A third possible explanation for why no association was found between maternal emotion socialization and children's vagal suppression could be the length of time in between each collection point. It is possible that parenting at age 3.5 does not predict the

development of vagal suppression, but parenting at an earlier age or across a longer time frame might influence physiological development. For example, Burgess, Marshall, Rubin, and Fox (2003) found that although attachment classification was not concurrently associated with vagal tone at age 2, it did predict vagal tone when the children were 4 years old. Therefore, supportive parenting at an earlier age might be more important in facilitating children's physiological skills than later on in their development.

The relationship between vagal suppression and adaptive emotion regulation behaviors was the third association addressed. Based on previous research it was predicted that higher vagal suppression would lead to more adaptive emotion regulation behaviors; however, this relationship was not found. Overall, most previous research has reported findings that are consistent with models of vagal tone as a marker of differences in emotion regulation responses (Gentzler, Santucci, Kovacs, & Fox, 2009; Santucci, Silk, Shaw, Gentzler, Fox, & Kovacs, 2008). It is unclear why the current findings do not also support a positive linear relationship between vagal tone and emotion regulation behaviors. It is possible that the measures used in this study do not give the most accurate account of adaptive emotion regulation behaviors or that the strategy used to frustrate the children did not elicit enough emotion. Perhaps using a different laboratory task would have produced findings in accordance with much of the previous work.

Finally, vagal suppression was proposed as a possible mediator in the association between maternal emotion socialization and adaptive emotion regulation behaviors. The criteria Baron and Kenny (1986) listed in order for mediation to be present were not met

in the current study. Thus, contrary to the hypotheses, vagal suppression did not mediate the relationship between supportive or non-supportive emotion socialization and observed or reported adaptive emotion regulation behaviors. Much of the previous work examining the role of vagal suppression in the association between supportive emotion socialization and emotion regulation behaviors has used vagal suppression as a moderator variable (Kennedy, Rubin, Hastings, & Maisel, 2004). It is possible that vagal suppression plays a moderating role instead of a mediating role such that children who display greater vagal suppression rely less on, or are less susceptible to, the emotion socialization of their mothers than children who display lower vagal suppression. Thus, children with greater physiological skills may develop more adaptive emotion regulation strategies and behaviors regardless of the supportive parenting they received, whereas children who did not develop as well physiologically would require supportive emotion socialization from their mothers in order to learn adaptive emotion regulation behaviors. However, it is evident that children vary in their physiological development therefore the question of what environmental influences if any lead to these differences in physiological functioning remains.

The null findings of the current study imply that the mechanisms through which emotion socialization facilitates emotion regulation behaviors must be further examined. Future research should attempt to examine parenting factors such as parental control, sensitivity, expressiveness, and communication, in addition to emotion socialization, to better understand how parenting relates to not only children's physiological functioning

but also their observed behaviors. It is possible that parents who are supportive and nurturing in multiple aspects of their children's lives including positive and negative emotions are better able to facilitate early social emotional development. In addition, future research might also examine gender as a moderator and test a moderated meditation model. Parents may socialize males and females differently and thus the mechanisms that link emotion socialization and emotion regulation behaviors might be different. Additionally, researchers should strive conduct more in-home observations so the differences in emotion regulation behavior between an artificial laboratory setting and a more natural setting can be examined. Finally, it would be useful to collect data from all family members in the home to better understand emotion socialization, specifically considering the possibility of joint socialization of mothers and fathers (McElwain et al., 2007).

The current study contributes to our knowledge of the development of emotion regulation and utilizes maternal emotion socialization and children's vagal suppression to show how internal and external factors might explain the process through which adaptive emotion regulation behaviors develop. The advantages of this study include a large and diverse sample and a focus on children of a specific age (all children were 3.5 and 4.5 years old when data were collected) across a time period of one year. Although the mediation effects were not significant, the study allowed the examination of the effects of parenting across time on biological and behavioral components of development and addressed questions that had not previously been asked in the literature; therefore

advancing the understanding of the role of physiological functioning and supportive parenting in early emotional development.

Despite its contributions, the current study was not without limitations. First, only one measure of maternal emotion socialization was used and it was obtained solely from mother-report questionnaires, which could introduce biases of social desirability not addressed in these analyses. It would have been beneficial to include an observational component of maternal emotion socialization and thus increase the validity of the emotion socialization construct. Second, all measures were collected in a laboratory setting. Although this context allows for uniformity across all families, the emotion socialization practices and emotion regulation behaviors referred to in the current project are more natural every day occurrences and therefore might have been captured easier with in-home observations. For example, being in an unfamiliar laboratory setting may have affected the way in which children reacted to the frustrating situation such that if they had been in more familiar surroundings they might have been more likely to display their typical everyday reactions to frustrating events. Finally, information from fathers or other relatives in the home was not available. This limits the conclusions we can draw about the emotion socialization in general beyond mother-child interactions.

In conclusion, emotion regulation is paramount in the ability to lead a healthy and productive life. People are faced with different emotions many times throughout one given day, if they are not able to control their emotions they will be unable to sustain

positive social relationships and function in daily activities; therefore, it is essential to understand the processes through which emotion regulation develops and how parents can be active contributors to the development of their children's early social emotional skills

REFERENCES

Baron, R., & Kenny, D. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Bocknek, E., Brophy-Herb, H., & Banerjee, M. (2009). Effects of parental supportiveness on toddlers' emotion regulation over the first three years of life in a low-income African American sample. *Infant Mental Health Journal*, *30*(5), 452-476.

Bronfenbrenner, U., & Ceci, S. (1994). Nature-nuture reconceptualized in developmental perspective: A bioecological model. *Psychological Review*, *101*(4), 568-586.

Calatayud, F., Coubard, S., & Belzung, C. (2004). Emotional reactivity in mice may not be inherited but influenced by parents. *Physiology & Behavior*, *80*(4), 465-474.

Calkins, S. (1994). Origins and outcomes of individual differences in emotion regulation. *Monographs of the Society for Research in Child Development*, *59*(2), 53.

Calkins, S. (1997). Cardiac vagal tone indices of temperamental reactivity and behavioral regulation in young children. *Developmental Psychobiology*, *31*(2), 125-135.

Calkins, S., & Dedmon, S. (2000). Physiological and behavioral regulation in two-year-old children with aggressive/destructive behavior problems. *Journal of Abnormal Child Psychology*, *28*(2), 103-118.

Calkins, S., Graziano, P., Berdan, L., Keane, S., & Degnan, K. (2008). Predicting cardiac vagal regulation in early childhood from maternal-child relationship quality during toddlerhood. *Developmental Psychobiology*, *50*(8), 751-76.

Calkins, S. D., Graziano, P. A., Keane, S. P. (2007). Cardiac vagal regulation differentiates among children at risk for behavior problems. *Biological Psychology, 74,* 144-153.

Calkins, S., & Fox, N. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology*, *14*(3), 477-498.

Calkins. S., & Hill, A. (2007). Caregiver influences on emerging emotion regulation. In J. J. Gross (Ed.), Handbook of emotion regulation (pp.229-248). New York, NY: Guilford Press.

Calkins, S., & Howse, R. (2004). Individual differences in self-regulation: Implications for childhood adjustment. *The regulation of emotion* (pp. 307-332).

Calkins, S., & Keane, S. (2004). Cardiac Vagal Regulation across the Preschool Period: Stability, Continuity, and Implications for Childhood Adjustment. *Developmental Psychobiology*, *45*(3), 101-112.

Calkins, S., Smith, C., Gill, K., & Johnson, M. (1998). Maternal interactive style across contexts: Relations to emotional, behavioral, and physiological regulation during toddlerhood. *Social Development*, *7*(3), 350-369.

Cole, P., Zahn-Waxler, C., Fox, N., Usher, B., & Welsh, J. (1996). Individual differences in emotion regulation and behavior problems in preschool children. *Journal of Abnormal Psychology, 105*(4), 518-529.

Degnan, K., Calkins, S., Keane, S., & Hill-Soderlund, A. (2008). Profiles of disruptive behavior across early childhood: Contributions of frustration reactivity, physiological regulation, and maternal behavior. *Child Development, 79*(5), 1357-1376.

Denham, S. (1989). Maternal affect and toddlers' social-emotional competence. *American Journal of Orthopsychiatry, 59*(3), 368-376.

Denham, S. (2006). Social emotional competence as a support for school readiness: What is it and how do we assess it? *Early Education and Development, 17(1),* 57-89.

Denham, S., Blair, K., DeMulder, E., Levitas, J., Sawyer, K., Auerbach-Major, S., et al. (2003). Preschool emotional competence: Pathway to social competence. *Child Development, 74*(1), 238-256.

Denham, S., Cook, M., & Zoller, D. (1992). 'Baby looks very sad': Implications of conversations about feelings between mother and preschooler. *British Journal of Developmental Psychology, 10*(3), 301-315.

Denham, S., & Kochanoff, A. (2002). Parental contributions to preschoolers' understanding of emotion. *Marriage & Family Review, 34*(3), 311-343.

Denham, S., Mitchell-Copeland, J., Strandberg, K., Auerbach, S., & Blair, K. (1997). Parental contributions to preschoolers' emotional competence: Direct and indirect effects. *Motivation and Emotion, 21*(1), 65-86.

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9,* 241-273.

Eisenberg, N., & Fabes, R. (1994). Mothers' reactions to children's negative emotions: Relations to children's temperament and anger behavior. *Merrill-Palmer Quarterly, 40*(1), 138-156.

Eisenberg, N., Fabes, R., Carlo, G., & Troyer, D. (1992). The relations of maternal practices and characteristics to children's vicarious emotional responsiveness. *Child Development, 63*(3), 583-602.

Eisenberg, N., Fabes, R., & Murphy, B. (1996). Parents' reactions to children's negative emotions: Relations to children's social competence and comforting behavior. *Child Development, 67*(5), 2227-2247.

Eisenberg, N., Fabes, R., Schaller, M., & Carlo, G. (1991). The relations of parental characteristics and practices to children's vicarious emotional responding. *Child Development, 62*(6), 1393-1408.

El-Sheikh, M. (2005). Stability of respiratory sinus arrhythmia in children and young adolescents: A longitudinal examination. *Developmental Psychobiology, 46*(1), 66-74.

El-Sheikh, M., Harger, J., & Whitson, S. (2001). Exposure to interparental conflict and children's adjustment and physical health: The moderating role of vagal tone. *Child Development, 72*(6), 1617-1636.

El-Sheikh, M., & Whitson, S. (2006). Longitudinal relations between marital conflict and child adjustment: Vagal regulation as a protective factor. *Journal of Family Psychology, 20*(1), 30-39.

Fox, N. (1994). Dynamic cerebral processes underlying emotion regulation. *Monographs of the Society for Research in Child Development, 59*(2), 152.

Fox, N., & Calkins, S. (2003). The development of self-control of emotion: Intrinsic and extrinsic influences. *Motivation and Emotion, 27*(1), 7-26.

Gentzler, A., Santucci, A., Kovacs, M., & Fox, N. (2009). Respiratory sinus arrhythmia reactivity predicts emotion regulation and depressive symptoms in at-risk and control children. *Biological Psychology, 82*(2), 156-163.

Gottlieb, G. (1991). Experiential canalization of behavioral development: Theory. *Developmental Psychology, 27*(1), 4-13.

Gottman, J., & Katz, L. (2002). Children's emotional reactions to stressful parent-child interactions: The link between emotion regulation and vagal tone. *Marriage & Family Review, 34*(3), 265-283.

Hastings, P., & De, I. (2008). Parasympathetic regulation and parental socialization of emotion: Biopsychosocial processes of adjustment in preschoolers. *Social Development, 17*(2), 211-238.

Hastings, P., Nuselovici, J., Utendale, W., McShane, K., Sullivan, C., & Coutya, J. (2008). Applying the polyvagal theory to children's emotion regulation: Social context, socialization, and adjustment. *Biological Psychology, 79*(3), 299-306.

Hastings, P., Sullivan, C., McShane, K. , Utendale, W., Vyncke, J., Coplan, R. (2008). Parental socialization, vagal regulation, and preschooler's anxious difficulties: Direct mothers and moderated fathers. *Child Development, 79(1),* 45-64.

Hill, A., Degnan, K., Calkins, S., & Keane, S. (2006). Profiles of externalizing behavior problems for boys and girls across preschool: The roles of emotion regulation and inattention. *Developmental Psychology*, *42*(5), 913-928.

Huffman, L., Bryan, Y., del Carmen, R., Pedersen, F., Doussard-Roosevelt, J., & Porges, S. (1998). Infant temperament and cardiac vagal tone: Assessments at twelve weeks of age. *Child Development*, *69*(3), 624-635.

Jahromi, L., Putnam, S., & Stifter, C. (2004). Maternal regulation of infant reactivity from 2 to 6 months. *Developmental Psychology*, *40*(4), 477-487.

Katz, L., & Gottman, J. (1995). Vagal tone protects children from marital conflict. *Development and Psychopathology*, *7*(1), 83-92.

Kennedy, A., Rubin, K., Hastings, P., & Maisel, B. (2004). Longitudinal relations between child vagal tone and parenting behavior: 2 to 4 years. *Developmental Psychobiology*, *45*(1), 10-21.

Mendez, J. L., Fantuzzo, J., Cicchetti, D. (2002).Profiles of social competence among low-income African American preschool children. *Child Development, 73(4),* 1085-1100.

Moore, G., & Calkins, S. (2004). Infants' vagal regulation in the still-face paradigm is related to dyadic coordination of mother-infant interaction. *Developmental Psychology, 40*(6), 1068-1080.

Ochsner, K. N., Ray, R. D., Cooper, J. C., Robertston, E. R., Chopra, S., Gabrieli, D.E., Gross, J.J. (2004). For better or for worse: Neural systems supporting the cognitive down and up regulation of emotion. *Neuroimage, 23(2),* 483-499.

O'Neal, C., & Magai, C. (2005). Do parents respond in different ways when children feel different emotions? The emotional context of parenting. *Development and Psychopathology, 17*(2), 467-487.

Phan, K., Fitzgerald, D., Nathan, P., Moore, G., Uhde, T., & Tancer, M. (2005, February). Neural substrates for voluntary suppression of negative affect: A functional magnetic resonance imaging study. *Biological Psychiatry, 57*(3), 210-219.

Porges, S. (1995). Orienting in a defensive world: Mammalian modifications of our evolutionary heritage: A Polyvagal Theory. *Psychophysiology, 32*(4), 301-318.

Porges, S. (2007). The polyvagal perspective. *Biological Psychology, 74*(2), 116-143.

Porges, S., Doussard-Roosevelt, J., & Maita, A. (1994). Vagal tone and the physiological regulation of emotion. *Monographs of the Society for Research in Child Development*, *59*(2), 167.

Porter, C., Wouden-Miller, M., Silva, S., & Porter, A. (2003). Marital harmony and conflict: Linked to infants' emotional regulation and cardiac vagal tone. *Infancy*, *4*(2), 297-307.

Posner, M., & Rothbart, M. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology*, *12*(3), 427-441.

Propper, C., & Moore, G. (2006). The influence of parenting on infant emotionality: A multi-level psychobiological perspective. *Developmental Review*, *26*(4), 427-460.

Propper, C., Moore, G., Mills-Koonce, W., Halpern, C., Hill-Soderlund, A., Calkins, S., et al. (2008). Gene-environment contributions to the development of infant vagal reactivity: The interaction of dopamine and maternal sensitivity. *Child Development*, *79*(5), 1377-1394.

Quirk, G., & Beer, J. (2006). Prefrontal involvement in the regulation of emotion: Convergence of rat and human studies. *Current Opinion in Neurobiology*, *16*(6), 723-727.

Ramsden, S., & Hubbard, J. (2002). Family expressiveness and parental emotion coaching: Their role in children's emotion regulation and aggression. *Journal of Abnormal Child Psychology*, *30*(6), 657-667.

Richards, J., & Cameron, D. (1989). Infant heart-rate variability and behavioral developmental status. *Infant Behavior & Development*, *12*(1), 45-58.

Rothbart, M., Ahadi, S., & Evans, D. (2000). Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology*, *78*(1), 122-135.

Rose-Krasnor, L., Rubin, K., Booth, C., & Coplan, R. (1996). The relation of maternal directiveness and child attachment security to social competence in preschoolers. *International Journal of Behavioral Development*, *19*(2), 309-325.

Rubin, K., Coplan, R., Fox, N., & Calkins, S. (1995). Emotionality, emotion regulation, and preschoolers' social adaptation. *Development and Psychopathology*, *7*(1), 49-62.

Russell, J., & Bullock, M. (1986). On the dimensions preschoolers use to interpret facial expressions of emotion. *Developmental Psychology*, *22*(1), 97-102.

Rydell, A., Berlin, L., & Bohlin, G. (2003). Emotionality, emotion regulation, and adaptation among 5- to 8-year-old children. *Emotion*, *3*(1), 30-47.

Santucci, A., Silk, J., Shaw, D., Gentzler, A., Fox, N., & Kovacs, M. (2008). Vagal tone and temperament as predictors of emotion regulation strategies in young children. *Developmental Psychobiology*, *50*(3), 205-216.

Schafer, J.L. (1997). *Analysis of Incomplete Multivariate Data*, Chapman & Hall, London.

Spinrad, T., Eisenberg, N., Cumberland, A., Fabes, R., Valiente, C., Shepard, S., et al. (2006). Relation of emotion-related regulation to children's social competence: A longitudinal study. *Emotion*, *6*(3), 498-510.

Sroufe, L. (2000). Early relationships and the development of children. *Infant Mental Health Journal*, *21*(1), 67-74.

Sroufe, L. (1996). *Emotional development: The organization of emotional life in the early years*. New York, NY US: Cambridge University Press.

Stansbury, K., & Gunnar, M. (1994). Adrenocortical activity and emotion regulation. *Monographs of the Society for Research in Child Development*, *59*(2), 108.

Stansbury, K., Sigman, M. (2000). Responses of preschoolers in two frustrating episodes: Emergence of complex strategies for emotion regulation. *Journal of Genetic Psychology, 161(2),* 182-202.

Strayer, J., & Roberts, W. (2004). Children's anger, emotional expressiveness, and empathy: relations with parents' empathy, emotional expressiveness, and parenting practices. *Social Development*, *13*(2), 229-254.

Supplee, L., Skuban, E., Shaw, D., & Prout, J. (2009). Emotion regulation strategies and later externalizing behavior among European American and African American children. *Development and Psychopathology, 21*(2), 393-415.

Thompson, R. A., Lewis, M.D., Calkins, S. D. (2008). Reassessing emotion regulation. *Child Development Perspectives, 2(3),* 124-131.

Weinstock, M. (1997). Does prenatal stress impair coping and regulation of hypothalamic pituitary-adrenal axis? *Neuroscience & Biobehavioral Reviews*, *21*(1), 1-10.