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Role of parent negative affect as a predictor of child cardiovascular reactivity and child internalizing symptoms

Emily Anne Wear

THE ROLE OF PARENT NEGATIVE AFFECT AS A PREDICTOR OF CHILD CARDIOVASCULAR REACTIVITY AND CHILD INTERNALIZING SYMPTOMS

A Thesis

Presented to the

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by

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ABSTRACT

Parent-child relationships have been implicated in the development of childhood and adolescent cardiovascular response and internalizing symptoms, however the characteristics of the relationship which effect these child outcomes are inconsistent (e.g. Beauchaine, & Williams, 2008; Porges, 1992, 1996, 2008; Cummings, Davies, & Simpson, 1994; Grych, Seid, & Fincham, 1992;). This study examined the relationship between parents' negative affect, child's cardiovascular response during a triadic interaction, and their child's self-report score on the Behavior Assessment System for Children (BASC) Depression and Anxiety scales. Families with children ages 7-12 years were observed during a ten-minute problem solving session. Each family discussed a relevant problem while the triadic interaction was video-taped. Affective communication patterns were assessed using the Specific Affect Coding System (SPAFF). Results of path analyses indicate that parent negative affect, particularly maternal negative affect, predicts daughters' sympathetic cardiovascular arousal (indexed by pre-ejection period). Nearly twenty percent (17.5%) of the variance in girls PEP change score was accounted for by fathers' negative affect and mothers'

negative affect. Neither the theoretical model, nor the revised model demonstrated good fit to the sample of boys. Sympathetic cardiovascular response is associated with environmental threats. Thus, the results suggest that parents' negative affect is a provocative physiological stimulus and is perceived as a threat to daughters. This study was funded by National Institute of Mental Health (MH42484), National Institute for Nursing Research (# 2 P30 NR04001), and the National Institute of Child Health and Human Development (P30 HD02274).

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This thesis is dedicated to the children that have and do reside at the Village of Childhelp USA. My research is inspired by traumatic environments like those they have endured.

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CHAPTER ONE

A PSYCHOPHYSIOLOGICAL MODEL OF FAMILY RELATIONS

Introduction

How the family unit functions affects the physical and mental health outcomes of children (Taylor, Lerner, Sage, Lehman, and Seeman, 2004; Whitman, Borkowski, Keogh, & Weed, 2001). In particular, parents are agents for positive or negative development in their child's life. Therefore, the role of parents in their child's development must be examined in order to understand the proliferation of physical and mental illnesses in the youth population. To understand this phenomenon, family interactions and the corresponding effects on children are important to study. Parenting practices and parental emotional expression are linked to the child's socio-emotional health (Eisenberg, Cumberland, & Spinrad, 1998; Katz & Gottman, 1995; McDowell, Kim, O'Neil, & Parke, 2002). Studies have demonstrated that parent emotional expression affects child academic, social, physical and mental health outcomes (Repetti, Taylor and Seeman, 2002; Taylor et al., 2004). How parents handle their own emotions and interact with

their children can significantly affect their child's physiology and mental health (Taylor et al., 2004).

The following section will provide a thorough explanation of the relationships between cardiac physiology and emotion before addressing the effect of parent behavior on child physiological and emotional outcomes. The relationships between parent emotional expression and child outcomes (cardiovascular response and internalizing symptoms) will more specifically be examined from research which utilizes parent-child interactions. Literature which explores the deleterious influence of parent negative affect within parent-child interactions will be examined in relation to child physiological response and child internalizing symptoms. These studies will support a psychophysiological model of parent emotion socialization which the present study is based upon.

Child Cardiac Physiology

Emotional arousal and stress in children have been indexed by physiological measurements (Beauchaine, 2001; Grych & Fincham, 2001; Porges, 1995; Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996). Some investigators have suggested there are specific

physiological processes which relate to distinct emotional states (Ax, 1953; Ekman, Levenson, & Friesen, 1983). Cardiovascular measurements, particularly heart rate, have been studied in relation to positive and negative emotions. Heart rate is an autonomic measurement which synthesizes the impact of both the parasympathetic and sympathetic influences on the heart (Brownley, Hurwitz & Schneiderman, 2000). The parasympathetic (PNS) and the sympathetic nervous systems (SNS) differentially activate the heart. More precisely, stimulation of the sinoatrial (SA) node by the SNS can increase heart rate while PNS stimulation of the SA node can decrease heart rate. Research is necessary to identify how the parasympathetic and sympathetic activity contributes to cardiovascular reactivity to emotion in children.

Both parasympathetic and sympathetic nervous systems differentially stimulate the heart in reaction to aversive stimuli (Vila et al., 1997). Studies of cardiovascular reactivity to aversive stimuli have delineated a progressive acceleration in heart rate as the defensive reflex, while a deceleration in heart rate signifies the orienting reflex (Graham, 1979). The orienting reflex has been associated with attention to novel changes in stimuli,

whereas increased stimulus intensity elicits the defensive reflex (Graham, 1979). The defensive response identifies the physiological stress response during a "fight or flight" position (Porges, 2008). The "fight or flight" position is a behavioral indicator of the sympathetic nervous system. Sympathetic reactions to negative emotional interactions are expected to increase heart rate (defensive response) and physiological preparedness for mobilization (fight or flight position; Porges, 2008). Often the sympathetic reactions are inhibited by the parasympathetic nervous system, which plays a significant role in dampening cardiovascular reactivity to sympathetic influence (Brownley et al., 2000). Parasympathetic influence antagonistically responds to sympathetic influence and suppresses cardiovascular reactivity to sympathetic stimulation (Brownley et al., 2000). Therefore, the parasympathetic influence can negate a simultaneous sympathetic influence which results in an overall deceleration of heart rate (Brownley et al., 2000). Due to the significant role of the parasympathetic nervous system in regulation of physiological reactivity to aversive or stressful stimuli, less research has focused on the role of the sympathetic nervous system. Thus,

physiological reactivity to socio-emotional reactivity in children has primarily discussed measurements of parasympathetic influence on the heart.

Parasympathetic Influence on the Heart

Similarly, among studies which measure child psychophysiological reactivity parasympathetic measures have primarily been utilized (e.g. Crowell, Beauchaine, Gatzke-Kopp, Sylvers, Mead, & Chipman-Chacon, 2006; Hessler & Katz, 2007; Lewis, 2004; Marsh, Beauchaine, & Williams, 2008; Porges, 1992, 2008; Porges et al., 1996). There are several ways that the parasympathetic influence on the cardiovascular system has been characterized which include vagal tone, respiratory sinus arrhythmia, and high frequency heart rate variability. Vagal tone, the electrical innervation of the heart by the vagus nerve, is indirectly measured through variation in the interbeat interval (IBI), high frequency heart rate variability (HF-HRV), and respiratory sinus arrhythmia (RSA) (Cacioppo, Tassinary & Berntson, 2000; Brownley et al., 2000). When children are exposed to parent conflict, high vagal tone is often used to explain the protective feature of the "vagal brake" (Katz and Gottman, 1995, Porges, 1996). The "vagal

brake" describes the "braking" or slowing down of the heart rate which results from greater parasympathetic influence. Each measure of vagal tone: interbeat interval, high frequency heart rate variability, and respiratory sinus arrhythmia index the vagal brake, is expected to slow the heart during heightened parasympathetic influence. Another cardiac measure of parasympathetic influence is respiratory sinus arrhythmia (RSA). In coordination with respiration, RSA measures the cardiac pace which occurs when the sinoatrial node innervates the heart (Porges, 2008). Another measurement of parasympathetic influence is High Frequency Heart Rate Variability (HF-HRV). Heart rate variability can be designated as low-frequency (less than 0.04 Hz), midfrequency (0.04-0.15 Hz) or high frequency variability (greater than 0.15 Hz). High frequency waves are extracted from total heart rate variability measures to determine HF-HRV (Beauchaine, 2001). Some studies report vagal suppression, which indicates the level of parasympathetic stimulation utilized in order to slow down the heart during a stressful task. Vagal suppression is measured by the difference between average HF-HRV during baseline and average HF-HRV during a stressful experimental condition. This article will refer to HF-HRV as the index

of parasympathetic stimulation of the heart. As Beauchaine (2001) suggests, parasympathetic response should be considered a component of the broader context of cardiovascular functioning. The parasympathetic nervous system in heart reactivity should be studied as it works antagonistically with the sympathetic nervous system, rather than as an independent effect. Based on the dual influence of PNS and SNS measures, sympathetic stimulation of the heart should be examined in an assessment of child cardiovascular reactivity to emotion.

The Role of Sympathetic Influence on the Heart

Previous research has denoted that children with more behavior problems and negative emotion have lower parasympathetic measurements (Porges, 2008). Given the parasympathetic nervous system counters the influence of the sympathetic nervous system on cardiovascular reactivity, an increase in sympathetic stimulation on the heart would be expected among children with low parasympathetic stimulation. Therefore, research which addresses the relationship between aversive stimuli (i.e. negative emotion), and parasympathetic reactivity should include the sympathetic reactivity. When a person feels threatened, the sympathetic nervous system reacts by

increasing the heart rate through electrical stimulation of the SA node. Sympathetic nerve stimulation increases force of the heart muscle contraction which leads to increased blood volume (Guyton, 1992). The period prior to ejection of the blood is measured as the pre-ejection period. Pre-ejection period (PEP) is measured through impedance cardiography. The sympathetic stimulation throughout the body serves to prepare to either run in escape of danger ("flight"), or "fight" for one's survival (Porges, 2008; Taylor et al., 2000). Such conditions known as "fight or flight" are recognized by tense muscles, alertness and preparation for action (Porges, 1992). These behavioral reactions stimulated by the SNS may be adaptive for immediate circumstances, but early environments characterized by chronic stress and negative emotional situations have been implicated in physical and psychological damage over time (Repetti et al., 2002; Taylor et al., 2004). Studies investigating child cardiovascular reactivity to emotional family contexts should include measures of sympathetic influence to identify the unique contribution of the SNS in the broader context of physiological arousal.

In order to investigate a concrete psychophysiological model within the context of family environments, research should assess parent-child interactions to identify the specific parent emotions which affect child physiology and consequently child mental health. Parent emotion needs to be assessed in concert with physiological and psychological measures in order to develop a model which distinguishes the role of parent negative emotion in child mental health outcomes. To identify detrimental parent negative emotions, investigators have utilized discrete measurements of affective states during stressful experimental tasks.

Parent Behavior Related to Child Outcomes

The effects of parent-child relationships are pervasive and last throughout the child's life. Positive and negative emotional exchanges within the parent-child relationship can affect child outcomes. Emotion has been broadly defined as "a complex pattern of changes, including physiological arousal, feelings, cognitive processes, and behavioral reactions, made in response to a situation perceived to be personally significant" (Gerrig & Zimbardo, 2002). As emotions are exchanged between parent and child, changes in facial expressions, speech tone, speech content,

posture and gestures take place. To capture emotional changes, researchers have utilized affect coding systems to rate specific participant affect within an observation. The affect ratings within a parent-child observation represent the emotional exchanges portrayed and communicate the level of positivity or negativity within the family emotional climate. To further understand the impact of negative emotional exchange between parents and children previous research has investigated relationships between parent affect states and child outcomes.

Child Psychophysiology and Marital Aggression

The effects of parent negative behaviors: hostility, withdrawal, anger, and conflict displayed during marital conflict have been widely examined in relationship to poor child outcomes (Grych & Fincham, 1990, 2001; Katz & Gottman, 1995; Whitson, & El-Sheikh, 2003). Fewer studies have examined child cardiovascular reactivity related to parent marital conflict. Whitson & El-Sheikh (2003) found that among children with lower vagal suppression there was a statistically significant positive relationship between mother reported psychological marital conflict ("avoidance/ capitulation, stalemate, and verbal aggression") and child's health problems. Similarly, the positive

relationship between child internalizing behavior and parent physical marital conflict ("physical aggression") was significant for children with low vagal tone and vagal suppression. Nevertheless, Katz & Gottman (1995) investigated positive outcomes related to high vagal tone in 4-5 year old children. Their study examined high vagal tone as a protective variable for children's externalizing behaviors in the context of marital hostility (Katz & Gottman, 1995). As expected, children with high vagal tone showed lower rates of externalizing behaviors than those with low vagal tone (Katz & Gottman, 1995). High vagal tone is indicative of greater parasympathetic influence and is expected to lower cardiovascular arousal. Consistently in the Katz & Gottman (1995) and the Whitson & El-Shiekh (2003) studies children that had lower vagal tone (less parasympathetic influence), had more internalizing and externalizing problems in relation to negative inter-parent behavior. These studies indicate the effect of parent negative behavior, indexed by the relationship between marital conflict and child health, is related to cardiovascular response. Although these studies have suggested a relationship between marital conflict and child outcomes, it is essential to develop a deeper understanding

of how negative behavior between parents can affect parent negative behavior during parent-child interactions.

Studies which examine the impact of inter-parent conflict on child behavior have examined the mediational role of parenting behavior. Theories suggest that parental displays of negative affect which communicated anger, irritation or dominance during an inter-parent conflict are systematically transmitted toward children from their parents (Buehler, Benson, & Gerard, 2006). This systematic transmission of negative affect from the marriage microsystem to the parent-child microsystem within the family characterizes the "spillover effect" (Almeida, Wethington, Chandler, 1999). Through 42 days of parents' daily diaries of marital and parent-child tensions Almeida et al., (1999) predicted parent-child tensions from marital tensions occurred the day before. Buehler et al. (2006) assessed child reported parent behaviors that mediated the relationship between interparental hostility and child internalizing or externalizing problems. Maternal harshness completely mediated the relationship between interparental hostility and child externalizing problems. Additionally, maternal harshness, low acceptance and psychological intrusiveness (child report of parental

control) completely mediated the relationship between interparental hostility and child internalizing problems. For fathers, the relationship between interparental hostility and child externalizing problems was completely mediated by fathers' harshness and monitoring knowledge. However, only fathers' harshness mediated the relationship between interparental hostility and child internalizing problems. Other studies have utilized observational methods to objectively assess parent behavior during marital interactions and family interactions. Gordis, Margolin, and John (1997) rated interparental hostility from a dyadic marital interaction; parent-child hostility and child behaviors (withdrawal, anxiety, and distraction) from a triadic family interaction. Results indicated observed child behaviors were significantly different for families that reported physical marital aggression. Specifically, boys' anxiety and distraction were significantly correlated to parent-to-child hostility for families that reported physical marital aggression. For families that did not report physical marital aggression, only boys' withdrawal was significantly correlated with parent-to-child hostility. Studies have examined the

direct effects of parent-to-child negative relations as predictors of poor child outcomes.

Parent Affect Associated with Poor Child Outcomes

Previous research has examined the effects of specific parent affective states during parent-child interactions. Estrada, Arsenio, Hess, & Holloway, (1987) coded maternal positive and negative affective states (rating criteria: responsiveness, flexibility, warm concern, acceptance, emotional displays of affect, punitiveness) during a mother-child interaction task for children at age 4. A composite score of maternal affective states predicted child cognitive functioning at ages 4, and 6 and scores on vocabulary and math at age 12 years. Barocas, Seifer, Sameroff, Andrews, Croft, and Ostrow (1991) rated mother-child interactions for affective style and teaching style in children at-risk for mental health problems. After controlling for family contextual risk factors, maternal affective codes (positive, negative, flattened or involved) and teaching style (mental operational demand) significantly predicted child Verbal IQ at age 4 years. Specifically, negative maternal affective states were negatively correlated with the child's Verbal IQ score such that as negative affect increased child Verbal IQ scores

decreased. These studies suggest that mothers' behavior predicts poor child outcomes such as cognitive and academic performance/ peer relations. Furthermore this research highlights the importance of measuring the child outcomes related to parent affect states. Recently, Brosschot & Thayer (2003) reported that the duration of cardiovascular reactivity in response to negative affect was longer compared to cardiovascular reactivity in response to positive affect. Relationships with parents pervade the life of a developing child; significant changes which result from parent negative affect, particularly physiological reactivity to parent negative affect should be examined.

Child Physiology during Parent-Child Interactions.

Several studies have demonstrated that family environments, particularly negative family environments, are predictors of child cardiovascular reactivity. When negative family environment was assessed, Taylor et al. (2004) found that males with high family risk had the highest heart rate "at baseline, immediately following laboratory stressors and at recovery." (p. 1378). This study suggests negative family environments are related to child cardiovascular arousal indicative of physiological stress (high heart rate).

Research which identifies the specific parent negative behaviors that elicit physiological stress is critical. In a model of negative family environments, Taylor et al. (2004) proposes early family socioemotional interactions may contribute to a child's "stress-regulation system." Through assessments of family negativity within the context of parent-child interactions results reveal more explicit predictors of child cardiovascular reactivity compared to global assessments of family environment. Therefore, explicit measures of parent-child interactions are preferable to global assessments. Evidence which supports a relationship between specific parent-child emotional interactions and child cardiovascular reactivity is necessary to clarify the model of negative family environments.

Studies have shown that children of parents that exhibit more negative affect during parent-child interactions demonstrate cardiovascular reactivity which denotes physiological stress. Based on ratings of fathers' support during stressful parent-child interactions, Hastings et al. (2008) reported that among children with lower HF-HRV, less support from fathers was related to higher child internalizing symptoms. Thus, low HF-HRV

during the parent-child interaction indicates that parasympathetic stimulation failed to increase, consequently children with less supportive fathers experienced greater physiological stress. The results from Hastings et al. (2008) demonstrate physiological stress is related to poor parent-child interactions and psychological health. Valiente et al. (2004) recorded maternal negative expressivity during a teaching task with their 6-8 year old child. Heart rate was also recorded during a calm film, and during a film of staged inter-parent verbal conflict. Higher rates of maternal negative expressivity during the teaching task were associated with lower child heart rates during the conflict film. Although the parent and child variables were measured during different laboratory sessions, lower heart rate is indicative of an orienting response to novel stimuli. Thus, attention to the novelty of the conflict film may explain this seemingly reverse association between maternal negative expressivity and low child heart rate. A noteworthy result was the positive correlation between maternal negative expressivity and the child's heart rate during the calm film (baseline). Similarly, previous research indicates negative parenting behaviors are associated with high resting heart rate among

children (Bell & Belsky, 2007; Taylor et al., 2004). These studies based on observations of parent-child interactions have the capability to capture a sample of recurrent parent-child relations. By examining the cardiovascular measurements during these interactions immediate effects of parent negative affect on child psychophysiology may generalize to regular family functioning.

This evidence supports a psychophysiological model of parent-child emotion socialization. Though previous research has demonstrated that parent affective states have been associated with poor child outcomes, more specifically, parent negative affectivity has predicted specific child cardiovascular reactivity. As an indicator of child physiological stress, cardiovascular measurements are significant to the formation of a psychophysiological model of negative parent-child interactions. To deepen our understanding of the impact of stressful parent-child emotion socialization, studies have recorded parent affective states during parent-child interactions. These methods measure parent negative behavior more precisely and account for significant cardiovascular changes during parent-child interactions. However, previous studies have based their results on independent recordings of parent

negative affect and child cardiovascular reactivity. Parent and child measures recorded from independent tasks lack contiguous relationships. Parent negative affect measured simultaneously with child cardiovascular reactivity during parent-child interactions control for temporal discrepancies which result from independent parent-child measures.

Internalizing Symptoms

As a child's primary coach and guide, the influence of parents can impact child internalizing symptoms. Harsh parenting patterns which reduce child autonomy and emotional maturity have been characterized by negative affect (Dix, 1991). Studies which predict child internalizing symptoms from parent negative behavior suggest parent negativity may be a risk factor for the development of mental illness (Grych, Jouriles, Swank, McDonald, & Norwood, 2000). Children with internalizing symptoms respond to parent negative affect with "intropunitive emotions and moods (e.g. sorrow, guilt, fear, worry)" (Zahn-Waxler, Klimes-Dougan, & Slattery, 2000, 443). Internalizing symptoms are often characterized by anxious and depressive symptoms; furthermore, components

of anxiety symptoms are characteristic of depressive symptoms (Beaver, 2008).

Clark and Watson's tripartite model of anxiety and depression posits there is an overlap of symptoms and diagnoses of anxiety and depression. The tripartite model suggests the common component between anxiety and depression is negative affect (Anderson & Hope, 2008; Crook, Beaver & Bell, 1998). Specifically, the autonomic reactions associated with preparation for sympathetic response i.e. focused attention, awareness of the surrounding environment, and anticipation of motor action are characteristic of anxious symptoms (Chorpita & Barlow, 1998). Chorpita & Barlow (1998) propose these internalized preparatory responses associated with anxious symptoms define negative emotion. Studies have suggested such internalized physiological responses are components of negative emotion that may contribute to depressive symptoms (see Brown, Chorpita, Korotitsch,& Barlow, 1997; Chorpita, Albano & Barlow, 1998; Joiner, Catanzaro,& Laurent, 1996; Lovibond & Lovibond, 1995). In particular, studies of community samples have indicated that more often youth are diagnosed with comorbid anxiety and primary depressive disorder (Anderson & Hope, 2008). Given that autonomic

reactions are components of negative emotion, it is critical to identify situations which elicit physiological reactivity characteristic of anxiety and depressive symptoms.

Across studies, parent negative emotion has been specifically defined as "hostility… rejecting…criticizing, accusing, scapegoating, belittling, ridiculing" (Berg-Nielson, Vikan, & Dahl, 2002, p.540). Negative emotion of this nature, may threaten one's security. If the child perceives parent negative emotion as threatening, the sympathetic nervous system will likely prepare to react. Thus, parent negative emotion may trigger the physiological component of anxious and depressive symptoms. Research is critical to understand the relationships between specific parent negative emotion and child internalizing symptoms.

Parent Negative Affect Related to Child Anxiety

A significant body of research has demonstrated parent negative emotion can lead to child distress, aggression, and induced fear, though most research has measured this relationship through global indicators (Dix, 1991; Zahn-Waxler et al., 2000). Global indicators of parent-child relationships are based on parent, child, and teacher self-reports; and assessments of overall positive or negative

parent-child interactions, rated with one score. Previous research has demonstrated that the microscopic level of analysis through parent-child observations is predictive of stable patterns of "adjustment or maladjustment" over time (Cummings, 1998; Cummings & Cummings, 1988; McDowell et al., 2002; Repetti, McGrath & Ishikawa, 1999; Repetti & Wood, 1997). Parent-child interactions analyzed at microscopic levels rely on specific affect coding systems which rate parent affect every second or discrete epochs of time. To determine explicit parent negative affect which predicts child internalizing symptoms, studies should assess parent negative affect through microscopic levels of analysis.

Internalizing symptoms have been associated with negative family environments characterized by criticism and hostility (Ariet & Bemporad, 1980; Kashani, Ray, & Carlson, 1984; Kaslow, Rehm, & Siegel, 1984). Based on family observations with children ages 9-13 years, Gordis et al. (1997) found observed child anxiety significantly correlated with parent-child hostility. Families with higher rates of inter-parent physical aggression had higher rates of parent-child hostility. This interaction accounted for a significant proportion of variance (11.0%)

in boys' anxiety (Gordis et al., 1997). Follow-up analyses demonstrated that boys' anxiety was significantly correlated with parent-child hostility among families with the highest inter-parent physical aggression. Within the context of inter-parent violence, parent negative emotion affects parent-child interactions. Parent negative emotion toward the child may threaten the child's security consequently increasing child anxiety. Outside the context of family violence, the relationship between parent negative emotion and child anxiety should be examined through observational ratings of parent-child interactions.

A large body of literature has identified dysfunctional families by the level of parent negative emotion (Dix, 1991). Expressed emotion has been utilized to rate criticism and "overinvolved attitudes" of parents of depressed children (Asarnow, Tompson, Hamilton, Goldstein, & Guthrie, 1994, p.130). Asarnow et al. (1993, 1994) utilized a Five Minute Speech Sample, which refers to a five minute uninterrupted period when the parent speaks about how they get along with their depressed child. These speech samples are assessed for criticism and emotional overinvolvement by blind raters (Asarnow et al., 1994). Based on family observations during the Five Minute Speech

Sample-Expressed Emotion (FMSS-EE), family expressed emotion significantly predicted a child's depression outcome 1 year after observations (Asarnow et al., 1993). Asarnow et al. (1994) compared family expressed emotion of criticism in clinically depressed children (7-14 years) to families of control children through observations of the FMSS-EE. After controlling for covariates ("age, gender, SES, family composition, parental stress"), logistic regression analyses indicated there were significant differences in family expressed emotion of criticism such that families of depressed children expressed more criticism compared to families of control children. These studies suggest parent negative emotion is related to child depression and maintenance of the disorder. However, these results are confounded by pre-existing child depression. Though control parents expressed less criticism, it is uncertain whether child behavior provoked parent negativity among the depressed group. To reduce the confounding effect of the diagnosed internalizing disorder, assessments of parent negative emotion and child internalizing symptoms from a community sample are critical.

While both anxiety and depression symptoms contribute to overall internalizing problems, research often assesses

these symptoms separately. Research has established that parent negative emotion affects both child anxiety and child depression, though questions remain unanswered. Does parent negative affect provoke anxiety symptoms? If so, are they related to depression symptoms? To determine the role of child anxiety symptoms in the development of child depression symptoms, studies should account for anxiety when depression is predicted from parent negative emotion.

The Role of Maternal and Paternal Negative Emotion

Observational methods of parent negative affect have indicated the importance of affective states is differentiated by the role of mother and father in family conflict. Low & Stocker (2005) coded parent-child hostility among families of 10-year old children from video-taped family interactions. Structural equation models demonstrated that the path from father's internalizing problems to child internalizing problems was mediated by father-child hostility, while the link between the mother's report of marital hostility and child internalizing problems was mediated by mother-child hostility (Low & Stocker, 2005). These results suggest the role of parent and inter-parent affect impacts the

development of child internalizing problems, though mother and father affect is differentially related to child internalizing problems. From a sample of battered women, Holden & Ritchie (1991) demonstrated that maternal stress and paternal irritability predicted child problem behaviors. This study suggests that different negative parent behaviors predict poor child outcomes, though the role of violence in this sample may confound the severity of child outcomes. Such evidence supports the investigation of maternal and paternal roles within a community sample to increase generalizability. Recent social changes within the family have affected the role of fathers in parenting. Research investigating the role of father's has shown their interactions with children have significant influence on child outcomes (Amato & Rivera, 1999; Downer, 2007). However, few studies have accounted for the role of each parent in the development of child cardiovascular reactivity and internalizing symptoms.

Child Gender

Studies of behavior problems have demonstrated that children respond to parent negative behavior differently based on the sex of the child. Previous research in

marital conflict has supported the male vulnerability model (Grych & Fincham, 2001). The male vulnerability model proposes that males are more susceptible to developing externalizing symptoms when exposed to marital conflict. These studies suggest that children react differently to parent conflict and may show different levels of internalizing symptoms.

Similarly, cardiovascular measurements differed by gender in previous studies, though few have examined parent behavior as a predictor of cardiovascular reactivity. Kudielka et al. (2004) found that girls aged 9-15 years had higher heart rates during a social stress task compared to boys. This gender difference was maintained in the young adult group (ages 19-32 years). There are gender differences in both cardiovascular response and internalizing symptoms, though the familial relationships which impact gender differences are unclear. Physiological and psychological gender differences should be explored within the family context to determine gender strengths and vulnerabilities.

The Present Study

Previous research has relied upon self-report and interview methods to index parent negative behavior (e.g. Katz & Gottman, 1991, 1995). Child interviews and child self-reports which ask about their reaction to parent negative behavior are limited by child minimization or other confounding interpretations (Grych & Fincham, 2001). Few studies which have utilized observational methods to measure parent-child interactions have examined child cardiovascular measurements (Gump, Matthews, & Räikkönen, 1999; Hastings et al., 2008). Furthermore those studies which have examined parent negative behaviors in relation to child cardiovascular reactivity have not measured parent and child variables simultaneously. First, this study aims to broaden the current understanding of parent emotion by assessing the relationship between parent negative affect and their child's cardiovascular reactivity during a triadic family interaction. Second, based on previous support from research related to the "spillover" model of marital conflict, this study expects lower parent marital satisfaction will predict higher levels of parent negative affect.

Second, this study intends to identify parent negative affect as a physiological stimulant within current psychophysiological models of family environment. The cardiovascular reactivity measurements are expected to display a stress response predicted by parental negative affect. The child's measurement of parasympathetic input, High Frequency Heart Variability (HF-HRV), is anticipated to be lower; the child's heart rate, a measure of autonomic response, will be higher, and Pre-ejection period (PEP), a measure of sympathetic input, is hypothesized to shorten (thus indicating an increase in SNS). A broad measurement of child cardiovascular reactivity that includes parasympathetic, autonomic and sympathetic contributions will build on current physiological research which has primarily focused on the parasympathetic influence.

Third, this study will investigate the relationship between parent negative affect and child internalizing symptoms. As a physiologically provocative stimulus, parent negative affect is expected to predict higher scores on ratings of child internalizing symptoms.

The fourth goal of this study is to examine the psychophysiological model within a diverse community sample of elementary school aged children. Previous studies which

assess cardiovascular measurements have focused on infants and toddlers. The changes occurring among elementary school precede the critical periods of puberty and the transition into adolescence. Psychophysiology and internalizing symptoms are crucial to understand during this developmental period.

CHAPTER TWO

PARENT NEGATIVITY AS A PREDICTOR OF CHILD OUTCOMES

Introduction

Child physical and mental health outcomes are affected by parent-child relationships (Taylor et al., 2004; Whitman et al., 2001). Parents have a significant role in positive or negative development of their child. In particular parent emotional expression has been implicated in child socio-emotional health (Eisenberg et al., 1998; Katz & Gottman, 1995; McDowell et al, 2002). A body of literature has demonstrated relationships between negative parent emotional expression and child academic, social, physical and mental health outcomes (Repetti et al., 2002; Taylor et al., 2004).

Child physiology is expected to underlie the relationships between parent negative emotional expression and child mental health outcomes. Specifically, cardiovascular measurements of heart rate, sympathetic and parasympathetic response reflect child stress. Heart rate is an autonomic measure which results from the parasympathetic and sympathetic influence on the heart (Brownley et al., 2000). Parasympathetic (PNS) and

sympathetic (SNS) nervous systems differentially contribute to heart rate such that the PNS acts to lower heart rate and SNS increases heart rate. Thus, parasympathetic influence on the heart responds antagonistically to increases in sympathetic influence on the heart which results in an overall deceleration in heart rate (Brownley et al., 2000). The parasympathetic contribution to the heart has been measured by vagal tone, respiratory sinus arrhythmia (RSA), and high frequency heart rate variability (HF-HRV). Sympathetic contributions are indicated by pre-ejection period (PEP) as measured by impedance cardiography. Most research has concentrated on parasympathetic measures of cardiovascular response to aversive situations (e.g. Crowell et al., 2006; Hessler & Katz, 2007; Lewis, 2004; Marsh et al., 2008; Porges, 1992, 2008; Porges et al., 1996). However, to build a theoretically relevant model, both parasympathetic and sympathetic measures of cardiovascular response should be included in a psychophysiological model.

Within the family, the inter-parent relationship as well as the parent-child relationship is related to child cardiovascular response and mental health outcomes. Previous research has demonstrated that child

cardiovascular response mediates the relationship between parent negative emotion expressed through marital conflict and child mental health outcomes. In particular among children with lower vagal tone, parent marital hostility was positively related to child mental health problems (Whitson & El-Sheikh, 2003). Similarly, parent physical aggression was positively related to child internalizing problems for children with lower vagal tone. In the context of marital conflict, Katz & Gottman (1995) examined high vagal tone as a protective factor for child externalizing problems. Children with high vagal tone had lower rates of externalizing behaviors than children with lower vagal tone. Higher vagal tone is indicative of higher parasympathetic influence and thus lower cardiovascular arousal. The results of these studies suggest that vagal tone mediates the effect of negative marital conflict between parents, and child internalizing and externalizing behaviors. Based on the "spillover" model of parent marital conflict and parent-child interactions, negative affect displayed during parent marital conflict is expected to transmit to parent negative emotional expression within parent-child interactions

(Buehler et al., 2006; Almeida et al., 1999; Gordis et al., 1997).

Multiple measures of parent negative emotion have supported a psychophysiological relationship between parent negative emotion and child outcomes (Gottman & Katz, 2002; Katz and Gottman, 1995, Porges et al., 1996). Recent research reported the duration of child cardiovascular reactivity was longer in response to negative affect when compared to child cardiovascular response to positive affect (Brosschot & Thayer, 2003). Global assessments of family risk have been associated with higher cardiovascular arousal (as measured by higher heart rate; Taylor et al., 2004). However, measures that more precisely measure parent negative emotion during parent-child interactions will clarify a psychophysiological model of negative family environments. Results from a study by Hastings et al. (2008) demonstrated that children with less supportive fathers experienced greater physiological stress (lower parasympathetic input) and higher internalizing symptoms. These findings are consistent with previous studies which reported negative parenting behaviors were associated with higher resting heart rates among children (Bell & Belsky, 2007; Taylor et al., 2004). Negative emotion is

characteristic of internalizing symptoms; and, defined by previous research, negative emotion incorporates a physiological response in preparation for an environmental threat, like parent negative affect (see Brown et al., 1997; Chorpita et al., 1998; Joiner et al., 1996; Lovibond & Lovibond, 1995).

Internalizing symptoms most often are categorized into the diagnostic categories of anxiety and depression; moreover anxiety symptoms can be incorporated into depression symptomatology. A significant body of literature supports a relationship between child internalizing symptoms and negative family environments, parent criticism and parent hostility (Arieti & Bemporad, 1980; Kashani et al., 1984; Kaslow et al., 1984). More discrete measures of parent negative emotion have been related to child anxiety and child depression outcomes. In a sample of depressed children, assessments of parent emotional expressivity rated parents of depressed children higher on criticism compared to control families (Asarnow et al., 1994). However, a pre-existing diagnosis of depression confounds these results. Research among community samples is critical to differentiate the effect

of parent behavior and child behavior on child internalizing symptoms.

Parent Gender

Within the family unit parent behavior and emotion are differentially expressed by fathers and mothers. Holden and Ritchie (1991) found that maternal stress and paternal irritability predicted child behavior problems. Currently, the social roles within the family have shifted such that fathers are becoming more involved in parenting (Dienhart, 2001; LaRossa, Gordon, Wilson, Bairan, & Jaret, 1991; Marsiglio, 1991;). Research has demonstrated father's interactions with their children have significant influence on child outcomes (Amato & Rivera, 1999; Downer, 2007). Further research is necessary to account for the role of each parent in child cardiovascular response and internalizing symptoms.

Child Gender

A relationship between children's response to parent negative behavior and the sex of the child has been supported by previous research. Specifically, within the context of marital conflict, research suggests a male vulnerability model (Grych & Fincham, 2001). This male vulnerability model proposes male children are more

susceptible to the development of externalizing behaviors when parent marital conflict increases within the family. This model suggests children react differently to parent negative behavior and may demonstrate differences in rates of internalizing symptoms. Among studies of cardiovascular response gender differences have been well documented. Specifically among children, Kudielka et al. (2004) demonstrated that girls ages 9-15 years had higher heart rates during a social stress task in comparison to boys. Gender differences in internalizing symptoms and cardiovascular response have been previously examined, though the relationship between parent-child interactions and child gender differences are unclear. Within the family context, physiological and psychological gender differences should be investigated to elucidate gender strengths and vulnerabilities.

The Present Study

This study will explore a psychophysiological model of parent-child interactions which includes child cardiovascular response and mental health outcomes. Based on a triadic family interaction, parent-child interactions can be measured in close temporal relationship to child cardiovascular reactivity. First, this methodology will

build upon the few studies which utilized observational methods of parent behavior in relation to child cardiovascular measures (Gump et al., 1999; Hastings et al., 2008). Secondly, based on the "spillover" model of parent marital conflict, low parent marital satisfaction is expected to predict higher levels of parent negative affect. Third, this study will examine parent negative affect as an aversive physiological stimulant within current psychophysiological models of negative family environments. Thus, parent negative affect is expected to predict a physiological stress response in their child. Child parasympathetic input as measured by High Frequency Heart Rate Variability (HF-HRV) is expected to be lower; child heart rate, a measure of autonomic response, is hypothesized to be higher; and Pre-ejection Period (PEP), an indicator of sympathetic influence, is anticipated to shorten (signifying increase input from the sympathetic nervous system). The inclusion of parasympathetic, autonomic and sympathetic measures will broaden child development psychophysiological research, which primarily has concentrated on the parasympathetic influence on cardiovascular response.

Fourth, this study will examine the relationship between parent negative affect and child internalizing symptoms. As an aversive environmental stimulus, parent negative affect is anticipated to predict higher scores on ratings of child internalizing symptoms.

The fifth goal of this study is to investigate this psychophysiological model of parent-child interactions within a diverse, community sample of elementary school-aged children. Previous research has yet to explore these relationships beyond infancy and toddlerhood. This age group represents a critical period of development prior to puberty and the transition to adolescence.

CHAPTER THREE

METHODS

Participants

As a part of the Family Health Project, 129 families with one child aged 7-12 years were recruited via flyers disbursed to local schools, libraries and community centers; in addition flyers were distributed at local presentations in community organizations, military bases, and ethnic festivals. The sample for the 5-year longitudinal study was constructed so there was an even distribution of marital satisfaction scores (i.e., a rectangular distribution of scores as opposed to a normal distribution). This was done in an effort to over-sample both very low and very high levels of marital satisfaction. Families were also recruited in an effort to over-sample for Interracial and African American families because these families have historically not been well represented in research studies. Families were matched on marital satisfaction and neighborhood crime level statistics (i.e., there were equal numbers of distressed and satisfied couples representing the different neighborhood crime levels). Neighborhood crime level statistics were obtained

through the US Economic Census, which provides crime level information by zip code. All research activities were approved by the campus Institutional Review Board for the protection of human subjects.

The present study is based on a sample of 129 families. The ethnicity of the husbands was as follows: 52 Caucasian (55.3%), 19 African American (20.4%), 10 Asian (11.1%), 8 Hispanic (8.3%), 4 Multi-racial (3.7%), 1 Pacific Islander, and one husband did not report his ethnicity. The ethnicity of the wives was as follows: 51 Caucasian (55.6%), 17 African American (17.6%), 15 Asian (15.7%), 5 Hispanic (5.6%), 4 Multi-racial (3.7%), 1 American Indian, and 1 wife did not report her ethnicity. The children included 43 males (45.8%) and 51 females (54.2%) aged between seven and eight years at the beginning of the study.

Measures and Materials

Marital Adjustment Test (MAT)

Prior to recruitment, each parent was interviewed over the phone regarding their marital satisfaction. After the Dyadic Adjustment Scale, the MAT is the second most widely cited assessment of relationship satisfaction (Funk &

Rogge, 2007; Spanier, 1976). The MAT includes items to differentiate between "well-adjusted and distressed" couples (Funk & Rogge, 2007, p. 572). The test consists of a 15-item questionnaire. Higher scores indicate greater marital satisfaction for that individual (Locke-Wallace, 1959). For the purposes of this study marital satisfaction will be assessed as a composite variable. Hence, marital satisfaction scores for each parent will be summed to indicate marital satisfaction for the parents.

Behavior Assessment System for Children (BASC)

The child completed 152 true/ false questions on a computer prior to the baseline condition and family problem solving discussion. This assessment was used to measure the child's perceptions about themselves and their behaviors. The questionnaire has scales to measure emotional problem variables of interest, including: behaviors and perceptions associated with internalizing problems (anxiety, depression, self-esteem, self-reliance, sense of inadequacy, social stress), behaviors and perceptions associated with externalizing problems (attitude to school and to teachers, relations with parents), and interpersonal relations. The gender-normed T-scores from the BASC Depression and Anxiety Scales served

as indicators of child internalizing behaviors (Reynolds & Kamphus, 1998).

Cardiovascular Reactivity

The child's cardiovascular reactivity was measured under baseline, and family problem solving discussion conditions. A Burdick Holter electrocardiogram (EKG) monitor recorded high frequency heart rate variability (HF-HRV) and heart rate (HR). Impedance and EKG electrodes were attached to the child by the research facilitator while both parents were present. To record impedance cardiography, two pairs of electrodes were attached to the sides of the child's neck and two other pairs were attached to each side of the child's torso. Two single EKG leads were attached to the child's chest. Respiration was collected through a BIOPAC Velcro respiration strap attached under the child's arms and around his/her torso. Cardiovascular measurements were then recorded during the vanilla baseline measurement and the ten-minute family problem solving discussion. Through MindWare Technologies software, impedance cardiography and EKG data was edited for artifacts and outliers by trained and cross-validated research assistants. To smooth impedance waves, data was filtered at 10Hz low pass. Following correction of

artifacts and outliers, the high frequency rhythms were extracted to compose the High Frequency Heart Rate Variability (HF-HRV). The pre-ejection period (PEP) is measured by the time between the onset of the cardiac wave (Q) and the "inflection on the dZ/dt waveform" (B point inflection) (Berntson, Quigley, & Lozano, 2007, p. 202). The dZ/dt wave is derived from the variation in the electrical impedance signal once basal impedance has been removed (Berntson et al., 2007). The PEP recordings are in seconds per minute. To account for the change in cardiovascular response during the problem solving session, a change score was calculated. The change score consisted of the difference between the value for each cardiovascular measure (HF-HRV, HR, and PEP) during the problem solving session and the value for each cardiovascular measure at baseline.

Specific Affect Coding (SPAFF)

Affective communication patterns video taped during the ten-minute Family Problem Solving Discussion were assessed using the Specific Affect Coding System (SPAFF; Carrère, Doohan, Siler, 2007; Gottman, McCoy, Coan, Collier, 1996). Seventeen different affect codes are rated based on changes in facial muscle movements (Ekman et al.,

1983), tone of voice and emotional gestures. Negative affect for each parent was measured by the number of seconds recorded for the affect codes: anger, contempt, belligerence and criticism throughout the 10-min discussion.

Procedures

Astronaut Training Theme

The data assessed in this study is derived from the second timepoint within the five year longitudinal study. Throughout the five conditions in this laboratory session, children and their parents participated in a mock "astronaut training camp" (Porges, Doussard-Roosevelt, Portales, & Suess, 1994; Whalen et al., 1979). The laboratory was decorated to resemble a space shuttle and children wore an astronaut NASA tee-shirt. Two of the conditions assessed parent teaching and coaching of their child through the execution of a space shuttle computer simulated "blast off." A third condition consisted of a five minute computer-based Stroop task. However, the teaching, coaching, and Stroop conditions were not included in the present set of analyses.

Computer-based Questionnaires

The children first completed computer-based self-reports which assessed emotion, gender roles and behavior. Among the assessments of emotion and behavior, the Behavior Assessment System for Children (BASC; Reynolds & Kamphus, 1998) was conducted. During this session a research assistant read the questions aloud to the child while the child also read and responded to the question online.

Vanilla Baseline Procedure

The first condition, the "vanilla baseline," is an alternative to using a resting baseline (Jennings, Kamarck, Stewart, Eddy and Johnson, 1992). The vanilla baseline provides a stable baseline against which changes in cardiovascular arousal can be evaluated. The child was seated in front of a computer screen. As the computer screen sequentially displayed a random set of six distinctly different colored screens (each color was displayed for 10 seconds), the child was asked to count the number of green screens they saw over a ten-minute period. Children who were color-blind were asked to count the number of white screens they saw. To reduce any competitive aspect of the task, study participants were not given any incentive pay for the correct color counts, and

they were not given feedback on the correctness of their answer. Cardiovascular measurements recorded during this procedure served as the baseline cardiovascular period. Due to the controlled level of participant cognitive attention during this procedure, this method is preferred over cardiovascular baseline recordings from a participant simply sitting in a room for five minutes.

Family Problem Solving Discussion

The family problem solving session began with a self report measure which assessed the occurrence of thirteen common family conflicts (Family Areas of Disagreement). Each family member rated whether the thirteen typical family conflicts (e.g., mealtime routines, chores, or school related problems) were either "not a problem, a little problem, or a big problem." The discussion facilitator reviewed the problem ratings from all three family members to determine the most frequently cited problems. Then the facilitator asked the family to attempt to resolve two of the most highly rated conflict items for ten-minutes. The triadic family interaction between mother, father and child was video-taped for ten-minutes while they discussed the problems. This session was

followed by the simulated space shuttle blast off video recorded to assess parent teaching and coaching behaviors.

CHAPTER FOUR

RESULTS

Data Reduction

Prior to analysis, the standardized scores of: marital satisfaction, father negative affect, mother negative affect, child HF-HRV change score, child PEP change score, child BASC anxiety and child BASC Depression were assessed for missing values, outliers and assumptions of multivariate analysis (Tabachnik & Fidell, 2007). The variables were screened separately for the 63 daughters and 57 sons.

All variables included less than 5% missing cases. Cases with more than two missing values were excluded from the analyses. Several cases with one or two missing values were imputed with the mean score. For 20 cases the mean of father negative affect was imputed, 13 of these cases were sons. While 17 cases had the mean of mother negative affect imputed, 11 of these cases were sons. In 3 cases the mean of BASC Depression was imputed, 2 of these cases were daughters. In 3 cases the mean for BASC Anxiety was imputed, 2 of these cases were daughters. In 1 case in the group of daughters the mean of baseline HF-HRV and the

Problem-Solving HF-HRV was imputed prior to the composition of the HF-HRV change score. Participants with missing data did not significantly differ on parent marital satisfaction compared to complete cases or cases missing 1-2 values. Cases excluded from this study were also compared on demographic variables of family income, parent education, or parent occupation. Most fathers from the excluded cases reported "some college", while most mothers from excluded cases reported a "graduate degree". Both parents included in this study more often reported that they "completed college." Fathers from the excluded cases reported a lower income than the fathers from the cases included in this study, however, mothers in both groups reported an income of "less than $10,000". Most parents in both groups reported "full-time" employment. The original sample of 140 families was reduced to 120 families from the analyses reported in this manuscript.

Eleven cases were univariate outliers based on their extremely high z-scores (criterion z >3.3). Of these high univariate outliers 2 were father negative affect in sessions with their daughters. One univariate outlier was mother negative affect in sessions with their son. One case had high univariate outliers for both father and

mother negative affect. One case from the group of daughters had a high univariate outlier for both baseline PEP and Problem-Solving PEP, prior to the composition of the PEP change score. Four cases were high univariate outliers for BASC Depression, two were daughters and two were sons. To reduce the influence of high univariate outliers, 1 was added to the next highest value in these variables. Variables with more than one univariate outlier were treated in the same manner, and the rank of each outlier within the variable was maintained.

Two cases included extremely low univariate outliers as determined by z-scores (criterion $z < -3.3$). Two cases had the same lowest scores on both anxiety and depression. These two cases remained the lowest values on both anxiety and depression but the influence was reduced by subtracting 1 from the next lowest score above the actual outlier value. This practice was also utilized for the low univariate outlier on the Marital Satisfaction variable for the families with a son. Data were screened for multivariate outliers through Mahalonobis distance with $p<.05$. No multivariate outliers were detected.

The multivariate assumption of absence of multicollinearity and singularity was evaluated by

Collinearity Diagnostics provided by the Multiple Regression analysis in SPSS 16.0. The PEP, HR and HF-HRV change scores demonstrated multicollinearity due to their high correlations. Though this result is expected given their biological relationships, the EQS 6.1 program for Windows is unable to converge if multicollinearity exists among variables (Bentler, 2005). Given that PEP and HF-HRV contribute to heart rate, these variables were included and heart rate was removed from analyses.

Due to the nature of a community sample, several variables demonstrated non-normality. BASC Depression, as well as both father and mother negative affect were significantly positively skewed based on a criterion of z-score for skewness +3.3. A large portion of our sample received normal BASC Depression scores (range = 40-50), and 40 was the Depression score received by more of the sample. Hence, the distribution of Depression scores was positively skewed toward the lower range of scores in the sample. Most parents displayed little or no negative affect, which led to a positively skewed distribution. For the group of daughters, Mardia's Normalized coefficient = 8.45. $p<.05$, and for the group of sons, Mardia's Normalized coefficient = 3.60, $p<.05$. The results of Mardia's coefficient indicate

both groups violate the assumption of multivariate normality. Therefore, the models were estimated with robust estimation (i.e. Comparative Fit Index (CFI) and Root Mean-Square Error of Approximation (RMSEA)) and tested with the Yuan-Bentler Residual-Based F-statistic for small samples (Bentler & Yuan, 1999).

Data Analyses

Preliminary analyses of means and standard deviations for daughters and sons are presented in Table 1. Parents of sons reported higher marital satisfaction than parents of daughters, however the differences were non-significant. The fathers and mothers of daughters demonstrated higher negative affect than parents of sons. Mean differences between father negative affect were significantly higher among the parents of daughters than those of sons. On average both sons and daughters demonstrated BASC Anxiety and Depression scores within the normal range (40-50). The standard deviations were large for PEP and HF-HRV change score for both sons and daughters, therefore their distributions overlapped. The average PEP change scores for daughters were smaller which indicates daughters had a higher sympathetic cardiovascular response in comparison to

sons. Similarly, the average HF-HRV change score was smaller for daughters, which indicates that there was less parasympathetic influence during the problem discussion than at baseline.

The relationships between measured variables were assessed in a set of Pearson bivariate correlations (see Table 2). Among daughters, fathers' negative affect was significantly, positively correlated with BASC Depression scores and negatively correlated with PEP change score. These relationships were not significant for sons. Similarly, mothers' negative affect was significantly positively correlated with daughters' PEP change scores. As expected, HF-HRV and PEP change scores were significantly negatively correlated with HR change scores for both sons and daughters, this is due to the contribution that HF-HRV and PEP make to heart rate. For sons, PEP and HF-HRV change scores were negatively correlated, which would suggest that during the problem discussion when PEP shortened, then HF-HRV increased. Among both sons and daughters, BASC Anxiety and Depression scores were positively correlated.

Initial Theoretical Model

The initial theoretical path model is displayed in Figure 1. All variables are continuous, measured variables, as represented by rectangles. The absence of a line connecting variables indicates that a direct effect is not hypothesized.

The theoretical model evaluated the predictors of child cardiovascular response (HF-HRV and PEP) and child internalizing symptoms (anxiety and depression). It was hypothesized that parent marital satisfaction would have a direct effect on parent negative affect and an indirect effect on child cardiovascular response and internalizing symptoms. The hypotheses predicted parent negative affect would directly affect child cardiovascular response and directly predict child internalizing symptoms. To develop a psychophysiological model, parent negative affect was hypothesized to indirectly predict child internalizing symptoms through child cardiovascular response. The relationships in the model were expected to differ by gender, thus, the sample was split by gender and a separate model was tested for each gender.

Model Estimation

The results failed to support the fit of the theoretical model to the observed data. For daughters: Yuan-Bentler Residual-Based F-statistic (7, 56) = 3.038, $p<.05$, Robust CFI = .086, RMSEA = .241. For sons: Yuan-Bentler Residual-Based F-statistic (7, 50) = 2.88, $p<.05$, Robust CFI = .082, RMSEA = .247. These results suggest a revised model might fit the data better. The CFI indicates a well-fit model if the index is greater than .95 (Hu & Bentler, 1999), while the RMSEA index should be close to .06 to determine good fit between the model and the observed data (Hu & Bentler, 1999).

Post hoc model modifications were performed to develop a better fitting model. On the basis of significant paths ($p<.05$) from the initial theoretical model and theoretical relevance, several paths and two variables were removed from the initial theoretical model (Watkins, 2001).

Revised Model

Due to an absence of significant paths, the revised model did not include marital satisfaction. The high correlation between mother and father negative affect was taken into account by adding a covariance path between mother and father negative affect. To maintain a

theoretically relevant model, both PEP and HF-HRV remained in the model, although the path to HF-HRV was not significant in the initial theoretical model. Anxiety was removed from the revised model as paths were non-significant in the initial model. Mother's negative affect was the only significant predictor of child Depression in the initial model, but on a theoretical basis both father and mother negative affect remained predictors of child Depression in the revised model. Based on the Chi-square difference test (Ullman, 2007), the revised model significantly improved the theoretical model, $\chi 2$ difference (4, N = 63) = 24.97, $p<.05$.

The final model in Figure 2, fit the data better for the group of daughters, Yuan-Bentler Residual-Based F-Statistic (3, 60) = 1.93, $p>.05$, Robust CFI = .903, RMSEA = .079. Whereas, the model remained unfit for the group of sons according to the Yuan-Bentler Residual-Based F-Statistic (3, 54) = 3.21, $p<.05$, Robust CFI = .034, RMSEA = .147 (see Figure 3).

Direct Effects in the Revised Model for Daughters. As expected, mothers' and fathers' negative affect covaried significantly (unstandardized coefficient=.401, $p<.05$). Mothers' negative affect predicted daughters' PEP change

score (unstandardized coefficient = -.276, $p<.05$). Mothers' negative affect did not predict daughters' HF-HRV change score (unstandardized coefficient = .084, $p>.05$), nor BASC Depression (unstandardized coefficient=.020, $p>.05$). Unexpectedly, fathers' negative affect failed to predict daughters' BASC Depression even though it was a significant direct effect in the theoretical model (unstandardized coefficient=.243, $p>.05$). Fathers' negative affect did not predict daughters' PEP change score (unstandardized coefficient=-.224, $p>.05$) or HF-HRV change score (unstandardized coefficient=.021, $p>.05$).

Nearly twenty percent (17.5%) of the variance in daughters' PEP change score was accounted for by fathers' negative affect and mothers' negative affect. Fathers' and mothers' negative affect accounted for 6.3% of variance in daughters' BASC Depression scores. Whereas, only .09% of the variance in HF-HRV change score was accounted for by fathers' and mothers' negative affect.

Direct Effects in the Revised Model for Sons. Similar to the group of daughters, mother and father negative affect were significantly covaried (unstandardized coefficient = .258, $p<.05$). There were no direct effects

of parent negative affect on sons PEP and HF-HRV change scores, or sons BASC Depression scores.

CHAPTER FIVE

DISCUSSION

The goal of this study was to examine the relationship between parent negative affect and child outcomes (cardiovascular response and internalizing symptoms) in a community sample. It was hypothesized that parents with lower marital satisfaction would demonstrate more negative affect. Greater parent negative affect was expected to predict less parasympathetic influence (indexed by lower HF-HRV), and increased sympathetic response (shorter PEP) in their child. Similarly, higher levels of parent negative affect were also expected to predict higher scores of internalizing symptoms (BASC anxiety and depression) for their child. The results of this study partially confirmed the hypotheses and raised additional questions.

Theoretical and exploratory models were tested to examine the hypotheses and build a psychophysiological model of parent-child relationships. Overall, the evidence does not support a psychophysiological model whereby child cardiovascular response to parent-child interactions underlies child internalizing symptoms. Unexpectedly, marital satisfaction was not associated with parent

negative affect. As expected parent negative affect predicted sympathetic cardiovascular response among daughters, such that high maternal negative affect predicted increased sympathetic response (shorter PEP). However, parent negative affect failed to predict the parasympathetic cardiovascular response (HF-HRV) of both sons and daughters. The revised model indicates parent negative affect failed to predict BASC Depression scores for both daughters and sons. However, this path was significant in the theoretical model and correlations suggest some association.

Child Cardiovascular Response

Both correlations and the revised model suggest that daughters' physiologically response differs based on parent gender. After accounting for the covariance between father and mother negative affect, mothers' negative affect was significantly negatively related to daughters' PEP change scores. These results indicate that mothers' negative affect predicted an increase in daughters' sympathetic cardiovascular response. The sympathetic nervous system is responsible for immediate physiological preparedness for an environmental threat. As hypothesized, the mother's

negative affect was linked to the daughter's sympathetically mediated cardiovascular arousal suggesting that, at least in the case of mothers and their daughters, negative parental affect may be a threatening physiological stimulant. However, this outcome only partially supports the original hypothesis. Fathers' negative affect failed to predict daughters' cardiovascular response.

Recent research which evaluates the effect of parent gender on child outcomes suggests fathers are less involved than mothers (Schock & Gavazzi, 2002). Specifically, fathers are less involved in communication, time spent, conflict, and demonstrate lower levels of "connectedness" with their children than mothers (Schock & Gavazzi, 2002, p.122). Furthermore, research which compares the father-daughter dyad to the other three parent-child dyads, argues the father-daughter dyad is marked by the lowest parent involvement (Schock & Gavazzi, 2002). In addition, research which evaluates the role of fathers in the emotional development of their children proposes the range of father-child emotional stimulation is more unpredictable than between mothers and children (McDowell et al., 2002; Parke, 1996). Perhaps, daughters' cardiovascular response to fathers' negative affect is variable. Thus, daughters'

cardiovascular response to fathers' negative affect may be difficult to predict.

Quigley, Barrett and Weinstein (2002) investigated the cardiovascular response to a challenge appraisal of a cognitive stress task (mental arithmetic). Their results indicated that sympathetic activation (indexed by decreased PEP) was associated with challenge appraisals prior to a stressful cognitive task (four mental arithmetic tasks). When pre-task challenge appraisal was entered as predictor of sympathetic and parasympathetic activity, multivariate analyses revealed that only the PEP-pre-task appraisal relationship maintained significance (Quigley et al., 2002). By definition a challenge appraisal is differentiated from a threat appraisal. The threat appraisal suggests the individual perceives they lack the coping abilities to face environmental demands, whereas a challenge appraisal is the perception that the individual has the coping abilities to respond to environmental demands (Quigley et al., 2002). In light of these definitions, further research is necessary to determine whether daughters perceive their mother's negative affect as a challenge, indicative of coping abilities to handle such an environmental threat.

Numerous studies by Berntson, Cacioppo and colleagues (Berntson et al., 1994, 1996; Berntson, Cacioppo, Quigley, 1991, 1993; Cacioppo et al., 1994) support four distinct patterns of cardiac reactivity in response to psychological stress. The four patterns describe the parasympathetic and sympathetic activation, or withdrawal. The reciprocal sympathetic is characterized by an increase in sympathetic activity (PEP decreases) and a decrease in parasympathetic activity (decrease in HF-HRV) during stress. The opposite pattern is referred to as a reciprocal parasympathetic pattern; increased parasympathetic activity (HF-HRV increases) and decreased sympathetic activity (PEP increases). The last two patterns involve coactivity and coinhibition between parasympathetic and sympathetic nervous systems. Coinhibition involves the decrease of both parasympathetic and sympathetic activity (lower HF-HRV, and higher PEP). While coactivity describes an increase in activity from both parasympathetic and sympathetic branches (higher HF-HRV and lower PEP). Thus, the results of the current study suggest that daughters respond to parent negative affect with a reciprocal sympathetic cardiac, or a coactivation pattern. Correlations of HF-HRV and parent negative suggest an

increase in parasympathetic cardiac input. These correlations were non-significant and HF-HRV was not associated with parent negative affect.

Furthermore, this study supports previous research which found sympathetic activation (reciprocal sympathetic and coactivation cardiac patterns) to be the most common response to psychological laboratory stressors. In a sample of children and adolescents, Salomon, Matthews, and Allen (2000) found the reciprocal sympathetic pattern was the most common response across three tasks (reaction time, mirror-tracing and a social competence interview). Within the reaction time task, coactivation was the second most common cardiac pattern. In contrast, an assessment of hostile attributes and the Family Environment Scale (FES; Moos & Moos 1981) suggested that family conflict and hostile affect were associated with coinhibition cardiac patterns among children (Moos & Moos 1981; Salomon et al., 2000). Further research is necessary to distinguish between child cardiovascular responses to laboratory stressors and social stressors, particularly parent-child interactions. A comparison between the current study and previous research which utilized self-report measures of family conflict and negative affect would be difficult. A

recent review of child emotion research methods highlighted the different aspects of emotion which are assessed through self-report and observational methods.

Zeman, Klimes-Dougan, Cassano, and Adrian (2007) discriminate between cognitive, behavioral, physiological, social and phenomenological characteristics of emotion. In particular, self-report methods are important to reveal the cognitive and motivational states of emotion. Observational methods rely on non-verbal and behavioral expressions of emotion. Zeman et al. (2007) propose multi-methodological assessments of emotion among children. In the absence of multiple measures of parent and child emotion in the current study, perhaps, the best approach is a comparison between two samples which utilized a comparable paradigm and observational methods.

The evidence of the current study is supported by Gottman & Katz's (2002) study which indicated observed measures of parent negative engagement and affect (e.g. father's mockery and mother's criticism) were related to child physiological reaction (as measured by vagal tone and heart rate). Similar to the current study, Gottman & Katz (2002) found that mother's criticism was related to an increase in child heart rate. Generally, increases in

autonomic cardiovascular response are indicative of a response environmental stress.

An increase in heart rate can result from three of the four cardiac patterns. The current study provides evidence unique to the current body of literature which predominately examines autonomic (heart rate) and parasympathetic measures of child cardiovascular response. This study is one of the few to establish child sympathetic response to a social stressor; let alone negative parent-child relations (Buss, Goldsmith, & Davidson, 2004; Cacioppo et al., 1992). Repetti and Wood (1997) argue that when even small portions of variance are accounted for by a specific situation, "the underlying processes can account for important long-term outcomes if the situations recur and the effects cumulate" (p.191). The evidence of the current study is critical to the understanding of a common, long-term and recurrent relationship, the parent-child relationship.

Child Internalizing Symptoms

The revised model failed to demonstrate a relationship between parent negative affect and daughter's BASC depression scores. The significant positive correlation

between father's negative affect and daughter's depression scores, and the significant path in the theoretical model suggested this relationship was important to the model. However, the variance in father negative affect available for daughters' depression was reduced in the revised model. After accounting for the covariance between mother and father negative affect in the revised model, the variance remaining between father negative affect and daughter's depression may have been too small to reach significance. These results partially support the hypothesis, which expected both parents' negative affect to predict child internalizing symptoms. Specifically, correlations suggested that daughters' depression scores were related to fathers' negative affect such that more displays of father negative affect were associated with higher depression scores. This correlation was not significant for mothers' negative affect. In an assessment of parenting styles, McDowell et al. (2002) indicated fathers' parenting behaviors (emotionality, focus on the child, positive interaction, and control) predicted daughters' nervous coping strategies. Research which examines differences in the relationship between parent gender and child

internalizing symptoms has been limited. Further research is necessary to substantiate the findings of this study.

Marital Satisfaction and Parent Negative Affect

In the theoretical model marital satisfaction was not significantly associated with parent negative affect as expected. Although this outcome was not hypothesized, the finding is consistent with research that suggests parent ratings of dissatisfaction and marital discord may differ from the level of marital conflict observed by children (Grych, Seid, Fincham, 1992). Grych et al. (1992) found that child reports of inter-parent conflict had a stronger relationship to child psychological adjustment. Our findings are contrary to previous research which supports a relationship between marital discord and poor child outcomes ((Belsky, 1985; Burman, John, & Margolin, 1987; Christensen & Margolin, 1988; Conger et al., 1992; Fauber, Forehand, Thomas, & Wierson, 1990; Peterson & Zill, 1986; Margolin, 1981; Tschann, Johnston, Kline, & Wallerstein, 1989). The findings of the current study specifically challenge research which supports parenting behavior as a mediator between marital discord and child maladjustment (Belsky, 1985; Burman et al., 1987; Conger et al., 1992;

Fauber et al., 1990; Peterson & Zill, 1986; Tschann et al., 1989). The current study utilized observational measures of parent negative affect, whereas, previous research has been based on self-report measures (Burman, John, & Margolin, 1987; Fauber, Forehand, Thomas, & Wierson, 1990; Peterson & Zill, 1986; Tschann et al., 1989). The measurement differences may account for the failure of parent negative affect as a mediator between marital satisfaction and child outcomes.

Child Gender

Child gender differences were explored through these analyses, though specific hypotheses were not defined. Path analyses completed through structural equations modeling demonstrated that neither the theoretical nor the revised model fit for the sample of sons. Previous studies have demonstrated that negative parent behavior is associated with child physiological response and internalizing symptoms, few have analyzed child gender separately (Hastings et al., 2008; Bell & Belsky, 2007; Taylor et al., 2004; Whitson & El-Sheikh, 2003; Gottman & Katz, 2002; Katz & Gottman, 1995; Asarnow et al., 1994; Kaslow et al., 1984). Those studies which compared gender

differences in physiological response support our results which indicate daughters demonstrate higher levels of cardiovascular arousal in response to stress (parent negative affect) (Kudielka et al., 2004; Matthews & Stoney, 1988; Stoney, Davis & Matthews, 1987). Recent research suggests that sex differences in neuroendocrine systems may relate to differences in responses to external threats (Taylor et al., 2000). To improve the model, future models of child physiological response to parent-child interactions should account for sex-linked biological differences (e.g. sex hormones, and pubertal development).

Strengths

There are several important strengths of the present study. It improves upon previous studies by examining a diverse, community sample with an overrepresentation of African-American and multiracial individuals, relative to the United States population. Therefore, this sample increases the generalizability of these findings.

A large body of previous research has relied upon self-report measures of parent negative behavior, which is open to social desirability biases, social biases based on identification with persons administering the tool, socio-

cultural constructs and ordering effects (Zeman et al., 2007). As suggested in recent research reviews, the current study did not rely solely upon self-report measures, but utilized observational and physiological methods (Larsen & Prizmic-Larsen, 2006; Morris, Robinson & Eisenberg, 2006; Zeman et al., 2007). Multimethod examinations of parent-child interactions capture the complexity and depth of emotion (Zeman et al., 2007).

As previously discussed, it should be recognized that this study measured sympathetic contributions to cardiovascular response through impedance cardiography. The current body of literature is dominated by parasympathetic cardiovascular relationships to emotion. This pattern is particularly evident among studies of parent-child relations. In consideration of the four distinct cardiac patterns, an identification of child cardiovascular response must include both autonomic branches (PNS and SNS). Therefore this study expands upon current views of child cardiovascular response during parent-child interactions.

Limitations

Notwithstanding, this investigation had several limitations that should be considered. The psychophysiological model of parent-child relationships should be reexamined with a larger sample of sons. In contrast to the physiological measurements, the BASC measures of depression and anxiety were self-reported. Although the child self-report measure is a valid and reliable measure, self-report measures must consider attribution biases.

As demonstrated by Gottman & Katz (2002) a time series analysis would strengthen the argument for temporal relationships between parent negative affect and child physiological response. Although measures from the current study were taken within the same time frame, a moment by moment relationship between parent negative affect and child physiological response may delineate the relationships between parasympathetic, autonomic and sympathetic contributions to child cardiovascular response and emotion. Several authors argue for "process-oriented" analyses of emotion which account for temporal and contextual relationships between predictors and outcomes (Bronfenbrenner, 1979; Cicchetti & Cohen, 1995; Zeman et

al., 2007). An ecological approach to analysis would allow for an assessment of the transaction between the child and their environment, or in this case parent relations.

Future Directions

Given that the more parsimonious revised model improved upon the theoretical model, the relationships remaining in the model may be important to consider in future model parameters. Furthermore, future research should examine additional relationships within parent-child interactions and reassess this model within a larger sample. A larger sample would allow for more statistical power, increase generalizability and could detect parent and child gender differences. As discussed, multiple methods of assessing both parent and child emotion would strengthen the conclusions of this study and consider the other aspects of emotion (phenomenological and larger social contexts).

Clinical Implications

The link between child outcomes and parent negative affect highlights the importance of assessing the level of parent negative affect displayed among at-risk families.

In particular, children of families experiencing adversity and higher levels of stress would benefit from preventive approaches and interventions which focus on a reduction of parent negative affect. Given the current study, parent negative affect stimulates a physiological stress response, specifically among daughters. Therefore, interventions which effectively reduce parent negative affect could impact the long-term aggregation of chronic stress (Repetti & Wood, 1997). Based on these preliminary results, reduction in father negative affect may have a positive effect on daughter's internalizing symptoms. Future research will strengthen these initial recommendations.

Conclusions

In summary, an assessment of parent negative affect as a predictor of child outcomes revealed that maternal negative affect predicted increased sympathetic cardiovascular response among daughters. There is some evidence to suggest father negative affect is related to daughter's depression (as indexed by BASC depression scores). Results failed to support a relationship between parent negative affect and child parasympathetic cardiovascular response or child anxiety (indexed by BASC

Anxiety scores). In particular, these relationships were not established within the sample of sons.

APPENDIX A

TABLE 1: MEANS AND STANDARD DEVIATIONS FOR SONS (N=57) AND DAUGHTERS (N=63)

Table 1. Means and Standard Deviations for Sons (n=57) and Daughters (n=63)

	Sons		Daughters	
Variable	**M**	**SD**	**M**	**SD**
Marital Satisfaction	230.43	3.13	224.31	35.58
Father NA	2.22	3.13	7.67	12.21
Mother NA	5.68	6.45	7.36	9.026
HF-HRV change score	-.1059	.7319	-.2035	.8166
PEP change score	-1.932	3.291	-2.903	4.557
BASC Anxiety	44.62	9.41	43.65	4.95
BASC Depression	45.17	10.69	45.00	6.58

NA = Negative Affect

APPENDIX B

TABLE 2: PEARSON BI-VARIATE CORRELATIONS FOR DAUGHTERS AND SONS

Table 2. Pearson Bi-variate Correlations for Daughters and Sons

Variable		1	2	3	4	5	6	7	8	
1. Father's Negative Affect		-	.253	-.201	.035	.035	-.039	.048	.008	**Sons**
2. Mother's Negative Affect		.395*	-	.022	-.152	-.152	-.036	-.069	-.030	
3. Marital Satisfaction		-197	-.067	-	-.096	.104	.139	-.190	-.182	
4. HF-HRV change score		.067	.052	-.015	-	-.334*	-.648*	-.070	-.103	
5. PEP change score		-.333*	-.364*	.180	.203	-	-.398*	-.099	-.105	
6. HR change score[a]		-.040	.059	-.047	-.672*	-.410*	-	.006	.170	
7. Child BASC Depression		.251*	.116	-.064	.081	-.021	-.016	-	.633*	
8. Child BASC Anxiety	**Daughters**	-.010	.030	-.132	-.009	.007	.030	.534*	-	

* = p<.05

a. HR change score is included to demonstrate the high correlation among cardiovascular measurements

APPENDIX C

FIGURE 1: THEORETICAL PATH MODEL

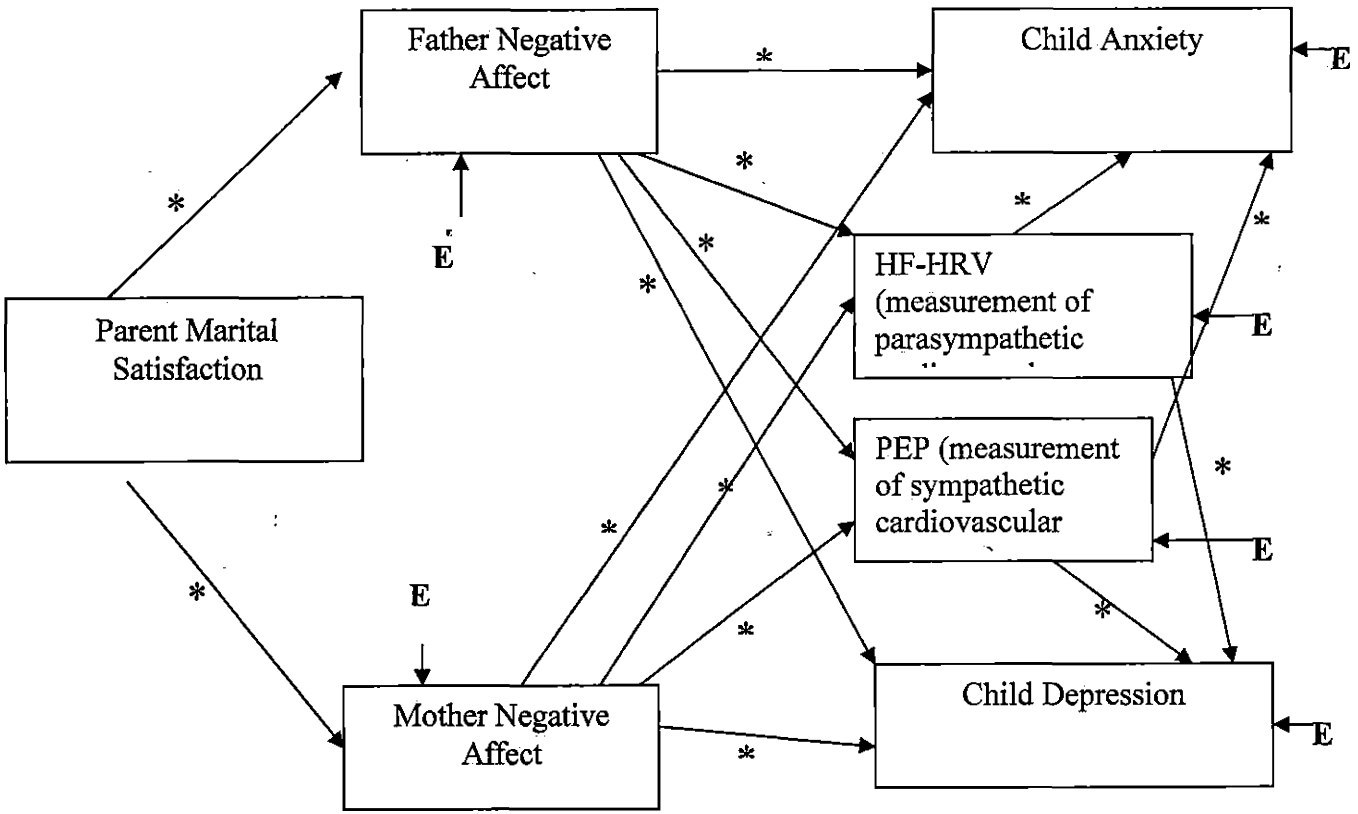

Figure 1. : Theoretical Path Model

APPENDIX D

FIGURE 2: REVISED PATH MODEL FOR DAUGHTERS

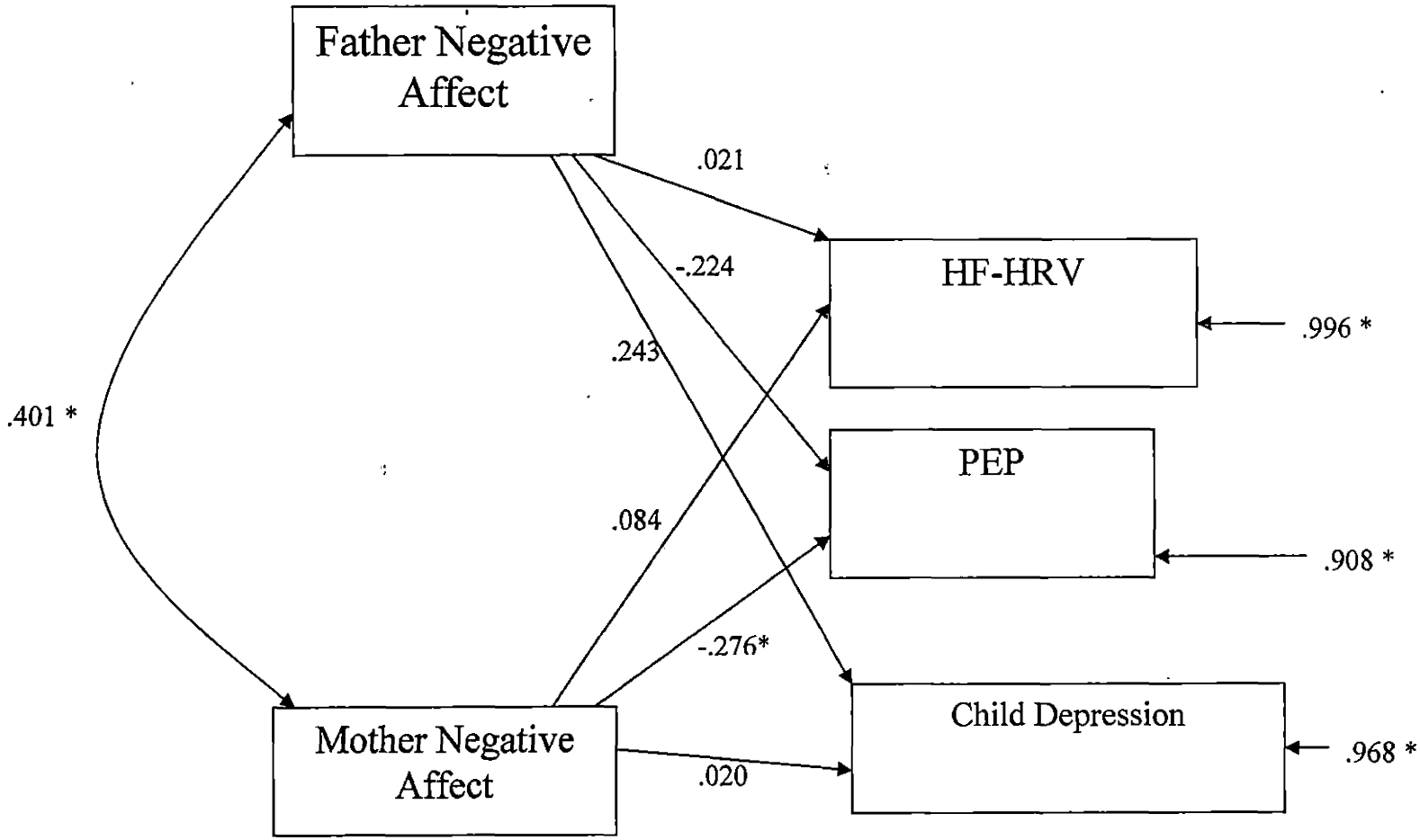

Figure 2: Revised Path Model for Daughters

APPENDIX E

FIGURE 3: REVISED PATH MODEL FOR SONS

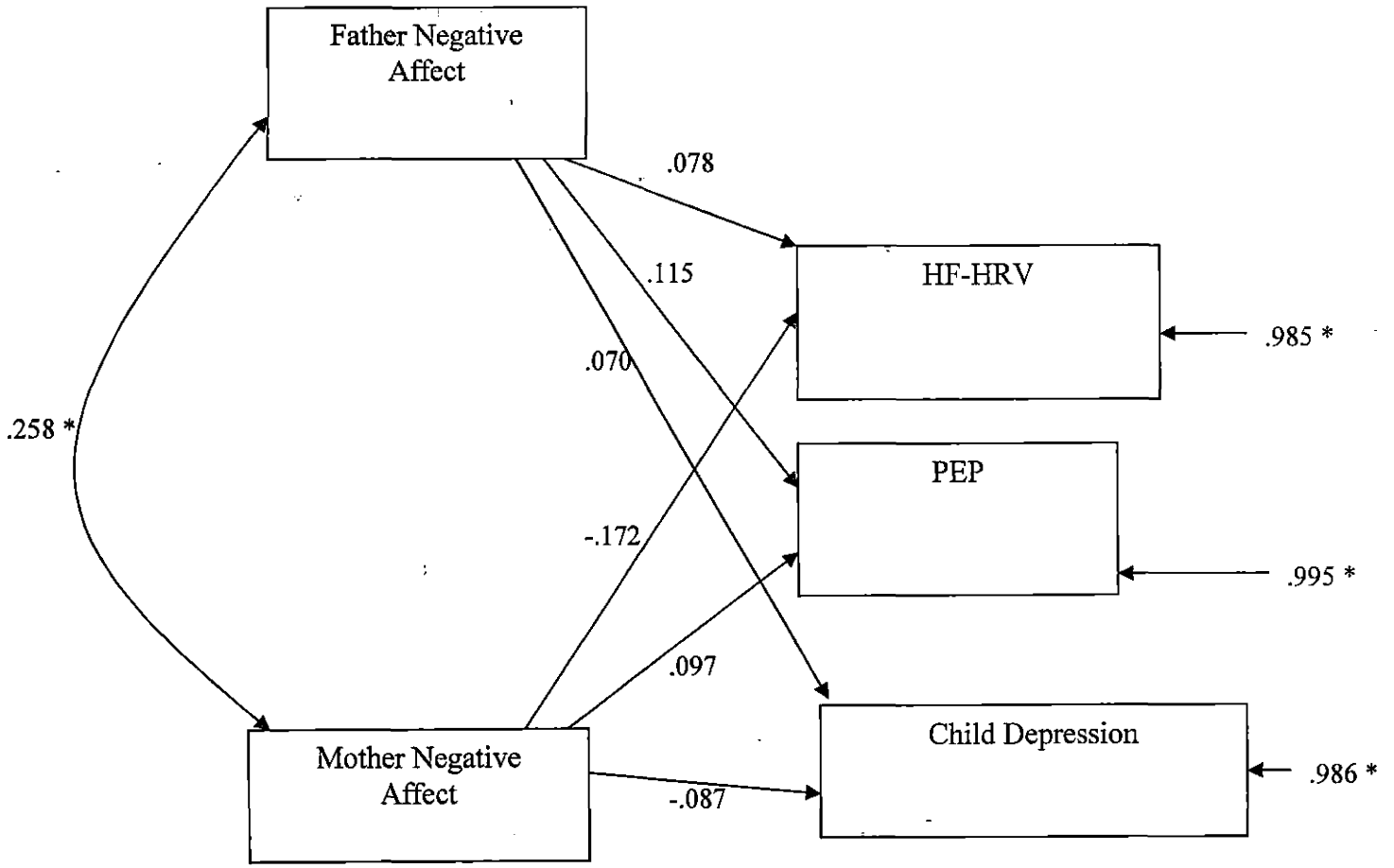

Figure 3: Revised Path Model for Sons

REFERENCES

Almeida, D.M., Wethington, E., & Chandler, A.L. (1999). Daily transmission of tensions between marital dyads and parent-child dyads. *Journal of Marriage and the Family, 61(1),* 49-91.

Amato, P.R., & Rivera, F. (1999). Paternal involvement and children's behavior problems. *Journal of Marriage and the Family, 61(2),* 375-384.

Anderson, E. R., & Hope, D. A. (2006). A review of the tripartite model for understanding the link between anxiety and depression in youth. *Clinical Psychology Review, 28,* 275-287.

Angold, A., Costello, E.J., & Worthman, C.M. (1999). Puberty and depression: the roles of age, pubertal status, and pubertal timing. *Psychological Medicine, 28,* 51-61.

Ariet, S., & Bemporad, J.R. (1980). The psychological organization of depression. *American Journal of Psychiatry, 137(11),* 1360-1365.

Asarnow, J.R., Goldstein, M.J., Tompson, M., & Guthrie, D. (1993). One-year outcomes of depressive disorders in

child psychiatric inpatients: Evaluation of the prognostic power of a brief measure of expressed emotion. *Journal of Child Psychology and Psychiatry, 34,* 129-137.

Asarnow, J.R., Tompson, M., Hamilton, E.B., Goldstein, M.J., & Guthrie, D. (1994). Family-expressed emotion, childhood-onset depression, and childhood-onset schizophrenia spectrum disorders: Is expressed emotion a nonspecific correlate of child psychopathology or a specific risk factor for depression?. *Journal of Abnormal Child Psychology, 22(2),* 129-146.

Ax, A.F. (1953). The physiological differentiation between fear and anger in humans. *Psychosomatic Medicine, 15(5),* 433-42.

Barocas, R., Seifer, R., Sameroff, A.J., Andrews, T.A., Croft, R.T., & Ostrow, E. (1991). Social and interpersonal determinants of developmental risk. *Developmental Psychology, 27(3),* 479-488.

Beauchaine, T. (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in

psychopathology. *Development and Psychopathology, 13,* 183-214.

Beaver, B.R. (2008). A positive approach to children's internalizing problems. *Professional Psychology: Research and Practice, 39(2),* 129-136.

Bell, B.G. & Belsky, J. (2007). Parenting and children's cardiovascular functioning. *Child: care, health and development, 34(2),* 194-203.

Belsky, J. (1985). Experimenting with the family in the newborn period. *Child Development, 56(2),* 407-414.

Bentler, P.M. (2005). EQS 6.1 for Windows (Build 84).

Bentler, P.M. & Yuan, K. (1999). Structural equation modeling with small samples: Test statistics. *Multivariate Behavioral Research, 34(2),* 181-197.

Berg-Nielson, T.S., Vikan, A., & Dahl, A.A. (2002). Parenting related to child and parental psychopathology: A descriptive review of the literature. *Clinical Child Psychology and Psychiatry, 7(4),* 529-552.

Berntson, G. G., Cacioppo, J. T., Binkley, P. F., Uchino, B. N., Quigley, K. S., & Fieldstone, A. (1994).

Autonomic cardiac control. Psychological stress and cardiac response in autonomic space as revealed by pharmacological blockades. *Psychophysiology, 31,* 599-608.

Berntson, G. G., Cacioppo, J. T., & Fieldstone, A. (1996). Illusions, arithmetic, and the bidirectional modulation of vagal control of the heart. *Biological Psychology, 44,* 1-17.

Berntson, G. G., Cacioppo, J. T., & Quigley, K. S. (1991). Autonomic determinism: The modes of autonomic control, the doctrine of autonomic space, and the laws of autonomic constraint. *Psychological Review, 98,* 459-487.

Berntson, G. G., Cacioppo, J. T., & Quigley, K. S. (1993). Cardiac psychophysiology and autonomic space in humans: Empirical perspectives and conceptual implications. *Psychological Bulletin, 114,* 296-322.

Berntson, G.G., Quigley, K.S., & Lozano, D. (2007). Cardiovascular psychophysiology. In Cacioppo, J.T., Tassinary, L.G., & Berntson, G. (Eds.), *Handbook of Psychophysiology, 3rd ed.* (pp. 182-210). United States of America: Cambridge University Press.

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design.* Cambridge, MA: Harvard University Press.

Brosschot, J.F., & Thayer, J.F. (2003). Heart rate response is longer after negative emotions than after positive emotions. *International Journal of Psychophysiology, 50,* 181-187.

Brown, T. A., Chorpita, B. R, Korotitsch, W., & Barlow, D. H. (1997). Psychometric properties of the Depression Anxiety Stress Scales (DASS) in clinical samples. *Behaviour Research and Therapy, 35,* 79-89.

Brownley, K.A., Hurwitz, B.E. & Schneiderman, N. (2000). Cardiovascular psychophysiology. In Cacioppo, J.T., Tassinary, L.G., & Berntson, G.G. (Eds.), *Handbook of Psychophysiology,* 2nd ed. (pp. 224-257). United States of America: Cambridge University Press.

Buehler, C., Benson, M.J. & Gerard, J.M. (2006). Interparental hostility and early adolescent problem behavior: The mediating role of specific aspects of parenting. *Journal of Research on Adolescence, 16(2),* 265-292.

Burman, B., John, R.S. & Margolin, G. (1987). Effects of marital and parent-child relations on children's adjustment. *Journal of Family Psychology, 1(1),* 91-108.

Buss, K.A., Goldsmith, H.H., & Davidson, R.J. (2004). Cardiac reactivity is associated with changes in negative emotion in 24-month olds. *Developmental Psychobiology, 46(2),* 118-132.

Cacioppo, J.T., Tassinary, L.G., & Berntson, G.G. (Eds.), *Handbook of Psychophysiology,* 2nd ed. (pp. 224-257). United States of America: Cambridge University Press.

Carrère, S. (Producer), Doohan, E. A.,& Siler, C. (Writers/Speakers). (2007). The specific affect coding system training materials. University of Washington, Seattle: NCAST-AVENUW Publishers.

Chorpita, B. F., Albano, A. M., & Barlow, D. H. (1998). The structure of negative emotions in a clinical sample of children and adolescents. *Journal of Abnormal Psychology, 107,* 74-85.

Chorpita, B.F., & Barlow, D.H. (1998). The development of anxiety: The role of control in the early environment. *Psychological Bulletin, 124(1),* 3-21.

Christensen, A. & Margolin, G. (1988). Conflict and alliance in distressed and nondistressed families. In Hinde, R.A. & Stevenson-Hinde, J. (Eds.), *Relationships within families: Mutual Influences* (pp. 263-282). Oxford: Clarendon Press.

Cicchetti, D., & Cohen, D. J. (1995). Perspectives on developmental psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology: Vol. 1. Theory and methods* (pp. 3-20). New York: Wiley.

Cole, P. M., Michel, M. K., & Teti, Laureen O'Donnell. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development, 59(2-3),* 73-100.

Conger, R.D., Conger, K.J., Elder, G.H., & Lorenz, F.O. (1992). A family process model of economic hardship and adjustment of early adolescent boys. *Child Development, 63(3),* 526-541.

Conger, R.D., Conger, K.J., Elder, G.H., Lorenz, F.O., Simons, R.L. & Whitbeck, L.B. (1993). Family economic stress and adjustment of early adolescent girls. *Developmental Psychology, 29(2),* 206-219.

Crook, K., Beaver, B.R., & Bell, M. (1998). Anxiety and depression in children: A preliminary examination of the utility of the PANAS-C. *Journal of Psychopathology and Behavioral Assessment, 20(4),* 333-350.

Crowell, S. E., Beauchaine, T.P., Gatzke-Kopp, L., Sylvers, P., Mead, H. & Chipman-Chacon, J. (2006). Autonomic correlates of attention-deficit/ hyperactivity disorder and oppositional defiant disorder in preschool children. *Journal of Abnormal Psychology, 115 (1),* 174-178.

Cummings, E.M. (1998). Children exposed to marital conflict and violence: Conceptual and theoretical directions. In Holden, G. W.; Geffner, R.; Jouriles, E. N. (Eds.), *Children exposed to marital violence: Theory, research, and applied issues* (pp. 55-93). Washington, DC, US: American Psychological Association.

Cummings, E.M., & Cummings, J.S. (1988). A process-oriented approach to children's coping with adults' angry behavior. *Developmental Review, 3,* 296-321.

Cummings, E. M., Davies, P. T., & Simpson, K. S. (1994). Marital conflict, gender, and children's appraisals and coping efficacy as mediators of child adjustment. *Journal of Family Psychology, 8(2),* 141-149.

Dienhart, A. (2001). Make room for daddy: The pragmatic potentials of a tag-team structure for sharing parenting. *Journal of Family Issues, 22*(8), 973-999.

Dix, T. (1991). The affective organization of parenting: Adaptive and maladaptive processes. *Psychological Bulletin, 110(1),* 3-25.

Downer, J.T. (2007). Father involvement during early childhood. Pianta, R.C., Cox, M.J., & Snow, K.L. (Eds.), *School readiness and the transition to kindergarten in the era of accountability* (pp. 329-354). Baltimore, MD, US: Paul H. Brookes Publishing.

Eisenberg, N., Cumberland, A., & Spinrad, T.L. (1998). Parent socialization of emotion. *Psychological Inquiry, 9(4),* 241-273.

Ekman, P., Levenson, R.W., & Friesen, W.V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science, 221(4616),* 1208-1210.

Estrada, P., Arsenio, W.F., Hess, R.D., & Holloway, S.D. (1987). Affective quality of the mother-child relationship: Longitudinal consequences for children's school-relevant cognitive functioning. *Developmental Psychology, 23(2),* 210-215.

Fauber, R., Forehand, R., Thomas, A.M. & Wierson, M. (1990). A mediational model of the impact of marital-conflict on adolescent adjustment in intact and divorced families: The role of disrupted parenting. *Child Development, 61(4),* 1112-1123.

Funk, J.L. & Rogge, R.D. (2007). Testing the ruler with item response theory: Increasing precision of measurement for relationship satisfaction with the couples satisfaction index. *Journal of Family Psychology, 21(4),* 572-583.

Gerrig, R.J. & Zimbardo, P.G. (2002). *Psychology and Life.* Boston, MA: Allyn and Bacon.

Gordis, E.B., Margolin, G. & John, R.S. (1997). Marital aggression, observed parental hostility, and child behavior during triadic family interaction. *Journal of Family Psychology, 11(1),* 76-89.

Gottman, J.M. & Katz, L.F. (2002). Children's emotional reactions to stressful parent-child interactions: The link between emotion regulation and vagal tone. *Marriage and Family Review, 34 (3/4),* 265-283.

Gottman, J.M., Katz, L.F. & Hooven, C. (1996). Parental meta-emotion philosophy and the emotional life of families: Theoretical models and preliminary data. *Journal of Family Psychology, 10(3),* 243-268.

Gottman, J. M., McCoy, K., Coan, J., & Collier, H. (1996). The specific affect coding system (SPAFF). In J. M. Gottman (Ed.), *What predicts divorce? The measures.* Mahwah, NJ: Lawrence Erlbaum Associates.

Graham, F. K. (1979). Distinguishing among orienting, defense and startle reflex. In H. D. Kimmel, E. H. van Olst, & J. H. Orlebeke (Eds.). The orienting reflex in humans (pp. 137-167). Hillsdale, NJ: Erlbaum.

Grych, J.H., & Fincham, F.D. (2001). *Interparental conflict and child development: Theory, research, and*

applications. New York, NY, US: Cambridge University Press.

Grych, J. H., Jouriles, E. N., Swank, P.R., McDonald, R., & Norwood, W.D. (2000). Patterns of adjustment among children of battered women. *Journal of Consulting and Clinical Psychology, 68(1),* 84-94.

Grych, J. H., Seid, M., & Fincham, F. D. (1992). Assessing marital conflict from the child's perspective: The children's perception of interparental conflict scale. *Child Development, 63(3),* 558-572.

Gump, B.B., Matthews, K.A., & Räikkönen, K. (1999). Modeling relationships among socioeconomic status, hostility, cardiovascular reactivity, and left ventricular mass in African American and White children. *Health Psychology, 18(2),* 140-150.

Hastings, P., Sullivan, C., McShane, K.E., Coplan, R.J., Utendale, W.T. et al. (2008). Parental socialization, vagal regulation, and preschoolers' anxious difficulties: Direct mothers and moderated fathers. *Child Development, 79(1),* 45-64.

Hessler, D.M., & Katz, L.F. (2007). Children's emotion regulation: Self-report and physiological response to peer provocation. *Developmental Psychology, 43(1),* 27-38.

Holden, G.W., & Ritchie, K.L. (1991). Linking extreme marital discord, child rearing, and child behavior problems: evidence from battered women. *Child Development, 62,* 311-327.

Hu, L. & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6(1),* 1-55.

Jennings, J. R., Kamarck, T., Stewart, C., Eddy, M., & Johnson, P. (1992). Alternate cardiovascular baseline assessment techniques: Vanilla or resting baseline. *Psychophysiology, 29,* 742-750.

Joiner, T. E., Jr., Catanzaro, S. J., & Laurent, J. (1996). Tripartite structure of positive and negative affect, depression, and anxiety, in child psychiatric inpatients. *Journal of Abnormal Psychology, 105,* 401-409.

Kashani, J.H., Ray, J.S., Carlson, G.A. (1984). Depression and depressive-like states in preschool-age children in a child development unit. *American Journal of Psychiatry, 141(11),* 1397-1402.

Kaslow, N.J., Rehm, L.P., & Siegel, A.W. (1984). Social-cognitive and cognitive correlates of depression in children. *Journal of Abnormal Child Psychology, 12(4),* 605-620.

Katz, L.F., & Gottman, J.M. (1991). Marital discord and child outcomes: A social psychophysiological approach. In Garber, J., & Dodge, K.A. (Eds.), *The development of emotion regulation and dysregulation* (pp. 129-155). New York, NY, US: Cambridge University Press.

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

Klimes-Dougan, B., Brand, A. E., Zahn-Waxler, C., Usher, B. & Hastings, P. D., Kendziora, K., & Garside, R. B. (2007). Parental emotion socialization in adolescence: Differences in sex, age and problem status. *Social Development, 16(2),* 326-342.

Kudielka, B.M., Buske-Kirshbaum, A., Hellhammer, D.H., & Kirshbaum, C. (2004). Differential heart rate reactivity and recovery after psychosocial stress (TSST) in healthy children, younger adults, and elderly adults: The impact of age and gender. *International Journal of Behavioral Medicine, 11(2),* 116-121.

LaRossa, R., Gordon, B.A., Wilson, R.J., Bairan, A., & Jaret, C. (1991). The fluctuating image of the 20th century American father. *Journal of Marriage and the Family, 53(4),* 987-997.

Larsen, R. J., & Prizmic-Larsen, Z. (2006). Measuring emotions: Implications of a multimethod perspective. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 337-351). Washington, DC:American Psychological Association.

Lewinsohn, P. M., Rohde, P., Klein, D. N., Seeley, J. R. (1999). Natural course of adolescent major depressive disorder: Continuity into young adulthood. *Journal of the American Academy of Child & Adolescent Psychiatry, 38(1),* 56-63.

Lewis, M. (2004). Emotion development: Past, present, and future. *Human Development, 47,* 66-70.

Locke, H.J. & Wallace, K.M. (1959). Short marital adjustment and prediction tests: Their reliability and validity. *Marriage and Family Living, 21,* 251-255.

Lovibond, P. E, & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behavior Research and Therapy, 33,* 335-342.

Low, S.M., & Stocker, C. (2005). Family functioning and children's adjustment: Associations among parents' depressed mood, marital hostility, parent-child hostility, and children's adjustment. *Journal of Family Psychology, 19(3),* 394-403.

Margolin, G. (1981). Behavior exchange in happy and unhappy marriages: A family cycle perspective. *Behavior Therapy, 12(3),* 329-343.

Margolin, G. & John, R.S. (1997). Children's exposure to marital aggression: Direct and mediated effects. In Kantor, G.K. & Jasinski, J.L. (Eds.), *Out of darkness:*

Contemporary perspectives on family violence. Thousand Oaks, CA, US: Sage Publications.

Marsh, P., Beauchaine, T., & Williams, B. (2008). Dissociation of sad facial expressions and autonomic nervous system responding in boys with disruptive behavior disorders. *Psychophysiology, 45,* 100-110.

Marsiglio, W. (1991). Paternal engagement activities with minor children. *Journal of Marriage and the Family, 53(4),* 973-986.

Matthews, K.A. & Stoney, C.M. (1988). Influences of sex and age on cardiovascular responses during stress. *Psychosomatic Medicine, 50(1),* 46-56.

McDowell, D. J., Kim, M., O'Neil, R. & Parke, R. D. (2002). Children's emotion regulation and social competence in middle childhood: The role of maternal and paternal interactive style. *Marriage and Family Review, 34 (3/4),* 345-364.

Moos, R., & Moos, B. (1981). *Family Environment Scale manual*. Palo Alto, CA, US: Consulting Psychologists Press.

Morris, A. S., Robinson, L. R., & Eisenberg, N. (2006). Applying a multimethod perspective to the study of developmental psychology. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 371-384). Washington, DC: American Psychological Association.

Parke, R.D. (1996). *Fatherhood.* Cambridge, MA: Harvard University Press.

Peterson, J. & Zill, N. (1986). Marital disruption, parent-child relationships, and behavior problems in children. *Journal of Marriages & the Family, 48(2),* 295-307.

Porges, S.W. (1992). Vagal tone: A physiologic marker of stress vulnerability. *Pediatrics, 90(3),* 498-504.

Porges, S. W. (1995). Orienting in a defensive world: Mammalian modifications of our evolutionary heritage. A Polyvagal theory. Presidential Address, 1994. *Psychophysiology, 32,* 301-318.

Porges, S.W. (2008). The polyvagal perspective. *Biological Psychology, 74(2),* 116-143.

Porges, S.W., Doussard-Roosevelt, J.A. & Portales, L. (1992). Difficultness and cardiac vagal tone: Stable indices of temperament in infants and toddlers. Unpublished manuscript.

Porges, S.W., Doussard-Roosevelt, J.A., Portales, A.L., & Greenspan, S. I. (1996). Infant regulation of the vagal "brake" predicts child behavior problems: A psychobiological model of social behavior. *Developmental Psychobiology, 29(8),* 697-712.

Porges, S.W., Doussard-Roosevelt, J.A., Portales, L., & Suess, P.E. (1994). Cardiac vagal tone: Stability and relation to difficultness in infants and 3-year-olds. *Developmental Psychobiology, 27(5),* 289-300.

Quigley, K.S., Barrett, L.F., & Weinstein, S. (2002). Cardiovascular patterns associated with threat and challenge appraisals: A within-subjects analysis. *Psychophysiology, 39,* 292-302.

Repetti, R.L., McGrath, E.P., & Ishikawa, S.S. (1999). Daily stress and coping in childhood and adolescence. In Goreczny, A.J., & Hersen, M. (Eds.), *Handbook of Pediatric and Adolescent Health Psychology* (pp. 343-360). Needham Heights, MA, US: Allyn & Bacon.

Repetti, R.L., Taylor, S.E., & Seeman, T.E. (2002). Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin, 128 (2),* 330-366.

Repetti, R.L., & Wood, J. (1997). Families accommodating to chronic stress: Unintended and unnoticed processes. In Gottlieb, B.J. (Ed.), *Coping with Chronic Stress* (pp.191-220). New York: Plenum Press.

Reynolds, C.R. & Kamphus, R.W. (1998). Behavior Assessment System of Children manual. Circle Pines, MN: American Guidance Service, Inc.

Sallinen, M., Rönkä, A., & Kinnunen, U. (2007). Trajectories of depressive mood in adolescents: Does parental work or parent-adolescent relationship matter? A follow-up study through junior high school in Finland. *International Journal of Behavioral Development, 31(2),* 181-190.

Salomon, K., Matthews, K.A., & Allen, M.T. (2000). Patterns of sympathetic and parasympathetic reactivity in a sample of children and adolescents. *Psychophysiology, 37,* 842-849.

Schock, A.M. & Gavazzi, S.M. (2002). Fathering court-involved daughters: Fathers' gender-specific concerns about their paternal role. *Fathering, 3(2),* 121-145.

Schwartz, C. E., Snidman, N., Kagan, J. (1999). Adolescent social anxiety as an outcome of inhibited temperament in childhood. *Journal of the American Academy of Child & Adolescent Psychiatry, 38(8),* 1008-1015.

Spanier, G. B. (1976). Measuring dyadic adjustment: New scales for assessing the quality of marriage and similar dyads. *Journal of Marriage and the Family, 38,* 15-28.

SPSS for Windows, Rel. 16.0.1. (2007). Chicago, IL, US: SPSS, Inc.

Stoney, C.M., Davis, M.C. & Matthews, K.A. (1987). Editorial: Sex differences in physiological responses to stress and in coronary heart disease: A causal link? *Psychphysiology, 24(2),* 127-131.

Tabachnik, B.G. & Fidell, L.S. (2007). Using multivariate statistics (5th Ed.). Boston: Pearson Education, Inc.

Taylor, S.E., Klein, L.C., Lewis, B.P., Gruenewald, T.L., Gurung, R.A.R., & Updegraff, J.A. (2000).

Biobehavioral responses to stress in females: Tend-and-befriend, not fight-or-flight. *Psychological Review, 107(3)*, 411-429.

Taylor, S.E., Lerner, J.S., Sage, R.M., Lehman, B.J., & Seeman, T.E. (2004). Early environment, emotions, responses to stress and health. *Journal of Personality, 72(6)*, 1365-1394.

Thompson, Ross A. (1994). The role of the father after divorce. *The Future of Children, 4(1)*, 210-235.

Tschann, J.M., Johnston, J.R., Kline, M. & Wallerstein, J.S. (1989). Family process and children's functioning during divorce. *Journal of Marriage & the Family, 51(2)*, 431-444.

Ullman, J. (2007). Structural equation modeling. In Tabachnik, B.G. & Fidell, L.S. Using multivariate statistics (5th Ed.). Boston: Pearson Education, Inc.

U.S. Economic Census. 1997.

Valiente, C., Eisenberg, N., Shepard, S.A., Fabes, R.A., Cumberland, A.J., Losoya, S.H., et al. (2004). The relations of mothers' negative expressivity to children's experience and expression of negative

emotion. *Applied Developmental Psychology, 25,* 215-235.

Vila, J., Pérezm M.N., Fernández, M. C., Pegalajar, J., & Sánchez, M. (1997). Attentional modulation of the cardiac defense response in humans. *Psychophysiology, 34,* 482-487.

Watkins, T.J. (2001). Teacher communications, child achievement, and parent traits in parent involvement models. *The Journal of Educational Research, 91(1),* 3-14.

Whalen, C.K., Henker, B., Collins, B.E., McAuliffe, S., & Vaux, A. (1979). Peer interaction in a structured communication task: Comparisons of normal and hyperactive boys and of methylphenidate (Ritalin) and placebo effects. *Child Development, 50(2),* 388-401.

Whitman, T.L., Borkowski, J.G., Keogh, D.A., & Weed, K. (2001). *Interwoven lives: Adolescent mothers and their children.* Mahweh, NJ: Lawrence Erlbaum Associates.

Zahn-Waxler, C., Klimes-Dougan, B., & Slattery, M.J. (2000). Internalizing problems of childhood and adolescence: Prospects, pitfalls, and progress in

understanding the development of anxiety and depression. *Development and Psychopathology, 12,* 443-466.

Zeman, J., Klimes-Dougan, B., Cassano, M. & Adrian, M. (2007). Measurement issues in emotion research with children and adolescents. *Clinical Psychology: Science and Practice, 14(4),* 377-401.