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Examining Emotion-related Processes in Selective Mutism; Autonomic, Behavioral and Parental Factors

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EXAMINING EMOTION-RELATED PROCESSES IN SELECTIVE MUTISM; AUTONOMIC, BEHAVIORAL, AND PARENTAL FACTORS

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Rachel Belle Tenenbaum

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To: Dean Michael R. Heithaus
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This dissertation, written by Rachel Belle Tenenbaum, and entitled Examining Emotion-Related Processes in Selective Mutism; Autonomic, Behavioral, and Parental Factors, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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DEDICATIONS

I dedicate this dissertation to my parents and grandparents. Their love, support, passion for education, hard work, and countless sacrifices have enabled me to achieve all of my dreams.

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ABSTRACT OF THE DISSERTATION

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Professor Erica D. Musser, Major Professor

Selective mutism (SM) is associated with considerable individual and family burdens, significant long-term functional impairment, and risk for later psychopathology. However, literature examining the phenomenology of SM has been scant, and it remains unclear which mechanisms are related to the development or maintenance of SM. Multiple theoretical perspectives have been proposed, and it appears that several pathways may be involved and interact to lead to the development of SM. Emotion-related processes, such as negative emotion reactivity, disruptions in emotion regulation, and parental behavior and emotionality have been proposed to be involved in the etiology and/or maintenance of SM. The present study examined each of these factors using a multi-method approach among a sample of children with SM, and typically developing children. Specifically, a mother-child dyad participated in a protocol of tasks in the laboratory. Behavioral coding and psychophysiological recording indexed emotion reactivity and regulation during tasks, as well as maternal report of these abilities. Expressed emotion, maternal behavior and self-report on emotionality was evaluated in mothers. Between-group comparisons were conducted using ANCOVAs and logistic binary regression, as well as linear regression to examine associations with a continuous measure of SM symptom severity.

The study provided preliminary evidence in the presence of heightened negative emotion reactivity indexed behaviorally, via maternal report, and sympathetic-based activity and reactivity (i.e., EDA and PEP) among children with SM. Disruptions in emotion regulation were also present in children with SM as indexed behaviorally, via maternal report, and parasympathetic-based dysregulation (RSA). Mothers of children with SM also demonstrated increased control and accommodation behaviors. In addition, mothers of children with SM demonstrated high negative affect and disruptions in emotion regulation abilities as evidenced via ratings on self-report measures. No differences were observed with respect to maternal expressed emotion. Findings suggest emotion-related processes are important to consider in the phenomenology of SM. Future directions are discussed with respect to longitudinal designs to assess temporal causality, and to contribute to the etiological theory of SM.

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CHAPTER I. INTRODUCTION

Selective mutism (SM) is a rare but impairing disorder characterized by consistent failure to speak in specific social situations, despite normal speech in other settings (American Psychiatric Association, 2013; Sharp, Sherman, & Gross, 2007). Selective mutism was historically classified as elective mutism highlighting an oppositional component of the disorder, and now SM is classified as an anxiety disorder with the initiation of DSM 5 (Anstendig, 1999; Sharp et al., 2007). Symptoms of SM must persist for at least one month (excluding the first month of school), and must cause interference with educational or occupational achievement or social communication (American Psychiatric Association, 2013; Diliberto & Kearney, 2018). Reported prevalence rates of SM vary from 0.3 to 1.9% (Bergman, Piacentini, & McCracken, 2002; Chavira, Stein, Bailey, & Stein, 2004; Sharp et al., 2007). Prevalence rate discrepancies may be associated with the variance in populations being assessed, as well as age at time of assessment, and clinical criteria used in each study (Kumpulainen, 2002). Particularly, some studies utilized community-based samples, while others utilized school-based or clinic-based samples (Standart & Couteur, 2003). Selective mutism is a low-base rate disorder, and is associated with considerable individual and family burden, significant longitudinal functional impairment, and risk for later psychopathology (Muris & Ollendick, 2015; Remschmidt, Poller, Herpertz-Dahlmann, Hennighausen, & Gutenbrunner, 2001; Steinhausen, Wachter, Laimböck, & Winkler Metzke, 2006).

The literature related to SM is small; however, a growing body of research has begun to examine the heterogeneity of symptom presentation, effective treatments for

SM, and methods of improving early identification of SM (Bergman, Gonzalez, Piacentini, & Keller, 2013; Capozzi et al., 2018; Cohan, Chavira, & Stein, 2006; Cornacchio et al., 2019; Diliberto & Kearney, 2018; Kovac & Furr, 2019; Mulligan & Shipon-Blum, 2015; Oerbeck, Stein, Wentzel-Larsen, Langsrud, & Kristensen, 2014; Zakszeski & DuPaul, 2017). While the body of literature is expanding, the etiological theory of SM remains relatively unexamined. However, SM studies conducted thus far are beginning to pave the way for future research investigating etiological theories of SM by highlighting potential etiological mechanisms that may be associated with the development of SM.

While the etiology of SM remains unclear, it is hypothesized to be multifactorial and a combination of environmental, genetic, neurodevelopmental, and temperament influences have been proposed to be involved in the etiology and/or maintenance of SM (Cohan et al., 2008, 2006; Muris & Ollendick, 2015; Scott & Beidel, 2011; Viana, Beidel, & Rabian, 2009). Specifically, emotion-related processes including emotion reactivity, disruptions in emotion regulation, as well as parenting behavior have been proposed to be involved in the etiology and/or maintenance of SM (Scott & Beidel, 2011; Viana et al., 2009). However, research examining the multi-dimensional phenomenology of SM has been scant, and to date, no studies have examined the role parenting and emotion-related processes play in SM using a multi-method approach (Scott & Beidel, 2011; Sharp et al., 2007; Viana et al., 2009). Elucidation of these processes may serve to identify potential biobehavioral targets of intervention that could shift the trajectory of illness for these high-risk youth and improve functional long-term outcomes for children with selective mutism (Diliberto & Kearney, 2018). Particularly, preliminary examination of the functioning of these emotion-related processes and the presence of particular parenting behavior in this population would be the first step to determine if these mechanisms are affected in children with SM that could serve as future treatment targets. For example, if these mechanisms are indeed altered in the SM population, focusing treatment on emotion regulation abilities, and modifying particular parental behavior could be beneficial for reducing symptoms of SM and associated impairment.

Background and Theory of the Phenomenology of SM

Selective mutism is typically observed during early childhood with an average age of onset prior to five years and a mean duration of eight years (Muris & Ollendick, 2015; Viana et al., 2009). The absence of speech in social settings typically declines across time, although children with SM typically continue to display both communication and social difficulties, as well as higher rates of comorbid and new onset psychiatric disorders across development (Remschmidt et al., 2001; Steinhausen et al., 2006). Children with SM differ from other diagnoses such as autism spectrum disorders (ASD), because of their normative social functioning and interaction with individuals they are comfortable with (Viana et al., 2009). Children with SM also do not exhibit stereotypical behavior or lack social interest (Steffenburg, Steffenburg, Gillberg, & Billstedt, 2018). Additionally, there are high rates of comorbidity and overlap of children with SM and social anxiety disorder (Muris & Olledndick, 2015). However, it appears that there is an additional component present among children with SM as opposed to social anxiety that is characterized related to social evaluation fears and lack of speech in social situations may not be present (Scott & Beidel, 2011). The relationship between the two disorders has only been examined in a handful of studies with small samples, and suggests children with SM may exhibit higher levels of social anxiety and oppositionality (Yeganeh, Beidel, & Turner, 2006). The relationship between SM and social anxiety requires further exploration, and better understanding of SM phenomenology would aid in clarifying this distinction. Unfortunately, research examining the etiology of SM is scant though, several relevant emotion-based factors, including excessive negative emotion reactivity and disruptions in emotion regulation, have been proposed as potential etiological and maintenance mechanisms (Muris, Hendriks, & Bot, 2016; Muris & Ollendick, 2015; Scott & Beidel, 2011). Additionally, the small number of empirical examinations of negative emotion reactivity and emotion dysregulation among children with SM have relied on either individual case studies or small samples (i.e., N<20) and more adequately powered empirical investigations in the field are needed (Muris & Ollendick, 2015; Sharp et al., 2007; Wong, 2010).

Prior literature has theorized that high negative emotion reactivity in social situations prompts avoidant behavior among children with SM, which may include avoidance of eye-contact, escape behaviors, and refusal to respond verbally (Muris et al., 2016; Scott & Beidel, 2011). Avoidance may serve as a maladaptive emotion regulatory mechanism, which may be utilized (in part) as a result of impairments in more adaptive emotion regulation abilities among children with SM (Scott & Beidel, 2011; Young, Bunnell, & Beidel, 2012). Indeed, prior work has indicated that children with SM exhibit both high levels of negative emotionality and shy/withdrawn behaviors in response to novel social stimuli, as well as high levels of both general and social anxiety symptoms (Kristensen & Torgersen, 2002; Kumpulainen, Räsänen, Raaska, & Somppi, 1998; Muris et al., 2016). Interestingly, both negative valence and regulatory systems have also been implicated as emotion-related mechanisms associated with anxiety broadly (Amstadter, 2008; Campbell-Sills & Barlow, 2007; Scott & Beidel, 2011; Suveg & Zeman, 2004). Particularly, youth with anxiety disorders demonstrate greater negative emotion reactivity and disruptions in emotion regulation abilities compared to youth without anxiety disorders, and high negative emotion reactivity coupled with poor emotion regulation abilities have been indicated as risk factors for the development of anxiety disorders (Anthony, Lonigan, Hooe, & Phillips, 2002; Carthy, Horesh, Apter, Edge, & Gross, 2010; Carthy, Horesh, Apter, & Gross, 2010; Crawford, Schrock, & Woodruff-Borden, 2011; Eisenberg et al., 2001; Tan et al., 2012). Furthermore, both children with SM and anxiety disorders appear to be characterized by high levels of behavioral inhibition and negative emotion reactivity, suggesting possible shared etiology (Black & Uhde, 1995; Ford, Sladeczek, Carlson, & Kratochwill, 1998; Gensthaler et al., 2016; Muris et al., 2016; Yeganeh et al., 2006). With respect to the theorized emotion dysregulation present in SM, this has not been examined empirically (Scott & Beidel, 2011; Wong, 2010). However, given the presence of comorbid anxiety disorders and symptomology in youth with SM, as well as potential shared etiological mechanisms contributing to both SM and anxiety disorders, SM may exhibit disruptions in emotion reactivity and regulation similar to those observed in anxiety disorders (Carbone et al., 2010; Gensthaler et al., 2016; Muris & Ollendick, 2015; Scott & Beidel, 2011; Sharp et al., 2007; Viana et al., 2009).

Autonomic-Linked Indices and Emotion in SM

In addition to behavioral and self-report studies, disruptions in psychophysiological autonomic-linked indexes of these domains have also been reported in youth with anxiety and to a much lesser extent in youth with SM (Alkozei, Creswell, Cooper, & Allen, 2015; Hannesdóttir, Doxie, Bell, Ollendick, & Wolfe, 2010; Kaeppler & Erath, 2017; Kossowsky, Wilhelm, Roth, & Schneider, 2012; Krämer et al., 2012; Schmitz, Krämer, Tuschen-Caffier, Heinrichs, & Blechert, 2011; Sharma, Balhara, Sagar, Deepak, & Mehta, 2011; Young et al., 2012). Prior studies utilized cardiac and electrodermal indices of autonomic nervous system functioning to index emotion reactivity and regulation. Specifically, sympathetic nervous system (SNS) activity has been used as an index of emotion reactivity, while parasympathetic nervous system (PNS) activity has been used as an index of emotion regulation (Beauchaine, 2001; Porges, 2007).

Sympathetic Nervous System and Emotion Reactivity

Electrodermal activity (EDA) involves measurements of autonomic-linked changes in the electrical properties of the skin and the sweat response and is a well-established index of SNS-based negative (and avoidance-based) emotion reactivity (Fowles, 1980; Fowles, 1993). Specifically, EDA is measured by the exclusive innervation of the eccrine sweat glands by cholinergic fibers that affect the electrical properties of these sweat glands (Uno, 1977). Additionally, these sweat glands have been associated with release of acetylcholine isolating the measurement of SNS reactivity (Uno, 1977). Electrodermal activity includes measurements of the tonic or resting electrical output (skin conductance level, SCL), and rapid phasic components (skin conductance response, SCR) (Benedek & Kaernbach, 2010). Skin Conductance Responses have been associated with sympathetic reactivity and emotional reactivity or arousal, particularly for negative emotions associated with avoidance (e.g., anxiety; Beauchaine, 2001; Fowles, 1980; Fowles & Kochanska, 2000).

Electrodermal activity has been measured more commonly among children with conduct problems, aggression, and psychopathic traits and lower levels of EDA have been attributed to decreased anxiety and fear and under-arousal in this population (Cappadocia, Desrocher, Pepler, & Schroeder, 2009; Fung et al., 2005; Lorber, 2004). With respect to children with anxiety, elevated tonic EDA and SCRs in response to stressful and fear provoking tasks has been associated with anxiety disorders and symptomology among youth (Bakker, Tijssen, van der Meer, Koelman, & Boer, 2009; Fowles & Kochanska, 2000; Schmitz et al., 2011).

Additionally, sympathetic-linked beta-adrenergic influence over the heart has been indexed via cardiac pre-ejection period (PEP), or the systolic time interval from left ventricular polarization to the onset of ejection of blood into the aorta. Pre-ejection period is a well-established index of SNS-based reactivity, as demonstrated via pharmacological stimulation of the beta-adrenergic system, and PEP has been linked to emotional reactivity/arousal and approach behaviors (Beauchaine, 2001; Berntson et al., 1994; Brenner & Beauchaine, 2011; Brenner, Beauchaine, & Sylvers, 2005; Cacioppo, Uchino, & Berntson, 1994; Sherwood, Allen, Obrist, & Langer, 1986). Pre-ejection period has been utilized in studies with youth with several forms of psychopathology and shortened PEP has been associated with sympathetic activation, while lengthening of PEP has been associated with sympathetic deactivation (Beauchaine, 2012; Beauchaine, Katkin, Strassberg, & Snarr, 2001; Cacioppo, Berntson, et al., 1994; Edmiston, Muscatello, & Corbett, 2017; McLaughlin, Sheridan, Alves, & Mendes, 2014; Musser et al., 2011; Tenenbaum et al., 2018). Disruptions in SNS-functioning, as indexed via lengthened PEP at rest and PEP reactivity during tasks (indexing low SNS activity and reactivity), has been associated with maladaptive behavior, including: conduct problems and aggression, impulsivity, externalizing behavior, oppositional defiant disorder, and attention-deficit hyperactivity disorder (Beauchaine et al., 2013; Beauchaine, 2012; Beauchaine et al., 2001; Brenner & Beauchaine, 2011; Crowell et al., 2006; Tenenbaum et al., 2018).

Parasympathetic-Based Functioning and Emotion Regulation

Parasympathetic-control of the vagus nerve (thought to regulate behavior, cognition, and emotion) has been indexed via respiratory sinus arrhythmia (RSA), which has been demonstrated to be linked specifically to PNS function via pharmacological blockade (Beauchaine, 2001; Porges, 2007). Respiratory sinus arrhythmia is characterized by the waxing and waning of heart rate across the respiratory cycle (Porges, 2007). Reduced basal RSA has been linked to several forms of psychopathology and greater RSA withdrawal from rest has been associated with adaptive emotional regulation abilities in specific contexts (Beauchaine et al., 2013; Beauchaine et al., 2001; Calkins, Graziano, & Keane, 2007; Graziano & Derefinko, 2013). In addition, low basal RSA and increased RSA withdrawal during a variety of emotionally evocative tasks have been associated with internalizing disorders, broadly, among children (Boyce et al., 2001; Dietrich et al., 2007; Forbes, Fox, Cohn, Galles, & Kovacs, 2006; Hinnant & El-Sheikh, 2009).

Sympathetic and Parasympathetic Autonomic Nervous System Functioning in SM

Using these methods, the only study to date in youth with SM revealed no significant differences in electrodermal responding or heart rate during a social interaction task compared to youth with social anxiety (Young et al., 2012). However, only a small sample of youth with SM (N=10) were included, and it was unclear whether youth with SM were participating in the social interaction or were behaviorally avoidant (Young et al., 2012). With respect to PNS functioning among 20 youth with SM in comparison to 49 typically developing youth, reduced RSA withdrawal during mild exercise was observed among SM youth compared to typically developing youth; however, no RSA reactivity differences were observed during a social interaction task (Heilman et al., 2012). Additionally, youth with SM exhibited lower levels of basal RSA compared to typically developing youth, consistent with previous findings in children with internalizing disorders (Heilman et al., 2012). Heilman and colleagues (2012) proposed that the social task might have recruited the SNS rather than the PNS, given the fear component of engaging in a social task (Heilman et al., 2012). Thus, future work is needed to examine the individual and roles of SNS-based reactivity and PNS-based regulation in children with SM.

Parental Emotionality and Behavior in Anxiety and SM

Parental factors, including parent behavior and emotionality, play an important role in the development of emotion in youth, broadly and particularly, among youth with anxiety disorders (Borelli, Rasmussen, John, West, & Piacentini, 2015; Cole, Dennis, Smith‐Simon, & Cohen, 2009; Crawford et al., 2011; Suveg et al., 2008; Suveg, Zeman, Flannery-Schroeder, & Cassano, 2005; Wald, Carthy, Shenaar-Golan, Tadmor-Zisman, & Ziskind, 2018; Williams & Woodruff-Borden, 2015). For example, in a community sample of children with anxiety symptoms, parent self-reported negative emotion reactivity in response to imagining their children experiencing distress significantly predicted higher levels of child basal RSA suggesting deficient parasympathetic-based regulation in children whose parent's reported greater negative emotion reactivity (Borelli et al., 2015). Additionally, disruptions in emotion regulation abilities among children with anxiety were associated with their parents demonstrating unsupportive emotion socialization practices and greater distress responses to their child's negative affect (Williams & Woodruff-Borden, 2015). The research examining development of emotionality suggests that the development of negative emotion reactivity and disruptions in regulation abilities is influenced or socialized via parenting behavior, which may contribute to the development or maintenance of anxiety disorders and symptoms, broadly (Crawford et al., 2011; Suveg et al., 2005; Wald et al., 2018; Williams & Woodruff-Borden, 2015).

One method of measuring parental emotionality with respect to emotional climate of the parent-child relationship is indexed via expressed emotion (EE) (Kazarian, 1992; Sher-Censor, 2015). Expressed emotion has typically been captured by utilizing and coding the Five Minute Speech Sample (FMSS), which originated in adult psychiatry, and requires a caregiver to speak about their relative for five minutes to assess elements of caregiver's speech for criticism (e.g., disapproval) and/or emotional over-involvement (EOI), which includes self-sacrificing or overprotective behaviors, excessive emotional displays, or excessive detail about the past (Kazarian, 1992; Magaña et al., 1986; Sher-Censor, 2015). Expressed emotion is conceptualized as a two-factor coded construct, including criticism and EOI (Magaña et al., 1986; Miklowitz, Goldstein, Falloon, & Doane, 1984; Vaughn & Leff, 1976). High parental EE has been examined briefly among youth with anxiety disorders, as well as among samples of youth with a broad range of psychopathology (i.e., eating disorders, ADHD, disruptive behavior disorders, depression) (Garcia-Lopez, Díaz-Castela, Muela-Martinez, & Espinosa-Fernandez, 2014; Garcia-Lopez, Muela, Espinosa-Fernandez, & Diaz-Castela, 2009; Hirshfeld, Biederman, Brody, Faraone, & Rosenbaum, 1997; Kazarian, 1992; McCarty & Weisz, 2002; Musser et al., 2018; Sher-Censor, 2015). High parental EE in these populations has been linked to increased clinical severity and poor long-term outcomes (Garcia-Lopez, Díaz-Castela, Muela-Martinez, & Espinosa-Fernandez, 2014; Garcia-Lopez, Muela, Espinosa-Fernandez, & Diaz-Castela, 2009; Hirshfeld, Biederman, Brody, Faraone, & Rosenbaum, 1997; Kazarian, 1992; McCarty & Weisz, 2002; Musser et al, 2018; Sher-Censor, 2015). Expressed emotion utilizing the FMSS has yet to be examined among parents of children with SM, and it remains unclear if parents will exist high parental EE as evidenced in studies of youth with anxiety more generally. It may be that parents of children with SM exhibit high EE as well, which may contribute to the development and maintenance of SM.

With respect to parenting behaviors, parental over-control and over-involvement are frequently present in families of children with anxiety, and similar parent behavior (i.e., reduced autonomy, over control) has been observed among parents of youth with SM to a lesser extent (Bayer, Sanson, & Hemphill, 2006; Bruggen, Stams, & Bögels, 2008; Chavira, Shipon-Blum, Hitchcock, Cohan, & Stein, 2007; Edison et al., 2011; Hudson & Rapee, 2001). Additionally, parents of children with SM tend to self-report greater social anxiety and demonstrate more avoidant behavior compared to parents of typically developing youth (Chavira et al., 2007; Viana et al., 2009). Furthermore, in line with previous literature that has examined modeling of parent anxious behavior and development of anxiety disorders in youth, it has been theorized that parents of children with SM may model anxious behavior, negative emotion reactivity, and avoidant strategies to their children in social situations contributing to the development of these behaviors and emotions in children with SM (Bögels & Brechman-Toussaint, 2006; Scott & Beidel, 2011). However, research examining parenting behaviors and parent emotionality among children with SM is in its infancy and the relationship between parental emotional factors and child negative emotionality and emotion regulation abilities has yet to be examined among children with SM.

Summary and Present Studies

The current dissertation study utilized a case-control, multi-method investigation into emotion-reactivity, regulation, and parental emotionality among children with SM and typically developing comparison children in an attempt to elucidate potential emotion-related etiological and maintenance mechanisms associated with SM. The study recruited 20 children with SM from a university-based SM specialty clinic and 40 typically developing comparison youth recruited from the community to serve as a comparison group. The present study aimed to provide a preliminary investigation of negative valence, regulatory systems, and parental emotionality and behavior in children with SM across multiple levels of analyses. The present study is novel, as there is an opportunity to expand the scarce literature examining emotion-based psychophysiological responding and parent scaffolding of emotion in children with anxiety providing information regarding emotion-related etiological mechanisms in SM, specifically, and in anxiety disorders more broadly.

Participants and their mothers completed a psychophysiological protocol comprised of three tasks while electrocardiogram, impedance cardiography, and electrodermal response data were obtained to derive psychophysiological and behavioral indexes of emotion reactivity and regulation. The tasks were videotaped and behavior coded for child and parent emotionality and related behaviors. Additionally, parents completed self-report and parental-report measures to index parental and child emotionality. Parents also completed a five-minute speech sample that was coded for parental expressed emotion (e.g., emotional over-involvement and criticism).

Study Aims Overview

Study 1 examined negative emotion reactivity in children with SM and typically developing children via behavioral coding of all three tasks (e.g., Stranger Interaction, Lock Box, and Parent-Child Interaction Tasks), parent-report and measures of sympathetic-based functioning and reactivity (e.g., PEP and EDA). Specifically, the aim of study 1 was to determine whether SM is associated with increased negative emotion reactivity compared to typically developing youth via indexes derived from behavioral coding, parent report, and related to sympathetic functioning (i.e., PEP, EDA).

Study 2 examined emotion regulation in children with SM and typically developing children via behavioral coding of the Lock Box task, parental report on emotion regulation abilities, and parasympathetic-based functioning and reactivity during resting baseline, neutral video baselines and the Lock Box and Parent-Child Interaction tasks. The aim of study 2 was to determine whether SM is associated with disruptions in emotion regulation compared to typically youth via indexes derived from behavioral coding, parent report, and related to parasympathetic functioning (i.e., RSA).

Study 3 examined parent emotionality and behavior via behavioral coding during all three tasks (e.g., Stranger Interaction, Lock Box, and Parent-Child Interaction Tasks), self-report of parental negative emotion reactivity and emotion regulation, and expressed emotion during the five-minute speech sample (FMSS). The aim of study 3 was to determine whether SM is associated with increased parent emotionality and parental control via indexes derived from behavioral coding, parent report, and coded expressed emotion during the Five Minute Speech Sample (FMSS).

CHAPTER II. STUDY 1

INTRODUCTION TO STUDY 1

As described in Chapter I, several etiological theories have been proposed with respect to SM, and child temperament has been indicated as potential etiological mechanism. Children with SM have demonstrated behavioral inhibition characterized by increased reactivity, shyness and withdrawal in novel and social situations (Black & Uhde, 1995; Cunningham et al., 2004; Manassis et al., 2007; Muris & Ollendick, 2015). Additionally, it is proposed that SM may exhibit shared etiological pathways with other anxiety disorders, and therefore it is plausible that children with SM demonstrate increased negative emotion reactivity similarly to children with anxiety (Amstadter, 2008; Campbell-Sills & Barlow, 2007; Scott & Beidel, 2011; Suveg & Zeman, 2004). Specifically, it has been theorized that children with SM demonstrate heightened arousal, and are vulnerable to intense emotional reactivity, and disruptions in negative valence systems in accordance with children with anxiety generally (Scott & Beidel, 2011). However, negative emotion reactivity has yet to be examined in children with SM using multiple methodologies.

Several studies have also examined negative emotion reactivity via sympathetic-based functioning (i.e., EDA and PEP) in youth with psychopathology including anxiety to a lesser extent (Bakker, Tijssen, van der Meer, Koelman, & Boer, 2009; Fowles & Kochanska, 2000; Schmitz et al., 2011). Briefly, EDA measures changes in the electrical properties of the skin and the sweat response and is a well-established index of SNS-based negative (and avoidance-based) emotion reactivity (Fowles, 1980; Fowles, 1993). Pre-ejection period is the systolic time interval from left ventricular polarization to the onset of ejection of blood into the aorta and is a sympathetic-linked beta-adrenal influence over the heart (Beauchaine, 2001; Berntson et al., 1994; Brenner & Beauchaine, 2011; Brenner, Beauchaine, & Sylvers, 2005; Cacioppo, Uchino, & Berntson, 1994; Sherwood, Allen, Obrist, & Langer, 1986). One study examined EDA in children with SM and failed to examine group-based differences, perhaps because of difficulty engaging in social task (Young et al., 2012). No studies have examined PEP in this population and it remains unclear if disruptions in SNS-based activity and reactivity are evident in children with SM.

Study 1 Aims and Hypothesis

The current study sought to fill the gap in literature by examining negative emotion reactivity via behavioral coding, psychopathology, and maternal report.

Hypothesis 1.1: Children with SM will exhibit greater negative emotion reactivity indexed via behavioral coding, including: 1) increased negative affect during Lock Box task, 2) increased avoidance behavior during the Stranger Interaction task, 3) decreased approach behavior during Stranger Interaction task, and 4) increased negative affect during Parent-Child Interaction task in comparison to typically developing children.

Hypothesis 1.2: Parents of children with SM will report greater child negative emotion reactivity on parent-report questionnaires than parents of typically developing children. Specifically, parents will report higher scores on the Negativity Scale of the Emotion Regulation Check List (ERC) and on the Negative Affect Scale of the Temperament in Middle Childhood Questionnaire (TMCQ)/Children's Behavior Questionnaire (CBQ) compared to parents of typically developing children.

Hypothesis 1.3: Children with SM will exhibit decreased sympathetic activity at baseline (i.e., higher levels of tonic EDA and shortened PEP at baseline) and attenuated sympathetic-based reactivity (i.e., Pre-ejection period shortening from baseline, increased EDA from baseline) compared to typically developing children during the stranger interaction task.

STUDY 1 METHODS

Participants

Participants were 60 children ages 5-10 years (*M*=7.18, *SD*=1.69 years; 63.3% female) and their mothers; 20 met Diagnostic and Statistical Manual 5 (DSM 5; American Psychiatric Association, 2013) criteria for SM and 40 were typically developing youth (TD). Ethnic minority children (identifying as Hispanic/Latinx) made up a large proportion of the sample (TD=67.5%, SM=35%). Additional demographic and diagnostic details are provided in Table 1 by diagnostic group. The Florida International University Institutional Review Board approved all study procedures (IRB-17-0177), and all procedures conformed to the Ethical Principles of Psychologists and Code of Conduct (American Psychological Association, 2002). Parents provided written consent, while children provided written assent.

Procedures

Recruitment and Identification. Children with SM and their mothers were recruited from an SM specialty treatment center in a large metropolitan region of the southern United States. All children with SM were seeking services at time of recruitment. Families were typically referred by other programs or professionals in the field, their school, by reading about the program online, or in national media coverage of the treatment center. The majority of children with SM in the current study participated in a one-week intensive group behavioral treatment. Children with SM participated in the current study prior to beginning the intensive group behavioral treatment.

Typically developing (TD) children were recruited from the community through advertisements (e.g., flyers) and community exhibitions. All consenting families completed a semi-structured diagnostic interview via telephone. All children and their mothers completed laboratory tasks in a quiet clinic room at the Center for Children and Families.

Diagnostic procedures: All DSM 5 diagnoses were determined using the *Anxiety Interview Schedule for Children-Parent Version* (ADIS; Silverman & Albano, 1997), a widely used semi-structured diagnostic interview administered to parents to assess present-state *DSM 5* defined internalizing and externalizing disorders. A trained master's level clinician administered the ADIS to mothers of all participating children. For each diagnosis, clinicians assigned a clinical severity rating (CSR) ranging from 0 (*no symptoms*) to 8 (*extremely severe symptoms*). CSRs of 4 and above indicate that diagnostic criteria for a particular disorder have been met. For all analyses, comorbid diagnoses were combined to create a count of total comorbid diagnoses.

Inclusion criteria: Children with SM were required to meet DSM 5 criteria for SM as determined by clinician administered, parent-report on the ADIS (Silverman & Albano, 1997). In contrast, on the basis of the ADIS, children in the TD group were required to have no more than four out of twenty-one symptoms endorsed of fear of particular social situations of the social anxiety disorder section, no symptoms of SM endorsed, and not to meet diagnostic criteria for any DSM 5 anxiety disorder (i.e., selective mutism, separation anxiety disorder, social anxiety disorder or generalized anxiety disorder). Other diagnoses were free to vary in both groups.

Exclusion criteria: All participants (SM children and TD children) were excluded if they had a prior diagnosis of autism, intellectual disability, cardiac arrhythmias, psychosis, or seizure disorder. All other DSM 5 diagnostic comorbidities were free to vary and are addressed in statistical analyses. Additionally, TD children were excluded if they were taking any psychoactive medication. Children with SM were excluded if they were taking any psychoactive medication other than selective serotonin reuptake inhibitors (SSRIs). Children with SM taking stable doses (no starting/stopping medication and no dose changes for at least 6 weeks prior to study participation) of SSRIs were included. The use of SSRIs was treated in analyses as a covariate.

Measures

SM Symptomology Measures

Selective Mutism Questionnaire (SMQ*;* Bergman, Keller, Piacentini, & Bergman, 2008). The SMQ is a 23-item parent-report measure that assesses SM symptoms continuously. Items consist of a statement assessing speaking behavior in different situations using a Likert scale (0=never, 1=seldom, 2=often, 3= always). Three subscales (home, school, and social) were computed by adding up all Likert scores that comprises each respective subscale to measure the child's verbal behavior in different settings. Additionally, interference and distress questions assessed interference across different settings, and overall distress of parent and child using a Likert scale (0= not at all, 1= slightly, 2=moderately, 3=extremely). A distress/interference subscale was computed including the 6 items (α=.96) assessing interference and distress across settings (e.g., “Overall how much does your child’s not talking bother you?”; “How much does not talking interfere with school for your child?”). The interference/distress subscale was utilized to examine SM symptom severity continuously. The SMQ has demonstrated excellent internal consistency of subscales (e.g., school α=.97, home α=.88, social α=.96) (Bergman et al., 2008). The SMQ has also demonstrated convergent validity with other well-validated measures of anxiety and discriminant validity against other anxiety subscales not related to SM (Bergman et al., 2008).

Emotion Reactivity Parent-Report Measures

The Temperament in Middle Childhood Questionnaire *(TMCQ; Simonds, Kieras, Rueda, & Rothbart, 2007; Simonds & Rothbart, 2004) and* ***The Children’s Behavioral Questionnaire*** *(CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001)* are parent-report measures that index different facets of temperament. The TMCQ has demonstrated good predictive validity as a temperament measure, and the CBQ has demonstrated good internal consistency (Kotelnikova, Olino, Klein, Kryski, & Hayden, 2016; Rothbart, Ahadi, Hershey, & Fisher, 2001b). Items include statements that describe children’s reactions to a number of situations and parents are asked to rate their responses on a 5 point Likert scale (1=almost always untrue, 2=usually untrue, 3= sometimes true, sometimes untrue, 4=usually true, 5=almost always true). A Negative Affect subscale was calculated with (31 items from the CBQ α=.75, and 47 items from the TMCQ α=.87) to index negative emotion reactivity including factors assessing anger/frustration (e.g., “Gets mad when provoked by other children”), discomfort (e.g., “Is bothered by loud or scratchy sounds”), fear (e.g., “Is afraid of the dark”),
sadness (e.g., “Tends to become sad if plans don’t work out”), and soothability (e.g.,

"Remains upset for hours when someone hurts his/her feelings"). The soothability subscale was reverse-coded.

Emotion Regulation Checklist *(ERC; Shields & Cicchetti, 1997)* is a 24-item, parent-report measure of perceptions of children's ability to manage their emotional experience rated on a Likert scale (0=never, 1=sometimes, 2=often, 3=almost always). The ERC is an additional index of parent-report of child's negative emotion reactivity. Specifically, a negativity scale was calculated from 15 items α=.88 (e.g., "Displays negative emotions when attempting to engage others in play"). The ERC has demonstrated good discriminate and construct validity, and reliability coefficients are high for the overall scale (.89), as well as for the negativity scale α=.83.

Tasks

Parent-Child Interaction Task (Deater-Deckard, 2000). Children were videotaped with their mother as they completed a five-minute task structured to require parent-child cooperation, while inducing mild to moderate levels of frustration. The dyads were instructed to copy a line drawing of a house using an Etch-A-Sketch toy with the parent being instructed to use only the vertical dial and the child to use only the horizontal dial. The task was coded by trained coders using the Parent-Child Interaction System (PARCHISY; Deater-Deckard, Pylas, & Petrill, 1997), which includes global ratings on a seven-point scale, and examines parental and child behavior. Specifically, child behavior was coded for negative affect (e.g., 1=no negative affect displayed, 2=one or two instances of negative affect displayed, 3=a few/several instances of negative affect displayed, 4=moderate amounts of negative affect for about half of the interaction, 5= negative affect for more than half of the interaction, 6=substantial amounts of negative affect, 7=constant negative affect). See Appendix A for additional explanation of PARCHISY behavior codes. Thirty percent of interactions were coded to establish inter-rater reliability of k= .90.

Stranger Interaction Task. The two-minute task was adapted from the Laboratory Temperament Assessment Battery (Lab-TAB) Middle Childhood Version, the scary mask task (Goldsmith, Reilly, Lemery, Longley, & Prescott, 2001) and the Lab-TAB preschool version stranger approach task (Goldsmith, Reilly, Lemery, Longley, & Prescott, 1999). The Scary mask task was deemed to be too stress inducing for this population of children, and thus, an adapted version was created to assess negative emotion reactivity to an interaction with an unfamiliar individual. The task consisted of a confederate entering the room and approaching the child and introducing herself and asking the child a standardized question ("Have you ever been here before?"). Confederates were trained to wait 10-14 seconds for child to respond and praise any response. Confederates then told the child they would be completing work and they could play with some Legos. Confederates handed the box of Legos to the child and sat nearby on a chair looking distracted and engaged in an activity for two minutes. After two minutes the confederate said "Bye" and left the room. All confederates were Caucasian females ages 18-25 years old. The task was coded using an adapted coding scheme used in Lab-TAB. *Responses to the confederate/stranger's question* were coded on a 5 point Likert scale (0= no response, 1= non-verbal response (e.g., head nod, shrugging shoulders), 2=sounds (e.g., mhm, uh oh, no actual words), 3=whisper (e.g., barely audible or whisper), 4= verbal response). Coder's were instructed to code the highest order behavior (e.g., if child responds "Yes" verbally and nods head, to code as a 4= verbal response); see Figure 1. Distress and fear responses were coded, although no children exhibited these during the task, and thus no results are reported. *Child spontaneous speech* was coded as the frequency of verbal behavior outside of answering the stranger's question. The total time spent exhibiting *avoidance behaviors* (e.g., not looking at stranger, turning body away, not engaging in task) was coded for children. *Approach behavior* was coded if they child took the toy from the stranger or opened the box of the toy after stranger handed the toy to them. Thirty percent of episodes were coded to establish inter-rater reliability of k=.88.

Lock Box Task (Goldsmith et al., 1999). The task is a four-minute task aimed to induce mild to moderate frustration. The child was instructed to choose one toy from a selection of attractive toys. After the child chose the toy it was placed in a transparent locked box and the child was handed a set of keys (e.g., incorrect keys that do not open the lock) and instructed to open the box, and the experimenter left the room. The keys were not the correct keys to open the box, and the child was tasked with attempting to open the box for five minutes. After five minutes, the experimenter returned and told the child they had made a mistake, and gave them the wrong keys. The experimenter then handed the child the correct keys, and allowed the child to unlock the box and get their prize. Child negative affect was indexed during the frustration-inducing task. The task was used to index emotion regulation abilities and persistence. The Lock Box task was coded using an adapted version of the Lab-TAB coding scheme. The frequency of child display of negative (e.g., frowning, crying) was coded and a total count *negative affect* was utilized. Thirty percent of episodes were be coded to establish inter-rater reliability of k=.89.

Psychophysiological Measures Overview

To obtain autonomic baseline activity and reactivity during tasks, psychophysiological recording occurred during resting and neutral baselines and during the three tasks described above. Electrodes were placed on the palm of the non-dominant hand to acquire electrodermal activity (EDA). Electrocardiography electrodes were placed at the right collarbone and the tenth-left rib with a ground electrode placed at the tenth-right rib. Impedance cardiography was obtained by placing two voltage electrodes below the suprasternal notch and xiphoid process and two current electrodes were placed on the back 3 to 4 cm above and below the voltage electrodes. A two-minute resting baseline where the child was instructed to sit as still as possible was recorded at the beginning of the psychophysiological recording session. Reactivity scores for each psychophysiological measure were calculated by subtracting the resting baseline physiological scores from the task scores to obtain a difference score.

Neutral Video Baseline. A neutral age-appropriate video "Spot" a short story about a puppy exploring the neighborhood, that has been rated as neutral and used in prior studies (Graziano, Calkins, Keane, & O'Brien, 2011), was presented on a computer screen positioned in front of the child for three minutes prior to the first task (Neutral Video 1), and for three minutes between the Stranger Interaction Task and the Lock Box Task (Neutral Video 2). Reactivity scores for each psychophysiological measure were calculated by subtracting the neutral video physiological scores from the task scores to obtain a difference score that accounts for orienting to a stimulus.

Cardiac Pre-Ejection Period. Pre-ejection period, a valid index of sympathetic-based approach (i.e., emotion reactivity), was derived in 30-second epochs using MindWare Impedance Cardiography V.3.1 software. PEP was indexed as the time interval in milliseconds from the onset of the Q-wave to the B point of the dZ/dt wave. Artifacts were examined and removed using software and visual inspection. One minute average PEP scores were calculated by averaging the first two 30-second epochs of each task. Among typically developing children 4.50% of cases were edited for artifacts, and among children with SM, 3.90% of cases were edited for artifacts. Thus, groups did not differ with respect to presence of artifacts (χ^2=0.06, p=.81). Inter-rater reliability (k>.85) was established by two raters examining 20% of the data obtained from each condition.

Galvanic Skin Conductance. Electrodermal activity, an index of sympathetic-based avoidance (i.e., emotion reactivity) was obtained with BioLab with a gain of 10 μO and a low pass filter of 10 Hz. Tonic skin conductance level (Tonic SCL) and responses (SCR-defined as .05 μS increase in conductance), were calculated and visually inspected for artifacts and outliers in MindWare EDA V.3.1 software. Four EDA variables were calculated: 1) total skin conductance response (Total SCR), 2) Tonic Skin Conductance Level (Tonic SCL), 3) Tonic Period, and 4) Mean Skin Conductance. Criteria for a skin conductance response (SCR) included at least 0.05 microsiemens of a difference from peak and to trough, and a SCR duration of no more than 10 seconds with at least 0.25 seconds between each SCR. One minute average scores were calculated for each EDA variable by averaging the first two 30-second epochs obtained per task. Among typically developing children 4.30% of cases were edited for artifacts. Among children with SM, on average 4.30% of cases were edited for artifacts. Thus, groups did not differ with respect to presence of artifacts (χ^2<0.01, p=.99). Inter-rater reliability (k>.90) was established by two raters examining 20% of the data obtained from each condition.

Importantly, EDA data obtained during the Lock Box Task could not be utilized due to movement-related noise causing invalid data recording (e.g., using hand to open and manipulate box).

Data Analysis Plan

Group comparisons (children with SM vs. TD children) were conducted using analysis of covariance (ANCOVA) to examine group differences in behavioral codes of emotion reactivity (Hypothesis 1.1), maternal-report of emotion reactivity on the ERC and TMCQ (Hypothesis 1.2), and psychophysiological indexes of sympathetic reactivity (i.e., PEP and EDA; Hypothesis 1.3) For binary or nominal variables (i.e., approach behavior during Stranger Interaction task) logistic regression analyses were used to assess group differences. The covariates, including: age, ethnicity, SSRI medication use, and total number of comorbid diagnoses were used in each analysis. These were chosen, as several outcome variables were correlated with these covariates, as well as significant between-group differences (i.e., SM vs TD youth) were present for these covariates. Follow-up ANOVAs were used to examine group differences without the inclusion of covariates. Additionally, linear regression models were used to examine continuous associations among emotion reactivity assessed via behavioral coding, maternal-report and psychophysiology (in separate models) with SM symptom severity (measured from the distress/interference subscale of the SMQ as the outcome in each model) with covariates included. These linear regression models were also computed without the inclusion of covariates. Missing data were addressed through multiple imputation in

SPSS (see Table 2 for description of missing data). Effect sizes were displayed as *partial eta squared* (η_p^2) for ANCOVAs, Odds Ratios for Logistic Regressions, and standardized beta coefficients for linear regressions.

STUDY 1 RESULTS

Sample Characteristics

Table 1 provides demographic and clinical description of the sample according to group. Children with SM were younger on average (M=6.35 years, SD=1.56) compared to TD youth (M=7.60 years, SD=1.61), F(1.58)=8.26, p=.006, partial η^2=.12. Children with SM were less likely to be Hispanic/Latinx compared to TD youth, χ^2=5.74, p=.02, ϕ=.31. Additionally, children with SM were more likely to be prescribed SSRIs compared to TD youth, χ^2=13.33, p<.001, ϕ =.47. No significant between-group differences were observed in terms of gender (χ^2=.14, p=.71, ϕ=-.05). With respect to SM symptomology and clinical severity, as expected and by design, children with SM displayed more symptoms of SM and interference/distress compared to TD youth (all F> 17.35, all p<.001, all partial η^2 >.22).

As expected, children with SM were more likely to be diagnosed with social anxiety disorder, separation anxiety disorder, generalized anxiety disorder, obsessive compulsive disorder (OCD), specific phobia, oppositional defiant disorder (ODD), and attention-deficit/hyperactivity disorder (ADHD) compared to TD youth (all χ^2>4.13 all p<.05, all ϕ>.25). With respect to total comorbid diagnoses collapsed across all categories, children with SM (M=1.80, SD=1.29) had more comorbid diagnoses on average compared to TD youth (M=0, SD=0.00), F(1,58)=465.83, p<.001, partial η^2 =.57.

Given group differences in age, ethnicity, medication use, and total comorbid diagnoses, each of these variables were included as covariates in all analyses. Analyses are also presented without covariates for comparison.

Correlations of the primary variables of interest, demographic, and clinical characteristics are displayed in Table 3.

Hypothesis 1.1 Emotion Reactivity Behavioral Coding by Diagnostic Group Results

Behavioral coded emotional reactivity data are presented in Table 4 with covariates and Table 5 without covariates according to diagnostic group status. Without covariates included, no group-based differences were observed in child's negative affect during the Lock Box task ($F(1,58)=3.31$, $p=.07$, partial $\eta^2=.05$), or during the Parent-Interaction task ($F(1,58)=1.66$, $p=.20$, partial $\eta^2=.03$). However, significant group-based differences were observed in the total time spent avoiding the confederate, $F(1,58)=8.81$, $p=.004$, partial $\eta^2=.13$. Specifically, children with SM spent more time avoiding the confederate during the Stranger Interaction task (*M*=6.29, *SD*=12.77) compared to TD youth (*M*=.29, *SD*=1.28). No group-based differences were observed in the percentage of children who engaged in approach behavior during the Stranger Interaction Task, *B*= 1.56, *S.E.*=.92, $p=.09$, OR=4.75.

Results were similar once covariates were included. Specifically, no group-based differences were observed in child's negative affect during the Lock Box task, suggesting similar levels of negative emotion reactivity in response to frustration across the groups, $F(1,54)=1.94$ $p=.17$, partial $\eta^2=.04$. Additionally, no group-based differences were observed in child's negative affect during the Parent-Child Interaction task, suggesting similar levels of negative emotion reactivity in response to a frustrating task with a parent across the groups, *F*(1,54)=.74, *p*=.40, partial η^2=.01. No group-based differences were observed in the percentage of children who engaged in approach behavior during the Stranger Interaction task (*B*= 1.06, *S.E.*=1.43, *p*=.46, OR=2.90). As described above, when covariates were not included the effect of total time spent avoiding the confederate was significant, however the effect does not hold when covariates were included, (*F*(1,54)=1.59, *p*=.21, partial η^2=.03). Specifically, ethnicity was significantly associated with total time spent avoiding the confederate, (*F*(1,54)=4.99, *p*=.03, partial η^2=.09), which may account for the effect not holding with the inclusion of covariates. In summary, with respect to coding of behavior across the tasks, children with SM did not demonstrate significantly different displays of negative emotion reactivity compared to TD youth.

Hypothesis 1.1 Emotion Reactivity Behavioral Coding and Continuous Measures of SM Results

All models are presented in Table 6 with covariates and Table 7 without covariates. When analyses are conducted without covariates, negative affect during the Lock box task and negative affect during the Parent-Child Interaction task was not significantly associated with SM symptom severity ratings (all β <-.16, *t*(58)<-1.14 *p*>.25). Additionally, approach behavior during the Stranger Interaction task was not significantly associated with SM symptom severity ratings, β=-.15, *t*(58)= -1.17, *p*=.24. However, avoidance behavior was a significant positive predictor of SM symptom severity ratings, β=.26, *t*(58)= 2.04, *p*=.04. Overall, children that spent more time in avoidance during the Stanger Interaction Task demonstrated higher levels of SM symptom severity.

In the models with SM symptom severity rating as the dependent variable and covariates included, negative affect during the Lock Box task, as well as negative affect during the Parent-Child Interaction task was not significantly associated with SM symptom severity ratings (all $\beta<-.04$, $t(54)<.35$, $p>.42$). Additionally, neither avoidance nor approach behavior during the Stranger Interaction task was significantly associated with SM symptom severity ratings (all $\beta<.07$, $t(54)<.46$, $p>.61$). The significant effect of avoidance that was mentioned above did not hold when covariates were included. Specifically, avoidance was no longer significantly associated with SM symptom severity, and SSRI use ($\beta=5.51$, $t(54)= 2.62$ $p=.009$), and total comorbid diagnoses ($\beta=2.40$, $t(54)= 4.31$, $p<.001$) were significantly associated with SM symptom severity.

Hypothesis 1.2 Emotion Reactivity Parent-Report by Diagnostic Group Results

Data from parent-report measures of emotion reactivity (TMCQ/CBQ and ERC) are presented in Table 4 with covariates and Table 5 without covariates according to diagnostic group status. When analyses are conducted without covariates, significant group-based differences were observed in maternal report of negative emotion reactivity on the ERC Negativity Scale ($F(1,58)=5.63$ $p=.02$, partial $\eta^2=.09$), and on the TMCQ/CBQ Negative Affect Scale ($F(1,58)=21.78$, $p<.001$, partial $\eta^2=.27$).

Specifically, on the ERC and on the TMCQ/CBQ, mothers of children with SM rated their children as displaying higher levels of negative emotion reactivity ($M=.71$, $SD=.43$, and $M=3.53$, $SD=.95$, respectively) compared to mothers of TD youth ($M=.44$, $SD=.42$, and $M=2.49$, $SD=.74$, respectively).

When covariates are included, the effects discussed above did not hold. Specifically, no group-based differences were observed in maternal report of negative emotion reactivity on the ERC Negativity Scale ($F(1,54)=.62$, $p=.43$, partial $\eta^2=.01$). The effect may be accounted for by ethnicity which was significantly associated with maternal report of negative emotion reactivity on the ERC Negativity Scale ($F(1,54)=6.87$, $p=.01$, partial $\eta^2=.11$), as well as total comorbid diagnoses that was also significantly associated with maternal report of negative emotion reactivity on the ERC Negativity Scale ($F(1,54)=6.57$, $p=.01$, partial $\eta^2=.11$). No significant group-based differences were observed on maternal report of negative affect on the TMCQ/CBQ Negative Affect Scale ($F(1,54)=.03$, $p=.87$, partial $\eta^2=.001$). The effect may be accounted for by age, which was significantly associated with maternal report of negative affect on the TMCQ/CBQ Negative Affect Scale ($F(1,54)=12.52$, $p=.001$, partial $\eta^2=.19$), or total comorbid diagnoses that was also significantly associated with maternal report of negative affect ($F(1,54)=12.76$, $p=.001$, partial $\eta^2=.19$).

Hypothesis 1.2 Emotion Reactivity Parent-Report and Continuous Measures of SM Results

All models are presented in Table 6 with covariates and Table 7 without covariates. When covariates are not included in the model, ratings on the Negativity Scale of the ERC were a significant positive predictor of SM symptom severity, $\beta=.41$, $t(58)=3.22$, $p=.001$. Additionally, ratings on the Negative Affect Scale of the TMCQ/CBQ were a significant positive predictor of SM symptom severity, $\beta=.51$, $t(58)=4.38$, $p<.001$. Overall, indicating that mothers of children with higher SM symptom severity rated their children as having greater levels of negative emotion reactivity.

When covariates are included in the model with SM symptom severity rating as the dependent variable, ratings on the Negativity Scale of the ERC was not significantly associated with SM symptom severity, $\beta=.10$, $t(54)=1.10$, $p=.27$. As mentioned above, the effect did not remain significant when controlling for the effect of covariates, perhaps due to SSRI use ($\beta=.30$, $t(54)=2.88$, $p=.004$) or total comorbid diagnoses ($\beta=.45$, $t(54)=3.81$, $p<.001$), which were significantly associated with SM symptom severity. Additionally, in the model with SM symptom severity as the dependent variable, ratings on the Negative Affect scale of the TMCQ/CBQ was not significantly associated with SM symptom severity, $\beta=.17$, $t(54)=1.21$, $p=.23$. SSRI use ($\beta=.30$, $t(54)=2.89$, $p=.004$) and total comorbid diagnoses may also explain the effect as well ($\beta=.40$, $t(54)=3.12$, $p=.002$).

Hypothesis 1.3 PEP and EDA by Diagnostic Group Results

Raw PEP and EDA scores (e.g. SNS-based activity) for all tasks and baselines, and reactivity change scores are presented in Table 8 with covariates and Table 9 without covariates according to diagnostic group. When covariates are not included in analyses, no group-based differences were observed in Total SCR, Tonic SCL, Tonic Period or Mean SCL during rest or either neutral video segment (all $F<3.71$, $p>.07$, partial $\eta^2<.07$). Additionally, no group-based differences were observed in PEP at rest or during either neutral video segment (all $F<.20$, $p>.66$, partial $\eta^2<.07$). No group-based differences were observed in Total SCR, Tonic SCL, Tonic Period, Mean SCL during the Stranger Interaction task (all $F<1.31$, $p>.30$, all partial $\eta^2<.03$). However, significant group-based differences were observed in PEP during the Stranger Interaction task, $F(1,58)=4.60$, $p=.04$, partial $\eta^2=.07$. Specifically, children with SM demonstrated greater SNS-based activity, indicating more emotion reactivity during the task (*M*=95.26, *SD*=8.59) compared to typically developing youth (*M*=100.29, *SD*=8.70). Additionally, significant group-based differences were observed in Tonic Period reactivity from the neutral video baseline to the Stranger Interaction task, $F(1,58)=4.77$, $p=.03$, partial $\eta^2=.08$. Specifically, children with SM demonstrated increased SNS-based reactivity (*M*=.60, *SD*=3.62) compared to typically developing youth (*M*=-2.01, *SD*=5.10) from baseline to the Stranger Interaction task. No significant group-based differences were observed in Tonic Period reactivity from resting baseline to the Stranger Interaction task $F(1,58)=1.73$, $p=.19$, partial $\eta^2=.03$. No significant group-based differences were observed in Total SCR reactivity, Tonic SCL reactivity, Mean SC reactivity or PEP reactivity from either resting baseline or neutral video baseline (all $F<2.22$, $p>.13$, partial $\eta^2<.05$). Therefore, it appears that children with SM demonstrated increased SNS-based activity and reactivity during a task aimed to induce fear.

When covariates are included, no group-based differences were observed in Total SCR, Tonic SCL, Tonic Period or Mean SCL during rest or either neutral video segment (all $F<.82$, $p>.41$, partial $\eta^2<.03$). Additionally, no group-based differences were observed in PEP at rest or during either neutral video segment (all $F<.20$, $p>.66$, all partial $\eta^2<.07$). No group-based differences were observed in Total SCR, Tonic SCL, Tonic Period, Mean SCL or PEP during the Stranger Interaction task (all $F<1.02$, $p>.31$, all partial $\eta^2<.03$). As mentioned above group-based differences were observed in PEP during the Stranger Interaction task, and the effect did not hold when covariates were included. The effect may be accounted for by age, which was significantly associated with PEP during the Stranger Interaction task ($F(1,54)=6.10$, $p=.02$, partial $\eta^2=.11$ With respect to SNS-based reactivity, no group-based differences were observed in Total SCR reactivity, Tonic SCL reactivity, Tonic Period reactivity or Mean SC reactivity from resting baseline or either neutral video segment to the Stranger Interaction task (all $F<1.57$, $p>.21$, partial $\eta^2<.04$). Additionally, no group-based differences were observed in PEP reactivity from resting baseline or either neutral video segment to the Stranger Interaction task (all $F<1.06$, $p>.30$, partial $\eta^2<.03$).

Hypothesis 1.3 PEP and EDA and Continuous Measures of SM Results

All models are presented in Table 10 with covariates and Table 11 without covariates. When covariates are removed, all EDA variables (i.e., Total SCR, Tonic SCL, Tonic Period and Mean SC) at rest and during both neutral video segments were not significantly associated with SM symptom severity (all $\beta<-.26$, $t(58)<1.84$, $p>.06$). Additionally, all EDA variables (i.e., Total SCR, Tonic SCL, Tonic Period and Mean SC) during the Stranger Interaction task were not significantly associated with SM symptom severity, all $\beta<-.17$, $t(58)<-1.34$, $p>.22$. Tonic SCL reactivity from rest was a significant negative predictor of SM symptom severity, $\beta=-.28$, $t(58)=-2.20$, $p=.03$. Specifically, greater SM symptom severity was associated with decreased SNS-based reactivity from rest to the Stranger Interaction task. No other EDA reactivity variables from rest or neutral video were significantly associated with SM symptom severity, all $\beta<-.29$, $t(58)<-1.85$, $p>.06$. Additionally, PEP during the Stranger Interaction task was a significant negative predictor of SM symptom severity, $\beta=-.32$, $t(58)=-2.10$, $p=.04$.

Neither PEP reactivity from resting baseline or neutral video to the Stranger Interaction task was a significant predictor of SM symptom severity, $\beta < -.08$, $t(58) < -.53$, $p > .59$. In summary, greater SM symptom severity was associated with increased SNS-based activity and reactivity.

In the model with SM symptom severity rating as the dependent variable and covariates included, all EDA variables (i.e., Total SCR, Tonic SCL, Tonic Period and Mean SC) at rest and during both neutral video segments were not significantly associated with SM symptom severity (all $\beta < .12$, $t(54) < 1.09$, $p > .27$). Additionally, all EDA variables (i.e., Total SCR, Tonic SCL, Tonic Period and Mean SC) during the Stranger Interaction task and all EDA reactivity variables from rest and neutral video were not significantly associated with SM symptom severity, all $\beta < .13$, $t(54) < -1.20$, $p > .31$. The significant effect mentioned above of Tonic SCL reactivity from task, did not hold when covariates were included because of the effect of SSRI medication use ($\beta = .29$, $t(54) = 2.67$, $p = .008$) and comorbid diagnoses ($\beta = .47$, $t(54) = 4.54$, $p < .001$).

Also, in the model with SM symptom severity rating as the dependent variable and covariates included, PEP at rest, during both neutral video segments, and during the Stranger Interaction task was not significantly associated with SM symptom severity (all $\beta < .22$, $t(54) < 1.30$, $p > .19$). The effect of PEP during the Stranger Interaction task did not hold when covariates were included, perhaps because of SSRI use ($\beta = .28$, $t(54) = 2.74$, $p = .006$) or comorbid diagnoses ($\beta = .55$, $t(54) = 4.50$, $p < .001$) confounding the effect.

In addition, PEP reactivity from resting baseline to the Stranger Interaction task was not significantly associated with SM symptom severity, β=-.20 $t(54)=-1.57$, $p=.12$. Pre-ejection period reactivity from neutral video to the Stranger Interaction task was also not significantly associated with SM symptom severity, β=-.19, $t(54)=-.79$, $p=.43$.

STUDY 1 DISCUSSION

Study 1 examined negative emotion reactivity among children with SM and typically developing comparison youth utilizing a multi-method approach. The goal of the present study was to provide a preliminary examination into emotion-related factors among children with SM to propel future research into etiological theory of SM. To date, no studies have directly examined the display of negative emotion reactivity in children with SM (Scott & Beidel, 2011). However, the relationship has been studied extensively among children with anxiety, and it clear from prior studies that children with anxiety demonstrate higher arousal and increased negative emotion reactivity (Amstadter, 2008; Campbell-Sills & Barlow, 2007; Scott & Beidel, 2011; Suveg & Zeman, 2004). Given the overlap between SM and anxiety and potential shared etiological pathways, it is plausible that children with SM exhibit similar emotional profiles (Muris & Ollendick, 2015). The present study sought to examine maternal report of negative affect and reactivity, and displays of negative affect and negative emotion reactivity using behavioral coding, and psychophysiological recording of children with SM compared to typically developing children during different tasks.

With respect to behavioral observation of negative emotion reactivity during the different tasks employed, in contrast to the first hypothesis, children with SM did not exhibit higher levels of negative emotion reactivity compared to typically developing children. It may have been that neither group was particularly distressed or frustrated by the tasks utilized in the present study, and thus did not demonstrate their typical emotion responding as they would in more ecologically valid environments. Perhaps, in more naturalistic settings, children with SM would display more negative emotion reactivity compared to typically developing children. Future work should attempt to examine displays of negative emotion of children with SM in environments where SM behavior is prominent, such as school. Additionally, the hypothesis that children with SM will demonstrate less approach behavior with a stranger present was not supported. However, children with SM spent more time engaging in avoidance behavior with the confederate present compared to typically developing children, which is in line with prior literature that has suggested children with SM demonstrate high levels of behavioral inhibition in response to novel situations, which may contribute to their avoidance of novel situations (Black & Uhde, 1995; Ford, Sladeczek, Carlson, & Kratochwill, 1998; Gensthaler et al., 2016; Muris et al., 2016; Yeganeh et al., 2006).

In accordance with prior studies of children with anxiety, mothers of children with SM rated them as displaying higher levels of negative emotion reactivity compared to typically developing children (Yeganeh et al., 2006). The finding of increased negative emotion reactivity suggests, that although during the tasks of the present study displays of negative emotion reactivity were not present to a greater degree than typically developing children, children with SM still exhibit high levles of negative emotion reactivity across situations in their own lives as rated by their mothers. The findings related to negative emotion reactivity sheds light on the presence of high levels of negative emotion reactivity in children with SM, that could potentially be addressed as future treatment mechanims, once these findings are replicated and extended.

With respect to SNS-based activity and reactivity, in contrast to the study hypothesis, children with SM did not demonstrate increased SNS-based activity or reactivity in either PEP or EDA. However, when covariates were not included, children with SM did exhibit increased SNS-based activity during the Stranger Interaction task indicating that they demonstrated higher levels of negative emotion reactivity during a socially-stressing task compared to typically developing children. In terms of SNS-based reactivity, from baseline to the Stranger Interaction task while accounting for orienting, children with SM demonstrated greater SNS-based reactivity as indexed via EDA compared to typically developing children. The finding is not in accordance to the one EDA study conducted in youth with SM that found no significant differences, but is in line with prior literature that has determined increased arousal and SNS-based functioning using EDA in youth with anxiety (Bakker, Tijssen, van der Meer, Koelman, & Boer, 2009; Fowles & Kochanska, 2000; Schmitz et al., 2011; Young et al., 2011). The pattern of SNS-based reactivity observed supports the notion that children with SM exhibit higher levels of negative emotion reactivity physiologically, and is in line with prior literature examing children with anxiety. When examining SM symptom severity, decreased PEP activity (i.e., increased SNS-based activity) was associated with greater SM symptom severity.

The finding suggests that children with SM that have more impairing symptoms of SM may have more deficits in sympathetic-based functioning (i.e., increased arousal and negative emotion reactivity), perhaps enhancing their behavioral responses to potentially stressful or anxiety provoking events.

In summary, children with SM demonstrated higher levels of negative emotion reactivity compared to typically developing children to some extent multi-modally. Specifically, children with SM were avoidant during a social interaction task and were rated by their mothers as displaying high rates of negative emotion reactivity, which suggests that children with SM are similar to children with anxiety broadly. Preliminary evidence is also present for sympthatic-based disruptions in children with SM as evidenced by increased SNS-based activity and reactivity suggesting similar patterns to that of children with anxiety. The present study was the first study to examine PEP activity and reactivity in youth with SM, and demonstrates preliminary support that SNS-based functioning may be altered in this population.

While the present study is an essential first step in examining emotion reactivity in chidlren with SM using multiple methodology, several limitaitons should be considered. First, more than 30% of data was missing for several PEP measures given the inherent movement associated with the tasks employed in the present study, resulting in increased noise and unsusable impedance data. Another limitation is the small sample size, potential heterogenity within the SM sample, and high comorbidty with other anxiety disorders making it difficult to parse out specific effects related specifically to SM. Thus, the limitation of small sample size is particularly concerning due to the loss of significant effects when including comorbid anxiety diagnoses, suggesting they may be accounting for some or all of the effects measured. Future work should determine proper methodology to index this measurement in this population, while accounting for issues associated with psychophysiological recording. Portable physiology recording may improve measurement ability, and should be examined further. Additionally, longitudinal work is needed to determine if increased negative emotion reactivity is associated with the development of SM.

CHAPTER III. STUDY 2

STUDY 2 INTRODUCTION

The theory that maladaptive emotion regulation abilities may be implicated in the development of SM is described in detail in Chapter I. Children with anxiety generally demonstrate poor emotion regulation abilities (Anthony, Lonigan, Hooe, & Phillips, 2002; Carthy, Horesh, Apter, Edge, & Gross, 2010; Carthy, Horesh, Apter, & Gross, 2010; Crawford, Schrock, & Woodruff-Borden, 2011; Eisenberg et al., 2001; Tan et al., 2012), and these same difficulties may be present among children with SM, given the potential shared overlap of etiological pathways. In addition, children with SM may implement avoidance as a maladaptive emotion regulation strategy in the presence of heightened arousal and negative affect when approaching an anxiety-provoking situation in order to decrease the emotional experience (Scott & Beidel, 2011). For example, children with SM may escape or avoid these situations as an emotion regulation strategy to reduce arousal, which in turn reinforces the poor emotion regulation strategy and further heightens arousal (Scott & Beidel, 2011). However, the theory regarding emotion regulation abilities in children with SM has yet to be evaluated empirically.

Psychophysiological measurement of emotion regulation has been employed in studies assessing different forms of psychopathology. Parasympathetic-control of the vagus nerve (thought to regulate behavior, cognition, emotion) has been indexed via respiratory sinus arrhythmia (RSA), which has been uniquely linked to PNS function via pharmalogical blockade (Beauchaine, 2001; Porges, 2007). Respiratory sinus arrhytmia measures the waxing and waning of of heart rate across the respiratory cycle (Porges, 2007). The one study to examine RSA in children with SM demonstrated reduced basal

RSA, and failed to examine signiifcant group-based differences between children with SM and typically developing controls (Heilman et al., 2012). While the one study provides initial evidence that parasympathetic-based regulation may be disrupted in children with SM, more studies are needed to examine the association.

Study 2 Aims and Hypotheses

Our study sought to fill the gap in the literature by examining emotion regulation abilities of children with SM and typically developing controls utilizing behavioral coding, maternal report and parasympethtic-based functioning across several frustration-inducing tasks.

Hypothesis 2.1: It was hypothesized that children with SM will exhibit less behaviorally coded: 1) global regulation and 2) task persistence, but greater behaviorally coded: 1) help-seeking, 2) frustration, 3) facial anger expression, and 4) body anger (i.e., indexes of display of emotion dysregulation) during the locked box task compared to typically developing children.

Hypothesis 2.2: Parents of children with SM will report disruptions their children's emotion regulation abilities on parent-report questionnaires compared to parents of typically developing children. Specifically, parents of children with SM will report lower scores on the Regulation Scale of the Emotion Regulation Check List (ERC) and on the Effortful Control scale of the Temperament in Middle Childhood Questionnaire (TMCQ)/Children's Behavior Questionnaire (CBQ) than parents of typically developing youth.

Hypothesis 2.3: Children with SM will exhibit lower basal RSA and reduced RSA withdrawal from baseline (indicating parasympathetic-based dysregulation) during the Locked Box task and Parent-Child Interaction task compared to typically developing children.

STUDY 2 METHODS

Participants

Participants were 60 children ages 5-10 years (*M*=7.18, *SD*=1.69 years; 63.3% female) and their mothers; 20 met Diagnostic and Statistical Manual 5 (DSM 5; American Psychiatric Association, 2013) criteria for SM and 40 were typically developing youth (TD). Ethnic minority children (identifying as Hispanic/Latinx) made up a large proportion of the sample (TD=67.5%, SM=35%). Additional demographic and diagnostic details are provided in Table 1 by diagnostic group. The Florida International University Institutional Review Board approved all study procedures, and all procedures conformed to the Ethical Principles of Psychologists and Code of Conduct (American Psychological Association, 2002). Parents provided written consent, while children provided written assent.

Procedures

Recruitment and Identification. Procedures are identical to those in Study 1 and described in detail in Study 1 method, and here in brief. Children with SM and their mothers were recruited from an SM specialty treatment center, and were seeking services at the time of recruitment. Typically developing (TD) children were recruited from the community.

All consenting families completed a semi-structured diagnostic interview via remote mechanisms (e.g., phone). All children and their mothers completed laboratory tasks in a quiet clinic room at the Center for Children and Families.

Diagnostic procedures: All DSM 5 diagnoses were determined using the *Anxiety Interview Schedule for Children-Parent Version* (ADIS; Silverman & Albano, 1997), a widely used semi-structured diagnostic interview administered to parents to assess present-state *DSM 5* based internalizing and externalizing disorders. See Study 1 Methods for detailed explanation. For all analyses, comorbid diagnoses were combined to create a count of total comorbid diagnoses.

Inclusion and exclusion criteria: Children with SM were required to meet DSM 5 criteria for SM as determined by clinician administered, parent-report on the ADIS (Silverman & Albano, 1997). In contrast, on the basis of the ADIS, children in the TD group were required to have no more than four out of twenty-one symptoms endorsed of fear of particular social situations of the social anxiety disorder section, no symptoms of SM endorsed, and not to meet diagnostic criteria for any DSM 5 anxiety disorder (i.e., selective mutism, separation anxiety disorder, social anxiety disorder or generalized anxiety disorder). Other diagnoses were free to vary in both groups.

Measures

SM Symptomology Measures

Selective Mutism Questionnaire (SMQ*;* Bergman, Keller, Piacentini, & Bergman, 2008), as described above in Study 1 and here in brief, is a 23-item parent-report measure that assesses SM symptoms continuously. The distress/interference scale was utilized to examine SM symptoms continuously.

Emotion Regulation Parent and Self Report Measures

The Temperament in Middle Childhood Questionnaire *(TMCQ; Simonds, Kieras, Rueda, & Rothbart, 2007; Simonds & Rothbart, 2004) and* ***The Children's Behavioral Questionnaire*** *(CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001)*, as mentioned above, are parent-report measures that index different facets of temperament. Items include statements that describe children's reactions to a number of situations and parents are asked to rate their responses on a 5 point Likert scale (1=almost always untrue, 2=usually untrue, 3= sometimes true, sometimes untrue, 4=usually true, 5=almost always true). An effortful control subscale was calculated (25 items from the CBQ α=.83 and 63 items from the TMCQ α=.87) to index emotion regulation abilities including factors assessing attention (e.g., "Is easily distracted when listening to a story"), inhibitory control (e.g., "Can stop himself/herself when he/she is told to stop"), low intensity pleasure (e.g., "Likes to play quiet games"), perceptual sensitivity (e.g., "Notices when parents are wearing new clothing"), and activation control (e.g., "Can take a band aid off when needed, even if painful").

Emotion Regulation Checklist *(ERC; Shields & Cicchetti, 1997),* as mentioned above, is a 24-item, parent-report measure of perceptions of children's ability to manage their emotional experience rated on a Likert scale (0=never, 1=sometimes, 2=often, 3=almost always). The measure is an additional index of parent-report of their child's emotion regulation abilities, and has demonstrated good discriminate and construct validity, with α =.96 for the regulation scale (Shields & Cicchetti, 1997). The regulation scale was computed from 8 items α=.80 (e.g., "Is able to delay gratification") measuring mother's report of their child's emotion regulation abilities.

Tasks

Parent-Child Interaction Task (Deater-Deckard, 2000). The five-minute task involving parent-child interaction and cooperation, while inducing mild-to-moderate frustration was included to examine emotion regulation abilities via parasympathetic-based functioning and reactivity. Additional details are provided below regarding the collection of psychophysiological data for the Parent-Child Interaction task.

Lock Box Task (Goldsmith et al., 1999). The task is a four-minute task aimed to induce mild to moderate frustration. As described in detail above in Study 1 and here in brief, the child was handed the incorrect keys to open a transparent locked box that included a prize that they had chose inside. After five minutes of the child attempting to open the lock to the box, the experimenter gave the child the correct keys, and allowed them to get their prize. The task was used to index emotion regulation abilities and persistence. The task was coded using an adapted version of the Lab-TAB coding scheme. The frequency of child *help-seeking behaviors* was coded (e.g., asking mother for help) and a total count of *help-seeking behaviors* was utilized during analyses. Child *persistence* was coded as the total time spent actively engaged in the activity trying to complete the task. *Child frustration was coded* as 0=no detectable frustration, 1=mild/ambiguous frustration, 2=child is clearly frustrated, 3=intense or extreme frustration in accordance with Lab Tab coding procedures. Additionally, *Facial Anger Expression* was coded as 0=not present, 1=1-3 instances, 2=half of the time and 3=more than half of the time in accordance with Lab Tab coding procedures. *Body Anger* was coded in accordance with Lab Tab coding procedures as 0=No detectable bodily anger/frustration, 1=Low bodily anger/frustration: Slight bodily tensing or mild frustration behavior (*e.g.*, sighing/grunting with frustration, placing hand/arm on table with more force than necessary), 2= Moderate bodily anger/ frustration: Moderate bodily tensing (*e.g.*, balling the fists, swinging the legs) or moderate frustration behavior (*e.g.*, pushing away from the table, sighing heavily, pushing the box away, slamming hand/arm on table with definite intention), 3 = High bodily anger/ frustration: High bodily tensing (*e.g.*, trembling) or high frustration behavior (*e.g.*, throwing the keys). *Global regulation* was coded as a combination of frustration, facial anger expression and body anger to determine degree of dysregulation. Thirty percent of episodes were be coded to establish inter-rater reliability of k=.85.

Psychophysiological Measures Overview

As described above in Study 1 in detail and here in brief, psychophysiological recording of parasympathetic baseline activity and reactivity during tasks, occurred during resting and neutral baselines, and during the two tasks (e.g., Parent-Child Interaction task and Lock Box task) described above. Electrocardiography electrodes were placed at the right collarbone and the tenth-left rib with a ground electrode placed at the tenth-right rib. A two-minute resting baseline where the child was instructed to sit as still as possible was recorded at the beginning of the psychophysiological recording session. Reactivity scores for PNS functioning were calculated by subtracting the resting baseline score from the task score to obtain a difference score.

Neutral Video Baseline. The neutral age-appropriate video "Spot" described in Study 1, was presented on a computer screen positioned in front of the child for three minutes prior to the first task (Neutral Video 1) and for three minutes between the Stranger Interaction Task and the Lock Box Task (Neutral Video 2).

Respiratory Sinus Arrhythmia. Respiratory sinus arrhythmia, a valid index of parasympathetic regulation (i.e., emotion regulation) encompasses the high frequency component (0>.15 Hz) of the R-R peak time series, was examined for artifacts and outliers using MindWare Heart Rate Variability software V.3.1. RSA was derived using spectral analysis in 30-second epochs and the time series was detrended and submitted to a Fourier transformation. Respiratory rates were derived from impedance cardiography (Z0). The high frequency band (ln(ms2)) was set over the respiratory frequency band 0.15 to > 0.40 Hz. One-minute average RSA scores were calculated by averaging the first two 30-second epochs from each task. Among typically developing children 3.50% of cases were edited for artifacts, while among children with SM, on average 2.80% of cases were edited for artifacts. Thus, groups did not differ with respect to presence of artifacts (χ^2=0.10, p=.75). Inter-rater reliability (k>.90) was established by two raters examining 20% of the data from each condition.

Data Analysis Plan

Group comparisons (children with SM vs. TD children) were conducted using analysis of covariance (ANCOVA) to examine group differences in behavioral coding of emotion regulation (Hypothesis 2.1), maternal-report of emotion regulation on the ERC and TMCQ/CBQ (Hypothesis 2.2), and psychophysiology measures (i.e., RSA; Hypothesis 2.3). The covariates: age, ethnicity, SSRI medication use, and total number of comorbid diagnoses were included in each analysis. ANOVAs were used to examine group differences without covariates present. Additionally, linear regression models were used to examine continuous associations among emotion regulation via behavioral coding, maternal-report and psychophysiology in separate models and SM symptom severity (measured from the distress/interference subscale of the SMQ as the outcome in each model) with covariates included. These linear regression models were also computed without covariates as well. Missing data were addressed through multiple imputation in SPSS (see Table 12 for description of missing data). Effect sizes were displayed as *partial eta squared* (η_p^2) for ANCOVAs, and standardized beta coefficients for linear regression.

STUDY 2 RESULTS

Sample Characteristics

As described in Study 1 and here in brief, Table 1 provides demographic and clinical description of the sample according to group. Children with SM were younger on average, less likely to be Hispanic/Latinx, and more likely to be prescribed SSRIs compared to TD youth. With respect to SM symptomology and clinical severity, children with SM displayed more symptoms of SM and interference/distress compared to TD youth (all $F > 17.35$, all $p < .001$, all partial $\eta^2 > .22$).

As expected, children with SM were more likely to be diagnosed with comorbid diagnoses compared to TD youth, $F(1,58)=465.83$, $p<.001$, partial $\eta^2 = .57$. Given group differences in age, ethnicity, medication use, and total comorbid diagnoses, each of these variables were included as covariates in all analyses. Analyses are also presented without covariates for comparison.

Correlations of the primary variables of interest, demographic, and clinical characteristics are displayed in Table 13.

Hypothesis 2.1 Emotion Regulation Behavioral Coding by Diagnostic Group Results

Behaviorally coded emotion regulation data is presented in Table 14 with covariate and Table 15 without covariates by diagnostic group. When covariates are not included in analyses, no group-based differences were observed in frustration, facial anger, body anger or global regulation during the Lock Box task (all $F<3.21$, $p>.07$, partial $\eta^2<.06$). Significant group-based differences were observed in task persistence, $F(1,58)=4.41$, $p=.04$, partial $\eta^2=.07$. Specifically, children with SM exhibited less time spent in persisting with the task ($M=255.80$, $SD=72.03$) compared to typically developing youth ($M=292.71$, $SD=59.95$). Additionally, significant group-based differences were observed in help-seeking behaviors, $F(1,58)=5.17$, $p=.03$, partial $\eta^2=.08$. Specifically, children with SM ($M=1.50$, $SD=1.79$) displayed more help-seeking behaviors during the Lock Box task compared to typically developing youth ($M=.65$, $SD=1.10$).

When covariates are included in analyses, no group-based differences were observed in global regulation during the Lock Box task, $F(1,54)= 1.62$, $p=.21$, partial $\eta^2=.03$. Additionally, no group-based differences were observed in frustration, facial anger or body anger during the Lock Box task (all $F<2.58$, $p>.11$, partial $\eta^2<.06$). No group-based differences were observed in help-seeking behaviors, $F(1,54)=1.02$, $p=.32$, partial $\eta^2=.02$. The effect for help-seeking behaviors discussed above was potentially accounted for by the effect of age, $F(1,54)=5.18$, $p=.03$, partial $\eta^2=.09$. However, significant group-based differences were observed in task persistence during the Lock Box task, $F(1,54)=5.75$, $p=.02$, partial $\eta^2=.10$. Specifically, children with SM exhibited less time spent in persisting with the task ($M=255.80$, $SD=72.03$) compared to typically developing youth ($M=292.71$, $SD=59.95$).

Hypothesis 2.1 Emotion Regulation Behavioral Coding and Continuous Measures of SM Results

All models are presented in Table 14 with covariates and Table 15 without covariates. All behaviorally coded emotion regulation variables (i.e., help-seeking, persistence, frustration, facial anger, body anger and global regulation) were not significantly associated with SM symptom severity when covariates were not included, as well as when covariates were included, all $\beta <-.20$, $t(58)<-1.42$, $p>.20$.

Hypothesis 2.2 Emotion Regulation Parent-Report by Diagnostic Group Results

Data from parent-report measures of emotion regulation (TMCQ/CBQ and ERC) is presented in Table 14 with covariates and Table 15 without covariates according to diagnostic group. When covariates are not included in analyses, significant group-based differences were observed in maternal report of emotion regulation abilities on the ERC Regulation Scale ($F(1,58)=23.79$, $p<.001$, partial $\eta^2=.29$) and on the TMCQ/CBQ Effortful Control Scale ($F(1,58)= 6.37$, $p=.01$, partial $\eta^2=.10$). Specifically, on the ERC mothers of children with SM rated their children as lower on emotion regulation abilities ($M=1.89$, $SD=.46$) compared to mothers of typically developing children ($M=2.48$, $SD=.43$). However, on the TMCQ/CBQ mothers of children with SM rated their children as higher on emotion regulation abilities ($M=4.54$, $SD=.91$) compared to mothers of typically developing children ($M=3.93$, $SD=.86$).

When covariates are included in analyses, no group-based differences were observed in maternal report of emotion regulation abilities and emotion dysregulation on the ERC Regulation Scale ($F(1,54)=.1.80$, $p=.19$, partial $\eta^2=.03$). As mentioned above the effect was significant when covariates were not included, perhaps the effect is accounted for by SSRI use (F(1,54)=5.74, p=.02, partial η^2=.10). Additionally, the significant effect discussed above when covariates were not included with respect to group-based differences on the TMCQ/CBQ Effortful Control Scale (F(1,54)=2.22, p=.14, partial η^2=.04), may be accounted for by age (F(1,54)=20.37, p<.001, partial η^2=.27).

Hypothesis 2.2 Emotion Regulation Parent-Report and Continuous Measures of SM Results

All models are presented in Table 16 with covariates and Table 17 without covariates. When covariates were not included in analyses, the Regulation Scale on the ERC remained a significant negative predictor of SM symptom severity, β=-.62, t(58)=-5.62, p<.001. Ratings on the Effortful Control scale of the TMCQ/CBQ was not significantly associated with SM symptom severity, β=.21, t(58)=1.55, p=.12.

In the model with SM symptom severity rating as the dependent variable with covariates included, ratings on the Regulation Scale of the ERC was a significant negative predictor of SM symptom severity, β=-.31, t(54)=-2.56, p=.01. Specifically, ratings of increased emotion regulation abilities were associated with lower SM symptom severity. In the model with SM symptom severity as the dependent variable and covariates included, ratings on the Effortful Control scale of the TMCQ/CBQ was not significantly associated with SM symptom severity, β=.06, t(54)=.41, p=.69.

Hypothesis 2.3 RSA by Diagnostic Group Results

RSA raw data for all tasks and reactivity change scores (i.e., PNS-based regulation) are presented in Table 18 with covariates and Table 19 without covariates according to diagnostic group. When covariates are not included in analyses, no group-based differences were observed in RSA at rest or during neutral video 1 (all F<3.71, *p*>.05, partial η^2<.07). However, significant group-based differences were observed in RSA during neutral video 2, *F*(1,58)=4.93, *p*=.03, partial η^2=.08. Specifically, children with SM demonstrated reduced basal RSA (*M*=6.24, *SD*=.93) during the second neutral video segment (i.e., parasympathetic-based dysregulation) compared to typically developing youth (*M*=6.80, *SD*=.89). Significant group-based differences were also observed in RSA during the Parent-Child Interaction task, *F*(1,58)=4.84, *p*=.03, partial η^2=.08. Children with SM demonstrated lower levels of RSA (*M*=5.75, *SD*= .90) (i.e., parasympathetic-based dysregulation) during the Parent-Child Interaction task compared to typically developing children (*M*=6.34, *SD*=.97). Additionally, significant group-based differences were observed in RSA reactivity from resting baseline to the Lock Box task, *F*(1,58)=5.85, *p*=.02, partial η^2=.09. Specifically, children with SM (*M*=-.58, *SD*=.70) demonstrated reduced RSA withdrawal from baseline to the Lock Box task compared to typically developing children (*M*=-1.00, *SD*=.85). However, no group-based differences were observed in RSA during the Lock Box task, *F*(1,58)=.27, *p*=.60, partial η^2=.005, RSA reactivity from neutral video to Lock Box and RSA reactivity from baseline and neutral video to Parent-Child Interaction task (all *F*<1.85, *p*>.17, partial η^2<.04).

When covariates are included, no group-based differences were observed in RSA at rest or during either neutral video segment (all *F*<1.00, *p*>.31, partial η^2<.03). No covariates were significant with respect to RSA during the second neutral video segment, so it is not clear what is driving the effect described above, and not accounted for in analyses with covariates. Additionally, no group-based differences were observed in RSA during the Parent-Child Interaction task or Lock Box task (all *F*<1.21, *p*>.27, partial η^2<.03). The significant between-groups effect of RSA during the Parent-Child

Interaction task that was discussed above may be accounted for by SSRI medication use (F(1,54)=4.99, p=.03, partial η^2= .08). With respect to RSA reactivity, no group-based differences were observed in RSA reactivity from resting baseline or neutral video baseline to the Parent-Child Interaction task (all F<1.75, p>.18, partial η^2<.04). In addition, no group-based differences were observed in RSA reactivity from resting baseline or neutral video baseline to the Lock Box task (all F<2.35, p>.12, partial η^2<.05). The significant effect of RSA reactivity from baseline to Lock Box task did not hold when covariates were included, the effect of ethnicity may be contributing to the lack of effect observed, F(1,54)=5.90, p=.02, partial η^2=.10.

Hypothesis 2.3 RSA and Continuous Measures of SM Results

All models are presented in Table 20 with covariates and 21 without covariates. In the model with SM symptom severity rating as the dependent variable with and without covariates, RSA at baseline and during both neutral video segments was not significantly associated with SM symptom severity, all β<.19, t(54)<.87, t(58)<.-1.43, p>.15.

RSA during the Parent-Child Interaction task and the Lock Box task was not significantly associated with SM symptom severity with or without covariates, all β<.48, t(54)<1.32, t(58)<.-1.09, p>.18. Additionally, RSA reactivity from resting baseline and neutral video to the Parent-Child Interaction task was not significantly associated with SM symptom severity with or without covariates, all β<.17, t(54)<-.26, t(58)<1.13, p>.25. Finally, RSA reactivity from resting baseline and neutral video to the Lock Box task was also not significantly associated with SM symptom severity with or without covariates, all β<.17, t(54)<.73, t(58)<1.13, p>.25.

STUDY 2 DISCUSSION

Study 2 examined emotion regulation among children with SM and typically developing children employing a multi-method approach. The main goal of the present study was to provide a preliminary investigation into emotion regulation abilities of children with SM in comparison to typically developing children. Our study is the first study to empirically examine this emotion process in children with SM. Etiological theory of SM proposed children with SM may utilize avoidance as a poor emotion regulation strategy to modulate anxiety/emotional arousal in social situations (Scott & Beidel, 2011; Young, Bunnell, & Beidel, 2012). Additionally, it is well known that children with anxiety demonstrate disruptions in emotion regulation abilities, and that dysfunctional emotion regulation is associated with the development of anxiety (Anthony, Lonigan, Hooe, & Phillips, 2002; Carthy, Horesh, Apter, Edge, & Gross, 2010; Carthy, Horesh, Apter, & Gross, 2010; Crawford, Schrock, & Woodruff-Borden, 2011; Eisenberg et al., 2001; Tan et al., 2012).

Parasympethetic-based functioning has extensively been examined in relation to emotion regulation abilities in different populations, and reduced basal RSA and RSA withdrawal has been associated with psychopatholgoy and reduced emotion regulation abilities (Beauchaine et al., 2013; Beauchaine et al., 2001; Calkins, Graziano, & Keane, 2007; Graziano & Derefinko, 2013). Children with internalizing disorders, and in the only study to be conducted with children with SM to date, have demonstrated reduced basal RSA (Heilman et al., 2012). Given that there was only one study conducted with children with SM, it remains unclear the extent to which parasympathetic-based dysregulation is present in children with SM.

Contrary to the first hypothesis of the present study, children with SM did not exhibit signiifcantly different behaviorally-coded global regulation, frustration, facial anger expression and body anger during the Lock Box task. The task was employed to induce frustration, and examine the ability of children with SM to regulate their emotions in a frustration-provoking situations. However, children with SM were quicker than typically developing youth to cease to try to open the box. Typically developing children demonstrated greater task persistence during the challenging task compared to children with SM. Perhaps, children with SM were using a maladaptive emotion regulation strategy by engaging in advoidance, and persisting in continuing the difficult task. This explanation would be in line with prior work in children with anxiety, and proposed etiological theory of SM (Carthy, Horesh, Apter, Edge, & Gross, 2010; Muris & Ollendick, 2015; Scott & Beidel, 2011). Additionally, children with SM engaged in more help-seeking behaviors compared to typically developing children suggesting the need for more maternal assistance in regulating when frustrated. Overall, it appears that children with SM that continued to engage in the task while frustrated requested more assistance in completing the challenging task, or withdrew and disengaged from the task, as perhaps an emotion regulation strategy.

Maternal measures of emotion regulation abilities did not differ with respect to SM status on either measure, which is not in line with the hypothesis that children with SM will exhibit less emotion regulation abilities compared to typically developing children. However, when covariates were not included in analyses both maternal measures of child regulation abilities were significantly different between mothers of children with SM and mothers of typically developing children. One measure indicated lower emotion regulation abilities in children with SM, while the other demonstrated increased emotion regulation abilities in children with SM compared to typically developing children. It is unclear the reasoning for the discrepency, but may suggest the questionnaires are measuring different facets of emotion regulation, and future work should explore the hypothesis by including additional parental report measures of emotion regulation abilities. Additionally, emotion regulation abilities as rated on one maternal report scale was significantly associated with SM symptom severity. Children with greater SM symptom severity demonstrated reduced emotion regulation abilities. Therefore, it appears that emotion regulation abilities are disrupted in children with SM, as previously hypothesized and theorized (Scott & Beidel, 2011).

With respect to parasympathetic-based functioning, contrary to our hypothesis, children with SM did not exhibit significantly reduced basal RSA or withdrawal to frustration-inducing task. However, when covariates were removed from analyses, children with SM demonstrated reduced basal RSA during one neutral video segment, and lower levels of RSA during the parent-child interaction task compared to typically developing children, suggesting deficient parasympathetic-based functioning. In addition, children with SM demonstrated reduced RSA withdrawal from baseline to the Lock Box task compared to typically developing controls, suggesting parasympathetic-based dysregulation and reduced ability to engage with the frustrating task (Beauchaine, 2013; Porges, 2007).

Overall, it appears that there are disruptions in emotion regulation abilities in children with SM. While results are not consistent across levels of analysis, it appears that mothers of children with SM detect distuptions in their emotion regulation abilities, and childen with SM have more difficulty persisting during a difficult task. Additionally, children with SM demonstrated lower levels of RSA suggesting parasympathetic-based dysregulation, which may contribute to the difficulty in engaging in anxiety-provoking situations. The study may have been underpowered to detect some effects, particularly given the association with SSRI-use and comorbid diagnoses, which will need to be examined further in additional studies with a larger sample size.

While the present study demonstrated preliminary evidence in disruption in emotion regulation abilities in children with SM, several limitations should be considered. Specifically, children with SM did not persist in the frustrating task as long as typically developing children, and therefore, they might have been engaging in a maladaptive emotion regulation strategy that was not able to be measured via psychophysiological indices. The explanation is in line with Heilman and colleagues (2012) hypothesis as to the lack of group differences among children with SM and typically developing children they observed during a socially challenging situation. Future research should employ a larger sample, and examine these emotion regulation mechanisms longitudinally to determine etiological role. Additionally, including other potentially emotionally evocative tasks that induce emotion regulation abilities would help clarify the functioning of these mechanisms in children with SM by ensuring emotion regulation processes are indeed activated during the tasks. Specifically, prior studies have had success in examining PNS-based dysregulation utilizing specific emotion regulation strategies via emotion induction and suppression tasks (Musser et al., 2011). The inclusion of self-report ratings of emotion regulation abilities would be important to determine if similar patterns that have been obseved in children with anxiety are examined in this population (Carthy, Horesh, Apter, Edge, & Gross, 2010), particularly with respect to self-efficacy regarding emotion regulation abilities. Finally, a larger sample of children with SM is needed given the small sample in the present study, we might have been underpowered to detect some group-differences. Additionally, a medication naiive sample, and if possible free of comorbid conditions, or include an additional comparison group of children with other anxiety disorders to attempt to clarify specification of mechanisms purely related to SM.

CHAPTER IV. STUDY 3

STUDY 3 INTRODUCTION

As discussed in Chapter I, parental factors, including parent behavior and emotionality, play an important role in the development of emotion in youth, broadly and particularly, among youth with anxiety (Borelli, Rasmussen, John, West, & Piacentini, 2015; Cole, Dennis, Smith‐Simon, & Cohen, 2009; Crawford et al., 2011; Suveg et al., 2008; Suveg, Zeman, Flannery-Schroeder, & Cassano, 2005; Wald, Carthy, Shenaar‐Golan, Tadmor‐Zisman, & Ziskind, 2018; Williams & Woodruff-Borden, 2015). Parental over-control and over- involvement are frequently present in families of children with anxiety, and similar parent behavior (i.e., reduced autonomy, over control) have been observed among parents of youth with SM (Hudson & Rapee, 2008). Parents of children with SM also tend to self-report greater social anxiety and demonstrate more avoidant behavior compared to parents of typically developing youth (Chavira et al., 2007). It has been theorized that parents of youth with SM may model anxious behavior, negative emotion reactivity, and avoidant strategies to their children in social situations contributing to the development of these behaviors and emotions in youth with SM (Scott & Beidel, 2011). The few studies that have examined parental behavior in this population have included small samples, or relied solely on self-report measures (Viana et al., 2009). The relationship between parental behavior and emotional factors has yet to be studied using multiple modalities in children with SM, and it remains unclear the role parental emotionality and behavior play in the development and maintenance of SM.

Study 3 Aims and Hypotheses

The present study sought to fill the gap in the literature by examining maternal self-report of emotion reactivity and regulation, behavioral observations of maternal behavior during several tasks, and parental expressed emotion among children with SM and typically developing youth to provide a preliminary investigation into these mechanisms in this population.

Hypothesis 3.1: Parents of children with SM will exhibit: 1) greater negative affect and less positive affect indexed via behavioral coding during the Parent-Child Interaction Task, 2) greater accommodation/helping behaviors via behavioral coding during the Stranger Interaction task and Lock Box task, 3) less positive control via behavioral coding during the Parent-Child Interaction task, 4) greater negative control via behavioral coding during the Parent-Child Interaction task, 5) higher levels of conflict via behavioral coding during the Parent-Child Interaction task, 6) lower levels of cooperation and reciprocity via behavioral coding during the Parent-Child Interaction task compared to parents of typically developing children.

Hypothesis 3.2: Parents of children with SM will self-report higher parental negative emotionality and lower emotion regulation abilities on self-report questionnaires (e.g., Adult Temperament Questionnaire; ATQ) compared to parents of typically developing children. Specifically, parents of children with SM will report higher scores on the Negative Affect scale of the ATQ and lower scores on the Effortful Control scale on the ATQ compared to parents of typically developing children.

Hypothesis 3.3: Finally, Parents of children with SM will display higher expressed emotion during the FMSS compared to parents of typically developing children. Specifically, parents of children with SM will display more criticism and EOI, as well as high EE compared to parents of typically developing children.

STUDY 3 METHODS

Participants

Participants are identical to Study 1 and Study 2, and are described in detail above in Study 1 and Study 2 methods, and here in brief. Participants were 60 children ages 5-10 years (*M*=7.18, *SD*=1.69 years; 63.3% female) and their mothers; 20 met Diagnostic and Statistical Manual 5 (DSM 5; American Psychiatric Association, 2013) criteria for SM and 40 were typically developing youth (TD). Demographic and diagnostic details are provided in Table 1 by diagnostic group. The Florida International University Institutional Review Board approved all study procedures, and all procedures conformed to the Ethical Principles of Psychologists and Code of Conduct (American Psychological Association, 2002). Parents provided written consent, while children provided written assent.

Procedures

Recruitment and Identification. Procedures are identical to those in Study 1 and described in detail in Study 1 method, and here in brief. Children with SM and their mothers were recruited from an SM specialty treatment center, and were seeking services at the time of recruitment. Typically developing (TD) children were recruited from the community.

All consenting families completed a semi-structured diagnostic interview via remote mechanisms (e.g., phone). All children and their mothers completed laboratory tasks in a quiet clinic room at the Center for Children and Families.

Diagnostic procedures: All DSM 5 diagnoses were determined using the *Anxiety Interview Schedule for Children-Parent Version* (ADIS; Silverman & Albano, 1997), a widely used semi-structured diagnostic interview administered to parents to assess present-state *DSM 5* based internalizing and externalizing disorders. See Study 1 Methods for detailed explanation. For all analyses, comorbid diagnoses were combined to create a count of total comorbid diagnoses.

Inclusion and exclusion criteria: Children with SM were required to meet DSM 5 criteria for SM as determined by clinician administered, parent-report on the ADIS (Silverman & Albano, 1997). In contrast, based on the ADIS, children in the TD group were required to have no more than four out of twenty-one symptoms endorsed of fear of particular social situations of the social anxiety disorder section, no symptoms of SM endorsed, and not to meet diagnostic criteria for any DSM 5 anxiety disorder (i.e., selective mutism, separation anxiety disorder, social anxiety disorder or generalized anxiety disorder). Other diagnoses were free to vary in both groups.

Measures

SM Symptomology Measures

Selective Mutism Questionnaire (SMQ*;* Bergman, Keller, Piacentini, & Bergman, 2008), as mentioned above in Study 1 and here in brief, is a 23-item parent-report measure that assesses SM symptoms continuously. The distress/interference scale was utilized to examine SM symptoms continuously.

Adult Temperament Questionnaire Short Form *(ATQ; Evans & Rothbart, 2007),* is a 77 item self-report measure of parental temperament and assesses parental negative emotion reactivity and regulation. The ATQ has demonstrated good convergent validity with other adult personality measures (Evans & Rothbart, 2009). Items are rated on a Likert scale (1= extremely untrue, 2= quite untrue, 3= slightly untrue, 4= neither true or untrue, 5= slightly true, 6= quite true, 7= extremely true). A parental negative affect scale was calculated to index parental negative emotion reactivity. The negative affect scale is comprised of 26 items (α=.83) from the fear (e.g., “I become easily frightened”), sadness (e.g., “Sometimes minor events cause me to feel intense sadness”), discomfort (e.g., “Loud music is unpleasant to me”) and frustration (e.g., “It doesn’t take very much to make me feel frustrated or irritated”) subscales. The effortful control scale assessing emotion regulation abilities is comprised of 19 items (α=.81) from the inhibitory control (e.g., “I can easily resist talking out of turn, even when I am excited and want to express an idea”), activation control (e.g., “I can make myself work on a difficult task even when I don’t feel like trying”), and attentional control items (e.g., “When interrupted or distracted, I usually can easily shift my attention back to whatever I was doing before”).

Tasks

Parent-Child Interaction Task (Deater-Deckard, 2000). As mentioned above in Study 1, and here in brief, children and their mothers participated in a five-minute structured task aimed to induce parent-child cooperation while creating mild-to-moderate frustration. The task was coded by trained coders using the Parent-Child Interaction System (PARCHISY; Deater-Deckard, Pylas, & Petrill, 1997), which includes global ratings on a seven-point scale examining parent behavior. Thirty percent of interactions were coded to establish inter-rater reliability of *k*= .88. Parent behavior is coded for positive content (control), negative content (control), positive affect and negative affect. Dyad behavior is coded for reciprocity, conflict and cooperation. See Appendix A for additional explanation of behavior codes.

Stranger Interaction Task. The task is explained in detail above in Study 1 and here in brief. The task is a two-minute tasks adapted from two Lab-TAB tasks; Lab-TAB middle childhood version scary mask task (Goldsmith et al., 2001) and the Lab-TAB preschool version stranger approach task (Goldsmith et al., 1999). Mothers were instructed not to interact or engage with the stranger or child during the task and to continue completing questionnaires during the task. A confederate entered the room, and asked the child a structured question. After waiting for the child to respond, the confederate hands the child a toy to play with, and sits in the room with the child and mother for 30 seconds before departing. Mothers were coded for *accommodation/helping behaviors*, which included answering the question to the confederate for the child, or helping the child during the task.

Lock Box Task (Goldsmith et al., 1999). As described in Study 1 and 2 in detail, the five-minute task was utilized to induce frustration in children, and assess their negative affect and emotion regulation abilities. Mothers were instructed not to engage or interact with the child during the task and to continue completing questionnaires. Mother's *helping behavior* (e.g., touching the keys, trying to open the box, giving advice) were coded.

Five Minute Speech Sample (FMSS; Magaña et al., 1986). The mother of each child was instructed to speak about their child and their relationship for five minutes in their own words without interruption or guidance from the administrator while they were audio recorded. The audio-recorded tapes were blindly coded by a trained coder using he FMSS coding manual (Magana-Amato, 1993). Tapes were transcribed to aid in interpretability and accountability as frequently employed in other studies utilizing the FMSS (Musser et al., 2018). Two expert independent raters each who were unaware to SM status independently coded the FMSS for expressed emotion (EE) based on established procedures employed in numerous studies (Musser et al., 2018). Specifically, EE was coded in two-steps following the FMSS coding manual (Magana-Amato, 1993). First the two subscales (Criticism and Emotional Over-Involvement) are coded as low, borderline, or high. These subscales are comprised of specific coded aspects of the speech sample, including the initial statement, the description of the parent-child relationship, critical remarks, and evidence of extreme self-sacrificing behavior or lack of objectivity. Coding considered the speech's content as well as tone. Second, a global score of EE is determined as either "low or high". A "high" score is obtained when a parent receives a "high" score in either (or both) of the Criticism or Emotional Over-Involvement domains. See Appendix B for more information. Thirty percent of speech samples were coded to establish inter-rater reliability of k=.90.

Data Analysis Plan

Group comparisons (children with SM vs. TD children) were conducted using analysis of covariance (ANCOVA) to examine group differences in behavioral coding of maternal behavior and negative affect (Hypothesis 3.1), maternal self-report of emotion regulation and negative emotion reactivity on the ATQ (Hypothesis 3.2), and expressed emotion via the FMSS (Hypothesis 3.3). For binary or nominal variables (i.e, dissatisfaction, excessive detail, and EE profile from the FMSS) logistic regression analyses were implemented to assess group differences. The covariates: age, ethnicity, SSRI medication use, and total number of comorbid diagnoses were included in each analysis. ANOVAs were used to examine group differences without covariates present. Additionally, linear regression models were used to examine continuous associations among maternal behavior and emotionality, maternal self-report of emotion regulation and negative emotion reactivity, and expressed emotion in separate models and SM symptom severity (measured from the distress/interference subscale of the SMQ as the outcome in each model) with covariates included. These linear regression models were also computed without covariates as well. Missing data were addressed through multiple imputation in SPSS (see Table 21 for description of missing data). Effect sizes were displayed as *partial eta squared* (η_p^2) for ANCOVAs, Odds Ratios for logistic regression, and standardized beta coefficients for linear regression.

STUDY 3 RESULTS

Sample Characteristics

As mentioned above in Study 1 and here in brief, Table 1 provides demographic and clinical description of the sample according to group. Children with SM were younger on average, less likely to be Hispanic, and more likely to be prescribed SSRIs compared to TD youth. With respect to SM symptomology and clinical severity, children with SM displayed more symptoms of SM and interference/distress, and more total comorbid diagnoses compared to TD youth (all F> 17.35, all p<.001, all partial η^2 >.22). Given group differences in age, ethnicity, medication use, and total comorbid diagnoses, each of these variables were included as covariates in all analyses. Analyses are also presented without covariates for comparison.

Correlations of the primary variables of interest, demographic, and clinical characteristics are displayed in Table 22.

Hypothesis 3.1 Maternal Behavior by Diagnostic Group Results

Behavioral coding of parent behavior is presented in Table 24 with covariates and Table 25 without covariates according to diagnostic group. When covariates are not included in analyses, no group-based differences were observed in maternal negative affect or positive affect during the Parent-Child Interaction task (all F<.25, all p>.62, all partial η^2<.005). Additionally, no group-based differences were observed in maternal positive or negative control during the Parent-Child Interaction task (all F<2.61, all p>.10, all partial η^2<.05). No significant group-based differences were observed in cooperation or reciprocity between mother and child during the Parent-Child Interaction task (all F<.60, p>.43, partial η^2<.02). However, significant group-based differences were observed in conflict between mother and child during the Parent-Child Interaction task, $F(1,58)=4.04$, $p<.05$, partial $\eta^2=.07$. Specifically, mother-child dyads of children with SM displayed more conflict ($M=1.25$, $SD=.55$) compared to mother-child dyads of typically developing children ($M=1.05$, $SD=.22$). Additionally, no significant group-based differences were observed in maternal helping/accommodation behaviors during the Stranger Interaction task, $F(1,58)=.64$, $p=.43$, partial $\eta^2=.005$. However, during the Lock Box task, significant group-based differences were observed in parental accommodation and helping behaviors, $F(1,58)= 4.79$, $p=.03$, partial $\eta^2=.08$. Specifically, mothers of children with SM demonstrated more accommodation and helping behaviors ($M=2.20$, $SD=2.90$) during the Lock Box task compared to mothers of typically developing children ($M=.78$, $SD=2.08$).

When covariates are included, no group-based differences were observed in maternal negative affect or positive affect during the Parent-Child Interaction task (all $F<1.57$, $p>.21$, partial $\eta^2<.04$). Additionally, no group-based differences were observed in maternal positive or negative control during the Parent-Child Interaction task (all $F<3.55$, $p>.06$, partial $\eta^2<.07$). Also, no group-based differences were observed in cooperation or reciprocity between mother and child during the Parent-Child Interaction task (all $F<2.04$, $p>.17$, partial $\eta^2<.08$). However, in line with analyses without covariates, significant group-based differences were observed in conflict between mother and child during the Parent-Child Interaction task, $F(1,54)=4.06$, $p<.05$, partial $\eta^2=.07$. Specifically, mother-child dyads of children with SM displayed more conflict ($M=1.25$, $SD=.55$) compared to mother-child dyads of typically developing children ($M=1.05$, $SD=.22$), suggesting that the effect may be specific to SM status.

With respect to parental behavior during the Stranger Interaction task when covariates are included, no group-based differences were observed in parental accommodation behaviors, $F(1,54)=.29$, $p=.59$, partial $\eta^2=.005$. In addition, during the Lock Box task, significant group-based differences were observed in parental accommodation and helping behaviors, $F(1,54)= 4.10$, $p<.05$, partial $\eta^2=.07$. Specifically, mothers of children with SM demonstrated more accommodation and helping behaviors ($M=2.20$, $SD=2.90$) during the Lock Box task compared to mothers of typically developing children ($M=.78$, $SD=2.08$).

Hypothesis 3.1 Maternal Behavior and Continuous Measures of SM Results

All models are presented in Table 26 with covariates and Table 27 without covariates. When covariates were not included in analyses, maternal negative affect, maternal positive affect, and positive control were all not significantly associated with SM symptom severity, all $\beta<-.19$, $t(58)<-1.28$, $p>.19$. Negative control was a significant positive predictor of SM symptom severity, $\beta=.29$, $t(58)=2.17$, $p=.03$. Additionally, maternal helping behavior during the Lock Box task was a significant positive predictor of SM symptom severity, $\beta=.42$, $t(58)=3.33$, $p=.001$. However, maternal accommodation/helping behavior during the Stranger Interaction task was not significantly associated with SM symptom severity, $\beta=.20$, $t(58)=1.54$, $p=.12$. Reciprocity, conflict, and cooperation were all also not significantly associated with SM symptom severity, all $\beta<.26$, $t(58)<1.91$, $p>.05$.

In the model with SM symptom severity rating as the dependent variable and covariates included, maternal negative affect and maternal positive affect were not significantly associated with SM symptom severity (all $\beta<.10$, $t(54)<-1.30$, $p>.19$).

Parental positive control, negative control, reciprocity, conflict and cooperation were all not significantly associated with SM symptom severity (all $\beta<.14$, $t(54)<-1.45$, $p>.14$). The significant effect of negative control may be explained by SSRI medication use ($\beta=.30$, $t(54)=2.82$, $p=.005$) or comorbid diagnoses ($\beta=.47$, $t(54)=4.13$, $p<.001$). Maternal accommodation/helping behaviors during the Stranger Interaction task was a significant positive predictor of SM symptom severity when covariates were included, $\beta=.31$, $t(54)=1.58$, $p=.002$. Additionally, maternal helping behaviors during the Lock Box task was a significant predictor of SM symptom severity, $\beta=.35$, $t(54)=3.63$, $p<.001$.

Hypothesis 3.2 Maternal Self-Report of Emotionality by Diagnostic Group Results

Data from the ATQ, parent self-report measure of emotion reactivity and regulation is presented in Table 24 with covariates and Table 25 without covariates according to diagnostic group. When covariates were not included in analyses, significant group-based differences were observed in ratings on the Negative Affect scale of the ATQ, $F(1,58)=8.30$, $p=.006$, partial $\eta^2=.13$. Specifically, mothers of children with SM rated higher levels of self-negative affect ($M=3.84$, $SD=.84$) compared to mothers of typically developing children ($M=3.29$, $SD=.65$). No significant group-based differences were observed in the Effortful Control scale of the ATQ, $F(1,58)=2.05$, $p=.16$, partial $\eta^2=.03$.

When covariates were included in the analyses, no group-based differences were observed in Parental Effortful Control, $F(1,54)=1.02$, $p=.32$, partial $\eta^2=.02$ or Parental Negative Affect, $F(1,54)=2.42$ $p=.13$, partial $\eta^2=.04$. The effect for ratings on the Negative Affect scale may be accounted for by ethnicity ($F(1,54)=5.67$, $p=.02$, partial $\eta^2=.10$), SSRI medication use ($F(1,54)=5.80$, $p=.02$, partial $\eta^2=.10$), or comorbid diagnoses ($F(1,54)=12.69$, $p=.001$, partial $\eta^2=.19$).

Hypothesis 3.2 Maternal Self-Report of Emotionality and Continuous Measures of SM Results

All models are presented in Table 26 with covariates and Table 27 without covariates. When covariates were not included in the models, maternal report of self effortful control was a significant negative predictor of SM symptom severity, $\beta=-.38$, $t(58)=-.3.02$, $p=.003$. Additionally, maternal self-report of negative emotion reactivity was a significant positive predictor of SM symptom severity, $\beta=.42$, $t(58)=3.14$, $p=.002$.

In the model with SM symptom severity rating as the dependent variable with covariates, ratings on the Effortful Control scale of the ATQ was not significantly associated with SM symptom severity, $\beta=-.12$, $t(54)=-1.38$, $p=.17$. Additionally, in the model with SM symptom severity as the dependent variable with covariates, ratings on the Negative Affect scale of the ATQ was not significantly associated with SM symptom severity, $\beta=-.04$, $t(54)=-.07$, $p=.95$. The significant effects observed without covariates may be accounted for by SSRI medication use ($\beta=.29$, $t(54)=2.67$, $p=.008$; $\beta=.31$, $t(54)=2.75$, $p=.006$, respectively) or comorbid diagnoses ($\beta=.47$, $t(54)=4.31$, $p<.001$; $\beta=.51$, $t(54)=4.06$, $p=<.001$, respectively).

Hypothesis 3.3 Maternal Expressed Emotion by Diagnostic Group

Maternal expressed emotion coded from the FMSS is presented in Table 24 with covariates and Table 25 with no covariates by diagnostic group; see Figure 4. When covariates were not included in analyses, there was a significant between-group difference observed in maternal expression of self-sacrificing/overprotective behavior, $F(1,58)=5.60$, $p=.02$, $\eta^2=.09$. Specifically, mothers of children with SM ($M=.20$, $SD=.52$) expressed more statements of self-sacrificing/overprotective behavior during the FMSS compared to mothers of typically developing children ($M=.00$, $SD=.00$). No significant between-groups differences were observed in expressed emotion subgroups, expressed emotion profile, initial statement, relationship, criticism, dissatisfaction, statement attitude, or positive remarks, all $F<3.58$, $p>.05$, partial $\eta^2<.07$.

When covariates are included in analyses, no group-based differences were observed in initial statement, relationship, criticism, statement attitude, self-sacrificing/overprotective behavior, excessive detail, or positive remarks (all $F<3.71$, $p>.05$, partial $\eta^2<.07$). Significant between-group differences were observed in maternal expression of dissatisfaction $B=6.62$, $S.E=2.33$, $p=.047$, *Odds Ratio*=101.6. Specifically, mothers of children with SM (25%) expressed less statements of dissatisfaction compared to mothers of TD children (28.2%). No significant between-group differences were observed in expressed emotion subgroup (i.e., high critical, high emotional over-involvement, high critical and emotional over-involvement, borderline critical, borderline emotional over-involvement, borderline critical and emotional over-involvement, borderline critical and high emotional over-involvement, borderline emotional over-involvement and high critical or low critical and emotional over-involvement),

$F(1,54)=.04$, $p=.85$, partial $\eta^2=.001$. When these expressed emotion subgroups are collapsed into the expressed emotion profile (i.e., low EE and high EE), no group-based differences were observed, $B=-.03$, $S.E.= 1.44$, $p=.99$, *Odds Ratio*=.98.

Hypothesis 3.3 Maternal Expressed Emotion and Continuous Measures of SM

Results

All models are presented in Table 26 with covariates and 27 without covariates. When covariates were not included in the regression models, initial statement, relationship, criticism, dissatisfaction, statement attitude, self-sacrificing/overprotective behavior, excessive detail, expressed emotion subgroup, and expressed emotion profile were not significantly associated with SM symptom severity, all $\beta<.35$, $t(58)<1.52$, $p>.16$. Maternal expression of positive remarks was a significant negative predictor of SM symptom severity, $\beta<-.34$, $t(58)=-2.44$, $p=.02$.

All of the EE variables (i.e., initial statement, relationship, criticism, dissatisfaction, statement attitude, self-sacrificing/overprotective behavior, excessive detail, positive remarks, EE subgroup, EE profile), when covariates were included were not significantly associated with SM symptom severity, all $\beta<-.12$, $t(54)<-.1.20$, $p>.23$. The effect of positive remarks may have been accounted for by SSRI medication use ($\beta=.29$, $t(54)=2.82$, $p=.005$) or comorbid diagnoses ($\beta=.46$, $t(54)=4.21$, $p<.001$).

STUDY 3 DISCUSSION

Study 3 examined maternal behavior and emotionality among children with SM and typically developing children using behavioral coding, self-report and expressed emotion coded via a speech sample. The aims of the present study were to determine the presence of specific maternal behaviors, and emotionality that have been associated with anxiety broadly. One etiological theory that has been proposed is the modeling of negative emotion reactivity, anxious behavior and poor emotion regulation abilities (i.e., avoidance) in social situations (Bögels & Brechman-Toussaint, 2006; Scott & Beidel, 2011). Parents of children with SM also self-report high levels of social anxiety and avoidant behavior in social situations (Chavira et al., 2007). Preliminary evidence also suggests parents of children with SM exhibit parental over-control and over-involvement, similar to parents of children with anxiety (Bayer, Sanson, & Hemphill, 2006; Bruggen, Stams, & Bögels, 2008; Chavira, Shipon-Blum, Hitchcock, Cohan, & Stein, 2007; Edison et al., 2011; Hudson & Rapee, 2001). Emotional expression has yet to be examined among parents of children with SM, but has been linked to poorer long-term outcomes, and several forms of psychopathology including anxiety (Garcia-Lopez, Díaz-Castela, Muela-Martinez, & Espinosa-Fernandez, 2014; Garcia-Lopez, Muela, Espinosa-Fernandez, & Diaz-Castela, 2009; Hirshfeld, Biederman, Brody, Faraone, & Rosenbaum, 1997; Kazarian, 1992; McCarty & Weisz, 2002; Musser et al., 2018; Sher-Censor, 2015). The present study sought to fill the gap by examining maternal behavior and emotionality among children with SM.

In contrast to the first hypothesis, mothers of children with SM did not demonstrate increased levels of negative affect or negative control, or decreased levels of positive affect or positive control during the Parent-Child Interaction task. However, maternal and child-dyads of children with SM demonstrated greater conflict compared to typically developing children.

Additionally, mothers of children with SM were more accommodating and helped their children more compared to typically developing children. In addition, increased negative control during the Parent-Child Interaction task was associated with increased SM symptom severity.

With respect to maternal self-report of negative emotion reactivity and emotion regulation abilities, initial analyses did not support the hypothesis that mothers of children with SM will rate themselves as higher in emotion negative reactivity and lower in emotion regulation abilities compared to mothers of typically developing children. However, when covariates are not included, mothers of children with SM rated themselves as higher in negative affect compared to mothers of typically developing children. Additionally, increased negative affect and decreased emotion reactivity abilities were associated with increased SM symptom severity. Therefore, there is some preliminary evidence that mothers of children with SM demonstrate high levels of negative emotion reactivity and decreased emotion regulation abilities. This finding may support the notion that parents of children with SM model high negative affect and poor emotion regulation abilities in social situations (Chavira et al., 2007; Scott & Beidel, 2011).

The measurement of maternal expressed emotion was not in support of the study hypothesis that mothers of children with SM will exhibit higher levels of expressed emotion. However, particular aspects of expressed emotion were significantly different between groups. Specifically, contrary to prior literature of mothers of children with anxiety, mothers of children with SM expressed less statements of dissatisfaction compared to typically developing children (Sher-Censor, 2015). In addition, in line with the study hypothesis and prior literature on children with anxiety, mothers of children with SM demonstrated more use of statements of self-sacrificing/overprotective behavior compared to typically developing youth (Sher-Censor, 2015). Finally, increased use of positive remarks was associated with decreased SM symptom severity. Overall, the present study did not support the notion that parents of children with SM demonstrate high levels of expressed emotion. Perhaps, the study was underpowered, and the inclusion of a larger sample could determine if differences in expressed-emotion are present in a larger sample.

In summary, there is preliminary evidence that high levels of negative emotion reactivity, disruptions in emotion regulation abilities, and over-control and accommodation behaviors in mothers is present among children with SM. The relationship needs to be examined longitudinally to determine temporal causality to inform if parental emotionality and behavior can serve as a treatment mechanism. Additionally, small sample size should be taken into consideration, specifically given that various effects were trending significance and lack of significant effects may have been due to lack of power. As mentioned in the previous studies, SSRI medication use and comorbid diagnoses may have accounted for some of the effects observed, and future research should include a treatment naiive sample, as well as attempts to limit comorbidity to test specificity related to SM.

CHAPTER V. OVERALL CONCLUSIONS

In summary, the three studies examined collectively demonstrate preliminary evidence that emotion-related factors including negative emotion reactivity, emotion regulation, and maternal emotionality and behavior are important mechanisms to consider in the development and maintenance of SM. Specifically, it appears that children with SM display higher levels of negative emotion reactivity both behaviorally as indexed with behavioral coding and maternal report, as well as with psychophysiological indices via increased SNS-based activity and reactivity. Children with SM also demonstrate emotion regulation difficulties indexed via maternal report, and PNS-based dysregulation. Finally, mothers of children with SM exhibited overly accommodating behaviors, and rated themselves as high in negative emotion reactivity and emotion regulation difficulties. While overall levels of expressed emotion was not significantly associated with SM, several specific factors related to expressed emotion were predictive of SM. Specifically, mothers of children with SM expressed self-sacrificing/overprotective statements, and SM symptom severity was associated with decreased rate of maternal expression of positive remarks. These findings may suggest maternal criticism and accommodation are associated with the development of SM, although future work will need to examine the relationship longitudinally in a larger sample of children with SM. Additionally, it may be that this relationship is bi-directional and SM may elicit these behaviors in their parents. Further exploration of parental mechanisms could inform treatment development, by targeting these mechanisms and determining treatment outcome.

Taken together, emotionality appears to be involved in the presentation of SM, which may contribute to etiological theory if findings are replicated and extended. Our study is the first to examine emotion-related factors using multiple levels of analyses in children with SM, and it offers promising preliminary evidence regarding mechanisms of emotion reactivity and regulation that may be disrupted in this population. Future studies should examine the interplay and interaction of these factors across development in this population using longitudinal methodology to clarify the phenomenology of SM, and shed light on potential treatment mechanisms.

Limitations and Future Directions

Longitudinal work is necessary to determine if these mechanisms are involved in the development and maintenance of SM. While these factors have been studied extensively in other anxiety disorders, they are just beginning to be examined in SM. Replication and extension of the present study among varied populations of children with SM is needed to ensure these factors are indeed disrupted in children with SM, and provide greater level of specificity given the preliminary nature of the present studies. While the present study was the first to employ a multi-modal examination of emotion-related factors in children with SM compared to typically developing children, and initial results are promising to advancing the field, several limitations should be taken into consideration.

First, the sample of children with SM was relatively small (N=20), and work is needed employing much larger samples. Given the low base rate of SM, it will be imperative to conduct multi-site studies to capture more children with SM, and compare across ethnic, racial and geographical diversity. Second, 30% of the SM sample was taking SSRI medication, thus greatly impacting findings when included as a covariate. Future work should include medication free samples of children with SM to determine the impact SSRI medication has on emotion-related factors. It will also be important to investigate these factors in a treatment naive sample, and include different age groups of children with SM to examine the functioning of these factors across age ranges. A major limitation of these studies was the significant difference in mean age across the diagnostic groups. For publication, age-matched analyses will be examined to determine if effects are more robust. Additional studies should limit the age range included, and attempt to age-match typically developing comparison youth. Another major limitation of these studies is the inclusion of particular tasks that may not have successfully recruited the emotional systems being examined. As previously mentioned, ecologically valid investigations of these mechanisms is needed. Future studies should examine emotion-related mechanisms in real-life settings. Another future direction can investigate these mechanisms in a pre-to-post treatment study to determine if these mechanisms can serve as treatment targets or predict treatment outcome. An additional limitation that has been discussed extensively in the SM literature is the nature of high rates of comorbidity in samples of SM youth, and difficulty parsing out effects of comorbid conditions. If possible, limiting comorbidity in this population would aid in elucidation of mechanisms that are specific to SM rather than comorbid conditions.

An additional limitation of these studies is the inclusion of parents in each task due to perceived separation difficulties, and future work should attempt to examine performance with parents present versus without their presence. Another avenue that could have been examined in the present study is lack of description to parents to determine if they would engage in more accommodation, and helping behaviors naturally. The present study also employed only behavioral observations, physiological recording and parental report, so it remains unclear if self-report would have determined more negative emotion reactivity or emotion regulation difficulties if children were able to self-report. Additionally, it is important to include self-report ratings of emotionality and distress associated with each task to determine if tasks were completing achieved aims.

Given the limitations discussed above and lack of literature regarding the phenomenology of SM, much more work is needed to elucidate etiological theory and inform treatment development and evaluation. The future direction and possibilities in the literature are limitless. For example, no studies to date have examined structural or functional neuroimaging in this population, and it remains unclear if neuronal regions or activity associated with emotion-related functioning are impacted in this population. The goal of these future studies should be to inform etiological theory, and treatment research to reduce the long-term functional impairment associated with SM. The present study was the first to provide preliminary evidence regarding the presence of disruptions in emotion reactivity and regulation, and the role of parenting behavior and emotionality in children with SM. Future work should include more investigations into these processes to determine specificity of mechanisms related to SM, temporal causality with an eye towards informing etiological theory and treatment research.

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STUDY 1 TABLES AND FIGURES

Table 1. *Descriptive and Diagnostic Statistics for SM and TD Participants*

Variable	TD (*n*=40)	SM (*n*=20)	$F(1,58)$/ $\chi^2(1)$	*p*	Partial η^2/ Cramer's V
Demographics					
Age, mean (SD)	7.60 (1.61)	6.35 (1.56)	8.16*	.006	.12
Gender (%female)	65%	60%	.14	.71	.05
Ethnicity (%Hispanic or Latinx)	67.5%	35%	5.74*	.02	.31
Medication-Use (%prescribed)[1]	0%	30%	13.33**	<.001	.47
Response to confederate's question[2]	2.65 (1.55)	.65 (1.27)	5.96*	.02	.11
Selective Mutism Questionnaire (SMQ)					
School Subscale	16.30 (2.61)	5.60 (4.02)	154.46**	<.001	.73
Home Subscale	14.83 (2.76)	11.30 (3.67)	17.35**	<.001	.23
Social Subscale	11.66 (3.46)	1.95 (1.90)	133.30**	<.001	.67
Interference/Distress Subscale	1.71 (3.61)	12.10 (3.45)	108.77**	<.001	.64
Comorbid Disorders (% diagnosis)					
Social Anxiety Disorder	0%	85%	47.44**	<.001	.51
Separation Anxiety Disorder	0%	35%	15.85**	<.001	.89
Generalized Anxiety Disorder	0%	15%	6.32*	.01	.32
OCD	0%	10%	4.14*	.04	.26
Specific Phobia	0%	15%	6.32*	.01	.32
ODD	0%	10%	4.14*	.04	.26
ADHD	0%	10%	4.14*	.04	.26
Total Number of Comorbid Diagnoses	0 (00)	1.80 (1.29)	465.83**	<.001	.57

[1]Parent-report of children who are currently taking selective serotonin reuptake inhibitors (SSRIs) prescribed for anxiety; [2] Coded response to the confederate's question during the Stranger Interaction Task. See Methods section of Study 1 for more detail.
Note: SD= Standard Deviation; OCD= Obsessive Compulsive Disorder; Dx= Diagnosis; ODD= Oppositional Defiant Disorder; ADHD= Attention-Deficit/Hyperactivity Disorder; SAD= Social Anxiety Disorder.

Table 2. *Missing Data Study 1*

Variable	Count of Missing	Percent Missing
SMQ Interference/Distress Subscale	5	8.3%
SMQ School Subscale	0	0%
SMQ Home Subscale	0	0%
SMQ Social Subscale	5	8.3%
Parent-Child Interaction Task Child Negative Affect	0	0%
Lock Box Task Child Negative Affect	0	0%
Avoidance Stranger Interaction Task	0	0%
Approach Stranger Interaction Task	0	0%
ERC Negativity Scale	0	0%
TMCQ/CBQ Negative Affect Scale	0	0%
Resting Baseline PEP	20	33.3%
Neutral Video 1 PEP	23	38.3%
Neutral Video 2 PEP	22	36.7%
Stranger Interaction PEP	2	3.3%
Resting Baseline Total SCR	2	3.3%
Resting Baseline Tonic SCL	2	3.3%
Resting Baseline Tonic Period	2	3.3%
Resting Baseline Mean SC	2	3.3%
Neutral Video 1 Total SCR	1	1.7%
Neutral Video 1 Tonic SCL	1	1.7%
Neutral Video 1 Tonic Period	1	1.7%
Neutral Video 1 Mean SC	1	1.7%
Neutral Video 2 Total SCR	1	1.7%
Neutral Video 2 Tonic SCL	1	1.7%
Neutral Video 2 Tonic Period	1	1.7%
Neutral Video 2 Mean SC	1	1.7%
Stranger Interaction Total SCR	2	3.3%
Stranger Interaction Tonic SCL	2	3.3%
Stranger Interaction Tonic Period	2	3.3%
Stranger Interaction Mean SC	2	3.3%

Table 3. *Correlation Table Study 1*

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Age	-.02	-.20	-.28*	-.28*	-.13	-.09	-.25	.20	-.06	-.51*	.57*	.39*	.51*	.45*	.13	-.12	-.15	-.12
2. Ethnicity	1	.27*	.13	.36*	-.13	-.14	-.14	-.05	.35*	.14	-.13	-.32	.16	-.13	-.25	-.06	.23	-.06
3. Medication-Use	.27*	1	.22	.47*	-.02	-.19	.27*	-.07	.14	.19	-.25	-.20	.04	-.24	.003	.03	.07	.03
4. Total Number of Comorbid Diagnoses	.13	.22	1	.60*	-.15	-.11	.31*	-.22	.39*	.62*	-.22	-.19	-.08	-.22	-.16	-.06	.21	-.06
5. SMQ Interference / Distress Subscale	-.28*	.47*	.60*	1	-.08	-.15	.26	-.15	.41*	.51*	-.10	-.16	-.08	-.32*	-.12	.05	.22	.05
6. Parent-Child Interaction Task Child Negative Affect	-.13	-.02	-.15	-.08	1	.13	-.15	.17	-.18	.03	.02	.006	-.01	.15	.31*	.27*	-.17	.27*
7. Lock Box Task Child Negative Affect	-.14	-.19	-.11	-.15	.13	1	-.11	.12	.03	.03	.35*	.32	.18	.21	-.06	-.05	.02	-.05
8. Avoidance Stranger Interaction Task	-.14	.27*	.31*	.26	-.15	-.11	1	-.65*	.03	.22	-.21	-.17	.09	-.18	.03	.04	-.001	.04
9. Approach Stranger Interaction Task	-.05	-.07	-.22	-.15	.17	.12	-.65*	1	-.01	-.08	.20	-.05	.02	.03	-.003	.11	.96	.11
10. ERC Negativity Scale	.35*	.14	.39*	.41*	-.18	.03	.03	-.01	1	.63*	-.12	.32	-.44*	-.40*	-.22	-.09	.27*	-.10

11.TMCQ/ CBQ Negative Affect Scale	.14	.19	.62*	.51*	.03	.03	.22	-.08	.63*	1	-.26	-.26	-.28	.32*	.19	.003	.23	.001
12. Resting Baseline PEP	-.13	-.25	-.22	-.10	.02	.35*	-.21	.20	-.12	-.26	1	.88*	.86*	.91*	.17	-.09	-.16	-.09
13. Neutral Video 1 PEP	-.32	-.20	-.19	-.16	.006	.32	-.17	-.05	.32	-.26	.88*	1	.89*	.89*	.29	-.14	-.29	-.14
14. Neutral Video 2 PEP	.16	.04	-.08	-.08	-.01	.18	.09	.02	-.44*	-.28	.86*	.89*	1	.89*	.34*	-.26	-.29	-.26
15. Stranger PEP	-.13	-.24	-.22	-.32*	.15	.21	-.18	.03	-.40*	.32*	.91*	.89*	.89*	1	.32*	-.09	-.33*	-.09
16. Resting Baseline Total SCR	-.25	.003	-.16	-.12	.31*	-.06	.03	-.003	-.22	.19	.17	.29	.34*	.32*	1	.18	-.92*	.18
17. Resting Baseline Tonic SCL	-.06	.03	-.06	.05	.27*	-.05	.04	.11	-.09	.003	-.09	-.14	-.26	-.09	.18	1	-.08	1.0*
18. Resting Baseline Tonic Period	.23	.07	.21	.22	-.17	.02	-.001	.96	.27*	.23	-.16	-.29	-.29	-.33*	-.92*	-.08	1	-.09
19. Resting Baseline Mean SC	-.06	.03	-.06	.05	.27*	-.05	.04	.11	-.10	.001	-.09	-.14	-.26	-.09	.18	1.0*	-.09	1
20. Neutral Video 1 Total SCR	.06	.38*	.01	.21	-.02	-.02	-.06	.03	.06	-.05	.18	.24	.27	.14	.13	-.07	-.16	.07
21. Neutral Video 1 Tonic SCL	-.22	-.15	-.09	-.14	.18	-.02	-.03	.11	-.19	-.14	-.14	-.18	-.13	-.09	.30*	.69*	-.26	.69*
22. Neutral Video 1 Tonic Period	-.13	-.39*	-.13	-.25	.11	.07	.08	-.003	-.15	-.06	-.17	-.23	-.30	-.15	-.03	.26*	.09	.26*
23. Neutral Video 1 Mean SC	-.22	-.15	-.09	-.13	.18	-.02	-.03	.11	-.19	-.14	-.15	-.18	-.13	-.10	.30*	.69*	-.26*	.69*
24. Neutral	.04	.17	-.08	.14	.18	.04	-.04	.01	.01	-.09	.24	.26	.26	.20	.18	-.05	-.12	-.05

Video 2 Total SCR																		
25. Neutral Video 2 Tonic SCL	-.20	-.05	-.10	-.12	.22	.10	.03	.04	-.14	-.12	-.12	-.11	-.13	-.05	.35*	.68*	-.31*	.68*
26. Neutral Video 2 Tonic Period	-.02	-.14	.09	-.08	-.10	-.12	.001	.01	-.06	.08	-.23	-.24	-.27	-.14	-.09	.68*	.05	.11
27. Neutral Video 2 Mean SC	-.20	-.06	-.10	-.12	.21	.10	.02	.04	-.14	-.13	-.12	-.11	-.14	-.05	.34*	.69*	-.30*	.69*
28. Stranger Total SCR	.03	.28*	-.01	.12	.002	.04	-.03	-.03	.12	.02	.18	.26	.24	.22	.13	-.20	-.18	-.20
29. Stranger Tonic SCL	-.27*	-.14	-.14	-.16	.19	.02	-.02	.11	-.22	-.17	-.06	-.07	-.08	-.02	.13	.67*	-.32*	.67*
30. Stranger Tonic Period	.02	-.19	.09	-.05	-.08	-.17	.05	.04	-.14	-.04	-.20	-.30	-.23	-.22	-.15	.26*	.17	.26
31. Stranger Mean SC	-.27*	-.16	-.14	-.16	.19	.02	-.02	.08	-.22	-.19	-.06	-.07	-.06	-.02	.32*	.64*	.-.30*	.65*

Table 3 Continued. *Correlation Table Study 1*

	20	21	22	23	24	25	26	27	28	29	30	31
1. Age	.08	.02	-.02	.02	-.06	.10	-10	-.06	.07	-.10	-.06	-.09
2. Ethnicity	.06	-.22	-.13	-.22	.04	-.20	-.02	-.20	.03	-.27*	.02	-.27*
3. Medication -Use	.38*	-.15	-.39*	-.15	.17	-.05	-.14	-.06	.28*	-.14	-.19	-.16
4. Total Number of Comorbid Diagnoses	.01	-.09	-.13	-.09	-.08	-.10	.09	-.10	-.01	-.14	.09	-14
5. SMQ Interference/ Distress Subscale	.21	-.14	-.25	-.13	.14	-.12	-.08	-.12	.12	-.16	-.05	-.16
6. Parent-Child Interaction Task Child Negative Affect	-.02	.18	.11	.18	.18	.22	-.10	.21	.002	.19	-.08	.19
7. Lock Box Task Child Negative Affect	-.02	-.02	.07	-.02	.04	.10	-.12	.10	.04	.02	-.17	.02
8. Avoidance Stranger Interaction Task	-.06	-.03	.08	-.03	-.04	.03	.001	.02	-.03	-.02	.05	-.02
9. Approach Stranger Interaction Task	.03	.11	-.003	.11	.01	.04	.01	.04	-.03	.11	.04	.08
10. ERC Negativity Scale	.06	-.19	-.15	-.19	.01	-.14	-.06	-.14	.12	-.22	-.14	-.22
11. TMCQ/CBQ Negative Affect Scale	-.05	-.14	-.06	-.14	-.09	-.12	.08	-.13	.02	-.17	-.04	-.19

12. Resting Baseline PEP	.18	-.14	-.17	-.15	.24	-.12	-.23	-.12	.18	-.06	-.20	-.06
13. Neutral Video 1 PEP	.24	-.18	-.23	-.18	.26	-.11	-.24	-.11	.26	-.07	-.30	-.07
14. Neutral Video 2 PEP	.27	-.13	-.30	-.13	.26	-.13	-.27	-.14	.24	-.08	-.23	-.06
15. Stranger PEP	.14	-.09	-.15	-.10	.20	-.05	-.14	-.05	.22	-.02	-.22	-.02
16. Resting Baseline Total SCR	.13	.30*	-.03	.30*	.18	.35*	-.09	.34*	.13	.13	-.15	.32*
17. Resting Baseline Tonic SCL	-.07	.69*	.26*	.69*	-.05	.68*	.68*	.69*	-.20	.67*	.26*	.64*
18. Resting Baseline Tonic Period	-.16	-.26	.09	-.26*	-.12	-.31*	.05	-.30*	-.18	-.32*	.17	-.30*
19. Resting Baseline Mean SC	-.07	.69*	.26*	.69*	-.05	.68*	.11	.69*	-.20	.67*	.26	.65*
20. Neutral Video 1 Total SCR	1	-.23	.89*	-.23	.60*	-.16	.55*	-.16	.86*	.26	-.71*	-.14
21. Neutral Video 1 Tonic SCL	-.23	1	.34*	1.0*	-.18	.83*	.17	.84*	-.36*	.96*	.44*	.95*
22. Neutral Video 1 Tonic Period	.89*	.34	1	.33*	-.53*	.33*	.51*	.33*	-.79*	.27*	.67*	.27*
23. Neutral Video 1 Mean SC	-.23	1.0*	.33*	1	-.18	.83*	.17	.84*	-.35*	.96*	.44	.95*
24. Neutral Video 2 Total SCR	.60*	-.18	-.53*	-.18	1	-.24	.93*	-.23	.52*	-.07	-.55*	-.05
25. Neutral Video 2 Tonic SCL	-.16	.17	.33*	.83*	-.24	1	.26*	1.0*	-.24	.84*	.23	.83*
26. Neutral Video 2 Tonic Period	.55*	.84*	.51*	.17	-.93*	.26*	1	.25	-.47*	.08	.51*	.06
27. Neutral Video 2 Mean SC	-.16	-.36*	.33*	.84*	-.23	1.0*	.25	1	-.24	.85*	.23	95*
28. Stranger Total SCR	.86*	.96*	-.79*	-.35*	.52*	-.24	-.47*	-.24	1	-.28*	-.89*	-.27*
29. Stranger Tonic SCL	.26	.44*	.27*	.96*	-.08	.84*	.08	.85*	-.28*	1	.33*	1.0*
30. Stranger Tonic Period	-.71*	.95*	.67*	.44*	-.55*	.23	.51*	.23	-.90*	.33*	1	.32*
31. Stranger Mean SC	-.14	.83	.27*	.95*	-.05	.83*	.06	.84*	-.27*	1.0*	.32*	1

Note= **p*<.05

Table 4. *Emotion Reactivity Rating Scales and Behavioral Data for TD and SM Participants with Covariates*

Variable	TD	SM	*F* (1,54)/ B(S.E.)	*p*	Partial η^2/ Odds Ratio
Emotion Regulation Checklist					
Negativity Scale	.44 (.42)	.71 (.43)	.62	.43	.01
TMCQ/CBQ					
Negative Affect Scale	2.49 (.74)	3.53 (.95)	.03	.87	.001
Parent-Child Interaction Task					
Child Negative Affect	1.48 (.91)	1.20 (.41)	.74	.40	.01
Stranger Task					
Avoidance Behavior (total time)	.29 (1.28)	6.29 (12.77)	1.59	.21	.03
Approach Behavior (% Engaged in approach behavior)	95%	80%	1.06 (1.43)	.46	2.90
Lock Box Task					
Child Negative Affect	1.75 (2.86)	.55 (.95)	1.94	.17	.04

Note= TD=typically developing. Covariates: age, ethnicity, total number of comorbid diagnoses, SSRI use

Table 5. *Emotion Reactivity Rating Scales and Behavioral Data for TD and SM Participants without Covariates*

Variable	TD	SM	*F* (1,58)/ B(S.E.)	*p*	Partial η^2/ Odds Ratio
Emotion Regulation Checklist					
Negativity Scale	.44 (.42)	.71 (.43)	5.63*	.02	.09
TMCQ/CBQ					
Negative Affect Scale	2.49 (.74)	3.53 (.95)	21.78**	<.001	.27
Parent-Child Interaction					

Task					
Child Negative Affect	1.48 (.91)	1.20 (.41)	1.66	.20	.03
Stranger Task					
Avoidance Behavior (total time)	.29 (1.28)	6.29 (12.77)	8.81**	.004	.13
Approach Behavior (% Engaged in approach behavior)	95%	80%	1.56 (.92)	.09	4.75
Lock Box Task					
Child Negative Affect	1.75 (2.86)	.55 (.95)	3.31	.07	.05

Note= TD=Typically Developing;*p<.05;**p<.01.

Table 6. *Results of Emotion Reactivity Behavioral Data and Rating Scales Regression Models Predicting Rating of SM Symptom Severity with Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
Emotion Regulation Checklist					
Negativity Scale	1.10	1.70	1.54	.10	.27
TMCQ/CBQ					
Negative Affect Scale	1.21	1.03	.85	.17	.23
Parent-Child Interaction Task					
Child Negative Affect	.34	.27	.79	.02	.73
Stranger Task					
Avoidance Behavior (total time)	.45	.04	.08	.06	.62
Approach Behavior (% Engaged in approach behavior)	-.03	-.06	1.97	-.01	.97
Lock Box Task					
Child Negative Affect	-.21	-.05	.24	-.04	.84

Note: Covariates= age, ethnicity, total number of comorbid diagnoses, SSRI use

Table 7. *Results of Emotion Reactivity Behavioral Data and Rating Scales Regression Models Predicting Rating of SM Symptom Severity without Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
Emotion Regulation Checklist					
Negativity Scale	3.22**	5.32	1.65	.41	.001
TMCQ/CBQ					
Negative Affect Scale	4.38**	3.13	.72	.51	<.001
Parent-Child Interaction Task					
Child Negative Affect	-.42	-.43	1.03	-.08	.67
Stranger Task					
Avoidance Behavior (total time)	2.04*	.20	1.00	.26	.04
Approach Behavior (% Engaged in approach behavior)	-1.17	-2.98	2.55	-.15	.24
Lock Box Task					
Child Negative Affect	-1.13	-.36	.32	-.15	.26

Note: *<.05, **<.01.

Table 8. *Emotion Reactivity Physiology Scores for TD and SM Participants with Covariates*

Variable	TD	SM	*F* (1,54)	*p*	Partial η^2
Resting Baseline					
PEP	97.45 (9.25)	93.39 (8.25)	.07	.80	.001
EDA					
Total SCR	1.45 (1.91)	.85 (1.16)	.09	.76	.002
Tonic SCL	5.38 (2.98)	5.53 (3.30)	.31	.58	.006
Tonic Period	24.91 (5.96)	27.42 (3.55)	.10	.75	.002
Mean SC	5.38 (2.99)	5.53 (3.18)	.30	.59	.005
Neutral Video 1					
PEP	99.09 (9.73)	95.97 (8.11)	.19	.67	.003
EDA					
Total SCR	.81 (1.45)	1.39 (1.98)	.66	.42	.01
Tonic SCL	7.12 (3.11)	6.46 (3.28)	.10	.76	.002
Tonic Period	27.40 (4.26)	24.93 (6.34)	.15	.70	.003
Mean SC	7.12 (3.11)	6.40 (3.31)	.15	.70	.003
Neutral Video 2					
PEP	99.13 (8.71)	97.24 (9.43)	.11	.75	.002
EDA					
Total SCR	.80 (1.25)	1.06 (2.18)	.81	.37	.02
Tonic SCL	7.29 (3.06)	6.62(3.34)	.004	.95	.00
Tonic Period	27.32 (4.28)	26.87 (5.80)	.38	.54	.007
Mean SC	7.33 (3.00)	6.68 (3.25)	.002	.96	.00
Stranger Interaction Task					
PEP	100.29 (8.70)	95.26 (8.59)	.20	.66	.004
PEP Reactivity Rest[1]	2.26 (3.89)	2.57 (3.47)	.55	.46	.01
PEP Reactivity NV1[2]	.95 (4.66)	.68 (3.53)	1.05	.31	.02
EDA					
Total SCR	1.33 (2.30)	1.93 (2.28)	1.01	.32	.02
Tonic SCL	7.46 (3.01)	6.55 (3.24)	.06	.81	.001
Tonic Period	25.39 (6.74)	25.37 (5.13)	.005	.94	.00
Mean SC	7.51 (2.99)	6.55 (3.21)	.14	.71	.003
Total SCR Reactivity Rest[1]	-.08 (2.66)	.86 (2.46)	.45	.51	.008
Total SCR Reactivity NV1[2]	.51 (1.35)	.37 (.81)	.03	.86	.001
Tonic SCL Reactivity Rest[1]	2.19 (2.33)	1.32 (2.85)	.02	.90	.00
Tonic SCL Reactivity NV1[2]	.35 (.90)	.36 (.95)	1.56	.22	.03
Tonic Period Reactivity Rest[1]	.80 (7.73)	-1.98 (6.09)	.09	.77	.002
Tonic Period Reactivity NV1[2]	-2.01 (5.10)	.60 (3.62)	.32	.57	.006
Mean SC Reactivity Rest[1]	2.19 (2.31)	1.41 (2.95)	.07	.79	.001
Mean SC Reactivity NV1[2]	.38 (.95)	.24 (1.07)	.17	.68	.003

Note= PEP= Pre-ejection period; EDA= Electrodermal Activity; SCR= Skin Conductance Response; SCL= Skin Conductance Level; SC= Skin Conductance; NV=Neutral Video.[1]Reactivity calculated from change score from resting baseline. [2]Reactivity calculated from change score from neutral video baseline. Covariates: age, ethnicity, comorbid diagnoses, SSRI use

Table 9. *Emotion Reactivity Physiology Scores for TD and SM Participants without Covariates*

Variable	TD	SM	*F* (1,58)	*p*	Partial η^2
Resting Baseline					
PEP	97.45 (9.25)	93.39 (8.25)	3.70	.06	.06
EDA					
Total SCR	1.45 (1.91)	.85 (1.16)	1.67	.20	.03
Tonic SCL	5.38 (2.98)	5.53 (3.30)	.001	.98	.00
Tonic Period	24.91 (5.96)	27.42 (3.55)	3.46	.07	.06
Mean SC	5.38 (2.99)	5.53 (3.18)	.03	.86	.001
Neutral Video 1					
PEP	99.09 (9.73)	95.97 (8.11)	1.30	.26	.02
EDA					
Total SCR	.81 (1.45)	1.39 (1.98)	1.30	.26	.02
Tonic SCL	7.12 (3.11)	6.46 (3.28)	.57	.45	.01
Tonic Period	27.40 (4.26)	24.93 (6.34)	3.03	.09	.05
Mean SC	7.12 (3.11)	6.40 (3.31)	.84	.37	.01
Neutral Video 2					
PEP	99.13 (8.71)	97.24 (9.43)	.44	.51	.008
EDA					
Total SCR	.80 (1.25)	1.06 (2.18)	.21	.65	.003
Tonic SCL	7.29 (3.06)	6.62(3.34)	.40	.53	.007
Tonic Period	27.32 (4.28)	26.87 (5.80)	.12	.73	.002
Mean SC	7.33 (3.00)	6.68 (3.25)	.77	.38	.01
Stranger Interaction Task					
PEP	100.29 (8.70)	95.26 (8.59)	4.60*	.04	.07
PEP Reactivity Rest[1]	2.26 (3.89)	2.57 (3.47)	.37	.55	.006
PEP Reactivity NV1[2]	.95 (4.66)	.68 (3.53)	.01	.91	.00
EDA					
Total SCR	1.33 (2.30)	1.93 (2.28)	.95	.34	.02
Tonic SCL	7.46 (3.01)	6.55 (3.24)	1.30	.26	.02
Tonic Period	25.39 (6.74)	25.37 (5.13)	.002	.97	.00

Mean SC	7.51 (2.99)	6.55 (3.21)	1.07	.31	.02
Total SCR Reactivity Rest[1]	-.08 (2.66)	.86 (2.46)	2.21	.14	.04
Total SCR Reactivity NV1[2]	.51 (1.35)	.37 (.81)	.20	.65	.003
Tonic SCL Reactivity Rest[1]	2.19 (2.33)	1.32 (2.85)	1.72	.20	.03
Tonic SCL Reactivity NV1[2]	.35 (.90)	.36 (.95)	.02	.90	.00
Tonic Period Reactivity Rest[1]	.80 (7.73)	-1.98 (6.09)	1.73	.19	.03
Tonic Period Reactivity NV1[2]	-2.01 (5.10)	.60 (3.62)	4.77*	.03	.08
Mean SC Reactivity Rest[1]	2.19 (2.31)	1.41 (2.95)	1.35	.25	.02
Mean SC Reactivity NV1[2]	.38 (.95)	.24 (1.07)	.74	.39	.01

Note= PEP= Pre-ejection period; EDA= Electrodermal Activity; SCR= Skin Conductance Response; SCL= Skin Conductance Level; SC= Skin Conductance; NV=Neutral Video.[1]Reactivity calculated from change score from resting baseline.
[2]Reactivity calculated from change score from neutral video baseline.

Table 10. *Results of Emotion Reactivity Physiology Data Regression Models Predicting Rating of SM Symptom Severity with Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
Resting Baseline					
PEP	1.29	.10	.08	.21	.20
EDA					
Total SCR	.27	1.00	.37	.006	.79
Tonic SCL	.58	.11	.18	.09	.56
Tonic Period	.34	.04	.11	.07	.74
Mean SC	.62	.11	.18	.09	.54
Neutral Video 1					
PEP	.52	.04	.07	.15	.60
EDA					
Total SCR	.89	.34	.38	.10	.37
Tonic SCL	-.16	-.03	.19	.006	.87
Tonic Period	-.42	-.05	.12	-.06	.67
Mean SC	-.16	-.03	.19	.007	.88
Neutral Video 2					
PEP	.01	.01	.08	.03	.85
EDA					
Total SCR	1.08	.39	.36	.11	.28
Tonic SCL	-.26	-.05	.19	-.007	.80
Tonic Period	-.78	-1.00	.12	-.08	.43
Mean SC	-.27	-.05	.19	-.007	.79
Stranger Interaction Task					
PEP	-.86	-.07	.08	-.11	.39
PEP Reactivity Rest[1]	-1.57	-.25	.16	-.20	.12
PEP Reactivity NV1[2]	-.79	-.11	.14	-.19	.43
EDA					
Total SCR	.55	.15	.27	.04	.58
Tonic SCL	-.07	-.10	.20	.02	.95
Tonic Period	-.45	-.04	.10	-.02	.65
Mean SC	-.07	-.01	.20	.02	.94
Total SCR Reactivity Rest[1]	.26	.06	.23	.03	.80
Total SCR Reactivity NV1[2]	-.03	-.02	.53	-.06	.98
Tonic SCL Reactivity Rest[1]	-1.19	-.28	.24	-.12	.23
Tonic SCL Reactivity NV1[2]	-.03	-.02	.65	.005	.98
Tonic Period Reactivity Rest[1]	-.85	-.07	.08	-.08	.39
Tonic Period Reactivity NV1[2]	-.24	-.03	.14	.02	.81
Mean SC Reactivity Rest[1]	-1.00	-.23	.23	-.12	.32
Mean SC Reactivity NV1[2]	.20	.12	.61	.02	.84

Note= PEP= Pre-ejection period; EDA= Electrodermal Activity;
SCR= Skin Conductance Response; SCL= Skin Conductance Level;
SC= Skin Conductance; NV=Neutral Video.
[1]Reactivity calculated from change score from resting baseline.
[2]Reactivity calculated from change score from neutral video baseline.
Covariates: age, ethnicity, comorbid diagnoses, SSRI use

Table 11. *Results of Emotion Reactivity Physiology Data Regression Models Predicting Rating of SM Symptom Severity without Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
Resting Baseline					
PEP	-.57	-.05	.09	-.10	.57
EDA					
Total SCR	-.74	-.35	.48	-.12	.46
Tonic SCL	.30	.08	.25	.05	.76
Tonic Period	1.51	.22	.15	.22	.13
Mean SC	.32	.08	.25	.05	.75
Neutral Video 1					
PEP	-.99	-.08	.09	-.16	.33
EDA					
Total SCR	1.55	.73	.47	.21	.12
Tonic SCL	-1.11	-.27	.25	-.14	.27
Tonic Period	-1.83	-.27	.15	-.25	.07
Mean SC	-.1.11	-.27	.25	-.13	.27
Neutral Video 2					
PEP	-.40	-.04	.09	-.08	.69
EDA					
Total SCR	.98	.48	.49	.14	.33
Tonic SCL	-.89	-.23	.25	-.12	.37
Tonic Period	-.64	-.10	.16	-.08	.52
Mean SC	-.89	-.23	.26	-.12	.37
Stranger Interaction Task					
PEP	-2.10*	-.19	.09	-.32	.04
PEP Reactivity Rest[1]	-.52	-.11	.21	-.07	.60
PEP Reactivity NV1[2]	-.10	-.02	.18	-.02	.92
EDA					
Total SCR	1.06	.37	.35	.12	.29
Tonic SCL	-1.21	-.31	.25	-.16	.23
Tonic Period	-.38	-.05	.13	-.05	71
Mean SC	-1.33	-.33	.25	-.16	.19
Total SCR Reactivity Rest[1]	1.16	.35	.30	.18	.25
Total SCR Reactivity NV1[2]	-.29	-.20	.69	-.06	.78
Tonic SCL Reactivity Rest[1]	-2.20*	-.66	.30	-.28	.03
Tonic SCL Reactivity NV1[2]	.52	-.45	.87	-.08	.60
Tonic Period Reactivity Rest[1]	-1.78	-.19	.11	-.23	.08
Tonic Period Reactivity NV1[2]	1.31	.22	.17	.22	.19
Mean SC Reactivity Rest[1]	-1.84	-.55	.30	-.28	.07

Mean SC Reactivity NV1[2]	-.53	-.44	.82	-.07	.59

Note= PEP= Pre-ejection period; EDA= Electrodermal Activity; SCR= Skin Conductance Response; SCL= Skin Conductance Level; SC= Skin Conductance; NV=Neutral Video.[1]Reactivity calculated from change score from resting baseline.
[2]Reactivity calculated from change score from neutral video baseline.

Figure 1. Response to Confederate's Question During Stranger Interaction Task

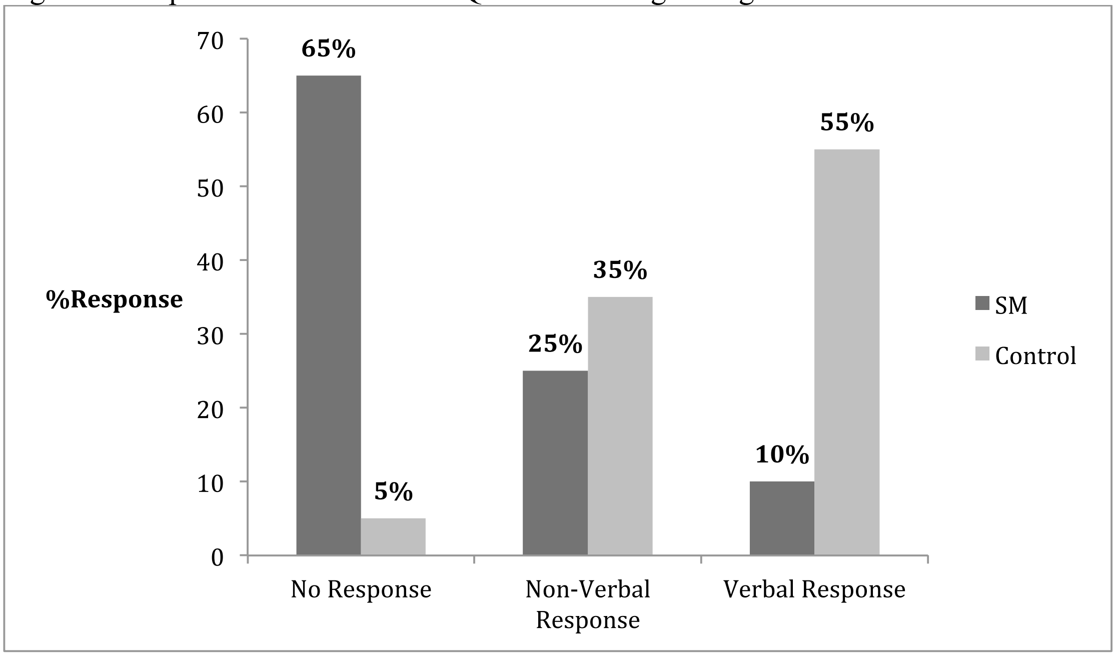
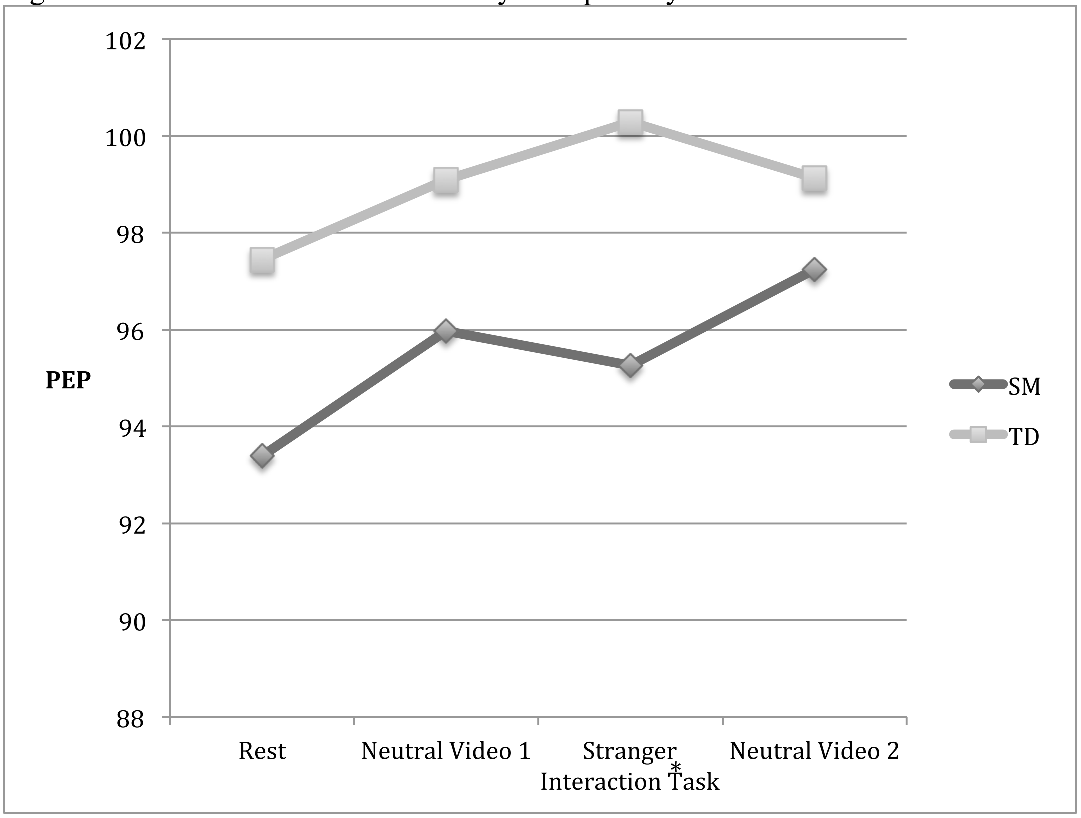


Figure 2. Mean PEP across Each Task by Group-Study 1



Note.*p<.05 for between-group effect.

STUDY 2 TABLES AND FIGURES

Table 12. *Missing Data Study 2*

Variable	Count of Missing	Percent Missing
Lock Box Global Regulation	0	0%
Lock Box Task Persistence	0	0%
Lock Box Help-Seeking	0	0%
Lock Box Frustration	0	0%
Lock Box Facial Anger	0	0%
Lock Box Body Anger	0	0%
ERC Regulation Scale	0	0%
TMCQ/CBQ Effortful Control Scale	0	0%
Resting Baseline RSA	3	5%
Neutral Video 1 RSA	2	3.3%
Neutral Video 2 RSA	2	3.3%
Parent-Child Interaction RSA	4	6.7%
Lock Box RSA	2	3.3%

Table 13. *Correlation Table Study 2*

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Age	-.02	-.20	-.28*	-.28*	-.26*	.21	-.38*	-.28*	-.18	-.24	.14	-.58*	.15	-.06	-.003
2. Ethnicity	1	.27*	.13	.36*	-.27*	-.03	-.03	-.25	-.27*	-.17	-.29*	-.10	-.10	-.30*	-.26*
3. Medication-Use	-.20	1	.22	.47*	-.25	.09	.25	-.23	-.25	-.15	-.48*	.12	-.38*	-.27*	-.29*
4. Total Number of Comorbid Diagnoses	-.28*	.22	1	.60*	-.09	-.16	.17	-.12	-.09	.00	-.43*	.22	-.24	-.04	-22
5. SMQ Interference/Distress Subscale	.36*	.47*	.60*	1	-.17	-.19	.16	-.16	-.17	-.11	-.62*	.21	-.18	-.08	-.17
6. Lock Box Global Regulation	-.27*	-.25	-.09	-.17	1	.24	.18	.94*	.91*	.81*	.23	.10	.14	.19	.10
7. Lock Box Task Persistence	-.03	.09	-.16	-.19	.24	1	-.002	.20	.23	.12	.13	-.02	.10	-.01	-.10
8. Lock Box Help-Seeking	-.38*	-.03	.09	-16	-.19	.24	1	.20	.09	.23	-.22	.26*	-.15	.06	-.08
9. Lock Box Frustration	-.25	-.23	-.12	-.16	.94*	.20	.20	1	.76*	.72*	.21	.11	.19	.19	.07
10. Lock Box Facial Anger	-.27*	-.25	-.09	-.17	.91*	.23	.09	.76*	1	.56*	.30*	.11	.19	.25	.17
11. Lock Box Body Anger	-.24	-.17	-.15	.00	-.11	.81*	.12	.23	.72*	1	.03	.03	.002	.03	-.03
12. ERC Regulation Scale	-.29*	-.48*	-.43*	-.62*	.23	.13	-.22	.21	.30*	.03	1	.05	.03	.02	.20
13. TMCQ/CBQ Effortful Control Scale	-.10	.12	.22	.21	.10	-.02	.26*	.11	.11	.03	.05	1	-.14	.02	.04
14. Resting Baseline RSA	-.10	-.38*	-.24	-.18	.14	.10	-.15	.19	.19	.002	.03	-.14	1	.72*	.71*
15. Neutral Video 1 RSA	-.30*	-.27*	-.04	-.08	.19	-.01	06.	.19	.25	.03	.02	.02	.72*	1	.79*
16. Neutral Video 2 RSA	-.26*	-.29*	-.22	-.17	.10	-.10	-.08	.07	.17	-.03	.20	.04	.71*	.79*	1
17. Parent-Child Interaction RSA	-.17	-.35*	-.18	-.15	.27*	.06	-.06	.26	.30*	.15	.10	.03	.69*	.70*	.73*
18. Lock Box RSA	-.32*	-.25	-.07	-.04	.14	-.20	.01	.14	.16	.06	-.07	.01	.63*	.70	.65*

Table 13 continued.

	17	18
1. Age	-.05	.04
2. Ethnicity	-.17	-.32*
3.Medication-Use	-.35*	-.25
4. Total Number of Comorbid Diagnoses	-.18	-.07
5. SMQ Interference/Distress Subscale	-.15	-.04
6. Lock Box Global Regulation	.27*	.14
7. Lock Box Task Persistence	.06	-.20
8. Lock Box Help-Seeking	-.06	.01

9. Lock Box Frustration	.26	.14
10. Lock Box Facial Anger	.30*	.16
11. Lock Box Body Anger	.15	.06
12. ERC Regulation Scale	.10	-.07
13. TMCQ/CBQ Effortful Control Scale	.03	.01
14. Resting Baseline RSA	.69*	.63*
15. Neutral Video 1 RSA	.70*	.70
16. Neutral Video 2 RSA	.73*	.65*
17. Parent-Child Interaction RSA	1	.69*
18. Lock Box RSA	.69*	1

Note: *p<.05

Table 14. *Emotion Regulation Rating Scales and Behavioral Data for TD and SM Participants with Covariates*

Variable	TD	SM	F (1,54)	p	Partial η^2
Emotion Regulation Checklist					
Regulation Scale	2.48 (.43)	1.89 (.46)	1.80	.19	.03
TMCQ/CBQ					
Effortful Control	3.93 (.86)	4.54 (.91)	2.22	.14	.04
Lock Box Task					
Child Help-Seeking Behaviors	.65 (1.10)	1.50 (1.79)	1.02	.32	.02
Child Persistence (total time)	292.71 (59.95)	255.80 (72.03)	5.75*	.02	.10
Child Frustration	1.30 (.91)	.85 (.93)	1.67	.20	.03
Child Facial Anger Expression	1.05 (1.01)	.65 (.93)	.46	.50	.008
Child Body Anger	.48 (.55)	.30 (.57)	2.57	.12	.05
Child Global Regulation	2.83 (2.24)	1.80 (2.12)	1.62	.21	.03

Note= TD=typically developing. *p<.05. Covariates: age, ethnicity, total number of comorbid diagnoses, SSRI use

Table 15. *Emotion Regulation Rating Scales and Behavioral Data for TD and SM Participants without Covariates*

Variable	TD	SM	F (1,58)	p	Partial η^2
Emotion Regulation Checklist					
Regulation Scale	2.48 (.43)	1.89 (.46)	23.79**	<.001	.29
TMCQ/CBQ					
Effortful Control	3.93 (.86)	4.54 (.91)	6.37*	.01	.10
Lock Box Task					
Child Help-Seeking Behaviors	.65 (1.10)	1.50 (1.79)	5.17*	.03	.08
Child Persistence (total time)	292.71 (59.95)	255.80 (72.03)	4.41*	.04	.07
Child Frustration	1.30 (.91)	.85 (.93)	3.20	.08	.05
Child Facial Anger Expression	1.05 (1.01)	.65 (.93)	2.19	.14	.04
Child Body Anger	.48 (.55)	.30 (.57)	1.30	.26	.02
Child Global Regulation	2.83 (2.24)	1.80 (2.12)	2.89	.09	.05

Note= TD=typically developing. **p<.01, *p<.05.

Table 16. *Results of Emotion Regulation Behavioral Data and Rating Scales Regression Models Predicting Rating of SM Symptom Severity with Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
Emotion Regulation Checklist					
Regulation Scale	-2.56*	-3.36	1.31	-.31	.01
TMCQ/CBQ					
Effortful Control	.41	.31	.77	.06	.69
Lock Box Task					
Child Help-Seeking Behaviors	-.31	-.14	.45	-.03	.76
Child Persistence (total time)	-1.26	-.01	.009	-.14	.21
Child Frustration	-.07	-.05	.73	.03	.94
Child Facial Anger Expression	-.03	-.02	.64	.03	.98
Child Body Anger	-.51	-.56	1.10	-.04	.61
Child Global Regulation	-.18	-.05	.30	.01	.86

Note: *<.05. Covariates: age, ethnicity, total number of comorbid diagnoses, SSRI use

Table 17. *Results of Emotion Reactivity Behavioral Data and Rating Scales Regression Models Predicting Rating of SM Symptom Severity without Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
Emotion Regulation Checklist					
Regulation Scale	-5.62**	-6.80	1.21	-.62	<.001
TMCQ/CBQ					
Effortful Control	1.55	1.29	.83	.21	.12
Lock Box Task					
Child Help-Seeking Behaviors	1.19	.65	.55	.16	.24
Child Persistence (total time)	-1.41	-.02	.01	-.19	.16
Child Frustration	-1.18	-.99	.84	-.16	.24
Child Facial Anger Expression	-1.19	-.93	.78	-.17	.23
Child Body Anger	-.79	-1.10	1.39	-.11	.43
Child Global Regulation	-1.23	-.43	.35	-.17	.22

Note: **<.01.

Table 18. *Emotion Regulation Physiology Scores for TD and SM Participants with Covariates*

Variable	TD	SM	*F* (1,54)	*p*	Partial η^2
Resting Baseline					
RSA	6.77 (.99)	6.18 (.92)	.03	.87	.001
Neutral Video 1					
RSA	6.75 (1.01)	6.29 (.87)	.99	.32	.02
Neutral Video 2					
RSA	6.80 (.89)	6.24 (.93)	.03	.87	.001
Parent-Child Interaction Task					
RSA	6.34 (.97)	5.75 (.90)	.65	.43	.01
RSA Reactivity Rest[1]	-.44 (.73)	-.43 (.90)	1.74	.19	.03
RSA Reactivity NV1[2]	-.34 (.75)	-.57 (.80)	.01	.92	.00
Lock Box Task					
RSA	5.78 (.95)	5.60 (.89)	1.20	.28	.02
RSA Reactivity Rest[1]	-1.00 (.85)	-.58 (.70)	2.34	.13	.04
RSA Reactivity NV2[3]	-1.02 (.82)	-.65 (.59)	1.92	.17	.03

Note: RSA= Respiratory Sinus Arrhythmia (ms^2); [1]Reactivity calculated from change score from resting baseline. [2]Reactivity calculated from change score from neutral video 1 baseline. [3]Reactivity calculated from change score from neutral video 2 baseline. Covariates: age, ethnicity, comorbid diagnoses, SSRI use

Table 19. *Emotion Regulation Physiology Scores for TD and SM Participants without Covariates*

Variable	TD	SM	*F* (1,58)	*p*	Partial η^2
Resting Baseline					
RSA	6.77 (.99)	6.18 (.92)	3.70	.06	.06
Neutral Video 1					
RSA	6.75 (1.01)	6.29 (.87)	2.78	.10	.05
Neutral Video 2					
RSA	6.80 (.89)	6.24 (.93)	4.93*	.03	.08
Parent-Child Interaction Task					
RSA	6.34 (.97)	5.75 (.90)	.4.84*	.03	.08
RSA Reactivity Rest[1]	-.44 (.73)	-.43 (.90)	.02	.88	.00
RSA Reactivity NV1[2]	-.34 (.75)	-.57 (.80)	1.50	.23	.03
Lock Box Task					
RSA	5.78 (.95)	5.60 (.89)	.27	.60	.005
RSA Reactivity Rest[1]	-1.00 (.85)	-.58 (.70)	5.85*	.02	.09
RSA Reactivity NV2[3]	-1.02 (.82)	-.65 (.59)	1.84	.18	.03

Note: RSA= Respiratory Sinus Arrhythmia (ms^2); [1]Reactivity calculated from change score from resting baseline.
[2]Reactivity calculated from change score from neutral video 1 baseline.
[3]Reactivity calculated from change score from neutral video 2 baseline. *p<.05

Table 20. *Results of Emotion Regulation Physiology Data Regression Models Predicting Rating of SM Symptom Severity with Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
Resting Baseline					
RSA	.86	.55	.64	.11	.38
Neutral Video 1					
RSA	.68	.44	.65	.09	.50
Neutral Video 2					
RSA	.62	.42	.68	.09	.54

Parent-Child Interaction Task					
RSA	.71	.46	.65	.47	.48
RSA Reactivity Rest[1]	-.17	-.14	.81	-.04	.86
RSA Reactivity NV1[2]	-.25	-.25	.80	-.06	.76
Lock Box Task					
RSA	1.31	.87	.66	.15	.19
RSA Reactivity Rest[1]	.49	.37	.76	.06	.62
RSA Reactivity NV2[2]	.72	.56	.78	.06	.47

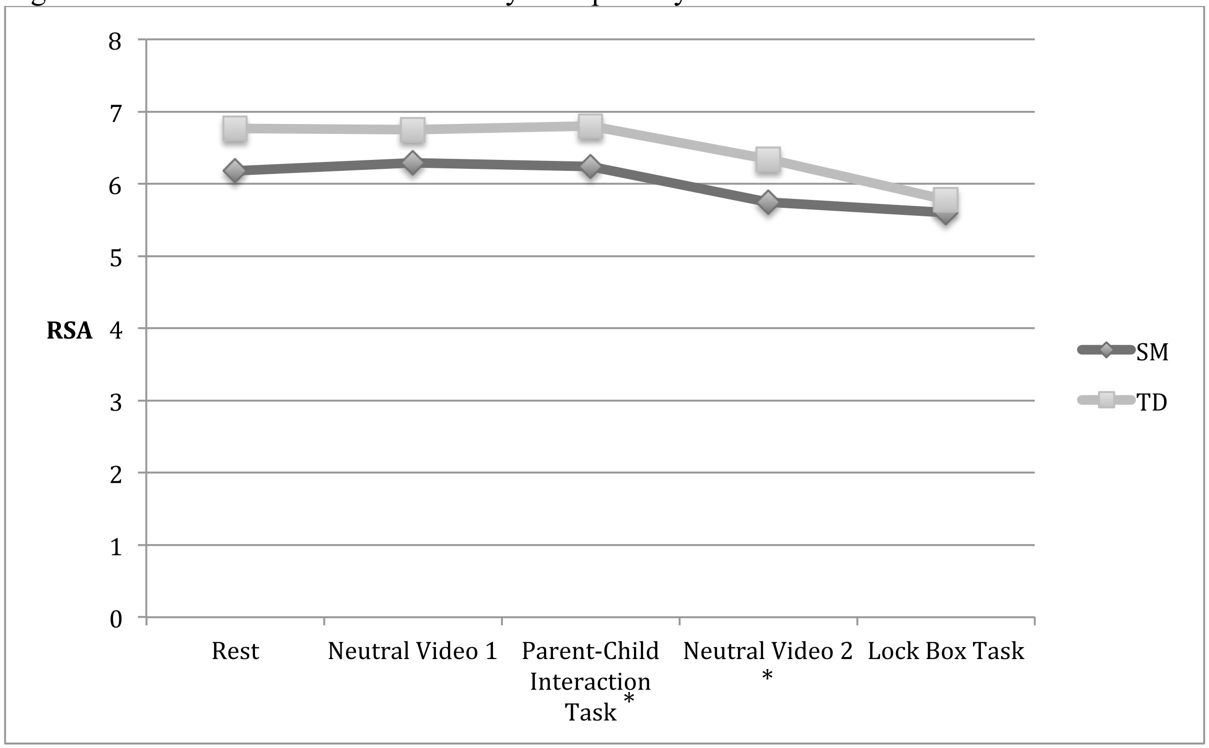
Note: RSA= Respiratory Sinus Arrhythmia (ms^2); [1]Reactivity calculated from change score from resting baseline. [2]Reactivity calculated from change score from neutral video 1 baseline. [3]Reactivity calculated from change score from neutral video 2 baseline. Covariates: age, ethnicity, comorbid diagnoses, SSRI use

Table 21. *Results of Emotion Regulation Physiology Data Regression Models Predicting Rating of SM Symptom Severity without Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
Resting Baseline					
RSA	-1.28	-1.05	.82	-.18	.20
Neutral Video 1					
RSA	-.69	.56	.82	-.08	.49
Neutral Video 2					
RSA	-1.42	-1.19	.84	-.17	.16
Parent-Child Interaction Task					
RSA	-1.08	-.85	.79	-.15	.29
RSA Reactivity Rest[1]	.31	.34	1.09	.02	.76
RSA Reactivity NV1[2]	1.12	1.17	1.05	.16	.26
Lock Box Task					
RSA	-.44	-.38	.86	-.04	.66
RSA Reactivity Rest[1]	1.02	1.00	.98	.16	.31
RSA Reactivity NV2[2]	1.12	1.17	1.05	.16	.26

Note: RSA= Respiratory Sinus Arrhythmia (ms^2); [1]Reactivity calculated from change score from resting baseline.
[2]Reactivity calculated from change score from neutral video 1 baseline.
[3]Reactivity calculated from change score from neutral video 2 baseline

Figure 3. Mean RSA across Each Task by Group-Study 2.



Note.*p<.05 for between-group effect.

STUDY 3 TABLES AND FIGURES

Table 22. *Missing Data Study 3*

Variable	Count of Missing	Percent Missing
Parent-Child Interaction Task Maternal Positive Affect	0	0%
Parent-Child Interaction Task Maternal Negative Affect	0	0%
Stranger Interaction Task Maternal Helping/Accommodation Behaviors	0	0%
Lock Box Task Maternal Helping Behaviors	0	0%
Parent-Child Interaction Task Maternal Positive Control	0	0%
Parent-Child Interaction Task Maternal Negative Control	0	0%
Parent-Child Interaction Task Conflict	0	0%
Parent-Child Interaction Task Cooperation	0	0%
Parent-Child Interaction Task Reciprocity	0	0%
ATQ Negative Affect Scale	1	1.7%
ATQ Effortful Control Scale	1	1.7%
FMSS Criticism	1	1.7%
FMSS Initial Statement	1	1.7%
FMSS Dissatisfaction	1	1.7%
FMSS Sacrificing/Overprotective	1	1.7%
FMSS Excessive Detail	1	1.7%
FMSS EE Subgroup	1	1.7%
FMSS EE Rating	1	1.7%

Table 23. *Correlation Table Study 3*

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Age	-.02	-.20	-.28*	-.28*	.20	-.35*	-.19	-.35	-.16	-.40*	-.17	.30*	-.03	-.003	.07	.05	.08
2. Ethnicity	1	.27*	.13	.36*	-.06	-.17	-.24	-.09	.10	-.10	-.19	.24	.001	.39*	-.36*	-.08	-.24
3. Medication-Use	.27*	1	.22	.47*	.10	-.20	.11	.19	-.12	.11	.20	.09	.03	.35*	-.25	-.16	.04
4. Total Number of Comorbid Diagnoses	.13	.22	1	.60*	-.10	.18	-.13	.10	.20	.40*	.51*	-.41*	.12	.46*	-.24	.05	-.11
5. SMQ Interference/Distress Subscale	.36*	.47*	.60*	1	-.18	-.001	.20	.42*	-.01	.29*	.25	-.05	-.08	.42*	-.38*	-.09	-.19
6. Parent-Child Interaction Task Maternal Positive Affect	-.06	.10	-.10	-.18	1	-.14	-.05	-.14	.28*	-.35*	-.08	.29*	.51*	-.19	.16	-.05	.20
7. Parent-Child Interaction Task Maternal Negative Affect	-.17	-.20	.18	-.001	-.14	1	.008	.20	-.08	.55*	.18	-.48*	-.05	-.09	.19	.02	.04
8. Stranger Interaction Task Maternal Helping/Accommodation Behaviors	-.24	.11	-.13	.20	-.05	.008	1	.33*	-.26*	.25	.19	-.15	.01	-.05	-.20	.003	.12
9. Lock Box Task Maternal Helping Behaviors	-.09	.10	.10	.42*	-.14	.20	.33*	1	.04	.27*	.10	-.13	-.14	.002	-.20	.11	-.07
10. Parent-Child Interaction Task Maternal Positive Control	.10	-.12	.20	-.01	.28*	-.08	-.26*	.04	1	-.21	-.03	.03	.49*	-.03	.11	-.01	-.10
11. Parent-Child Interaction Task Maternal Negative Control	-.10	.11	.40*	.29*	-.35*	.55*	.25	.27*	-.21	1	.35*	-.57*	-.11	.16	-.03	-.03	-.07
12. Parent-Child Interaction Task Conflict	-.19	.20	.51*	.25	-.08	.18	.19	.10	-.03	.35*	1	-.42*	.08	.08	-.04	-.14	.12
13. Parent-Child Interaction Task Cooperation	.24	.09	-.41*	-.05	.29*	-.48*	-.15	-.13	.03	-.57*	-.42*	1	.02	-.03	-.11	-.05	-.05
14. Parent-Child Interaction Task Reciprocity	.001	.03	.12	-.08	.51*	-.05	.01	-.14	.49*	-.11	.08	.02	1	.02	.07	-.002	.10
15. ATQ Negative Affect Scale	.39*	.35*	.46*	.42*	-.19	-.09	-.05	.002	-.03	.16	.08	-.03	.02	1	-.64*	-.002	-.30*
16. ATQ Effortful Control Scale	-.36*	-.25	-.24	-.38*	.16	.19	-.20	-.20	.11	-.03	-.04	-.11	.07	.64*	1	-.10	.23
17. FMSS Initial Statement	-.08	-.16	.05	-.09	-.05	.02	.003	.11	-.01	-.03	-.14	-.05	-.002	-.002	-.10	1	.03
18. FMSS Relationship	-.24	.04	-.11	-.19	.20	.04	.12	-.07	-.10	-.07	.12	-.05	.10	-.30*	.23	.03	1
19. FMSS Criticism	.27*	.14	.15	.19	-.05	-.06	-.08	-.14	-.03	.06	.09	-.08	.05	.29*	-.07	-.16	-.18
20. FMSS Dissatisfaction	.09	.05	.18	.13	-.25	-.12	-.02	.09	-.13	.12	.32*	-.12	-.15	.19	-.16	-.16	-.17
21. FMSS Statement Attitude	-.13	-.05	.29*	.08	-.28*	.04	-.14	-.01	.03	.15	.03	-.29*	-.22	-.03	.10	-.20	-.02
22. FMSS Sacrificing/Overprotective	.25	-.05	.12	.19	.17	.12	-.09	.04	.13	.01	-.07	.03	-.07	-.05	.02	-.03	.09
23. FMSS Excessive Detail	.004	-.12	-.06	-.11	.03	.03	-.15	-.17	.05	-.05	.02	.19	-.11	-.07	.14	-.26*	-.18
24. FMSS Positive Remarks	-.16	-.13	-.26*	-.34*	.07	.04	.10	-.12	.001	-.16	-.19	-.009	.04	-.22	.12	.32*	.36*
25. FMSS EE Subgroup	.08	.09	.16	.11	-.19	-.04	-.19	-.14	-.05	.03	.18	-.12	-.19	.12	.05	-.27*	-.06
26. FMSS EE Rating	.10	.05	.14	.08	-.16	-.05	-.21	-.19	.06	-.05	.10	-.05	-.13	.06	.11	-.26*	-.14

Table 23 continued.

	19	20	21	22	23	24	25	26
1. Age	.03	.06	-.23*	-.25	.15	.09	-.002	-.06
2. Ethnicity	.27*	.09	-.13	.25	.004	-.16	.08	.10
3. Medication-Use	.14	.05	-.05	-.05	-.12	-.13	.09	.05
4. Total Number of Comorbid Diagnoses	.15	.18	.29*	.12	-.06	-.26*	.16	.14
5. SMQ Interference/Distress Subscale	.19	.13	.08	.19	-.11	-.34*	.11	.08
6. Parent-Child Interaction Task Maternal Positive Affect	-.05	-.25	-.28*	.17	.03	.07	-.19	-.16
7. Parent-Child Interaction Task Maternal Negative Affect	-.06	-.12	.04	.12	.03	.04	-.04	-.05
8. Stranger Interaction Task Maternal Helping/Accommodation Behaviors	-.08	-.02	-.14	-.09	-.15	.10	-.19	-.21
9. Lock Box Task Maternal Helping Behaviors	-.14	.09	-.01	.04	-.17	-.12	-.14	-.19
10. Parent-Child Interaction Task Maternal Positive Control	-.03	-.13	.03	.13	.05	.001	-.05	.06
11. Parent-Child Interaction Task Maternal Negative Control	.06	.12	.15	.01	-.05	-.16	.03	-.05
12. Parent-Child Interaction Task Conflict	.09	.32*	.03	-.07	.02	-.19	.18	.10
13. Parent-Child Interaction Task Cooperation	-.08	-.12	-.29*	.03	.19	-.009	-.12	-.05
14. Parent-Child Interaction Task Reciprocity	.05	-.15	-.22	-.07	-.11	.04	-.19	-.13
15. ATQ Negative Affect Scale	.29*	.19	-.03	-.05	-.07	-.22	.12	.06
16. ATQ Effortful Control Scale	-.07	-.16	.10	.02	.14	.12	.05	.11
17. FMSS Initial Statement	-.16	-.16	-.20	-.03	-.26*	.32*	-.27*	-.26*
18. FMSS Relationship	-.18	-.17	-.02	.09	-.18	.36*	-.06	-.14
19. FMSS Criticism	1	.31*	-.07	.09	-.14	-.23	.44*	.43*
20. FMSS Dissatisfaction	.31*	1	.09	-.13	-.11	-.30*	.27*	.17
21. FMSS Statement Attitude	-.07	.09	1	-.10	.04	.02	.52*	.56*
22. FMSS Sacrificing/Overprotective	.09	-.13	-.10	1	.26*	.008	.12	.14
23. FMSS Excessive Detail	-.14	-.11	.04	.04	1	-.07	.32*	.32*
24. FMSS Positive Remarks	-.23	-.30	.02	.02	-.07	1	-.07	-.04
25. FMSS EE Subgroup	.44*	.27*	.52	.52*	.32*	-.07	1	.92*
26. FMSS EE Rating	.43*	.17	.56*	.56*	.32*	-.04	.92*	1

Note: *$p<.05$

Table 24. *Maternal Emotionality and Behavior Data for TD and SM Participants with Covariates*

Variable	TD	SM	*F* (1,54)/ B(S.E.)	*p*	Partial η^2/ Odds Ratio
ATQ					
Maternal Effortful Control	5.28 (.73)	4.95 (.79)	1.02	.32	.02
Maternal Negative Affect	3.29 (.65)	3.84 (.84)	2.42	.13	.04
Stranger Interaction Task					
Maternal Accommodation/Helping Behaviors	.55 (1.24)	.30 (.92)	.29	.59	.005
Lock Box Task					
Maternal Helping Behaviors	.78 (2.08)	2.20 (2.90)	4.10*	.048	.07
Parent-Child Interaction Task					
Positive Control	3.20 (1.57)	3.95 (1.93)	1.44	.23	.03
Negative Control	1.55 (.85)	1.95 (1.10)	3.54	.07	.06
Maternal Positive Affect	3.53 (1.38)	3.35 (1.14)	.009	.93	.00
Maternal Negative Affect	1.47 (.96)	1.50 (.76)	1.56	.22	.03
Dyad Codes					
Reciprocity	3.40 (1.22)	3.35 (1.50)	2.03	.16	.04
Conflict	1.05 (.22)	1.25 (.55)	4.06*	.049	.07
Cooperation	6.70 (.52)	6.55 (1.00)	.02	.90	.00
FMSS					
Initial Statement	1.10 (1.00)	1.20 (1.01)	1.26	.27	.02
Relationship	1.81 (.56)	1.60 (.82)	.08	.78	.002
Criticism	.22 (.70)	.30 (.57)	1.93	.17	.03
Dissatisfaction (% present)	28.2%	25%	4.62 (2.33)*	.047	101.65
Statement Attitude	.19 (.37)	.40 (.68)	.67	.42	.01
Self-Sacrificing /Overprotective Behavior	.00 (0.00)	.20 (.52)	3.70	.06	.06
Excessive Detail (% present)	12.8%	10%	-.97 (1.58)	.54	.38
Positive Remarks	9.97 (5.78)	7.20 (4.38)	.008	.93	.00
Expressed Emotion Subgroup	2.88 (2.38)	3.70 (2.60)	.04	.85	.001
Expressed Emotion Profile	35.9%	55%	-.03 (1.44)	.99	.98

(%high EE)

Note: TD=typically developing; EE= expressed emotion.*p<.05. Covariates: age, ethnicity, total number of comorbid diagnoses, SSRI use

Table 25. *Maternal Emotionality and Behavior Data for TD and SM Participants without Covariates*

Variable	TD	SM	F (1,58)/ B(S.E.)	p	Partial η^2/ Odds Ratio
ATQ					
Maternal Effortful Control	5.28 (.73)	4.95 (.79)	2.05	.16	.03
Maternal Negative Affect	3.29 (.65)	3.84 (.84)	8.30**	.006	.13
Stranger Interaction Task					
Maternal Accommodation/Helping Behaviors	.55 (1.24)	.30 (.92)	.64	.43	.01
Lock Box Task					
Maternal Helping Behaviors	.78 (2.08)	2.20 (2.90)	4.79*	.03	.08
Parent-Child Interaction Task					
Positive Control	3.20 (1.57)	3.95 (1.93)	2.60	.11	.04
Negative Control	1.55 (.85)	1.95 (1.10)	2.43	.12	.04
Maternal Positive Affect	3.53 (1.38)	3.35 (1.14)	.24	.63	.004
Maternal Negative Affect	1.47 (.96)	1.50 (.76)	.01	.92	.00
Dyad Codes					
Reciprocity	3.40 (1.22)	3.35 (1.50)	.02	.89	.00
Conflict	1.05 (.22)	1.25 (.55)	4.04*	.049	.07
Cooperation	6.70 (.52)	6.55 (1.00)	.59	.44	.01
FMSS					
Initial Statement	1.10 (1.00)	1.20 (1.01)	.19	.70	.003
Relationship	1.81 (.56)	1.60 (.82)	1.04	.31	.02
Criticism	.22 (.70)	.30 (.57)	.31	.58	.005
Dissatisfaction (% present)	28.2%	25%	.20 (.63)	.78	1.22
Statement Attitude	.19 (.37)	.40 (.68)	3.48	.07	.06
Self-Sacrificing /Overprotective Behavior	.00 (0.00)	.20 (.52)	5.60*	.02	.09

Excessive Detail (% present)	12.8%	10%	.37 (.89)	.71	1.40
Positive Remarks	9.97 (5.78)	7.20 (4.38)	3.57	.06	.06
Expressed Emotion Subgroup	2.88 (2.38)	3.70 (2.60)	1.49	.23	.03
Expressed Emotion Profile (%high EE)	35.9%	55%	-.76 (.56)	.18	.47

Note: TD=typically developing; EE= expressed emotion. **p<.01,*p<.05

Table 26. *Results of Maternal Emotionality and Behavior Data Regression Models Predicting Rating of SM Symptom Severity with Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
ATQ					
Maternal Effortful Control	-1.38	-1.16	.84	-.12	.17
Maternal Negative Affect	-.07	-.07	.99	-.04	.95
Stranger Interaction Task					
Maternal Accommodation/Helping Behaviors	3.16**	1.58	.50	.31	.002
Lock Box Task					
Maternal Helping Behaviors	3.63**	.83	.23	.35	<.001
Parent-Child Interaction Task					
Positive Control	-1.05	-.37	.36	-.09	.29
Negative Control	.48	.34	.71	.06	.63
Maternal Positive Affect	-1.29	-.59	.46	-.12	.20
Maternal Negative Affect	-.48	-.35	.74	-.08	.63
Dyad Codes					
Reciprocity	-1.44	-.64	.45	-.13	.15
Conflict	-.45	-.86	1.91	-.05	.65
Cooperation	1.14	1.09	.96	.12	.26
FMSS					
Initial Statement	-.30	-.18	.61	-.01	.76

Relationship	-.64	-.58	.92	-.08	.53
Criticism	.17	.15	.93	.03	.87
Dissatisfaction (% present)	.10	.14	1.40	-.005	.92
Statement Attitude	-.60	-.72	1.20	-.02	.55
Self-Sacrificing /Overprotective Behavior	.30	.59	1.96	.04	.76
Excessive Detail (% present)	-.41	-.74	1.82	-.02	.69
Positive Remarks	-1.19	-.13	.11	-.11	.24
Expressed Emotion Subgroup	-.16	-.04	.24	-.003	.88
Expressed Emotion Profile (%high EE)	-.40	-.47	1.18	-.01	.69

Note: *<.05, **<.01. Covariates: age, ethnicity, total number of comorbid diagnoses, SSRI use

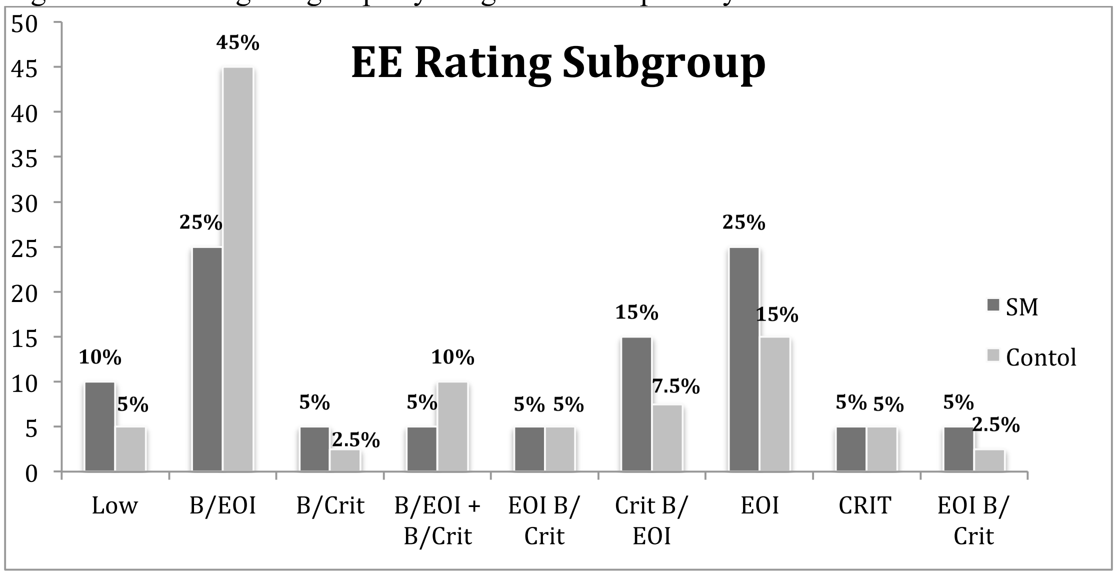
Table 27. *Results of Maternal Emotionality and Behavior Data Regression Models Predicting Rating of SM Symptom Severity without Covariates*

Predictor	*t*	*b*	*SE*	β	*p*
ATQ					
Maternal Effortful Control	-3.02**	-2.85	.94	-.38	.003
Maternal Negative Affect	3.14**	3.01	.96	.42	.002
Stranger Interaction Task					
Maternal Accommodation/Helping Behaviors	1.54	1.04	.67	.20	.12
Lock Box Task					
Maternal Helping Behaviors	3.33**	.98	.29	.42	.001
Parent-Child Interaction Task					
Positive Control	-.08	-.04	.46	-.01	.93
Negative Control	2.17*	1.72	.79	.29	.03
Maternal Positive Affect	-1.27	-.76	.60	-.18	.20
Maternal Negative Affect	.01	.009	.90	-.001	.99
Dyad Codes					

Reciprocity	-.54	-.33	.61	-.08	.59
Conflict	1.90	3.87	2.04	.25	.058
Cooperation	-.41	-.45	1.10	-.05	.68
FMSS					
Initial Statement	-.55	-.44	.80	-.09	.58
Relationship	-1.32	-1.56	1.18	-.19	.19
Criticism	1.51	1.51	1.21	.19	.21
Dissatisfaction (% present)	.85	1.53	1.79	.13	.39
Statement Attitude	.31	.48	1.55	.08	.76
Self-Sacrificing /Overprotective Behavior	1.38	3.41	2.48	.19	.17
Excessive Detail (% present)	-.87	-2.08	2.38	-.11	.38
Positive Remarks	-2.44*	-.34	.14	-.34	.02
Expressed Emotion Subgroup	.81	.26	.32	.11	.42
Expressed Emotion Profile (%high EE)	.49	.78	1.58	.08	.62

Note: *<.05, **<.01. Covariates: age, ethnicity, total number of comorbid diagnoses, SSRI use

Figure 4. EE Rating Subgroups by Diagnostic Group-Study 3



Note: Crit=critical: negative initial statement or negative relationship or 1 or more criticism; EOI= emotional over-involvement: self-sacrificing/overprotective behavior or 2 of excessive detail about past, one or more statements of attitude or five or more positive remarks (excessive praise); Low=No critical, emotional over-involvement or borderline ratings; B/EOI= borderline emotional over-involvement: one or more statements of attitude, borderline self-sacrificing/overprotective/lack of objectivity, excess detail about the past or five or more positive remarks; B/Crit= borderline critical: one or more statements of dissatisfaction are present; B/EOI + B/Crit= combination of borderline emotional over-involvement and borderline critical; EOI B/Crit= combination of emotional over-involvement and borderline critical; Crit B/EOI= combination of borderline critical and emotional over-involvement; EOI B/Crit= combination of borderline emotional over-involvement and critical

APPENDIX A

PARCHISY CODES

- **Positive content (control): Use of praise, explanation, and open-ended questions**
  1) **No positive control shown**
  2) **One or two instances of positive control**
  3) **A few/several instances of positive control; reliance on explicit directions ("up, down, stop")**
  4) **Moderate amounts of positive control shown; reliance on explicit directions with at least one instance of praise, explanation, or questioning**
  5) **Two or more instances of explanation, questioning, and praise with some explicit directions**
  6) **Substantial use of explanation, questioning, and praise, and few explicit directions; only one or two instances of non-positive control shown**
  7) **Exclusive use of explanation, questioning, and praise**

- **Negative content (control): Use of physical control of dials or child's hand/arm/body, use of criticism; (Physical control of dials or child's body must be with intention, not accidental or momentary. Touching a dial, for instance, is not necessarily an instance of negative control- touching the dial and turning it implies intention, and would be coded as an instance of negative control, even if it was very quickly done).**
  1) **No negative control shown**
  2) **One or two instances of negative control**
  3) **A few/several instances of negative control**
  4) **Moderate amounts of negative control: reliance on critical comments ("no, don't do that"), and/or manipulation of dials**
  5) **Negative control used for more than half of the interaction**
  6) **Substantial use of criticism, and physically "taking over" task; only a few instances of non-negative control shown**
  7) **Exclusive use of criticism (can include shaming) and physical control of dials and/or child's hand/arm/body; may include instances of corporal punishment**

- **Positive affect (warmth): smiling, laughing**
  1) **No positive affect displayed**
  2) **One or two instances of positive affect**
  3) **A few/several instances of positive affect**
  4) **Moderate amounts of positive affect- smiling, laughing for about half of the interaction**
  5) **Positive affect for more than half of interaction**

6) **Substantial amounts of positive affect; only one or two instances of non-positive affect**
7) **Constant positive affect- smiling and laughing throughout the task**

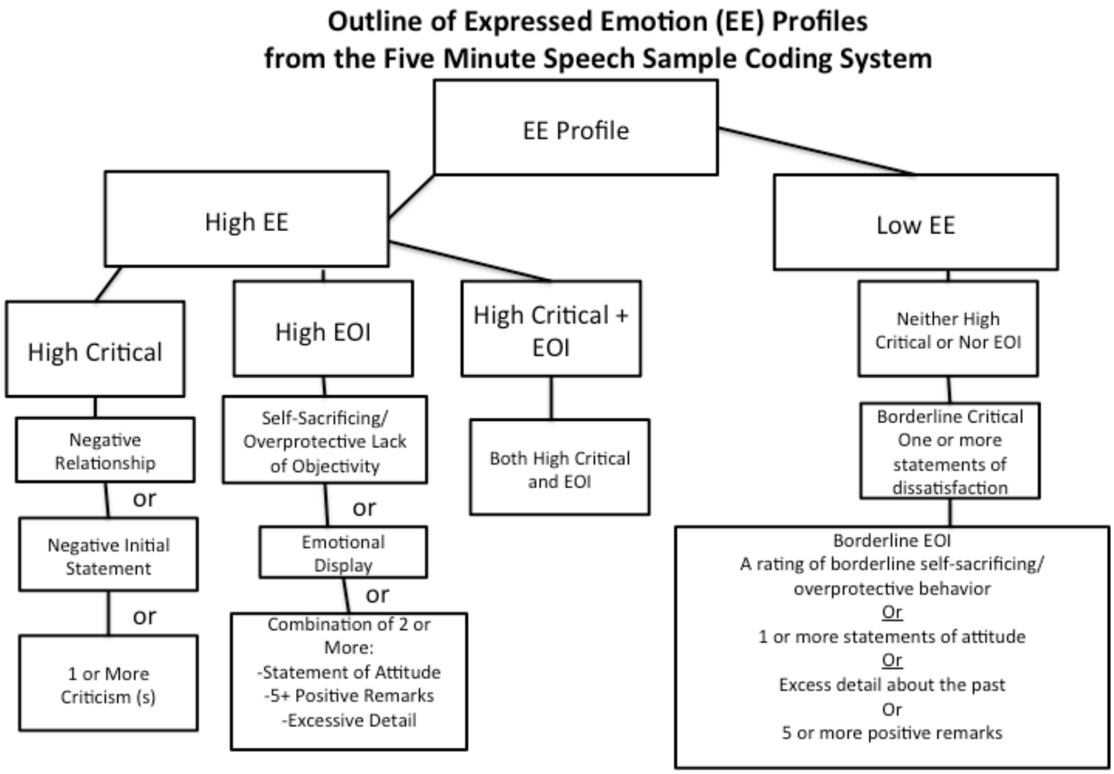
- **Negative affect- rejection: frowning, cold/harsh voice**
  1) **No negative affect displayed**
  2) **One or two instances of negative affect**
  3) **A few/several instances of negative affect**
  4) **Moderate amounts of negative affect- frowning, stern looking, harsh/cold voice for about half of the interaction**
  5) **Negative affect for more than half of the interaction**
  6) **Substantial amounts of negative affect; only one or two instances of non-negative affect**
  7) **Constant negative affect- always scowling/frowning, voice always in harsh tones**

- **Reciprocity- shared positive affect, eye contact a "turn taking" (i.e., conversation-like) quality of interaction**
  1) **No evidence of reciprocity**
  2) **One or two instances of reciprocity- either shared affect or eye contact**
  3) **A few/several instances of reciprocity (either shared affect or eye contact)**
  4) **Moderate levels of reciprocity; evidence of both shared affect and eye contact; some evidence of "conversation-like" interaction**
  5) **Clear evidence of reciprocity; one or two episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns" between mother and child**
  6) **Substantial reciprocity involving numerous episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns"; only one or two instances of non-reciprocity**
  7) **Highly integrated and reciprocal- constant shared positive affect and eye contact that never loses "turn taking" quality**

- **Conflict minor or major disagreement- mutual or shared negative affect; arguing; tussling over toy, etc.**
  1) **No evidence of conflict during task**
  2) **One or two instances of conflict**
  3) **A few/several instances of conflict**
  4) **Moderate amounts of conflict- about half of interaction is conflictual**
  5) **Conflicted interaction throughout, with a few/several instances of no conflict**
  6) **Substantial conflict throughout, with only one or two instances of no conflict**
  7) **Highly conflicted interaction for entire task**

- **Cooperation- defined as explicit agreement and discussion, about how to proceed with and complete task (e.g., "Shall we do this next?" and child says "Yes")**
  1) **No evidence of cooperation during the task**
  2) **One or two instances of cooperation**
  3) **A few/several instances of cooperation**
  4) **Moderate amounts of cooperation- appears during about half of interaction**
  5) **Cooperative interaction throughout, with a few/several instances of lack of explicit cooperation**
  6) **Substantial cooperation throughout, with only one or two instances of lack of explicit cooperation**
  7) **Highly cooperative interaction for entire task**

APPENDIX B


Outline of Expressed Emotion (EE) Profiles
from the Five Minute Speech Sample Coding System
EE Profile
High EE
Low EE
High Critical
High EOI
High Critical + EOI
Neither High Critical or Nor EOI
Negative Relationship
or
Negative Initial Statement
or
1 or More Criticism (s)
Self-Sacrificing/ Overprotective Lack of Objectivity
or
Emotional Display
or
Combination of 2 or More:
-Statement of Attitude
-5+ Positive Remarks
-Excessive Detail
Both High Critical and EOI
Borderline Critical
One or more statements of dissatisfaction
Borderline EOI
A rating of borderline self-sacrificing/ overprotective behavior
Or
1 or more statements of attitude
Or
Excess detail about the past
Or
5 or more positive remarks

VITA

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EDUCATION

2009-2012	B.S. Psychology Florida State University
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SELECT PUBLICATIONS AND PRESENTATIONS

Morris, S.S.J., Musser, E.D., Tenenbaum, R.B., Ward, A.R., Martinez, J., Raiker, J.S., Coles, E.K., & Riopelle, C. (in-press). Emotion regulation via the autonomic nervous system in children with attention-deficit/hyperactivity disorder (ADHD): Replication and extension. *Journal of Abnormal Child Psychology*.

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