



Preschoolers' psychophysiological responses to mood induction tasks moderate the intergenerational transmission of internalizing problems



Molly Davis*, Cynthia Suveg, Monica Whitehead, Anna Jones, Anne Shaffer

Department of Psychology, University of Georgia, Athens, GA 30602-3013, United States

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ABSTRACT

To identify factors that can both exacerbate risk for, and protect against, internalizing problems during early childhood, the present study examined whether children's respiratory sinus arrhythmia (RSA) suppression in response to emotionally-laden film clips would moderate the association between maternal and child anxious/depressive symptoms in a cross-sectional sample of 108 mothers (M age = 30.68 years, SD = 6.06) and their preschool-age children (M age = 3.50 years, SD = 0.52, 61.30% male). Results indicated that RSA suppression in response to the fear clip moderated the positive association between maternal and child anxious/depressive symptoms, such that higher suppression served a protective-stabilizing function while lower suppression exacerbated children's risk for internalizing symptoms in the context of higher maternal symptoms. Moderation findings involving RSA suppression in response to a happiness-inducing clip were consistent with biological sensitivity to context; the association between maternal and child symptoms was strongest for children higher in suppression.

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1. Introduction

Extensive empirical and theoretical work has supported the link between maternal and child psychopathology, particularly in regard to internalizing symptoms and disorders (Goodman & Gotlib, 1999; McClure, Brennan, Hammen, & Le Brocque, 2001; Silk, Shaw, Forbes, Lane, & Kovacs, 2006). Yet, not all children at familial risk for the development of psychopathology ultimately exhibit socioemotional difficulties (Masten & Coatsworth, 1998; Masten, 2001). Therefore, there is a persistent need to examine variables that may confer further risk for, or protect against, maladjustment during early childhood. Children's physiological regulation, often measured via respiratory sinus arrhythmia (RSA) suppression (i.e., decreases in RSA from a resting state to a challenge task; Calkins, 2007), may be one promising moderator to consider given that greater RSA suppression has been found to protect against maladjustment in the context of environmental risk whereas lower RSA suppression may exacerbate risk for adverse outcomes (e.g., El-Sheikh, 2001; McLaughlin, Alves, & Sheridan, 2014). Thus, the present study examined whether child RSA suppression in response to emotion-inducing video clips

moderates the relation between mothers' and preschoolers' anxious/depressive symptoms to demonstrate whether physiological functioning under emotionally-laden conditions can impact the intergenerational transmission of internalizing symptoms. Understanding factors that can both confer risk for, and buffer against, the onset of internalizing symptoms during the preschool period is critical given that problems in these domains can persist into later development (Luby, Si, Belden, Tandon, & Spitznagel, 2009; Mesman & Koot, 2001).

1.1. The role of child RSA suppression in the intergenerational transmission of risk

RSA change is a parasympathetic nervous system process governed by the vagus nerve (Porges, 2007) and is measured in terms of RSA suppression (the removal of vagal influence) or RSA augmentation (increased vagal influence) in the extant literature (e.g., Hinnant & El-Sheikh, 2009). RSA suppression has most often been conceptualized as being synonymous with vagal regulation (e.g., El-Sheikh & Whitson, 2006; Graziano, Keane, & Calkins, 2007; McLaughlin et al., 2014) and, given the present manuscript's focus on physiological regulation, we use this term throughout to describe the extent to which RSA decreased from a resting period to a challenge task (Calkins, Graziano, Berdan, Keane, & Degnan, 2008). To be sure, this does not mean that all children in the stud-

* Corresponding author.

E-mail address: mfdavis2@uga.edu (M. Davis).

ies reviewed hereafter exhibited suppression, or that all children in the current sample demonstrated decreases in RSA. Rather, this term is used to describe a continuum of RSA change scores, with higher, more positive scores indicating a greater decline from a resting state to a task and therefore, greater regulation.

RSA suppression has been linked to indices of both adaptive and maladaptive functioning (Calkins & Keane, 2004; Calkins, Graziano, & Keane, 2007; Fortunato, Gatzke-Kopp, & Ram, 2013; Gentzler, Santucci, Kovacs, & Fox, 2009). These disparate findings suggest that examining bivariate relations between RSA suppression and internalizing problems is likely to yield an incomplete snapshot of this association; RSA suppression should instead be examined in context. Theory on vagal tone more broadly can help to shed light on the ways in which context matters when considering the role of child RSA suppression in indices of adjustment and maladjustment. According to Porges' Polyvagal Theory (Porges, 2007), vagal withdrawal promotes fight and flight behaviors. Thus, because decreases in RSA in response to a challenge can signify the ability to cope effectively during demanding situations (for a review, see Calkins, 2007), higher RSA suppression might be especially important for promoting adjustment in the context of higher levels of risk. In a low-risk context, such decreases in RSA are unnecessary and can contribute to maladaptation (Hastings et al., 2008). In line with this view, excessive vagal withdrawal has been deemed a "nonspecific marker of emotional lability" (p. 198, Beauchaine, 2001). In sum, it is critical to examine child RSA suppression in context.

Overall, research examining child RSA suppression as a moderator of the links between adverse environmental conditions and children's psychosocial functioning has garnered support for two primary conceptualizations of higher RSA suppression, with some researchers reporting results consistent with the biological sensitivity to context theory (e.g., Obradović, Bush, Stamperdahl, Adler, & Boyce, 2010; Shanahan, Calkins, Keane, Kelleher, & Suffness, 2014) and others illustrating that higher RSA suppression serves a protective function in the context of environmental risk (e.g., El-Sheikh, Erath, & Keller, 2007; El-Sheikh & Whitson, 2006; McLaughlin et al., 2014). The biological sensitivity to context theory posits that children who exhibit high levels of biological reactivity thrive under positive environmental conditions but experience the worst psychological and physical health outcomes in the context of adversity (Boyce & Ellis, 2005). Alternatively, research from a traditional risk/protective framework has indicated that whereas lower RSA suppression serves as a risk factor for child maladjustment, greater RSA suppression may buffer against adjustment problems (e.g., El-Sheikh & Whitson, 2006). For instance, RSA suppression has been found to moderate the concurrent relation between marital conflict and children's internalizing problems among elementary school children such that the positive association between marital conflict and child internalizing problems was only found for children lower in RSA suppression (El-Sheikh & Whitson, 2006). Furthermore, longitudinal results suggested that greater RSA suppression continued to serve a protective function for girls in the context of increased marital conflict when internalizing problems were measured 2 years later (El-Sheikh & Whitson, 2006). Obradović, Bush, and Boyce (2011) posit that the divergent interaction patterns involving children's autonomic nervous system reactivity found across the extant literature may be, at least in part, due to differences in the lab tasks employed to measure such reactivity. In this study, Obradović et al. (2011) defined higher RSA reactivity as lower RSA during a challenge than would be expected given the child's baseline RSA and the sample's regression line. Thus, this construct is akin to RSA suppression. The authors concluded that traditional biological sensitivity to context patterns may be specific to studies that employ a cognitive challenge task (e.g., a digit span task in which children receive corrective feedback for errors). Alternatively, interpersonal challenge tasks (e.g., watching an emotionally-evocative film clip of a child

being bullied) may yield opposite findings in which environmental risk has no impact on child adjustment problems for children higher in RSA suppression (Obradović et al., 2011). Though helpful in beginning to explain the discrepant moderation findings involving child RSA suppression, these explanations leave unanswered questions about mood induction tasks that are neither interpersonally- or cognitively-focused, suggesting this is an area ripe for further investigation.

Of note, recent meta-analytic findings revealed a marginally significant impact of the type of challenge task employed on the average weighted effect size for the correlation between RSA suppression and child adjustment problems (i.e., internalizing, externalizing, social, and cognitive/academic problems; Graziano & Derefinco, 2013). Specifically, the magnitude of the negative correlation between RSA suppression and child adjustment problems was stronger for studies that used a negative mood/stressor task compared to studies using a cognitive task to calculate RSA suppression. The authors concluded that negative mood/stressor tasks may be "tapping a key element of RSA withdrawal that elucidates its influence on adaptive outcomes" (p. 27, Graziano & Derefinco, 2013). Therefore, examining child RSA suppression in response to negative mood induction tasks may be particularly informative for understanding the joint effects of maternal psychopathology and child RSA suppression on child adjustment problems.

In line with the field's growing emphasis on the need to consider RSA in context, recent research has examined how child RSA suppression is implicated in the links between maternal psychopathology and child adjustment (e.g., Blandon, Calkins, Keane, & O'Brien, 2008). Because RSA suppression (i.e., vagal withdrawal) reflects one's capacity to manage environmental challenges (for a review, see Calkins, 2007; Porges, 1995), studying RSA suppression as a moderator of the association between maternal and child anxious/depressive symptoms may be particularly informative for elucidating how children's regulation at a physiological level plays a role in child adjustment under conditions of environmental risk. To date, the limited research that has examined child RSA suppression as a moderator of the association between maternal psychopathology and child adjustment has yielded mixed findings. For instance, Blandon et al. (2008) demonstrated that the interaction between mothers' depression symptoms and children's RSA suppression did not significantly predict children's emotion regulation or negativity trajectories from ages 4 to 7, nor did this interaction predict levels of emotion regulation or negativity at age 7. However, marginally significant moderation findings indicated that the positive association between maternal depression and child negativity at age 7 was stronger for children higher in RSA suppression (Blandon et al., 2008). Using data from the same larger study as Blandon et al. (2008), Shanahan et al. (2014) explicitly examined the joint contributions of maternal internalizing symptoms and child RSA suppression to children's internalizing symptoms from ages 4 to 10 years old, demonstrating that higher RSA suppression was positively associated with children's internalizing symptoms between the ages of 4–7, but not after age 7, when maternal internalizing symptoms were above the median. However, RSA suppression was not significantly associated with child internalizing symptoms when mothers scored below the median on internalizing symptoms. Importantly, the measures of RSA suppression that Shanahan et al. (2014) relied on for testing interactions used between-persons estimates because the within-persons values were generally not significantly associated with child internalizing problems. Additionally, Shanahan et al. (2014) oversampled children with externalizing problems, suggesting it is important to investigate similar research questions in more representative community samples to enhance generalizability. Thus, further research is needed to clarify how the interplay between

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