Risk for Child Psychopathology Across Development: The Role of Paternal Internalizing Symptoms and Child Self-Regulation

by

Kelsie Slater

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Department of Educational Psychology

University of Alberta

Abstract

Dramatic increases in anxiety, depression, and behavioral problems have been documented during the transition from middle childhood to early adolescence (Merikangas et al., 2010; Twenge et al., 2020). Therefore, developmental psychopathologists are continually trying to understand factors that confer risk or resilience to facilitate early intervention and prevention efforts (Cicchetti & Rogosh, 2022). Although fathers exert a significant influence on older children and adolescents (Wilson & Durbin, 2010), there is only a limited understanding of how anxiety and depression in fathers influence maladaptation in youth. Additionally, extant literature suggests that children's ability to self-regulate may protect or enhance risk for maladaptation during this time (Eisenberg, 2010; Nigg, 2017), however, no studies known to me have examined how interactions between paternal internalizing symptoms and child SR influence child mental health. Thus, using longitudinal data from the Adolescent Brain and Cognitive Development Study (ABCD Study®), the current study adopted a multi-method, multi-informant, longitudinal design combined with a rigorous statistical approach to understand how internalizing symptoms in fathers interact with child SR to predict later externalizing and internalizing symptoms in youth. Results indicated that paternal internalizing problems positively predicted youth internalizing symptoms over time. Further, children of fathers with elevated internalizing problems and weak top-down SR skills were at a higher risk of later internalizing symptoms. Paternal internalizing problems did not significantly predict child externalizing symptoms, though results demonstrated that poor top-down SR is a particularly salient risk factor for externalizing problems regardless of paternal symptoms. Important implications for research and early intervention efforts targeting paternal mental health and child SR were discussed.

Preface

The current study is original research by Kelsie Slater. No part of this thesis has been previously published. Data in the current study was obtained from a larger, ongoing longitudinal study (the Adolescent Brain and Cognitive Development Study; ABCD Study®), in the United States held in the National Institute of Mental Health archive. A data use agreement was obtained in January, 2023.

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Introduction

Middle childhood (age range 6-10) to early adolescence (age range 11-14) is a significant transitional period for youth, with changes happening at many levels of functioning (Eccles, 2007). During this time, hormonal, neurocognitive, and physical maturation may result in higher levels of emotional instability and increased vulnerability to psychopathology (Kessler et al., 2007). Psychopathology in youth, broadly characterized by symptoms across empirically derived internalizing and externalizing spectra, is significantly influenced by parents' own mental health (Goodman et al., 2008). To date, research has consistently established that maternal internalizing problems confer risk for child maladaptation across development, though limited studies have explored the risk conferred by paternal internalizing symptoms (Wilson & Durbin, 2010). At the same time, children's individual differences in self-regulation (SR), or their ability to engage in goal-directed behavior, also plays an important role in emerging psychopathology, as it is significantly related to adaptive outcomes across development (Goodman et al., 2008; Wade et al., 2020). To date, almost no studies have explored whether children's SR skills serve as a risk or protective factor for emerging psychopathology in the context of fathers' internalizing problems (Sweeney & Macbeth, 2016), which has significant implications for prevention and early intervention efforts. As such, the current study aimed to understand how internalizing symptoms in fathers and child SR interact to predict internalizing and externalizing psychopathology in youth across middle childhood and early adolescence using a longitudinal, multi-method, multi-informant study design combined with a rigorous statistical approach.

Psychopathology Across Development: Definition, Prevalence Rates, and Societal Costs

The prevalence of mental health problems in youth has been rising at an alarming rate for

the last 20 years (Twenge et al., 2020), with approximately 50% of youth meeting diagnostic criteria for mental health disorders before age 14 (Kessler et al., 2005; Kessler & Wang, 2008). Additionally, symptoms of anxiety, depression, and disruptive behavioral problems often peak in adolescence (Merikangas et al., 2010). This marked increase in child psychopathology suggests that the developmental period before adolescence (i.e., age 9 to 13: middle childhood to early adolescence) may be an important target for research to understand risk factors across development. At the same time, the rise in prevalence of psychopathology is not well understood, as it is likely due to an interplay between various factors, including greater mental health literacy (Jorm et al., 2021), access to social media heightening incidences of cyberbullying and social comparison (Twenge et al., 2020), increased academic and social pressures (Galloway et al., 2013), a rise in overprotective parenting negatively impacting children's development of autonomy and resilience (Schiffrin et al., 2014), and the 2020-2022 COVID-19 pandemic (Cost et al., 2022). For instance, the COVID-19 pandemic was a period of significant stress and uncertainty for youth. In particular, continuous educational disruptions, fear of illness, and social isolation exacerbated rates of mental health problems across childhood, resulting in a marked 127% increase in rates of anxiety, 240% increase in depression (Cost et al., 2022; Racine et al., 2021), and a 275% increase in behavioral problems relative to pre-pandemic rates (Cost et al., 2022; Racine et al., 2021). As such, there is a significant need to support youth across development, and given that middle childhood to early adolescence is a significant period of stress and transition, research targeting this age group is necessary for early intervention and prevention efforts.

Given the alarming rates of psychopathology in youth, developmental psychopathologists have made extensive efforts to understand the structure and classification of psychopathology

across development. In particular, due the limitations of the *DSM*-based categorical, polythetic system of classification of mental disorders (i.e., excessive between-disorder comorbidity, within-disorder heterogeneity, and low reliability of diagnostic categories, to name a few), extensive efforts have taken place to examine the structure of psychopathology using rigorous empirical methods (e.g., Kotov et al., 2017). Specifically, factor analytic methods suggest that mental health symptoms assessed across the lifespan can be combined into several broad dimensions, but externalizing (i.e., disruptive behavior disorders) and internalizing (i.e., depressive disorders, anxiety disorders) spectra are particularly relevant for describing child and adolescent psychopathology (Achenbach et al., 2016). In particular, the internalizing spectrum is characterized by overcontrolled behaviors and negative emotions (i.e., fear, anger, sadness) directed inward towards the self, and symptoms may manifest as anxiety, depression, somatic complaints, social withdrawal, or low self-esteem (Achenbach et al., 2016). On the other hand, the externalizing spectrum is characterized by undercontrolled behaviors and negative emotions outwardly directed towards the external environment and others, and symptoms may manifest as aggression, defiance, rule-breaking behavior, risk-taking, impulsivity, hyperactivity, or substance use problems (Achenbach et al., 2016).

Internalizing problems rise dramatically during the transition from middle childhood (before age 10) to early adolescence (age 11 to 14), with anxiety disorders representing the most common problem marked by an increase from 4.2% to 7.8%, and depressive disorders rising from 1.1% to 5.2%, respectively (Georgiades et al., 2019; Merikangas et al., 2010). Externalizing disorders (i.e., conduct disorder, oppositional defiant disorder, attention-deficit hyperactivity disorder) represent the second most common mental health concern in youth, as 9.6% of youth meet diagnostic criteria by age 11 (Merikangas et al., 2010). Specifically, rule-breaking behavior

(Bongers et al., 2004), sensation seeking behaviors (Steinberg et al, 2008), and impulsive behaviors (Galvin et al., 2007) tend to peak between the ages of 10 to 15. Given the high prevalence rates of psychopathology during middle childhood and early adolescence, it is well established that the earlier symptoms manifest, the more likely a person may experience lifelong impairments marked by drastic societal costs (Kessler et al., 2005). For instance, in Canada, treatment for adolescent psychopathology has been estimated to cost up to $50 billion annually (Lim et al., 2008). When left untreated, psychopathology heightens risk of suicide and lifelong impairments across health, social, educational, and occupational domains (Smetanin et al., 2011). Indeed, suicide was the leading cause of death in youth aged 10 to 14 in 2018 (Statistics Canada, 2020), highlighting a need for further understanding of the risk factors associated with psychopathology and timely prevention. Thus, establishing a thorough understanding of risk factors for psychopathology before symptoms peak in adolescence (i.e., during the ages of 9 to 13), is paramount for prevention and early intervention.

Risk Factors for Child Psychopathology

From a developmental perspective, risk for psychopathology involves complex interactions between biological, psychological, and environmental factors dependent on individual context (Cicchetti & Rogosh, 2022). Rooted in developmental psychopathology, the Research Domain Criteria (RDoC) framework, initiated by the National Institute of Mental Health (NIMH), was created to advance a dimensional approach to understanding risk factors for maladaptation across development (NIMH, 2023). This framework integrates multiple levels of analysis (i.e., genes, molecules, neurology, physiology, behavior, self-report) to understand mental health problems with the goal of developing effective, targeted interventions. Consistent with the RDoC framework, there are many, multifaceted factors that can confer risk for

psychopathology across child development.

In particular, biological transitions from middle childhood to early adolescence, such as rapid brain development (particularly in the prefrontal cortex; PFC), can lead to heightened emotional reactivity, which may limit children's ability to engage in goal-directed behavior, manifesting as deficits in SR (Casey et al., 2008; Nigg, 2017). Indeed, gaps in emotional, cognitive, and behavioral SR domains have been consistently established as transdiagnostic risk factors for the internalizing and externalizing spectra (Casey et al., 2008). Additionally, familial environment can also significantly increase risk for child maladaptation across development (Goodman et al., 2008). Currently, the role of anxiety and depression in mothers has been well established, though fathers remain understudied (i.e., Goodman et al., 2008; Goodman et al., 2011; Kane & Garber, 2009; Wilson & Durbin, 2010). However, extant literature suggests that negative parenting behaviors and coping strategies expressed by fathers with internalizing problems may model maladaptation for youth, particularly in middle childhood to early adolescence (McLaughlin et al., 2012; Sweeney & Macbeth, 2016).

Paternal Psychopathology as a Risk Factor For Child Psychopathology

Relevance of Fathers

Parenting is a cornerstone for adaptive child development. From infancy through adolescence, children rely on their parents to provide physical care, emotional support, and scaffolding to prepare them to navigate life independently (Goodman et al., 2008; Kopp, 1982). Across child development, parents who are emotionally responsive, consistent, supportive, and warm tend to model adaptive self-regulatory skills in their children, reinforcing children's ability to self-soothe and regulate independently during times of stress (Trussel et al., 2018). However, the influence of fathers relative to mothers has been relatively underemphasized by

developmental psychopathologists. The relative underemphasis on fathers is problematic, because they play a substantial role in modeling behaviors crucial for adaptive child development, particularly during middle childhood to early adolescence (Kane & Garber, 2009; Kiss et al., 2014). Specifically, fathers play a substantial role in supporting children's exploration, autonomy, and navigation of peer relationships over and above mothers (Bögels & Phares, 2008). Notably, in middle childhood to adolescence, youth naturally look to their fathers for cues on how to respond across new social and novel situations, suggesting that fathers' reactions to new people, experiences, and events may have a more significant impact on child behavior than mothers during this important transitional period (Bögels & Perotti, 2011).

Despite the important role fathers exert on child development, approximately 21% of fathers experience an episode of depression at least once before their child reaches 12 years of age (Dave et al., 2010; Kiss et al., 2014). Prevalence rates of anxiety in fathers during middle childhood to early adolescence of their offspring are unclear; however, extant literature suggests approximately 4.1%-16.0% of fathers experience anxiety during the prenatal period, while 2.4-18% experience anxiety during the postnatal period (Leach et al., 2016). Despite these high prevalence rates, understanding the effect of paternal internalizing problems on youth mental health has been impeded for several reasons. First, research on child development has historically focused on mothers, as they are often viewed as primary caregivers who are more influential in children's lives (Lamb, 2010; Phares, 1992). Second, fathers are often perceived to be less involved or less important to overall child development, leading to challenges for recruiting them particularly in the context of longitudinal research studies (Phares et al., 2005; Pleck, 2010). Such an underappreciation of the role of fathers in parenting has led to a significant gap in understanding of paternal influences on child mental health (Cabrera et al., 2018),

particularly in the context of fathers with elevated internalizing problems. Thus, there is a notable need to further investigate how internalizing psychopathology in fathers can interfere with child development, causing maladaptation, particularly during the important period of middle childhood to early adolescence.

Impact of Paternal Internalizing Psychopathology on Youth Mental Health

Extant literature has consistently demonstrated that maternal anxiety and depression have profound negative effects on children's neurocognitive, emotional, behavioral, and social development, significantly increasing the risk of both internalizing and externalizing problems in offspring (Goodman et al., 2008). This association is particularly robust for depression, with strong and consistent relations observed between maternal depression and depressive symptoms in children (Goodman et al., 2011). In light of the extensive research on maternal influences, recent efforts have expanded the field of developmental psychopathology by investigating the impact of paternal depression and anxiety on child development (Wilson & Durbin, 2010). In particular, extant literature indicates that the impact of maternal anxiety and depression may have more pronounced effects in early childhood, while fathers' influence may be more pronounced during middle childhood to adolescence due to their increased role during that time (Kane & Garber, 2009; Ramchandani et al., 2008; Ramchandani & Psychogiou, 2009).

Research on paternal influences on child development has gained momentum in recent years. To date, the majority of research has evaluated the impact of paternal anxiety and depression during postnatal and early childhood years, which have been found to predict internalizing and externalizing problems in youth up to 8 years old (Kiss et al., 2014; Ramchandani et al., 2008). Studies extending this work into later stages of child development have found that paternal internalizing problems predict both internalizing and externalizing

symptoms in youth over 12 years old, highlighting that fathers play an important role in emerging psychopathology across development (Reeb et al., 2010; Wickersham et al., 2020; Wilson & Durbin, 2010). Indeed, large-scale meta-analytic reviews have reported that paternal anxiety and depression notably predict child mental health across development, with effects ranging from small to moderate for internalizing problems (Bögel & Phares, 2008; Reeb et al., 2010; Sweeney & Macbeth, 2016) and small for externalizing problems (Reeb et al., 2010; Sweeney & Macbeth, 2016).

Although recent efforts have highlighted the important role of fathers in child development, the pathways underlying these associations are poorly understood, as they are influenced by a complex interplay of various factors at different levels of analysis. For example, internalizing problems in youth are heavily influenced by genetic heritability of depression and anxiety (i.e., 30-40% of the variance in child internalizing problems is accounted for by genetic factors), and children who have anxious or depressed parents are 2-3 times more likely to experience internalizing problems relative to children with psychologically healthy parents (Flint & Kendler, 2014; Smoller et al., 2009). Further, similar to mothers, fathers with elevated internalizing symptoms may inadvertently create an unhealthy familial environment for their offspring due to negative parenting practices (Wilson & Durbin, 2010). However, significantly less research is available on the unique ways in which fathers' internalizing symptoms may impact their children, and very few studies have made an attempt to address this significant gap in the literature (Wilson & Durbin, 2010).

In particular, extant literature suggests that fathers who are anxious are more likely to engage in safety behaviors, making them more intrusive, controlling (Teetsel et al., 2014), and at times rejecting towards their offspring (Bögels & Phares, 2008) over and above anxious mothers.

Through modeling, these behaviors may translate into similar behaviors in youth, increasing risk for overcontrolled behaviors marked by anxiety, depression, withdrawal, and self-esteem difficulties that impede their ability to cope with adversity (Goodman et al., 2008). At the same time, depressed mothers may show high levels of withdrawal and disengagement towards their offspring (Lovejoy et al., 2000), and this association has been extended to fathers as well (Wilson & Durbin, 2010). However, fathers' depression in particular may also manifest as heightened irritability, hostility (Ramchandani et al., 2011), reduced play and social engagement, lower levels of emotional support (Sethna et al., 2015), consequently enhancing the risk for internalizing or externalizing problems in youth (Sweeney & Macbeth, 2016).

Additionally, depressed fathers' heightened stress and irritability in response to their children increase the likelihood of hostile discipline strategies (i.e., spanking, yelling) and parent-child conflict (Bronte-Tinkew et al., 2007; Fletcher et al., 2006; Fletcher et al., 2020) over and above the influence of mothers. Heightened parent-child conflict due to negative parenting behaviors is strongly associated with higher rates of externalizing problems in youth, including conduct problems, attention problems, hyperactivity, oppositional, and antisocial behavior (Fletcher et al., 2020; Sweeney & Macbeth, 2016). Children may be more likely to respond to such hostile parenting behaviors with frustration by displaying similar patterns of behavior, including impulsive, aggressive, or rule-breaking behavior to cope with negative emotions (Fletcher et al., 2004). Overall, hostile parenting practices of depressed fathers can significantly increase the risk of externalizing and likely internalizing problems in children across development, though this pathway requires further investigation due to the paucity of extant studies (Sweeney & Macbeth, 2016; Wilson & Durbin, 2010).

Taken together, the specific mechanisms by which paternal anxiety and depression

contribute to either internalizing or externalizing problems in youth remain poorly understood (Fletcher et al., 2006; Reeb et al., 2010; Sweeney & Macbeth, 2016), highlighting a significant gap in the extant literature pertaining to the effects of fathers' mental health on child development. In addition to underrepresentation of fathers, research on these pathways has been further impeded due to small sample sizes that tend to focus on early childhood and cross-sectional studies, failing to provide generalizable results (Goodman et al., 2008). Thus, one of the goals of this study was to clarify the role of paternal anxiety and depression for maladaptation (both internalizing and externalizing symptoms) across an important developmental period, middle childhood to early adolescence. Further, given that internalizing and externalizing problems often involve self-regulatory deficits influenced by an array of factors at different levels of analyses (i.e., genetic disposition, temperament, familial, peer, and school influences; Bridgett et al., 2015; Nigg, 2006; Nigg, 2017), the aim of the current study was to investigate how children's capacity to self-regulate moderates this association (i.e., would child SR protect or enhance the risk for child psychopathology in the context of elevated paternal internalizing symptoms?)

Child Self-Regulation: Relevance to Child Development

Conceptualizations Across Development

Children's ability to engage in SR, or goal-directed behavior, has important implications for their developmental outcomes (Nigg, 2017; Wade et al., 2020). SR skills represent children's ability to adjust their mental and physiological states for the purpose of adapting to context and responding in a socially appropriate manner. Adaptive SR is associated with the ability to organize, plan, and persist through tasks (Zimmerman, 2000). It is fundamental to adaptive functioning across the lifespan and closely associated with positive adjustment, school

achievement, social functioning, as well as occupational and academic success (Diamond, 2013; Nigg, 2017; Zhou et al., 2012). SR skill development is influenced by many factors at different levels of analysis (Bridgett et al., 2015; Nigg, 2017), underscoring the complex and multifaceted nature of etiological mechanisms underlying this construct. Although many SR conceptualizations have emerged, an integrated approach is necessary to gain a thorough understanding of SR development across childhood (Nigg, 2017; Zhou et al., 2012).

An integrative approach to understanding SR acknowledges how closely related constructs, such as Effortful Control (EC) and Executive Functioning (EF), complement each other and evolve across development (Posner & Rothbart, 2007; Nigg, 2017). EC, a domain of temperament typically studied in early childhood, is the ability to inhibit dominant responses in favor of subdominant ones, to detect errors, and to engage in planning (Rothbart & Bates, 2006). On the other hand, EF is a cognitive neuroscience construct historically studied in adolescence and adulthood, reflecting a set of interrelated skills of attentional focusing and shifting, inhibitory control, working memory, and cognitive flexibility that enable goal-directed behavior (Diamond, 2013; Miyake et al., 2000). In the context of integrated models, EC and EF have a significant conceptual overlap and shared neurocognitive substrates (Nigg, 2017; Zhou et al., 2012), operating through shared executive attention networks within the anterior cingulate cortex (ACC) and PFC (Botvinick et al., 2001). This network supports top-down SR, which is the conscious, deliberate ability to engage in goal-directed behavior in the face of competing outside stimuli, cognitions, emotions, and behaviors (Posner & Rothbart, 2007; Nigg, 2017).

Consistent with integrated models, top-down SR reflects a complex interplay between separable, but interrelated components including attentional focusing and shifting (attentional shifting is also often referred to as cognitive flexibility; Diamond, 2013), inhibitory control, and

working memory, skills that rapidly develop across childhood (Diamond, 2013; Nigg, 2017), and collectively interact to facilitate higher order SR skills such as planning, problem solving, and reasoning. More specifically, attentional processes include the ability to select goal-relevant information, suppress distractions, and shift attentional focus, which are associated with activation in the ACC, dorsolateral PFC, and posterior parietal cortex (Corbetta & Shulman, 2002). Inhibitory control involves the suppression of a prepotent response in favor of a goal directed response, and is associated with activation in the orbitofrontal cortex, ACC, dorso-lateral and ventrolateral PFC (Aron et al., 2014; Diamond, 2013). Together, attention and inhibitory control are considered foundational skills that support the development and execution of other SR processes, including working memory, cognitive flexibility, and planning (Garon et al., 2008).

At the same time, integrated models of SR also consider how bottom-up, reactive processes, such as motivationally-based approach/avoidance tendencies influenced by subcortical brain regions (i.e., the amygdala), exert an influence on top-down control mechanisms (Nigg, 2017). Specifically, SR operates through successive reciprocal neural feedback loops between the PFC, amygdala, and other brain networks (Bridgett et al., 2015; Ochsner et al., 2005), reflecting a complex combination of deliberate (top-down) and reactive (bottom-up) processes (Nigg, 2017). Bottom-up SR, rooted in child temperament, or biologically-based individual differences in reactivity and self-regulation (Nigg, 2006; Rothbart & Bates, 2006), plays an important role in automatic response tendencies. It involves approach motivation (associated with positive affect, motivation towards rewarding or novel experiences, and left-lateralized frontal EEG activation) and avoidance motivation (or withdrawal associated with negative affect, avoidant and uncertain responses to novelty, sensitivity to threat cues,

behavioral inhibition, and right-lateralized frontal EEG activation; Nigg, 2006; Nigg, 2017). Rooted in developmental psychopathology, integrated models provide a more nuanced perspective of child SR across development, underscoring the dynamic interplay between top-down (i.e., EC and EF) and bottom-up (i.e., approach/avoidance) processes and how they contribute to SR, which is fundamental to adaptive development across the lifespan. At the same time, SR deficits have been identified as transdiagnostic risk factors across externalizing and internalizing spectra (Nigg, 2017), highlighting the importance of studying this construct from a developmental psychopathology perspective.

Under/Over-Regulation as a Risk Factor for Child Psychopathology

Top-down control (attention, inhibitory control, working memory, and cognitive flexibility) of goal-directed behavior interacts with bottom-up, reactive processes (approach and avoidance), interactions which may manifest as "failures in adaptive self-regulation" that increase risk for both internalizing and externalizing psychopathology (Nigg, 2017). Notably, during middle childhood to adolescence, there are developmental immaturities within the PFC (i.e., reduced synaptic density and gray matter volume; Bridgett et al., 2015), negatively impacting top-down control, while bottom-up, reactive processes are fully developed (Bridgett et al., 2015). Thus, during this time, there is a “maturity gap” in SR, and bottom-up reactive processes are more likely to override top-down processes, limiting children’s ability to engage in adaptive SR, consequently increasing risk for psychopathology (Bridgett et al., 2015; Nigg, 2017). These SR deficits are particularly critical due to ongoing brain maturation and increased environmental demands during middle childhood to early adolescence, which may result in lifelong impairments if left untreated (i.e., physical health problems, poor academic/professional achievement, financial difficulties, and strained interpersonal relationships; i.e., Blair & Raver,

2015; Duckworth & Carlson, 2013; Moffitt et al., 2011; Zhou et al., 2012;).

In particular, during middle childhood to adolescence, youth are at a higher risk for externalizing behaviors because top-down SR skills are not fully developed, while motivation towards novel and exciting experiences tends to increase concurrently with the desire for autonomy (Casey et al., 2008; Steinberg & Morris, 2001). As such, the combination of overactive bottom-up approach tendencies and under-developed top-down SR may manifest as impulsivity, risk-taking, rule-breaking, and aggression, all traits associated with the disorders of the externalizing spectrum (Nigg, 2017; Steinberg et al., 2008). In particular, elevated impulsivity, or the tendency to engage in automatic, nonreflective selection of immediately rewarding responses (Nigg, 2017; Shulman et al., 2016), is associated with SR deficits across emotional (i.e., the tendency to experience strong emotions under conditions of positive or negative affect), cognitive (i.e., difficulty persisting through challenging or boring tasks), and behavioral (i.e., acting without thinking, sensation seeking) domains (Cyders et al., 2007). Elevated impulsivity may also lead to rule-breaking and aggressive behavior, characteristic of externalizing problems in youth (Achenbach et al., 2016; Nigg, 2017). For example, rule-breaking (or risk-taking) behavior involves devaluing potential consequences in favor of rewards, and is associated with engagement in dangerous activities including substance use, stealing, stunting, and high-risk sexual behavior (Casey, 2015). In addition, aggressive behavior may arise from frustration when youth struggle to control impulses in challenging situations, which may manifest as increased defiance towards authority figures (Eisenberg et al., 2009). Overall, overactive bottom-up approach motivation in combination with deficits in top-down SR represent risk factors for externalizing problems in youth (Nigg, 2017).

Similarly, the complex interplay between bottom-up reactive and top-down control

mechanisms has been implicated in the etiology of internalizing problems in youth (Nigg, 2017), with disruptions in inhibitory control processes being particularly relevant (Eisenberg, 2010; Joormann & Gotlib, 2010). Disruptions of inhibitory control in internalizing disorders may manifest as either inability to disengage from internal or external stimuli (i.e., poor inhibitory control in the context of negative, emotionally charged thoughts or external cues) or excessive behavioral inhibition (Eisenberg, 2010), manifesting as *ineffective* SR strategies that contribute to the etiology and maintenance of anxiety and depression. For example, anxious or depressed youth may exhibit an inability to disengage from negative, emotionally charged environmental cues (i.e., *poor inhibitory control*), which may manifest as difficulty suppressing intrusive thoughts and inhibiting automatic responses, resulting in SR deficits (Snyder et al., 2015). Anxious youth, in particular, might struggle to inhibit attention to threat-related environmental cues, leading to heightened vigilance and emotional reactivity (Bar-Haim et al., 2007). Similarly, depressed youth may struggle with heightened levels of rumination marked by an inability to suppress responses to negative information (Joormann & Gotlib, 2010). At the same time, youth with internalizing problems may also experience *excessive behavioral inhibition*, which may manifest as rigid adherence to rules, extreme caution in novel situations, or social withdrawal associated with anxiety disorders (i.e., excessive bottom-up avoidance; Eisenberg, 2010; Clauss & Blackford, 2012). In depression, excessive inhibition may manifest as reduced approach behaviors towards rewarding stimuli, associated with the experience of anhedonia or the inability to experience joy (Treadway & Zald, 2011). Taken together, youth with *ineffective, over or undercontrolled,* top-down SR processes in combination with overactive bottom-up avoidance/low approach tendencies may significantly enhance risk for internalizing problems across development.

Overall, internalizing symptoms are commonly associated with overactive avoidance tendencies and under or over-controlled top-down SR, while externalizing symptoms are associated with overactive approach tendencies and low top-down SR (Nigg, 2006; 2017). As SR is rapidly developing during middle childhood through adolescence, internalizing and externalizing symptoms may be part of normative development to some extent. In particular, the developmental trajectories of internalizing symptoms tend to increase linearly across development, while externalizing symptoms peak in adolescence and decline in adulthood (Bongers et al., 2004; Costello et al., 2011). At the same time, normative development during this important developmental period can be disrupted by environmental factors, such as paternal internalizing problems as well as resultant negative parenting styles, and parent-child conflict, that compound risk for psychopathology in youth (Sweeney & Macbeth, 2016). However, it is currently unclear how children's SR skills confer a risk or resilience in this association.

Interactions Between Paternal Internalizing Symptoms and Child Self-Regulation in Predicting Youth Mental Health

Etiological pathways for emerging psychopathology in youth are complex, and they may involve interactions between multiple risk factors, such as paternal internalizing symptoms and children's individual differences. SR capacity, including top-down and bottom-up processes, is a particularly important pathway implicated in the etiology of internalizing and externalizing problems in youth (Eisenberg, 2010; Nigg, 2017). Extant literature suggests that children of fathers with internalizing problems are more likely to have SR deficits, a combination that exacerbates their risk for depression and anxiety across development (i.e., Affrunti & Woodruff-Borden, 2015; Bögels & Brechman-Toussaint, 2006). In particular, youth who struggle with focusing and shifting attention (i.e., attentional biases toward negative stimuli), inhibiting

negative cognitions in the presence of negative environmental cues (Breaux et al., 2016), and show stronger avoidance tendencies (Reeb et al., 2010), are more likely to develop depressive symptoms, particularly in the context of paternal psychopathology characterized by negative parenting practices. Similarly, children of anxious fathers are more likely to have SR deficits characterized by attentional biases towards threats, excessive behavioral inhibition, and higher levels of avoidance (Affrunti & Woodruff-Borden, 2015; Hirshfeld-Becker et al., 2008). As a result, such youth may experience excessive worry, avoidance, and hyper-vigilance towards environmental threats, particularly in an environment where their fathers model similar behaviors, consequently enhancing risk for anxiety and contributing to the maintenance of anxious behaviors over time.

Similarly, children of anxious or depressed fathers who also have SR deficits could be more likely to develop externalizing symptoms. In particular, such youth may be more impulsive and struggle with adaptive emotion regulation (i.e., overactive approach motivation and poor top-down SR; Lamb & Lewis, 2013). Further, fathers struggling with depression and anxiety may have difficulty instilling consistent discipline, setting limits (Breaux & Harvey, 2019; Chang et al., 2011), and providing positive support (Fletcher et al., 2006), thus reinforcing externalizing behaviors in their offspring (Goodman et al., 2008). As such, children of depressed or anxious fathers who also have weak top-down SR and overactive approach motivation may have greater difficulty suppressing inappropriate responses further reinforced by negative parenting, thus compounding their likelihood of engaging in disruptive behaviors (Eisenberg et al., 2015). Such youth may engage in higher levels of aggression, conduct problems, associations with rule-breaking peers (Chang et al., 2011; Wilson & Durbin, 2010; Yan et al., 2020) and even develop callous-unemotional traits that are strong predictors of antisocial behavior (Waller et al,

2012). Thus, children with SR deficits who are also living with fathers struggling with internalizing problems are at an exacerbated risk for subsequent maladaptation, underscoring the complex interplay between paternal factors and child factors in predicting emerging internalizing and externalizing symptoms in youth.

At the same time, given that child SR development is influenced by a variety of factors at different levels of analysis (Bridgett et al., 2015; Nigg, 2017), youth may develop adaptive SR skills despite the influence of paternal psychopathology, potentially protecting them from familial risk associated with anxiety and depression in fathers. Although extant literature suggests children are at a higher risk for maladaptation when they have fathers with internalizing problems and ineffective SR skills, previous studies conducted with both mothers and fathers suggest that youth with stronger adaptive SR skills may be more resilient in the face of negative parenting and parent psychopathology, highlighting the role of SR as a potential moderating variable in this association (Bögels & Phares, 2008; Silk et al., 2006). Adaptive SR in children is associated with better emotional and cognitive regulation (Compas et al., 2017), problem-solving skills (Eisenberg et al., 2015), reduced parental stress and stress management (Eisenber, 2010), positive father-child interactions (Eisenberg, 2010), and overall positive family dynamics (Bridgett et al., 2015). Thus, children's strong adaptive SR skills may be protective against the influence of paternal internalizing problems. However, to date, *no studies known to me have examined how an interaction between paternal internalizing symptoms and child SR influences child outcomes*. As such, the aim of this study was to further understand this association and advance developmental psychopathology literature by using a longitudinal, multi-method, multi-informant analysis from middle childhood (age 9) to early adolescence (age 13).

The Current Study

Based on the extant literature, there is a limited understanding of how paternal anxiety and depression influence child mental health during middle childhood to adolescence. It is also unclear how children's SR capacity can moderate this association (i.e., serve as risk or a protective factor), as there have been almost no studies of this interaction. Thus, using a multi-method, multi-informant longitudinal design combined with a rigorous statistical approach during an important developmental period, middle childhood to early adolescence, the current study had three goals: (1) to clarify the role of *paternal* internalizing symptoms (i.e., anxiety and depression) in predicting child psychopathology (both, internalizing and externalizing symptoms) during middle childhood (age 9) to early adolescence (age 13); (2) to investigate the role of emerging SR skills (both, top-down and bottom-up processes) in middle childhood in predicting later psychopathology (both, internalizing and externalizing) in early adolescence and, (3) to understand how paternal internalizing symptoms interact with children's SR to predict later internalizing and externalizing psychopathology in youth.

It was expected that paternal internalizing problems would positively predict internalizing and externalizing symptoms in youth, with evidence of larger effects for the former, based on the extant literature (Sweeney & Macbeth, 2016). Further, this study aimed to understand the associations between SR and psychopathology in youth, with a particular emphasis on the directionality of associations between SR and child internalizing symptoms in an attempt to gain a better understanding of the role of poor inhibitory control and over-control in the etiology of depression and anxiety in youth (Bridgett et al., 2015; Eisenberg, 2010). Thus, it was expected that *ineffective* top-down SR (i.e., attentional biases and under or over active inhibitory control), as well as overactive avoidance tendencies in middle childhood would predict later internalizing symptoms in early adolescence, while poor top-down SR and overactive approach motivation in

middle childhood would predict later externalizing symptoms in early adolescence. Finally, it was hypothesized that paternal internalizing symptoms would interact with child SR, such that children demonstrating ineffective SR (under/overactive top-down skills and overactive reactive tendencies) who also had fathers with elevated internalizing symptoms would experience compounded risk for anxiety, depression, and externalizing behaviors. However, the exact nature of these interactions was speculative due to a particular paucity of extant literature in this area.

Methods

Sample

Data in the current study were a part of a larger longitudinal study, The Adolescent Brain Cognitive Development [SM] Study, publicly available deidentified data held in the National Institutes of Mental Health (NDA) data archive (ABCD Study®). With the baseline data released in 2018, the ABCD study is a consortium of numerous research institutions in the United States of America (USA) that provided data on cognitive and social-emotional development in adolescence over time. Data were collected at 21 sites across the USA, comprising a nationally representative sample of over 11,000 children aged 9-10. The current study included 497 community-dwelling fathers and their children collected at four time points, including baseline or year 1[1] (Child - M_{age} = 9.94, SD_{age} = .61; $range_{age}$ = 8.92-10.51; 60.4% boys; 39.6% girls; fathers - M_{age} = 43.18, SD_{age} = 7.13, $range_{age}$ = 21.79-71.70); year 2 (Child - M_{age} = 11.47, SD_{age} = .69; $range_{age}$ = 10.09-14.23; 60.8 % boys; 39.2% girls; fathers - M_{age} = 44.62, SD_{age} = 7.05, $range_{age}$ = 23.47-72.82); year 3 (Child - M_{age} = 12.41, SD_{age} = .72; $range_{age}$ = 10.97-16.01; 60.9 % boys; 39.1 % girls; fathers - M_{age} = 45.36, SD_{age} = 7.00, $range_{age}$ = 24.36-73.36); and year 4 (Child - M_{age} = 13.64, SD_{age} = .74; $range_{age}$ = 12.16-15.12; 61.4% boys; 38.6% girls; fathers - M_{age} = 46.84, SD_{age} = 7.16, $range_{age}$ = 25.36-75.48). Child ethnicity and family income data were

[1] Year 1,2,3, and 4 will be used interchangeably with time 1, 2, 3, and 4 in text of this manuscript

collected at baseline, and the majority of the sample was Caucasian (*n* = 409; 82.3%), with some African American (*n* = 42; 8.5%), Indigenous (*n* = 19; 3.8%), and Chinese (*n* = 18; 3.6%) participants, and those who endorsed other ethnicity (*n* = 9; 1.8%). Total annual household income was reported as follows: 16.4% - $25,000 or less (*n* = 82), 20.6% - $25,000 to $50,000 (*n* = 102), 17.9% - $50,000 to $75,000 (*n* = 89), 14.7% - $75,000 to $100,000 (*n* = 73), 21.3% - $100,000 to $199,999 (*n* = 106), and 5.6% - $200,000 or higher (*n* = 28), and 3.5% (*n* = 17) of participants either did not know or chose not to disclose annual household income.

Measures of Parent and Child Psychopathology

At baseline, fathers described their own mental health using the Adult Self-Report (ASR; ASEBA; 18-59 years of age; Achenbach, 2009), a 126-item self-report measure of behavioral, emotional, and social problems. Items were rated on a three-point scale (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true). Fathers' Anxious/Depressed syndrome scale (i.e., excessive worry, sadness, hopelessness, nervousness, tension, fatigue, changes in sleep or appetite, and suicidal thoughts; $\alpha = .88$) was used as a marker of risk for child psychopathology in the current study. This decision was made due to theoretical and data-driven considerations. In particular, the Anxious/Depressed scale is an empirically derived syndrome scale reflecting internalizing symptoms of anxiety and depression dimensionally, compensating for construct validity limitations posed by *DSM*-based scales (Achenbach et al., 2005). In the current study, the Anxious/Depressed scale was transformed using the natural logarithm function to correct for kurtosis due to its non-normal distribution.

At baseline and year 4, primary caregivers (fathers in this study) completed the school-age version of the Child Behavior Checklist (CBCL; 6-18 years of age; Achenbach, 2009), a 112-item parent-report measure of children's symptoms, behavior, and psychopathology.

Items were rated on a three-point scale (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true). CBCL data from baseline (Child - M_{age} = 9.94, SD_{age} = .61) and year 4 (Child - M_{age} = 13.64, SD_{age} = .74) were used in the current study. Although numerous internalizing and externalizing scales can be derived for the CBCL, Anxious/Depressed (i.e., symptoms of anxiety and depression, including excessive worry, nervousness, sadness, and feelings of worthlessness), Withdrawn/Depressed (i.e., depressive symptoms such as social withdrawal, isolation, and lack of involvement in social activities), and Externalizing (i.e., aggressive and rule-breaking behavior, commonly associated with conduct and oppositional problems) syndrome scales were used in the current study. These selections were made based on theoretical considerations (i.e., stronger construct validity of the syndrome scales vs. *DSM*-based scales; Ebesutani et al., 2010; Hudziak et al., 2004) as well as data driven decisions (i.e., normality of distribution). Transformations using natural logarithm were used to correct for kurtosis of the CBCL Anxious/Depressed and Withdrawn/Depressed at both baseline and in year 4. Internal consistency statistics for the CBCL scales were acceptable: baseline Externalizing (α = .87), Anxious/Depressed (α = .78), Withdrawn/Depressed (α = .72), as well as time 4 Externalizing (α = .86), Anxious/Depressed (α = .79), and Withdrawn/Depressed (α = .73).

Measures of Child Self-Regulation

Questionnaire Measures

In year 2 (Child - M_{age} = 11.47, SD_{age} = .69), fathers completed the Early Adolescent Temperament Questionnaire-Revised (EATQ-R; 9-15 years of age; Ellis & Rothbart, 1999), a 62-item parent-report measure of temperament in youth. Items were rated on a five-point scale (1 = almost always untrue, 2 = usually untrue, 3 = sometimes true, 4 = usually true, 5 = almost always true). The EATQ-R assesses eight facets of temperament (including Activation,

Affiliation, Fear, Frustration, Surgency, Inhibitory Control, Attention, and Shyness), comprising three higher-order domain scales of Effortful Control, Surgency, and Negative Affect. In the current study, Effortful Control (EC; the adolescents ability to regulate behavior and attention through planning and inhibitory control; α = .87), which includes Attention (ATTN; or capacity to focus and sustain attention on tasks; α = .77), and Inhibitory Control (IC; or ability to suppress inappropriate responses and actions; α = .50) as facets, were used in the analyses as markers of top-down SR. These scales were chosen based on the extant literature demonstrating associations between weaker top-down SR and subsequent psychopathology in children (Santens et al., 2020). The EATQ-R scales were normally distributed, and all except one had acceptable internal consistency.

In year 2 (Child - M_{age} = 11.47, SD_{age} = .69), youth completed the Behavioral Inhibition/Behavioral Approach System Scale (BIS/BAS; Carver & White, 1994), a 20-item, self-report measure of behavioral inhibition (BIS) and behavioral activation (BAS), two motivational systems capturing bottom-up SR. Items were rated on a four-point scale (0 = not true; 1 = somewhat true; 2 = true; 3 = very true). One scale indexing BIS and three scales indexing BAS were included in the analyses: BIS (the tendency to avoid aversive or unsafe outcomes in the environment; α = .72), BAS Drive (BASDR; the tendency to be motivated to follow one's goals; α = .81), BAS Reward Responsiveness (BASRR; the tendency to be sensitive to immediate rewards and reinforcers in the environment; α =.81), and BAS Fun Seeking (BASFS; the tendency to be seek out novel and exciting experiences; α =.77). Previous studies have found that youth with higher BAS (approach) and lower BIS (avoidance) ratings were more likely to experience heightened reward sensitivity and novelty seeking, which confer risk for externalizing problems (Kim-Spoon et al., 2016). At the same time, youth with higher BIS

(avoidance) and lower BAS (approach) ratings were more likely to struggle inhibiting negative emotions and attention toward negative stimuli, making them more likely to internalize and experience feelings of anxiety or depression (Eriksson et al., 2016; Kim-Spoon et al., 2016). All BIS/BAS scales were normally distributed, and they had acceptable internal consistency.

In year 2 (Child - M_{age} = 11.47, SD_{age} = .69), youth also completed the Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, Impulsive Behavior Scale for Children (UPPS; Cyders et al., 2007; Whiteside et al., 2005), a 20-item self-report measure tapping into dimensions of impulsive behavior as a combination of failures in top-down SR and over-active approach motivation (bottom-up SR). Items were rated on a four-point scale (1 = not at all like me, 2 = not like me, 3 = somewhat like me, 4 = very much like me). All five subscales were included in the analyses: top-down SR was indexed by the Lack of Premeditation/Planning (UPPSLPLN; lack of planning or tendency to act without regard for consequences; α = .80) and Lack of Perseverance (UPPSLPR; or tendency to give up/have difficulty focusing on a task that may be boring/difficult; α = .76) scales; bottom-up SR was indexed by the Negative Urgency (UPPSNU; tendency to engage in rash actions when experiencing negative affect; α = .64), Sensation Seeking (UPPSSS; or tendency to engage in activities that are exciting, novel, or risky; α = .65), and Positive Urgency (UPPSPU; or tendency to engage in rash actions when experiencing positive affect; α = .82) scales. This measure was chosen due to evidence that inefficient top-down SR and overactive approach tendencies (bottom-up SR), including impulsive behavior, increase risk of externalizing problems in children (Roberts et al., 2011). All UPPS scales were normally distributed, and they also had acceptable internal consistency.

Cognitive-Behavioral Tasks

In year 2 (Child - M_{age} = 11.47, SD_{age} = .69), youth completed the Little Man Task (LMT),

a computerized task which presents a male figure holding a briefcase in one hand in the middle of the screen (Acker, 1982). The figure appeared in one of four positions; right side up, upside down, facing the respondent, or with his back to the respondent. The briefcase was in either the right or left hand. Respondents pressed a button to indicate which hand is holding the briefcase. This task is associated with increased frontoparietal brain activity, as it engages visual-spatial mental rotation, attention, cognitive flexibility, inhibitory control, working memory and perspective-taking, which are important components of top-down SR (Rosenberg et al., 2020). Proportion correct was used to index SR, and it was normally distributed. Lower accuracy scores (or lower percent correct) indicated more errors in selecting the target response, thus indexing weaker top-down SR.

In year 3 (Child - M_{age} = 12.41, SD_{age} = .72), youth completed the Emotional Word-Emotional Face Stroop task (EWEFS; Banich et al., 2019; Başgöze et al., 2015), which assesses top-down cognitive control in the presence of emotional stimuli. The EWEFS asked participants to categorize emotional words as indicating either a "good" feeling (i.e., happy, joyful) or a "bad" feeling (i.e., angry, upset). Concurrently, an image of a teenager's face, displaying either a happy or angry expression was the task-irrelevant dimension. Trials were of two types: congruent and incongruent. Congruent trials presented a word and facial expression of the same valence (i.e., a happy face paired with the word "joyful") and incongruent trials presented a word and facial expression of different valence (i.e., a happy face paired with the word "angry"). Difficulties with inhibitory control were indexed by lower accuracy rates and longer reaction times on incongruent trials compared to congruent trials, often referred to as an "interference effect" (Smolker et al., 2022). *Higher levels of interference effect indicated weaker top-down SR*. This composite was normally distributed.

Statistical Analyses

A progression from univariate (i.e., descriptive statistics; see Table 1) to bivariate (see Table 1), and multivariate (see Table 2) analyses was followed (Hayes, 2019). Univariate analyses indicated that almost all psychopathology scales were not normally distributed and required transformations to correct for elevated kurtosis. As indicated earlier in the Method section, the scales selected in the current study (i.e., ASR Anxious/Depressed, CBCL Anxious/Depressed, Withdrawn/Depressed) were transformed using a natural logarithm to correct for higher-than-acceptable levels of kurtosis (i.e., exceeding +/-3). The bivariate associations between variables are presented in Table 1. For the multivariate analyses (see Table 2), paternal Anxious/Depressed symptoms at baseline (year 1, age 9) were used to predict the outcomes of child Anxious/Depressed, Withdrawn/Depressed, and Externalizing symptoms in year 4 (age 13), after controlling for child symptoms at baseline. The top-down and bottom-up SR variables in years 2 and 3 (age 11 and 12, respectively) were moderators; therefore, interactions between the SR variables and fathers' Anxious/Depressed symptoms at baseline were included in all models for each outcome variable.

Statistically significant main effects demonstrated which predictors had a significant effect on the outcomes when the moderator value was zero. Statistically significant interactions were probed using simple slope plots, which provided a visual analysis of the relationship between the predictor (paternal Anxious/Depressed symptoms) and outcome variable (child psychopathology), at different levels of the moderator (SR variables). For significant two-way interactions, regions of significance (ROS) were calculated using the Johnson-Neyman technique (Johnson & Fay, 1950). ROS specifies the values of the moderator (SR variables) at which the slope of the regression of the outcome (child psychopathology) on the focal predictor (paternal

internalizing symptoms) reaches significance. For more informative visual representations of results, the ROS was also calculated for the focal predictor (paternal internalizing symptoms).

Results

Self-Regulation and Psychopathology: Bivariate Associations

Bivariate associations between all study variables are presented in Table 1. Given the large sample size, the magnitude of the correlations were examined based on Cohen's (1992) guidelines for interpreting effect size ranges (.10 - .30 = small, .30 - .50 = medium, .50 - 1.0 = large; Cohen, 1992). All study variables displayed theoretically meaningful associations both concurrently and longitudinally.

Bivariate Associations Between Psychopathology Variables

Paternal ASR Anxious/Depressed symptoms at baseline were positively correlated with children's CBCL Anxious/Depressed, Withdrawn/Depressed, and Externalizing scores concurrently and over time with small-to-medium effect sizes. This pattern of results is unsurprising due to paternal psychopathology being a risk factor for emerging psychopathology in youth (Kane & Garber, 2009; Lamb, 2010; Ramchandani et al., 2005). Child internalizing and externalizing symptoms were significantly correlated concurrently and over time with mostly medium-to-strong effect sizes, underscoring the homotypic and heterotypic comorbidity and stability of these constructs over time (Angold et al., 1999).

Bivariate Associations Between SR Variables

Children's accuracy on the LMT at age 11 or time 2 was positively associated with all EATQ-R scales (i.e., Attention, Inhibitory Control, and the overall EC composite; all with small effect sizes) at the same time point, suggesting that strong top-down SR abilities assessed by cognitive-behavioral tasks are linked to higher EC reported concurrently by fathers. At the same

time, children's accuracy on the LMT at age 11 or time 2 was negatively associated with the UPPS Lack of Perseverance (small effect size) at the same time point, suggesting that youth lagging in development of top-down SR skills may have difficulty persisting in the face of difficult cognitive tasks (Coutlee et al., 2014). Similarly, children's performance on the EWEFS (tapping into top-down inhibitory control) at age 12 or time 3 was negatively associated with bottom-up SR scales of UPPS Sensation Seeking and Positive Urgency at age 11 or time 2 (small effect size). This pattern of results aligns with previous literature indicating that those with stronger top-down emotional regulation are less likely to engage in risky or impulsive behavior (Nigg 2017; Romer & Hennessey, 2007).

At the same time, it was notable that children's accuracy on the LMT at age 11 or time 2 was not correlated with the EWEFS interference at age 12 or time 3, likely due to task impurity inherent with many cognitive-behavioral tasks, meaning that they tend to assess multiple cognitive dimensions simultaneously. In addition, the EWEFS interference is a measure of emotionally-salient top-down SR processes while the LMT is a decontextualized cognitive control task, both of which operate and develop through different brain regions involving the prefrontal cortex (Nigg, 2017). Lastly, it is also possible that the difference in time points of each task (LMT at age 11, EWEFS at age 12) limited the association between the two, highlighting differential developmental trajectories that top-down child SR follows over time (Prencipe et al., 2011).

With respect to bivariate associations between age 11 or time 2 SR questionnaires, EATQ Attention, Inhibitory Control, and EC scales were strongly positively correlated with medium-to-large effect sizes, consistent with extant literature showing top-down SR abilities as interrelated but separable constructs (Rothbart & Posner, 2000), and also research indicating that

Rothbart's measures do not provide sufficient differentiation between facets of EC (Kotelnikova et al., 2016; 2017). Not surprisingly, the EATQ-R scales were also negatively correlated with the UPPS scales tapping into impulsivity marked by overactive behavioral activation and deficits in broad SR (i.e., bottom-up SR tapping into Negative Urgency and Positive Urgency, top-down SR tapping into Lack of Planning and Lack of Perseverance) with small-to-moderate effect sizes, aligning with previous findings that weaker top-down SR is associated with higher bottom-up impulsivity (Rothbart et al., 2000).

Not surprisingly, the BAS subscales tapping into bottom-up reactive processes (Reward Responsiveness, Fun Seeking, and Drive) were positively correlated with the UPPS Sensation Seeking and Urgency (small-to-moderate effect sizes), consistent with previous findings demonstrating a relationship between higher approach motivation and impulsive tendencies, both characteristic of bottom-up SR (Franken & Muris, 2006; Nigg, 2017). The UPPS Lack of Perseverance, or a marker of deficits in top-down SR, was negatively correlated with all of the BAS scales, albeit with small effect sizes. This pattern of results is consistent with previous literature indicating that children with difficulty persisting through difficult or boring tasks may have top-down SR impairments, failing to upregulate their approach motivation required for task completion (Corr, 2008). Not surprisingly, the UPPS Lack of Planning and Lack of Perseverance were also moderately positively correlated, underscoring top-down SR impairments impacting the ability to plan effectively and persist through difficult or boring tasks.

All BIS/BAS scales were positively intercorrelated, demonstrating the multifaceted nature of behavioral activation. They were also positively associated with bottom-up SR processes indexed by the UPPS Positive and Negative Urgency (small-to-moderate effect sizes). Although positive associations among BIS, BAS, and UPPS Urgency may appear surprising, in

the context of Reinforcement Sensitivity Theory (Corr, 2008), BIS also represents a conflict detection and resolution system. Thus, higher BIS is not only associated with avoidance but also may lead to heightened awareness of potential rewards (activating BAS) and risks (related to impulsivity), resulting in positive correlations amongst all (Corr, 2008). Finally, the UPPS scales showed weak-to-moderate associations, except for a strong correlation between Negative and Positive Urgency, which is unsurprising given their shared core of emotion-based action without consideration for consequences (Cyders & Smith, 2008).

Bivariate Associations Between Psychopathology and SR Variables

Consistent with the study hypotheses, paternal Anxious/Depressed symptoms at baseline were significantly negatively correlated with the EATQ-R scales at time 2 (small effect size), supporting previous findings that paternal psychopathology is associated with weaker top-down SR in youth (Sweeney & Macbeth, 2016). Paternal internalizing symptoms at baseline were also positively, albeit weakly, associated with higher BIS in children at time 2, which is consistent with literature demonstrating that fathers struggling with anxiety and depression may model behaviors like avoidance, sensitivity to possible threat, or overprotection, which can subsequently translate into overactive avoidant behaviors in youth across time (Fisak & Grills-Taquechel, 2007; Kiff et al., 2011).

All child psychopathology variables at baseline (age 9) and time 4 (age 13) were significantly related to weaker top-down SR at time 2 (lower EATQ-R Attention, IC, and EC; small-to-moderate effect sizes), and this association was the strongest for Externalizing symptoms (moderate effect size). This pattern of results is not surprising given that rule breaking and aggressive externalizing behaviors have been consistently associated with weaker

Table 1.

Bivariate Correlations Between Study Variables.

	Anx/ DepF1[a]	Anx/ DepC1[a]	With/ DepC1[a]	ExtC1	Anx/ DepC4[a]	With/ DepC4[a]	ExtC4	EATQ ATTN2	EATQ IC2	EATQ EC2	BIS2	BAS RR2	BAS DR2	BAS FS2	UPPS NU2	UPPS LPL2	UPPS SS2	UPPS PU2	UPPS LPR2	LMT2	Stroop3
Anx/DepF1[a]	--																				
Anx/DepC1[a]	.38**	--																			
With/DepC1[a]	.42**	.55**	--																		
ExtC1	.31**	.41**	.44**	--																	
Anx/DepC4[a]	.36**	.46**	.30**	.26**	--																
With/DepC4[a]	.27**	.23**	.35**	.24**	.58**	--															
ExtC4	.24**	.22**	.24**	.56**	.38**	.45**	--														
EATQATTN2	-.25**	-.12**	-.25**	-.38**	-.19**	-.26**	-.39**	--													
EATQIC2	-.15**	-.11**	-.19**	-.38**	-.07†	-.16**	-.35**	.54**	--												
EATQEC2	-.23**	-.15**	-.27**	-.43**	-.16**	-.26**	-.43**	.90**	.75**	--											
BIS2	.09*	.06	.043	-.07	.19**	.08†	-.04	.00	.04	.00	--										
BASRR2	-.01	.04	-.06	-.02	-.03	-.09*	-.04	-.00	-.01	.00	.31**	--									
BASDR2	-.06	-.03	-.06	-.02	-.01	-.00	.02	-.02	-.06	-.02	.15**	.48**	--								
BASFS2	-.02	-.02	-.09*	.05	.00	-.01	.13**	-.04	-.08†	-.05	.18**	.43**	.42**	--							
UPPSNU2	.06	.03	.02	.15**	.08†	.10*	.18**	-.16**	-.12**	-.17**	.23**	.07†	.23**	.27**	--						
UPPSLPL2	.04	.07	.02	.16**	.03	.08*	.18**	-.19**	-.20**	-.24**	-.03	-.07†	.07†	.20**	.23**	--					
UPPSSS2	-.00	-.04	-.05	.04	-.12**	-.08*	.08*	.00	.07†	.02	-.00	.22**	.21**	.41**	.18**	.15**	--				
UPPSPU2	.03	-.00	.01	.08†	-.05	-.00	.08†	-.10*	-.07	-.10*	.11*	.12**	.20**	.27**	.52**	.21**	.27**	--			
UPPSLPR2	.07†	-.01	.09*	.13**	.05	.20**	.13**	-.29**	-.12**	-.29**	-.04	-.20**	-.08†	-.07†	.09*	.47**	-.10*	.08†	--		
LMT2	-.01	.01	-.06	-.01	-.06	-.02	-.07	.16**	.15**	.15**	-.07†	-.03	-.01	-.00	-.04	.01	.07†	-.07†	-.12**	--	
Stroop3	-.01	.05	.01	.07†	.04	.03	.03	.05	-.01	.02	-.03	.03	.01	-.03	-.03	-.06	-.19**	-.12**	-.05	-.04	--
M	3.97	3.95	3.96	43.98	3.95	3.96	42.42	3.37	3.79	3.46	9.13	9.75	3.52	4.40	7.71	7.90	9.63	7.32	6.86	.75	.06
SD	.100	.08	.08	9.52	.08	.08	8.55	.72	.57	.58	3.73	3.03	2.63	2.63	2.26	2.31	2.81	2.52	2.13	.16	.05

*Note. **p <.01, *p <.05, † p <.10; a = ASR Paternal Anxious/Depressed and CBCL Child Anxious/Depressed and Withdrawn/Depressed at baseline and time 4 were transformed using natural logarithm transformation due to non-normality; Anx/DepF1 = Baseline Paternal Anxious/Depressed; Anx/DepC1 & Anx/DepC4 = Baseline & Time 4 Child Anxious/Depressed; With/DepC1 & With/DepC4 = Baseline & Time 4 Child Withdrawn/Depressed; ExtC1 & ExtC2 = Baseline & Time 4 Child Externalizing; Time 2 SR Variables: EATQATTN2 = Attention; EATQIC2 = Inhibitory Control; EATQEC2 = Effortful Control; BIS2 = Behavioral Inhibition; BASRR2 = Reward Responsiveness; BASFS2 = Fun Seeking; UPPSNU2 = Negative Urgency; UPPSLPL2 = Lack of Premeditation/Planning; UPPSSS2 = Sensation Seeking; UPPSPU2 = Positive Urgency; UPPSLPR2 = Lack of Perseverance; LMT2 = Little Man Task; Time 3 SR Variables: Stroop3 = Emotional-Word-Emotional Face Stroop Task.*

top-down SR in extant literature (Perry et al., 2018). Similarly, externalizing symptoms at baseline (age 9) and time 4 (age 13) were also positively associated with all top-down and bottom-up SR processes measured by the UPPS scales and bottom-up BAS Fun Seeking at time 2 or age 12 (small effect sizes), consistent with prior literature indicating that externalizing behaviors are associated with higher impulsive and approach behaviors, characteristic of overactive reactive approach processes and deficits in top-down SR in children (Eisenberg et al., 2009).

Child Withdrawn/Depressed symptoms at baseline (age 9) and time 4 (age 13) were positively but weakly correlated with UPPS Negative Urgency (bottom-up SR) and Lack of Planning and Lack of Perseverance (deficits in top-down SR) at time 2 (age 11). These associations can be explained by deficits in emotion regulation common in those with depression (Carver et al., 2008), which may manifest as difficulties inhibiting negative emotions in the context of negative affect (Smith et al., 2013) or difficulties with motivation to plan and sustain effort through boring/difficult tasks (Rudolph et al., 2013; Snyder, 2013). In addition, child Withdrawn/Depressed symptoms at baseline (age 9) and time 4 (age 13) were negatively correlated with BAS Fun Seeking, BAS Reward Responsiveness, and UPPS Sensation Seeking (bottom-up SR) at time 2 or age 11 (small effect size). Therefore, children struggling with depressive symptoms may experience reduced sense of pleasure or motivation to engage in novel or rewarding experiences (low approach motivation), a key feature related to the experience of anhedonia in depression (Forbes & Dahl, 2005; Pizzagalli et al., 2008). Finally, child Anxious/Depressed symptoms at time 4 (age 13) were positively correlated with BIS and negatively correlated with the UPPS Sensation Seeking at time 2 or age 11 (small effect sizes for both). These results are unsurprising given that high levels of behavioral inhibition (overactive

avoidance) are often reported for anxious children, making them more likely to be fearful and avoidant and less likely to engage in approach behaviors characterized by novelty and reward (Fox et al., 2005). Given the theoretically meaningful concurrent and longitudinal bivariate associations between psychopathology and SR variables, more complex multivariate analyses were pursued to examine the role of children's top-down and bottom-up SR dimensions as moderators between paternal internalizing symptoms and youth psychopathology over time.

Self-Regulation and Psychopathology: Multivariate Analyses

Multivariate regression analyses were conducted including paternal self-rated Anxious/Depressed symptoms at baseline (child age 9) as the focal predictor of father-rated child Withdrawn/Depressed, Anxious/Depressed, and Externalizing symptoms as outcomes at time 4 (age 13). Child symptoms at baseline (age 9) were included as covariates in each model to control for initial levels of child psychopathology in all longitudinal regression models. All questionnaire SR scales at time 2 or age 11 (father-reported EATQ-R Attention, Inhibitory Control, EC; child-reported BIS/BAS Behavioral Inhibition, Drive, Reward Responsiveness, Fun Seeking; child-reported UPPS Negative Urgency, Lack of Planning, Sensation Seeking, Positive Urgency, Lack of Perseverance) and cognitive/behavioral tasks (LMT proportion correct - time 2/age 11; EWEFS interference effect - time 3/age12) were included as moderators. On average, all models had R^2 values ranging between .14 and .36, indicating that approximately 14-36% of the variance in child psychopathology at time 4 (age 13) was explained by the interplay between paternal Anxious/Depressed symptoms at baseline and child SR variables at times 2 and 3 (age 11 and 12, respectively). These results are presented in Table 2, and significant interactions are also depicted in Figures 1-7.

Table 2.

Interactions Between Paternal Anxious/Depressed Symptoms and Child Self-Regulation in Predicting Child Psychopathology Across Time

	With/DepC4				Anx/DepC4				ExtC4			
Predictors: SR=EATQ	*B*	*SE*	*t*	*p*	*B*	*SE*	*T*	*p*	*B*	*SE*	*t*	*p*
With/DepC1	0.24**	0.04	5.54	0.00								
Anx/DepC1					0.35**	0.04	8.89	0.00				
ExtC1									0.43**	0.03	11.93	0.00
Anx/DepF1	0.10**	0.04	2.57	0.00	0.12**	0.03	3.28	0.00	4.16	3.58	1.16	0.24
EATQATTC2	-0.01**	0.00	-3.68	0.00	-0.01**	0.00	-2.47	0.01	-2.32**	0.46	-4.94	0.00
EATQATTC x Anx/DepF1	0.01	0.05	0.32	0.74	-0.10**	0.05	-2.15	0.03	3.16	4.88	0.64	0.51
R^2	0.16				0.27				0.36			
With/DepC1	0.26**	0.04	5.89	0.00								
Anx/DepC1					0.36**	0.04	9.05	0.00				
ExtC1									0.44**	0.03	11.89	0.00
Anx/DepF1	0.12**	0.03	3.19	0.00	0.17**	0.03	4.86	0.00	5.25	3.40	1.54	0.12
EATQIC2	-0.01†	0.00	-1.72	0.08	0.00	0.00	0.18	0.85	-2.34**	0.59	-3.93	0.00
EATQIC2 x Anx/DepF1	0.05	0.06	0.77	0.43	-0.00	0.06	-0.05	0.95	1.16	6.10	0.19	0.84
R^2	0.14				0.25				0.35			
With/DepC1	0.24**	0.04	5.40	0.00								
Anx/DepC1					0.36**	0.04	8.85	0.00				
ExtC1									0.41**	0.03	11.09	0.00
Anx/DepF1	0.11**	0.04	2.71	0.00	0.15**	0.03	3.99	0.00	3.23	3.60	0.89	0.37
EATQEC2	-0.02**	0.00	-3.53	0.00	-0.00	0.00	-1.42	0.15	-3.25**	0.60	-5.38	0.00
EATQ2EC x Anx/DepF1	0.03	0.07	0.45	0.64	-0.05	0.06	-0.80	0.42	-1.62	6.43	-0.25	0.80
R^2	0.16				0.25				0.36			
	With/DepC4				Anx/DepC4				ExtC4			
Predictors: SR=BIS/BAS	*B*	*SE*	*t*	*p*	*B*	*SE*	*T*	*p*	*B*	*SE*	*t*	*p*
With/DepC1	0.27**	0.04	6.22	0.00								
Anx/DepC1					0.36**	0.03	9.17	0.00				
ExtC1									0.49**	0.03	14.00	0.00
Anx/DepF1	0.10**	0.03	2.81	0.00	0.15**	0.03	4.48	0.00	5.99†	3.39	1.76	0.07
BIS2	0.00	0.00	1.31	0.19	0.01**	0.00	4.14	0.00	-0.01	0.08	-0.17	0.85
BIS2 x Anx/DepF1	0.01	0.00	1.56	0.11	0.01†	0.00	1.65	0.09	-0.44	0.82	-0.53	0.59
R^2	0.49				0.28				0.33			
With/DepC1	0.26**	0.04	6.04	0.00								
Anx/DepC1					0.37**	0.04	9.24	0.00				
ExtC1									0.49**	0.03	14.06	0.00
Anx/DepF1	0.12**	0.03	3.27	0.00	0.17**	0.03	5.10	0.00	5.49†	3.31	1.65	0.09
BASRR2	-0.01†	0.00	-1.74	0.08	0.00	0.00	-1.23	0.21	-0.07	0.10	-0.68	0.49
BASRR x Anx/DepF1	-0.00	0.01	-0.09	0.92	-0.02†	0.01	-1.94	0.05	1.14	1.03	1.10	0.27
R^2	0.14				0.26				0.33			
With/DepC1	0.27**	0.04	6.16	0.00								
Anx/DepC1					0.36**	0.04	9.08	0.00				
ExtC1									0.48**	0.03	14.00	0.00
Anx/DepF1	0.12**	0.03	3.27	0.00	0.17**	0.03	5.07	0.00	6.07†	3.31	1.83	0.06
BASDR2	0.00	0.00	0.49	0.62	0.00	0.00	0.25	0.80	0.12	0.12	1.03	0.30
BASDR2 x Anx/DepF1	-0.00	0.01	-0.21	0.82	-0.00	0.01	-0.30	0.75	2.09†	1.27	1.64	0.10
R^2	0.14				0.25				0.33			
With/DepC1	0.26**	0.04	6.06	0.00								
Anx/DepC1					0.36**	0.04	9.08	0.00				
ExtC1									0.48**	0.03	14.00	0.00
Anx/DepF1	0.12**	0.03	3.29	0.00	0.18**	0.03	5.21	0.00	6.04†	3.29	1.83	0.06
BASFS2	0.00	0.00	0.27	0.78	0.00	0.00	0.43	0.66	0.34**	0.11	2.87	0.00
BASFS2 x Anx/DepF1	-0.00	0.01	-0.71	0.47	-0.02*	0.01	-2.29	0.02	-0.24	1.17	-0.20	0.83
R^2	0.14				0.26				0.34			

	With/DepC4				Anx/DepC4				ExtC4			
Predictors: SR=UPPS	*B*	*SE*	*t*	*p*	*B*	*SE*	*T*	*p*	*B*	*SE*	*t*	*p*
With/DepCI	0.27**	0.04	6.19	0.00								
Anx/DepC1					0.37**	0.04	9.15	0.00				
ExtC1									0.48**	0.03	13.69	0.00
Anx/DepF1	0.12**	0.03	3.12	0.00	0.16**	0.03	4.60	0.00	5.06	3.37	1.49	0.13
UPPSNU2	0.01†	0.00	1.91	0.05	0.00	0.00	1.47	0.14	0.37**	0.14	2.61	0.00
UPPSNU2 x Anx/DepF1	-0.00	0.01	-0.27	0.78	0.02	0.01	1.31	0.19	0.97	1.64	0.59	0.55
R^2	0.14				0.26				0.33			
With/DepC1	0.27**	0.04	6.18	0.00								
Anx/DepC1					0.38**	0.04	9.37	0.00				
ExtC1									0.47**	0.03	13.61	0.00
Anx/DepF1	0.12**	0.03	3.35	0.00	0.18**	0.03	5.22	0.00	5.95†	3.31	1.79	0.07
UPPSPLN2	0.01†	000	1.69	0.09	-0.00	0.00	-0.14	0.88	0.33**	0.13	2.40	0.01
UPPSPLN2 x Anx/DepF1	0.03†	0.01	-1.80	0.07	0.04**	0.01	-2.59	0.00	-1.27	1.54	-0.82	0.40
R^2	0.15				0.26				0.33			
With/DepC1	0.26**	0.04	6.07	0.00								
Anx/DepC1					0.35**	0.03	9.00	0.00				
ExtC1									0.49**	0.03	14.04	0.00
Anx/DepF1	0.12**	0.03	3.32	0.00	0.18**	0.03	5.33	0.00	5.68†	3.31	1.71	0.08
UPPSSS2	-0.01†	0.00	-1.79	0.07	-0.01**	0.00	-2.69	0.00	0.18†	0.11	1.62	0.10
UPPSSS2 x Anx/DepF1	-0.01	0.01	-1.17	0.23	0.03**	0.01	-3.67	0.00	0.49	1.07	0.46	0.64
R^2	0.14				0.28				0.33			
With/DepC1	0.27**	0.04	6.17	0.00								
Anx/DepC1					0.36**	0.04	8.92	0.00				
Ext4									0.49**	0.03	14.15	0.00
Anx/DepF1	0.12**	0.03	3.30	0.00	0.18**	0.03	5.43	0.00	4.74	3.34	1.41	0.15
UPPSPU2	-0.00	0.00	-0.35	0.72	-0.01†	0.00	-1.71	0.08	0.09	0.12	0.78	0.43
UPPSPU2 x Anx/DepF1	-0.00	0.01	-0.60	0.54	-0.02*	0.01	-2.15	0.03	2.18†	1.25	1.74	0.08
R^2	0.14				0.26				0.33			
With/DepC1	0.26**	0.04	6.00	0.00								
Anx/DepC1					0.37**	0.04	9.22	0.00				
ExtC1									0.48**	0.03	13.94	0.00
Anx/DepF1	0.11**	0.03	3.07	0.00	0.16**	0.03	4.74	0.00	4.76	3.33	1.42	0.15
UPPSLPR2	0.01**	0.01	4.18	0.00	0.00	0.00	1.29	0.19	0.22	0.14	1.54	0.12
UPPSLPR2 x Anx/DepF1	0.00	0.01	0.39	0.69	0.02	0.01	1.32	0.18	2.19	1.48	1.47	0.14
R^2	0.17				0.26				0.33			
	With/DepC4				Anx/DepC4				ExtC4			
Predictors: SR= Tasks	*B*	*SE*	*t*	*p*	*B*	*SE*	*T*	*p*	*B*	*SE*	*t*	*p*
With/DepC1	0.27**	0.04	6.13	0.00								
Anx/DepC1					0.36**	0.04	9.04	0.00				
ExtC1									0.49**	0.03	14.28	0.00
Anx/DepF1	0.12**	0.03	3.25	0.00	0.17**	0.03	5.14	0.00	5.40	3.29	1.64	0.10
LMT2	0.00	0.02	0.00	0.99	-0.02	0.01	-1.45	0.14	-3.27†	1.85	-1.76	0.07
LMT2 x Anx/DepF1	-0.04	0.21	-0.18	0.85	-0.40*	0.19	-2.08	0.03	40.41*	19.14	2.11	0.03
R^2	0.14				0.26				0.33			
With/DepC1	0.26**	0.04	6.00	0.00								
Anx/DepC1					0.36**	0.04	8.99	0.00				
ExtC1									0.49**	0.03	14.09	0.00
Anx/DepF1	0.12**	0.03	3.29	0.00	0.17**	0.03	5.11	0.00	5.49†	3.32	1.65	0.09
Stroop3	0.05	0.05	0.99	0.32	0.02	0.05	0.48	0.62	-0.25	5.49	-0.04	0.96
Stroop3 x Anx/DepF1	-1.02**	0.53	-1.92	0.05	0.12	0.49	0.25	0.80	-41.00	48.34	-0.84	0.39
R^2	0.14				0.25				0.33			

Note. **p <.01, *p <.05, † p <.10; SR = self-regulation; Anx/DepF1 = Baseline Paternal Anxious/Depressed; Anx/DepC1 & Anx/DepC4 = Baseline & Time 4 Child Anxious/Depressed; With/DepC1 & With/DepC4 = Baseline & Time 4 Child Withdrawn/Depressed; ExtC1 & ExtC2 = Baseline & Time 4 Child Externalizing; Time 2 SR Variables: EATQIC2 = Inhibitory Control; EATQEC2 = Effortful Control; BIS2 = Behavioral Inhibition; BASRR2 = Reward Responsiveness; BASFS2 = Fun Seeking; UPPSNU2 = Negative Urgency; UPPSLPL2 = Lack of Premeditation/Planning; UPPSSS2 = Sensation Seeking; UPPSPU2 = Positive Urgency; UPPSLPR2 = Lack of Perseverance; LMT2 = Little Man Task; Time 3 SR Variables: Stroop3 = Emotional-Word-Emotional Face Stroop Task.

Paternal Anxious/Depressed Symptoms Interacting With Child Self-Regulation in Predicting Child Internalizing Problems Across Time

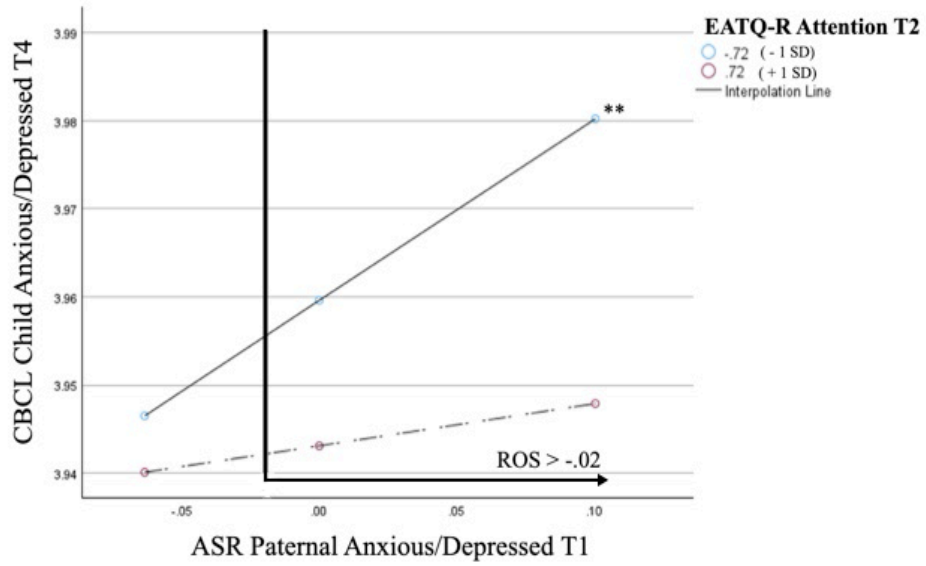
Child internalizing symptoms at baseline (age 9) were consistently positive and significant predictors of the same symptoms at time 4 (age 13) across all models, providing evidence of stability of child internalizing symptoms over time. Similarly, across all models, paternal Anxious/Depressed symptoms at baseline (age 9) consistently emerged as positive and significant predictors of child internalizing (Anxious/Depressed and Withdrawn/Depressed) symptom at time 4 (age 13), aligning with the hypothesis that paternal internalizing symptoms significantly predict child internalizing symptoms during middle childhood to early adolescence.

Father-rated child EATQ-R Attention (B = -.01, p = <.01), Inhibitory Control (B = -.01, p = 0.08; strong trend), and EC (B = <.01, p = -.02) at time 2 (age 11) negatively predicted youth Withdrawn/Depressed symptoms at time 4 (age 13). This pattern of results suggests that parent-rated weaker top-down SR skills in children, such as the ability to sustain attention and exercise inhibitory control, play a significant role in later internalizing symptoms. Father-rated child EATQ-R Attention (i.e., child capacity focus and sustain attention) also negatively predicted later youth Anxious/Depressed symptoms (B = -.01, p = .01), and this main effect was qualified by a significant interaction with paternal Anxious/Depressed symptoms at baseline (B = -.10, p = .03). Depicted in Figure 1, children with lower father-reported EATQ-R Attention (i.e., capacity to focus and sustain attention) at time 2 (age 11) who also had fathers with elevated Anxious/Depressed symptoms at baseline (age 9), were more likely to experience higher Anxious/Depressed symptoms at time 4 (age 13; ROS father Anxious/Depressed at baseline >-.02). This pattern of results is unsurprising and consistent with the study hypothesis that youth with internalizing symptoms are significantly more likely to experience deficits in top-down

attentional control (i.e., focusing and shifting). In addition, these results provide additional evidence that paternal internalizing symptoms confer familial risk for later anxious/depressed psychopathology and disruptions in top-down SR in youth (Snyder, 2013). Moreover, weaker top-down SR skills (focusing and sustaining attention in this case) exacerbate the risk for internalizing symptoms for youth who already experience familial risk for such symptoms.

Figure 1

Paternal Anxious/Depressed Symptoms Interacting with Child EATQ-R Attention in Predicting Child Anxious/Depressed Symptoms Longitudinally



Note. Paternal Anxious/Depressed symptoms at baseline (time 1) interact with father-reported child EATQ-R Attention (i.e., child capacity to focus and sustain attention) at time 2 to predict father-reported Anxious/Depressed symptoms in children at time 4; ASR Anxious/Depressed T1 = father self-report Anxious/Depressed symptoms at baseline; CBCL Child Anxious/Depressed T4 = father-rated child Anxious/Depressed symptoms at time 4; EATQ-R Attention T2 = parent-rated child Attention (i.e., focusing and sustaining attention) at time 2; ** = $p < .01$; Interpolation Line = Region of Significance.

Regarding the BIS/BAS scales predictors of youth internalizing symptoms, not surprisingly, self-rated BIS at time 2 (age 11) emerged as a positive significant predictor of later Anxious/Depressed symptoms at time 4 (age 13; $B = .01$, $p = <.01$). Such a pattern was not

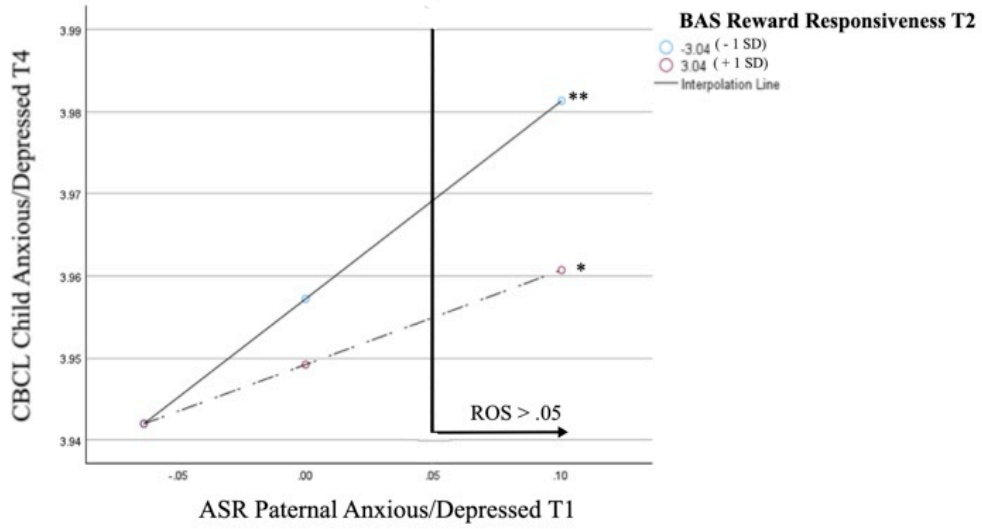
significant for Withdrawn/Depressed symptoms, which may be due to differences in the construct coverage by the Anxious/Depressed and Withdrawn/Depressed CBCL scales. That is, anxious children may be more fearful and less likely to engage in risky behaviors than children who are experiencing depressive symptoms, aligning with previous research linking overactive BIS or avoidance primarily to anxiety disorders (Carver & White, 1994).

Also, not surprisingly, self-reported BAS Reward Responsiveness at time 2 (age 11) was a significant negative predictor of father-reported child Withdrawn/Depressive symptoms at time 4 (age 11), indicating that children with lower approach motivation towards rewards at age 11 were at a greater risk for experiencing Withdrawn/Depressed symptoms at age 13 (B = -.01, p = .08; strong trend). There were no significant main effects of the child self-reported BAS Reward Responsiveness and Fun Seeking for time 4 (age 13) child Anxious/Depressed symptoms; however, both interacted significantly with paternal Anxious/Depressed symptoms at baseline (see Table 2 and Figure 2). That is, children with lower self-rated reward sensitivity and fun seeking behaviors (lower bottom-up approach motivation) who also had fathers with higher levels of Anxious/Depressed symptoms, were more likely to develop later Anxious/Depressed symptoms themselves (B = -.02, p = .05; ROS father Anxious/Depressed at baseline >.05; B = -.02, p = .02; ROS father Anxious/Depressed at baseline >.25, respectively for BAS Reward Responsiveness and Fun Seeking). The results pertaining to BAS Fun Seeking followed a similar pattern as seen in Figure 2. This pattern of results suggest that children with Anxious/Depressed symptoms may have lower approach motivation characterized by a lack of positive reinforcement from fun or rewarding activities (Trew, 2011), representing an exacerbating risk factor especially for those youth who also had fathers with higher levels of internalizing symptoms. These results also align with previous literature suggesting that lower BAS scores are

linked to lower dopaminergic functioning (i.e., leading to a reduced experience of pleasure), a pathway implicated in the etiology of internalizing disorders (Whittle et al., 2006).

Figure 2

Paternal Anxious/Depressed Symptoms Interacting with Child BAS Reward Responsiveness in Predicting Child Anxious/Depressed Symptoms Longitudinally



Note. Paternal Anxious/Depressed symptoms at baseline (time 1) interact with child self-reported BAS Reward Responsiveness at time 2 to predict father-reported youth Anxious/Depressed symptoms at time 4; ASR Anxious/Depressed T1 = father self-report Anxious/Depressed symptoms at baseline; CBCL Child Anxious/Depressed T4 = father-rated child Anxious/Depressed symptoms at time 4; BAS Reward Responsiveness T2 = self-rated child Reward Responsiveness at time 2; ** = $p < .01$; * = $p < .05$; Interpolation Line = Regions of Significance.

Regarding the UPPS impulsivity traits as predictors of later internalizing problems, children's self-rated Lack of Perseverance at time 2 (age 11) positively predicted father-reported child Withdrawn/Depressive symptoms at age 13 or time 4 ($B = .01$, $p = <.01$). Children with lower perseverance (i.e., higher UPPS Lack of Perseverance or deficit in top-down SR) were more likely to experience depressive symptoms, which is unsurprising given withdrawal, disengagement, and lack of positive reinforcement from activities are associated with depression

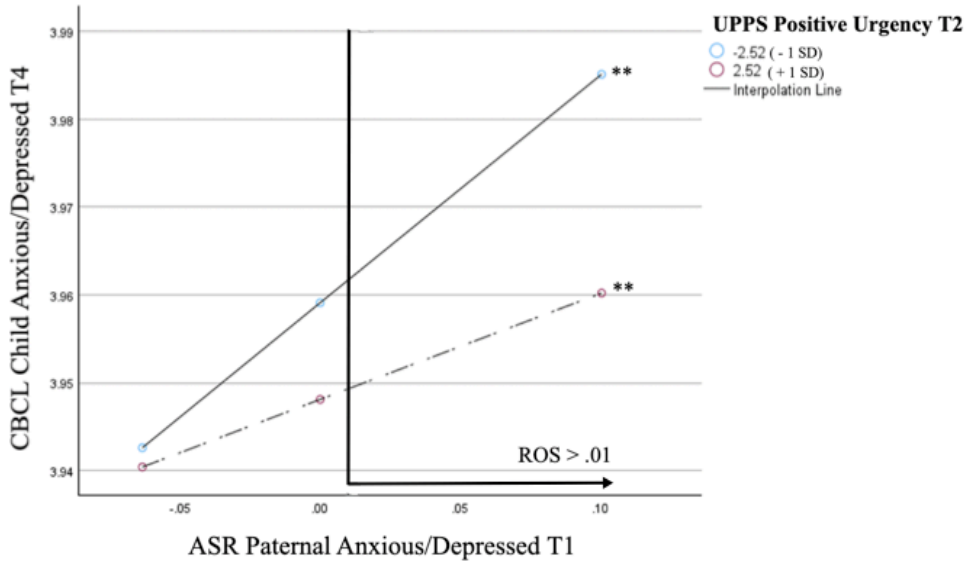
(Berg et al., 2015). Similarly, self-rated bottom-up SR indexed by UPPS Negative Urgency (or tendency to engage in rash actions when experiencing negative affect) at time 2 (age 11) positively predicted father-reported child Withdrawn/Depressive at time 4 or age 13 (B = .01, p = .05). This finding is also not surprising given previous findings that children with depression may engage in rash actions (i.e., self-harm) when experiencing negative affect to cope with distress (Smith et al., 2013).

At the same time, child self-reported bottom-up SR indexed by UPPS Positive Urgency (or tendency to engage in rash actions under conditions of positive affect) at time 2 (age 11) interacted with paternal Anxious/Depressed symptoms at baseline (age 9) in predicting father-reported child Anxious/Depressed symptoms at time 4 (age 13). This pattern of results indicates that youth with lower positive urgency (or lower approach behaviors) who also had fathers struggling with internalizing symptoms were at greater risk for elevated Anxious/Depressed symptoms at age 13 (B = -.02, p = .03; ROS father Anxious/Depressed at baseline >.01; see Figure 3). These results are unsurprising, as previous research has indicated that youth experiencing internalizing symptoms may struggle to experience or act on positive emotions, which is likely due to increased anhedonia and over inhibition in situations that would typically elicit positive affect. Additionally, fathers with their own internalizing symptoms may adopt overcontrolling and intrusive parenting styles that limit the child's capacity for bottom-up, approach behaviors, potentially translating to excessive inhibition and a tendency to internalize negative emotions (Bögels & Brechman-Toussaint, 2006). Overall, the results pertaining to positive and negative urgency suggest that over- or under-reactive, bottom-up SR might make a child more likely to engage in negative, impulsive behaviors when experiencing negative affect while simultaneously failing to benefit from experiences associated with positive affect. These

findings extend previous research conducted with young children (Ramchandani et al., 2008), indicating that fathers' internalizing symptoms confer risk for emotional SR deficits during middle childhood to early adolescence.

Figure 3

Paternal Anxious/Depressed Symptoms Interacting with Child UPPS Positive Urgency in Predicting Child Anxious/Depressed Symptoms Longitudinally



Note. Paternal Anxious/Depressed symptoms at baseline (T1) interact with child self-reported Positive Urgency at time 2 to predict father-reported Anxious/Depressed symptoms in children at time 4; ASR Anxious/Depressed T1 = father self-report Anxious/Depressed symptoms at baseline; CBCL Child Anxious/Depressed T4 = father-rated child Anxious/Depressed symptoms at time 4; UPPS Positive Urgency T2 = self-rated Positive Urgency at time 2; ** = $p < .01$; Interpolation Line = Region of Significance.

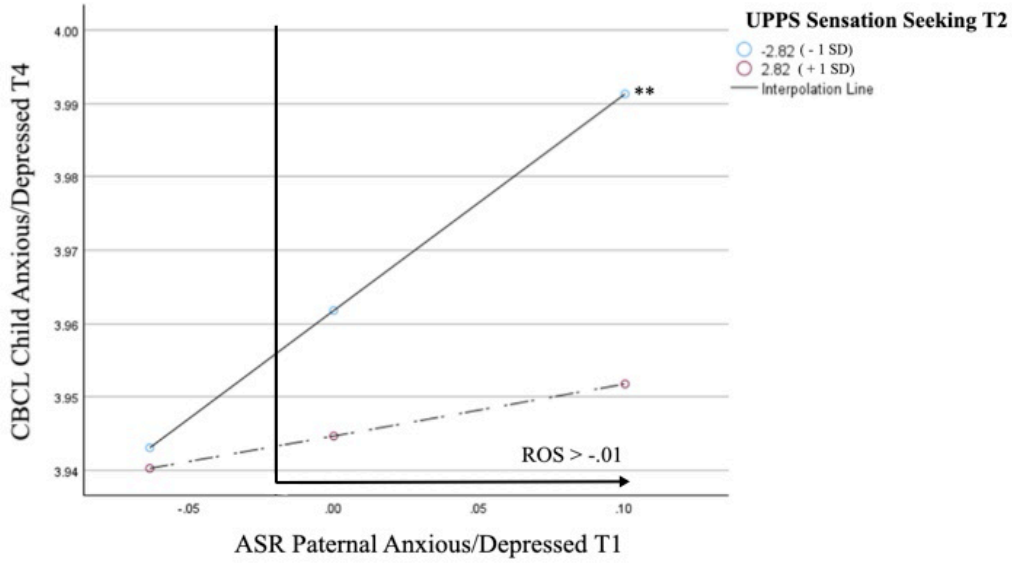
Similar to the pattern of results observed for the UPPS Positive Urgency, children with lower self-rated bottom-up UPPS Sensation Seeking (bottom-up SR, approach behaviors) at time 2 (age 11) were also at a greater risk for Withdrawn/Depressed (B = -.01, p = .07; strong trend) and Anxious/Depressed symptoms at time 4 or age 13 (B = -.01, p < .01), and the latter main effect was qualified by a significant interaction with paternal Anxious/Depressed

symptoms. Specifically, children with lower self-rated Sensation Seeking (i.e., lower motivation to engage in novel or thrilling activities) who also had fathers with elevated Anxious/Depressed symptoms were more likely to go on to experience higher levels of Anxious/Depressive symptoms themselves (B = .03, p = <.01; ROS father Anxious/Depressed at baseline >-.02; see Figure 4). A similar pattern of results was observed for lower child self-rated top-down UPPS Lack of Planning at time 2 (age 11), which interacted with paternal Anxious/Depressed symptoms in predicting both father-reported child Withdrawn/Depressed and Anxious/Depressed symptoms at time 4 or age 13 (see Table 2: B = .03, p = .07 and B = .04, p < .01; pattern of results is similar to that depicted in Figure 4). These results indicate that children with lower sensation seeking and poor planning abilities (underactive approach motivation and top-down SR deficits) who also had fathers with higher levels of Anxious/Depressed symptoms were at a greater risk for developing internalizing symptoms themselves. This pattern may suggest that youth with internalizing problems may struggle with reduced motivation to achieve and plan through goal-directed behavior, underscoring impairments in both top-down and bottom-up SR processes (White et al., 2013).

Although several main effects were noted for father-reported and child self-reported top-down and bottom-up SR in predicting later youth internalizing symptoms, there was no significant main effect of top-down SR assessed through cognitive-behavioral tasks completed by youth (LMT percent correct time 2/age 11 and EWEFS interference time 3/age 12) on their time 4 (age 13) internalizing symptoms. However, top-down SR skills indexed by the LMT percent correct at time 2 or age 11 significantly interacted with baseline paternal Anxious/Depressed symptoms to predict father-reported child Anxious/Depressed symptoms at time 4 or age 13 (see Table 2). In particular, the results indicated that children with lower scores

Figure 4

Paternal Anxious/Depressed Symptoms Interacting with Child UPPS Sensation Seeking in Predicting Child Anxious/Depressed Symptoms Longitudinally

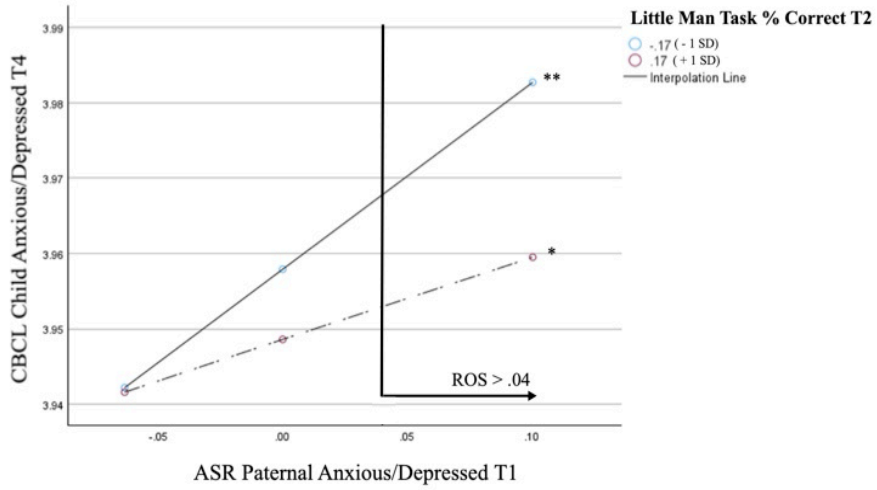


Note. Paternal Anxious/Depressed symptoms at baseline (T1) interacted with child self-reported UPPS Sensation Seeking at time 2 to predict father-reported Anxious/Depressed symptoms in youth at time 4; ASR Anxious/Depressed T1 = father self-report Anxious/Depressed symptoms at baseline; CBCL child Anxious/Depressed T4 = father-rated child Anxious/Depressed symptoms at time 4; UPPS Sensation Seeking T2 = self-rated child Sensation Seeking at time 2; ** = $p < .01$; Interpolation Line = Region of Significance.

on a cognitive control SR task at time 2/age 11 who also had fathers with elevated Anxious/Depressed symptoms were particularly at risk for Anxious/Depressed symptoms at time 4/age 13 (B = -.40, p = .03; ROS father Anxious/Depressed at baseline >.04; see Figure 5). This pattern of results aligns with previous findings indicating that weak top-down SR (or difficulties with sustaining and focusing attention and inhibitory control in particular) in youth compounds risk for child anxiety and depression, particularly when fathers are also experiencing their own internalizing symptoms (Breaux et al., 2016; Taraban et al., 2020); similar findings were discussed above for father-reported and youth self-reported top-down SR.

Figure 5

Paternal Anxious/Depressed Symptoms Interacting with Child SR Indexed by the Little Man Task Percent Correct in Predicting Child Anxious/Depressed Symptoms Longitudinally



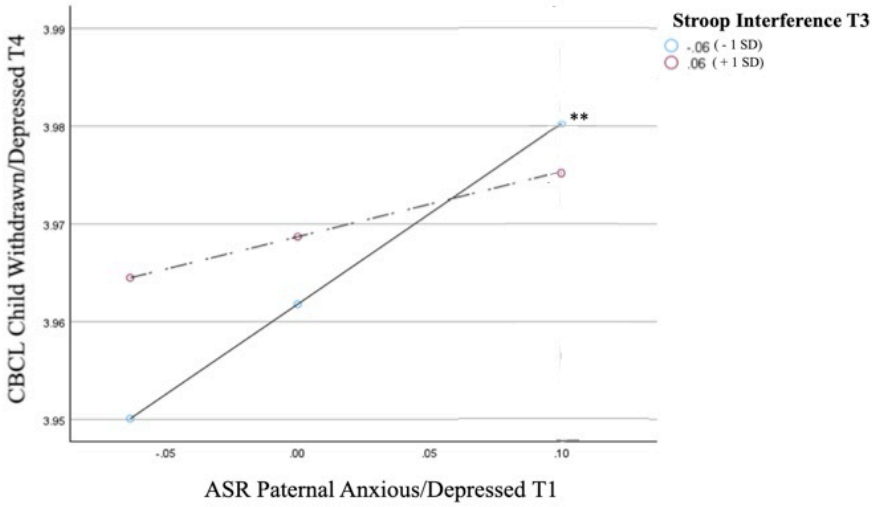
Note. Paternal Anxious/Depressed symptoms at baseline (T1) interacted with child SR at time 2 to predict father-reported Anxious/Depressed symptoms in children at time 4; ASR Anxious/Depressed T1= father self-report Anxious/Depressed symptoms at baseline; CBCL Child Anxious/Depressed T4 = father-rated child Anxious/Depressed symptoms at time 4; Little Man Task % Correct T2 = proportion of correct responses on a cognitive-behavioral task completed by children at time 2 as an index of SR; ** = $p < .01$; * = $p < .05$; Interpolation Line = Region of Significance.

A notably different pattern of results was observed for a significant interaction between paternal Anxious/Depressed symptoms and interference effects on the EWEFS (or cognitive-behavioral task completed by children at time 3/age 12 tapping into top-down SR, primarily inhibitory control). In particular, youth who performed ***better*** on the EWEFS (indexed by the lower level of the moderator, or lower interference effects, or higher top-down SR) who also had fathers with Anxious/Depressed symptoms were more likely to experience Withdrawn/Depressed symptoms at age 13 or time 4 (B = -1.02, p = .05; see Figure 6 blue simple slope line, $p < .01$). Although these results contradict previous research that has shown higher interference effects are associated with weaker top-down SR in the context of negative stimuli

due to attentional processing biases (i.e., Hankin et al., 2010), our results indicated that *higher* levels of top-down SR measured by EWEFS interference represented a risk factor for later Withdrawn/Depressed symptoms. These results suggest that children with *ineffective* top-down SR may be overcontrolled due to such behavior being modeled in their environment by their fathers with internalizing symptoms, including being excessively attuned, biased, and over inhibited in the presence of negative emotional situations (Eisenberg, 2010). Thus, risk for Withdrawn/Depressed symptoms may increase due to an over-active regulatory system biasing top-down control of behavior towards negative environmental stimuli (Bariola et al., 2011; Williams et al., 1996), consequently magnifying the risk of rumination and anhedonic manifestations of depression (Treadway & Zald, 2011).

Figure 6

Paternal Anxious/Depressed Symptoms Interacting with Child SR Indexed by the Stroop Interference in Predicting Child Withdrawn/Depressed Symptoms Longitudinally



Note. Paternal Anxious/Depressed symptoms at baseline (T1) interacted with child SR indexed by performance on the EWEFS at time 3 (interference effects) to predict father-reported Withdrawn/Depressed symptoms in children at time 4; lower interference score = higher child SR; ASR Anxious/Depressed T1 = father self-report Anxious/Depressed symptoms at baseline; CBCL Child Anxious/Depressed T4 = child Withdrawn/Depressed symptoms at time 4; Stroop

Interference T3 = Interference effects on Emotional Stroop-Emotional Face Stroop task at time 3; ** = $p < .01$.

To summarize, main effects in models with father-reported child Withdrawn/Depressed symptoms at time 4/age 13 as outcomes revealed that weaker top-down SR (EATQ-R Attention, Inhibitory Control, EC; UPPS Lack of Perseverance) *and* under-active bottom-up SR approach behaviors (i.e., low BAS Reward Responsiveness and UPPS Sensation Seeking, higher Negative Urgency) at time 2/age 11 predicted higher levels of father-reported child Withdrawn/Depressed symptoms at time 4/age 13. These results indicate that children with *poor top-down SR skills* (including sustaining attention, inhibitory control, and planning for multi-step tasks) and *under-active bottom-up approach motivation* (lower BAS Reward Responsiveness and UPPS Sensation Seeking) were more likely to experience Withdrawn/Depressed symptoms at time 4 (age 13), regardless of the influence of paternal Anxious/Depressed symptoms at time 1 (age 9). Similarly, impulsive children with higher UPPS Negative Urgency and top-down SR impairments (i.e., lower UPPS Lack of Perseverance) were at a greater risk of later Withdrawn/Depressed symptoms, indicating that youth who become depressed may struggle with strong emotions when experiencing negative affect and struggle to persevere through difficult or boring tasks.

At the same time, top-down child SR indexed by the EWEFS Interference at time 3/age 12 interacted with paternal Anxious/Depressed symptoms at time 1/age 9 to predict later Withdrawn/Depressed symptoms at time 4/age 13 (see Figure 6). This pattern of results suggests that children with particularly elevated top-down SR may be over- inhibited and overcontrolled especially in environments where their fathers are experiencing elevated Anxious/Depressed symptoms, which consequently compounds youth risk for developing Withdrawn/Depressed symptoms. Overall, these results are consistent with extant literature indicating children with

internalizing problems may experience either under or overcontrolled top-down SR processes (Eisenberg, 2010), and children at risk for depression may be more likely to exhibit ineffective, overcontrolled top-down SR particularly in the context where their fathers have elevated internalizing symptoms themselves.

Further, in models with child Anxious/Depressed symptoms at time 4/age 13 as outcomes, children with overactive self-reported BIS at time 2/age 11(bottom-up SR) were more likely to experience Anxious/Depressed symptoms at time 4 (age 13). This pattern of results is consistent with the hypothesis that Anxious/Depressed children are more likely to have overactive avoidance tendencies. Similarly, top-down SR impairments (i.e., lower parent-rated EATQ-R ability to focus and sustain Attention, see Figure 1; lower self-rated UPPS Lack of Planning; lower inhibitory control indexed by the LMT, see Figure 5) *and* under-active approach motivation (i.e., lower self-rated BAS Reward Responsiveness, see Figure 2; lower UPPS Positive Urgency, see Figure 3; lower UPPS Sensation Seeking, see Figure 4) at time 2/age 11 interacted with paternal Anxious/Depressed symptoms at time 1/age 9 to predict father-reported child Anxious/Depressed symptoms at time 4/age 13. These results indicate that children with poor SR, including weaker top-down SR and lower bottom-up approach motivation, were at a higher risk for Anxious/Depressed symptoms, particularly when their fathers were also experiencing elevated Anxious/Depressed symptoms. These findings are particularly impressive given the longitudinal, multi-method, and multi-informant nature of the study design.

Paternal Anxious/Depressed Symptoms Interacting With Child Self-Regulation in Predicting Child Externalizing Problems Across Time

Paternal Anxious/Depressed symptoms at baseline did not significantly predict father-reported youth Externalizing outcomes in youth at time 4 or age 13, although trends in this

direction were found (p_{range} = .06 - .37). These trends align with previous studies indicating that fathers with elevated internalizing symptoms may exert an influence on the development of externalizing problems in youth, but the evidence for these pathways is usually not as strong as for internalizing symptoms (Connell & Goodman, 2002). However, father-reported child Externalizing symptoms at baseline (age 9) consistently predicted the same symptoms in youth at time 4 (age 13), underscoring temporal stability of externalizing symptoms during this period (Bongers et al., 2004).

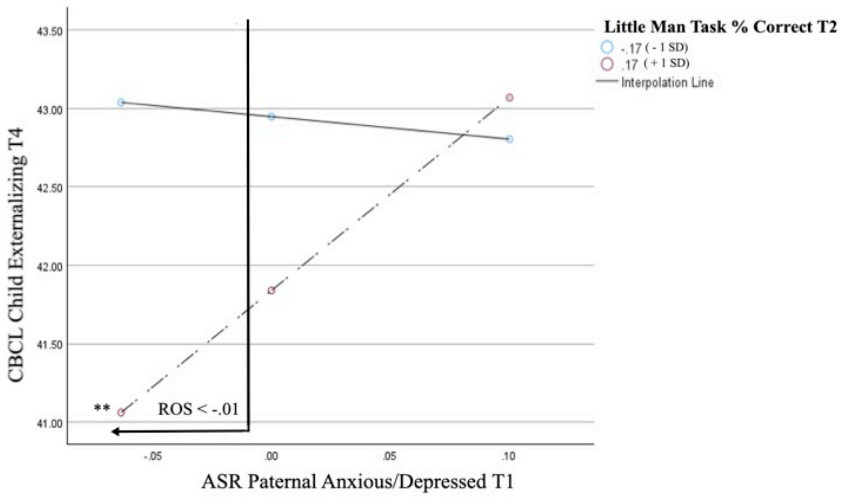
As expected, father-reported top-down child SR indexed by the EATQ-R scales (Attention: B = -2.32, p = <.01; Inhibitory Control: B = -2.34, p = <.01; Effortful Control: B = -3.25, p = <.01) at time 2 (age 11) negatively predicted father-reported youth Externalizing symptoms at time 4 (age 13), consistent with the extant literature indicating that impairments in top-down SR, including difficulties with sustaining attention and inhibitory control, significantly increase risk for later externalizing problems (Atherton et al., 2020). Also unsurprisingly, given previous studies have found that overactive bottom-up approach motivation is predictive of risky behaviors in adolescence, such as substance abuse (Willem et al., 2010), youth self-rated BAS Fun Seeking at time 2 (age 11) positively predicted father-reported child Externalizing symptoms at time 4 or age 13 (B = .34, p = <.01). Similarly, bottom-up SR indexed by self-report UPPS impulsivity traits at time 2 (age 11), Negative Urgency (B = .37, p = <.01), Sensation Seeking (B = .18, p = .10; weak trend), and Positive Urgency (B = 2.18; p = 0.08; strong trend) as well as lower top-down SR (lower Lack of Planning; B = .33, p = .01), also positively predicted father-reported youth Externalizing symptoms at time 4 (age 13). Overall, these results align with the study hypothesis and previous literature demonstrating an association between weak top-down SR and overactive approach motivation (bottom-up SR) with impulsivity and

externalizing problems (Nigg, 2017). For instance, the tendency to react impulsively based on strong emotions (reflected by high levels Positive and Negative Urgency) is often associated aggressive behavior, Sensation Seeking- with risky or rule-breaking behavior, and Lack of Planning - with top-down SR difficulties (Zapolski et al., 2010).

Finally, top-down SR skills indexed by the percent of correct responses on the LMT completed by children at time 2 (age 11), interacted with paternal Anxious/Depressed symptoms in predicting father-reported youth Externalizing problems at age time 4 or age 13 ($B = 40.41$, $p = 0.03$; see Figure 7).

Figure 7

Paternal Anxious/Depressed Symptoms Interacting with Child SR Indexed by the Little Man Task in Predicting Child Externalizing Symptoms Longitudinally



Note. Paternal Anxious/Depressed symptoms at time 1 interacted with child SR at time 2 to predict father-reported Externalizing symptoms in children at time 4. ASR Anxious/Depressed T1 = father self-reported Anxious/Depressed symptoms at baseline; CBCL Child Externalizing T4 = father-rated child Externalizing symptoms at time 4; Little Man Task % Correct T2 = proportion of correct responses on a cognitive-behavioral task completed by children at time 2 as an index of SR; ** = $p < .01$; Interpolation Line = Regions of Significance.

This pattern of results demonstrated that children with weaker top-down SR (lower inhibitory control and sustained attention) were at an increased risk for later Externalizing behaviors regardless of the influence of paternal symptoms. These results align with previous findings demonstrating an association between weaker top-down SR (poor inhibitory control and attentional focusing in particular) as a risk factor for externalizing problems in youth (Fosco et al., 2019).

Overall, these results suggest that child-specific factors, including weaker top-down SR (indexed by the lower EATQ-R Attention, Inhibitory Control, and EC scales as well as reduced accuracy on the LMT, and lower UPPS Lack of Planning) *and* overactive bottom-up approach behaviors (indexed by higher BAS Drive/Fun Seeking, higher UPPS Negative/Positive Urgency, and higher Sensation Seeking) are significant predictors of Externalizing problems during the middle childhood to early adolescent period, regardless of the influence of paternal internalizing symptoms.

Discussion

The overall aim of this study was to understand factors that contribute to risk for or resilience against emerging psychopathology during middle childhood to early adolescence, an important development period marked by heightened emotional instability and change. There were also three more specific questions, including: (1) do paternal internalizing symptoms predict child psychopathology during middle childhood to early adolescence?; (2) are emerging SR skills (both, top-down and bottom-up processes) in middle childhood associated with later psychopathology in early adolescence? and (3) do paternal internalizing symptoms interact with children's SR to predict later internalizing and externalizing psychopathology in youth?

Paternal internalizing problems were expected to positively predict internalizing and externalizing symptoms in youth, with evidence of larger effects for the former, based on the extant literature (Sweeney & Macbeth, 2016). Another aim of this study was to understand how child SR (top-down and bottom-up) processes are implicated in emerging internalizing and externalizing symptoms in youth. In particular, ineffective top-down SR (i.e., attentional biases and under/over active inhibitory control), as well as overactive avoidance tendencies in middle childhood were expected to predict later internalizing symptoms in early adolescence, while poor top-down SR and overactive approach motivation in middle childhood would predict later externalizing symptoms in early adolescence. It was expected that elevated internalizing symptoms in fathers would interact with both bottom-up and top-down SR processes, such that children with ineffective SR (overactive reactive tendencies and under/overactive top-down skills) who also have fathers with elevated internalizing symptoms would experience compounded risk for anxiety, depression, and externalizing behaviors. Notably, the exact nature of these interactions was speculative due to a particular paucity of extant literature in this area.

The results were theoretically meaningful and consistent with the study predictions. In particular, children with weak top-down SR and low approach motivation who also had fathers with elevated Anxious/Depressed symptoms were at a higher risk of experiencing Anxious/Depressed symptoms themselves, while children with overcontrolled top-down SR and low approach motivation who also had fathers with elevated Anxious/Depressed symptoms were at a higher risk for Withdrawn/Depressed symptoms. These findings were particularly impressive given the longitudinal, multi-method, and multi-informant nature of the study design. Finally, weaker top-down SR and overactive bottom-up approach behaviors were significant predictors

of Externalizing problems during the middle childhood to early adolescent period, regardless of the influence of paternal internalizing symptoms.

Paternal Internalizing Symptoms as Predictors of Youth Psychopathology Over Time

The first goal of this study was to understand how paternal anxiety and depression predict internalizing and externalizing symptoms during the transition period from middle childhood to adolescence (age 9 to 13), an association that has been relatively understudied in the extant literature (Sweeney & Macbeth, 2016). The results of bivariate and multivariate analyses indicated that paternal internalizing symptoms assessed when children were 9 years old significantly predicted internalizing problems in youth at age 13, with moderate effect sizes. This pattern of findings extends prior literature demonstrating similar effects during early and middle childhood (Ramchandani et al., 2011), indicating that familial risk for anxiety and depression in fathers unfolds across child development. At the same time, contrary to the study predictions based on the extant literature (i.e., Sweeney & Macbeth, 2016), paternal internalizing problems did not significantly predict externalizing symptoms in youth, although trends in this direction were observed. Overall, these results suggest that heterotypic developmental pathways from paternal internalizing psychopathology to youth externalizing problems could be more complex than could be explained by the current study and may require considering additional variables that were not included. At the same time, paternal internalizing problems clearly confer risk for emerging youth anxiety and depression, likely due to genetic susceptibility and negative environmental influences (i.e., modeling of avoidance behavior and negative parenting practices resulting from elevated anxious and depressive symptoms in fathers; Goodman et al., 2008; Ramchandani et al., 2011).

Top-down and Bottom-up SR as Predictors of Youth Psychopathology Over Time

The second goal of this study was to understand how different facets of child SR (both top-down and bottom-up processes) assessed at age 11/12 were associated with internalizing and externalizing symptoms at age 13. In particular, main effect findings from the multivariate analyses demonstrating which predictors had a significant effect on the outcomes when the moderator value was zero, indicated that deficits in self- and father-reported child top-down and bottom-up SR at age 11 significantly predicted father-reported Anxious/Depressed, Withdrawn/Depressed, and Externalizing symptoms at age 13. In particular, child attentional focusing consistently emerged as a negative predictor for all psychopathology variables, which is unsurprising given that deficits in the ability to sustain and focus attention are often described as a transdiagnostic risk factor (Nigg, 2017). Further, child top-down SR skills of inhibitory control (father-reported) and planning (self-reported) at age 11 emerged as negative predictors of father-reported Withdrawn/Depressed and Externalizing symptoms, but not for Anxious/Depressed symptoms in youth at age 13. This pattern of findings is unsurprising, given that top-down SR impairments characterized by difficulty inhibiting negative emotional responses (Eisenberg et al., 2010; Snyder, 2013) and planning effectively across contexts (Wagner et al., 2015; Zimmerman, 2000), have been noted to significantly increase risk for both internalizing and externalizing problems in youth. At the same time, the lack of significance for child inhibitory control and planning in predicting their Anxious/Depressed symptoms was somewhat unexpected and contrary to extant literature (Eisenberg et al., 2009), though examination of moderating factors may clarify the nature of the relationship between child anxiety and top-down SR (Nolen-Hoeksema & Watkins, 2011). Further, children with higher levels of father-reported Withdrawn/Depressed symptoms at age 13 also demonstrated lower

levels of self-reported perseverance at age 11, which is unsurprising given that depression is frequently characterized by struggles with motivation, making it difficult to plan and persist through the challenging demands of everyday life (Vergara-Lopez et al., 2016). Overall, these results confirm that children who have weaker top-down SR skills may be more likely to experience psychopathology across the internalizing or externalizing spectra in middle childhood to early adolescence (Nigg, 2017).

Similarly, main effect findings from the multivariate analyses demonstrated that, consistent with the study predictions, child self-reported bottom-up SR (i.e., approach and avoidance tendencies) at age 11 emerged as significant predictors of father-reported youth internalizing and externalizing symptoms at age 13. Namely, higher levels of behavioral inhibition at age 11 were associated with higher levels of Anxious/Depressed symptoms at age 13, a pattern consistent with the extant literature stating that children at a higher risk for anxiety have higher avoidance tendencies, marked by withdrawal and negative affect (Gray & McNaughton, 2000). Similarly, children with elevated Withdrawn/Depressed symptoms at age 13 were more likely to have fewer approach behaviors characterized by lower levels of reward sensitivity and sensation seeking at age 11. Indeed, youth who experience depressive symptoms may struggle to benefit from rewarding experiences as a result of withdrawal and reduced ability to experience pleasure, a core feature of anhedonia (Clark & Watson, 1991). Overall, the study findings indicated that children with overactive avoidance motivation were more likely to develop anxious symptoms, while children with reduced approach tendencies were at greater risk for later depression.

Conversely, children with elevated father-reported Externalizing symptoms at age 13 self-reported overactive approach tendencies at age 11, characterized by higher levels of fun

seeking behavior, sensation seeking, and negative urgency. Therefore, children who tend to engage in immediately rewarding and/or dangerous fun seeking and impulsive behavior may be more likely to develop externalizing symptoms over time (Nigg, 2017; Zapolski et al., 2010). Similarly, children who respond impulsively when experiencing negative emotions may be more likely to engage in disruptive behavior in adolescence (Beauchaine & Zisner, 2017). Taken together, these results highlight the relevance of individual variations in bottom-up reactive processes, providing additional evidence for previously reported associations between fewer approach behaviors/higher avoidance with internalizing, and stronger approach motivation with externalizing (Nigg, 2006; Rothbart & Bates, 2006). The results were mostly consistent with the study predictions, highlighting the importance of SR processes in middle childhood and how they may differentially contribute to risk for psychopathology in early adolescence. These theoretically meaningful findings were particularly impressive given the multi-method, multi-informant, longitudinal nature of the study.

Child SR Deficits May Exacerbate the Risk Conferred by Paternal Psychopathology

The third goal of this study was to understand how paternal internalizing problems interact with children's bottom-up and top-down SR at age 11/12 to predict youth psychopathology at age 13. Overall, three distinct patterns of findings were observed. First, paternal internalizing symptoms and deficits in top-down and bottom-up SR (i.e., *poor attentional focusing, weak inhibitory control, and reduced approach behaviors*) interacted compounding the overall risk for later *Anxious/Depressed* symptoms in youth. Second, paternal internalizing problems and ineffective top-down SR (i.e., *overactive inhibitory contro*l) also interacted in predicting later *Withdrawn/Depressed* symptoms. Third, *weaker top-down SR (i.e., underactive inhibitory control)* emerged as a predictor of *Externalizing* symptoms over time, an

association that persisted regardless of paternal internalizing problems. These patterns of findings were consistent across measures, informants, and methods, highlighting the robustness and generalizability of study findings.

More specifically, the first pattern of findings indicated that children who had fathers with elevated internalizing problems and SR deficits (weak top-down SR indexed by father reports on the EATQ-R and child performance on the LMT; and underactive approach tendencies indexed by child self-reports on BAS Reward Responsiveness and UPPS Positive Urgency and Sensation Seeking) were at a greater risk for Anxious/Depressed symptoms themselves during early adolescence. These results are consistent with previous literature demonstrating that children with weak top-down SR and underactive approach tendencies may be more likely to internalize negative parenting behaviors of depressed or anxious fathers, resulting in heightened levels of avoidance and difficulties with emotion regulation (Teetsel et al., 2014). Further, these results align with the Diathesis-Stress Model of psychopathology in the context of the broader developmental psychopathology literature (Belsky & Pleuss, 2009), which posits that the combination of vulnerability and stress compounds the likelihood of psychopathology beyond individual effects of vulnerability and stress alone. In the current study, children with weak top-down SR and underactive approach tendencies (in this case, diathesis or vulnerability) and exposure to paternal internalizing symptoms (in this case, environmental stressors) were at higher risk for internalizing psychopathology (Belsky & Pluess, 2009). Thus, to my knowledge, the current study was the first to demonstrate that an interaction between top-down/bottom-up SR deficits and paternal internalizing symptoms multiplies the risk for anxious/depressed symptoms in youth across middle childhood and early adolescence.

At the same time, findings pertaining to Withdrawn/Depressed symptoms at age 13 as an

outcome followed a different pattern. In particular, only one significant interaction between paternal internalizing symptoms and child SR was noted to predict Withdrawn/Depressed symptoms in youth. Specifically, stronger inhibitory control indexed by the EWEFS interference at age 12 interacted with paternal internalizing symptoms to predict Withdrawn/Depressed symptoms in youth at age 13, such that children with overactive inhibitory control who also had fathers with elevated internalizing symptoms were at a higher risk for later Withdrawn/Depressed symptoms. As this was the only significant interaction between paternal internalizing problems and child SR in predicting Withdrawn/Depressed symptoms in youth, these results should be replicated in future studies. In particular, researchers should consider using psychopathology measures that, unlike the CBCL Anxious/Depressed and Withdrawn/Depressed scales, clearly differentiate between anxiety and depression in youth. Indeed, the evidence for interactions between paternal internalizing problems and child SR was notably more extensive for Anxious/Depressed symptoms in youth (vs. Withdrawn/Depressed). These results may reflect extant literature demonstrating that anxiety tends to have an earlier onset than depression (Kessler et al., 2005), it is the most common mental health concern during adolescence (Merikangas et al., 2010), and it is more likely to occur in the context of continuous maltreatment (i.e., persistent negative paternal behaviors) while depression tends to emerge after isolated stressful life events (i.e., physical or sexual abuse; Hovens et al., 2010).

Notably, children who had fathers with elevated internalizing symptoms and excessive inhibitory control were at a higher risk for later Withdrawn/Depressed symptoms. In the context of broader developmental psychopathology literature, this pattern of results may reflect the Differential Susceptibility Theory (Belsky & Pluess, 2009), which posits that some individuals are more susceptible than others to both positive and negative environmental influences. In this

case, children with stronger top-down SR might be more attuned to their environment, such as their father's emotional state, making them more vulnerable to internalizing outside negative information and increasing the likelihood that they will also develop Withdrawn/Depressed symptoms. Although these findings may point to potential specificity in developmental pathways (undercontrolled top-down SR for anxiety, excessive top-down SR for depression), symptoms of anxiety and depression are often comorbid (i.e., 45% comorbidity; Kalin, 2020) and demonstrate a significant overlap in symptoms (i.e., withdrawal, negative affect; Kalin, 2020). As this is the first study to explore the interaction between paternal internalizing problems and child SR in middle childhood to early adolescence, replicability of the current findings is paramount. For now, it can be concluded that deficits in top-down and bottom-up SR (both under- and overactive top-down SR and deficits in approach motivation) in children, especially in the context of fathers with elevated internalizing problems, are at a significantly higher risk for internalizing problems themselves during the transition from middle childhood to adolescence. Although these findings were consistent with the study predictions, the pattern of results obtained for the Externalizing symptoms in youth was somewhat discrepant from what was originally anticipated.

In particular, weak top-down SR (poor inhibitory control and inattention indexed by child performance on the LMT) emerged as a risk factor for externalizing problems regardless of the influence of paternal internalizing symptoms. These results point to the well documented connection between the top-down SR deficits and externalizing symptoms in youth (Eisenberg, 2010; Nigg, 2017). However, the current study findings do not fully align with the original predictions and previous literature demonstrating small associations between paternal internalizing problems and child externalizing problems (Sweeney & Macbeth, 2016). There are several possible explanations for the inconsistencies between the extant literature and current

study findings. In particular, previous studies have identified that internalizing symptoms in fathers significantly predicted externalizing outcomes in early childhood (Ramchandani et al., 2008), thus, it is possible that such an association later in child development is less pronounced. Additionally, this pathway may be better understood through mechanisms that were outside the scope of the current study (i.e., family conflict, marital discord, gender-specific pathways; Sweeney & Macbeth, 2016; Wilson & Durbin, 2010). Additionally, no significant interactions were found between paternal internalizing symptoms and bottom-up approach/avoidance motivation, though children at risk for externalizing problems tended to show higher approach behaviors regardless of paternal symptoms. Therefore, these results demonstrated that children with poor top-down SR and overactive bottom-up approach tendencies are at a significant risk for externalizing problems, an association that remains strong regardless of familial risk associated with internalizing problems in fathers.

Study Strengths and Limitations

Strengths

The current study had numerous strengths. First, the *large-scale* ($N = 497$) longitudinal study design allowed for rigorous statistical analyses, confirming the important *role of fathers* in child development concurrently and over time and thus addressing an important gap in the extant literature. Previous studies have failed to provide consistent, generalizable results pertaining to the impact of fathers' psychopathology on child development, which is at least partially due to small sample sizes (Goodman et al., 2008). Second, the *longitudinal* study design in particular facilitated an understanding of how paternal internalizing symptoms and child SR interacted to predict *child psychopathology over time*. The ability to examine the role of predictors over time facilitated identification of important prevention and early intervention targets (i.e., specific

components of child SR and paternal mental health as well as parenting) that can be addressed during early-to-middle childhood, preceding adolescence. Third, the approach to *operationalization of psychopathology and SR* represents a strength of the current study. In particular, both father and child psychopathology were measured using evidence-based dimensions with stronger construct validity, reliability, and temporal stability than offered by the *DSM*-based categorical diagnoses (Achenbach et al., 2005). Further, the current study used an integrated SR model, including both top-down and bottom-up SR processes (i.e., attentional focusing, inhibitory control, [lack of] planning and perseverance, behavioral approach/avoidance, positive/negative urgency, impulsivity, and sensation seeking) incorporating both EC and EF constructs relevant to child development (Nigg, 2017). Previous studies tend to have limited SR construct coverage (i.e., focusing only on top-down SR; Aite et al., 2018), thus undermining the importance of its multifaceted nature and how top-down and bottom-up processes may differentially contribute to maladaptation. Finally, the *multi-method, multi-informant approach* adopted in the current study contributed to breadth and depth of construct coverage and enhanced statistical rigor. Specifically, including multiple cognitive-behavioral tasks, self-reports, and informant reports of key study variables helped reduce the potential for rater bias, increased construct coverage (Campbell & Fiske, 1959; Eid & Diener, 2006), and reduced the likelihood of shared method variance, which often inflates correlations between study variables (Podsakoff et al., 2003). Overall, the multi-method, multi-informant approach of the current study strengthened the reliability of the results by highlighting their replicability across measures, informants, and methods.

Limitations

Although the current study had numerous strengths, its limitations have to be acknowledged as well. Importantly, the measures chosen in the current study may not confer the most accurate representation of underlying constructs. Specifically, possible *limitations of construct validity of the psychopathology and some of the SR measures* have to be discussed. In particular, the ASR and CBCL Anxious/Depressed empirically derived syndrome scale include symptoms of both anxiety and depression, complicating attempts at disentangling these two constructs. Notably, the current study also required transformations of the ASR and CBCL scales to correct for particularly elevated kurtosis, which is not surprising given the commonly noted patterns of distribution of psychopathology in community samples. After conducting natural logarithmic transformations, the CBCL Anxious/Depressed scale still had skewness and kurtosis somewhat higher than recommended in the extant literature (Kline, 2005). Similar to the psychopathology measures used in the current study, SR questionnaires, the EATQ-R in particular and other measures from Rothbart's temperament assessment battery, have been criticized for their limited construct validity, leading to inadequate coverage and differentiation of SR facets (Kotelnikova et al., 2016; 2017). Given these gaps in construct validity, it was not surprising that the internal consistency of some of the SR scales was also lower than desired (i.e., EATQ-R Inhibitory Control alpha = .50; and some UPPS sub-scales had alphas at .64-.65). However, the results pertaining to the EATQ-R Inhibitory Control scale were consistent with other EATQ-R and SR scales. As well, the results obtained with the UPPS were consistent and theoretically meaningful, facilitating an understanding of top-down and bottom-up SR deficits. Finally, many cognitive-behavioral tasks suffer from *task impurity* (Best & Miller, 2010), and the scores on the tasks used in the current study (LMT and EWEFS) may not sufficiently distinguish between different SR facets. For instance, performance on the LMT is strongly associated with

visual-mental rotation ability (Rosenberg et al., 2020), so it is possible that this task is not a pure measure of top-down SR skills. Further, it is possible that shared networking between inhibitory control processes and attention processes confounded interpretation of the interference scores on the EWEFS as a pure measure of inhibitory control (Smolker et al., 2022). Limitations of the existing developmental psychopathology and SR measures (questionnaires and cognitive-behavioral tasks) used in the current study offer extensive opportunities for future directions in measure development research.

Additionally, it is important to note that *measure selection in the current study was limited by the availability of data in the ABCD study* and the specific time points that the project focused on. For example, the ABCD study includes psychometrically stronger measures of top-down SR variables (i.e., the Flanker Task, Dimensional Change Card Sort) that were not included in the current study, since they did not meet the requirements of the design. As a result, the specific role of important SR facets (such as working memory and cognitive flexibility) was impossible to account for in the current study. Finally, given the data in this study were part of a larger, longitudinal study (the ABCD Study®), it is possible that *"cohort effect" limited the generalizability of the current results*. Cohort effects capture how environmental or contextual factors during the period of time youth are followed may impact a single group, impeding generalizability of results to the broader population (Schaie, 1984). Notably, data were collected between the years of 2018 to 2023, a period marked by the COVID-19 pandemic. Thus, due to the heightened stress inherent to the COVID-19 pandemic, it is possible that families in this sample were more likely to experience elevated rates of psychopathology than would be observed in other cohorts. A few more *sample characteristics limited the generalizability* of the study findings. This study included fathers who were primary caregivers for children in the study

and who also completed all four waves of data collection used in the current project; thus, future studies may wish to examine the role of fathers in different contexts (i.e., single fathers, secondary caregivers) to fully understand the role of paternal mental health for child development. Further, the extent of impact of diversity in paternal education level and family SES may also have implications for future studies replicating current findings (Wesseldjik et al., 2018). Overall, the results of the current study shedding light on the role of paternal internalizing symptoms and child SR in predicting later psychopathology in youth should be replicated in other large-scale longitudinal studies with diverse samples using a multi-method, multi-informant approach.

Study Implications and Future Directions

Research Implications and Future Directions

Historically, generalizable conclusions regarding the role of SR in child development have been impeded by the the Jingle-Jangle fallacy (i.e., an incorrect assumption that two different constructs are the same, because they have the same label, or two almost identical constructs are different, because they have different names; Nigg, 2017; Thurstone, 1947), an artificial divide between neurocognitive and developmental psychopathology bodies of literature preventing an understanding of the nature and structure of SR across the lifespan (Zhou et al., 2012), inadequate selection of assessment methods for covering important top-down and bottom-up SR processes (Aite et al., 2018), and construct validity limitations of existing measures (Best & Miller, 2010). The current study addressed some of these limitations by utilizing an integrated model of SR based on a multi-method, multi-informant approach with the goal of understanding how distinct top-down (i.e., measured through cognitive-behavioral tasks, EATQ-R, and UPPS Lack of Planning/Lack of Perseverance) and bottom-up SR (i.e., measured

through BIS/BAS and UPPS Negative/Positive Urgency/Sensation Seeking) processes confer risk for psychopathology across development. The findings based on this model suggest that an integrated model provides a more nuanced perspective on child SR over time, shedding light on how distinct SR processes may differentially confer risk for youth psychopathology. Thus, the use of an integrated SR model reduces an artificial divide between EC and EF and improves validity and generalizability of conclusions in developmental psychopathology studies.

Future studies should continue using integrated comprehensive developmental models of SR. In particular, given that the current study focused on only two important top-down SR processes, inhibitory control and attention, due to evidence that these processes are foundational SR skills (Diamond, 2013; Garon et al., 2008; Nigg, 2017) and the limitations of the ABCD data set, the role of other important top-down SR skills, such as cognitive flexibility and working memory (Diamond, 2013) was not examined. Thus, future studies should integrate the full range of relevant top-down SR processes (i.e., cognitive flexibility, working memory) to further advance the literature on risk factors associated with child maladaptation in a developmental psychopathology macro-paradigm.

In addition, a particular focus on further reducing the methodological limitations of SR measures (questionnaires and cognitive-behavioral tasks) is also warranted. In particular, widely-used, existing self- and parent-report measures of child temperament (i.e., EATQ-R and other measures of Rothbart's developmental temperament assessment battery) have gaps in construct validity and developmental sensitivity (Kotelnikova et al., 2016, 2017). Therefore, future studies should target the development of evidence-based, developmentally sensitive measures of SR to improve longitudinal prediction of child psychopathology. Further, given task impurity (i.e., a single task usually assesses multiple cognitive mechanisms simultaneously;

Miyale et al., 2000), is a long-standing limitation in psychological research, future research should focus on developing novel scoring approaches (i.e., in contrast to total scores or percentages of correct responses) that will increase the likelihood of capturing the target constructs accurately (Miyake et al., 2000; Smolker et al., 2022). For instance, in the current study, interference effects were calculated for the EWEFS rather than using a total score of correct responses to improve the construct validity of the inhibitory control variable (Smolker et al., 2022). This scoring approach was chosen due to the evidence that interference effect calculation improves specificity of inhibitory control processes by tapping into the ability to override a prepotent response in favor of a goal-directed response (i.e., suppressing emotional responses to negatively valenced words on incongruent trials; Smolker et al., 2022), thus, providing a targeted index of emotion regulation skills. Further, combining novel, more precise scoring approaches of cognitive-behavioral data with other methods (i.e., EEG brain activation, neurological connectivity patterns, biological markers such cortisol levels) may further help researchers delineate the unique contributions of SR facets to developmental psychopathology.

Lastly, although the importance of fathers' role in child development is becoming increasingly recognized, relatively few studies, including the current project, have examined the unique pathways contributing to this association. The current study addressed a significant gap in the extant literature by examining interactions between paternal internalizing symptoms and child SR in predicting subsequent maladaptation in youth. However, researchers are encouraged to examine additional mediating and moderating mechanisms linking paternal psychopathology and youth mental health across development. In particular, the current study did not examine SR as a mediator in the relationship between paternal internalizing symptoms and youth psychopathology. This is an important future direction, as extant literature indicates that fathers

may exert a significant influence of emerging SR skills in children (Bridgett et al., 2015; Sweeney & Macbeth, 2016), which may subsequently fully mediate the pathway from paternal psychopathology and youth mental health. Further, father parenting behaviors (i.e., intrusiveness, overcontrolling, rejecting behaviors, parenting styles) can be examined as either mediators or moderators of the pathway between paternal psychopathology and youth internalizing and externalizing symptoms. The current study included several important top-down and bottom-up SR skills as moderators; however, future studies may wish to explore how other SR variables, such as working memory (Diamond, 2013), may further moderate the relationship between paternal and youth mental health. Additionally, extant literature suggests that child sex and gender may differentially impact the developmental pathways to emerging internalizing and externalizing psychopathology (Sweeney & Macbeth, 2016; Wilson & Durbin, 2010). Therefore, the role of sex and gender as moderators should be examined in future studies. Lastly, given the majority of the sample in the current study was Caucasian with 45% of the sample having annual household income of $75,000, families from marginalized cultural groups and those with lower socioeconomic status were not adequately represented, therefore not capturing some of the important predictors of child maladaptation reported in extant literature (Goodman et al., 2008). Thus, future studies are encouraged to examine how other potential moderating factors, such as cultural background and socioeconomic status, may further moderate the association between paternal psychopathology and child outcomes.

Clinical Implications and Future Directions

The current study demonstrates several important implications for prevention and early intervention targeting internalizing and externalizing problems in youth. First, given that paternal anxiety and depression have consistently emerged as significant and positive predictors of child

internalizing problems and trended in the same direction for the externalizing symptoms, greater attention to fathers is warranted in the context of the evidence-based interventions for families and youth. For example, Strengthening Families Program (SFP; Kumpfer et al., 2010), the Positive Parenting Program (Triple P; Sanders et al., 2014), and the Supporting Father Involvement (SFI; Cowan et al., 2009) interventions include components that emphasize father engagement in treatment to promote child and family well-being. In particular, the SFP includes specific outreach strategies and emphasizes unique contributions of fathers with the aim of improving father-child relationships (Kumpfer et al., 2010), the Triple P program addresses common barriers to paternal participation in treatment (i.e., work scheduling conflicts resulting in reduced father involvement) by providing flexible formatting to encourage father attendance (Sanders et al., 2014), and the SFI provides opportunities for support for each family member mental health individually and concurrently with group treatment to improve relationship quality among family members (i.e., father-child, father-mother) and reduce risk associated with familial stress (Cowan et al., 2009). Further, given the important role fathers play in fostering a children's exploration and autonomy during middle childhood to adolescence, the results of the current study suggest that clinicians may wish to further address father-specific negative parenting behaviors (i.e., intrusiveness, control, rejection) to mitigate the detrimental effects these behaviors may have on children. Overall, focusing on developing, improving, and implementing existing family-based interventions that are particularly attuned to the role of fathers is an important future direction for clinical scientists and mental health practitioners.

Second, given that, similar to paternal internalizing symptoms, child SR, including top-down and bottom-up processes, emerged as a significant predictor of later psychopathology in youth (small-to-moderate effect sizes), interventions targeting emerging SR skills should be

strongly considered. For example, interventions for internalizing problems may target increasing adaptive approach behaviors to reduce avoidance behaviors (Chorpita & Daleiden, 2009), while interventions for externalizing problems may target increasing adaptive impulse control or focus on reward/sensation seeking behaviors with the goal of harm reduction (i.e., engagement in adaptive, competitive sports rather than risky or harmful behaviors; Conduct Problems Prevention Research Group, 2011). Many evidence-based approaches such as Cognitive Behavioral Therapy, focus on strategies that foster SR through the interplay of cognitions, emotions, and behaviors, but SR skills in particular are seldom the primary focus of these interventions (Arco, 2024).

Overall, relatively few interventions exist that specifically target SR skills in children. For example, the Tools of The Mind Program (ToM) for preschool children (Diamond et al., 2007), and the Promoting Alternative Thinking Strategies (PATHS) for youth aged 7-12 (Crean & Johnson, 2013) are notable for focusing on top-down SR skills. These interventions use direct skill training, metacognitive strategies, emotional awareness building, and practice in real-life situations to help youth generalize their top-down SR skills across environments (Crean & Johnson, 2012; Zhou et al., 2012). In particular, ToM uses play scenarios to improve working memory, inhibitory control, and cognitive flexibility, and PATHS involves explicit instruction, targeting emotional awareness, understanding cognitions, reciprocal links between thoughts, feelings, and behavior, and social skills training, found effective for improving top-down SR and reducing behavioral problems, such as aggressive behavior in middle school-aged children (Blair et al., 2018; Crean & Johnson, 2012). Further, other top-down SR-focused interventions, such as Central Executive Training (CET) and Inhibitory Control Training (ICT; Kofler et al., 2020), have been effective for improving attentional focusing, inhibitory control, and working memory

for children diagnosed with ADHD. Despite some evidence for effectiveness of these interventions, some studies have noted the lack of long-term gains (i.e., ICT in Kofler et al., 2020, ToM in Wilson & Farran, 2012). Nonetheless, extant literature suggests that interventions targeting specific aspects of top-down SR in particular may be important clinical tools to support youth at risk for psychopathology (McClelland et al., 2018). Further, although the intervention programs discussed are primarily implemented in educational settings for younger children, the results of the current study indicated that adapting SR interventions for middle childhood and early adolescence is an important future direction for clinical scientists.

Conclusions

The current study adopted a longitudinal, multi-method, multi-informant design combined with a rigorous statistical approach to understand a complex interplay of risk factors at different levels of analysis in predicting child maladaptation during middle childhood and early adolescence. Paternal internalizing problems assessed when children when 9 years old significantly and positively predicted later anxious and depressive symptoms in early adolescence (age 13); the results for the youth externalizing problems were weaker, but they trended in the same direction. Further, child individual factors, including overactive bottom-up and ineffective top-down self-regulatory skills at age 11/12 significantly predicted later internalizing and externalizing symptoms in youth at age 13. Importantly, this study was the first, to my knowledge, to examine how child SR moderates the association between paternal internalizing psychopathology and child maladaptation. In particular, consistent with the study predictions, ineffective top-down SR and under-active bottom-up approach tendencies exacerbated the risk conferred by paternal internalizing problems in predicting emerging anxious and depressive symptoms in youth. At the same time, weak top-down child SR and over-active

bottom-up approach tendencies emerged as a significant risk factor for externalizing problems in youth regardless of fathers's mental health. The current study advanced the scant body of literature on the interplay between paternal internalizing problems and top-down/bottom-up child SR in predicting youth outcomes across an important developmental period of middle childhood to early adolescence, and it has extensive implications for both clinical scientists and mental health practitioners.

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