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Trajectories of Child Externalizing Problems between Ages 3 and 10 Years:

Contributions of Children's Early Effortful Control, Theory of Mind, and Parenting Experiences

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Abstract

Preventing problem behavior requires an understanding of earlier factors that are amenable to intervention. The main goals of our prospective longitudinal study were to trace trajectories of child externalizing behavior between ages 3 and 10 years, and to identify patterns of developmentally significant child and parenting risk factors that differentiated pathways of problem behavior. Participants were **218** 3-year-old boys and girls who were reassessed following the transition to kindergarten (**age 5 – 6 years**) and during the late school-age years (age 10). Mothers contributed ratings of children's externalizing behavior at all three time points. Children's self-regulation abilities and theory of mind were assessed during a laboratory visit, and parenting risk (**frequent** corporal punishment and low **maternal** warmth) was assessed using interview-based and questionnaire measures. Four developmental trajectories of externalizing behavior **yielded the** best **balance of parsimony and fit with** our longitudinal data **and latent class growth analysis**. Most young children followed a pathway marked by relatively low levels of symptoms that continued to decrease across the school-age years. Atypical trajectories marked chronically high, increasing, and decreasing levels of externalizing problems across early and middle childhood. Three-year-old children with low levels of effortful control were far more likely to show the chronic pattern of elevated externalizing problems than changing or low patterns. Early parental corporal punishment and maternal warmth, respectively, differentiated preschoolers who showed increasing and decreasing patterns of problem behavior compared to the majority of children. The fact that children's poor effortful regulation skills predicted chronic early onset problems reinforces the need for early childhood screening and intervention services.

KEYWORDS: preschool; longitudinal; parenting; self-regulation; theory of mind; externalizing

Trajectories of Externalizing Problems between Ages 3 and 10 Years:

Contributions of Children's Early Effortful Control, Theory of Mind, and Parenting Experiences

A sizable number of preschool-age children have shown persistent externalizing problems that cascade into pervasive impairments in social, emotional, and academic functioning across childhood and adolescence (e.g., Campbell et al., 2010; Shaw, Hyde, & Brennan, 2012). Thus, from a prevention standpoint it is important to identify individual and family characteristics that differentiate children who show persistent problems from those who follow typical or changeable pathways. **Guided by a developmental psychopathology framework, we assessed individual and family characteristics that represent critical adaptive challenges for young children: establishment of adequate self-regulation and social cognition, and the presence of supportive parent-child relationships. Deficits in all three domains have been implicated as key risk factors in the development of persistent early onset externalizing problems. However, measures of these constructs are not independent and have rarely been included in the same predictive study (Olson et al., 2011). By simultaneously assessing effortful control, theory of mind, and parenting experiences in children who were just beginning to meet these developmental challenges, we aimed to identify early risk markers that uniquely predicted children's diverse pathways of externalizing problems.**

Development of Early Onset Externalizing Behavior

Learning to establish cooperative social relationships is a critical developmental task for preschool-age children. Getting along with others requires a complex array of skills, particularly sharing attention and play materials, inhibiting aggressive and destructive impulses, following directions, responding appropriately to requests, and delaying gratification of immediate desires. Young children who fail to master these challenges, especially those who show chronically high levels of defiance and aggression, are at risk for later academic failure, conflicted relationships with parents, siblings, peers, and teachers, delinquency, and substance abuse (e.g., Broidy et al., 2003; Campbell et al., 2010; Keenan et al., 2011). On the other hand, defiant and aggressive behaviors are common in early childhood, reflecting typical variations in the development of self-regulatory competence, communication skills, and social **cognition**

(Olson. Sameroff, Kerr, & Lunkenheimer, 2009). For example, most children show acts of aggression by the second year of life which peak in the third year; by the time children enter kindergarten, aggressive behaviors are largely inhibited (e.g., Alink, Mesman, Zeijl, Stolk, Juffer, Koot, & Van IJzendorn, 2006; Hay, Payne, & Chadwick, 2004; Tremblay, 2010). However, a sizable **minority** of children will continue to show problem behavior across the preschool to school-**age transition** (Campbell, Spieker, Burchinal, Poe, and the NICHD ECCRN, 2006; Shaw, Gilliom, Ingoldsby, & Nagin, 2003). Importantly, high levels of disruptive and aggressive behavior in kindergarten are warning signs of long-term problems that "cascade" into multiple domains of impairment (Broidy et al., 2003; Vitaro, Brendgen, Larose, & Tremblay, 2005). To understand the origins of chronic externalizing problems, we must identify developmental factors and mechanisms in early childhood that are associated with persistent vs. self-limiting patterns of problem behavior. Effective prevention of these problems hinges upon knowledge of early risk factors and etiological processes. Thus, the main goals of our study were to trace trajectories of child externalizing behavior between ages 3 and 10 years, and to identify patterns of early risk factors that differentiate individual pathways of problem behavior.

Group-based trajectory modeling**, also known as latent class growth analysis (LCGA), has been** used to **identify developmental trajectories** of children who manifest **discrete** patterns of **growth in** externalizing behavior across childhood and adolescence (e.g., Broidy et al., 2003; Campbell et al., 2010; Odgers et al., 2008; Nagin & Tremblay, 1999; Schaeffer et al., 2006). Typically, children's externalizing behaviors have been tracked beginning in the school-age years. All studies have revealed **trajectory classes** of children who manifest persistently high, persistently low, and mixed patterns of problem behavior (e.g., high but declining; increasing) across development. However, relatively few studies have focused on trajectories of child externalizing problems that begin before school entry. Noteworthy exceptions have shown that children at risk for persistent problem behavior across the school-age years can be identified as early as 2 to 3 years of age (Campbell et al., 2006; Shaw et al., 2003). For example, Shaw et al. (2003) identified developmental trajectories of overt aggressive behaviors between ages 2 and 8 years. Most toddlers showed a decline in overt aggression across development. Using **LCGA**, the

authors identified boys who followed persistently high and low trajectories of problem behavior, as well as high- and moderate-level desisting pathways. Boys who followed the persistently high trajectory comprised 5.6% of the sample, whereas 14% of boys were in the persistently low group. Those in the moderate and high desisting groups (42% and 38%, respectively) showed elevated levels of aggressive behavior at age 2 that declined steadily across time. All participants were boys who were growing up in low-income family settings. Similarly, using a large **national** sample, Campbell et al. (2006) classified boys and girls who followed diverse trajectories of aggressive behavior between ages 2 and 9 years. The authors identified **trajectory classes** of children who showed high stable (3%), moderate and stable **(15%), moderate declining (12%), stable low (25%), and very low (45%) levels of overt aggressive behavior.** As expected, children in the high stable **trajectory class** showed the most severe and pervasive adjustment problems. However, children who showed **moderate and low levels of stable aggression** were at risk for some developmental problems during the late school-age years. Conversely, children who showed early moderate levels of aggression that declined to very low levels had good developmental outcomes at age 12 years.

In sum, **trajectory classes** of children at risk for persistent aggressive and disruptive problem behavior can be identified during the toddler period. However, available studies have been few in number and have varied with regard to families' socioeconomic backgrounds, statistical methods used to identify trajectories, **inclusion of girls,** and whether persistent patterns of moderate- or low-level symptom patterns emerge. As shown below, studies also have varied in relation to the nature and assessment of risk factors that differentiate **trajectories** of children who manifest persistent high, low, or changing patterns of problem behavior across development.

Early Childhood Risk Factors

What characteristics place young children at elevated risk for aggressive and disruptive behaviors across the school-age years? **Our choice of risk factors was drawn from developmental psychopathology theory, specifically the concept of age-salient adaptive tasks (Rutter & Sroufe, l984; Cicchetti, 2006). According to this theory, each age period is characterized by a series of**

adaptive challenges that, if adequately met, provide a foundation for the child's adjustment to the next set of age-salient developmental issues. Establishing adequate levels of self-regulation, theory of mind and parent-child adjustment are fundamental developmental challenges for preschool-age children. For example, because the preschool period is a time of rapid development in children's self-regulation and social-cognitive skills, it also is a period of heightened vulnerability for children at risk (Olson et al., 2009). Moreover, many young children struggle with these complex adaptive challenges, and thus it is essential to differentiate those who show transient difficulties from those at risk for serious and cascading problems. In largely separate literatures, deficits in children's self-regulation, delays in children's social **cognition**, and exposure to adverse or suboptimal parent-child interactions have been linked to the development of persistent early onset externalizing problems. In what follows, we briefly review prior work relating these individual risk domains to the development of persistently high levels of aggressive and disruptive behavior.

Disturbances in self-regulation. A growing body of research indicates that early childhood onset externalizing problems reflect inadequate regulation of attention and impulses (e.g., Moffitt, 2003). The construct of effortful control is thought to be central here. *Effortful control* (EC; Rothbart, 1989) refers to a general executive component of temperament that governs the child's capacity to inhibit a dominant response (e.g., grabbing a toy from a peer) and initiate a subdominant response (asking for a turn to play with the toy). Individual differences in executive attention and inhibitory control develop rapidly during the toddler and preschool years and are thought to underlie the establishment of children's behavioral adjustment (Posner & Rothbart, 2000; Zelazo et al., 2003). Supporting this theory, preschool-age children with high levels of externalizing problems have been found to manifest lower levels of inhibitory and attentional control abilities than their peers with few externalizing symptoms (e.g., Hughes & Ensor, 2006; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Raaijmakers et al., 2008). **Moreover, children's poor EC skills have been found to predict growth of externalizing problem behavior in preschool-age children (e.g., Chang, Olson, Sameroff & Sexton, 2011; Eiden et al., 2009) and across the school-age period (Eisenberg et al., 2009; Lengua et al., 2008), and associations between low EC and**

elevated externalizing behavior have been replicated across diverse cultures (Olson et al., 2011; Zhou et al., 2009). Thus, deficits in **EC** play a key role in the development of early onset conduct problems.

   Delayed social cognition. Delays in social cognitive **skills** also have been posited to play a major role in the development of early onset and later childhood aggression (Lemerise & Arsenio, 2000). Furthermore, early self-regulatory competence and social **cognition** are closely intertwined (Carlson, Mandell, & Williams, 2004). As with the development of self-regulation, children's understanding of themselves and others changes rapidly across early childhood and individual differences become quite salient during this time (Wellman, Harris, Banerjee, & Sinclair, l995). One important set of competencies has been labeled "theory of mind". Between the ages of 3 and 6, children develop an increased awareness that mental states are internal, subjective experiences distinct from the behaviors and contexts associated with them (Wellman, Cross, & Watson, 2001). Examining these developments in children at risk for psychopathology is a natural and important extension of this work, providing a possible link between early mental representations and later impairments in moral understanding and conduct. For example, even after controlling for differences in verbal I.Q., aggressive/disruptive toddlers and preschoolers have been found to show delays in theory of mind (Hughes & Ensor, 2006; Olson et al., 2011). Moreover, preschoolers with **poor** theory of mind coupled with disturbances in self-regulation have been found to be at risk for showing hostile attributional biases following school entry (Choe, Lane, Grabell, & Olson, 2013).

   Adverse or suboptimal parenting behaviors. Most toddlers and preschoolers who manifest high levels of aggressive/disruptive behavior do not follow a chronic course. The quality of the child's early family relationships is critical to our understanding of why some young children with challenging temperaments show persistent disruptive behavior whereas others do not (Olson et al., 2009; Trentacosta, Criss, Shaw, Lacourse, Hyde, & Dishion, 2011). As shown below, the genesis of child behavior problems reflects transactional processes linking parent-child interactions to the development of self-regulation. Through infancy and early childhood, there is a general progression from reliance on caregivers for

external regulation of arousal to self-initiated modulation of affective reactions and behavioral impulses (Sameroff, 2009). Thus, warm and responsive caregiving, a major component of secure parent-infant attachment relationships, is thought to help the child modulate states of negative arousal, permitting positive social exchanges and children's internalization of self-regulatory skills (Sroufe, l996). In prospective longitudinal studies, unresponsive mother-infant interaction has been linked to self-regulatory problems across middle childhood and adolescence (Lahey, Van Hulle, et al., 2008; Olson, Bates, Sandy, & Lanthier, 2000). Moreover, toddlers and preschoolers who manifest high levels of early disruptive behavior have been found to experience lower levels of warm, responsive parenting than others (Gardner, l994; Olson et al., 2005; Shaw et al., l998). Conversely, sensitive, responsive caregiving has been associated with the development of positive self-regulation (Bernier et al., 2010; Choe, Olson, & Sameroff, 2013a; Feldman, Greenbaum, & Yrimiya, 1999).

The quality of early parent-child disciplinary interactions also has important implications for children's future behavioral adjustment. During toddlerhood, a period of rapid cognitive, social, and motor growth, it is normal for children to test parental limits and resist control (Shaw & Bell, 1993). The manner in which parents and toddlers resolve these developmental challenges may forecast continuing adjustment problems. In many previous reports, highly directive, negatively toned parent-toddler interactions have been associated with noncompliance, aggression, and other early manifestations of self-control problems (e.g., Chang et al., 2009; Combs-Ronto, Olson, Lunkenheimer, & Sameroff, 2009; Shaw et al., 2003). Early conflicts around noncompliance may place children at risk for escalating cycles of coercive interactions with parents, siblings, and peers, fostering persistent and pervasive patterns of impairment (Smith, Dishion, Shaw, Wilson, Winter, & Patterson, 2014). For example, parents' frequent use of corporal punishment with their preschool-age children has been related to impaired child self-regulation and high levels of aggressive problem behavior that persist or increase across development (e.g., Campbell et al., 2010; Choe, Olson, & Sameroff, 2013b; Olson et al., 2011).

Goals of the Current Study

In summary, deficits in children's effortful control, delayed social **cognition**, and adverse parenting experiences have been implicated as key risk factors in the development of persistent early onset externalizing problems. **All three domains encapsulate critical developmental challenges for young children that provide a foundation for future behavioral competence. Typically, these factors have been related to child behavior problems in separate studies. Thus, we have a limited understanding of how these risk factors work together in the genesis and development of persistent externalizing problems.**

Our prospective longitudinal study addressed several gaps in the research literature. First, there have been few **group-based** trajectory studies of child externalizing behavior that have begun during the preschool years, and even fewer that have included both boys and girls. Second, to our knowledge no studies have focused on models of early risk factors that include simultaneous assessments of child effortful control, theory of mind, and parenting experiences. By examining children who were just beginning to meet these challenges, our central aims were: **l) to identify boys and girls who showed diverse patterns of externalizing symptoms between ages 3 and 10 years and determine whether they fit clear trajectory classes; and 2) to identify risk markers and processes that differentiated children who showed diverse patterns of externalizing problems across time.** Children's problem behavior, self-regulation, theory of mind, and parenting experiences were assessed using multiple informants and methods **of data collection**. We estimated growth in children's externalizing behavior over time using latent growth curve (LGC) modeling and then approximated discrete but homogenous trajectories of externalizing behavior across ages 3, 6, and 10 with latent class growth analysis. Lastly, while accounting for children's gender, IQ, and family socioeconomic status (SES), we used multinomial logistic regression to determine whether preschool-age levels of children's social-cognitive and self-regulatory abilities and parental caregiving, as well as interactions between child abilities and parental caregiving differentially predicted affiliation in the **externalizing** trajectory classes.

Method

Participants

The **core** study included **238** children (48% girls), mothers, and a subsample of fathers (63%) involved in an ongoing longitudinal study investigating the development of school-age conduct problems (Olson et al., 2005). **Most families (95%) were recruited from newspaper announcements and advertisements sent to day care centers and preschools; others were individually referred from pediatricians and teachers. In order to recruit children with a range of behavioral adjustment levels, two different ads were periodically placed in local and regional newspapers and child care centers, one focusing on hard-to-manage toddlers, and the other on normally developing toddlers. Once a parent indicated interest, a screening questionnaire and brief follow-up telephone interview were used to determine the family's appropriateness for participation and willingness to engage in a longitudinal study. Children with serious chronic health problems, mental retardation, and/or pervasive developmental disorders were excluded (< .03 of screening sample). At recruitment, children represented the full range of externalizing symptom severity on the Child Behavior Checklist (CBCL/2-3; Achenbach, 1992), with oversampling of toddlers in the medium to high range on the Externalizing Problems (T > 60 = 44%). The remaining sample was split relatively evenly between children whose Externalizing Problems T-scores exceeded 50 but were below 60, and those whose T-scores were below 50.**

Among target children, 86% were non-Hispanic White and 14% were of other racial–ethnic backgrounds (e.g., African American, biracial). The majority of mothers reported being married (89%), 5% of mothers reported being single, 3% reported living with a partner, and 3% reported being separated or divorced. Approximately 6% of mothers reported their family as being blended or a stepfamily. Overall, 92% of households were identified as having at least two adults living with the target child, whereas 8% of households had a single, separated, or divorced parent living with the child. During recruitment from 1999 to 2001, 43% of mothers and 32% of fathers reported a bachelor's degree as their highest level of education, and another 39% of mothers and 46% of fathers reported some graduate or professional training. Approximately 14% of mothers and 10% of fathers reported partial college experience or specialized training, and about 4% of mothers and 11% of fathers reported a high school

diploma as their highest level of education (one mother and three fathers reported partial high school completion up to tenth or eleventh grade). Hollingshead (1979) four-factor measure of family socioeconomic status (SES) was created by combining levels of occupational status and educational attainment of parents living in the household during recruitment. Family SES scores ranged from 22 to 66 ($M = 54.44$, $SD = 10.83$) representing the top four of five social strata in the Hollingshead system. Most families (87%) resided in the two highest social strata. Average annual family income at recruitment was between $60,000 and $70,000, although incomes ranged from $10,000 to more than $100,000.

Procedure

At the first assessment, a female social worker interviewed mothers, and fathers when available, in their homes to collect demographic information and to administer a packet of questionnaires assessing children's behavioral adjustment, parents' caregiving behavior, and other parent and child characteristics. Data collection for the third assessment was carried out entirely online with electronic questionnaires. Mothers and fathers completed interviews and questionnaires at time 1 (T1) when children were about 3-years-old ($M = 3.14$ years, $SD = .23$). Mothers completed questionnaires at time 2 (T2) when children were between **5- and 6-years-old** ($M = 5.28$ years, $SD = .23$), and at time 3 (T3) when about 10-years-old ($M = 10.42$ years, $SD = .63$). Families were paid for participating. **Approximately 91% of the sample continued to participate in the study at T3, whereas 21 families stopped participating mainly due to family relocation.**

At T1, graduate student **examiners** assessed children's self-regulation, general cognitive functioning (i.e., IQ), and theory of mind in 3- to 4-hour behavioral assessments at a local preschool on Saturday mornings. Appointments were scheduled during home visits, so children were slightly older than at T1 when mothers were initially assessed ($M = 3.45$ years, $SD = .17$). Children received small gifts for participating. **Parents were compensated modestly for their time and participation.**

Sociodemographic Measures

Family background. During the initial assessment, mothers reported their marital status, household composition, and other sociodemographic information regarding their family members. Mothers reported

their racial-ethnic background and that of their partner and child (if adopted). The Hollingshead (1979) four-factor index of SES was calculated for each family.

Parenting Measures

Maternal warmth. Mothers completed the Parenting Dimensions Inventory (Power, Kobayashi-Winata, & Kelley, 1993), a 47-item multidimensional measure of parental support, control, and structure. **The PDI has been shown to have high levels of reliability (Slater & Power, l987) and numerous studies have supported its validity by showing significant concurrent and predictive correlations between PDI scales and behavioral and parent report measures of similar parenting constructs (see Power, l993).** In the current study, we averaged standardized scale scores for two intercorrelated ($r = .47$, $p < .001$) dimensions of support most theoretically related to maternal warmth (Eisenberg et al., 2005), *nurturance* ($\alpha = .74$, *N* of items = 6) and *responsiveness* ($\alpha = .36$, *N* of items = 4), into the composite variable T1 *maternal warmth*.

Physical discipline. Dodge, Pettit, and Bates' (1994) Harshness of Discipline scale was administered during home interviews at T1 and T2. **This measure was found to have strong reliability ($\alpha = .97$; Dodge et al., l994) and has shown consistent evidence of concurrent and predictive validity (e.g., Olson et al., 2005).** Mothers reported the frequency with which each parent had physically disciplined their child (e.g., spank with a hand or object, grab, or shake) during the last three months using a 5-point scale: *never* (0), *once per month* (1), *once per week* (2), *daily* (3), and *several times daily* (4). Half point responses were accepted (e.g., *once every two weeks* (1.5); *every other day* (2.5); no responses of 3.5 or 4.5 were provided). **Rank order scores from 0 to 35 were created based on mothers' reported frequencies of each parent's use of physical discipline. The lowest ranking, 0, was assigned to children who did not receive physical discipline from either parent (i.e., responses of 0, 0). Children assigned the next lowest ranking, 1, did not receive physical discipline from one parent, but were physically disciplined once every two months by the other (0, .5). Children who experienced physical discipline several times daily from both parents received the highest ranking of 35 (4, 4). There were no responses of 3.5, so the next highest ranking, 34, indicated children who were**

physically disciplined daily by one parent and several times daily by the other (3, 4). Parents' use of physical punishment was relatively low in frequency ($M = 1.06$, $SD = .87$, range = 0–4 for mother's report of her own use of physical discipline; $M = .69$, $SD = .81$, range = 0–3 for mother's report of the father's use of physical discipline). According to mothers, 58 children had never received physical discipline from either parent in the past three months; 16 children were physically punished every day or several times a day by at least one parent.

Child Measures

Externalizing behavior. Mothers rated children's externalizing behavior using the CBCL/2–3 at T1 (Achenbach, 1992) and the CBCL/6–18 at T2 and T3 (Achenbach & Rescorla, 2001). **The Achenbach scales have shown high reliability and consistent evidence of construct validity (Achenbach & Rescorla, 2001).** Because different versions of the CBCL were administered across the three assessment times, we selected 16 CBCL items that were relatively consistent across versions to average into separate externalizing behavior scales.[1] These items included: Physically attacks people; Gets in many fights; Destroys his/her own things; Destroys things belonging to his/her family or others ("other children" is mentioned in lieu of "others" in the CBCL/6–18); Can't concentrate, can't pay attention for long; Stares into space or seems preoccupied ("Stares blankly" is the description used in the CBCL/6–18); Can't sit still or restless ("hyperactive" is also mentioned in the CBCL/6–18); Gets hurt a lot, accident prone; Temper tantrums or hot temper; Easily jealous; Stubborn, sullen, or irritable; Sudden changes in mood or feelings; Sulks a lot; Unusually loud; Screams a lot; Whining. In sum, these items described problems of physical aggression, destructive behavior, inattention, hyperactivity, and emotion dysregulation. Mothers responded to each item using a 3-point response scale (0 = "Not True", 1 = "Somewhat or Sometimes

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[1] **Externalizing items omitted from CBCL/2–3: Hits others; Can't stand waiting, want everything now; Demands must be met immediately; Easily frustrated; Angry moods; Disobedient; Defiant; Uncooperative; Resists going to bed at night; Quickly shifts from one activity to another. Externalizing items omitted from CBCL/6–18: Cruelty, bullying, or meanness to others; Threatens people; Inattentive or easily distracted; Impulsive or acts without thinking; Disobedient at home; Disobedient at school; Sets fires; Teases a lot; Lying or cheating; Steals at home; Steals outside the home. Both forms included "cruel to animals" but this item was not included in Externalizing scales because of very low frequencies of non-zero responses.**

True", 2 = "Very True or Often True"). Mothers' responses were averaged into Externalizing behavior

scales at each assessment with acceptable internal consistency (**T1**: $N = 238$, $M = .36$, $SD = .28$, $\alpha = .83$;

T2: $N = 228$, $M = .27$, $SD = .25$, $\alpha = .82$; **T3**: $N = 197M = .24$, $SD = .26$, $\alpha = .84$).

    Effortful control. Child effortful control (EC) was assessed using a behavioral battery and parent-

report index. Child temperament was assessed by mother and father ratings at T1 using an abbreviated

version of the Children's Behavior Questionnaire, **a widely used parent report measure that has high**

reliability and consistent evidence for convergent and predictive validity (CBQ; Rothbart et al.,

2001). CBQ scales for inhibitory control and attentional focusing represented constituents of

temperament most closely related to EC (Rothbart & Bates, 2006). Children also completed a

toddler-age behavioral battery consisting of six tasks that assessed individual differences in EC

(Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996). The tasks included Turtle and Rabbit,

Tower Task, Snack Delay, Whisper Task, Tongue Task, and Lab Gift, administered in that order (see

Olson et al., 2005). Each task was designed to tap Rothbart's (1989) general construct of EC (i.e.,

suppressing a dominant response and initiating a subdominant response according to varying task

demands). All tasks were introduced as "games", and children were reminded of the rules midway

through each. **This widely used behavioral battery has shown high reliability and moderate levels of**

stability across development; bivariate correlations between different subtests averaged .45 ($\alpha =$

.75; Kochanska et al., l996). To check the accuracy of recordings, 15 test administrations were

videotaped and independently scored. Reliability was excellent, $\kappa = .95$. As recommended by Kochanska

and colleagues (1996), a total behavioral score was computed by summing standardized subtest scores.

Inhibitory control and *attentional focusing* ($r = .44$, $p < .001$), *inhibitory control* and EC behavioral score

($r = .33$, $p < .001$), and *attentional focusing* and EC behavioral score ($r = .27$, $p < .001$) were all positively

correlated. **Z-scores** of each scale (parent ratings and behavioral scores) were **averaged** into a composite

score of preschool-age EC, **following recommendations to combine multiple assessment methods of**

temperament to help compensate for specific weaknesses inherent in parent ratings and

observational data and to provide a more valid and comprehensive measure of children's self-

regulation (Rothbart & Bates, 2006).

General cognitive functioning. Children's general cognitive functioning was operationalized as their

IQ scores, which were created by aggregating scaled scores on the Block Design and Vocabulary subtests

of Wechsler's Preschool and Primary Scale of Intelligence-Revised (WPPSI-R; Wechsler, 1989). The

Vocabulary and Block Design subtests are reported by Wechsler (1989) to have good reliability (αs =.84

and .85, respectively), as well as sufficient construct and concurrent validity. **Children's raw**

Vocabulary and Block Design scores averaged 12.49 (*SD* = 5.54) and 7.84 (*SD* = 5.53), respectively.

Scaled scores were used in further analyses to control for age salient levels of variability.

Theory of mind. Children's theory of mind was measured using standard false-belief explanation and

prediction tasks (Bartsch & Wellman, 1989), which index children's **abilities** to predict and explain the

actions of hypothetical children who have erroneous information about the location of everyday objects.

This measure has shown high levels of interrater reliability (.88 to .90; Bartsch & Wellman, l989) as

well as consistent evidence of construct validity (e.g., Dunn, Brown, Slomkowski, Tesla &

Youngblade, l991; Choe et al., 2013). In four *prediction* tasks, children predicted where a doll character

will look for a desired object based on what that character believes about that object's location. For

example, in one false-belief prediction task, the experimenter showed the child a crayon box and a plain

box. The experimenter then suggested that they play a "trick" on the story character and proceeded to take

the crayons out of the crayon box and put them in the plain box, emphasizing to the child that the story

character cannot see them play this trick. The child was then asked to predict where the story character

will look for the crayons. A *false-belief prediction* score was calculated as the total number of stories

(range: 0-4) where children correctly predicted the protagonist's behavior. Four *explanation* tasks

followed the same format, where the desired objects were moved in order to "trick" the story character.

For example, raisins were moved from a raisin box to a plain box. The explanation tasks differ in that the

experimenter then proceeded to have the story character look for the desired object in the original location

(raisin box). The child was then asked to explain why the story character looked for the raisins in that

location. In order to respond correctly, the child must refer to the story character's mental state, such as

"He thinks the raisins are in the raisin box." If the child did not spontaneously provide this sort of explanation, he/she is explicitly asked, "What does (the character) think?" A *false-belief explanation* score was calculated as the total number of stories (0-4) where the child correctly explained the protagonist's behavior as stemming from a false belief. A *false-belief* composite was computed as the total number of stories for which the child correctly predicted or explained the protagonist's false belief, for a maximum score of 8 (α = .80). **Children's false belief explanation and prediction scores averaged .96 and .62 (*SD*s = 1.45 and 1.15), respectively.**

Data Analysis Plan

We first examined descriptive statistics, missing data, and attrition with SPSS 21 and then used M*plus* 7 (Muthén & Muthén, 2012) for structural equation modeling (SEM) of an unconditional LGC model of children's externalizing behavior. After evaluating whether a single LGC sufficiently represented the sample's externalizing behavior, we used LCGA to approximate trajectories of externalizing from early to middle childhood. To yield all fit statistics for LCGA, we used maximum likelihood with robust standard errors (MLR), a conservative form of full-information maximum likelihood (FIML) estimation of missing data that is robust to non-normality (Yuan & Bentler, 2000). Class assignment data were analyzed in SPSS in a series of ANOVAs comparing externalizing trajectory classes on **T1** early childhood variables. Lastly, class assignment data were analyzed with M*plus* in three multinomial logistic regression models predicting affiliation in externalizing trajectory class with T1 measures of maternal warmth, parental harsh discipline, child EC, theory of mind, and interactions between parenting and child variables, while accounting for child gender, IQ, and family SES at T1.

<center>**Results**</center>

Preliminary Analyses

Table 1 presents means, standard deviations, and correlations among study variables. Distributional values did not indicate problems with skewness (< ±1.90) or kurtosis (< ±3.6). All models tested in

M*plus*, except LCGA solutions,[2] estimated missing data with FIML.

Attrition and Missing Data

We examined missing data and attrition to determine whether they occurred at random, an assumption that underlies use of FIML in SEM. Little's missing completely at random (MCAR; 1988) test with expectation maximization was not significant, $\chi^2(39) = 32.49$, $p = .760$, which suggests data were MCAR and that conditions were sufficient to use FIML to approximate missing data. T1 child IQ significantly differed between participants in final multinomial logistic regression models ($M = .02$, $SD = .78$, $n = 218$) and participants missing these data ($M = -.57$, $SD = .81$, $n = 8$), $t(224) = 2.09$, $p = .037$, 95% CI [.03, 1.14]. There were no missing data or attrition-related differences in any study variable.

Although most mothers rated children's externalizing behavior at each assessment, some mothers did not provide these data at T2 ($n = 10$) or T3 ($n = 41$). Children's IQ scores at T1 differed between mothers who provided data at T2 ($M = .01$, $SD = .78$) and mothers who did not ($M = -.64$, $SD = .90$), $t(224) = 2.19$, $p = .030$, 95% CI [.07, 1.24]. Mothers who provided data at T2 reported significantly greater maternal warmth at T1 ($M = .07$, $SD = 1.69$) than mothers who did not ($M = -1.64$, $SD = 1.67$), $t(231) = 2.64$, $p = .009$, 95% CI [.44, 2.99]. Mothers who provided data at T2 reported lower levels of child externalizing behavior at T1 ($M = .36$, $SD = .27$) than mothers who did not ($M = -.56$, $SD = .43$), $t(236) = -2.31$, $p = .022$, 95% CI [−.38, −.03]. Mothers who provided data at T3 ($M = 1.70$, $SD = 2.24$) significantly differed from mothers who did not ($M = 1.00$, $SD = 1.43$) in children's theory of mind, $t(68.79) = 2.40$, $p = .019$, 95% CI [.12, 1.28]. There were no other missing data or attrition differences.

Latent Class Growth Model of Children's Externalizing Behavior

We estimated an unconditional LGC model of children's externalizing behavior from ages 3 to 10 to evaluate whether a single **latent** growth curve adequately represented all children's data. Following guidelines for reporting SEM results from Kline (2005) and Bentler (2007), LGC results include model chi-square (χ^2), comparative fit index (CFI), root mean square error of approximation (RMSEA) and its

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[2] Results of LCGA did not differ when using FIML or MLR to estimate missing data.

90% confidence interval (CI), and standardized root mean square residual (SRMR). SRMR values < .10 are favorable, RMSEA values ≤ .05 indicate close approximate fit, CFI values > .95 reflect good fit, and nonsignificant and low model χ^2 values suggest good fit.

We found an unconditional LGC model of children's externalizing behavior fit the data well when estimating an intercept and slope (loadings of 0, *, 1)[3] and fixing all residual variances of externalizing to be equal in value over time: $\chi^2(2, N = 238) = .54$, $p = .764$, CFI = 1.00, RMSEA = .00, 90% CI [.00, .09], SRMR = .01. The LGC model's significant intercept ($\alpha_i = .37$, $SE = .02$, $p < .001$) and negative slope ($\alpha_s = -.12$, $SE = .02$, $p < .001$) were negatively related to each other ($r = -.02$, $SE = .01$, $p = .002$). Significant variances of the intercept ($\sigma_i^2 = .05$, $SE = .01$, $p < .001$) and slope ($\sigma_s^2 = .03$, $SE = .01$, $p = .001$) indicated sample heterogeneity in initial levels and growth of children's externalizing behavior over time. These estimates were significant after adjusting for child gender, IQ, and family SES at T1 in a conditional LGC model (covariates were nonsignificant in all models). **Children** showed modest levels of externalizing behavior that linearly decreased from ages 3 to 10, and greater initial levels of externalizing behavior were associated with greater rates of desistance over time; however, variation in **both** initial levels and rates of change **in** externalizing **justified extending analyses to** LCGA to approximate trajectory classes.

Identification of Latent Trajectory Classes of Children's Externalizing Behavior

We conducted LCGA, semi-parametric group-based trajectory modeling, to identify an optimal number of distinct developmental **trajectory classes** of externalizing behavior in childhood (Nagin & Odgers, 2010; Nagin & Tremblay, 1999). Within each class, variance and covariance estimates for growth factors were fixed to zero values and residual variances were fixed to be equal in value with one another. **Slope loading values were consistent with linear modeling (i.e., 0, 1, 2).** Following Jung and Wickrama (2008), we evaluated the optimal number of classes with the following criteria: lowest Bayesian Information Criterion (BIC) value, entropy value close to 1, no less than 1% of total participants in each class, high posterior probabilities close to 1 for class membership, a significant Lo, Mendell, and Rubin

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[3] **The estimated slope loading value at T2 was .82.**

(2001) likelihood ratio test (LMR-LRT), and a significant bootstrap likelihood ratio test (BLRT). **After**

testing **one** through six trajectory classes (see Table 2 for **model fit comparison**), the 4-class solution

appeared to have the best **balance of parsimony and fit with the longitudinal data** (Figure 1).

Estimating four trajectory classes resulted in the second lowest BIC value, adequate entropy, 4% to

71% of participants assigned to each class, latent class probabilities of most likely membership ranging

from 79% to 99%, a significant LMR-LRT value of 30.06 ($p = .013$), and a significant BLRT ($p < .001$).

The latter two tests indicated a 4-class solution fit the data significantly better than a 3-class solution.

Only the 4-class solution produced a significant LMR-LRT score. BLRT scores remained significant

through the 5-class model, but the best log likelihood was not replicated in most bootstrap draws,

indicating that the 5-class **solution's BLRT** was unreliable. The 4-class solution was a more trustworthy

approximation of discrete **trajectory classes** of externalizing behavior than other LCGA solutions.

The *Chronic* group, the highest line in Figure 1, included 9 children (3.8%, 7 boys) with persistently

high levels of externalizing behavior over time. The *Chronic* group's externalizing trajectory had a

significant intercept ($\alpha_i = .99$, $SE = .12$, $p < .001$) but a nonsignificant slope ($\alpha_s = -.03$, $SE = .09$, $p = .755$). The average latent class probability for most likely latent class membership was 99%. The *Chronic*

group included the fewest number of children who were consistently rated by mothers as having the

highest levels of externalizing behavior throughout childhood.

The *Rising* group in Figure 1 included 23 children (9.7%, 14 boys) with increasing levels of

externalizing behavior over time. The *Rising* group's externalizing trajectory had a significant intercept

($\alpha_i = .39$, $SE = .04$, $p < .001$) and positive slope ($\alpha_s = .11$, $SE = .03$, $p = .001$). The average latent class

probability for most likely latent class membership was 79%. The *Rising* group represented a modest

number of children who were rated by their mothers as initially showing low levels of externalizing

behavior that linearly increased through childhood to moderate levels around age 10.

The *Decreasing* group in Figure 1 included 38 children (16.0%, 18 boys) with decreasing levels of

externalizing behavior over time. The *Decreasing* group's externalizing trajectory had a significant

intercept ($\alpha_i = .65$, $SE = .06$, $p < .001$) and negative slope ($\alpha_s = -.21$, $SE = .03$, $p < .001$). The average

latent class probability for most likely latent class membership was 83%. The *Decreasing* group

represented a medium-sized number of children who were rated by their mothers as initially showing

moderate levels of externalizing behavior that linearly decreased to low levels **by middle childhood**.

The ***Low*** group, the lowest line in Figure 1, included 168 children (70.6%, 86 boys) with the lowest

externalizing behavior over time. The ***Low*** group's externalizing trajectory had a significant intercept (α_i

= .23, *SE* = .02, *p* < .001) and negative slope (α_s = −.06, *SE* = .01, *p* < .001). The average latent class

probability for most likely group membership was 92%. The ***Low*** group included the most children who

were rated by mothers as showing the lowest levels of externalizing behavior that linearly decreased

throughout childhood.

After estimating the 4-class solution, we extracted membership data from M*plus* for analysis in SPSS.

We then compared the four trajectory classes on preschool-age sociodemographic measures **with chi-**

square (χ^2) tests and ANOVAs. We applied Bonferroni-correction for multiple comparisons to paired

contrasts, except when data violated the homogeneity of variances assumption, in which case we applied

Tamhane's T2 correction. As shown in Table 3, externalizing trajectory class membership was not related

to children's gender, ethnicity, or family SES. **Although they did not differ consistently across**

externalizing trajectory classes, we included child gender and family SES as covariates in final

analyses to account for their putative links to child externalizing behavior.

Multinomial Logistic Regression Models Predicting Children's Externalizing Trajectories

We used M*plus* Monte Carlo integration to estimate a series of multinomial logistic regression models

examining preschool-age predictors of children's externalizing **trajectory classes**, while accounting for

child gender, IQ, and family SES at T1. The predictors were mean-centered child EC, ToM, maternal

warmth, and parental harsh discipline at T1, as well as four 2-way interactions between child and

parenting variables (e.g., Effortful Control*Maternal Warmth, Theory of Mind*Parental **Harsh**

Discipline). The criterion variable was the externalizing behavior trajectory **classes** with four groups.

Three models with a different reference group were tested to yield all possible contrasts among

externalizing **trajectory classes**. Overall model fit was evaluated with the Likelihood Ratio comparing

our model to a baseline intercept-only model. Only unstandardized estimates are reported for multinomial

logistic regression models with effect sizes represented by odds ratios (ORs) and their 95% CI (in tables).

Model 1. Table 4 summarizes results of a multinomial logistic regression model with the **Low**

externalizing trajectory class as the baseline group. A Likelihood Ratio Test indicated our final model

(log likelihood = −164.58, df = 36) fit the data significantly better than a null, intercept-only model (log

likelihood = −196.02, df = 3), $\chi^2(33)$ = 62.88, p = .001, and a Monte Carlo (5000) simulation model that

estimated all variances and covariances between predictors and covariates (log likelihood = −5816.78, df

= 113), $\chi^2(77)$ = 11304.41, p < .001. The most parsimonious and best-fitting model only estimated effects

of predictors and covariates on externalizing trajectory class membership: Cox and Snell R^2 = .25,

Negelkerke R^2 = .30, McFadden R^2 = .16.

Lower EC in the preschool years predicted children's chronically high externalizing trajectory.[4]

Shown in bold text in Table 4, a one-unit increase in children's EC at T1 resulted in a −3.68 (p = .005**, OR**

= .03) change in log odds of being in the Chronic vs. **Low** externalizing trajectory class. In other words, a

one-unit increase in **child** EC during the preschool years was associated with **approximately** 40:1 odds of

being classified in a Low vs. Chronic externalizing trajectory **class (see comparison with Chronic**

trajectory as baseline group in Table 5: β = 3.68, p < .01, OR = 39.78).

Greater parental harsh discipline in the preschool years predicted children's rising externalizing

trajectory. A one-unit increase in the frequency of parental harsh discipline at T1 resulted in a .08 (p =

.043**, OR = 1.08)** change in log odds of being in the Rising vs. **Low** externalizing trajectory class.

Lower EC or maternal warmth in the preschool years predicted children's initially elevated but

decreasing externalizing trajectory. A one-unit increase in children's EC at T1 resulted in a −1.07 (p =

.004**, OR = .34**) change in log odds of being in the Decreasing vs. **Low** externalizing trajectory class,

while a one-unit increase in maternal warmth resulted in a −.24 (p = .046**, OR = .79)** change in log odds.

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[4] **Reanalysis of our final models with just children's EC behavioral scores did not replicate**
significant findings provided by our EC composite score of parent ratings and behavioral scores.

When compared to a low externalizing trajectory, the expected risk of following a decreasing externalizing trajectory was higher for preschool-age children with low EC or **low** maternal warmth. There were no other significant coefficients, interactions, or covariates. **In alternative models without interaction terms, significant coefficients of parenting variables only approached significance (harsh discipline marginally predicted membership to the Rising vs. Low externalizing trajectory class, p = .061, and maternal warmth marginally predicted membership to the Decreasing vs. Low externalizing trajectory class, p = .091).**

    Model 2. Table 5 summarizes results of a multinomial logistic regression model with the Chronic externalizing trajectory as the baseline group. **Higher EC in the preschool years predicted children's decreasing and rising externalizing trajectories.** A one-unit increase in children's EC at T1 resulted in a 2.61 (p = .048, OR = **13.62**) increase in log odds of being in the Decreasing vs. Chronic externalizing trajectory class. A one-unit increase in children's EC at T1 resulted in a 2.99 (p = .026, OR = **19.96**) change in log odds of being in the Rising vs. Chronic externalizing trajectory. Preschool-age children high in EC were more likely to **show** a decreasing **or rising** externalizing trajectory than a **chronic pattern of** externalizing **behavior.** There were no other significant coefficients, interactions, or covariates.

    Model 3. Table 6 summarizes results of a multinomial logistic regression model with the Decreasing externalizing trajectory as the baseline group, yielding a contrast between the Rising and Decreasing externalizing trajectory classes not provided in Models 1 and 2. There were no significant coefficients, interactions, or covariates. **Child** and parenting variables at T1 **did not distinguish children's membership** in the Rising vs. Decreasing externalizing trajectory class.

<div align="center">**Discussion**</div>

    Our main goals were to identify **discrete classes** of children who showed diverse externalizing problem trajectories between ages 3 and 10 years and to show how early child and parenting risk factors mapped onto these different pathways of problem behavior. The early preschool period is a compelling time to examine these issues because normative levels of aggressive and disruptive behavior are relatively

high, posing child management challenges for parents (Shaw & Bell, 1993). Our findings are discussed below in the context of each major research question.

Early Onset Trajectories of Child Externalizing Problems

We estimated change in children's externalizing behavior using LGC modeling and approximated discrete but homogenous trajectories of externalizing behavior across ages 3, 6, and 10 using LCGA. Although we oversampled young children with moderate to high levels of externalizing behavior, children generally showed low levels of problem behavior that decreased over time. Our findings are consistent with previous studies that have shown elevated, normative levels of aggressive and disruptive behavior in early childhood that decline across development (e.g., Alink et al., 2006; Miner & Clarke-Stewart, 2008; NICHD ECCRN, 2004; Tremblay et al., l999). For example, in a large longitudinal study of typically developing children in daycare (Study of Early Child Care and Youth Development; NICHD ECRRN; 2004), mothers rated the frequency of children's physical aggression at ages 24, 36, and 56 months and throughout the early school-age years. The most frequent form of early aggression, hitting others, occurred in 70% of the sample at ages 2 and 3 but declined to 20% at ages 4 and 5 and to 12% in third grade. Other forms of disruptive behavior (e.g., "destroys others' things") also showed marked declines across the preschool and early school-age years (NICHD ECCRN, 2004).

Thus, aggressive and disruptive behavior is relatively common in toddlerhood, declining rapidly across the preschool period. However, these normative trends summarize average behavioral tendencies across large groups of children. A **few** previous studies have shown that within the context of declining externalizing behavior for most children, we can identify discrete **trajectory classes** of preschoolers who manifest persistent or changeable patterns of problem behavior across the school-age years (Campbell et al., 2006; Shaw et al., 2003). Consistent with these findings, we identified four developmental trajectories of externalizing behavior **beginning at age 3 years**. The *Chronic* group included 9 children (3.8%, 7 boys) with persistently high levels of externalizing behavior over time**, which is consistent with the 3% of children who demonstrated a high stable pattern of externalizing behavior in Campbell and colleagues' (2006) national sample.** In all previous studies, investigators have identified a small group of

preschoolers whose problems exceed normative standards and remain high across development (e.g., Moffitt, 2003; Shaw et al., 2003). Thus, our findings affirm both the existence and rarity of this high-risk **trajectory that** young children **may follow**.

The *Rising* group represented a modest number of children (9.7%; 14 boys, 9 girls) who were rated by their mothers as initially showing low levels of externalizing behavior that linearly increased to moderate levels around age 10. To the best of our knowledge, this interesting **trajectory** was unique to our study. The *Decreasing* group represented a medium-sized number of children (16.0%, 20 girls, 18 boys) who were rated by their mothers as initially showing moderate levels of externalizing behavior that linearly decreased to low levels around age 10. **Trajectory classes** of preschoolers showing declining levels of externalizing problems have been identified in previous studies (e.g., Campbell et al., 2006; Shaw et al., 2003) but with some noteworthy **variation among** studies. For example, Shaw et al. (2003) identified two **decreasing trajectory classes** of children: those who showed high versus moderate levels of aggressive behavior at age 2 that declined steadily across time. Thus, our findings provide strong support for the generalizability of a discrete **trajectory** of children whose problem behaviors are higher than normal in early childhood but decline to normative levels of concern **over** time. Diverging findings reflect the number and severity level of declining **trajectories** based on levels of initial concern.

Finally, the ***Low*** group included **most** preschoolers in our sample (70.6%, 86 boys, 82 girls). These children were rated by mothers as showing low levels of externalizing behavior that linearly decreased throughout childhood. All previous investigators have identified children who show persistently low levels of externalizing behavior across the preschool and school-age years. However, Shaw et al. (2003) found that 14% of the boys in his sample showed persistently low levels of aggression between ages 2 and 8 years, **whereas Campbell et al. (2006) found that 45% of the boys and girls in the NICHD sample showed very low levels of aggression between ages 2 and 9 years and an additional 25% showed stable, low levels of aggression that were slightly higher than those in the former trajectory class**. Our findings were most consistent with those of Campbell et al. in that the *majority* of children were classified into a low problem behavior **trajectory**. Discrepancies between

studies most likely reflect differing levels of ecological risk between samples, as well as differing

operational definitions of child externalizing behavior. For example, the Shaw et al. study focused on

boys **(about 40% African American)** growing up in low-income **family and urban neighborhood**

environments, whereas the NICHD study contained both boys and girls from predominantly middle

class, European American families. In both studies, children were **classified** using a narrowband index

of overt aggressive behavior. By contrast, in our study **trajectory classes** of children were identified

using a **set of** heterogeneous externalizing behavior**s**.

Early Childhood Predictors of Diverse Externalizing Problem Pathways

Our second research aim was to identify early child and parenting risk factors that differentiated the

four externalizing behavior trajectories. **Drawing upon a developmental psychopathology framework**

that highlighted key adaptive tasks for preschool-age children, we determined whether individual

differences in child effortful control, theory of mind, and quality of parenting would predict

children's diverse pathways of externalizing problems. Simultaneous assessments of these constructs

allowed us to examine possible interaction effects **between child and parenting variables.**

Child effortful control. Individual differences in child effortful control (EC), assessed using parental

reports and a multidimensional battery of behavioral tasks, strongly differentiated preschoolers on the

Chronic versus **Low** pathways. For example, a one-unit increase in EC during the preschool years was

associated with 40:1 odds of following a **Low** vs. Chronic externalizing trajectory. Moreover, those who

followed changeable pathways (Decreasing or Rising) had better EC skills than those who followed the

Chronic pathway but worse skills than those on the **Low** pathway. Children's EC did not interact with

parenting variables to predict differences between trajectory groups.

Our findings are consistent with a growing body of research showing that children's early self-

regulation difficulties predict relatively high levels of externalizing behavior and associated adjustment

problems across development. Externalizing problems in the toddler and preschool years have been

associated with low **levels of EC** (e.g., Murray & Kochanska, 2002; Olson et al., 2005) and related

constructs, such as impulsivity (Calkins & Dedmon, 2000; Hughes, Dunn & White, l998) and attentional

disorganization (Olson, Bates, Sandy, & Schilling, 2002; Raaijmakers et al., 2008). Moreover, children's

poor **EC** skills have been found to **predict elevated levels of externalizing behavior problems across**

the preschool to school-age transition (e.g., Chang et al., 2011) and growth of externalizing behavior

across the school-age years (Eisenberg et al., 2009; Zhou et al., 2007). Two recent reports have shown

that ratings of children's self-control problems in early and middle childhood predicted a host of negative

outcomes at age 32 years, including criminal behavior, poor health, and low educational and occupational

attainment (Fergusson, Boden, & Horwood, 2013; Moffitt et al., 2011). For example, in their 30-year

longitudinal study of New Zealand children, Fergusson et al. (2013) found that parent and teacher reports

of children's self-regulation problems were associated with violent offending, welfare dependence, and

poor educational and employment outcomes in adulthood, even after controlling for variations in family

SES and child IQ. Our studies **collectively** suggest that individual differences in children's **EC**

capabilities provide a foundation for psychosocial adjustment across the lifespan.

   One challenge to the validity of our findings concerns the potential circularity of association

between measures of temperament risk and child behavior problems. For example, one could argue

that measures of temperament and early problem behavior are confounded, in that they are defined

by similar items and constructs. However, EC was assessed using both behavioral indices and

parent ratings, and correlations between EC and child externalizing were in the .40 to .50 range, a

robust but hardly overlapping level of association. Finally, at least two prior studies have shown

that measurement confounds did not account for associations between maternal ratings of

temperament and mother, father, and caregiver reports of behavior problem symptoms in early

childhood (Lemery, Essex, & Smider, 2002; Lengua, West, & Sandler, 1998). Although these

considerations do not eliminate this thorny issue, they do increase our confidence that the current

findings are not simply artifacts of confounded measures. Pending further research, we posit that

EC and child externalizing problems are interrelated but theoretically distinct constructs.

   Child theory of mind. To a modest degree, our findings also supported the hypothesis that delays in

children's emerging understanding of others' mental states contribute to persistent early onset

externalizing problems. Consistent with other findings (e.g., Hughes & Ensor, 2006), preschool-age

children with relatively poor theory of mind were at elevated risk for chronic early onset externalizing

problems. Descriptive analyses revealed that the *Chronic* group scored lower in theory of mind than the

Low and *Decreasing* groups, but did not differ from the *Rising* group. Because measures of EC and

theory of mind were positively intercorrelated (see also Carlson & Moses, 2001), integrative models were

needed to clarify how these vulnerabilities worked in concert to elevate children's risk status. Controlling

for the effects of EC and other study measures (e.g., IQ), theory of mind did not differentiate **trajectory**

classes, nor did interactions between theory of mind and parenting **variables**. Thus, these data affirmed **a**

hierarchical model of early adaptive deficits wherein children's poor self-regulation skills were primary

contributors to early externalizing behavior, subsuming contributions of other co-occurring

developmental skills (Hughes et al., 2000; Olson et al., 2011). **In other words, children with adequate**

levels of ToM could have their skills compromised during moments of behavioral or emotion

dysregulation, especially in the context of conflictual social interactions (e.g., Choe et al., 2013).

    Parental warmth and harsh discipline. As expected, children in the Chronic **trajectory** received the

highest frequencies of parental corporal punishment, followed by children in the Rising, Declining, and

Low trajectories. Moreover, we found that compared with children in the **Low** group, the expected risk

of a Rising trajectory was higher for preschool-age children who experienced high levels of harsh

discipline. This was a compelling finding, given that children in this **trajectory** were in the normal range

of behavioral adjustment at age 3 years but developed later problems. Toddler and preschool-age children

with significant and persistent externalizing problems have been found to experience higher levels of

parental corporal punishment than others (Campbell et al., 2010; Olson et al., 2011; Shaw, Owen,

Giovanelli, & Winslow, 2007; Miner & Clarke-Stewart, 2008). Moreover, Olson et al. (2011) found that

frequent corporal punishment at age 3 years predicted *increased* levels of child peer aggression across the

transition from preschool to school. Similarly, Smith, Dishion, Shaw, Wilson & Winter (2014) found that

coercive exchanges between toddlers and their parents were associated with an amplification of child

externalizing behavior across later development. Our findings add to this sobering literature by showing

that frequent harsh punishment during the early preschool years predicted the **escalation of** externalizing problems in **preschool-age** children who had been showing **only modest** levels of these behaviors. Clearly, harsh parental discipline is a critical risk marker for the amplification of early problem behavior.

We found partial support for our expectation that children in the riskiest trajectory classes would experience lower levels of maternal **warmth** and responsiveness than others. Preschool-age levels of maternal warmth predicted the odds of being in the Decreasing vs. **Low** externalizing trajectory class. In other words, the expected risk of following a Decreasing externalizing trajectory (compared to the lowest risk **Low** trajectory) was higher for preschool-age children who experienced relatively low levels of maternal warmth. In previous studies, low parental warmth (or related constructs such as sensitivity) has **predicted** trajectories of early onset externalizing behaviors, but with mixed findings regarding the strength of these associations between boys and girls. For example, using an observational index of maternal warmth summed across multiple times points, Campbell et al. (2010) found that maternal sensitivity in early childhood predicted low levels of physical aggression across the school-age years, but only for girls. Miner **and** Clarke-Stewart (2008) found that low maternal sensitivity modestly predicted higher levels of externalizing behavior for both sexes, but results were strongest for boys. In the current study, strengthening our maternal report measure of warm responsiveness with observational measures of parent-toddler interaction may have yielded a stronger pattern of findings. However, unlike the ECCRN sample described in Campbell et al. (2010), our sample size did not allow us to construct gender specific trajectories. Given these inconsistent findings, the extent to which child gender moderates pathways between early parental warmth and long-term patterns of externalizing remains an issue for further **study**.

Finally, we wish to highlight the importance of further research that articulates transactional processes underlying the development of preschoolers whose problem behaviors changed significantly across time. First, children who showed a desisting course had lower levels of EC and maternal warmth than those in the low group, yet showed steady decrements in externalizing behavior across time. Our findings converged with those of others in revealing the existence of this important trajectory class, but explaining *how and why* these children developed fewer symptoms

was beyond the scope of the current study. This is an important direction for further research. For example, how did these children's relationships with both parents change across the transition to formal schooling, and to what extent did these changes reflect the child's ability to appropriately regulate his or her emotion expressions and behavior? What types of broader ecological resources or parental characteristics were associated with positive behavior change? Or, given that we tracked heterogeneous externalizing behavior across time, did the child's positive behavior gains also encompass broader patterns of social and emotional adjustment? Similarly, to the best of our knowledge the increasing group was unique to our study. Here we had a group of children who did not show externalizing problems during a period of heightened risk but developed them during the school-age years. Our findings revealed harsh parental discipline as a key contributor to this pattern of behavior, but here again we must conduct further research to understand broader patterns of risk underlying developmental and social processes that account for this association.

Strengths and Limitations

Our study had noteworthy strengths, including prospective longitudinal assessments of children's early externalizing problems across a seven-year period of development; assessments of early developmental risk that spanned multiple constructs, informants, and methods; use of both observational and parent rating measures of child EC; the participation of relatively equal numbers of boys and girls; and consideration of interrelationships and interactions **among** risk factors.

We also wish to highlight features of this study that may limit the generalizability of our findings. First, most children were from intact two-parent families. Therefore, our findings may not generalize to children growing up in other family constellations or to those whose families experience severe economic hardship. Similarly, reflecting the local population, children and parents were primarily from European American backgrounds, limiting generalizability to racially and ethnically diverse groups. Children in our constrained community sample represented the full range externalizing spectrum with a disproportionate number in the medium-high to high range. However, **although 75% of the children in our chronic trajectory class were in the clinical range on the CBCL Externalizing Problems scale at age 10**

(median *t*-score = 70; range = 56 – 76), relatively few had externalizing scores in the extreme range, limiting generalizability to clinical populations of young children.

Another potential limitation concerned our measure of parental corporal punishment. Our interview based assessment focused on the frequency of parents' use of physical punishment. We did not directly assess the broader spectrum of punitive discipline that also includes harsh emotional behaviors, such as screaming at or denigrating the child. Given the importance of frequent corporal punishment as a correlate and predictor of child externalizing problems, in future studies it would be worthwhile to include broader constructs of punitive discipline that encompass a full range of harsh practices.

Our externalizing trajectory classes represent unobserved heterogeneity in growth of children's externalizing symptoms from early to middle childhood. Nagin and Odgers (2010) state that LCGA only approximates trajectory classes and requires variances and covariances of growth factors to be fixed to values of zero. Individuals within each class are presumed to show the same pattern or functional form of change over time and to vary in their initial starting point or degree of change without these within-group differences being estimated. Growth mixture modeling (GMM) is an alternative method used to estimate developmental trajectories that offers advantages over LCGA by actually allowing within-class variances in growth factors (e.g., intercept, slope) and their covariances across trajectory classes using a combination of random effects and finite mixtures (Muthén, 2008). The key distinction between LCGA and GMM is that GMM assumes that the population distribution of trajectories is composed of multiple subpopulations, whereas LCGA makes no assumption regarding population distribution of trajectories but uses trajectory classes as a statistical means of approximating the unknown distribution of trajectories among members of a population (Nagin & Odgers, 2010). GMM is typically conducted one step after LCGA when increasing the complexity of trajectory modeling (Jung & Wickrama, 2008), and GMM's greater computational burden is a disadvantage in that it often yields unreliable solutions and multiple local maxima. Muthén and Asparouhov (2008) recommend mixture models be run with different sets of starting values to compensate for their general proneness to producing multiple local

maxima. We ran several sets of starting values to attain reliable LCGA solutions but we could not resolve problems with local maxima when we conducted GMM. Thus, we present evidence of developmental trajectories of externalizing from LCGA, which produced more trustworthy and reliable data than GMM. Future studies will help determine whether our externalizing trajectory classes replicate with other analytic techniques and samples, and whether these trajectories represent qualitatively distinct subgroups of children (e.g., see Walters & Ruscio, 2013).

Our sample size was relatively small for a group-based trajectory analysis. This may account for the lack of statistical interactions, which require more power than we likely had in the current study. Similarly, having only three assessment points available was acceptable for estimating latent growth models, but prohibited us from analyzing quadratic and curvilinear trajectories.

Lastly, over 50 different risk factors have been related to the development of child externalizing problems (Dodge & Pettit, 2003). In singling out child EC, theory of mind, maternal warmth and harsh discipline, we do not mean to imply that other sources of child vulnerability and environmental risk are insignificant in the development of early onset externalizing problems. In fact, salient risk factors have included child fearlessness (Shaw et al., 2003), callous unemotional behavior (Hyde et al., 2016), maternal depression (Shaw et al., 2012; Choe et al., 2014), and other risk factors associated with poverty, especially neighborhood deprivation and violence (Shaw & Shelleby, 2014).

Implications

A critical challenge for researchers is to understand processes that underlie the translation of early child vulnerabilities into stable adjustment problems. Early self-regulatory skills reflect reciprocal influences between the child and his or her social partners as well as the larger social and cultural environment (Sameroff, 2009). The fact that stable disruptive behavior problems emerge during the toddler and preschool years strongly indicates the need for early intervention. High-risk, early-onset pathways can be altered (Mesman et al., 2009). Not surprisingly, interventions focused on helping parents respond positively and effectively to provocative child behavior produces better outcomes in early

childhood than interventions implemented in later childhood or adolescence (McCart, Priester, Davies, & Azen, 2006). For example, Shelleby, Shaw et al. (2012) found that a family-centered intervention**, the Family Check Up,** improved parental positive discipline and reduced behavior problems in high-risk toddlers and preschoolers**. Intervention effects were not only mediated by improvements in positive parenting, but double mediated by improvements in the child's behavioral regulation. On the latter note**, in addition to parent-centered interventions we may be able to develop prevention programs that directly target children's emerging EC and emotion regulation skills. For example, studies have shown that we can significantly improve preschool children's executive functioning skills through repeated practice or by teaching them meta-cognitive skills (e.g., Diamond et al., 2007). Given strong evidence supporting both the early childhood onset of serious behavior problems and the role of adequate effortful regulation as a foundation for children's behavioral and academic adjustment, developing affordable and accessible screening and prevention services remains a critical unmet need.

In summary, four developmental trajectories of externalizing behavior provided the best balance of parsimony and fit with our longitudinal data spanning ages 3 to 10 years. Most young children followed a pathway marked by relatively low levels of concern that continued to decrease across the school-age years. Atypical trajectories marked chronic, increasing, and decreasing levels of externalizing problems across early and middle childhood. Three-year-old children with low levels of effortful control were far more likely to show the chronic pattern of elevated externalizing problems than changeable or normative patterns. Early parental corporal punishment and maternal warmth, respectively, differentiated preschoolers who showed increasing and decreasing patterns of problem behavior over time from those in the normative group. The fact that children's poor effortful regulation skills predicted chronic, early onset problems strongly reinforces the need for widespread early childhood screening and intervention services.

References

Achenbach, T. M. (1992). *Manual for the Child Behavior Checklist/2–3 and 1992 profile*. Burlington, VT: University of Vermont, Department of Psychiatry.

Achenbach, T. M., & Rescorla, L. A. (2001*). Manual for ASEBA School-Age Forms & Profiles*. Burlington, VT: University of Vermont, Research Center for Children, Youth, & Families.

Ahadi, S. A., Rothbart, M. K., & Ye, R. M. (1993). Child temperament in the U.S. and China: Similarities and differences. *European Journal of Personality, 7,* 359–378.

Alink, L.R.A., Mesman, J., van Zeijl, J., Stolk, M.N., Juffer, F., Koot, H., Bakermans-Kranenburg, M.J., & van IJzendoorn, M.H. (2006). The early childhood aggression curve: Development of physical aggression in 10- to 50-month-old children. *Child Development, 77*, 954-966.

Bartsch, K., & Wellman, H. M. (1989). Young children's attribution of action to beliefs and desires. *Child Development, 60, 946–964. doi:10.2307/1131035*

Bernier, A., Carlson, S.M., & Whipple, N. (2010). From external regulation to self-regulation: Early Parenting precursors of young children's executive functioning. *Child Development, 81(1), 326-339.*

Broidy, L. M, Nagin, D. S, Tremblay, R. E, Bates, J. E; Brame, B., Dodge, K. A., et al. (2003). Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: A six-site, cross-national study. *Developmental Psychology*, *39* (2), 222-245.

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

Campbell, S. B., Spieker, S., Burchinal, M., Poe, M., & The NICHD Early Child Care Research Network. (2006). Trajectories of aggression from toddlerhood to age 9 predict academic and social functioning through age 12. *Journal of Child Psychology and Psychiatry, 47,* 791–800.

Campbell, S. B., Spieker, S., Vandergrift, N., Belsky, J., Burchinal, M., & The NICHD Early Child Care Research Network. (2010). Predictors and sequelae of trajectories of physical aggression in

school age boys and girls. *Development and Psychopathology, 22,* 133-150. *doi:*

10.1017/S0954579409990319

Carlson, S. M, Mandell, D. J., & Williams, L. (2004). Executive function and theory of mind: stability

and prediction from ages 2 to 3. *Developmental Psychology, 40(6),* 1105-1122. *DOI:*

10.1037/0012-1649.40.6.1105

Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory

of mind. *Child Development, 72, 1032–1053. doi:10.1111/1467-8624.00333*

Chang, H., Olson, S.L., Combs-Ronto, L., & Sameroff, A.J. (2009). Child effortful control as a mediator

of parenting practices on externalizing behavior: Evidence for a sex- differentiated pathway

across the transition from preschool to school. *Journal of Abnormal Child Psychology.*

39(1), 71-81. *doi:10.1007/s10802-010-9437-7*

Choe, D.E., Lane, J.D., Grabell, A.S., & Olson, S.L. (2013). Developmental precursors of young school-

age children's hostile attribution bias. *Developmental Psychology, 49(12*), 2245-2256. *doi:*

10.1037/a 003 2293

Choe, D., Olson, S.L., & Sameroff, A.J. (2013a). Effects of early maternal distress on parenting and the

development of children's self-regulation and externalizing behavior problems. *Development and*

Psychopathology. 25(2), 437-53.doi:10.1037/t00789-000

Choe, D. E., Olson, S. L., & Sameroff, A. J. (2013b). The interplay of externalizing problems and

inductive and physical discipline during childhood. *Developmental Psychology*, *49*, 2029–2039

doi: 10.1037/a 003 2054.

Combs-Ronto, L., Olson, S.L., Lunkenheimer, E.S., & Sameroff, A.J. (2009). Interactions between

maternal parenting and children's early disruptive behavior: Bidirectional associations across the

transition from preschool to school. *Journal of Abnormal Child Psychology, 37,* 1151-1163.

doi:10.1007/s10802-009-9332-2

Diamond A., Barnett W.S., Thomas J., Munro S. (2007). Preschool program improves cognitive control.

Science, 318, 1387–1388.

Dodge, K. A., Pettit, G. S., & Bates, J. E. (1994). Socialization mediators of the relation between

      socioeconomic status and child conduct problems. *Child Development, 65*, 649–665.

Dodge, K. A. (2006). Translational science in action: Hostile attributional style and the development of

      aggressive behavior problems. *Development and Psychopathology, 18(3),* 791-814.

Eisenberg, N., Valiente, C., Spinrad, T., Cumberland, A., Liwe, J., Reiser, M., Zhou, Q., & Losoya, S.H.

      (2009). Longitudinal relations of children's effortful control, impulsivity, and negative

      emotionality to their externalizing, internalizing, and co-occurring behavior problems.

      Developmental Psychology, *45* (4), 988-1008.

Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among

      positive parenting, children's effortful control, and externalizing problems: A three-wave

      longitudinal study. *Child Development, 76, 1055–1071*.

Feldman, R., Greenbaum, C. W., & Yirmiya, N. (1999). Mother-infant affect synchrony as an antecedent

      of the emergence of self-control. *Developmental Psychology, 35(1) 223-231*

Fergusson, D.M., Boden, J.M., & Horwood, L.J. (2013). Childhood self-control and adult outcomes:

      Results from a 30-year longitudinal study. *Journal of the American Academy of Child and

      Adolescent Psychiatry, 52(7), 709-717. Doi.org/10.1016/j.jaac.2013.04.008*.

Gardner, F. E. M. (1994). The quality of joint activity between mothers and their children with behaviour

      problems. *Journal of Child Psychology and Psychiatry, 35,* 935–948.

Hollingshead, A.A. (l979). *Four-Factor Index of Social Status*. Unpublished manuscript, Yale University,

      New Haven, CT.

Hughes, C., Dunn, J., & White, A. (1998). Trick or treat? Uneven understanding of mind and emotion and

      executive dysfunction in "hard-to-manage"preschoolers. *Journal of Child Psychology and

      Psychiatry, 39,981–994. doi:10.1111/1469-7610.00401*

Hughes, C. & Ensor, R. (2006). Behavioral problems in two-year-olds: Links with individual differences

      in theory of mind, executive function, and negative parenting. *Journal of Child Psychology and*

Psychiatry, 47, 488-497.

Hyde, L.W., Waller, R., Trentacosta, C. J., Shaw, D. S., Neiderhiser, J. M., Ganiban, J. M….Leve, L. D. (2016). Heritable and nonheritable pathways to early callous-unemotional behaviors. *American Journal of Psychiatry*. doi:10.1176/appi.ajp.2016.15111381

Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass*, *2*, 302–317. doi:10.1111/j.1751-9004.2007.00054.x

Keenan, K., Boeldt, D., Chen, D., Coyne, C., Donald, R., Duax, J., Hart, K., Perrott, J., Strickland, J., Danis, B., & Hill, C. et al. (2011). Predictive validity of DSM-IV oppositional defiant and conduct disorders in clinically referred preschoolers. *Journal of Child Psychology and Psychiatry, 52(1), 47-55.*

Kochanska, G., Murray, K., Jacques, T. Y., Koenig, A. L., & Vandegeest, K. (1996). Inhibitory control in young children and its role in emerging internalization. *Child Development, 67*, 490–507. *doi: 10.1111/j.1467-8624.1996.tb01747.x*

Kochanska, G., Coy, K. C, & Murray, K. T. (2001). The development of self-regulation in the first four years of life. *Child Development, 72(4),* 1091-1111.

Lahey, B.B., Van Hulle, C.A., Keenan, K., Rathouz, P.J., D'Onofrio, B.M., Rodgers, J.L., & Waldman, I.D. (2008). Temperament and parenting during the first year of life predict future child conduct problems. *Journal of Abnormal Child Psychology, 36: 1139-1158. DOI 10.1007/s10802-008-9247-3.*

Lemerise, E. A., & Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child Development, 71(1)*, 107-118. *doi: 10.1111/1467-8624.00124*

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*, *83*, 1198–1202. doi:10.2307/2290157

Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). Testing the number of components in a normal mixture.

Biometrika, *88*, 767-778. doi:10.1093/biomet/88.3.767

McCart, M. R., Priester, P. E., Davies, W. H., & Azen, R. (2006). Differential effectiveness of behavioral parent-training and cognitive-behavioral therapy for antisocial youth: A meta-analysis. *Journal of Abnormal Child Psychology*, *34*(4), 525-541.

Mesman, J., Stoel, R., Bakermans-Kranenburg, M.J., vanIJzendoorn, M.H., Juffer, F., Koot, H.M., et al. (2009). Predicting growth curves of early childhood externalizing problems: Differential susceptibility of children with difficult temperament. *Journal of Abnormal Child Psychology, 37, 625-636*.

Miner, J.L., & Clarke-Stewart, K.A. (2008). Trajectories of externalizing behavior from age 2 to age 9: Relations with gender, temperament, ethnicity, parenting, and rater. *Developmental Psychology, 44(3), 771-786.* doi:10:10370012-1689.44.3.771.

Moffitt, T. E. (2003). Life-course-persistent and adolescence-limited antisocial behavior: A 10-year research review and a research agenda. In B. B. Lahey, T. E. Moffitt, & A. Caspi (Eds.), Causes of conduct disorder and juvenile delinquency (pp. 49–75). New York: Guilford Press.

Moffitt, T.E., Arseneault, L., Belsky, D. et al. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Science, 108: 2693-98.*

Murray, K. T., & Kochanska, G. (2002). Effortful control: Factor structure and relation to externalizing and internalizing behaviors. *Journal of Abnormal Child Psychology, 30,* 503–514.

Muthén, B. O., & Asparouhov, T. (2008). Growth mixture modeling: Analysis with non-Gaussian random effects. In G. Fitzmaurice, M. Davidian, G. Verbeke, & G. Molenberghs (Eds.), *Longitudinal data analysis* (pp. 143–165). Boca Raton, FL: Chapman & Hall/CRC.

Muthén, L. K., & Muthén, B. O. (2012). Mplus version 7 user's guide. Los Angeles, CA: Muthén & Muthén.

Nagin, D. S., & Odgers, C. L. (2010). Group-based trajectory modeling in clinical research. *Annual Review of Clinical Psychology*, *6*, 109–138. doi:10.1146/annurev.clinpsy.121208.131413

Nagin, D. S., & Tremblay, R. E. (1999). Trajectories of boys' physical aggression, opposition, and

hyperactivity on the path to physically and nonviolent juvenile delinquency. *Child Development,*

   70, 1181–1196. doi:10.1111/1467-8624.00086

NICHD Early Child Care Research Network. (2004). Trajectories of physical aggression from

   Toddlerhood to middle childhood. *Monographs of the Society for Research in Child Development,*

   69(4, Serial No. 278).

Odgers, C. L., Moffitt, T. E., Broadbent, J. M., Dickson, N., Hancox, R. J., Harrington, H., et al. (2008).

   Female and male antisocial trajectories: From childhood origins to adult outcomes. *Development*

   and Psychopathology, 20, 673–716. doi:10.1017/S0954579408000333

Olson, S.L., Bates, J.E., Sandy, J.M., & Lanthier, R. (2000). Early developmental precursors of

   externalizing behavior in middle childhood and adolescence. *Journal of Abnormal Child*

   Psychology, 28, 119-133.

Olson, S.L., Bates, J.E., Sandy, J.M., & Schilling, E.M. (2002). Early developmental precursors of

   impulsive and inattentive behavior: From infancy to middle childhood. *Journal of Child*

   Psychology and Psychiatry, 43, 435-447.

Olson, S.L., Lopez-Duran, N.L., Chang, H., & Lunkenheimer, E.S. (2011). Individual differences in the

   development of early peer aggression: Integrating contributions of self-regulation, theory of

   mind, and parenting. *Development and Psychopathology, 23(1),* 253-266.

   doi:10.1017/S09545.794/0000775

Olson, S.L., & Sameroff, A.J., Kerr, D. C. R., Lopez, N. L, & Wellman, H. M. (2005). Developmental

   foundations of externalizing problems in young children: The role of effortful control.

   Development and Psychopathology, 17(1), 25-45. doi:10.1017/S0954579405050029

Olson, S.L., Sameroff, A.J., Kerr, D.C.R., & Lunkenheimer, E.S. (2009). Self-regulatory processes in

   early disruptive behavior: the preschool to school transition. In: S.L. Olson & A.J. Sameroff

   (Eds.) *Regulatory processes in the development of childhood behavior problems: Biological,*

   Behavioral, and Social-Ecological Interactions. NY: Cambridge University Press.

Posner, M.I. & Rothbart, M.K. (2000). Developing mechanisms of self-regulation. *Development and*

Psychopathology, 12, 427-441.

Power, T. (1993). *Parenting Dimensions Inventory (PDI): A research manual*. Unpublished manuscript, University of Houston, Department of Psychology.

Raaijmakers, M. A. J., Smidts, D. P., Sergeant, J. A., Maasen, G.H., Posthumus, J. A., van Engeland, H., et al. (2008). Executive functions in preschool children with aggressive behavior: Impairments in inhibitory control. *Journal of Abnormal Child Psychology, 36, 1097–1107.*

Rothbart, M. K. (1989). Temperament and development. In G. A. Kohnstamm, J. E. Bates, & M. K. Rothbart (Eds.), *Temperament in childhood* (pp. 187–247). New York: Wiley.

Rothbart, M.K. & Bates, J.E. (2006). Temperament. In W. Damon and N. Eisenberg (Eds.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development (6th Ed.).* N.Y.: Wiley.

Sameroff. A.J. (2009). *Transactional processes in development.* Washington, DC: American Psychological Association.

Schaeffer, C. M., Petras, H., Ialongo, N., Masyn, K. E., Hubbard, S., Poduska, J., et al. (2006). A comparison of girls' and boys' aggressive–disruptive behavior trajectories across elementary school: Prediction to young adult antisocial outcomes. *Journal of Consulting and Clinical Psychology, 74,* 500–510.

Shaw, D. S., & Bell, R. Q. (1993). Developmental theories of parental contributors to antisocial behavior. *Journal of Abnormal Child Psychology*, *21*, 493–518.

Shaw, D. S, Gilliom, M., Ingoldsby, E. M., & Nagin, D. S. (2003). Trajectories leading to school-age conduct problems. *Developmental Psychology, 39,* 189–200. *DOI: 10.1037/0012-1649.39.2.189*

Shaw, D.S., Hyde, L.W., & Brennan, L.W. (2012). Early predictors of boys' antisocial trajectories. *Development and Psychopathology, 24,* 871-888. *Doi: 1017/S0954579412000429*

Shaw, D. S., Winslow, E. B., Owens, E. B., Vondra, J. I., Cohn, J. F., & Bell, R. Q. (1998). The development of early externalizing problems among children from low-income families: A transformational perspective. *Journal of Abnormal Child Psychology, 26,* 95–107.

Shelleby, E.C., Shaw, D.S., Cheong, J., Chang, H.C., Gardner, F., Dishion, T., & Wilson, M. (2012).

Behavioral control in at-risk toddlers: The influence of the Family Check-Up. *Journal of Clinical Child and Adolescent Psychology, 41(3),* 288-301.

Smith, J.D., Dishion, T.J., Shaw, D.S., Wilson, M.N., Winter, C.C., & Patterson, G.R. (2014). Coercive family process and early-onset conduct problems from ages 2 to school entry. *Development and Psychopathology, 26, 917-932.*

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

Tremblay, R.E. (2010). Developmental origins of disruptive behavior problems: The 'original sin' hypothesis, epigenetics, and their consequences for prevention. *Journal of Child Psychology and Psychiatry*, 51:4, 341-67.

Trentacosta, C.J., Criss, M.M., Shaw, D.S., LaCourse, E., Hyde, L.W., & Dishion, T.J. (2011). Antecedents and outcomes of mother-son conflict and warmth during middle childhood and adolescence. *Child Development, 82(5), 1676-90.*

Vitaro, F., Brendgen, M., Larose, S., & Tremblay, R. E. (2005). Kindergarten disruptive behaviors, protective factors, and educational achievement by early adulthood. Journal of Educational Psychology, 97, 617–629.

Wechsler, D. (1989). *Preschool and Primary Scale of Intelligence—Revised. San Antonio, TX: Psychological Corporation.*

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development, (3),* 655-684.

Wellman, H. M., Harris, P. L., Banerjee, M., & Sinclair, A. (1995). Early understanding of emotion: Evidence from natural language. *Cognition & Emotion, 9(2-3),* 117-149.

Yuan, K. H. & Bentler, P. M. (2000). Three likelihood-based methods for mean and covariance structure analysis with nonnormal missing data. *Sociological Methodology*, *30*, 165–200. doi:10.1111/0081-1750.00078

Zhou, Q., Hofer, C., Eisenberg, N., Reiser, M., Spinrad, T., & Fabes, R. (2007). The developmental

trajectories of attention focusing, attentional and behavioral persistence and externalizing

problems during school-age years. *Developmental Psychology, 43,* 369–385.

Table 1.

Descriptive Statistics and Correlations of Study Variables (N = 238).

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. T1 Family SES	–														
2. T1 Child IQ	.17*	–													
3. T1 Effortful Control Behavioral Battery[a]	.16*	.33***	–												
4. T1 Inhibitory Control Mom[a]	.15*	.27***	.33***	–											
5. T1 Inhibitory Control Dad[a]	–.05	.11	28**	.44***	–										
6. T1 Attentional Focusing Mom[a]	.15*	.17*	.26***	.42***	.19*	–									
7. T1 Attentional Focusing Dad[a]	.09	.11	.20*	.24**	.42***	.46***	–								
8. T1 False Belief Prediction[b]	–.01	.13+	.23**	.08	–.02	–.04	–.06	–							
9. T1 False Belief Explanation[b]	.10	.34***	.31***	.37***	.30***	.07	.06	.34***	–						
10. T1 Maternal Nurturance[c]	.05	.23**	.13+	.28***	–.08	.24***	–.08	.10	.11	–					
11. T1 Maternal Responsiveness[c]	.03	.08	.04	.19**	–.04	.29***	–.03	.06	.04	.47***	–				
12. T1 Parental Harsh Discipline	–.19**	–.07	–.20**	–.32***	–.18*	–.16*	–.04	–.16*	–.19**	–.18**	–.21**	–			
13. T1 Child EXT	–.12+	–.06	–.15*	–.43***	–.29***	–.33***	–.12	–.02	–.10	–.14*	–.22**	.28***	–		
14. T2 Child EXT	–.03	–.02	–.09	–.35***	–.27**	–.24***	–.12	–.11+	–.16*	–.13+	–.15*	.24***	.46***	–	
15. T3 Child EXT	–.04	–.05	–.05	–.34***	–.22*	–.21**	–.15+	–.09	–.09	–.06	–.01	.21**	.44***	.59***	–
M	54.44	–.01	.00	4.59	4.47	4.68	4.51	.63	.96	5.37	5.49	6.32	.36	.27	.24
SD	10.83	.79	.55	.72	.73	.85	.76	1.15	1.46	.56	.52	6.87	.28	.25	.26

Note. T1 = Age 3. T2 = Age 5. T3 = Age 10. SES = Socioeconomic Status. EXT = Externalizing Behavior. [a]Effortful Control Behavioral Battery, Inhibitory Control, and Attentional Focusing were averaged into Child Effortful Control. [b]False Belief Prediction and Explanation were summed into Child Theory of Mind. [c]Maternal Nurturance and Responsiveness were averaged into Maternal Warmth.

$+p < .10.$ $*p < .05.$ $**p < .01.$ $***p < .001.$

Table 2.

Comparison of Fit Among Latent Class Growth Analysis Solutions for Externalizing Behavior

Fit Statistic	**1-Class**	2-Class	3-Class	4-Class	5-Class	6-Class[1]
1. BIC **Adj. BIC**	**122.62** **113.11**	−10.40 **−29.42**	−52.12 **−80.65**	−67.59 **−105.63**	−72.53 **−120.07**	−59.13 **−116.18**
2. Entropy	**1.0**	.88	.80	.81	.83	.85
3. % in Classes	**100%**	**11%, 89%**	**4%, 26%, 71%**	**4%, 10%, 16%, 71%**	**1%, 3%, 11%, 17%, 68%**	**1%, 1%, 3%, 11%, 17%, 67%**
4. **Average** Probability of Trajectory Class Membership	**100%**	**89%, 98%**	**84%, 92%, 100%**	**79%, 83%, 92%, 99%**	**77%, 82%, 87%, 93%, 100%**	**77%, 82%, 91%, 91%, 93%, 96%**
5. LMR-LRT	**N/A**	140.86, $p = .163$	54.80, $p = .064$	30.06, $p = .013$	26.32, $p = .094$	2.84, $p = .284$
6. BLRT	**N/A**	149.44 (3), $p < .001$	58.14 (3), $p < .001$	31.89 (3), $p < .001$	27.93 (3), $p < .001$	3.02 (3), $p = $**.227**

Note: BIC = Bayesian Information Criterion. Adj. BIC = Sample-Size Adjusted BIC. LMR-LRT = Lo, Mendell, and Rubin **Adjusted** Likelihood Ratio Test. BLRT = Bootstrap Likelihood Ratio Test (difference in number of parameters). **[1]The best loglikelihood was not replicated, so the 6-class solution may not be trustworthy.**

Table 3.

Chi-Square (χ^2) Test and ANOVA Results with Preschool-age Variables and Children's Trajectory

Classes of Externalizing Behavior

Variables	1. *Chronic* (*n* = 9)	2. *Rising* (*n* = 23)	3. *Decreasing* (*n* = 38)	4. ***Low*** (*n* = 168)	χ^2 *or F*-Test (*df*s), *p*-value
Gender	7 boys, 2 girls	14 boys, 9 girls	18 boys, 20 girls	86 boys, 82 girls	$\chi^2(3)$ = 3.47, *p* = .325
Child Race	8 non-Hispanic Whites, 1 other	19 non-Hispanic Whites, 4 others	35 non-Hispanic Whites, 2 others	139 non-Hispanic Whites, 26 others	$\chi^2(3)$ = 2.96, *p* = .399
Family SES	53.50 (9.55)	54.34 (11.80)	53.93 (10.19)	54.62 (10.99)	*F*(3, 229) = .06, *p* = .979
Maternal Warmth	−.80 (2.04)	−.22 (1.53)	−.47 (1.94)	.20 (1.63)	*F*(3, 229) = 2.51, *p* = .060
Harsh Discipline	15.67 (11.14)	8.78 (8.32)	6.03 (6.76)	5.54 (5.96)	*F*(3, 27.27) = 3.28, *p* = .036
Effortful Control	−.97 (.61) [1 < 2,3,4]	−.20 (.57)	−.25 (.56) [3 < 4]	.12 (.60)	*F*(3, 224) = 13.34, *p* < .001
Theory of Mind	.22 (.44) [1 < 3, 4]	1.04 (1.43)	1.49 (1.99)	1.77 (2.29)	*F*(3, 51.71) = 15.44, *p* < .001
IQ	−.09 (.57)	−.14 (.66)	−.11 (.77)	.04 (.82)	*F*(3, 222) = .62, *p* = .603

Note: Standard deviations are in parentheses. Superscript numbers indicate significant differences in pairwise comparisons of externalizing trajectories, *p*s < .05. Bonferroni adjustments corrected for multiple comparisons in pairwise comparisons, except for ANOVAs that violated tests of homogeneity of variances, in which case, we used Tamhane's T2 correction.

Table 4

Multinomial Logistic Regression Model 1 for Preschool-Age Predictors of Externalizing (EXT) Trajectories in Childhood (n = 218)

Predictor	Chronic EXT Trajectory (n = 9)				Rising EXT Trajectory (n = 21)				Decreasing EXT Trajectory (n = 35)			
	B	*SE B*	*OR*	**OR** *95% CI*	*B*	*SE B*	*OR*	**OR** *95% CI*	*B*	*SE B*	*OR*	**OR** *95% CI*
Child												
Effortful Control (EC)	**–3.68****	**1.30**	**.03**	**[.002, .32]**	–.69	.46	.50	[.21, 1.23]	**–1.07****	**.37**	**.34**	**[.17, .71]**
Theory of Mind (TM)	–1.29	1.29	.28	[.02, 3.46]	–.10	.16	.91	[.66, 1.25]	.02	.11	1.02	[.82, 1.27]
Parenting												
Maternal Warmth (MW)	.05	.65	1.05	[.29, 3.78]	–.08	.17	.93	[.66, 1.29]	**–.24***	**.12**	**.79**	**[.63, 1.00]**
Harsh Discipline (HD)	.15	.19	1.17	[.81, 1.68]	**.08***	**.04**	**1.08**	**[1.00, 1.17]**	.01	.04	1.01	[.94, 1.08]
Interactions												
EC X MW	.71	.58	2.03	[.65, 6.35]	–.16	.26	.86	[.52, 1.42]	–.22	.21	.80	[.53, 1.20]
EC X HD	.11	.11	1.12	[.91, 1.37]	–.03	.06	.97	[.86, 1.09]	.03	.06	1.03	[.93, 1.15]
TM X MW	–.35	.34	.70	[.36, 1.36]	.02	.10	1.02	[.84, 1.24]	.01	.05	1.01	[.92, 1.11]
TM X HD	.01	.12	1.01	[.80, 1.28]	.05[+]	.03	1.05	[1.00, 1.10]	.01	.02	1.01	[.97, 1.05]
Constant/Intercept	–6.33*				–2.88*				–2.02[+]			
Log Likelihood (df)		–164.58 (36)										
% in EXT Trajectory		4%				10%				16%		

Note: The **Low** EXT Trajectory is the reference category (*n* = 153, 70%). Covariates are child gender, IQ, and family socioeconomic status at age 3 (omitted from table). *SE* = Standard Error, *OR* = Odds Ratio. *CI* = Confidence Interval. All values are unstandardized estimates. All child and parenting variables are mean centered. Significant estimates are in bold.

[+]*p* < .10. *p < .05. **p < .01. ***p < .001.

Table 5

Multinomial Logistic Regression Model 2 for Preschool-Age Predictors of Externalizing (EXT) Trajectories in Childhood (n = 218)

Predictor	Low EXT Trajectory (n = 153)				Decreasing EXT Trajectory (n = 35)				Rising EXT Trajectory (n = 21)			
	B	*SE B*	*OR*	**OR** *95% CI*	*B*	*SE B*	*OR*	**OR** *95% CI*	*B*	*SE B*	*OR*	**OR** *95% CI*
Child												
Effortful Control (EC)	**3.68****	**1.30**	**39.78**	**[3.10, 510.39]**	**2.61***	**1.32**	**13.62**	**[1.03, 180.28]**	**2.99***	**1.34**	**19.96**	**[1.43, 277.92]**
Theory of Mind (TM)	1.29	1.29	3.63	[.29, 45.57]	1.31	1.29	3.71	[.29, 46.81]	1.19	1.30	3.30	[.26, 41.99]
Parenting												
Maternal Warmth (MW)	−.05	.65	.95	[.27, 3.44]	−.28	.66	.75	[.21, 2.75]	−.13	.67	.88	[.24, 3.29]
Harsh Discipline (HD)	−.15	.19	.86	[.60, 1.23]	−.15	.19	.86	[.60, 1.24]	−.07	.19	.93	[.64, 1.34]
Interactions												
EC X MW	−.71	.58	.49	[.16, 1.54]	−.93	.60	.39	[.12, 1.27]	−.87	.61	.42	[.13, 1.39]
EC X HD	−.11	.11	.90	[.73, 1.10]	−.08	.11	.93	[.74, 1.16]	−.14	.11	.87	[.69, 1.09]
TM X MW	.35	.34	1.42	[.73, 2.76]	.36	.34	1.44	[.74, 2.80]	.37	.35	1.45	[.73, 2.88]
TM X HD	−.01	.12	.99	[.78, 1.26]	.00	.12	1.00	[.79, 1.27]	.04	.12	1.04	[.82, 1.32]
Constant/Intercept	6.33*				4.31				3.45			
Log Likelihood (df)		−164.58 (36)										
% in EXT Trajectory		70%				16%				10%		

Note: The Chronic EXT Trajectory is the reference category (*n* = 9, 4%). Covariates are child gender, IQ, and family socioeconomic status at age 3 (omitted from table). *SE* = Standard Error, *OR* = Odds Ratio. *CI* = Confidence Interval. All values are unstandardized estimates. All child and parenting variables are mean centered. Significant estimates are in bold text.

$^+p < .10.$ *p < .05. **p < .01. ***p < .001.

Table 6

Multinomial Logistic Regression Model 3 for Preschool-Age Predictors of Externalizing (EXT) Trajectories in Childhood (n = 218)

Predictor	Low EXT Trajectory (*n* = 153)				Rising EXT Trajectory (*n* = 21)				Chronic EXT Trajectory (*n* = 9)			
	B	*SE B*	*OR*	*OR* 95% CI	*B*	*SE B*	*OR*	*OR* 95% CI	*B*	*SE B*	*OR*	*OR* 95% CI
Child												
Effortful Control (EC)	**1.07****	**.37**	**2.92**	**[1.41, 6.06]**	.38	.53	1.47	[.51, 4.18]	**−2.61***	**1.32**	**.07**	**[.01, .97]**
Theory of Mind (TM)	−.02	.11	.98	[.79, 1.22]	−.12	.18	.89	[.62, 1.27]	−1.31	1.29	.27	[.02, 3.40]
Parenting												
Maternal Warmth (MW)	**.24***	**.12**	**1.27**	**[1.00, 1.59]**	.16	.19	1.17	[.80, 1.71]	.28	.66	1.33	[.36, 4.84]
Harsh Discipline (HD)	−.01	.04	.99	[.92, 1.07]	.07	.05	1.08	[.98, 1.19]	.15	.19	1.16	[.80, 1.67]
Interactions												
EC X MW	.22	.21	1.25	[.83, 1.88]	.07	.30	1.07	[.60, 1.90]	.93	.60	2.54	[.79, 8.21]
EC X HD	−.03	.06	.97	[.87, 1.08]	−.06	.07	.94	[.81, 1.08]	.08	.11	1.08	[.86, 1.35]
TM X MW	−.01	.05	.99	[.90, 1.09]	.01	.11	1.01	[.82, 1.24]	−.36	.34	.70	[.36, 1.35]
TM X HD	−.01	.02	.99	[.95, 1.03]	.04	.03	1.04	[.98, 1.10]	.00	.12	1.00	[.79, 1.27]
Constant/Intercept	2.02+				−.87				−4.31			
Log Likelihood (df)		−164.58 (36)										
% in EXT Trajectory		70%				10%				4%		

Note: The Decreasing EXT Trajectory is the reference category (*n* = 35, 16%). Covariates are child gender, IQ, and family socioeconomic status at age 3 (omitted from table). *SE* = Standard Error, *OR* = Odds Ratio. *CI* = Confidence Interval. All values are unstandardized estimates. All child and parenting variables are mean centered. Significant estimates are in bold text.

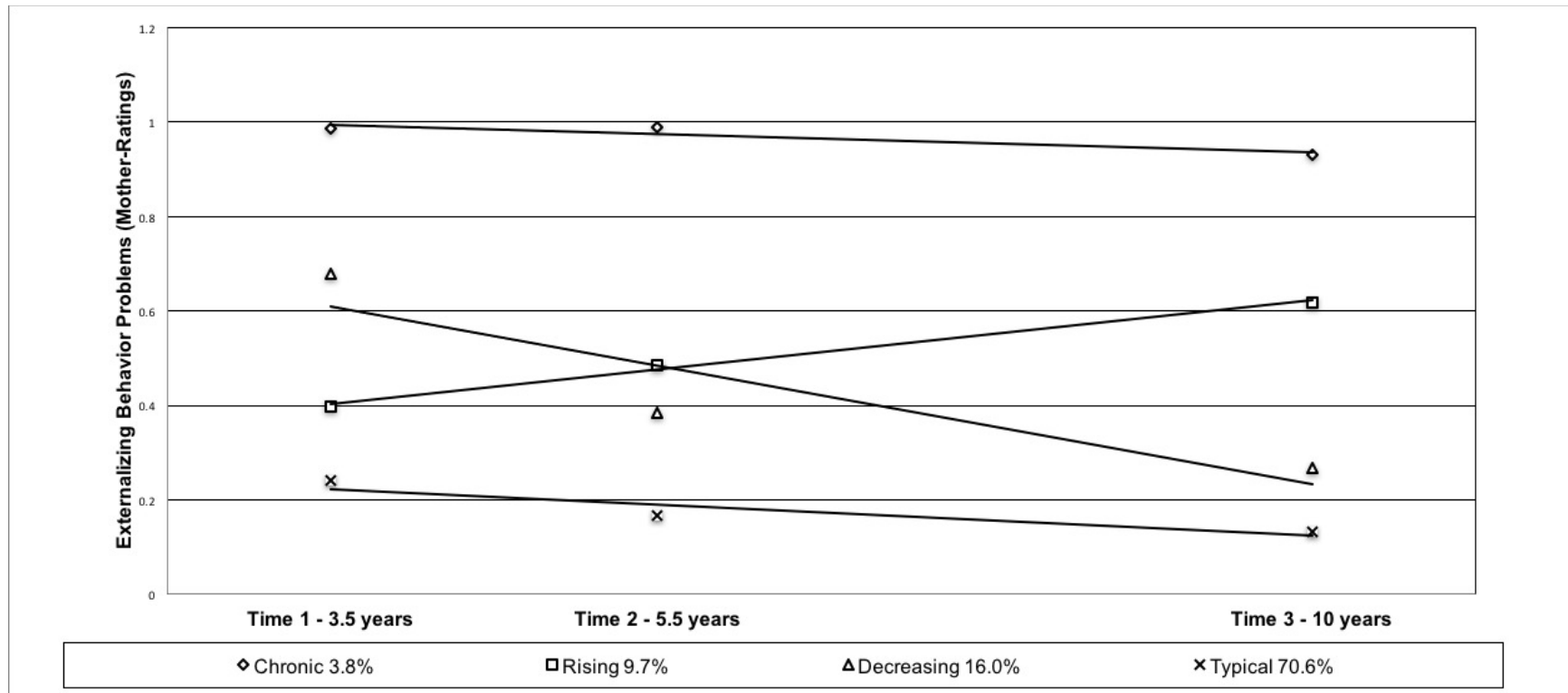+*p* < .10. *p < .05. **p < .01. ***p < .001.

Figure 1. A latent class growth analysis approximated four discrete developmental trajectories of children's externalizing (EXT) behavior from early to middle childhood. The *Chronic* group **(*n* = 9) had the highest** EXT behavior among all groups over time. The *Rising* group's (*n* = 23) EXT behavior increased from a low to moderate level through childhood. The *Decreasing* group's (*n* = 38) EXT behavior decreased from a moderate to low level through childhood. The ***Low*** group's (*n* = 168) EXT behavior was lowest among all groups and decreased over time. Markers represent sample means. Solid lines connect estimated means.