THE DEVELOPMENT OF AGGRESSION FROM AGES 2 TO 9.5 IN A HIGH RISK SAMPLE OF MALES AND FEMALES: SIMILARITIES AND DIFFERENCES IN PATTERNS, PREDICTORS, AND OUTCOMES

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Sex differences in base rates of aggression are well-established, with males showing higher levels from preschool-age through adulthood. Research investigating the etiology of these sex differences in base rates of aggression has the potential to inform basic science and prevention. A growing body of work has produced relatively consistent results showing that boys possess a greater number of child-level risk factors for aggression beginning in early childhood; however, findings are less consistent with respect to whether associations between risk and aggression are stronger in boys than in girls. The current study aimed to advance our understanding of associations between early childhood risk and the development of aggressive behavior, as well as the middle childhood consequences of early-starting aggression, in a sample of 731 boys and girls recruited at age 2 for being at high risk of developing conduct problems. Children were followed longitudinally to age 10.5 utilizing multiple data collection techniques including parent and teacher reports, home observation, and structured assessments of child behavior and parent-child interaction. The findings showed that a small proportion of both sexes exhibited high and persistent trajectories of aggression from early to middle childhood and that boys (13.3%) were more likely to exhibit this pattern than girls (6.9%). Toddler-age child-level risk factors for aggression (e.g., low inhibitory control, language delays) were more prevalent in boys than in

girls, but no sex differences were observed with respect to base rates of contextual risk factors (e.g., parent depression, parent-child coercion). Associations between toddler-age risk and trajectories of high persistent aggression were not stronger in boys than in girls. A pattern of high persistent aggressive behavior was associated with a broad array of impairments during middle childhood for both sexes, including externalizing and internalizing problems, as well as difficulties in social domains.

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1.0 INTRODUCTION

Early starting conduct problems (CP) that begin in childhood and persist throughout adolescence and adulthood, in the form of antisocial behavior, result in a substantial amount of harm to individual victims and to society (U.S. Bureau of Justice Statistics, 2010). In addition to the consequences such behavior has on others, people who commit antisocial acts are often impaired in psychological, social, and occupational domains (Odgers et al., 2008) . Individuals who engage in antisocial behavior as adults tend to be repeat offenders who have a long-standing history of delinquency beginning in childhood (Moffitt, 1993a). Accordingly, identifying childhood precursors that predict future antisocial behavior is an important goal of research.

Efforts to understand mechanisms leading to risk for persistent CP have focused on identifying homogeneous subgroups of children based on common developmental patterns of CP, such as age of onset and severity (Broidy et al., 2003). This work has demonstrated that a subset of children whose CP emerge during early childhood *and* remain elevated into school-age are at the highest risk of exhibiting antisocial behavior into adolescence and adulthood (Shaw & Gross, 2008). Moreover, these "early-starters" have been found to be characterized by common individual and proximal risk factors (e.g., difficult temperament, harsh parenting; Campbell, Shaw, & Gilliom, 2000) beginning in early childhood. However, much of the work on CP development has focused on all male samples (e.g., Loeber et al., 2005; Shaw, Hyde, & Brennan, 2012) or failed to probe mixed-sex samples for sex differences (e.g., Aguilar, Sroufe, Egeland, &

Carlson, 2000). Although rates of CP have been found to be reliably higher in males than in females beginning around preschool-age (Keenan & Shaw, 1997), there is growing recognition of the importance of understanding female CP, which has been linked with maladaptive outcomes such as teen pregnancy (Woodward & Fergusson, 1999) and adult poverty (Odgers et al., 2008).

Numerous theories have been proposed to explain the differences in base rates of CP between boys and girls, ranging from differential exposure to risk factors for CP (Rutter, Caspi, & Moffitt, 2003), to boys having greater susceptibility to CP risk factors than girls (Eme, 2007); yet, the source of sex differences in the prevalence of CP remains poorly understood. Furthermore, empirical work examining other aspects of the development of CP that have been established in males, such as course and predictive utility, have found few *consistent* sex differences in risk factors, trajectories, and outcomes associated with CP (Campbell et al., 2010; Lahey et al., 2006). However, reliance on lower-risk middle class and community samples often produce too few females with clinically-meaningful CP to permit statistical comparison (Moffitt & Caspi, 2001), and results from these samples may have limited generalizability to higher risk populations (Bronfenbrenner, 1986). In addition, methodological differences, such as the use of broad- versus narrow-band factors to measure CP, and the method used to compute trajectories, likely contribute to the inconsistent findings.

To date, no study could be identified that examines whether there are sex differences in the mechanisms, patterns, and outcomes associated with early-starting aggression in a high risk, ethnically diverse sample of boys and girls followed longitudinally from toddlerhood through middle childhood. Thus, the current study aims to examine developmental trajectories of aggression from age 2 to age 9.5, including how aggression trajectories differ when sexes are

estimated together and separately, in a diverse sample of 731 boys and girls recruited on the basis of elevated risk for CP at age 2. This study will also examine whether there are sex differences in the associations between child and contextual risk factors for trajectories of early-starting aggression measured from early to middle childhood, and if there are sex differences in the predictive utility of aggression trajectories for middle childhood functioning.

1.1 LITERATURE REVIEW

1.1.1 Developmental taxonomy theory

Researchers have long posited that age of onset of CP is a valuable way to identify subgroups of children who share similar causal mechanisms and show a common course to the development of their CP (Moffitt, 1993a; Patterson, DeBaryshe, & Ramsey, 1989; Shaw, Bell, & Gilliom, 2000). This seminal developmental taxonomy theory (e.g., Moffitt, 1993a; Patterson et al., 1989) has provided a theoretical framework capable of explaining mechanisms underlying the heterogeneity in both the etiology and course of early-starting CP. Specifically, Patterson and colleagues (1989) described the crucial contribution of parent-child interaction, beginning in early childhood, to the development of CP and later antisocial behavior. Their work explained that noncontingent parental responses to prosocial and antisocial child behavior from early childhood lead to the inadvertent reinforcement of child behavior problems. Moreover, parents' engagement in "coercive cycles," in which children learn the functional value of their aversive behaviors for escape and avoidance from unwanted interactions, ultimately leads to the use of heightened aversive behaviors (e.g., physical aggression) from the child and other family

members to obtain social goals. As a result, these children are also more likely to struggle in academic and social domains, which carry a different set of behavioral demands. Patterson's theory states that it is this combination of child behavioral training and social rejection that leads to deviant peer affiliation and delinquency in adolescence. Thus, according to this theory, it is a complex interplay of child and proximal factors that ensnare a child in the early-starter pathway.

Furthermore, Moffitt (1993a) detailed the existence of subgroups of youth who engage in antisocial behavior. Moffitt furthered Patterson's theory by specifying child characteristics that might account for early-starting trajectories, focusing on neuropsychological deficits (e.g., verbal and executive functions). Accordingly, infants born with these deficits were hypothesized to be "difficult" to manage and to evoke negative reactions from their caregivers. In addition, as many children with neuropsychological deficits are often born into environments that are not well-equipped to care for them, Moffitt posited that the stage would be set for coercive parent-child interaction similar to those described by Patterson's. Moffitt's model also emphasized the consequences of early-emerging CP for later academic, social, and occupational functioning.

A body of empirical work spurred by taxonomy theory has identified common predictors, correlates, and outcomes associated with the age of onset and developmental course of CP. The results have supported the existence of a subgroup of children who show an early onset to their CP, persist throughout childhood, and exhibit more serious forms of antisocial behavior into adolescence and adulthood (Broidy et al., 2003). Moreover, this subgroup of children has been found to be characterized by a common set of biological and contextual risk factors and a more persistent and severe course to their antisocial behavior, as well as more maladaptive outcomes, than those identified with an adolescent CP onset (Aguilar et al., 2000; Odgers et al., 2008).

Building upon the original taxonomy theory, several theoretical reformulations have been posited, including those suggesting that adolescent antisocial behavior is less "limited" than originally believed (Byrd, Loeber, & Pardini, 2012), those identifying of a group of early-starting children whose CP desists throughout childhood (i.e., childhood limited; Barker & Maughan, 2009), and those suggesting that different developmental taxonomies may be required for girls (Silverthorn & Frick, 1999). Thus, questions surrounding the identification of subgroups of children based on developmental patterns of CP and the underlying mechanisms as well as predictive utility associated with CP patterns remain unanswered.

1.1.2 Sex differences in conduct problems

Although a great deal of work has been done to investigate the development of CP, research that included females was very limited prior to the 1990s. To provide some context for why female CP may have been neglected by researchers, the following section will offer an overview of sex differences in the prevalence and development of CP. As noted above, boys show reliably higher rates of CP and antisocial behavior during middle childhood (Lahey et al., 2000), adolescence, and adulthood (Broidy et al., 2003). Beginning around preschool-age, males are more likely than females to exhibit elevated levels of conduct problems (Fergusson & Horwood, 2002) whether the construct is defined as disruptive behavior disorder symptoms (Thomas, Byrne, Offord, & Boyle, 1991), physical aggression (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006), or symptoms of conduct disorder (Odgers et al., 2008). However, this male predominance is not reliably observed in early childhood, with some research finding a lack of sex differences in difficult temperament, behavioral inhibition, noncompliance, and even physical aggression prior to age 4 (Keenan & Shaw, 1997; Zahn-Waxler, 1993).

The prevalence of CP is known to increase for both sexes during adolescence (Maughan, Rowe, Messer, Goodman, & Meltzer, 2004); however, some findings suggest that this increase is disproportionately higher in girls, resulting in the narrowest CP sex ratio at any point in the lifespan occurring during adolescence (Moffitt, Caspi, Rutter, & Silva, 2001; Silverthorn & Frick, 1999). These base rate sex differences, along with developmental shifts during preschool-age and adolescence, have led to speculation as to whether female CP may be better characterized by different developmental patterns than male CP. Given the robustness of the association between child sex and CP, an increased understanding of CP development in both sexes is likely to contribute important etiological information to the field (Rutter et al., 2003).

1.1.3 Developmental trajectories of conduct problems in males and females

Recent empirical work utilizing a prospective longitudinal design in community samples has supported the application of traditional taxonomy theory to females. This work demonstrated that a small group of females can be identified based on the existence of elevated *and* persistent CP from early and middle childhood into late adolescence and adulthood (Barker, Oliver, & Maughan, 2010; Fergusson & Horwood, 2002). In fact, studies have shown that males and females follow largely parallel developmental trajectories (Lahey et al., 2006; Odgers et al., 2008), although males demonstrate the early-starting and persistent pattern with greater frequency than females (Brennan & Shaw, 2013; Broidy et al., 2003), The results suggest that males and females follow similar developmental trajectories of CP; however, there is a great deal of inconsistency in studies' findings and associated methodologies.

An important variation in developmental modeling approaches is whether trajectories are estimated for males and females together or separately. One advantage to estimating trajectories

separately is that the number of identified classes can differ between sexes and, if there are sex-specific developmental patterns, they can be more readily identified. Nonetheless, one limitation of this strategy is the potential identification of a female "high" group that would actually exhibit lower levels of CP than lower male groups. However, there is a lack of research examining the effects of mixed-sex versus single-sex models on identified rates and mean levels of male and female CP, particularly in a high risk sample where sizable numbers of both sexes would be expected to demonstrate elevated levels of CP.

Measurement differences also appear to play a major role in many of the discrepancies found between studies in both the types of CP trajectories identified and the percentage of males and females classified in each trajectory. The importance of measurement may be particularly amplified when examining sex differences in CP trajectories. For example, within New Zealand birth cohorts following children from ages 7 to 13 (Broidy et al., 2003), the addition of one item (i.e., temper tantrums) to the physical aggression measure might have influenced the pattern of results. Although the Christchurch cohort had approximately 10% of females showing high and stable CP based on three items, no high stable group was identified based on the Dunedin cohort's two items. Notably, this measurement difference did not appear to affect results for males (11% high stable males in Christchurch vs. 9% in Dunedin sample), suggesting that female CP rates may be more sensitive to measurement differences than male CP rates. However, it is also possible that true differences between samples contributed to the discrepant results. The effect of measurement on identified CP base rates, developmental patterns, and sex differences in these domains is difficult to determine because of the heterogeneity in measurement, study design, statistics, and sample characteristics between studies.

Theoretically, it is likely that narrow definitions of CP, such as physical aggression, that capture more salient behavior problems throughout development are better able to identify a homogenous subgroup of children at risk for problematic outcomes in comparison with definitions based on broad CP measurement, such as externalizing. For example, studies that evaluate whether males and females persist on narrowly-defined but theoretically important dimensions (e.g., early physical aggression for later violent offending; Farrington, 1991) are likely valuable for identifying a high-risk subgroup that should be targeted for intervention. Frequent use of verbal and physical aggression from early childhood may be a more meaningful predictor of future impairment than other externalizing dimensions (Brennan, Shaw, Dishion, & Wilson, 2012; Nagin & Tremblay, 1999), in part because of the extreme nature of aggression. Although all disruptive behaviors are relatively normative during early childhood (Campbell, 2002), high levels of aggression may be more reflective of serious underlying deficits in self-regulation and inhibition than other age-normative behaviors (Blair & Coles, 2000).

Moreover, aggressive behavior may be particularly relevant to the topic of sex differences, as the prevalence, manifest behaviors, social acceptability, and consequences of aggression have been theorized to differ for males and females (Crick & Grotpeter, 1995; Odgers & Moretti, 2002; Zahn-Waxler, 1993). Researchers have previously introduced the notion of a "gender paradox" to refer to findings that disorders with an unequal sex ratio are more impairing for the sex with the lower prevalence (Eme, 1992; Loeber & Keenan, 1994). This concept has been applied to disruptive behaviors in females such as ADHD (Gaub & Carlson, 1997) and may be even more applicable to overtly aggressive behavior, which is seen as particularly female atypical (Zahn-Waxler, 1993). Thus, this study aims to examine developmental patterns of *aggression* in males and females followed from toddlerhood to middle childhood in a high-risk

sample, and to examine whether predictors and outcomes associated with persistently elevated aggression differ for males and females.

1.1.4 Developmental trajectories of aggression in males and females

A growing body of work has examined longitudinal development of aggressive behavior in males and females in the last decade. The results largely demonstrate that, as with broadly-defined CP, males and females exhibit similar developmental trajectories of aggression whether studies begin in early childhood (Côté et al., 2006) or middle childhood (Broidy et al., 2003), although more males than females tend to demonstrate the early-starting pattern. When CP is restricted to physical and/or verbal aggression (e.g., hitting or threatening others), the results of prospective, longitudinal work with both sexes consistently show a group characterized by early-starting and persistent aggression, a group with low-to-moderate aggression, and a group with very low stable levels of aggression (Broidy et al., 2003; Harachi et al., 2006; NICHD Early Child Care Research Network, 2004b). However, even within studies focusing on aggression, there is variability around the number of patterns identified, the percentage of males and females showing each pattern, and the associated levels of aggression.

A subset of children demonstrating an early-starting and persistent, or high, trajectory has been identified in numerous studies of aggression in males and females (Broidy et al., 2003), albeit with different frequencies. Overall, when male and female trajectories are estimated together from early and middle childhood to adolescence, rates of early-starting and persistent aggression range between 4.3% and 20% for males and 1% and 13.5% for females. For example, in one large, longitudinal multi-site study of predominantly middle class U.S. children, referred to throughout this manuscript as the "NICHD sample," five trajectories of parent-rated

physical aggression (six items), high, moderate, moderate declining, low, and very low, were identified from ages 2 through 8. The results showed that, modeled together, 1.4% of girls versus 4.3% of boys demonstrated persistently high aggression (NICHD Early Child Care Research Network, 2004b). Yet, in a representative Canadian sample of the same age range, boys and girls modeled as one group showed four trajectories based on parent ratings of physical aggression (three items), high, moderate desisting, low desisting, and low stable, with 13.5% of girls and 15.6% of boys exhibiting persistently high levels of aggression (Côté, Vaillancourt, Barker, Nagin, & Tremblay, 2007). Despite similarities between the studies' age ranges and modeling strategy, they differ with respect to both measurement and sample characteristics. Thus, it is difficult to interpret whether measuring physical aggression with six versus three items allows for the identification of a small, relatively extreme subgroup or whether the results reflect true population differences. In addition, estimating males and females together limits the potential identification of sex-specific trajectory groups. As a result, many mixed-sex models may inaccurately reflect the mean levels and patterns of aggression identified for both sexes.

A number of studies have also examined the developmental course of aggression in males and females estimated separately. These studies have found rates of early-starting and persistent aggression between 6.6% and 11.9% for males and between 3% and 10.4% for females; however, one study failed to identify this pattern in females (i.e., Dunedin; Broidy et al., 2003) while another found it to be less stable than the corresponding male pathway (Campbell et al., 2010). In one study in a predominantly Caucasian community sample from the northwestern United States, researchers used four teacher-rated items measuring physical and/or verbal aggression from ages 7 to 13 and found trajectories of high, moderate, low, and no aggression in both boys and girls (Harachi et al., 2006). The study found that 10.4% of girls and 11.9% of boys

demonstrated the high stable pattern. In addition, the mean level of aggression associated with the male high group was higher than the mean level for the female high group. Yet, membership in the high group was similarly associated with risk variables and negative outcomes, including substance use and violent behavior, for males and females.

Campbell and colleagues (2010) examined the development of teacher-rated aggression (six items) from ages 6 to 12 in the same longitudinal NICHD sample noted above. The authors estimated trajectories separately by sex and found that 4.5% of females and 6.4% of males showed a pattern of elevated aggression across all ages; however, the female high group's levels were lower than the male high group's levels and were also more variable over time. Despite lower and less consistent mean levels of aggression associated with the female high trajectory, females differed from those on the moderate and low trajectories on nine of ten sixth grade outcomes while males only differed on six of ten outcomes. Thus, although females' aggression levels were less elevated and more variable than males' levels, the pattern of high aggression throughout childhood predicted poor outcomes for both sexes. It is possible that estimating males and females together would have overlooked the differences between these sex-specific high groups. No study could be identified that compares how the trajectories identified, the proportion of males and females on each trajectory, or the corresponding mean levels of aggression differ if males and females are estimated together versus separately. It is unclear if one technique is superior at identifying subgroups of children at risk for persistent aggression, whom would be important targets of intervention.

1.1.5 Risk for early-starting aggression

Validation for the identification of both male and female subgroups based on developmental trajectories of CP, including aggression, stems from research examining risk profiles associated with the early-starting pattern (Côté et al., 2006; Lahey et al., 2006). To maximize the evidence included in this review and because many theoretical mechanisms underlying risk for CP and aggression are not be expected to differ (unless noted), studies that focused on risk for *either* aggression or broader definitions of CP that include other disruptive behaviors will be reviewed. Thus, the term "CP," inclusive of aggression, will be used, but the term "aggression" will be reserved for studies focusing on physical and/or verbal aggression.

Consistent with the broader literature on CP development, studies examining risk for CP neglected females or failed to examine whether risks differ between sexes. As a result, it was previously unknown whether risk factors associated with early-starting CP in males (e.g., child fearlessness (Shaw, Gilliom, Ingoldsby, & Nagin, 2003), parent socioeconomic status (Nagin & Tremblay, 2001)) would also be linked with CP in females. Recent work has identified similar associations between individual and contextual characteristics during early childhood and early-starting CP and aggression in males and females. Moreover, few risk factors show consistent sex-specific associations with the development of early-starting CP, including aggression (Campbell et al., 2010; Lahey et al., 2006; Odgers et al., 2008; Tremblay et al., 2005), suggesting that existing CP taxonomies and processes proposed to underlie them are similar for males and females. However, the inclusion of females in this research is recent and the causes of sex differences in base rates of aggression are poorly understood.

Current evidence showing that males and females follow parallel CP trajectories with few sex-specific risk factors indicates that risk factors that occur more frequently in males (e.g.,

language delays, impulsivity) likely play an important role in the etiology of sex differences in CP (Keenan & Shaw, 1997). However, arguments have been put forth suggesting that the relative magnitude of association between some early childhood risk factors (e.g., hyperactivity, socioeconomic status) and CP is larger in males than in females (Moffitt et al., 2001). Although there is some evidence in support of this claim (Caspi, Henry, McGee, Moffitt, & Silva, 1995; McFadyen-Ketchum, Bates, Dodge, & Pettit, 1996; Moffitt et al., 2001; Ribeaud & Eisner, 2010), data are inconsistent; the majority of results do not support stronger associations between early childhood risk and CP in males than in females (Barker & Maughan, 2009; Campbell et al., 2010; Odgers et al., 2008; Parent et al., 2011; Webster-Stratton, 1996). Moreover, it is likely that a large number of studies examining sex differences go unpublished because no sex differences were found in the magnitude of associations between risk and CP.

A plethora of early childhood biological, social, and contextual characteristics have been linked with risk for early-starting CP. In addition to sex, child variables measured before age 5 that have been linked with CP include aspects of temperament, such as negative emotionality, fearlessness, and activity level (Barker, Oliver, Viding, Salekin, & Maughan, 2011; Caspi et al., 1995; Lahey et al., 2008), insecure or disorganized attachment (Munson, McMahon, & Spieker, 2001; Shaw, Owens, Vondra, Keenan, & Winslow, 1996), early language delays (Lahey et al., 2006), self-regulation difficulties (Olson et al., 2011), aggressive behavior (Pakiz, Reinherz, & Giaconia, 1997), and hyperactivity (Lahey et al., 2006). Similarly, numerous social and environmental factors present during early childhood ranging from low socioeconomic status (NICHD Early Child Care Research Network, 2004b) and family conflict (Odgers et al., 2008) to parent psychopathology (Tremblay et al., 2005), physical abuse (Aguilar et al., 2000), and

caregiving characterized by low sensitivity and hostility (Campbell et al., 2010; Côté et al., 2006), have been shown to confer risk for elevated levels of CP and aggression.

Despite advances in this area of research, limitations that include samples with few females with clinically meaningful levels of CP or aggression and a lack of focus on the interplay between sex and risk during the early childhood period (a critical developmental period for early identification and intervention) leave a need for clarification of the role of child and contextual factors in the etiology of male and female aggression. Thus, this paper will examine early childhood variables that have been consistently empirically and theoretically linked with early-starting aggression to determine whether sex differences in the prevalence of risk, susceptibility to risk, or both, drive the well-established sex differences in base rates of aggression.

1.1.5.1 Child characteristics

Fearlessness

Numerous aspects of temperament measured during early childhood, such as negative emotionality (Eisenberg et al., 2009), low effortful control (Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Olson, Schilling, & Bates, 1999), and high activity levels (Fox & Henderson, 1999), have been linked with later CP. One dimension, fearlessness, which reflects individual differences in approach to novel situations, has been theorized to place children at risk for later CP through disinhibition to engage in high stimulating activities, some of which might involve defying normative standards of conduct (Rothbart & Bates, 1998).

Correspondingly, fearlessness in 2-to 3-year-old boys and girls in longitudinal community samples predicts early-starting and persistent CP into adolescence (Barker et al., 2011; Lahey et al., 2008). Similarly, cross sectional and longitudinal associations between

preschool-age fearlessness and *aggressive* behavior in later preschool and middle childhood have also been found (Kimonis et al., 2006; Raine, Reynolds, Venables, Mednick, & Farrington, 1998; Rothbart, Ahadi, & Hershey, 1994). For example, in a representative sample of over 1000 boys and girls from Mauritius, Raine and colleagues (1998) showed that examiner-rated fearlessness at age 3 predicted parent-rated aggression at age 11. In the Dunedin cohort, boys and girls rated by examiners as temperamentally inhibited at age 3 scored significantly lower on self-reported aggression at age 18 than all other children (Caspi & Silva, 1995). However, this association has largely been examined in relation to aggression at a single time-point, rather than longitudinal trajectories, and has yet to be tested in a sample of high-risk boys and girls.

Although sex differences in temperament likely change throughout development (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006), there is some consistent evidence that boys are less fearful than girls beginning in infancy, according to parent reports (Gartstein & Rothbart, 2003; Lahey et al., 2008; Martin, Wisenbaker, Baker, & Huttunen, 1997). Similarly, a meta-analysis of research spanning ages 3 months to 13 years revealed a small but significant effect size for fear, with girls demonstrating higher levels and no moderation by age. Current evidence does not suggest differential associations between fearlessness and CP for boys and girls, although the association is more well-established for boys (e.g., Shaw, 2003). Thus, it was expected that fearlessness would be associated with risk for aggression in both sexes and that boys' higher rates would be a contributing factor to sex differences in base rates of aggression.

Inhibitory control

Research has shown that the development of self-regulation abilities such as delay of gratification are closely tied to emerging child CP (Posner & Rothbart, 2000). Theoretically, executive regulation of an impulsive response, or inhibitory control, would be crucial to the

development of socially appropriate behavior, with deficits in these skills likely to lead to disruptive problem behavior (Kochanska, Coy, & Murray, 2001; Moffitt, 1993b; Olson et al., 2011; Posner & Rothbart, 2000). Moreover, inhibitory control would be expected to play an important role in one's ability to suppress an aggressive response (Blair, 2001). The capacity to regulate impulses is known to rapidly develop throughout early childhood (Olson et al., 2011; Zelazo et al., 2003), paralleling growth in the frontal lobe of the brain (Diamond, 1990). Thus, individual differences in this development may underlie early-starting aggressive behavior.

A growing body of work in community and at-risk samples has demonstrated concurrent associations between inhibitory control or similar constructs and CP during early childhood (Olson et al., 2005; Olson et al., 2011; Raaijmakers et al., 2008), with evidence that this association strengthens as children age and those who do not develop inhibitory control stand out more from their peers (Utendale & Hastings, 2011). Longitudinal associations between preschool-age inhibitory control and school-age CP and aggression have also been found (Brocki, Nyberg, Thorell, & Bohlin, 2007; Kochanska et al., 2001; Olson, Bates, Sandy, & Schilling, 2002). For example, in one study, preschoolers rated by parents as being at or above the 93rd percentile on the Aggressive Behavior Scale of the Child Behavior Checklist (which assesses predominantly aggressive behaviors) performed more poorly on neuropsychological measures of inhibition than controls (Raaijmakers et al., 2008). However, more work is needed on the relationship between early childhood inhibitory control and narrow-band aggressive behavior, particularly when aggression is measured longitudinally from early to middle childhood. In sum, lower inhibitory control during early childhood has implications for concurrent and future CP and would be expected to similarly predict early-starting aggression.

Comparisons of boys and girls from high-risk and community samples frequently show a sex difference in inhibitory control. Boys typically demonstrate lower inhibitory capacities than girls beginning in toddlerhood (Kochanska, Murray, & Harlan, 2000; Moilanen, Shaw, Dishion, Gardner, & Wilson, 2010; Olson et al., 2005), although there are some inconsistencies in the literature (Olson et al., 2011; Rhoades, Greenberg, & Domitrovich, 2009). Sex differences in the *relationship* between inhibitory control and CP are even less consistent. For example, Chang and colleagues (2011) examined longitudinal associations between age 3 effortful control measured via observation and mother report and age 6 CP in a sample of at-risk and community children. The results showed that after accounting for parenting during early childhood the relationship between effortful control and CP remained significant only for boys. However, many studies fail to find significant sex differences in this relationship (Olson et al., 2005; Olson et al., 2011; Raaijmakers et al., 2008) and there is little evidence to suggest sex-specific associations with aggressive behavior. In sum, sex differences in base rates of inhibitory control have typically been found, but less consistent are sex differences in the magnitude of association between inhibitory control and CP. Thus, it was expected that boys' lower average levels of inhibitory control, rather than a stronger relationship between inhibitory control and aggression in boys than in girls, would contribute to sex differences in rates of early-starting aggression.

Language ability

Children with language delays commonly struggle with aspects of social and emotional competence (Horwitz et al., 2003; Lundervold, Heimann, & Manger, 2008; Paul, Looney, & Dahm, 1991; Qi & Kaiser, 2004). Over half of parents in the National Survey of Children's Health who reported concerns regarding their toddlers' or preschoolers' language ability also reported concerns over their behavior (Long, Gurka, & Blackman, 2008). One theoretical

explanation for this relationship is that children who struggle to communicate effectively may turn to aggressive and oppositional strategies (Redmond & Rice, 1998; Tomblin, Zhang, Buckwalter, & Catts, 2003). This tendency, coupled with a coercive home environment could set the stage for engrained patterns that persist into later development (Moffitt, 1993b; Patterson et al., 1989). In Moffitt's (1993b) seminal paper on the role of neuropsychological functioning in CP development, she theorized that deficits in verbal ability, among other executive skills, are at the core of the early-starting and persistent CP pathway.

Concurrent associations between language/verbal ability and both CP and aggression have been found in preschoolers and school-age children (Kaiser, Hancock, Cai, Foster, & Hester, 2000; Qi & Kaiser, 2004). Correlations between aggressive behavior and language ability in non-clinical children have been found as early as 19 months of age (Dionne, Tremblay, Boivin, Laplante, & Perusse, 2003). In addition, research has shown longitudinal associations between early language and later CP, albeit inconsistently (Aguilar et al., 2000; Silva, Williams, & McGee, 1987). Less work has been done on the relationship between language *during early childhood* and the development of later narrow-band aggressive behavior. In a longitudinal community sample of boys and girls, Campbell and colleagues (2010) did not find an association between examiner-assessed language across 36 and 54 months of age and trajectories of teacher-reported physical aggression from ages 6 to 12 when an index of social risk was included in the analysis. However, the mean language scores of the male and female high aggression groups were 10 to 15 points lower than their respective "no aggression" groups' scores. Thus, early language ability was notably lower in preschool-age children who went on to demonstrate early-starting and persistent aggressive behavior compared to those who did not.

With respect to sex differences in language development, in typically developing samples boys commonly produce fewer words than girls by around two years of age and show a slower rate of vocabulary growth across early childhood (Bouchard, Trudeau, Sutton, Boudreault, & Deneault, 2009; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Rescorla, Hadicke-Wiley, & Escarce, 1993). One study of close to 1000 children found that the largest sex difference in spoken words occurs between 2 and 3 years of age, when girls speak over 100 more words than boys, on average (Bouchard et al., 2009). In addition, epidemiological studies show that boys begin to show higher rates of language delay as early as the second year of life and into school-age (Horwitz et al., 2003; Lundervold et al., 2008; Silva et al., 1987).

In line with the broader literature on language ability and CP, sex differences in the magnitude of the association have been inconsistently identified. For example, in a cross-sectional study of at-risk 4 to 5 year-olds, language was more strongly correlated with observed behavior problems for boys than for girls (Stowe, Arnold, & Ortiz, 1999). In contrast, in a longitudinal study of children oversampled to be at-risk for behavior problems, Pitzer and colleagues (2010) found that average verbal ability across 2, 4.5, and 8 years of age differentiated early-starters from low externalizing children at ages 8 to 15 for females but not for males. Yet, other researchers have found no sex differences in the magnitude of association between early childhood language ability and risk for CP or aggression in large community samples (Barker & Maughan, 2009; Campbell et al., 2010; Lahey et al., 2006). Evidence suggests that there are reliable sex differences in language that emerge during toddlerhood, with girls on average producing more words than boys, but there are few consistent sex differences in the magnitude of the association between early language and later aggression. Thus, boys' lower

levels of language, rather than a stronger association between language ability and aggression, were expected to contribute to sex differences in base rates of early-starting aggression.

Attention-Deficit/Hyperactivity Disorder (ADHD)

Early ADHD-like behaviors, such as inattention, hyperactivity and impulsivity, are associated with an early age of onset of CP and more serious antisocial behavior (Farrington et al., 1990; Loeber et al., 1993). Theoretically, children who are impulsive and hyperactive are more likely to act on aggressive impulses or engage in risky behavior without considering the consequences (Barkley, 2003). Moreover, children with ADHD alone frequently exhibit deficits in social skills and experience peer rejection (Gaub & Carlson, 1997; Lee, Lahey, Owens, & Hinshaw, 2008), which likely further increases their risk for early-starting aggression (Miller-Johnson, Coie, Maumary-Gremaud, Bierman, & Conduct Problems Prevention Research, 2002).

Longitudinal studies conducted on boys and girls from community samples beginning at ages 5 to 8 have found an increased likelihood of early-starting and persistent CP into later childhood and adolescence when ADHD symptoms were present at the study outset (Harachi et al., 2006; McEachern & Snyder, 2012; Waschbusch, 2002). Moreover, numerous studies show that children who exhibit symptoms of ADHD in addition to noncompliance and aggression during early childhood are at greater risk of following an early-starting and persistent pathway compared to those who demonstrate noncompliance or aggression alone (Hinshaw, 1987; Pierce, Ewing, & Campbell, 1999; Waschbusch & Willoughby, 2008). In one review of risk factors contributing to toddlers' and preschoolers' continued problem behaviors into later childhood and adolescence, the authors concluded that children exhibiting multiple problem behaviors (i.e., aggression *and* hyperactivity) in multiple contexts are particularly susceptible to showing CP past the early childhood period (Campbell et al., 2000). Similarly, early and middle childhood

ADHD behaviors in combination with aggression have been shown to predict continued aggression and broader functional impairment at later ages better than either behavior alone (Waschbusch, 2002; Waschbusch & Willoughby, 2008).

It is well-established that boys exhibit symptoms of ADHD more frequently than girls, with male-to-female ADHD diagnosis ratios between 9:1 in clinical samples and 3:1 in epidemiological samples (Barkley, 2003; Cantwell, 1996; Swanson et al., 1998). However, it is less clear whether the magnitude of the relationship between ADHD behaviors and CP differs for males and females. The association between ADHD behaviors in early and middle childhood and persistent CP has been more consistently identified in males than in females (Babinski, Hartsough, & Lambert, 1999; Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002; Moffitt & Caspi, 2001; Waschbusch, 2002). For example, Côté and colleagues (2002) found in a Canadian school sample that 18.1% of boys versus only 2.4% of girls who were rated as hyperactive by teachers from kindergarten to sixth grade met criteria for Conduct Disorder in adolescence. Yet, some studies find that ADHD behaviors predict CP and aggression equally in both sexes (Harachi et al., 2006; Lahey et al., 2006). In summary, it is clear that boys show higher base rates of ADHD than girls beginning in the preschool period, with some evidence to suggest that the association between ADHD behaviors and aggression is stronger in males than in females. However, more research is needed to establish or disconfirm this latter finding, particularly with at-risk, ethnically-diverse samples with males and females exhibiting clinically significant behavior problems in early childhood. Thus, it was expected that boys and girls with similar levels of ADHD behaviors would be equally likely to exhibit early-starting aggression.

1.1.5.2 Contextual characteristics

Socioeconomic status

Socioeconomic status (SES), an index of a family's financial and social capital that traditionally includes occupational status and/or income, is a robust predictor of a number of child outcomes such as physical health, cognitive development, and socioemotional functioning, including CP (Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997). Research indicates that the effects of SES are more pronounced when poverty is endured during early childhood, particularly if lasting for several years (Magnuson & Votruba-Drzal, 2009; McLoyd, 1998). Numerous mechanisms have been proposed to underlie the association between SES and child development, with two of the more prominent being access to resources (i.e., nutrition, cognitive stimulation, institutions; Brooks-Gunn & Duncan, 1997; Leventhal & Brooks-Gunn, 2000) and compromised parenting resulting from poverty-related stressors (Bradley & Corwyn, 2002; Conger et al., 1992; Dodge, Pettit, & Bates, 1994).

Research consistently supports links between low SES during early and middle childhood and concurrent and longitudinal CP, including aggression. Cross-sectional associations have been found between characteristics of SES, including parent employment status, parent education, neighborhood, and income and CP in preschool- (Campbell et al., 2000; Duncan, Brooks-Gunn, & Klebanov, 1994) and school-aged children (Deater-Deckard, Dodge, Bates, & Pettit, 1998; McLeod & Shanahan, 1993). Even within low SES samples, lower SES is associated with increased risk for CP and aggression, albeit more modestly than in samples with a full range of SES (e.g., Dishion et al., 2008; Ingoldsby et al., 2006). Moreover, longitudinal work has shown that low SES during early childhood predicts aggression in middle childhood (Campbell et al., 2010; Côté et al., 2006), delinquency in adolescence (Fergusson & Horwood,

2002; van Domburgh, Vermeiren, Blokland, & Doreleijers, 2009), and criminality into adulthood (Odgers et al., 2008). For example, in a representative sample of boys and girls followed from preschool to third grade, preschool-age SES predicted teacher-rated externalizing problems and peer-rated aggressive behavior through third grade (Dodge et al., 1994). Similarly, in the NICHD sample, income composited across 6 and 24 months of age differentiated mother-reported early-starting and persistent aggression from very low, low, and moderate aggression trajectories from ages 2 to 8 (NICHD Early Child Care Research Network, 2004b).

Data from the U.S. Census Bureau indicate that more than 1 in 5 children lived in poverty in 2010. In addition, data show that rates are even higher, about 1 in 4, in children under 5 years of age (Brooks-Gunn & Duncan, 1997). There is little theory or data to suggest sex differences in the prevalence of poverty for children. According to the Federal Interagency Forum on Child and Family Statistics (2012), between 1980 and 2010 rates of child poverty fluctuated similarly for boys and girls under the age of 17. Thus, the prevalence of low SES and poverty would not be expected to differ for boys and girls.

Studies that examine SES in relation to CP and aggression show inconsistent associations with respect to sex differences. For example, some studies have found differences, typically indicating that the association between low SES and CP or aggression is stronger in males than in females (Bolger, Patterson, Thompson, & Kupersmidt, 1995; Pakiz et al., 1997; Patterson, Kupersmidt, & Vaden, 1990). In one study, Pakiz and colleagues (1997) examined associations between family disadvantage at ages 5 and 6 in relation to antisocial personality disorder (APD) symptoms at age 21 in a longitudinal sample of public school kindergarteners. Their results showed that early family disadvantage predicted APD symptoms for males but not females. Yet, many studies examining SES in early and middle childhood show no differences between males

and females in longitudinal associations with early-starting and persistent CP, particularly before emerging adulthood (Fergusson & Horwood, 2002; Lahey et al., 2006; Tremblay et al., 2005). In sum, results show that SES is a risk factor for the development of aggression and many indicate that associations are similar in males and females. Thus, SES was expected to contribute to risk for early-starting and persistent aggression similarly for boys and girls in this study.

Parent-child coercion

The relationship between negative parenting practices characterized by harshness, rejection, inconsistency, aggression, and/or coercion during early childhood and the development of early-starting CP and aggression is well-established in the literature (Hoeve et al., 2009; Loeber & Stouthamer-Loeber, 1986; Patterson et al., 1989; Rothbaum & Weisz, 1994; Shaw et al., 2003; Stormshak, Bierman, McMahon, & Lengua, 2000). In fact, a central tenet of Patterson's (1989) developmental theory of early-starting CP is the presence of "coercive cycles," or parent-child exchanges that include child escalation followed by parental withdrawal, which serves to establish, reinforce, and maintain child problem behavior. Accordingly, positive correlations between parent coercive behavior and child CP and aggression during early and middle childhood have been found (Bor & Sanders, 2004; Dishion, Duncan, Eddy, Fagot, & et al., 1994; Johnson & O'Leary, 1987; Loeber & Stouthamer-Loeber, 1986; Webster-Stratton, 1996). Moreover, longitudinal relationships between coercive parent-child interactions during early childhood and CP or delinquency in later childhood (Kilgore, Snyder, & Lentz, 2000; McFadyen-Ketchum et al., 1996) and adolescence (Hoeve et al., 2009) have also been established. For example, in a representative sample of over 10,000 Canadian boys and girls, maternal reports of hostile/ineffective parenting during early childhood predicted membership in the high physical aggression trajectory from ages 2 to 11 (Browne, Odueyungbo, Thabane,

Byrne, & Smart, 2010; Côté et al., 2006). However, more work is needed as there are few U.S. samples that follow children longitudinally from *early* childhood and examine the association between early parent coercion and later aggression in both boys and girls.

A body of work suggests that boys and girls are parented differently, specifically with respect to the use of harshness, physical discipline, and coercion, with boys receiving higher levels of this type of parenting than girls (Keenan & Shaw, 1997; Lytton & Romney, 1991; McKee et al., 2007). Moreover, child effects on parents' use of discipline have also been demonstrated (Lytton, 1990; Sameroff, 1975), which based on boys' higher rates of CP and aggression, would also be expected to contribute to differential parenting between boys and girls. Yet, numerous studies fail to find consistent sex differences in parenting practices (Cowan, Cowan, & Kerig, 1993; Eddy, Leve, & Fagot, 2001; Parent et al., 2011). There is also much debate over whether boys are more *susceptible* to developing aggressive behavior from harsh and inconsistent parenting than girls (Browne et al., 2010; Deater-Deckard & Dodge, 1997; Hoeve et al., 2009; Keenan & Shaw, 1997; Kilgore et al., 2000; Rothbaum & Weisz, 1994). For example, in a sample of over 500 boys and girls, observed coercive parenting behaviors when children were in preschool predicted teacher-rated aggressive-disruptive behavior in kindergarten for boys and girls (McFadyen-Ketchum et al., 1996). However, early childhood coercive parenting was associated with high-increasing aggressive-disruptive behavior from kindergarten to third grade in boys only. In contrast, early childhood coercion predicted high-decreasing aggression over the same age period for females. Furthermore, in a meta-analysis by Hoeve and colleagues (2009), associations between aspects of parenting, such as inconsistent discipline and behavioral control, and delinquency did not differ for males and females. In sum, there is some evidence that boys are more susceptible to developing aggression in the context of coercive parenting than girls;

however, coercive parenting may also occur more frequently in boys than in girls. Based on the lack of consistent moderation by sex, it was expected that boys and girls with similar levels of coercive parenting would be equally likely to develop early-starting and persistent aggression.

Positive parenting

Elements of positive parenting such as warmth, sensitivity, responsivity, and proactively anticipating children's needs based on context during early childhood are associated with later social competence, academic success, and psychological adjustment (Baumrind, 1971). Positive parental behaviors have also been shown to buffer children from maladaptive outcomes in the context of risk (McKee et al., 2007; Patterson et al., 1989). Moreover, a lack of parental positive affect and behavior has been linked with socio-emotional and behavioral problems, including aggression (Mize & Pettit, 1997; Rubin & Burgess, 2002). Associations between early positive parenting dimensions and child CP are consistent with developmental theories of attachment (Bowlby, 1990; Lyons-Ruth; van Ijzendoorn, 1997) and social learning (Bandura, 2006; Miller & Prinz, 1990), which posit that parental sensitivity and warmth during infancy and toddlerhood help to model and establish emotional security (Cummings & Davies, 1996), emotional understanding (Laible & Thompson, 1998) and adaptive emotional and behavioral control (Lyons-Ruth, 1996; NICHD Early Child Care Research Network, 2004a). Thus, children of parents who employ positive parenting techniques are less likely to demonstrate elevated levels of CP and aggression (Londerville & Main, 1981; Miller & Eisenberg, 1988; van Ijzendoorn, 1997).

Empirical work has shown concurrent associations between positive parenting characteristics, such as warmth, responsivity, reinforcement, and proactive anticipation and aggression during toddlerhood (Brook, Zheng, Whiteman, & Brook, 2001; Rubin, Hastings,

Chen, Stewart, & McNichol, 1998), middle childhood (Rothbaum & Weisz, 1994; Stormshak et al., 2000), and adolescence (Eisenberg et al., 2005). Longitudinal research has also illustrated the importance of positive parenting, particularly during early childhood, for later socio-emotional competence (Stams, Juffer, & van Ijzendoorn, 2002) and low levels of aggression (Bugental, Corpuz, & Schwartz, 2012; Rubin & Burgess, 2002). For example, in the NICHD study, observations of maternal sensitivity during infancy and toddlerhood differentiated between children who showed consistently low levels of parent-reported aggression from ages 2 to 8 and all others, including the early-starting and persistent pattern (NICHD Early Child Care Research Network, 2004b). Moreover, intervention work has repeatedly demonstrated that increases in positive parenting strategies during toddlerhood and preschool are associated with subsequent decreases in child problem behavior (Dishion et al., 2008; Thomas & Zimmer-Gembeck, 2007).

As noted above, there is evidence that boys and girls are parented differently from early childhood (Cowan et al., 1993; Keenan & Shaw, 1997; Lytton & Romney, 1991). However, the majority of data specific to *positive dimensions* of parenting in toddlers and school-age children show no sex differences (Browne et al., 2010; Lytton & Romney, 1991; Mize & Pettit, 1997; Rubin et al., 1998), with some exceptions (e.g., Fagot, 1978; Schoppe-Sullivan et al., 2006). Many cross-sectional and longitudinal studies examining associations between positive parenting during early childhood and early-starting CP in boys and girls also do not find sex differences in the *relationship* (Browne et al., 2010; NICHD Early Child Care Research Network, 2004b; Rubin et al., 1998; Stormshak et al., 2000). However, other results are inconsistent. For example, in a longitudinal school sample described earlier, boys with teacher-rated high-increasing levels of aggression from kindergarten to third grade had mothers who showed less affection during a kindergarten interaction task than boys who exhibited high but decreasing aggression; this

association did not hold for girls (McFadyen-Ketchum et al., 1996). Similarly, in the NICHD sample, observations of maternal sensitivity from ages 2 to 9 were associated with higher levels of parent- and teacher-rated externalizing behaviors over the same age range for both boys and girls; however, the association was stronger in boys than in girls (Miner & Clarke-Stewart, 2008). Yet, in the same sample, observations of maternal sensitivity across child ages 6 to 54 months were associated with persistently high levels of teacher-rated physical aggression from ages 6 to 12 only for girls (Campbell et al., 2010). Thus, evidence suggests that boys and girls receive similar levels of positive parenting during early childhood, but it is unclear whether risk for aggression in the context of low positive parenting is the same for both sexes. As a result, it was expected that boys and girls in this study would be equally likely to develop early-starting aggression when they experience similar levels of positive parenting.

Maternal depression

Having a depressed mother during early and middle childhood, as well as adolescence, is associated with disturbances in multiple socio-emotional domains ranging from internalizing problems, such as depression, to externalizing problems, such as aggressive behavior (Connell & Goodman, 2002; Goodman et al., 2011). Theories regarding why children of depressed mothers show elevated rates of CP point to four broad, likely overlapping, mechanisms, including a genetic vulnerability to behavioral disorders, dysfunctional regulatory mechanisms, exposure to high levels of maternal negative emotionality, and living in a stressful home environment (Goodman & Gotlib, 1999; Radke-Yarrow, Nottelmann, Martinez, & Fox, 1992). Moreover, mothers of young children who are forming attachment bonds and rapidly developing internalized systems of emotional and behavioral regulation are likely more susceptible to the adverse effects of maternal depression than older children (Goodman & Gotlib, 1999; Radke-

Yarrow, Cummings, Leon, & Chapman, 1985; van Ijzendoorn, 1997). Consistent with theory, a recent meta-analysis demonstrated small-to-medium effect sizes between maternal depression and child CP in both clinical and non-clinical samples, with effect sizes and child age being inversely correlated (Goodman et al., 2011). A body of work has shown longitudinal associations between maternal depression during early childhood and early-starting persistent aggression (Kim-Cohen, Moffitt, Taylor, Pawlby, & Caspi, 2005; Munson et al., 2001; Radke-Yarrow et al., 1992; Shaw et al., 2003). For example, in a community sample of Canadian boys and girls, more mothers of children who demonstrated consistently high levels of mother-rated aggression from 17 to 42 months reported experiencing postpartum depression when their children were 3 months of age than mothers of children who showed either modest or low levels of aggression from 17 to 42 months (Tremblay et al., 2005).

Major depression is a relatively common occurrence, with a lifetime prevalence estimate of 17.1% for individuals between 15 and 54 years of age (Blazer & Kessler, 1994). Rates of depression in women are twice as high as in men, with point prevalence estimates showing that women of childbearing age, especially pregnant women and mothers of young children, are at elevated risk for depression (Bennett, Einarson, Taddio, Koren, & Einarson, 2004; Hobfoll, Ritter, Lavin, Hulsizer, & Cameron, 1995). Although there are little data to suggest differences in the prevalence of maternal depression by child sex, some research indicates that there are sex differences in the association between depression in mothers and child CP, albeit inconsistently, with some finding that boys (Hipwell, 2005) and some finding that girls are more vulnerable (Harachi et al., 2006; Keenan & Shaw, 1994). In contrast, meta-analyses fail to show consistent sex differences in maternal depression and risk for CP (Goodman et al., 2011). Thus, it was

expected that boys and girls would have similar rates of mothers with depression and that maternal depression would be associated with early-starting aggression in both sexes.

1.1.5.3 Cumulative risk

Numerous child and contextual characteristics assessed during toddlerhood have been found to be associated with early-starting and persistent aggression. However, it is well-known that many of these risk factors co-occur, particularly in low-income populations (Campbell et al., 2000; Shaw et al., 2000). It has been repeatedly demonstrated that the accumulation of multiple risk factors are more reliable predictors of early-starting problem behavior than any one risk factor in isolation (Ackerman, Izard, Schoff, Youngstrom, & Kogos, 1999; Rutter, 1979; Sameroff, Gutman, & Peck, 2003). Researchers have attempted to capture the effect of multiple risks occurring simultaneously through cumulative risk models, in which risk factors are dichotomized as present or absent based on predetermined criteria and then summed. Such models frequently demonstrate a linear relationship between number of risk factors present during early childhood and later CP (Appleyard, Egeland, van Dulmen, & Alan Sroufe, 2005; Deater-Deckard et al., 1998; Sameroff et al., 2003; Trentacosta et al., 2008).

Although most work in the cumulative risk literature does not differentiate between child- and contextual-level risk (*cf.* Deater-Deckard et al., 1998), separate risk domains may be particularly important in the study of sex differences. Two prominent theories explaining sex differences in base rates of aggression posit that males have more risk factors than females (Eme, 2007; Lahey & Waldman, 2003) and/or males have a lower threshold for developing aggression in the context of risk (Moffitt et al., 2001). While findings frequently show that males possess more child-level risk factors than females, support for sex differences in contextual risk and for an increased male susceptibility to either type of risk is inconsistent. Thus, it would be important

to distinguish between child and contextual-level cumulative risk when examining sex differences in both base rates and associations with aggression. Examining separate cumulative risk domains enables the analysis of whether risk in each domain is similarly associated with risk for aggression in males and females. In sum, it was expected that cumulative child risk and cumulative contextual risk would similarly predict early-starting and persistent aggression for males and females, but that males will have higher levels of cumulative child risk.

1.1.6 Early-starting CP and middle childhood impairment

As noted above, current evidence suggests that patterns of early-starting and persistent aggression are at least as meaningful in terms of predictive utility for males and females (Fontaine et al., 2008; Odgers et al., 2008). In fact, there is some evidence to suggest that early-starting females are more broadly impaired during middle childhood than early-starting males (Campbell et al., 2010; Keenan, Loeber, & Green, 1999; Robins, 1986). For example, some studies have shown that during childhood and adolescence, conduct disordered females are at increased risk of multiple comorbidities relative to conduct disordered males, including ADHD, anxiety, and substance use (Loeber & Keenan, 1994; Robins, 1986). Moreover, gender paradox theory (Eme, 1992) predicts that because females with early-starting aggression exhibit these behaviors *in spite of* lower biological and social risks (Keenan & Shaw, 1997), girls who show early-starting aggression are at increased risk for maladaptive outcomes relative to boys. In addition, as verbal and physical aggression is often viewed as gender atypical for females (Maccoby, 2004), social consequences (e.g., rejection) may be especially severe during middle childhood for girls, a developmental stage when gender-typed behavior is particularly salient (Maccoby, 2002). Crick (1997) showed in a community sample of school-age children that a

small group of overtly aggressive girls demonstrated higher levels of self-reported internalizing and externalizing problems than overtly aggressive, relationally aggressive, and non-aggressive boys and girls. Accordingly, girls who show early-starting and persistent patterns of aggression would be expected to demonstrate impairment in a broader range of middle childhood domains (e.g., internalizing problems and social competence) than early-starting males.

A number of studies have examined developmental consequences of elevated levels of CP in both males and females from early to middle childhood in community samples. These studies have consistently shown CP to be associated with a range of maladaptive outcomes in later childhood and adolescence for both boys and girls, including continued engagement in disruptive behavior, peer rejection, substance use, internalizing problems, and academic failure (Aguilar et al., 2000; Barker et al., 2010; Lahey et al., 2006; Lipman, Bennett, Racine, Mazumdar, & Offord, 1998). However, research also indicates that a history of early-starting CP is more strongly associated with impairments in the externalizing domain (e.g., Conduct Disorder diagnosis, court petitions) for males than females (Lipman et al., 1998; McGee, Feehan, Williams, & Anderson, 1992; Piquero & Chung, 2001), while internalizing comorbidities and deficits in social functioning may be more characteristic of early-starting females (Loeber & Keenan, 1994; Miller-Johnson et al., 2002). For example, in one report from the NICHD community sample, Campbell and colleagues (2010) found that at age 12 females who showed early-starting and persistent aggression from ages 6 to 12 were as impaired relative to the low aggression group in the same domains as their male counterparts (i.e., conflict, school performance, risk behavior), but early-starting females were also impaired on measures of relationship quality with friends and parents compared to low aggression females. Thus, females exhibited impairment in a broader range of domains than males. Similarly, in the Fast Track

sample of children recruited to be at high risk for the development of CP, first grade girls rated by peers as aggressive scored significantly lower on a concurrent multi-informant measure of social competence than girls rated as nonaggressive; there was no difference in ratings of social competence for aggressive and nonaggressive males. Yet, other studies show that the sexes are comparably impaired (Bradshaw, Schaeffer, Petras, & Ialongo, 2010; Harachi et al., 2006; Schaeffer et al., 2006). One possible explanation for the discrepant findings may be that few studies examine the broad range of domains likely to capture deficits that are characteristic of early-starting and persistent aggression in both sexes. Moreover, no study could be identified that examines the consequences of early-starting and persistent aggression from early to middle childhood in a high-risk sample of males and females.

1.2 STATEMENT OF PURPOSE

Sex differences in base rates of aggression and serious antisocial behavior are well-established, with males showing higher levels from preschool-age through adulthood (Keenan & Shaw, 1997). In combination with other risk factors, male sex is one of the most consistent and robust predictors of elevated aggression throughout the lifespan (Rutter et al., 2003). As a result, much effort has been dedicated to understanding the etiology of aggression in males (Loeber et al., 2005; Tremblay, 2000). However, research investigating the etiology of *sex differences* in base rates of aggression has the potential to inform basic science and prevention. A growing body of work has produced relatively consistent results showing that boys possess a greater number of child-level risk factors for aggression beginning in early childhood; however, findings are less consistent with respect to whether boys are also more susceptible than girls to

developing aggressive behavior in the context of similar levels of risk. Few studies have the opportunity to investigate whether base rate risk differences, differential susceptibility to risk, or both underlie sex differences in the prevalence of early-starting aggression, particularly in a sample of both boys and girls who show clinically significant levels of behavior problems followed from early childhood. Similarly, few studies have been able to examine outcomes associated with early-starting and persistent aggression in both males and females.

The current study aimed to advance our understanding of associations between early childhood risk and the development of aggressive behavior, as well as the middle childhood consequences of early-starting aggression, in a sample of 731 boys and girls recruited at age 2 for being at high risk of developing CP. Children have been followed longitudinally to age 10.5 utilizing multiple data collection techniques including caregiver-report, home observation, structured assessment, and teacher-report. This study investigated patterns of aggression development from child ages 2 to 9.5, including how patterns and levels of trajectories differed when boys and girls were estimated together versus separately. We also examined whether early childhood risk factors differentiated early-starting and persistent aggression from low aggression groups similarly for boys and girls. Finally, age 10.5 outcomes associated with early-starting and persistent aggression in boys and girls were examined.

1.3 HYPOTHESES

The following hypotheses were tested:

1.3.1 Hypothesis 1: Developmental trajectories of aggression in males and females

Based on previous literature and theory (Broidy et al., 2003; Lahey et al., 2006), it was expected that males and females would exhibit similar patterns of developmental trajectories of aggression from ages 2 to 9.5; however, more males than females were expected to fall on the early-starting persistent aggression trajectory when both sexes were analyzed conjointly. Relatedly, more females than males were expected in the persistent low trajectory. In addition, it was expected that different developmental patterns of aggression would be found when estimating separate trajectories for males and females. Moreover, when estimated separately the mean level of aggression for females showing early-starting persistent aggression was expected to be lower than the analogous mean for persistently high males, but still higher than *all other male and female* groups.

1.3.2 Hypothesis 2: Early childhood risk for early-starting aggression in males and females

Based on literature showing associations between child (e.g., language, inhibitory control) and contextual (e.g., parenting, SES) factors and early-starting and persistent aggression for males and females (Campbell et al., 2010; Lahey et al., 2006; Odgers et al., 2008), it was expected that the magnitude of associations between risk factors and trajectory group membership would be similar for males and females for both child and contextual factors; however, males were expected to exhibit a greater number of child risk factors (e.g., more fearlessness, lower inhibitory control, higher cumulative child risk) during early childhood than females.

1.3.3 Hypothesis 3: Middle childhood outcomes associated with early-starting aggression

Based on work showing the predictive utility of early-starting and persistent aggression for later functioning in males and females (Bradshaw et al., 2010; Campbell et al., 2010; Harachi et al., 2006), it was expected that within-sex comparisons would show that both sexes on early-starting persistent aggression trajectories would be more likely than all other groups to meet criteria for disruptive behavior disorders and internalizing disorders, as well as show deficits in social skills in middle childhood. Also, based on theory and evidence that females with externalizing behaviors are more susceptible to comorbidities (Loeber & Keenan, 1994), particularly internalizing disorders, it was expected that girls with an early-starting and persistent trajectory of aggression would more likely meet criteria for an internalizing diagnosis at age 10.5 and show more social skill deficits than males with a high and persistent trajectory of aggression.

2.0 METHOD

2.1 PARTICIPANTS

Participants included 731 children and primary caregivers recruited between 2002 and 2003 from Women, Infants, and Children Nutrition Programs (WIC) in the metropolitan areas of Pittsburgh, PA, and Eugene, OR, and in and outside the town of Charlottesville, VA. Primary caregivers were contacted at WIC sites and invited to participate if they had a son or daughter between age 2 years 0 months and 2 years 11 months, following a screen to ensure that they met the study criteria by having socioeconomic, family, and/or child risk factors for future behavior problems (Dishion et al., 2008). Recruitment risk criteria were defined as one standard deviation above normative averages on screening measures in at least two of the following three domains: (1) child behavior problems (conduct problems or high-conflict relationships with adults), (2) primary caregiver problems (maternal depression, daily parenting challenges, self-report of substance or mental health diagnosis, or adolescent parent at birth of first child), and (3) sociodemographic risk (low education achievement – less than or equal to a mean of 2 years of post-high-school education between parents and low family income using WIC criterion; Trentacosta et al., 2008). In the case of children not qualifying on the criterion of child CP, participants were required to have at least above-average scores to increase parent motivation to reduce child problem behavior.

Of the 1,666 primary caregivers who had children in the appropriate age range and who were contacted at WIC sites across the three study sites, 879 met the eligibility requirements (52% in Pittsburgh, 57% in Eugene, and 49% in Charlottesville) and 731 (83.2%) agreed to participate (88% in Pittsburgh, 84% in Eugene, and 76% in Charlottesville). The children in the sample had a mean age of 29.9 months (*SD* = 3.2) at the time of the age 2 assessment. Of the 731 (49% female), 272 (37%) were recruited in Pittsburgh, 271 (37%) in Eugene, and 188 (26%) in Charlottesville. Across sites, primary caregivers self-identified as belonging to the following ethnic groups at the study outset: 28% African American, 50% European American, 13% biracial, and 9% other groups (e.g., American Indian, Native Hawaiian). Thirteen percent of the sample reported being Hispanic American. During the 2002-2003 screening period, more than two thirds of those families enrolled in the project had an annual income of less than $20,000, and the average number of family members per household was 4.5 (*SD* = 1.63). Forty-one percent of the sample had a high school diploma or general education diploma (GED), and an additional 32% had 1 to 2 years of post-high school training.

Of the 731 primary caregiver-child dyads who initially participated, 659 (90%) were available at the age-3 follow-up, 619 (85%) participated at the age-4 follow-up, 621 (85%) participated at the age-5 follow-up, 578 (79%) participated at the age 7.5 follow-up, 571 (78%) participated at the age 8.5 follow-up, 587 (80%) participated at the age 9.5 follow-up, and 574 (78.5%) participated at the age 10.5 follow-up. Selective attrition analyses comparing age-2 study variables for participants retained versus attrited at ages 3, 4, 5, 7.5, 8.5, 9.5, and 10.5 have revealed no significant differences with respect to project site, children's race, ethnicity, income, or gender, children's conduct problems, or intervention status. However, primary caregivers who

participated at the age 7.5, 8.5, 9.5, and 10.5 visit reported having a higher education level at age 2 than primary caregivers who did not participate at these ages.

2.2 PROCEDURE

At child ages 2, 3, 4, 5, 7.5, 8.5, 9.5, and 10.5, the target child (TC), primary caregiver (PC), and when available, the alternate caregiver (AC) participated in 2-3 hour assessments at the family's home. These assessments consisted of self-report measures, observational interaction tasks, child testing sessions, and teacher reports. This study used a subset of the collected data, which are described below. PCs who participated in the age 2, 3, 4, 5, 7.5, 8.5, 9.5, and 10.5, assessments were reimbursed $100, $120, $140, $160, $180, $90, $200, and $150, respectively. At each wave, a minimum of 97% of PCs were parents of the TC; therefore, the terms PC and parent are used interchangeably throughout this document.

2.2.1 Assessment protocol

Age 2 assessments began by having an adult stranger (i.e., undergraduate videographer) approach the child, introduce him/her to an assortment of age-appropriate toys, and then allow him/her to play for 15 min. while the PCs completed questionnaires. After the free play (15 min.), each PC and child participated in a cleanup task (5 min.), followed by a delay of gratification task (5 min.), four teaching tasks (3 min. each, with the last task being completed by alternate caregiver and child), a second free play (4 min.), a second cleanup task (4 min.), the presentation of two inhibition-inducing toys (2 min. each), and a meal preparation and lunch task

(20 min.). Similar procedures were used to assess child behavior and parent-child interaction at later ages, with minor modifications made to adjust for the developmental status of the child (e.g., wait task lasting 5 vs. 3 minutes at age 5).

2.2.2 Intervention protocol: The Family Check-Up (FCU)

The FCU is a brief, typically three-session, intervention based on motivational interviewing techniques (also see Dishion et al., 2008). In contrast to the standard clinical model, the FCU uses a health maintenance approach, which explicitly promotes periodic contact with families (yearly at a minimum). Whereas traditional clinical models are activated in response to clinical pathology, the health maintenance model involves regular periodic contact between client and provider to proactively prevent problems (analogous to the use of semiannual cleanings in dentistry).

Following the initial assessment at age 2, the PC and the target child were randomly assigned to the intervention condition (n = 367, 50.2%). Parents assigned to the FCU were scheduled to meet with a parent consultant for two or more sessions, depending on the family's preference. Parents could also identify an alternate caregiver that helps care for the target child to participate in both the assessment and the FCU. The three meetings in which the primary caregiver and/or alternate caregiver were typically involved include an assessment meeting, an initial contact meeting, and a feedback session (Dishion & Kavanagh, 2003). For research purposes, the sequence of contacts at age 2 was assessment, randomization, initial interview, and feedback session, with the option for follow-up treatment sessions. Families assigned to the FCU received a $25 gift certificate for completing the feedback session.

After the first meeting, (the assessment described above), the second visit called the "get to know you" (GTKY) meeting consisted of the parent consultant meeting with the caregiver(s) and discussing their concerns with a focus on current family issues that were most critical to their child's and family's functioning. For the third meeting, the feedback session, parent consultants utilized motivational interviewing to summarize the results of the assessment and highlight areas of strength and areas in need of attention. The caregiver was given the choice to participate in additional follow-up sessions that were focused on parenting practices as well as other family management and contextual issues (e.g., co-parenting, child care resources, or housing). Parent consultants were also able to recommend community service organizations that may be of assistance to the family. Caregivers in the intervention group were offered the FCU after each year's assessment at child ages 2, 3, 4, 5, 7.5, 8.5, and 9.5. For the current study, treatment group assignment (intervention = 1) will be used as a covariate in all analyses to account for potential influence of group status. However, no hypothesis is put forth because of lack of theory to suggest that males or females would be more or less responsive to intervention.

2.3 MEASURES

2.3.1 ADHD behaviors (age 2)

The CBCL (Achenbach & Rescorla, 2000) for ages 1 ½-5 is a 99-item questionnaire that assesses behavioral problems in children. PCs completed the CBCL at the age 2 visit. The CBCL asks parents to rate the validity of several statements about child behaviors on a 3-point Likert scale in which 0 = *not true*, 1 = *somewhat, sometimes true,* and 2 = *very true, often true* and

produces two broad-band factors, internalizing and externalizing. Items from the CBCL were combined with items from the Eyberg Child Behavior Inventory (ECBI) to create a scale of inattention and hyperactivity-impulsivity.

The ECBI is a 36-item parent-report behavior checklist also administered at the age 2 assessment (Robinson, Eyberg, & Ross, 1980). The ECBI assesses conduct problems in children between 2 and 16 years of age via two factors, one that focuses on the perceived intensity of behavior and another on the degree the behavior is a problem for caregivers. As the intensity factor is similar in structure and complementary in content to the CBCL externalizing factor, items from this were used to supplement items from the CBCL in creating DSM-based scales of inattention and hyperactivity-impulsivity. To do so, ECBI items were rescaled from a 7-point Likert scale to match the 3-point scale of the CBCL. Scores were recoded so that values reflecting conceptually similar behavior frequencies were equated (i.e., 1, or "Never," on the ECBI was equal to 0, or "Not True," on the CBCL; 2-4, or "Sometimes," on the ECBI was equal to 1, or "Somewhat or Sometimes True," on the CBCL; and 5-7, or "Always," on the ECBI was equal to 2, or "Very True or Often True," on the CBCL). Individual items from the CBCL were then averaged with rescaled items from the ECBI and matched with DSM-IV criteria for ADHD-Inattentive and ADHD-Hyperactive-Impulsive to create a scale of ADHD behaviors (6 CBCL items; 6 ECBI items) at age 2. Internal consistency for the ADHD scale at age 2 was .76.

2.3.2 Fearlessness (age 2)

Children's behavior during the standardized Stranger Task derived from the LABTAB temperament procedures (Goldsmith & Rothbart, 1999) and reactions during an introduction to a novel toy at 27 months were coded to provide an index of fearlessness. The stranger approach

was designed to measure children's responses to unfamiliar social encounters and was conducted when the interviewer first arrived at the families' home, so that the interviewer would be a stranger to the child. In the novel toy task a remote controlled robot was manipulated to approach the child while making movements and noises. For each task, child behaviors were coded in 30-second intervals on a four-point scale from *(1) fearless/explorative* to *(4) fearful/not explorative* (Kochanska, 1991). For the stranger approach task, seven categories were used to describe the behaviors: (a) the child's proximity to caregivers; (b) the child's proximity to the stranger (c) the child's inhibition to the stranger (the degree to which the child acted uncomfortably with the stranger and retreated from the stranger); (d) the child's inhibition to exploration; (e) the child's active exploration; (f) the global impression of the child's fearlessness with objects (i.e., the coder's overall impression of the child's fearlessness toward the toys); and (g) the coder's global impression of the child's inhibition/approach toward the toys. For the novel toy task, the same categories as the stranger task, except for child's proximity to the stranger, were used. All thirteen categories were aggregated to construct the child's fearlessness score ($\alpha = .88$) at age 2, with lower scores indicating higher levels of fearlessness.

2.3.3 Inhibitory control (age 2)

The 13-item inhibitory control subscale of the Child Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001) was used to assess behavioral self-regulation at child age 2. This subscale includes items such as, "Has difficulty waiting in line for something," and "Can easily stop an activity when s/he is told 'no.'" Parents responded to each item on a 7-point scale, ranging from 1 (*extremely untrue of child*) to 7 (*extremely true of child*). Scores were computed by averaging numeric responses. Parents could also indicate whether any items were

not applicable to their child, and these items were treated as missing. Scale scores were not computed if data were missing for three or more items. The scale demonstrated adequate internal consistency at age 2 with Cronbach's alpha=.63.

2.3.4 Language ability (age 2)

The MacArthur Communicative Development Inventory-Short Form (MCDI; Fenson et al., 2000) is a widely used parent-report checklist of children's vocabulary. Parents completed this measure about their children at the age two assessment, using the version of the MCDI designed for children between the ages of 24 and 29 months. The MCDI has demonstrated good validity and reliability and has been shown to be significantly correlated with other forms of language assessment (Fenson et al., 2000). In the current study, the total number of words produced on the age 2 MCDI was used in conjunction with age 3 Fluharty-2 scores (see below) to increase reliability of language measurement.

The Fluharty-2 (Fluharty, 2001) is a brief examiner-administered screening tool used to assess children between the ages of 2 and 6 who may be at risk for language difficulties. The measure produces three composite scores: Receptive Language, Expressive Language, and a General Language Quotient (GLQ). For purposes of this study, the GLQ from the Fluharty-2 at age 3 was standardized and composited with parent report of the total words spoken by the target child on the MCDI at age 2 to produce a composite measure of language ability. The correlation between age 2 MCDI scores and the age 3 GLQ was significant (r = .46, p < .01), thus supporting the use of a composite. The composited scale demonstrated adequate reliability between ages 2 and 3 with Cronbach's alpha = .63.

2.3.5 Parent-child coercion (age 2)

The videotaped interaction tasks involving the child and the PC were coded using the Relationship Affect Coding System (RACS; Peterson, Winter, Jabson, & Dishion, 2008; Smith et al., in press). The RACS coding system is a dynamic systems measurement method consisting of three continuous streams of parallel behavior: verbal, physical, and affect. Verbal codes are comprised of positive, neutral, and negative talk and include verbal behavior change codes, such as positive structuring, neutral, and negative directives. Physical behaviors (e.g., handing each other objects, hugging) are coded as positive, neutral, and negative. Affect codes include anger/disgust, distress, ignoring, validation, and positive affect. The "off" codes of no talk, no physical, and neutral affect are used when the other codes in the verbal, physical behavior, or affect streams are not observed. The RACS coding was recorded using Noldus Observer XT, Version 11.0 (Noldus Information Technology, 2012) which allows for continuous coding of an interaction of child and caregivers simultaneously. Using this approach, it is possible to calculate durations and frequencies of behavior clusters for each family member and the interaction dynamic between family members.

The complexity of three parallel behavior streams for two people necessitated further manipulation of the data streams. First, the verbal, physical, and affect streams were combined to create six behavior clusters, positive engagement (POS), neutral engage (NEU), no talk (NTK), directives (DIR), negative engagement (NEG) and ignore (IGN) that comprise a state-space grid with one person on each axis (Caregiver on y-axis and Child on x-axis in Figure 1). This was accomplished by forming a set of priority rules from the three parallel streams. For instance, if the parent smiled and at the same time was observed to be saying something negative to the child, the negative verbal code trumped the smile, a positive affect code, and the parent's

behavior was classified within the negative engagement cluster, which is labeled as NEG in Figure 1. The end result allows us to analyze and identify dyadic interaction patterns that can be graphed on a state space grid (Hollenstein, 2007; Lewis, 2000). State space grids have previously been adapted for the study of parent-child interactions and their relationship with child psychopathology (e.g., Granic, Hollenstein, Dishion, & Patterson, 2003).

We then identified dyadic regions of the grid representing distinct and meaningful behavior patterns. In this study, parent-child coercion (i.e., mutually coercive behaviors between the parent and the child) was defined as either parent or child being negatively engaged (NEG) or directive (DIR), and the other member of the dyad responding by not talking (NTK), ignoring (IGN), NEG, or DIR. This region is thus comprised of 12 cells from the 36 total possible cells of the complete matrix, represented by the black outlined area in Figure 1.We then calculated the total duration each parent-child dyad was observed in this region and divided that time by the overall session time to get a duration proportion score. Reliability coefficients were in the "good" to "excellent" range with overall Kappa scores of .93, and percent agreement of 93 at age 2. The Kappas are computed based on the duration and sequencing of coded behavior.

2.3.6 Parent-child engagement (age 2)

The second factor generated from state space grids and using the affect coding system (RACS) is parent-child engagement, which was calculated as the duration of time either the parent or child spends being positively engaged (POS) and the other member of the dyad spends being positive or neutral (NEU) divided by overall session time to calculate a duration proportion score. Reliability coefficients were in the "good" to "excellent" range with overall Kappa scores of .93, and percent agreement of 93 at age 2.

2.3.7 Parent depression (age 2)

The Center for Epidemiological Studies on Depression Scale (CES-D; Radloff, 1977) was used to assess parent depression. The CES-D, which consists of 20 items, is a well-established and widely used measure of depressive symptoms. This measure uses a 0 (*less than 1 day*) to 3 (*5–7 days*) Likert scale to assess the frequency of experiencing depressive symptoms during the past week. An overall depressive symptoms score was created using the sum of the items. Scores greater than 16 are considered indicative of clinical depression. At the age 2 assessment, internal consistency was .76.

2.3.8 Socioeconomic status (age 2)

A demographics questionnaire was administered to parents during the age 2, 3, 4, 5, 7.5, 8.5, 9.5, and 10.5 visits. This measure included questions about family structure, parental education and income, and areas of family stress. For this study, years of parent education and family income at age 2 were used to measure socioeconomic status.

2.3.9 Cumulative child and contextual risk

To differentiate between cumulative child-level and contextual-level risk, two composites were computed. For cumulative child risk, age 2 ADHD behaviors, age 2 fearlessness, age 2 inhibitory control, and age 2-3 language ability will be dichotomized (0 or 1) so that the most at-risk quartile of the sample (top or bottom 25%, depending on the scale; see Table 1) were assigned a value of 1. A one quartile cutoff point was chosen in lieu of the 1

standard deviation convention to accurately reflect the higher-risk status of children in the current sample relative to scores found in samples on which these measures were normed. For cumulative contextual risk, for age 2 parent-child coercion and engagement, the quartile procedure was also used; however, for parent depression, scores greater than 16 received a 1 and scores less than 15 a 0 based on previous criterion for clinically significant levels established by the authors of the CES-D (Radloff, 1977). For SES, parents who reported having less than a high school education were assigned a 1 while all others were assigned a 0 (for a summary, see Table 1). The summed scores were used to measure cumulative child and cumulative contextual risk.

2.3.10 Child aggressive behavior (ages 2-9.5)

A measure of child aggressive behavior was created using items from the CBCL for ages 1.5-5 and ages 6-18 (CBCL; Achenbach & Rescorla, 2001). When children were 5 years of age, the school-age forms (i.e., 6-18) were used in place of the preschool-age forms (i.e., 1.5-5), which were used at child ages 2, 3, and 4. Thus, a version of the CBCL was administered to PCs at child ages 2, 3, 4, 5, 7.5, 8.5, and 9.5. To generate a factor of aggressive behavior that was both developmentally meaningful across age 2 through 9.5 and clinically relevant, individual items from the CBCL were chosen that mapped onto DSM-IV criteria for the aggressive items from the Conduct Disorder diagnosis. A composite variable was then computed by averaging the values for these items at each assessment age. Only 5 aggressive items that were continuously present on the CBCL across ages 2 through 9.5 were used. Behaviors in this scale were: is cruel to animals, destroys own things, destroys others' things, gets in many fights, and physically attacks people. Alpha reliabilities for the aggression scale were acceptable at all ages (.68 at age 2, .69 at age 3, .72 at age 4, .71 at age 5, .74 at age 7.5, .69 at age 8.5, and .72 at age 9.5).

2.3.11 Child internalizing disorder (age 10.5)

The Computerized Diagnostic Interview Schedule for Children (DISC; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000) is a structured diagnostic interview for children between 9 and 17 years of age. The DISC was administered to TCs and parents reporting on the TC's symptoms at the age 10.5 home visits. The DISC produces a report that includes both symptom counts and diagnostic information. Children were assessed for the following diagnoses at age 10.5: Generalized Anxiety Disorder, Panic Disorder, Separation Anxiety, Social Phobia, Specific Phobia, Obsessive-Compulsive Disorder, Post-Traumatic Stress Disorder (parent-report only), Major Depressive Disorder, Bipolar Disorder, and Dysthymia. For the purposes of this study, diagnoses were collapsed within mood and anxiety disorder categories and considered present if a child was diagnosed by *either* child or parent report. Symptom counts were also examined.

2.3.12 Child disruptive behavior disorder (age 10.5)

The Disruptive Behavior Disorder (DBD; Pelham, Gnagy, Greenslade, & Milich, 1992) rating scale is a 45-item inventory of DSM-IV symptoms of Oppositional Defiant Disorder, Conduct Disorder, and Attention-Deficit/Hyperactivity Disorder. The scale requires parents to assess how well each phrase describes their child on a 4-point scale from 0 = *not at all* to 3 = *very much*. Parents completed the DBD scale at child age 10.5. Diagnostic cut-off scores and continuous symptom counts were examined.

2.3.13 Social functioning (age 9.5)

Child social skills were assessed via the Social Skills Rating System (SSRS; Gresham & Elliot, 1990), a 38-item survey administered to teachers. This scale has been widely used and demonstrates high reliability and validity. Two continuous scales from teacher reports on characteristics of child-peer and child-teacher relationships to were used in this study: cooperation ($\alpha = .89$) and self-control ($\alpha = .90$).

The target child's social functioning with peers was assessed using a modified version of the Preschool Social Behavior Scale (PSBS) Six items from the PSBS (Crick, Casas, & Mosher, 1997) that were determined to be developmentally appropriate for school-age children were used to assess relational aggression, including items such as, "This child tries to get others to dislike a peer," rated on an 5-point scale. This measure has been previously adapted for use with elementary school children (Brown, Arnold, Dobbs, & Doctoroff, 2007). A sum score of relational aggression ($\alpha = .95$) was used as an indicator of the TC's social functioning in school.

Another measure used in this study, Peer Affiliation and Social Acceptance (PASA), was developed to assess peer relationships and affiliation patterns in childhood and adolescence, and has been validated with respect to peer nominations of relationships and a peer assessment of deviant peer affiliation in early adolescence (Dishion, Kim, Stormshak, & O'Neill, 2014). For this study, one item rating peer rejection ("Peers dislike and reject TC.") and one item rating peer acceptance ("This child is well-liked by peers of the same sex.") were used as child outcome indicators of peer relationship functioning in school.

An abridged 15-item version of the Student-Teacher Relationship Scale (STRS; Pianta, 2001) was administered to teachers to assess the quality of relationships they have with target children. Items are derived from attachment theory and have been widely-used to capture

child-teacher relationship quality (e.g., Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002). Items were used to create a subscale score of teacher-student conflict ($\alpha = .91$).

2.4 ANALYTIC PLAN

The first aim of this project's analyses was to identify developmental trajectories of aggressive behavior from ages 2 to 9.5 using latent class growth analysis (LCGA) (Nagin & Tremblay, 2005). The LCGA is a finite mixture (i.e., latent class model) that constrains the within class variances to 0. Thus, this approach is designed to identify clusters of individuals who share common developmental pathways, which may be particularly relevant for examining aggression because it addresses such issues as course, timing, and severity of behaviors. Previous work using LCGA has been helpful in identifying groups relatively homogenous with respect to developmental course, precursors, and outcomes (e.g., Broidy et al., 2003; Shaw et al., 2012). LCGA is designed to efficiently handle data that are missing at random; when data are missing, the equations are adapted to accommodate missing observations and the sample size count is adjusted so as not to include missing observations (Nagin & Tremblay, 2005). As a result, LCGA is useful for longitudinal data analysis, allowing the researcher to retain individuals with incomplete assessment histories. Using finite mixtures of suitably defined probability distributions, the LCGA approach is intended to provide an easily applied method for identifying distinctive clusters of individual trajectories within the population. Thus, whereas the hierarchical and latent growth curves methodology models *population* variability in growth with multivariate continuous distribution functions, LCGA utilizes a multinomial modeling strategy that has the strength of being able to identify trajectories of sub-groups of *individuals* over time.

A polynomial function is used to model the relationship between an attribute (e.g., aggressive behavior) and age or time (Nagin & Tremblay, 1999; Nagin & Tremblay, 2005). Model parameters are estimated via maximum likelihood with robust standard errors (MLR), an iterative approach that identifies parameters most likely to have given rise to the observed data and is suitable for handling non-normally distributed data (e.g., aggressive behavior). The model also generates posterior probabilities, which estimates each individual's probability of belonging to each of the trajectory groups. Individuals are assigned to the group with the largest posterior probability estimate. High within group posterior probabilities indicate close fit between predicted and actual group proportions. In this study, the optimal model was identified based on the following criteria: maximized Bayesian Information Criteria (BIC), maximized average posterior probabilities, significant log-likelihood ratio tests, and model entropy approaching 1.0. However, a priori theory about aggression development and potential explanatory value of additional trajectories were also considered when choosing an optimal model.

3.0 RESULTS

3.1 HYPOTHESIS 1: DEVELOPMENTAL TRAJECTORIES OF AGGRESSION IN MALES AND FEMALES

To examine the hypothesis that when analyzed conjointly males and females would exhibit similar developmental trajectories of aggression from ages 2 to 9.5, albeit differ in the proportions of males and females showing each pattern, a known-class LCGA procedure (described above) with sex specified as the known-class was used. Based on model fit criteria including the magnitude of the decrease in BIC from 3 to 4 groups, entropy, and maximized posterior probabilities for both sexes (see Table 2), a 4-group solution was identified as the best-fitting known-class model. Using group assignment as determined by posterior probabilities, the four aggression classes identified were high (female n = 25; male n = 49), increasing (female n = 33, male n = 38), decreasing (female n =72, male n =83), and low (female n = 232, male n = 199). As expected, a chi-square test showed sex differences in the distribution of males and females across trajectory groups (χ^2 (3) = 11.38, $p < .05$), with a larger proportion of females than males in the low group and the opposite pattern in the persistently high group. Mean levels of aggression from ages 2 to 9.5 are presented in Table 3. A two-way analysis of variance (ANOVA; factor 1 = class membership, factor 2 = sex) with contrasts was conducted to examine mean group differences in levels of aggression for males and females. Results demonstrated a

main effect of class membership (F (3, 644) = 882.22, p < .001), indicating mean within-sex differences between classes. For both sexes, the mean level of aggression in the persistently high group was greater than the increasing/decreasing groups which, in turn, were greater than the low group (all ps < .001; see Table 3). Neither the main effect of sex (F (1, 644) = 1.30, p = .26) nor the sex by class interactions (F (3, 644) = 2.07, p = .10) were significant. Thus, corresponding male and female group means did not differ from one another nor did the pattern of between group means for males and females.

Next, to examine whether similar *numbers* and *types* of aggression trajectories to those identified in the known-class framework would be found when estimating patterns for males and females separately, the same LCGA procedure described above was repeated for each sex individually. In separate sex models, the 4-group solution was again selected as the best-fitting model for females based on a significant Lo-Mendell Rubin likelihood ratio test (LM-LRT) and bootstrap likelihood ratio test (BLRT), as well as the magnitude of the decrease in BIC from 3 to 4 classes (see Table 4). Similarly, for males, the 4-group solution was selected based on a significant BLRT, the magnitude of the decrease in BIC, and an increase in entropy from 3 to 4 classes (see Table 5). The course of aggression and sex distribution associated with each trajectory was identified. For both males and females, the 4 classes identified based on posterior probabilities were high (female n =26; male n = 48), increasing (female n = 32, male n = 37), decreasing (female n =72, male n =86), and low (female n = 232, male n = 198). Males and females in analogous classes were assigned the same numeric group value for subsequent analyses (e.g., 1 = high, 2= increasing). Similar to known-class models, chi-square tests indicated statistically significant distributions of males and females across aggression classes (χ^2 (3)) = 10.766, p <.05), with a greater proportion of males showing persistently high aggression and a

greater proportion of females showing persistently low aggression. Mean levels of aggression from ages 2 to 9.5 for each class are presented in Table 6. A two-way ANOVA (factor 1 = class membership, factor 2 = sex) was used to examine the hypothesis that the mean level of aggression for females on the high trajectory would be lower than the mean for persistently high males, but still higher than all other male and female groups. However, as with known-class models, two-way ANOVAs (with contrasts) indicated only a main effect of class on mean aggression levels (F (3,644) = 870.34, $p < .001$). For both sexes, the mean level of aggression in the high persistent group was greater than the decreasing/increasing groups, which were greater than the low group mean (all ps < .001). There was no main effect of sex (F(1,644) = 2.28, *ns*) or sex by class interaction (F(1,644) = 1.7, *ns*).

To evaluate the hypothesis that separate-sex models would provide a clearer picture of male and female aggression development than known-class (combined-sex) models, model fit criteria including log-likelihood ratios, model entropy, average posterior probabilities, and group size for the optimal separate-sex and known-class models were compared (see Table 7). Further, equality constraints were added to homologous classes in the known-class model to determine whether growth parameters were equal across sexes. Contrary to expectations, based on model entropy and average posterior probabilities, as well as similarity of group sizes and means across models, the 4-class solutions from the known-class and separate sex models were similar. In addition, sequentially imposing equality constraints to intercepts and slopes across homologous classes for males and females in the known-class model did not significantly worsen model fit. Thus, the 4-class solution from the more parsimonious known-class model was selected (see Figure 2). Group assignments as determined by posterior probabilities from the optimized model were used in all subsequent analyses.

3.2 HYPOTHESIS 2: EARLY CHILDHOOD RISK FOR HIGH AGGRESSION IN MALES AND FEMALES

To analyze the hypothesis that males would exhibit higher levels of child, but not contextual, risk factors than females during early childhood, mean differences were tested between males and females on age 2 risk factors (i.e., socioeconomic status, parent depression, parent-child coercion, parent-child positive engagement, inhibitory control, fearlessness, ADHD behaviors, language ability, cumulative child risk, and cumulative contextual risk) using independent sample t-tests. Mean levels of toddler-age risk and percentage meeting risk criteria (see Table 1) for males and females are presented in Table 8. Consistent with expectations, boys had lower levels of inhibitory control (t = 3.132, p < .01) and language abilities (t = 2.705, p < .01) and a trend towards higher ADHD behaviors (t = 1.706, p < .10) in toddlerhood than girls. Boys also had a significantly higher level of cumulative child, but not contextual, risk than girls at age 2 (t = 3.565, p < .001).

Next, descriptive data for trajectory groups are presented in Table 9. To test for differences in toddler-age child and contextual risk profiles associated with each trajectory group, within-sex ANOVAs (factor = class membership) with contrasts were conducted. Early childhood risk profiles differed between trajectory groups for both boys and girls. For males (top of Table 9), those classified in the high group showed significantly lower levels of inhibitory control and higher levels of ADHD behaviors, parent-child coercion, and parent depression at age 2 compared to those showing persistently low levels of aggression. For females (bottom of Table 9), those in the high aggression group showed significantly lower levels of inhibitory control and higher levels of ADHD behaviors at age 2 than those in the persistently low aggression group but no differences on coercive parenting or parent depression. Also, females in

the increasing aggression group showed the lowest levels of child risk but the highest levels of age 2 parent depression. This pattern was not evident for males.

To examine the hypothesis that the predictive utility of early childhood characteristics for high persistent aggression would be similar for males and females, multinomial logistic regression analyses were conducted. To determine which early childhood variables differentiated persistently high trajectories of aggressive behavior from other groups and whether these are similar in males and females, trajectory group membership was simultaneously regressed on sex and toddler-age risk factors (child language, child inhibitory control, child ADHD behaviors, child fearlessness, parent-child engagement, parent-child coercion, parent depression, parent education, and family income), and all sex by risk factor interaction terms. Treatment group assignment was also included as a covariate. A separate regression was then conducted replacing individual risk factors with cumulative child and contextual risk indices and both sex by cumulative risk interaction terms to examine whether risk in one domain is more strongly associated with developmental patterns of aggression and whether this association is similar for males and females.

Table 10 demonstrates within- and between-sex patterns of prediction by toddler-age risk. A value greater than one indicates that a predictor is negatively related to membership in the referent group (in this case, high aggression) and a value less than one indicates that a predictor is positively related to membership in the referent (high aggression) group. Although specific hypotheses were only put forth for the low versus high group comparisons, other significant findings differentiating high aggression from increasing and decreasing aggression are also presented.

3.2.1 Within-sex results: Risk for high aggression in males

3.2.1.1 Male Low versus High

For males (top half of table 10), higher levels of age 2 inhibitory control were associated with reduced odds of showing persistently high versus low levels of aggression (B = .646, *SE* = .257, $p < .05$). Higher levels of age 2 parent-child coercion (B = -3.186, *SE* = 1.482, $p < .05$), parent depression (B = -.036, *SE* = .013, $p < .01$) and ADHD behaviors (B = -1.471, *SE* = .613, $p < .05$) were associated with a greater likelihood of showing high persistent relative to low trajectories of aggression. Cumulative child (B = -.357, *SE* = .170, $p < .05$) and cumulative contextual risk (B = -.465, *SE* = .131, $p < .001$) each contributed to an increased likelihood of high persistent relative to low trajectories of aggression.

3.2.1.2 Male Increasing versus High

Cumulative child risk at age 2 increased the likelihood (B = -.695, *SE* = .193, $p < .001$) of males showing high relative to increasing trajectories of aggression.

3.2.1.3 Male Decreasing versus High

Higher levels of age 2 parent depression were associated with increased odds (B = -.031, *SE* = .014, $p < .05$) of being in the high relative to the decreasing group.

3.2.2 Within-sex results: Risk for high aggression in females

3.2.2.1 Female Low versus High

For females (bottom half of table 10), higher levels of age 2 inhibitory control were associated with reduced odds of showing persistently high versus low trajectories of aggression (B = 1.198, *SE* = .345, $p < .01$). Higher levels of age 2 parent-child coercion (B = -3.186, *SE* = 1.482, $p < .05$), parent depression (B = -.036, *SE* = .013, $p < .01$) and ADHD behaviors (B = -3.246, *SE* = .839, $p < .001$) were associated with a greater likelihood of showing high relative to low trajectories of aggression. Cumulative child (B = -.914, *SE* = .239, $p < .001$) and cumulative contextual risk (B = -.465, *SE* = .131, $p < .001$) each contributed to an increased likelihood of high relative to low trajectories of aggression.

3.2.2.2 Female Increasing versus High

Age 2 cumulative child risk (B = -.695, *SE* = .193, $p < .001$) increased the likelihood of females showing high persistent relative to increasing trajectories of aggression.

3.2.2.3 Female Decreasing versus High

Higher levels of age 2 parent depression were associated with increased odds (B = -.031, *SE* = .014, $p < .05$) of being in the high persistent relative to the decreasing trajectory group. Higher levels of child inhibitory control at age 2 were associated with reduced risk (B = .741, *SE* = .356, $p < .05$) of females showing high relative to decreasing trajectories of aggression.

3.2.3 Between-sex results: Differential associations between toddler-age risk and high aggression in males and females

3.2.3.1 Low versus High

As shown in Table 10, one (of eleven tested) sex by risk interactions were significant. Unexpectedly, higher age 2 levels of cumulative child risk (interaction B = -.588, *SE* = .292, $p < .05$) were more strongly associated with membership in the high (versus low) group for females than for males.

3.2.3.2 Decreasing versus High

Only one (of eleven tested) sex by risk interactions were significant. Specifically, higher levels of age 2 inhibitory control were associated with an increased likelihood of being in the decreasing relative to the high aggression group for females but not for males (interaction B = .945, *SE* = .406, $p < .05$).

3.2.3.3 Increasing versus High

Zero (of eleven tested) sex by risk interactions were significant. Thus, in multivariate analyses, there were no sex differences in associations between toddler-age risk and odds of exhibiting increasing versus high aggression.

In summary, for boys and girls, both within-child and contextual factors differentiated between high persistent aggression and other aggression patterns from early to middle childhood. Specifically, in toddlerhood, parent depression and parent-child coercion, as well as child inhibitory control and ADHD behaviors, played an important role in risk for high

aggression. Further, the findings suggest that within-child factors were more strongly associated with high aggression in girls than in boys.

3.3 HYPOTHESIS 3: MIDDLE CHILDHOOD OUTCOMES ASSOCIATED WITH HIGH AGGRESSION

To investigate the hypothesis that both sexes showing high aggression trajectories would be more likely than all other groups to meet criteria for a disruptive behavior disorder in middle childhood and that females would be more likely to demonstrate a broader range of impairments than males, extending to internalizing disorders and social skills, sex, trajectory group membership and class by sex interaction terms were used to predict outcomes at ages 9.5 and 10.5.

For continuous outcomes, ordinary least squares (OLS) regressions were conducted to determine if group membership would predict social skills, relational aggression, peer acceptance/rejection, student-teacher conflict, and internalizing and externalizing symptoms in middle childhood, as well as whether these patterns would differ for males and females. These results are summarized in Table 11. For dichotomous outcomes, binomial logistic regressions were conducted to examine associations between trajectory class membership, sex, and parent-reported clinical diagnoses of ADHD-Inattentive Type, ADHD-Hyperactive Type, Oppositional Defiant Disorder, and Conduct Disorder, as well as a Mood or Anxiety Disorder endorsed by *either the parent or the child* (see Table 12 for prevalence rates). Logistic regression results are shown in Table 13.

In all regressions, dummy codes were created to reflect aggression class membership with the high aggression class as the referent group. Interaction terms were calculated by multiplying each dummy code by child sex (female = 1). Intervention status was included as a covariate (treatment = 1). The values presented reflect results for boys and girl from the final regression models, which included intervention status, sex, trajectory class dummy codes, and sex by trajectory class interaction terms. Of 20 regressions conducted, the addition of sex by class membership interaction terms to the model contributed statistically significant variance only once (as indicated by an r^2 change p-value < .05). Thus, the following results are collapsed across boys and girls and the single sex-specific association is noted in Table 11. As with the previous analyses, results comparing high aggression with each other trajectory group are presented although the low versus high group comparisons were the focus of this study.

3.3.1 Within-sex results: High aggression and middle childhood outcomes

3.3.1.1 Low versus High

Teacher reports demonstrated several differences associated with low versus high aggression class membership (see Table 11). Boys and girls in the low aggression class had significantly higher levels of teacher-reported self control (B = 2.15, *SE* = .94, $p < .05$) and peer acceptance (B = .71, *SE* = .30, $p < .05$) and lower levels of peer rejection (B = -.82, *SE* = .37, $p < .05$) at age 9.5 than children in the high aggression class. Group differences were also found for parent reports of child disruptive behavior at age 10.5. As expected, children in the low aggression class had lower levels of ADHD-Inattentive (B = -.78, *SE* = .12, $p < .001$), ADHD-Hyperactive (B = -.86, *SE* = .10, $p < .001$), ODD (B = -.95, *SE* = .10, $p < .001$), and CD (B = -.09, *SE* = .01, $p < .001$) symptoms than children in the high aggression class. Further, boys and

girls in the low group had significantly lower child/parent reports of anxiety symptoms (B = -5.52, *SE* = 1.16, $p < .001$) compared to the high class, while only boys in the low group also had lower levels of mood symptoms relative to boys in the high class (B = -4.87, *SE* = 1.15, $p < .001$).

For diagnostic outcomes (see Table 13), both boys and girls in the low aggression class were significantly less likely than those in the high aggression class to meet criteria for ADHD-Inattentive Type (B = -2.11, *SE* = .44, $p < .001$), ADHD-Hyperactive Type (B = -2.57, *SE* = .49, $p < .001$), ODD (B = -2.82, *SE* = .45, $p < .001$), CD (B = -3.10, *SE* = 1.11, $p < .01$), and any of the disruptive behavior disorders (B = -2.92, *SE* = .44, $p < .001$) based on parent reports. Children in the low group were also less likely than those in the high group to meet criteria for an anxiety disorder (B = -1.16, *SE* = .38, $p < .01$) and any internalizing disorder (B = -1.10, *SE* = .38, $p < .01$) based on child or parent reports. In sum, a high persistent (versus low) aggression pattern was related to broad impairment for both sexes.

3.3.1.2 Increasing versus High

Only one group difference (out of six comparisons tested) was found between the increasing and high aggression classes on teacher reports at age 9.5. Children in the increasing group had significantly lower levels of cooperation than those in the high aggression group (B = -2.83, *SE* = 1.36, $p < .05$). On parent reports of disruptive behaviors, boys and girls classified in the increasing trajectory had lower levels of parent-reported of ADHD-Inattentive (B = -.34, *SE* = .16, $p < .05$), ADHD-Hyperactive (B = -.32, *SE* = .13, $p < .05$), ODD (B = -.56, *SE* = .13, $p < .001$), and CD (B = -.04, *SE* = .01, $p < .01$) symptoms than children in the high aggression class. However, there were no differences between aggression classes on combined parent/child reports of mood or anxiety symptoms at age 10.5.

For diagnostic outcomes, children showing an increasing aggression trajectory were less likely than those in the high aggression class to meet criteria for parent reported ADHD-Hyperactive Type (B = -1.46, *SE* = .63, $p < .05$), ODD (B = -2.05, *SE* = .63, $p < .01$), and any disruptive behavior disorder (B = -1.67, *SE* = .54, $p < .01$) at age 10.5.

3.3.1.3 Decreasing versus High

On teacher reports at age 9.5, boys and girls in the decreasing aggression group had significantly higher levels of teacher-reported self control (B = 2.12, *SE* = 1.07, $p < .05$) and peer acceptance (B = .70, *SE* = .34, $p < .05$) and lower levels of teacher conflict (B = -.09, *SE* = .05, $p < .05$) than children in the high persistent aggression class. Boys and girls in the decreasing aggression class also had lower levels of parent-rated disruptive behavior symptoms including ADHD-Inattentive (B = -.61, *SE* = .13, $p < .001$), ADHD-Hyperactive (B = -.75, *SE* = .11, $p < .001$), ODD (B = -.81, *SE* = .11, $p < .001$), and CD (B = -.08, *SE* = .01, $p < .001$) symptoms than children in the high aggression class. Children in the decreasing class also had lower levels of child/parent reported anxiety (B = -5.02, *SE* =1 .31, $p < .001$) symptoms than those in the high aggression group. For boys in the decreasing group, mood (B = -4.24, *SE* = 1.30, $p < .01$), symptoms were also lower than the high group.

For clinical diagnoses, boys and girls who showed a decreasing pattern of aggression during childhood were less likely than children exhibiting high aggression to meet criteria for parent-reported ADHD-Inattentive Type (B = -1.43, *SE* = .49, $p < .01$), ADHD-Hyperactive Type (B = -2.67, *SE* = .68, $p < .001$), ODD (B = -2.51, *SE* = .54, $p < .001$), and any disruptive behavior disorder (B = -2.25, *SE* = .47, $p < .001$) in middle childhood.

3.3.2 Between-sex results: Differential associations between high aggression and middle childhood outcomes for males and females

As noted above, the addition of sex by class membership interaction terms to the model contributed statistically significant variance in only one of twenty regressions, indicating that associations between aggression trajectory class and middle childhood outcomes were largely similar for males and females. Specifically, when predicting middle childhood mood disorder symptoms endorsed by either the child or parent from aggression class membership, differences between the high persistent aggression and low aggression class means (interaction B = 4.45, *SE* = 1.90, $p < .05$) as well as the high aggression and decreasing class means (interaction B = 4.49, *SE* = 2.12, $p < .05$) were evident in boys but not girls (r^2 change = .015, $p < .05$; see bottom of Table 11). Thus, the findings did not support the hypothesis that females showing high aggression would be more broadly impaired than their male counterparts.

4.0 DISCUSSION

4.1 SUMMARY

This study examined: 1) whether there are sex differences in the pattern and frequency of aggressive behavior trajectories from ages 2 to 9.5 in a high risk sample of boys and girls; 2) whether risk factor prevalence, susceptibility, or both during early childhood account for sex differences in base rates of persistently high aggression; and 3) whether a persistently high aggression trajectory is associated with similar consequences during middle childhood for boys and girls. The results demonstrated that regardless of modeling strategy, males and females exhibited similar patterns of aggression throughout childhood, with four latent trajectory classes identified: high, decreasing, increasing, and low. Furthermore, mean levels of aggression associated with each class were not significantly different across sexes. However, in line with expectations, a greater percentage of males showed a high persistent trajectory of aggression and a greater percentage of females showed a consistently low aggression trajectory. The percentage of males and females showing increasing and decreasing trajectories did not differ. With respect to risk for persistently high aggression, the findings partially supported our hypothesis in that males showed higher mean levels of child risk factors during toddlerhood. However, in contrast to expectations, associations between two toddler-age indicators of child risk, inhibitory control and cumulative child risk, and the odds of exhibiting high aggression were stronger in females

than in males. Lastly, demonstrating high persistent aggression throughout childhood was predictive of parent- and child-rated internalizing and externalizing symptoms and diagnoses for both sexes, as well as poorer teacher-rated social functioning in middle childhood. In contrast with expectations, only males who showed persistently high aggression had higher means levels of parent- and child-reported mood symptoms in middle childhood than males with low aggression.

In summary, boys and girls exhibited similar trajectories and mean levels of aggression throughout childhood, albeit boys showed the high persistent pattern more frequently than girls. Toddler-age child risk factors for aggression were more prevalent in boys than in girls, but no differences were observed with respect to contextual risk. Associations between toddler-age risk factors and a high persistent aggression trajectory were not stronger in boys than in girls; in fact, two early childhood risk factors were more strongly related to high persistent aggression in girls than in boys. High persistent aggression was associated with pervasive dysfunction in middle childhood for both sexes.

4.2 DEVELOPMENTAL TRAJECTORIES OF AGGRESSION IN MALES AND FEMALES

The findings from the current study add to a growing body of research demonstrating that males and females exhibit similar developmental trajectories of aggression from early to middle childhood, with males showing the early-starting and persistent aggression pattern at a greater frequency than females (e.g., Broidy et al., 2003; NICHD Early Child Care Research Network, 2004b). Although it was expected that estimating male and female

trajectories separately would provide a clearer picture of the development of aggression than estimating male and female trajectories together, both estimation strategies produced very similar results, with both male and female aggression development explained by four latent classes (high, decreasing, increasing, low). In addition, successively constraining intercept, slope, and quadratic terms across sexes did not significantly change model fit, indicating that boys and girls assigned to analogous classes showed equivalent initial levels (age 2) of aggression and equivalent patterns of change in aggressive behavior over time. This finding was consistent with previous work showing that reliable sex differences in aggression typically do not emerge until the preschool age (Keenan & Shaw, 1997), but differs with other research suggesting that males show higher levels of aggressive behavior than females as early as toddlerhood (Baillargeon et al., 2007; Tremblay et al., 2005). The lack of sex differences in mean levels of aggression was particularly unexpected with respect to the high persistent aggression class as previous studies have demonstrated that mean levels of aggression associated with the high persistent aggression class are consistently greater in males than in females (Broidy et al., 2003; Odgers et al., 2008; Schaeffer et al., 2006). However, an important difference between this study and the extant literature is our use of a high risk sample of males and females who were recruited based on the presence of risk for CP at age 2, one factor of which was high levels of parent-reported child disruptive behavior. Thus, in the context of high risk, including child, family, and socioeconomic domains, a sizable proportion of females showed aggressive behavior similar in severity to males. This finding accompanied by the finding that equal proportions of both sexes exhibited decreasing aggression, suggests that when multiple risk factors are present, females showing high aggression during toddlerhood should be considered as at-risk for continued aggressive behavior as males.

4.3 RISK FOR HIGH AGGRESSION

Based on the large literature demonstrating higher rates of aggression in males than in females throughout the lifespan beginning typically during the preschool period (e.g., Fergusson & Horwood, 2002), this project examined whether higher base rates of aggression in males could be attributed to males' higher rates of exposure to risk, an increased likelihood of aggression in the context of risk for boys (i.e., a lower threshold), or both. The results showed that by the age of 2 boys had a greater level of child risk for aggression, as evidenced by lower levels of language and inhibitory control, as well as higher levels of cumulative child risk. Boys also showed higher levels of ADHD behaviors at a trend level. However, mean levels of contextual/proximal risk (e.g., parent-child engagement and coercion, parent depression, and SES) did not differ. These findings are consistent with prior work showing robust sex differences in numerous child characteristics, including language (Bouchard et al., 2009), inhibitory control (Olson et al., 2005), and ADHD behaviors (Barkley, 2003) from early childhood. Although child fearlessness was also expected to be higher in boys than in girls, the results did not support this hypothesis. While it is possible that the measure used in this study (a 1 to 4 scale) did not capture enough variability in fearlessness to identify sex differences, it is also possible that the sex differences in fearlessness that are typically identified in the literature (Else-Quest et al., 2006) were not present in our study because of the high risk nature of the sample, which may have a more restricted range of fearlessness in comparison to the general population. However, the lack of sex differences in mean levels of *contextual* risk factors is consistent with a body of work (e.g., Browne et al., 2010; Goodman et al., 2011), which shows no or inconsistent sex differences with respect to proximal variables such as parenting and parent depression.

In contrast, associations between toddler-age risk and high aggression were not expected to differ for males and females. When all child and contextual risk factors were examined simultaneously, age 2 levels of inhibitory control, ADHD behaviors, parent-child coercion, and parent depression differentiated both boys and girls showing persistently low aggression from the high persistent aggression group in expected directions (e.g., higher levels of age 2 parent-child coercion were associated with increased risk for high aggression). Contrary to expectations, associations between child risk and high aggression were actually stronger in females than in males, suggesting that females possessing gender atypical behaviors, such as lower levels of inhibitory control and higher levels of cumulative child risk, are more likely to develop high persistent (as compared to both low and decreasing) aggression than their male counterparts. Although this finding was unexpected, the pattern of results is consistent with gender paradox theory (Eme, 1992), which posits that gender atypical behaviors are more detrimental than gender typical behaviors in the less commonly affected sex. During early childhood, girls have been consistently shown to develop inhibitory control at a faster rate than boys (Else-Quest et al., 2006). Thus, girls who fail to do so may be more likely to possess additional characteristics that place them at risk for early-starting aggression and to encounter negativity and rejection from caregivers and peers, which further perpetuates their maladaptive behavior patterns. However, more research is needed to determine the mechanism through which inhibitory control is associated with early-starting aggression in girls compared to boys.

Overall, the results suggest that the prevalence of greater child-level risk in boys, but not boys' greater susceptibility to risk, underlies sex differences in aggression. To our knowledge, this is the first study to compare base rate risk differences versus susceptibility to risk in a sample of males and females where a significant proportion of both sexes are at risk for

demonstrating early-starting and persistent aggressive behavior. These findings are particularly intriguing because they suggest that the biological basis of aggression (Eme, 2007), rather than social influences, largely drive the preponderance of aggressive behavior in males. Additional support for this theory comes from the finding that females with lower levels of inhibitory control and higher levels of cumulative child risk factors, which are more common in males, are at particularly elevated risk of showing high relative to low aggression throughout childhood. However, these findings need to be replicated in additional high risk and large community samples before firm conclusions can be drawn about the relative importance of child versus contextual risk factors in the etiology of base rate sex differences in aggression.

4.4 HIGH AGGRESSION AND MIDDLE CHILDHOOD IMPAIRMENT

Based on work showing continuity between childhood CP and aggression trajectories and middle childhood functioning (Broidy et al., 2003; Campbell et al., 2010; Côté et al., 2002) but a relative lack of research comparing the outcomes of high aggression in boys and girls, we examined whether high persistent aggression predicted continued disruptive behaviors and broader dysfunction in both sexes during middle childhood. We found that boys and girls assigned to the persistently high aggression trajectory were more likely than those in the low aggression trajectory to meet criteria for each parent-reported disruptive behavior disorder in middle childhood. Early-starters were also more likely to meet criteria for at least one disruptive behavior disorder than both the increasing and decreasing classes. Additionally, the high persistent group had higher symptom counts for every disruptive behavior than the other classes. The pattern of results did not differ for males and females. Thus, as expected, children of both

sexes were impaired in the disruptive behavior domain. These findings add to a plethora of studies showing substantial homotypic continuity between childhood aggression trajectories and middle childhood functioning (Broidy et al., 2003; Côté et al., 2002) and demonstrate that the likelihood of a disruptive behavior disorder for those showing high aggression does not differ for males and females.

In addition, both boys and girls in the high persistent group were more likely to meet criteria for an anxiety disorder and any internalizing disorder than children in the low aggression group. Similarly, children in the high group had significantly higher symptoms of anxiety than those in the low and decreasing (but not the increasing) groups. There were no sex differences in these associations. However, in contrast with theory that females showing high aggression throughout childhood would be more broadly impaired in middle childhood than their male counterparts (i.e., a gender paradox; Eme, 1992; Robins, 1986), only males in the high aggression group showed greater mean mood disorder symptoms than males in the low and decreasing classes. Surprisingly, there were no differences in mean mood disorder symptoms between any of the female aggression classes. Although this finding was unexpected, a closer examination of the results revealed that mood disorder symptoms were elevated for females across all trajectory classes, including the low aggression group, but not for males ($t = 2.041$, $p < .05$); even females who did not show aggressive behavior throughout childhood exhibited mood disorder symptoms in middle childhood. These findings are consistent with the high risk nature of the sample and the female preponderance of depression emerging around puberty (Hyde, Mezulis, & Abramson, 2008). Thus, in this sample of males and females with multiple risk factors for CP in early childhood, high aggression is associated with elevated middle childhood

anxiety for both sexes and middle childhood mood symptoms for males only, in part, because females' mood symptoms are elevated regardless of their aggressive behavior.

Differences between the high persistent aggression class and other aggression classes were less consistent with respect to teacher-rated outcomes. Children exhibiting high persistent aggression were rated as having lower mean levels of self control, peer acceptance, and higher levels of peer rejection than those in the persistently low aggression group. There were no sex differences in these associations. Although the findings do not suggest pervasive impairment in the school setting (i.e., not all outcomes were significantly different), the teacher ratings are particularly meaningful because they demonstrate cross-context and -informant validation of the trajectory groups and indicate particular impairment in the peer domain. Peer functioning during middle childhood has been shown to be a salient contributor to CP and aggression in adolescence (Patterson, Forgatch, Yoerger, & Stoolmiller, 1998). These findings are also consistent with a theoretical pathway linking childhood aggression trajectories to continued behavior problems into adolescence and adulthood through peer rejection and deviant peer affiliation in middle childhood (Granic & Patterson, 2006; Patterson et al., 1989). Importantly, our results indicate that aggressive males and females are equally likely to be unaccepted and rejected by their peers, which contrasts with theory that female aggression may be received by peers as more aversive than male aggression (Crick & Grotpeter, 1995; Maccoby, 2002). The results also add to a growing literature indicating that male and female aggression throughout childhood is broadly detrimental socially and emotionally for both sexes (Barker et al., 2010; Campbell et al., 2010; Odgers et al., 2008).

4.5 LIMITATIONS

Despite the strengths of this study, which include the use of a prospective longitudinal design, multiple methods and informants, and a sample recruited based on the presence of risk for CP, the results must be interpreted in light of a number of limitations. First, this study utilized data from a randomized controlled trial that offered a parenting-focused intervention for CP, the Family Check-Up, to families assigned to the intervention group. To maximize the number of participants who could be included in the sample rather than restrict the study to control group participants, group status was treated as a covariate. Although this accounts for variance in trajectory group membership and outcomes that are associated with intervention status, it is also possible that group status alters associations between risk factors, outcomes, and aggressive behavior trajectories. Therefore, future studies should examine interactions between sex and risk for aggression as well as middle childhood functioning in large community or high risk samples without an intervention component.

Second, despite our use of a high risk sample, the number of children in the high aggression class was only 49 for boys and 25 for girls. Similarly, relatively few children within each trajectory class met criteria for clinical diagnoses based on parent and/or child report at age 10.5 (see Table 12). For example, only 5 boys and 5 girls in the high aggression classes met criteria for CD at age 10.5. As a result of small initial group sizes in addition with attrition and difficulty obtaining teacher reports, some cells in analyses examining middle childhood functioning were very small (*n*s less than 10). Thus, failure to find sex differences in associations between risk factors and trajectory groups as well as sex differences between trajectory groups and middle childhood functioning, may have been at least partially attributable to having small

group sizes. Future work should utilize larger samples of high risk boys and girls to rule out that our results were due to lack of power.

Third, a small percentage of children dropped out or were lost to the study over the 8.5 year period examined and all participants were included in aggression trajectory analyses, regardless of the number of data points present. However, 96% of children in the study had at least 2 data points and 90% of the sample had 4 or more data points available. Attrition analyses revealed that children whose parents reported lower education levels at age 2 were less likely to participate at ages 7.5 through 10.5. Thus, given that all participants had some element of socioeconomic risk at the start of the study, the results may not reflect those at the highest level of socioeconomic risk.

Lastly, although we consider the use of a sample recruited based on the presence of risk for CP during early childhood a strength of this study, it is also possible that our results would not generalize to lower risk samples. For example, screening children for the presence of CP and risk for CP likely resulted in the inclusion of females showing behaviors, such as high levels of fearlessness and physical aggression, which remain statistically rare in the general population. Future work should examine sex differences in aggression trajectories, risk factors, and outcomes in large community samples that would still be able to identify large groups of boys and girls showing clinically meaningful aggressive behavior to determine whether the results generalize to lower risk populations. Similarly, it would be interesting to test these ideas with groups of boys and girls who all show clinically-meaningful levels of aggression in early childhood.

4.6 CLINICAL IMPLICATIONS

The results of this study have a number of potential implications that may be used to inform future clinical research and practice. First, when all children are at elevated risk for CP, a proportion of females show aggressive behavior similar in severity and course to males. In fact, boys and girls with high aggression at age 2 were equally likely to continue showing high aggression later. Thus, early interventions should screen for boys and girls who possess socioeconomic or family risk in combination with elevated aggression to increase the likelihood of identifying those likely to show a high aggression pattern. Second, in the context of high risk, inhibitory control, ADHD, parent-child coercion, and parent depression, each contributed additional risk to high aggression for both sexes, while inhibitory control deficits were particularly important for females. Thus, interventions that screen based on risk for CP should target parent-child interactions and parent depression as well as childhood ADHD behaviors (i.e., hyperactivity and impulsivity), as these behaviors were salient indicators of risk above and beyond characteristics such as fearlessness, child language, parent engagement, and socioeconomic status. Finally, both sexes showing persistently high levels of aggression were broadly impaired during middle childhood. Therefore, middle childhood interventions should target clinical ADHD and anxiety symptoms as well as peer functioning/social skills to decrease the rates of compounding difficulties and potentially the likelihood of continued aggression into adolescence.

4.7 FUTURE DIRECTIONS

As noted above, the results need to be replicated across large community and other high risk samples to determine whether the findings generalize and to ensure this study's findings are not spurious. Further, the results of this study lead to several follow-up questions that will better explicate the relationship between sex and risk for the development of aggression. For example, what aspect of males' histories accounts for sex differences in language and inhibitory control at the age of 2? The lack of sex differences in contextual variables measured at the same time point in this study suggest that biological processes likely play an important role in child aggression. Specifically, prenatal androgen levels have been linked to individual differences in aggression during early and middle childhood (Eme, 2007; Hines, 2004) and females exposed to unnaturally high levels of androgen in utero have been shown to be more "masculine" in terms of play and aggressive behavior than typically developing females (Auyeung et al., 2009; Pasterski et al., 2007). Thus, prenatal androgen levels may partially account for both between-sex differences in child level risk factors and within-sex differences in risk factors. However, it is also possible that there are omitted proximal/contextual variables that were not measured in this study that do differ for boys and girls. It is also plausible that there were sex differences in proximal risk factors that occurred prior to age 2, including during the prenatal period. This study could not rule out that boys experienced higher levels of contextual risk than girls earlier in childhood (before age 2). Additionally, based on findings that males and females develop at different rates during early childhood (i.e., males are behind females, Rutter et al., 2003), effects of exposure to stressors such as parent depression or socioeconomic strain may differ for males and females depending on the developmental stage during which the stressor is experienced. Follow-up work should examine a sample of children followed prospectively from the prenatal period to

determine whether biological variables or contextual experiences that occur very early in life explain the increased occurrence of aggression risk factors in males versus females.

Lastly, the main focus of this study was to examine risk for high aggression versus low aggression. However, risk factors in both sexes that differentiate early-starters who persist from those who desist have numerous theoretical and practical implications. This study found very few age 2 risk factors that differentiated the two groups. Given that both males and females were showing elevated aggression at age 2, it might be expected that change in risk throughout early and middle childhood (e.g., decreases in coercion or parent depression) would be more important than initial risk for differentiating high persisting from high desisting aggression. Future studies should examine how change in proximal risk throughout early childhood is associated with diverging aggression trajectories.

4.8 CONCLUSION

In summary, overall the results are counter to previous theory that the course and manifest behaviors of aggression, as well as the predictors and outcomes, differ for males and females. The findings from this study suggest that a small proportion of both sexes exhibit aggression from early childhood that persists into middle childhood and that males (13.3%) are more likely to exhibit this aggression pattern than females (6.9%). Moreover, toddler-age inhibitory control, ADHD symptoms, parent-child coercion, and parent depression independently predict high persistent aggression in both sexes. The presence of greater child-level risk such as inhibitory control and language delay in males, rather than stronger associations between risk factors and aggression in males, likely account for sex differences in aggression base rates.

Finally, aggressive behavior that emerges in toddlerhood and persists into middle childhood is associated with broad impairment in externalizing, internalizing, and social domains for both sexes.

APPENDIX A

TABLES

Table 1. Cumulative risk summary table.

Domain	Risk Criterion (1 = present)	Percentage of sample with risk
Child Risk		
ADHD symptoms	Mean ≥ 1.33	Top 29.1%
Fearlessness	Score > 3	Top 16.5%
Inhibitory control	Mean ≤ 3.46	Bottom 26.3%
Language ability	Mean ≤ -.66	Bottom 25.2%
Family Risk		
Dyadic coercion	Mean ≥ .3106	Top 25%
Positive engagement	Mean ≤ .1506	Bottom 25%
Maternal depression	Total > 16	41.6%
SES	Less than HS education	23.5%

Table 2. Model-fit Criteria for 1 through 5 Classes (Known-class Models)

# classes	BIC	Log-likelihood	Entropy	Lowest Avg PP M	Lowest Avg PP F
1	4072.30	-1989.99	1.0	n/a	n/a
2	2648.45	-1254.98	0.95	0.95	0.94
3	2398.49	-1106.92	0.88	0.82	0.86
4	**2183.08**	**-976.14**	**0.89**	**0.84**	**0.83**
5	2086.92	-904.98	0.89	0.82	0.82

Note. BIC = Bayesian Information Criterion; Avg PP = Average Posterior Probability. Optimal model reflected in bold text.

Table 3. Aggression Class Distribution and Means from Known-Class Models

			Aggressive behavior mean (range)	
Class	Males N (%)	Females N (%)	M	F
High	49 (13.3)	25 (6.9)	.83 (.6-1.23)	.84 (.65-1.32)
Increasing	38 (10.5)	33 (9.1)	.47 (.31-.71)	.49 (.27-.80)
Decreasing	83 (22.5)	72 (19.9)	.44 (.24-.80)	.39 (.26-.70)
Low	199 (53.9)	232 (64.1)	.14 (0-.4)	.10 (0-.35)

Table 4. Model-fit Criteria for 1 through 6 Classes (Females Only)

# classes	BIC	Log-likelihood	LMR-LRT	BLRT	Entropy	Lowest Avg PP	Smallest Class (%)
1	1193.12	-567.10	n/a	n/a	1	n/a	n/a
2	494.21	-205.87	<.05	<.05	0.91	0.95	20.63%
3	315.44	-104.69	>.05	<.05	0.88	0.90	7.07%
4	**197.82**	**-34.10**	**<.05**	**<.05**	**0.88**	**0.86**	**7.04%**
5	131.57	10.81	>.05	<.05	0.89	0.84	2.79%
6	97.10	39.83	>.05	>.05	0.90	0.84	1.38%

Note. BIC = Bayesian Information Criterion; LMR-LRT = Lo-Mendell Rubin Likelihood Ratio Test; BLRT = Bootstrap Likelihood Ratio Test; Avg PP = Average Posterior Probability. Optimal model reflected in bold text.

Table 5. Model-fit Criteria for 1 through 6 Classes (Males Only)

# classes	BIC	Log-likelihood	LMR-LRT	BLRT	Entropy	Lowest Avg PP	Smallest Class (%)
1	1844.08	-892.49	n/a	n/a	1	n/a	n/a
2	1122.34	-519.79	<.05	<.05	0.90	0.95	22.57%
3	1014.73	-454.17	>.05	<.05	0.75	0.80	17.75%
4	**922.20**	**-396.08**	**>.05**	**<.05**	**0.80**	**0.82**	**11.11%**
5	879.72	-363.02	0.05	<.05	0.81	0.81	4.34%
6	839.58	-331.13	>.05	>.05	0.82	0.83	3.70%

Note. BIC = Bayesian Information Criterion; LMR-LRT = Lo-Mendell Rubin Likelihood Ratio Test;BLRT = Bootstrap Likelihood Ratio Test; Avg PP = Average Posterior Probability. Optimal model reflected in bold text.

Table 6. Aggression Class Distribution and Means from Separate Sex Models

			Aggressive behavior mean (range)	
Class	Males N (%)	Females N (%)	M	F
High	48 (13.0)	26 (7.2)	.83 (.6-1.23)	.83 (.65-1.32)
Increasing	37 (10.0)	32 (8.8)	.46 (.31-.70)	.47 (.27-.80)
Decreasing	86 (23.3)	72 (19.9)	.44 (.24-.8)	.40 (.26-.70)
Low	198 (53.7)	232 (64.1)	.14 (0-.4)	.10 (0-.32)

Table 7. Fit Indices of Four-class Solutions from Known-class and Separate Sex Models

Model type	BIC	Log-likelihood	LMR-LRT	BLRT	Entropy	Lowest Avg PP Male	Lowest Avg PP Female	Smallest Class Male	Smallest Class Female
Known-class	2183.08	-976.14			0.89	0.84	0.83	10.50%	6.91%
Females only	197.82	-34.10	<.05	<.05	0.88		0.86		7.04%
Males only	922.20	-396.08	>.05	<.05	0.80	0.82		11.96%	

Table 8. T-test comparisons of toddler-age risk for males and females

Risk Factor	Male Mean (% meeting risk)	Female Mean (% meeting risk)	Significance
Child Factors			
Language	-.11 (27.9%)	0.07 (22.4%)	$p < .01$
Inhibitory control	3.88 (29.5%)	4.06 (19.6%)	$p < .01$
ADHD	1.14 (31.4%)	1.10 (26.8%)	$p < .10$
Fearlessness	2.97 (17.6%)	2.91 (13.5%)	n.s.
Cumulative Risk	1.07	0.82	$p < .001$
Contextual Factors			
Engagement	0.23 (25.5%)	0.23 (24.0%)	n.s.
Coercion	0.25 (25.2%)	0.24 (24.3%)	n.s.
Depression	17.20 (44.4%)	16.29 (38.4%)	n.s.
Education	5.23 (21.1%)	5.16 (26.0%)	n.s.
Income	3.72	3.84	n.s.
Cumulative Risk	1.16	1.13	n.s.

Table 9. Within-sex comparisons of toddler-age risk between trajectory groups.

Males	High (1) (n = 49)	Increasing (2) (n = 38)	Decreasing (3) (n = 83)	Low (4) (n = 199)	Significance
Child Risk					
Language	-.139	.058	-.184	-.106	n.s.
Inhibitory Control	3.59	4.03	3.54	4.05	2,4>1,3
ADHD	1.25	1.12	1.26	1.06	1>4; 3>2,4
Fearlessness	2.96	2.97	3.00	2.96	n.s.
Contextual Risk					
Engagement	.211	.212	.213	.245	4>3
Parent-Child Coerce	.277	.264	.257	.240	1>4
Depression	21.10	18.05	17.15	16.09	1>3,4
Education	5.10	5.13	5.14	5.31	n.s.
Income	3.54	3.53	3.71	3.80	n.s.
Females					
	High (1) (n = 25)	Increasing (2) (n = 33)	Decreasing (3) (n = 72)	Low (4) (n = 232)	Significance
Child Risk					
Language	-.064	.365	-.077	.088	2>3
Inhibitory Control	3.33	3.99	3.84	4.22	2>1; 4>3>1
ADHD	1.44	1.11	1.25	1.01	1>3>2,4
Fearlessness	2.92	2.84	3.01	2.89	n.s.
Contextual Risk					
Engagement	.224	.219	.205	.242	4>3
Parent-Child Coerce	.261	.226	.250	.239	n.s.
Depression	18.88	21.60	16.64	15.14	2>3,4
Education	5.00	5.30	5.07	5.18	n.s.
Income	4.00	3.58	3.51	3.96	n.s.

Table 10. Multinomial logistic regression results of early childhood risk predicting aggression trajectories in males and females

Males			
	Increasing vs. High OR	Decreasing vs. High OR	Low vs. High OR
Child Risk	.564		.700 [a]
Language			
Inhibitory			1.899
Control			
ADHD			.226
Fearlessness			
Contextual Risk			.580
Engagement			
Coercion			.017
Depression		.966	.956
Education			
Income			
Females			
	Increasing vs. High OR	Decreasing vs. High OR	Low vs. High OR
Child Risk	.564		.401 [a]
Language			
Inhibitory		2.098 [a]	1.899
Control			
ADHD			.226
Fearlessness			
Contextual Risk			.580
Engagement			
Coercion			.017
Depression		.966	.956
Education			
Income			

Note. OR = Odds Ratio; Only significant values are shown (all *p*s < .05); [a] Statistically significant sex by risk interaction.

Table 11. Regression results showing mean trajectory group differences in middle childhood outcomes for males and females

Outcome	N	Increasing vs. High Mean difference (SE)	Decreasing vs. High Mean difference (SE)	Low vs. High Mean difference (SE)	F
Teacher-Rated (Age 9.5)					
Cooperation	386	-2.83 (1.36)*	.89 (1.13)	1.02 (1.00)	8.05***
Self Control	384	-.73 (1.28)	2.12 (1.07)*	2.15 (.94)*	5.28***
Relational Aggression[c]	329	-.01 (.06)	-.04 (.05)	-.07 (.04)	2.12*
Peer Acceptance	330	.22 (.41)	.70 (.34)*	.71 (.30)*	2.26*
Peer Rejection	330	.02 (.50)	-.68 (.41)	-.82 (.37)*	2.84**
Teacher Conflict[c]	384	.09 (.05)	-.09 (.05)*	-.08 (.04)	5.78***
PC-Rated (Age 10.5)					
ADHD-I Symptoms	563	-.34 (.16)*	-.61 (.13)***	-.78 (.12)***	12.61***
ADHD-H Symptoms	562	-.32 (.13)*	-.75 (.11)***	-.86 (.10)***	20.80***
ODD Symptoms	561	-.56 (.13) ***	-.81 (.11) ***	-.95 (.10) ***	23.57***
CD Symptoms[c]	562	-.04 (.01)**	-.08 (.01)***	-.09 (.01)***	28.93***
PC/TC-Rated (Age 10.5)					
Mood Symptoms	548	-.94 (1.56) [a]	-4.24 (1.30) [a] **	-4.87 (1.15) [a]***	3.32**
		-.41 (1.91)[b]	-.14 (1.68) [b]	-.53 (1.53) [b]	
Anxiety Symptoms	548	-3.06 (1.57)	-5.02 (1.31)***	-5.52 (1.16)***	5.27***

Note. SE = Standard error, ADHD-I = Attention-Deficit Hyperactivity – Inattentive Type, ADHD-H = Attention Deficit Hyperactivity – Hyperactive Type, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder; PC =Primary Caregiver; TC = Target Child. [a] Values for males; [b] Values for females; [c] Variable was log transformed to correct skew. *$p < .05$; **$p < .01$, ***$p < .001$.

Table 12. Prevalence rates of clinical diagnoses for males and females by most likely aggression class membership

Males				
	High *n* (%)	Increasing *n* (%)	Decreasing *n* (%)	Low *n* (%)
PC-Rated (Age 10.5)				
ADHD-I	16 (41)	6 (21)	9 (14)	12 (8)
ADHD-H	16 (41)	4 (14)	3 (5)	8 (5)
ODD	22 (56)	4 (14)	6 (10)	11 (7)
CD	5 (13)	0	1 (2)	1 (1)
Any DBD	27 (69)	7 (25)	8 (13)	15 (10)
PC/TC-Rated (Age 10.5)				
Mood Disorder	4 (12)	3 (15)	2 (4)	4 (3)
Anxiety Disorder	25 (66)	12 (48)	27 (53)	54 (38)
Any Internalizing Disorder	25 (66)	13 (52)	27 (53)	56 (39)
Females				
	High *n* (%)	Increasing *n* (%)	Decreasing *n* (%)	Low *n* (%)
PC-Rated (Age 10.5)				
ADHD-I	6 (35)	6 (21)	2 (4)	14 (8)
ADHD-H	6 (35)	5 (17)	4 (8)	9 (5)
ODD	9 (53)	13 (45)	3 (6)	19 (10)
CD	5 (29)	4 (14)	0	1 (1)
Any DBD	11 (65)	15 (52)	5 (10)	21 (12)
PC/TC-Rated (Age 10.5)				
Mood Disorder	0	2 (7)	3 (7)	12 (8)
Anxiety Disorder	10 (63)	13 (43)	30 (60)	91 (55)
Any Internalizing Disorder	10 (63)	13 (43)	31 (62)	93 (56)

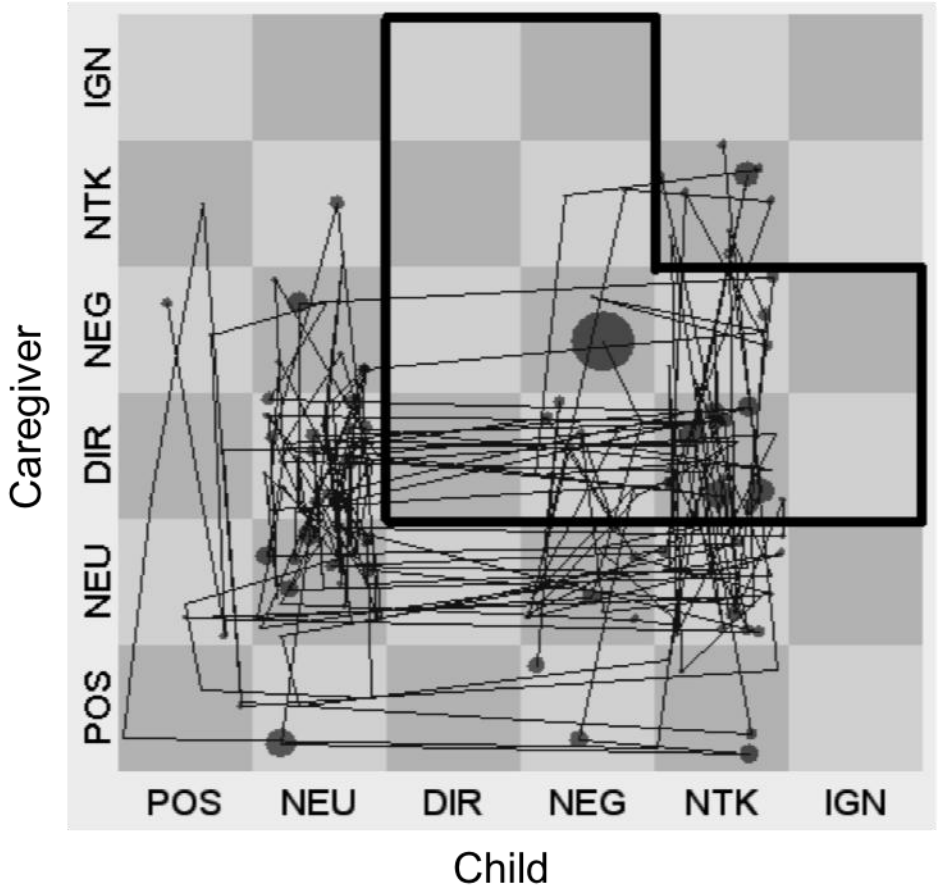
Table 13. Binary logistic regression results predicting clinical diagnoses from aggression trajectory group

	Increasing vs. High OR	Decreasing vs. High OR	Low vs. High OR
PC-Rated (Age 10.5)			
ADHD-I		.239	.121
ADHD-H	.233	.070	.077
ODD	.129	.082	.060
CD			.045
Any Externalizing Disorder	.189	.106	.054
PC/TC-Rated (Age 10.5)			
Mood Disorder			
Anxiety Disorder			.313
Any Internalizing Disorder			.333

APPENDIX B

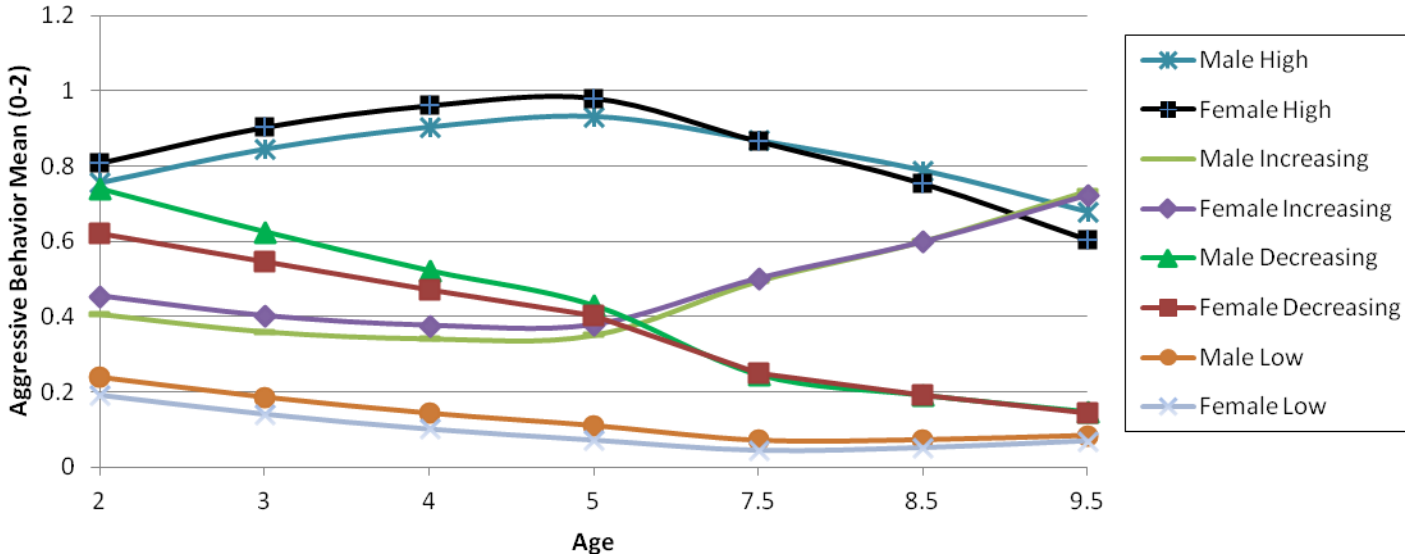
FIGURES

Figure 1. Dyadic coercive interactions region on the state-space grid



Note. Dyadic coerce region outlined in black. Lines within the grid indicate transitions between regions. Larger sized circles indicate longer durations of time the dyad spent in the region (Smith et al., under review). POS = Postive engagement. NEU = Neutral engagement. DIR = Directive. NEG = Negative engagement. NTK = No talk. IGN = Ignore.

Figure 2. Known-class model-estimated four-class aggression trajectories for males and females



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