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EARLY GROWTH IN SOCIAL COMPETENCE  
AND TREATMENT RESPONSIVITY TO THE FAST TRACK INTERVENTION

A Dissertation in

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by

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## ABSTRACT

Social-emotional learning (SEL) interventions targeting the prevention of antisocial behavior are based on theoretical frameworks underscoring the key role of social-emotional competencies in promoting adjustment and protecting youth against trajectories of antisocial behavior. However, little research has directly tested this theoretical model by investigating whether the promotion of social competence functions as a mechanism by which SEL interventions reduce antisocial behavior. The present study explored this issue in the context of the Fast Track prevention program, a 10-year SEL program aimed at the prevention of childhood conduct problems. This study explored the extent to which the promotion of early elementary social competence accounted for the positive long-term effects of Fast Track on the reduction of early adult criminal behavior. Participants included 766 children enrolled in Fast Track (50% African-American, 47% European American, 3% other racial/ethnic groups; 69% male) in the intervention ( $n = 389$ ) and control conditions ( $n = 377$ ). Beginning in first grade, children in the intervention condition received universal and indicated intervention components aimed at promoting social-emotional competencies and academic development. Social competence was assessed via teacher ratings in kindergarten through third grade, and criminal behavior was assessed via court records at age 20. Results revealed a significant effect of intervention on individual growth in social competence that partially mediated the effect of intervention on early adult crime and that was also moderated by baseline characteristics. Further analyses indicated that individual growth in social competence predicted crime outcome with moderate accuracy. These findings are the first to validate the role of individual social competence growth in the effect of SEL-based antisocial behavior prevention, with implications for intervention implementation including early identification of individual treatment responsiveness.

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## Introduction

In 1991, the Fast Track Project was initiated to evaluate the potential of a multicomponent, multi-year prevention program to reduce risks for criminal outcomes among children entering school exhibiting high rates of aggressive-disruptive behavior. It was an unprecedented effort, involving the screening of nearly 10,000 kindergarten children in four geographically-diverse sites (Durham, NC, Nashville, TN, rural Pennsylvania, and Seattle, WA), and the subsequent involvement of 445 families in a 10-year prevention program. Evaluated in the context of a randomized-controlled trial, the outcomes of these children were compared to those of 446 children assigned to a “usual practice” control group. Followed through young adulthood, the intervention group exhibited significantly lower levels of externalizing and internalizing problems, substance use, and crime than the control group, validating the prevention approach.

These positive results and the resulting rich, longitudinal database provide a unique opportunity to test theories regarding the critical mechanisms of action operating in the Fast Track Program and underlying effective prevention of criminal outcomes. Fast Track was designed based on a developmental model that specified key risk and protective factors thought to support the development of aggression (or protect against it), and hypothesized a set of developmental processes that were targeted in early elementary school to produce positive outcomes two decades later, as youth transitioned into adulthood. This study applied growth curve models to test key features of the logic model built upon this developmental theory that guided the design of the Fast Track early elementary prevention program. A central hypothesis was that the promotion of social competence, reflected by growth in social competence during

the initial years of intervention, would serve as a key mechanism of intervention action that fueled reductions in later antisocial behavior.

In addition, this study explored individual differences in response to the intervention. Despite overall positive effects of Fast Track, there were variations across individuals in intervention impact. Rates of adult crime were reduced for youth in the intervention group relative to the control group, but considerable individual variation still characterized the level of crime committed by individuals within the intervention group. A second goal of the study was to determine the degree to which growth curve models of individual growth in social competence during the early elementary years represented a proximal indicator of response to the intervention which could be used in the future to identify early non-responders in need of alternative intervention.

The following sections provide an overview of the developmental model that informed the Fast Track program design, a description of the preventive intervention logic model and approach, along with the rationale for this study's focus on testing mechanisms of change in Fast Track and exploring variations in program impact across individuals.

### **Prevention Approaches: Reducing Risks for Aggression**

Children displaying early levels of heightened aggression are at high risk for the continued development of aggressive and antisocial behaviors (Broidy et al., 2003; Dodge, Coie, & Lynam, 2006). In particular, young children with elevated aggressive tendencies are more likely to engage in later delinquent and violent behavior, often leading to pathways involving criminality and violent offending (Burke, Loeber, & Birmaher, 2002; Moffitt, Caspi, Harrington, & Milne, 2002). Children growing up in poverty are especially likely to encounter adversities that place them at elevated risk for early externalizing problems, and thus, face particularly

heightened risk of antisocial outcomes and poor adjustment in adolescence and adulthood (Blair & Raver, 2012; Stouthamer-Loeber, Loeber, Wei, Farrington, & Wikström, 2002).

In response to the need to address the development of antisocial and violent behavior in at-risk youth, the last half century has seen a rise in programs aimed at the prevention and reduction of aggressive behavior (e.g., Kazdin, Siegel, & Bass, 1992; Patterson, Chamberlain, & Reid, 1982; Webster-Stratton, 1984). Such programs, influenced by developmental theory emphasizing the role of early aggression in antisocial behavior development, have largely been grounded in models consistent with social learning theory (Miller & Prinz, 1990). According to social learning theory, elevated levels of aggression emerge when children's aggressive and disruptive behavior is met by parents' harsh and inconsistent discipline strategies, leading to frequent and escalating cycles of coercive interactions, which both model and reinforce aggression (Patterson, DeBaryshe, & Ramsey, 1989). Upon entering school, children with aggressive tendencies are likely to befriend peers who also model and reinforce aggression, thus contributing to trajectories of continued aggressive and disruptive behavior (Dodge, Greenberg, Malone, & CPPRG, 2008; Snyder et al., 2008). Given the emphasis on the cascading nature of early aggression, interventions based on this model have typically focused on targeting problematic parent-child interactions in order to reduce child aggression before it escalates and further develops. In particular, such preventative interventions, drawing from basic principles of social learning, have typically focused on promoting parents' use of effective behavior management strategies, such as the strategic use of reinforcement and reward, to reduce aggressive and disruptive behaviors (Kazdin, 2008; Miller & Prinz, 1990). For example, the Oregon Model of Parent Management Training, a well-validated program that has been widely implemented, emphasizes parents' use of effective discipline and limit-setting (e.g., time-out,

removal of privileges), in addition to strategic praise, positive attention, and encouragement, to discourage defiance and aggression and promote compliant behavior (Forgatch, Bullock, & Patterson, 2004).

In addition to providing parent training for families at risk, prevention programs have also been designed to address risks in the school context. These school-based programs have typically used similar principles of behavior management to promote compliant classroom behavior, discourage disruptive behaviors, and promote a positive classroom climate (Gottfredson et al., 2000). For example, the Good Behavior Game intervention involves the division of classrooms into competing teams in which individual off-task behavior is tracked and team-level compliant behavior is rewarded (e.g., team with less off-task behavior receives a special privilege) (Barrish, Saunders, & Wolf, 1969). In this way, the Good Behavior Game, and other similar group contingency programs, encourages not only individual compliance but peer reinforcement for compliance, thus promoting class-wide positive behavior.

### **Prevention Approaches: Promoting Resilience with Social-emotional Learning**

Adding to developmental and prevention models underscoring the role of early aggression in later antisocial behavior, accumulating evidence over the past few decades has documented the key role of early social competence in protecting against the development of antisocial behavior and poor adjustment. Defined as the set of interpersonal skills facilitating the integration of feelings, thoughts, and actions needed to achieve particular social goals, social competence includes several interrelated abilities. These include the ability to encode and accurately interpret relevant social cues, the ability to realistically anticipate possible obstacles to and consequences of one's actions, and the ability to effectively problem-solve around interpersonal conflicts, including effective solution generation and translation of decisions into

successful actions (Caplan et al., 1992; Consortium on the School-Based Promotion of Social Competence, 1994). While some research on social competence has focused on its generally protective role, such as its facilitation of positive social relationships and connection to peers, family, and community (Masten & Coatsworth, 1998; Pittman, Irby, Tolman, Yohalem, & Ferber, 2003), other research has more specifically explored the developmental interplay between social competence and externalizing behaviors. Much of this latter work has demonstrated the particularly problematic role of low social competence in children with early heightened aggression.

Research indicates that aggression and poor social competence often co-occur. That is, children with elevated levels of aggressive behavior commonly also demonstrate low levels of social competence (Keane & Calkins, 2004; Welsh, Parke, Widaman, & O'Neil, 2001) and show low rates of prosocial behavior (Bornstein, Hahn, & Haynes, 2010; Denham et al., 2003; Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000; Warden, Cheyne, Christie, Fitzpatrick, & Reid, 2003). The common co-occurrence of aggression and low social competence is likely partially a result of shared risk factors that contribute to the development of these behaviors in early childhood. For example, both aggression and poor social competence have been linked to a variety of psychosocial stressors, including poverty, low parental warmth, and harsh and punitive parenting (Hastings et al., 2000; Kaiser, Hancock, Cai, Foster, & Hester, 2000; Zhou, et al., 2002), as well as to contextual risk more generally (Lengua, Honorado, & Bush, 2007). Further, earlier deficits in social competence have been shown to predict later problems with aggression and externalizing behavior (Bornstein et al., 2010; Hastings et al., 2000; Sorlie, Hagen, & Ogden, 2008). However, despite their considerable overlap, aggression

and social competence represent distinct behavioral dimensions that necessitate consideration separately, as well as together (Sorlie, et al., 2008).

Extensive research indicates that children with elevated levels of aggressive behavior are at risk for social difficulties. Beginning in early elementary school, demonstration of disruptive and aggressive behaviors places children at risk for being disliked by peers and being judged as unpopular (Coie & Dodge, 1998; Warden et al., 2003). As a result, children who are aggressive at school often have few friends and are rejected by mainstream peers (Bierman, 2004). Similarly, poor social competence also places children at heightened risk for problems with peers. Across childhood and adolescence, youth with low rates of prosocial behavior and poor social problem-solving skills are less likely to be perceived as popular by peers (Coleman & Byrd, 2003; Denham et al., 2003; Gifford-Smith & Brownell, 2003; Warden & MacKinnon 2003). They are also more likely to have fewer friends and unreciprocated or poorer quality friendships (Rose & Asher, 2004; Wentzel, Barry, & Caldwell, 2004). Given the social consequences of aggressive behavior and poor social competence, it follows that children with these concurrent difficulties are at particularly high risk for peer dislike and rejection (Bierman, 2004; Keane & Calkins, 2004).

Supporting the role of social competence in the development of antisocial behavior and peer problems, research has also demonstrated that these patterns are bidirectional, with problems in one area often contributing to problems in the other over time. Indeed, as children spend more time with their peers, their individual behaviors become increasingly shaped and influenced by the behaviors of those peers. For children with elevated levels of aggression and/or poor social competence, rejection by socially adept mainstream peers deprives them of exposure to more socially competent models of behavior and thus opportunities to develop more prosocial

tendencies. Further, facing rejection by more adept peers, children with social difficulties often develop mutual friendships, which typically model and reinforce poor social skills and antisocial behaviors (Powers & Bierman, 2013; Snyder et al., 2008). As such, children entering school with social behavior difficulties face heightened risk of establishing friendships that exacerbate these difficulties, further isolating them from mainstream peers and positive social models, and thus contributing to a developmental cascade of escalating antisocial behavior (Dishion & Tipsord, 2011).

In addition, children with social difficulties and aggressive tendencies are often poorly equipped with the skills needed to successfully engage in the classroom environment, and as a result, are at risk for reduced classroom participation and poor academic functioning (Blair, 2002; Buhs & Ladd, 2001; Coolahan, Fantuzzo, Mendez, & McDermoot, 2000). As children with poor social skills and aggressive behaviors face academic difficulties and struggle to positively engage in the classroom environment, they often experience lack of connection to and support from teachers (Bradshaw, O'Brennan, & McNeely 2008; Catalano, Berglund, Ryan, Lonczak, & Hawkins, 2004). This dismissal by teachers, combined with rejection from mainstream peers, contributes to feelings of devaluation by and isolation from the school environment (Hawkins & Weis, 1985). Exacerbated by affiliation with problematic peers who reinforce deviant norms, children with these difficulties become further alienated from school and the conventional goals and values associated with this key socializing system, leading to increased risk for delinquency and further development of antisocial behavior (Blum et al., 2004; Eisenberg, Fabes, & Spinrad, 2006; Hawkins & Weis, 1985).

In support of the key role of early social competence, growing research has linked early social competence to reduced antisocial behavior and better adjustment in adulthood (Carneiro,

Crawford, & Goodman, 2007; Heckman, 2006). Using the control sample of the Fast Track study, Jones, Greenberg, and Crowley (2015) found that children's kindergarten social competence, including the ability to cooperate with peers, understand feelings, and independently resolve social problems, was a strong predictor of multiple young adult outcomes. In particular, the study demonstrated that, while controlling for relevant child and contextual factors, children's kindergarten social competence negatively predicted criminal behavior, including young adult arrests and arrests for severe offenses, and positively predicted indices of educational attainment and stable employment at age 25.

### **Focus on Competencies**

In many ways, the accumulation of research on social competence in the past few decades reflects an important conceptual shift in developmental theory and research. Specifically, it reflects a shift away from the exclusive study of risk towards the study of resilience, or the demonstration of competence in the face of significant adaptive or developmental challenges (Masten & Coatsworth, 1998). Whereas risk research seeks to identify the factors that increase the likelihood of poor outcomes, resilience research aims to identify protective factors that reduce the likelihood of such outcomes in contexts of heightened risk (Catalano et al., 2004). As such, with a focus on resilience, researchers increasingly explored the role of individual competencies, specific patterns of effective adaptation, that protect against maladaptive outcomes (Masten & Coatsworth, 1998; Zins & Elias, 2006), with specific attention to the role of social and emotional competencies.

### **SEL Programming**

Echoing this theoretical shift towards a focus on competencies and emerging evidence on the protective function of social competence, intervention science began to move towards a

model of prevention that underscored the importance of competency development (Greenberg et al., 2003; Zins & Elias, 2006). During a landmark meeting of the Fetzer Institute in 1994, in recognition of the key role of social competence in positive youth development and the need for prevention programs to address this competency, researchers introduced the term social and emotional learning (SEL), broadly referring to the acquisition of skills necessary for socially competent behavior (Elias et al., 1997). Following this meeting and the creation of the Collaborative for Academic, Social, and Emotional Learning (CASEL), an organization dedicated to incorporating SEL into school-based programming (see [www.CASEL.org](http://www.CASEL.org)), SEL became established as a key target for school-based prevention and promotion interventions (Greenberg et al., 2003).

The rise of SEL for school-based programming in the last twenty years has redirected attention to the promotion of skills and individual competencies believed to play a crucial role in the development of socially competent behavior. In particular, SEL programming focuses on five main competencies: self-awareness, including recognition of one's emotions; social awareness, including empathy and perspective taking; responsible decision making; self-management, including emotion regulation and goal setting; and relationship skills, including cooperation, helping behaviors, and communication (Collaborative for Academic, Social, and Emotional Learning, 2005). Generally, SEL programs attempt to help build these competencies through multiple mechanisms, including interactive instruction of SEL skills, promotion of caring and engaging classroom and school practices to foster student connection to school, promotion of partnerships among school, families, and the community, and development of supports that foster student social-emotional adjustment and academic success (Elias et al., 1997). Due to the broad scope of these intervention targets, many of these programs involve multiple intervention

components and occur across multiple years, with such programs typically demonstrating more effective results (Greenberg et al., 2003).

While the overarching goal of SEL programs is to generally build social and emotional competencies to improve student functioning across both academic and psychosocial domains, the SEL framework has very often been applied to the particular area of violence prevention (Zins & Elias, 2006). Such SEL-based violence prevention programs are organized around the idea that fostering the development of abilities needed to adaptively approach and navigate social situations, particularly social conflict, will help improve children's aggressive behavior. In many ways, these programs, which utilize modeling and reinforcement of socially competent behavior, also draw heavily from social learning theory (Hahn et al., 2007; Miller & Prinz, 1990). However, unlike programs solely focused on the diminishment of aggressive and disruptive behavior, SEL programs aimed at the prevention of violence emphasize the development of adaptive social functioning and prosocial behavior as key mechanisms in the reduction of violent outcomes.

SEL-based violence prevention programs have varied in emphasis, with some including a strong focus on the home environment and promoting family, as well as child, competencies (e.g. Reid, Eddy, Fetrow, & Stoolmiller, 1999), and some consisting solely of school-based practices (e.g., Botvin, Griffin, & Nichols, 2006). Additionally, while some programs have focused mainly on preschool and early elementary populations (e.g., Shure, 1993; Webster-Stratton, Reid, & Hammond, 2004), others have targeted older children, such as youth transitioning to adolescence (e.g., Lochman & Wells, 2004). Still, all of these programs share a central emphasis on fostering social and emotional competencies in order to prevent the development of aggressive and antisocial behaviors.

The use of SEL-based methods in the prevention of antisocial behavior has been consistently linked to positive outcomes (Wilson, Gottfredson, & Najaka, 2001), with programs targeting interpersonal competencies demonstrating greater efficacy than those exclusively targeting skills aimed at non-aggressive responding (Mytton, DiGuseppi, Gough, Taylor, & Logan, 2006). In particular, a large number of SEL-based violence prevention programs have shown positive effects on the reduction of problem behaviors such as aggression, violence, truancy, substance use, and sexual risk taking. They have also been linked to improvements in social and emotional skills, problem solving, nonverbal reasoning, and academic functioning, as well as increased self-efficacy, more positive school attitudes, and greater involvement in school and the community (Catalano et al., 2004; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Zins & Elias, 2006).

The PATHS® (Promoting Alternative Thinking Strategies) Curriculum (Kusche & Greenberg, 1994) is one such SEL program, implemented with school-aged children at the universal level (i.e., delivered to all students in a classroom), that has been consistently associated with positive outcomes. In particular, the program, which targets the development of emotional awareness, self-regulation, prosocial skills, and the facilitation of a positive peer climate, has been associated with increased emotion recognition, emotional understanding, social problem-solving, and social competence, as well as reduced externalizing and internalizing behaviors (Greenberg & Kusche, 1998; Greenberg, Kusche, Cook, & Quamma, 1995; Riggs, Greenberg, Kusche, & Pentz, 2006).

Another area of SEL programming that has shown robust effects on social-emotional development and reduction of antisocial behavior is that of social skills training interventions (Losel & Beelmann, 2003). Social skills training programs, which typically occur in peer group

settings, provide children with a live interpersonal context in which to practice and receive coaching on social-emotional competencies, thus scaffolding their development of these abilities (Lochman & Wells, 1996). As such, social skills training programs allow for an intensive focus on improving children's social skill deficits (Bierman, Miller, & Staub, 1987) and show particularly strong effects among at-risk groups (Losel & Beelmann, 2003).

### **The Fast Track Intervention**

The Fast Track Program, initiated in the early 1990's, was one of the earliest multicomponent, SEL-based violence prevention programs and is the focus of the current study. Comprising both home and school interventions at universal and indicated levels and extending over a 10-year period, the program represents the most ambitious SEL program to date. Implemented with at-risk youth at school entry, Fast Track was founded on developmental theory and research emphasizing the role of child, family, and community risk factors, and their interactive and cumulative influences on the development of antisocial behavior. According to this framework, child vulnerabilities, such as impulsivity, emotional reactivity, and poor emotional control, in conjunction with parental tendencies towards harsh and inconsistent discipline, place children at risk for engagement in behavioral patterns (e.g., escalating coercive interactions with parents) that contribute to the development of elevated aggressive and disruptive behaviors (Conduct Problems Prevention Research Group [CPPRG], 1992). Often compounded by contextual factors, such as poverty and community violence, this developmental pattern heightens children's risk for entering school with elevated aggressive behaviors and without the social-emotional competencies needed for successful academic and social functioning (Guerra, Huesmann, & Spindler, 2003; Ryan, Fauth, & Brooks-Gunn, 2006). Subsequently, lack of early school success places them at further risk for continuing along a

trajectory of increasing antisocial behavior, and engagement in delinquency, violence, and crime in adolescence and early adulthood (Dodge & Pettit, 2003).

Beginning in 1991, Fast Track was implemented in four different, predominately high poverty, areas of the United States. Children were screened in kindergarten for elevated conduct problems and were randomly assigned to the intervention or control condition based upon the school of first-grade matriculation. Children received the intervention from first grade through tenth grade, with the heaviest concentration of the intervention in the first few years. A major goal of the intervention was to help children develop social competencies that contribute to positive social, emotional, and academic functioning and that reduce risk for engagement in violent and antisocial behavior. To achieve this goal, the intervention consisted of multiple separate components, each addressing a different area of risk. Children selected into the intervention participated in social skills training groups (i.e., Friendship Groups) in which they reviewed and practiced skills relating to emotional understanding, prosocial behavior, self-regulation, and social problem-solving. In order to help generalize these competencies to the classroom setting, children also engaged in “peer-pairing” sessions in which they were encouraged to practice these skills while playing with individual classroom peers. In addition, children received reading tutoring aimed at promoting their literacy and general academic competencies. Parents of children in the intervention received behavior management training focused on effective parenting practices and the use of strategies to support their children’s developing social competence and self-regulation skills. To support parents in the practical application of these practices, parents also received home visits from intervention staff. Lastly, at the universal level, the PATHS® Curriculum was implemented in first through fifth grade classrooms in all schools containing children in the intervention, with the aim of promoting

positive management of classroom behavior and reducing problems associated with disruptive and chaotic classroom environments (Kusche & Greenberg, 1994).

Prior studies exploring the efficacy of Fast Track have demonstrated positive effects of the intervention on child social and emotional functioning, antisocial behavior, and overall adjustment. In particular, in the first few years of elementary school when intervention delivery was most intensive, children receiving the intervention showed greater gains in core social-emotional skills (emotion recognition, emotion coping, social problem-solving), more positive peer interactions and improved peer acceptance, and greater reductions in aggressive and disruptive behaviors, relative to control children (CPPRG, 1999, 2002a). By late adolescence, youth in the intervention condition experienced fewer juvenile arrests, and among those with greater levels of initial risk, there was an intervention effect on reduction of high-severity adult arrests (CPPRG, 2010a). Importantly, the intervention also demonstrated positive effects that were sustained following completion of the intervention and into adulthood. In particular, at the age of 25, individuals who had received the intervention were less likely to have externalizing, internalizing, or substance use psychiatric problems, showed lower rates of engagement in violent crime and risky sexual behavior, and had higher levels of overall well-being (CPPRG, 2015).

Fast Track, and other similar SEL programs, is based on the central tenet that, through promoting the development of social competence, particularly in the early elementary years, reduction of antisocial behavior and facilitation of positive adjustment can be achieved, with long-lasting effects into adulthood. However, in the case of Fast Track and other similar interventions, the question of whether early intervention effects on social competence accounted for later intervention effects on crime and related outcomes remains largely unexplored.

## **Exploration of Mechanisms in Intervention Research**

The lack of research on the extent to which the purported mechanism of change (i.e., development of social competence) accounts for the effects of Fast Track and similar violence prevention programs is not specific to violence prevention research. In fact, across intervention and prevention science, considerably little research has specifically investigated the means, or mechanisms, by which interventions produce their positive outcomes. Yet, the exploration of mechanisms in interventions is crucial for several reasons. Most importantly, the exploration of mechanisms in an intervention enables testing of the intervention logic model. Logic models, which delineate the theorized pathway of change in an intervention, typically assert that an intervention works through affecting one or more proximal, or mediating, variables that subsequently impact the more distal or longer-term outcomes. A test of intervention mechanisms asks the question, does the intervention produce a given outcome through its effect on the mediating variable, as specified by the logic model? More specifically, does the intervention change the mediating variable, and, if so, does this change account for the change in the outcome? (Krull & MacKinnon, 2001; MacKinnon & Dwyer, 1993). Testing theorized mechanisms of change is particularly important for multicomponent interventions which, in addition to including multiple intervention elements, often postulate multiple mediating mechanisms. For such programs, a test of mechanisms can elucidate whether certain outcomes are being driven by the theorized mediating variables or whether they are being driven by other factors, and thereby inform future refinement of the intervention design. Further, since intervention logic models are typically based on broader theoretical frameworks, testing and, if needed, re-conceptualization of logic models can lead to the scientific revision and refinement of such frameworks (CPPRG, 2002b).

To the extent that mediational pathways can be explored at an individual level, evidence of effective intervention mechanisms can also provide valuable information regarding variability in treatment response. Given that individuals receiving the same intervention very often experience substantial differences in treatment outcome, variability in treatment response is an issue of central importance to intervention science. In fact, in recent years there has been a call for more careful study of variation in intervention impact, with specific attention directed towards investigating for whom, and under what conditions, interventions work (Raudenbush & Bloom, 2015).

Indeed, helping to unpack treatment response variability, evidence of a mediating mechanism of a distal intervention effect can provide researchers with a proximal index of who will experience that later effect (Raudenbush & Bloom, 2015). For example, if intervention-promoted improvements in proximal skills across the early elementary years mediate the effect of an intervention on a later adolescent outcome, assessment of individual differences in the degree of early skill development may allow for identification of children who are more and less responsive to the intervention and more or less likely to demonstrate that later outcome. In this way, an empirically validated mediating mechanism can serve as a proximal index of individual treatment response, with potential utility for the refinement and modification of continued intervention implementation. For multi-year violence prevention programs such as Fast Track, in which mediating mechanisms/proximal indicators (e.g., improved social competence) may precede the distal outcome (e.g., reduced criminal activity) by many years, identification of early indices of treatment responsiveness are likely to be especially useful, as they can inform timely program modification needed for maximally effective intervention implementation.

## **Studies Examining Mechanisms of Change in the Fast Track Intervention**

With regard to the Fast Track intervention, only a couple of studies have explored mediating mechanisms related to social competencies. In the first study, which assessed high school outcomes, the effect of the intervention on ninth grade delinquent behavior was shown to be mediated by multiple indices of social cognitive functioning across the elementary school years, including competent responding to social problems, reduction of hostile attributions, and improved evaluation of aggressive responding (Dodge, Godwin, & CPPRG, 2013). The other study, conducted by Sorensen and colleagues (2015), investigated the degree to which gains in interpersonal and intrapersonal competencies in elementary school mediated the effect of Fast Track on criminal behavior and mental health outcomes in early adulthood. Specifically, the study assessed interpersonal competence, including social competence, aggressive behavior, and peer sociometric status, and intrapersonal competence, including emotion regulation, social cognitive skills, emotion coping, and social problem-solving abilities, across the elementary school years. Results indicated that reduced criminal outcomes were mediated by the effect of the intervention on interpersonal competence and intrapersonal competence, accounting for about 10 and 20 percent of the overall intervention effect on crime, respectively. These important findings support the role of interpersonal competencies, such as social competence, as key mechanisms of action in the Fast Track intervention.

While validating the logic model of Fast Track, the methodology used in the Sorensen et al. (2015) study does not allow for an examination of individual differences in Fast Track responding, nor did it compare the relative contribution of the promotion of social competence versus the reduction of aggressive responding as mediators of later effects on crime. These are

two core goals of the present study that guide its use of an individual growth modeling approach to analyses.

### **Individual Growth Modeling**

As more intervention studies have focused on investigating intervention mechanisms and exploring complex patterns of change, individual growth modeling (i.e., longitudinal growth modeling) has been increasingly looked to as an important statistical technique for intervention research. Generally regarded as helpful for exploring individual-level change and individual differences in change (DeLucia & Pitts, 2006; Lipsey & Cordray, 2000; Rogosa, Brandt, & Zimowski, 1982), individual growth models provide a useful way for understanding behavior change in the context of interventions. First, individual growth models are helpful because they assess change across multiple time points, providing a continuous representation of change that includes information about the rate and shape of growth over time (DeLucia & Pitts, 2006; Rogosa et al., 1982). In addition to generally allowing for a more descriptive depiction of change, this continuous representation of change is more likely to accurately reflect developmental theories of behavior and behavioral intervention. Indeed, developmental theories of behavior typically illustrate change in a continuous manner, with change often characterized by rates of growth that vary at different points in time (e.g., acceleration, steady growth, deceleration, plateauing) (Curran & Muthén, 1999). As such, the use of individual growth analyses to model change in an intervention-targeted behavior (e.g., social competence) is more likely to sensitively and appropriately reflect the complex nature of the behavior change.

Second, since individual growth models provide information about individual-level change, as well as aggregate-level change, they allow for the investigation of individual variability in growth, as indicated by individual variability in intercepts and rates of change. This

information not only enables researchers to explore whether individuals show different rates of growth over time, but also allows them to investigate potential person-level predictors of such variability, such as initial status in the phenomenon of interest (Bryk & Raudenbush, 1987; Taylor, Graham, Cumsille, & Hansen, 2000).

Given the benefits of individual growth modeling, this approach provides a very useful tool for exploring change in the context of intervention studies. Beyond providing information on whether an intervention resulted in change in a certain domain, the use of individual growth modeling can provide information on the manner in which an intervention influenced change over time (Bryk & Raudenbush, 1987; DeLucia & Pitts, 2006; Lipsey & Cordray, 2000). For example, modeling individual growth in the context of an intervention promoting social competence could show that the intervention produced its effect by promoting a sharp increase in social competence that slowly decelerated and stabilized over time, or alternatively, that the intervention produced its effect by contributing to a steady and gradual increase in social competence over time. Importantly, the ability to model main effects of intervention in this more nuanced manner provides more statistical power to detect intervention effects (Taylor et al., 2000). Individual growth models can also be used to explore processes of mediation in interventions, with analyses exploring how growth in mediating mechanisms may impact intervention outcomes (DeLucia & Pitts, 2006).

Indeed, several studies have used individual growth modeling to demonstrate positive intervention effects. For example, in an evaluation of a substance prevention program for adolescents, growth modeling revealed positive effects of the program on rate of growth in cigarette and alcohol use, with youth in the intervention demonstrating lower rates of growth than those in the control group (Taylor et al., 2000). In a similar study exploring the effects of

another drug prevention program, the program increased growth in parenting behaviors dissuading alcohol use and also reduced growth in youth alcohol rates over a three-year period (Park et al., 2000). Furthermore, a small number of intervention studies have explored individual growth in mediating mechanisms, demonstrating positive associations between individuals' growth in proximal domains and later intervention outcomes (e.g., Cheong, MacKinnon, & Khoo, 2003). Conceptually, individual growth curves might also be used to identify treatment responders and non-responders, although they have not yet been applied in this way.

### **The Present Study**

The general utility of SEL-based violence prevention programs has been established, with many such programs demonstrating positive effects, and several, including Fast Track, having been identified as model or promising programs by the Center for the Study and Prevention of Violence (Mihalic, Irwin, Elliott, Fagan, & Hansen, 2001). Yet, despite the positive effects of these programs on the reduction of violence and antisocial outcomes, knowledge regarding the ways in which they work is quite limited. To be sure, the majority of SEL-based violence prevention programs are based on theoretical frameworks underscoring the role of early social-emotional deficits and elevated aggression in patterns of problematic peer relations, academic difficulties, and disconnection from school, that, together, lead to trajectories of antisocial and criminal behavior (Dodge et al., 2008). Accordingly, many intervention models conceptualize the development of social competence to be a central means through which the intervention achieves its effect on antisocial behavior reduction. Indeed, the Fast Track model postulates that much of the intervention effect on distal outcomes of antisocial behavior and crime stems from early growth in social competence, which provides a crucial foundation for continued positive

social, emotional, and academic growth, thus protecting against antisocial behavior development (CPPRG, 1992).

Yet, despite the theoretical basis for this general intervention model, very little research has actually explored its purported mechanism of action, that is, that the intervention's ultimate effect on antisocial behavior is an outcome of the intervention's earlier effect on social competence. Further, no investigations of Fast Track or any other SEL-based violence prevention programs, to the author's knowledge, have explored individual-level growth in social competence, and tested for mediation of long-term prevention effects, nor examined individual differences in growth as an index of positive treatment responding. The present study aims to address these gaps in the violence prevention literature.

Seeking to help advance the understanding of effective violence prevention programs and their underlying mechanisms, the current study explored the extent to which the development of early elementary social competence accounted for the positive long-term effects of Fast Track's SEL-based violence prevention model on crime. Specifically, using data from the Fast Track intervention, the study examined how children's individual growth in social competence during the first three years of the intervention mediated the effect of the intervention on initiation of criminal activity by early adulthood. Due to the considerable overlap between early elementary deficits in social competence and aggressive behavior, and their bidirectional and interactive influences on antisocial development, the study similarly explored growth in aggression over the first three years of the intervention and its role in mediational pathways from intervention to criminal activity. Recognizing that base rates of social competence and aggression, as well as criminal activity, vary for boys and girls, the study also examined the degree to which these associations were moderated by gender and initial (pre-intervention) levels of social competence

and aggression. Finally, the study explored the degree to which individual differences in treatment responsiveness, represented by early growth in social competence and aggression, accounted for the later intervention benefits, thus providing a potential proximal index of intervention response. With the aim of identifying a treatment responsiveness index that could be easily implemented during the course of intervention, social competence and aggression growth were assessed via individual teacher ratings, which provide reliable, cost-effective assessments of behavior with particular utility in the context of school-based intervention.

With the central goal of exploring the degree to which individual differences in treatment responsiveness, reflected by early growth in social competence and aggression, accounted for ultimate treatment impact on crime, the study included the following six aims: (1) examine the effect of intervention on individual growth in social competence from kindergarten (pre-intervention) through third grade, (2) examine the extent to which the effect of intervention on social competence growth accounts for the initiation of criminal activity by early adulthood, (3) examine the effect of intervention on growth in aggression from kindergarten through third grade, (4) examine the extent to which the effect of intervention on aggression growth accounts for the initiation of criminal activity by early adulthood, (5) explore the extent to which intervention effects on social competence growth and aggression growth are moderated by baseline child characteristics, including gender and initial levels of social competence and aggression, and (6) explore the combination of markers of social competence and aggression (i.e., individual initial levels, individual growth) that best allow for the identification of treatment responders identified based on crime outcomes.

With regard to Aims 1 and 2, it was predicted that the intervention would result in positive growth in social competence and that growth in social competence would mediate the

effect of the intervention on the initiation of criminal activity by early adulthood. With regard to Aims 3 and 4, it was predicted that the intervention would result in reduction (i.e., negative growth) in aggression and that growth in aggression would mediate the effect of the intervention on the initiation of criminal activity by early adulthood. Due to the exploratory nature of Aims 5 and 6, no specific hypotheses were generated.

## **Method**

### **Participants**

This study was conducted across four separate geographical sites: (1) Durham, North Carolina, a small city with a sizable low-income population that is predominantly African-American; (2) Nashville, Tennessee, a moderate-sized city comprised of a low- to middle-income, African-American and European American population; (3) Seattle, Washington, a moderate-sized city with a low- to middle-income population and low to medium levels of ethnic diversity; and (4) central Pennsylvania, a primarily rural area with a predominately low- to middle-income European American population. Site minority and poverty (represented by free or reduced lunch rates in participating schools) statistics were as follows: Durham, 90% minority, 80% free/reduced lunch; Nashville, 54% minority, 78% free/reduced lunch; Seattle, 52% minority, 46% free/reduced lunch; and rural Pennsylvania, 1% minority, 39% free/reduced lunch.

Schools in high-risk areas (based on crime and poverty statistics) were selected within each site (12 in Durham, 9 in Nashville, 16 in Seattle, and 18 in Pennsylvania). Within each site, schools were divided into sets of pairs matched on demographics (size, ethnic composition, rates of free or reduced lunch), and within each pair, one school was assigned to intervention and one was assigned to control.

To identify children with elevated levels of aggressive-disruptive behavior, a multiple-gating screening procedure was applied to kindergarteners in each of the schools across three successive cohorts (1991-1993), with 9,594 kindergarteners screened in total. First, children were screened for conduct problems by teachers using 10 items from the Authority Acceptance subscale of the TOCA-R (Werthamer-Larsson, Kellam, & Wheeler, 1991). Children who scored within the top 40% within site and cohort were then selected for the next step of the screen, and their parents were contacted and asked to provide information on behavior problems at home. Ninety-one percent ( $n = 3,274$ ) agreed to provide ratings of their children using 24 items comprised from the Child Behavior Checklist (CBCL; Achenbach, 1991), the Revised Behavior Problem Checklist (Quay & Peterson, 1987), and similar items created for the study. Next, the teacher and parent ratings were standardized within site, based on a normative sample of approximately 100 children identified within each site, and summed together to produce a final screen score. Using this score, children were then recruited for the Fast Track high-risk sample beginning with the highest score and moving down the list until desired sample sizes were reached within sites, cohorts, and groups.

The final Fast Track high-risk sample included 891 children ( $ns = 445$  for intervention and 446 for control) with a mean age of 6.5 years ( $SD = 0.48$ ) at the time of identification. Across the four sites, the sample was 51% African-American, 47% European American, 2% other ethnicity (e.g., Hispanic, Pacific Islander), and 69% male. Reflecting elevated levels of socioeconomic disadvantage, 58% of children came from single-parent families, 29% of parents were high school dropouts, and 35% of families were in the lowest socioeconomic class, according to Hollingshead scoring (Hollingshead, 1975). Regarding the high-risk nature of the sample, on the kindergarten Teacher's Report Form of the Child Behavior Checklist (TRF;

Achenbach, 1991), the average Externalizing T-score (available for 88% of the sample) was 66.4, with 76% of children scoring above a T-score of 60, signifying sub-clinical to clinical levels of externalizing behavior problems.

For the current study's purpose of estimating behavior growth, children who were missing data on social competence at two or more of the four time points (i.e., kindergarten, first grade, second grade, third grade) and those who were missing data on aggression at two or more of the four time points were excluded, resulting in a final sample of 766 children ( $ns = 389$  for intervention and 377 for control). As compared to participants excluded from the final sample on account of missing data, participants included in the final sample were more likely to be from the Durham or Pennsylvania sites, less likely to be from the Nashville site, more likely to be from Cohorts 2 or 3, and less likely to be from Cohort 1. They did not differ on pre-intervention teacher ratings of social competence or aggression. Participants in the intervention and control conditions also did not differ on pre-intervention teacher ratings of social competence or aggression.

For the analyses predicting the initiation of criminal activity, participants were only included if arrest records were available (698 of the original 766 participants, 91%). As compared to participants without arrest records, participants with arrest data who were included in the sample were more likely to be African-American and were more likely to have lower IQ scores.

## **Intervention Procedures**

**Elementary school phase (Grades 1-5).** The elementary school phase of Fast Track consisted of intervention components at both the universal (school-based) and indicated levels.

***Universal intervention.*** For the universal component of the intervention, an SEL-focused curriculum, the PATHS® Curriculum (Kusche & Greenberg, 1994), was implemented in all intervention schools from Grade 1 through Grade 5. Classroom teachers, who were trained in the curriculum prior to implementation, delivered the program throughout the school year and taught on average two to three lessons per week (see Bierman, Greenberg, & CPPRG, 1996 for more details). Teachers implementing the program received support and consultation from Fast Track Educational Coordinators (EC's) who visited classrooms and met with the teachers weekly. During these visits, EC's also monitored fidelity of implementation. Lessons from the curriculum addressed four main areas of social-emotional skills: (1) skills for emotional understanding and communicating (i.e., recognizing and labeling emotions), (2) friendship skills (i.e., participation, cooperation, fair play, negotiation), (3) self-control skills (i.e., behavioral inhibition and arousal modulation), and (4) social problem-solving skills (i.e., problem identification, response generation, response evaluation, and anticipatory planning). At each grade level, the content of the curriculum expanded upon the content of the curriculum from the previous grade level, with concepts introduced in a developmentally guided sequence.

***Indicated interventions.*** In addition to the PATHS® Curriculum implemented at the classroom level, children in the high-risk intervention condition and their families were offered several other intervention components, including parent groups, child social skills training, peer pairing, academic tutoring, and home visiting.

***Enrichment program.*** Parent and child groups were conducted during a weekly two-hour "enrichment program" held at the school on weekday evenings or Saturdays. During the first hour of the enrichment program, high-risk intervention children met in groups of five or six in Friendship Groups. These groups, led by EC's and coleaders, focused on reviewing and

practicing skills in emotional understanding and communication, friendship building, self-control, and social problem-solving. Discussions, stories, films, and role-plays were used to review and develop skill concepts, and cooperative activities allowed for the practice of skills (see Bierman et al., 1996 for more details).

At the same time that children met in Friendship Groups, parents met in a group focused on parenting strategies led by Family Coordinators (FC's) and coleaders. The group, aimed at helping parents support children's school adjustment and improve child behavior, focused on the following areas: (1) establishing a positive family-school relationship and supporting child adjustment to school, (2) fostering parent self-control, (3) promoting developmentally appropriate expectations for child behavior, and (4) improving parenting skills to enhance parent-child interactions and decrease disruptive child behavior. Session content and training techniques were drawn from the parenting program developed by Forehand and McMahon (1981), with additional material drawn from the programs developed by Webster-Stratton (1989) and Burgoyne, Hawkins, and Catalano (1991; see McMahon, Slough, & CPPRG, 1996 for more details about the parent-focused intervention components).

Following the child and parent groups, children and their parents met together for 30 minutes during which they participated in cooperation activities, including games, crafts, and joint reading. During this time, parents were encouraged to practice the parenting skills that had been presented in the group, and staff support was provided (see McMahon et al., 1996 for more details).

*Home visits.* In order to provide further support to families, FC's conducted home visits focused on addressing individual family needs and helping parents and children generalize the skills addressed in the enrichment program. These visits, which were conducted every other

week on average and supplemented by telephone contact between visits, specifically aimed to: (1) promote the development of trusting relationships between FC's and families, (2) support generalization of new parenting skills to the home environment, (3) promote parent support for child school adjustment, and (4) promote parent problem-solving, coping, and goal-setting skills in order to manage stressful life events. The promotion of problem-solving was modeled after the problem-solving approach developed by Wasik, Bryant, and Lyons (1990) and centered on the ultimate goal of fostering parent empowerment and self-efficacy (Dunst, Trivette, & Deal, 1989).

*Peer pairing and academic tutoring.* At school, high-risk intervention children also engaged in weekly "peer-pairing" sessions in which they engaged in 30-minute play sessions with classroom peer partners (who rotated over the course of the year). These sessions, led by paraprofessional tutors, allowed high-risk children the opportunity to generalize friendship skills to the school setting and develop friendships with classroom peers. In addition, children received academic tutoring provided by the paraprofessional tutors. Tutoring, aimed at the promotion of reading skills, was based on the Wallach and Wallach (1976) tutoring program designed for children low in academic readiness and from disadvantaged backgrounds. During Grade 1, tutors met with children for three 30-minute sessions per week, with two sessions dedicated to academic tutoring and one session dedicated to peer pairing. In Grade 1, children also received tutoring during the weekly enrichment program. After Grade 1, tutoring was delivered as needed based on children's academic progress.

*Indicated intervention component dosage.* The greatest concentration of the intervention components occurred in Grade 1. The enrichment program sessions were held weekly in Grade 1 (total of 22 sessions), biweekly in Grade 2 (total of 14 sessions), and monthly during Grades 3 through 5 (total of nine sessions per year). With regard to home visiting, tutoring, and peer

pairing, the standard level of services (as previously described) was administered in Grade 1. Following Grade 1, staff used criterion-referenced assessments to adjust the level of each component to match the needs of each child and family (CPPRG, 2000). This study focused on the progress children made during the first three years of the intervention (Grades 1-3).

**Middle and early high school phase (Grades 6-10).** Fast Track continued to provide prevention services as children prepared for and navigated the middle school and high school transitions. Monthly group sessions were held during Grades 5 and 6, targeting issues of high relevance in adolescence.

In addition, in Grades 7 through 10, individualized intervention plans, based on assessments of risk and protective factors, were developed and implemented with each youth. Based on regular assessments of risk and protective factors made by staff, youth and families received either the base level of intervention contact (once per month) or additional intervention contact in the relevant domain (i.e., academic tutoring, mentoring, support for positive peer-group involvement, home visiting and family problem-solving, liaisons with school and community agencies). Additional intervention contact was implemented for up to several hours more per month.

**Intervention participation.** In the years of intervention studied here (Grades 1-3), rates of parent and youth intervention participation were high across sites. Ninety-eight percent of children and 96% of parents participated in at least one group session in Grade 1. Of those families, 90% of children and 79% of parents participated in at least half of all group sessions. In Grade 2, 92% of children and 88% of parents participated in at least one group session, with 87% of children and 79% of parents participating in at least half of all sessions. In Grade 3, 86% of children and 80% of parents participated in at least one group session, with 84% of children and

78% of parents participating in at least half of all sessions. In the subsequent years of group sessions, the proportion of families unable to participate increased at a rate of about 3% per year, largely as a result of families moving out of the area.

**Intervention staff and program fidelity.** Intervention staff were hired from local communities in order to match the ethnic composition of children at each site (as much as possible). EC's were usually former teachers, and FC's had either graduate degrees in counseling or social work, or extensive experience working with high-risk families. At the outset of the intervention, staff attended a 3-day cross-site workshop where they were trained in intervention procedures. Intervention fidelity was further ensured by manualization of all treatment components, regular cross-site training and communication, weekly staff meetings to prepare for upcoming sessions, and ongoing clinical supervision and feedback. Outside interventions (e.g., other school programs, other family services) were neither encouraged nor discouraged and were presumed to occur at the same rate in intervention and control groups. The control condition adhered to a "treatment as usual" model which included school prevention programs to the degree that schools chose to use them.

## **Measures**

**Childhood measures.** In each summer following kindergarten through Grade 3, trained research assistants conducted home visits in which they interviewed parents on a range of measures. During these visits, research assistants interviewed the primary caregiver (usually the mother) by reading the measures aloud and then recording the responses. As a part of these interviews, parents reported on family information, including information on demographics, socioeconomic status, and parent functioning, as well as on child behavior. Parents provided written consent, and children provided oral assent for study procedures. Parents were financially

compensated for completing interviews. All procedures were approved by the Institutional Review Boards of the participating universities.

In the spring of every year from kindergarten through Grade 3, classroom teachers provided ratings on the behaviors of each high-risk child. Teachers reported on children's social competence by completing the Social Competence Scale (CPPRG, 1995). Consistent with previous research on Fast Track exploring social competence (Jones et al., 2015), the present study focused on teacher ratings on the prosocial behavior subscale of the Social Competence Scale. The prosocial behavior scale included eight items describing the child's ability to interact positively with others (i.e., resolves peer problems on own, very good at understanding feelings, shares materials, cooperates with peers without prompting, helpful to others, listens to other points of view, can give suggestions without being bossy, acts friendly toward others;  $\alpha = 0.97$ ). Items were rated on a 5-point Likert scale, according to how well the item described the child (from 0 = not at all to 4 = very well). Teachers also reported on children's aggressive behavior by completing the externalizing subscale of the Child Behavior Checklist – Teacher Report Form (TRF; Achenbach, 1991), which included 34 items (e.g. argues, defiant, destroys things, fights, lies, attacks others, disruptive, explosive, stubborn, swears, teases, tantrums, threatening,  $\alpha = 0.97$  for girls, 0.96 for boys). Items were rated on a 3-point Likert scale indicating the presence of child behavior problems (0 = Not True; 1 = Somewhat or Sometimes True; 2 = Very True or Often True). Teachers received \$10 per child for completing these measures.

**Early adulthood outcome.** Court records at age 20 were collected from the court system in the youth's county of residence and surrounding counties and were supplemented using a national database that included all arrests, adjudications, and diversions, based on full name, birthdate, and social security number. Offenses were limited to convictions and diversions. In

order to index initiation of criminal activity by early adulthood, the probability of never having been arrested as a juvenile and the probability of never having been arrested as an adult, both outcomes on which Fast Track has demonstrated positive effects (CPPRG, 2010a; Sorensen et al., 2015), were combined. The resulting measure reflected probability of never having been arrested as a juvenile or as an adult.

### **Plan of Analysis**

Data analyses proceeded in several stages. First, correlations were computed to demonstrate simple associations among the study variables. Next, in order to estimate individual growth in prosocial behavior and aggression, individual growth models were computed to generate subject-specific estimates of slope (growth) and intercept. To examine the effect of the intervention on individual growth in prosocial behavior (Aim 1), linear regressions were computed with intervention status predicting subject-specific estimates of prosocial behavior slope. To examine the effect of the intervention on individual growth in aggression (Aim 3), this step was repeated with intervention predicting subject-specific estimates of aggression slope. Next, to examine the extent to which the effect of intervention on prosocial behavior growth and aggression growth accounted for initiation of criminal activity (Aims 2 and 4), logistic step-wise regressions with intervention and subject-specific estimates of slope predicting probability of no arrests were computed, and tests of mediation were employed. Then, to explore the extent to which intervention effects on prosocial behavior growth and aggression growth were moderated by baseline child characteristics, including gender and initial levels of prosocial behavior and aggression (Aim 5), interaction terms representing these factors were entered into the original linear regressions with intervention predicting subject-specific estimates of slope. Lastly, to explore the combination of markers of prosocial behavior and aggression that best allowed for

identification of treatment responders based on crime outcome (Aim 6), ROC curve analyses using the subject-specific estimates of slope and intercept for prosocial behavior and aggression were employed.

## Results

### Descriptive Analyses

The means and standard deviations for prosocial behavior and aggression at each of the four elementary school time points (kindergarten, first grade, second grade, third grade), and for initiation of criminal activity, are shown in Table 1, with means and standard deviations presented separately by study condition. Correlations among these variables are shown in Table 2. From kindergarten through third grade, prosocial behavior showed modest stability (average year-to-year  $r = .29$ ), and aggression showed moderate stability (average year-to-year  $r = .44$ ). Within each year, prosocial behavior and aggression were moderately inversely correlated (average with-year  $r = -.40$ ). Prosocial behavior and aggression were both modestly correlated with probability of no arrests in the expected direction (average prosocial behavior with probability of no arrests  $r = .18$ , average aggression with probability of no arrests  $r = -.29$ ).

### Estimating Individual Growth

To estimate growth in prosocial behavior and growth in aggression from kindergarten through third grade, unconditional growth models were fit using SAS 9.4 Proc Mixed (Singer, 1998). Ratings of prosocial behavior and aggression were nested within child over time, and random slopes and intercepts were estimated, with prosocial behavior and aggression modeled separately. For both prosocial behavior and aggression, linear and quadratic effects of time were modeled but only linear terms were significant, and therefore only linear effects of time were

Table 1. *Descriptive Statistics for Study Variables*

Variable	<u>Intervention (N = 389)</u>			<u>Control (N = 377)</u>		
	N	<i>M (SD)</i>	Range	N	<i>M (SD)</i>	Range
<u>Early Elementary Child Behavior (T)</u>						
Prosocial Behavior – Kindergarten	320	1.42 (0.74)	0.00 – 3.88	315	1.49 (0.70)	0.00 – 3.50
Prosocial Behavior – Grade 1	236	1.78 (0.80)	0.00 – 4.00	228	1.84 (0.98)	0.00 – 4.00
Prosocial Behavior – Grade 2	382	1.84 (0.91)	0.00 – 4.00	366	1.85 (0.89)	0.00 – 4.00
Prosocial Behavior – Grade 3	377	1.95 (0.86)	0.00 – 4.00	358	1.82 (0.93)	0.00 – 4.00
Aggression – Kindergarten	359	25.49 (15.80)	0.00 – 64.00	349	24.42 (15.50)	0.00 – 63.00
Aggression – Grade 1	381	22.45 (15.77)	0.00 – 62.00	365	21.54 (15.65)	0.00 – 63.00
Aggression – Grade 2	382	21.45 (15.99)	0.00 – 61.00	354	19.97 (14.74)	0.00 – 61.00
Aggression – Grade 3	377	20.12 (15.04)	0.00 – 59.00	360	19.50 (15.27)	0.00 – 59.00
<u>Early Adult Criminal Behavior (R)</u>						
Probability of No Arrests	361	0.44 (0.50)	0.00 – 1.00	337	0.40 (0.49)	0.00 – 1.00

*Note.* T = teacher rating, R = records.

Table 2. *Correlations among Study Variables within and across Time*

Variable	2	3	4	5	6	7	8	9
<u>Early Elementary Child Behavior (T)</u>								
1 Prosocial Behavior – Kindergarten	.12*	.23**	.21**	-.64**	-.23**	-.25**	-.23**	.14**
2 Prosocial Behavior – Grade 1	--	.35**	.35**	-.22**	-.69**	-.35**	-.34**	.11*
3 Prosocial Behavior – Grade 2		--	.46**	-.31**	-.42**	-.69**	-.43**	.23**
4 Prosocial Behavior – Grade 3			--	-.19**	-.36**	-.43**	-.66**	.23**
5 Aggression – Kindergarten				--	.38**	.38**	.30**	-.27**
6 Aggression – Grade 1					--	.52**	.48**	-.27**
7 Aggression – Grade 2						--	.55**	-.31**
8 Aggression – Grade 3							--	-.29**
<u>Early Adult Criminal Behavior (R)</u>								
9 Probability of No Arrests								--

Note. T = teacher rating, R = records.

\*  $p < .05$ . \*\*  $p < .01$ .

retained. In order to allow for estimates of initial level of prosocial behavior and aggression prior to intervention, intercepts were centered at kindergarten.

The intraclass correlations (ICCs) for prosocial behavior and aggression were .36 and .45, respectively, indicating that 36% of the variation in prosocial behavior over time and 45% of the variation in aggression over time was accounted for by the child. This pattern suggests moderate stability in prosocial behavior and aggression over time, in addition to substantial variability in both of these behaviors across the three years.

Results of the prosocial behavior unconditional growth model revealed significant increases in prosocial behavior from kindergarten through third grade ( $\gamma_{10} = .13, p < .001$ ), with an average intercept (i.e., prosocial behavior value in kindergarten) of 1.55. Results of the

aggression unconditional growth model revealed significant decreases in aggression from kindergarten through third grade ( $\gamma_{10} = -1.62, p < .001$ ), with an average intercept (i.e., aggression value in kindergarten) of 24.30.

### **Regressions Examining Individual Growth**

Subject-specific estimates generated from the unconditional growth models were used to generate the following variables: prosocial behavior slope ( $M = .13, SD = .09$ ), prosocial behavior intercept ( $M = 1.55, SD = 0.32$ ), aggression slope ( $M = -1.62, SD = 1.00$ ), and aggression intercept ( $M = 24.30, SD = 8.29$ ), which were saved as new variables and used in subsequent analyses. These variables were used to represent growth (slope) and initial levels (intercept) of prosocial behavior and aggression in the subsequent analyses. In addition, to control for certain relevant child and family characteristics prior to the start of the intervention, several background variables were included as baseline covariates. For the regression models, these covariates included information on demographics (gender, race, family socioeconomic status), family/neighborhood context (maternal depression, parental discipline, neighborhood quality), and child characteristics (prosocial behavior, aggression, IQ), assessed in kindergarten, as well as site and cohort identifiers. Parent ratings of prosocial behavior and aggression (i.e., parent ratings on the prosocial behavior subscale of the Social Competence Scale [CPPRG, 1995] and parent ratings on the externalizing subscale of the Child Behavior Checklist [Achenbach, 1991]) were used as the kindergarten prosocial behavior and aggression covariates. All of these baseline variables are shown in Table 3 and are described in more detail on the Fast Track study website, <http://fasttrackproject.org/data-instruments.php>.

Table 3. *Descriptive Statistics for Pre-intervention Covariates*

Variable	Intervention (N = 389)	Control (N = 377)
	<i>M (SD)</i>	<i>M (SD)</i>
Gender (Male Indicator)	.72	.67
Race (African-American Indicator) <sup>b</sup>	.53	.47
Family Socioeconomic Status	24.76 (13.19)	24.49 (12.26)
Maternal Depression (measured by the Feeling Scale)	16.15 (9.92)	16.69 (10.37)
Parental Discipline (mean of warmth, harsh, and appropriate discipline; measured by the Parent Questionnaire)	2.01 (.28)	1.99 (.27)
Neighborhood Quality (measured by the Neighborhood Questionnaire)	-.02 (.60)	-.03 (.59)
Prosocial Behavior (measured by the prosocial subscale of the Social Competence Scale – parent rating) <sup>a</sup>	2.42 (.69)	2.32 (.69)
Aggression (measured by the externalizing subscale of the Child Behavior Checklist – parent rating)	18.71 (8.61)	17.93 (8.08)
Average Standard Wechsler Intelligence Scale for Children Score <sup>b</sup>	-.05 (.78)	-.10 (.79)

<sup>a</sup>Data represents significant difference between intervention and control participants. <sup>b</sup>Data represents significant difference between participants with and without crime data (arrest records).

**Predicting individual growth.** To examine the effect of the intervention on individual growth in prosocial behavior and aggression, two separate linear regressions were computed. Both regression models included intervention status and the baseline covariates as predictors, with the first model including prosocial behavior slope as the outcome and the second model including aggression slope as the outcome. These regressions are presented in Table 4. Results from the first regression revealed a significant effect of intervention on prosocial behavior slope ( $\beta = .09, p < .05$ ), indicating that individuals in the intervention condition showed greater growth in prosocial behavior from kindergarten through third grade than those in the control condition. In particular, being in the intervention condition was associated with an increase of .09 points in prosocial behavior per year, equivalent to an increase of one standard deviation in prosocial behavior slope. Results from the second regression revealed that intervention did not have a significant effect on aggression slope, indicating comparable decreases in aggression over time for individuals in the intervention and control conditions.

**Individual growth as a mediator of outcome.** Given the demonstrated positive effect of intervention on prosocial behavior slope, a set of step-wise logistic regressions was computed to test the extent to which prosocial behavior slope mediated the effect of intervention on initiation of crime. For these analyses, only cases with outcome data (i.e., arrest records) ( $n = 698$ ) were included. This set of logistic regressions, focused on the prediction of initiation of crime, included intervention and the baseline covariates as predictors in step one, with prosocial behavior slope added as a predictor in step two. As shown in Table 5, when included in the first step of the model, intervention showed a significant effect on crime ( $B = .35, p < .05$ ), with individuals in the intervention condition 1.42 times more likely to have had no crime initiation than those in the control condition. When prosocial behavior slope was added in step two, it

Table 4. *Intervention Predicting Prosocial Behavior Growth and Aggression Growth*

Variable	Prosocial Behavior Slope (K – Grade 3)			Aggression Slope (K – Grade 3)		
	$R^2$	$\beta$	$F$	$R^2$	$\beta$	$F$
	.07		4.65**	.11		7.13**
Gender		-.08*			.12**	
Race		-.22**			.20**	
Family Socioeconomic Status		.03			-.07	
Maternal Depression		-.03			.06	
Parental Discipline		-.06			.05	
Neighborhood Quality		<.01			-.02	
Prosocial Behavior		-.02			.03	
Aggression		-.09*			.08	
IQ		.08*			-.08*	
Intervention		.09*			<.01	

*Note.* Regressions also control for site and cohort.  $df = 15, 742$ . K = Kindergarten.

\*  $p < .05$ . \*\*  $p < .01$ .

showed a strong positive effect on crime ( $B = 3.91, p < .01$ ), with a one unit increase in prosocial behavior slope associated with being 50.05 times more likely to have had no crime initiation. Also, when prosocial behavior slope was added in step two, the effect of intervention became nonsignificant ( $p = .11$ ), suggesting potential mediation. Formal tests of mediation for dichotomous outcomes (MacKinnon, & Dwyer, 1993) revealed that 1% of the intervention effect on crime outcome was mediated by prosocial behavior slope, with a subsequent Sobel-Goodman test indicating significant mediation ( $p < .05$ ).

Since the earlier regression analyses exploring the effect of intervention on aggression slope showed no significant effect of intervention, analyses testing for mediation of intervention

Table 5. *Intervention and Prosocial Behavior Growth Predicting Crime*

Variable	Probability of No Arrests		
	<i>B</i>	<i>SE B</i>	$e^B$
<u>Step 1</u>			
Intervention	.35*	.18	1.42
<u>Step 2</u>			
Intervention	.29	.18	1.34
Prosocial Behavior Slope	3.91**	1.03	50.05

*Note.* Control variables include site, cohort, gender, race, SES, maternal depression, parental discipline, neighborhood quality, kindergarten prosocial behavior, kindergarten aggression, and IQ.

$e^B$  = exponentiated *B*. Step 1 df = 15; Step 2 df = 16.

\*  $p < .05$ , \*\*  $p < .01$ .

effect on crime by aggression slope were not conducted.

**Moderation of intervention effect on individual growth.** To explore the extent to which intervention effects on prosocial behavior slope and aggression slope were moderated by gender or baseline levels of prosocial behavior and aggression, another set of linear regressions was conducted. Despite the previous finding of a null effect of intervention on aggression slope, moderation analyses for aggression slope were still explored, given that a null main effect does not preclude moderation. For this set of analyses, the subject-specific estimates of prosocial behavior intercept and aggression intercept generated from the unconditional growth models were used to represent initial level of prosocial behavior and initial level of aggression, respectively.

In order to test for the moderation of intervention effect by baseline characteristics, two sets of linear regressions were conducted, one based on the original linear regression predicting prosocial behavior slope and one based on the original linear regression predicting aggression

slope. For each set of regressions, the variables from the original regression were entered in step one, (i.e., intervention, baseline covariates), and one of five interaction terms representing each of the potential interactive effects was added in the subsequent steps. These terms included the following two-way interactions: intervention by gender, intervention by prosocial behavior intercept, and intervention by aggression intercept, as well as the following three-way interactions: intervention by gender by prosocial behavior intercept, and intervention by gender by aggression intercept. For the regressions with an interaction term involving prosocial behavior intercept or aggression intercept, the corresponding intercept variable was included as a predictor in step one. For the two-way interactions, the interaction term was added in step two. For the three-way interactions, each of the two-way interactions comprised of the component parts of the three-way interaction (e.g., intervention by gender, intervention by prosocial behavior intercept, gender by prosocial behavior intercept) was added in step two, and the three-way interaction (e.g., intervention by gender by prosocial behavior intercept) was added in step three. Of the 10 regressions models tested, two showed significant interactive effects.

A significant interaction emerged for the effect of intervention by aggression intercept (i.e., initial level of aggression) in the prediction of prosocial behavior slope ( $\beta = .21, p < .05$ ) (see Table 6). This interaction is graphed in Figure 1, which depicts the associations among prosocial behavior slope, intervention condition, and initial level of aggression (differentiated by line). As can be seen in the graph, while prosocial behavior slope was greater for individuals in the intervention condition versus the control condition across individuals with high and low levels of initial aggression, the magnitude of the difference in prosocial behavior slope between intervention and control was much greater for individuals with high levels of initial aggression. This pattern indicates that the effect of the intervention on prosocial behavior growth was

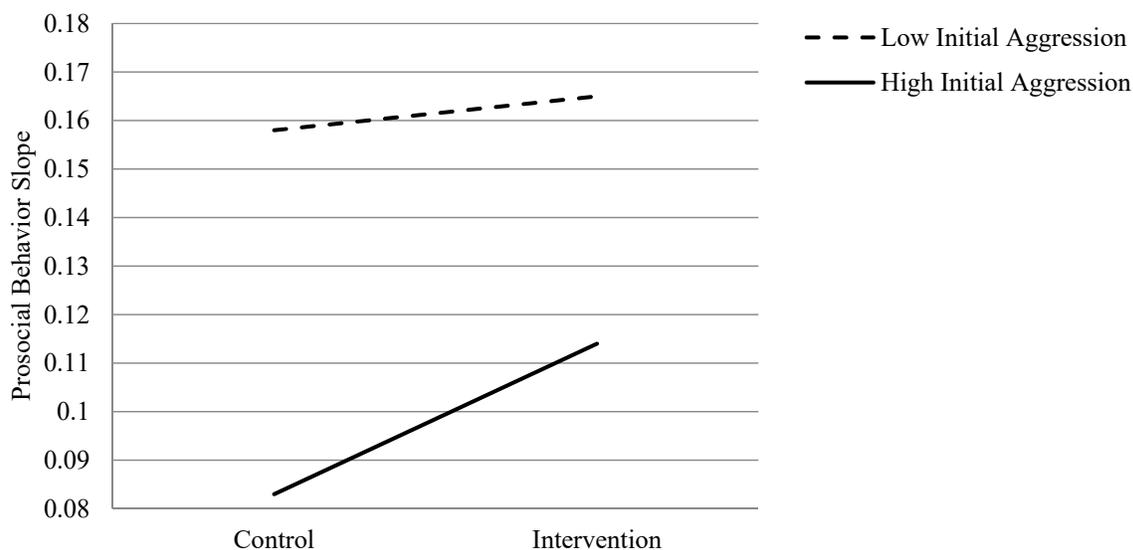
Table 6. *Intervention and Aggression Intercept Predicting Prosocial Behavior Growth*

Variable	Prosocial Behavior Slope (K – Grade 3)		
	$R^2$	$\beta$	$\Delta F$
<u>Step 1</u>	.25		16.48**
Intervention		.10**	
Aggression Intercept		-.50**	
<u>Step 2</u>	.25		4.15*
Intervention x Aggression Intercept		.21*	

*Note.* Control variables include site, cohort, gender, race, SES, maternal depression, parental discipline, neighborhood quality, kindergarten prosocial behavior, kindergarten aggression, and IQ. Step 1 df = 16, 741; Step 2 df = 17, 740.

\*  $p < .05$ . \*\*  $p < .01$

Figure 1. Results from Regression Predicting Prosocial Behavior Growth



*Figure 1.* Prosocial behavior slope for individuals with high and low levels of initial (pre-intervention) aggression. Initial aggression indexed via aggression intercept from aggression growth model. High and low levels of initial aggression dichotomized using a median split.

stronger for individuals who started the intervention with higher levels of aggression.

As shown in Table 7, a significant interaction also emerged for the effect of intervention by gender in the prediction of prosocial behavior slope ( $\beta = .14, p < .05$ ), however, this interaction was qualified by a three-way interaction of intervention by gender by prosocial behavior intercept (i.e., initial level of prosocial behavior) ( $\beta = .69, p < .05$ ). This three-way interaction is graphed in Figures 2 and 3, each of which depict the associations among prosocial behavior slope, intervention condition, and initial level of prosocial behavior (differentiated by line), with Figure 2 focused on males and Figure 3 focused on females. As can be seen in the figures, for individuals with low initial levels of prosocial behavior, prosocial behavior slope was greater for individuals in the intervention condition versus the control condition, and this was true for both males and females. However, relative levels of prosocial behavior slope in the intervention versus control conditions for individuals with high initial levels of prosocial behavior differed by gender. While prosocial behavior slope was greater for individuals in the intervention condition versus the control condition for males with high initial levels of prosocial behavior, for females with high initial levels of prosocial behavior, prosocial behavior slope was slightly smaller for those in the intervention versus the control condition. These results suggest that while there was a positive effect of intervention on prosocial behavior slope for males who started the intervention with both high and low levels of prosocial behavior, for females, only those who started the intervention with low levels of prosocial behavior experienced the positive effect of intervention on prosocial behavior growth.

### **Identification of Treatment Responders**

In order to explore how the markers of prosocial behavior and aggression, as generated by the growth curves analyses, could facilitate identification of intervention responders, as based

Table 7. *Intervention, Gender, and Prosocial Behavior Intercept Predicting Prosocial Behavior Growth*

Variable	Prosocial Behavior Slope (K – Grade 3)		
	$R^2$	$\beta$	$\Delta F$
<u>Step 1</u>	.39		31.03**
Intervention		.09**	
Gender		.01	
Prosocial Behavior Intercept		.63**	
<u>Step 2</u>	.39		1.91*
Intervention x Gender		.14*	
Intervention x Prosocial Behavior Intercept		.06	
Gender x Prosocial Behavior Intercept		-.11	
<u>Step 3</u>	.39		5.83*
Intervention x Gender x Prosocial Behavior Intercept		.69*	

*Note.* Control variables include site, cohort, race, SES, maternal depression, parental discipline, neighborhood quality, kindergarten prosocial behavior, kindergarten aggression, and IQ. Step 1 df = 16, 741; Step 2 df = 19, 738; Step 3 df = 20, 737.

\*  $p < .05$ , \*\*  $p < .01$ .

on initiation of crime by early adulthood, ROC curve analyses were employed. ROC curves plot sensitivity (probability of the test correctly identifying true positives) against 1 minus specificity (probability of the test correctly identifying true negatives) for the cutoff values of a diagnostic test. Tests with higher levels of sensitivity and specificity have ROC curves closer to the top left corner of the graph. In this way, the proximity of a ROC curve to the top left corner of the graph, quantified as area under the curve (AUC), directly corresponds to the accuracy of the diagnostic test (Fischer, Bachmann, & Jaeschke, 2003).

To examine the combination of markers of prosocial behavior and aggression that could best identify intervention responders, logistic regressions predicting probability of no arrests

Figure 2. Males Only: Results from Regression Predicting Prosocial Behavior Growth

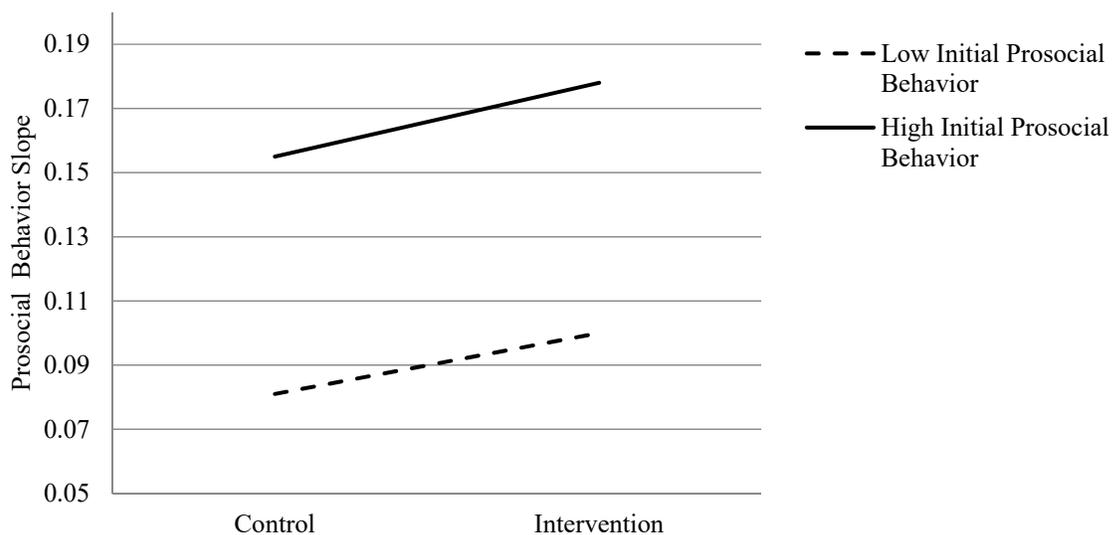


Figure 2. Prosocial behavior slope for males with high and low levels of initial (pre-intervention) prosocial behavior. Initial prosocial behavior indexed via prosocial behavior intercept from prosocial behavior growth model. High and low levels of initial prosocial behavior dichotomized using a median split.

Figure 3. Females Only: Results from Regression Predicting Prosocial Behavior Growth

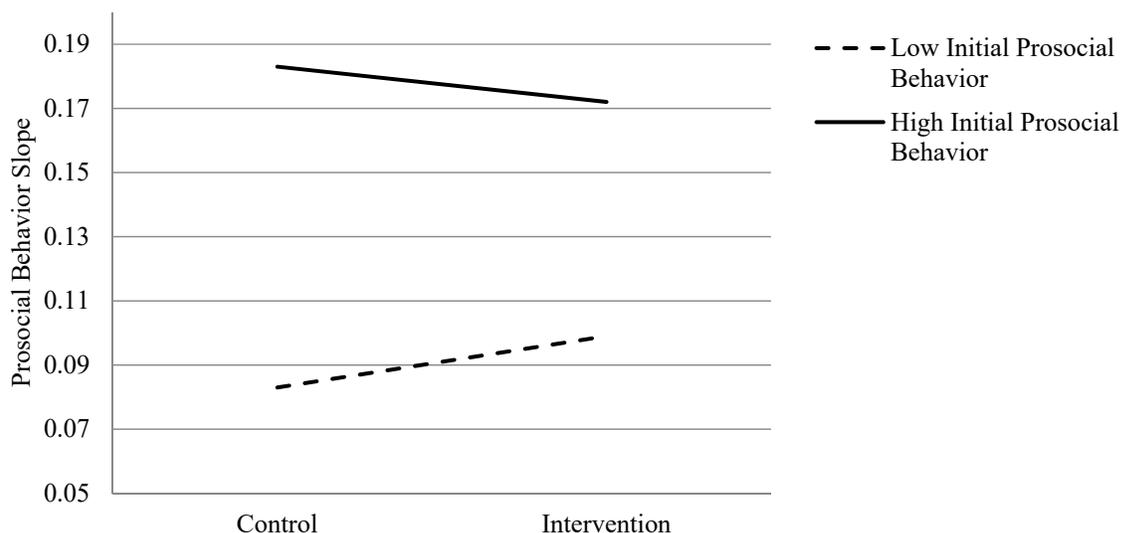


Figure 3. Prosocial behavior slope for females with high and low levels of initial (pre-intervention) prosocial behavior. Initial prosocial behavior indexed via prosocial behavior intercept from prosocial behavior growth model. High and low levels of initial prosocial behavior dichotomized using a median split.

were conducted with different combinations of prosocial behavior slope and intercept and aggression slope and intercept as predictors, and corresponding ROC curves were plotted. Consistent with the aim of identifying intervention responders based on crime outcome, only individuals in the intervention condition with arrest outcome data were included in the analyses ( $n = 361$ ). Due to the study's key focus on prosocial behavior growth, prosocial behavior slope was included as a predictor in all of the regression models. The combinations of predictors included: (1) prosocial behavior slope, (2) prosocial behavior slope and prosocial behavior intercept, (3) prosocial behavior slope and aggression slope, (4) prosocial behavior slope and aggression intercept, (5) prosocial behavior slope, prosocial behavior intercept, and aggression slope, (6) prosocial behavior slope, prosocial behavior intercept, and aggression intercept, (7) prosocial behavior slope, aggression slope, and aggression intercept, and (8) prosocial behavior slope, prosocial behavior intercept, aggression slope, and aggression intercept. Since gender and race were highly predictive of crime outcome in the previous logistic regression analyses ( $ps < .001$ ), they were also included in all of the regression models.

Of the eight potential combinations, the diagnostic test with greatest accuracy for predicting no initiation of crime was yielded by the set of predictors including prosocial behavior slope, prosocial behavior intercept, and aggression intercept. For this set of predictors, the AUC of the corresponding ROC curve was .784, 95% CI [.737, .831], indicating moderate accuracy (Fischer et al., 2003) for predicting which intervention participants had not initiated criminal activity by early adulthood and thus had demonstrated positive responsivity to treatment. The ROC curve is depicted in Figure 4. When aggression slope was also included in this model, it yielded the same AUC, indicating that aggression slope did not contribute additional predictive power to the model.

Figure 4. ROC Curve Predicting Crime

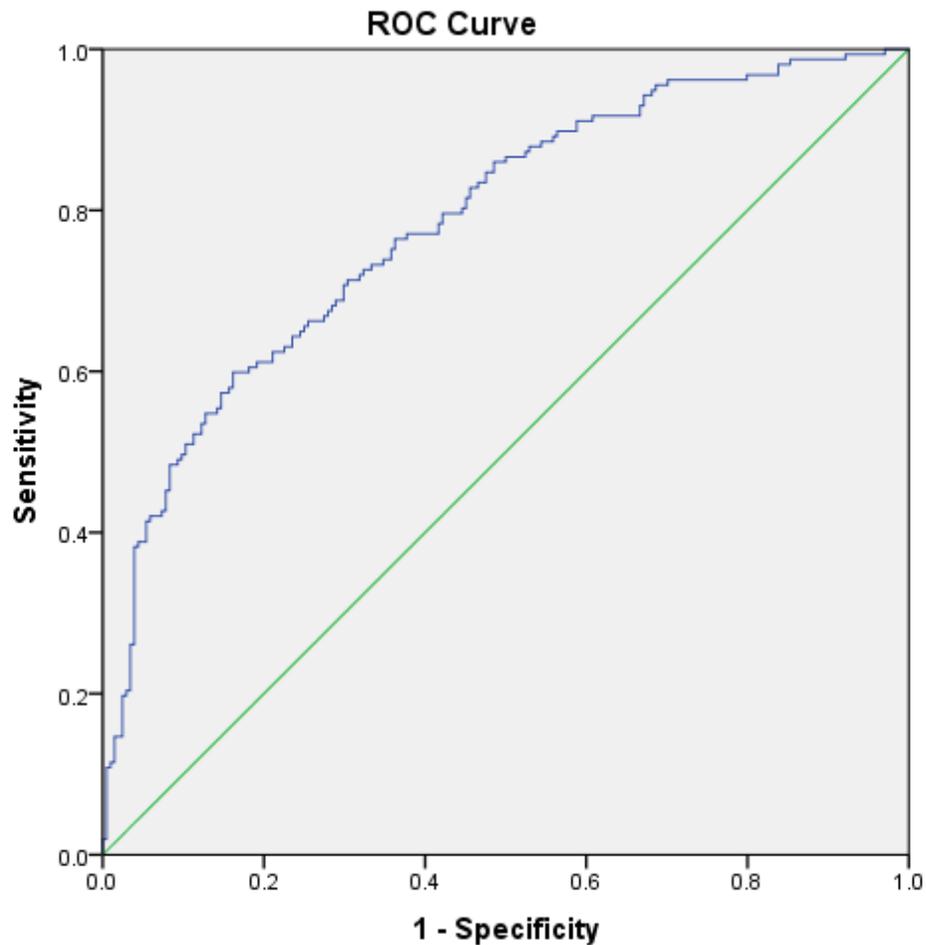


Figure 4. ROC Curve plotted with gender, race, prosocial behavior slope, prosocial behavior intercept, and aggression intercept as predictors. AUC = .784, 95% CI [.737, .831].

To illustrate the utility of this set of predictors in forecasting treatment responsiveness, the cutoff score maximizing both sensitivity and specificity (i.e., the point on the ROC curve closest to the top left corner of the graph) was identified, and sensitivity and specificity were estimated. Positive predictive value (PPV), the probability that an individual with a positive test result truly had the identified outcome (i.e., no crime initiation, treatment responsiveness), and negative predictive value (NPV), the probability that an individual with a negative test result truly did not

have the identified outcome (i.e., showed crime initiation, treatment non-responsivity), were also calculated based on the base rate of no crime initiation (.43) in the sample. With the identified cutoff score (cutoff = .42), the test generated a sensitivity of .73 and a specificity of .68, indicating that the test demonstrated a 73% probability of correctly identifying an individual who showed treatment responsivity (i.e., no initiation of crime) and a 68% probability of correctly identifying an individual who did not show treatment responsivity (i.e., showed crime initiation). The PPV was .64 and the NPV was .77, indicating that, based on this cutoff, there was a 64% probability that an individual identified as a treatment responder actually showed positive treatment responsivity (i.e., no initiation of crime) and that there was a 77% probability that an individual identified as a treatment non-responder actually showed no response to treatment (i.e., showed crime initiation). Corresponding to the AUC value of .784, these test statistics suggest that this index demonstrated moderate levels of accuracy in predicting which intervention participants responded to treatment, as indexed by absence of criminal activity by early adulthood.

### **Discussion**

Fast Track represents a SEL-based violence prevention program, guided by a theoretical framework that emphasized the role of early social-emotional deficits in developmental trajectories of antisocial behavior. Its core components included universal and indicated SEL programs (e.g., the PATHS® Curriculum and Friendship Group) focused on the promotion of social competence, designed to deflect aggressive children from an escalating developmental trajectory characterized by interpersonal conflict, alienation, and ultimately crime. Over the past 20 years, accumulating research has validated the capacity of SEL programs to reduce antisocial behavior (Catalano et al., 2004; Zins & Elias, 2006). Yet, very little research has investigated the

central premise of these programs and examined whether child growth in social competence in the context of SEL intervention mediates reductions in antisocial behaviors and related crime. The present study addressed this question by exploring the extent to which the Fast Track intervention promoted growth in children's social competence in early elementary school, and whether that growth mediated the long-term impact of the program on reduced criminal behavior in high-risk, aggressive youth.

### **Social Competence Growth as Mediator of Intervention Outcome**

Based on the Fast Track logic model, it was hypothesized that the intervention would positively influence the development of social competence over the first three years of the intervention, and that this development would help account for the intervention's distal impact on the reduction of criminal behavior by early adulthood. Both parts of this hypothesis were confirmed. First, intervention positively influenced growth in social competence from kindergarten through third grade, with intervention receipt associated with an average increase of one standard deviation in prosocial behavior per year. Second, growth in social competence from kindergarten through third grade mediated the effect of the intervention on initiation of criminal behavior by early adulthood. These findings are consistent with prior research on the Fast Track intervention demonstrating both positive effects of the intervention on elementary school social competence (CPPRG, 2004), as well as positive effects of the intervention on initiation of criminal behavior (CPPRG, 2010a, 2015). They are also consistent with the broader literature indicating positive effects of SEL programs on the development of social and emotional competencies, as well as on the reduction of antisocial behaviors (Durlak et al., 2011; Zins & Elias, 2006).

Prior research on the Fast Track control sample demonstrated strong predictive links between early elementary social competence and reduced criminal outcomes in early adulthood (Jones et. al, 2015). In addition, a study of the Fast Track intervention by Sorensen and colleagues (2015) demonstrated that intervention effects on interpersonal skills during elementary school mediated the intervention effect on later crime.

Although the proportion of effect mediated found in the present study was notably smaller than (about one-tenth of) the proportion of effect mediated found in the Sorensen study, this difference in magnitude of effect is to be expected given the aims and methods of the two studies. The Sorensen study explored the extent to which interpersonal competencies broadly defined (i.e., socially competent behavior, aggression, peer sociometric status) assessed over the course of elementary school (5 years) mediated the intervention effect on crime. In contrast, the present study examined whether a single, brief measure of interpersonal competence administered during the first few years of the intervention could help explain treatment responsivity and predict ultimate intervention outcome. With a mediator narrower in scope, such as the one used in the present study, mediation of a smaller proportion of the overall intervention effect would be expected. However, that significant patterns of mediation and predictivity were found with this much narrower index of interpersonal competence underscores the value of this index as meaningful marker of intervention mechanism. Indeed, the present findings confirm the utility of this simple measure of social competence in reflecting the broader role of interpersonal competence development in the effect of Fast Track on crime, as well as the utility of this measure as a meaningful index of responsivity to the Fast Track intervention.

The present study also extended the findings of the Sorensen study in several other ways. In addition to examining the unique role of social competence development in the effect of the

intervention, the present study also explored the development of aggressive behavior as distinct from social competence and social status in order to explore its unique role in mediating the effect of the intervention. Further, the present study took a developmental focus by examining growth in social competence and aggression over time. By focusing on growth during the first three years of the intervention, the study specifically focused on the effects yielded by the most intensive phase of the intervention. Lastly, by utilizing individual growth modeling, the present study explored individual-level change in a way that allowed for the examination of individual response to intervention.

The finding that individual growth in social competence over the first three years of the intervention helped account for the effects of the intervention on criminal behavior almost 15 years later has several important implications. First, it supports the intervention logic model, demonstrating experimentally that promoting social competence functions as a means through which Fast Track achieved its effect on crime. Fast Track SEL programming and work with parents and teachers fostered children's acquisition of skills such as emotional understanding, helping others, and cooperating with peers, thereby supporting positive social and behavioral development in a way that reduced the likelihood of later antisocial outcomes (Greenberg et al., 2003; Zins & Elias, 2006). Although not tested directly, the current findings are consistent with developmental theory linking growth in social competence in the early school years with reduced risk for the negative cascade of peer rejection, deviant peer affiliation, and school alienation that fuel trajectories of antisocial behavior (CPPRG, 1992; Dodge et al., 2008; Eisenberg et al., 2006).

Another important aspect of this finding concerns the early nature of the demonstrated mediating mechanism. Despite the fact that the Fast Track intervention spanned 10 years, the

finding that effects generated within the first three years of the intervention (i.e., growth in social competence) mediated ultimate intervention gains almost 15 years later signifies the powerful nature of the early portion of the intervention. In addition, it indicates that, in the case of Fast Track, markers of distal intervention outcome were present within the first few years of the intervention.

### **Aggression Growth**

Given the associated nature between poor social competence and aggressive behavior and their shared developmental sequelae (Denham et al., 2003; Hastings et al., 2000), the present study also investigated whether intervention effects on aggression development during the initial phase of the intervention mediated the impact of the intervention on later criminal behavior. It was hypothesized that the intervention would show a significant effect on aggression slope (i.e., decreased slope), from kindergarten through third grade, and that this reduction would mediate the intervention effect on reductions in crime by early adulthood. However, this hypothesis was not supported, as the results indicated that there was no significant effect of intervention on aggression reduction, with aggression decreasing comparably in both the intervention and control conditions. The effect of intervention on aggression slope was also not moderated by any of the child baseline characteristics.

It is important to note that earlier studies of Fast Track demonstrated a positive intervention effect on the reduction of aggressive behavior by third grade (CPPRG, 2002a, 2010b). While these previous findings appear to contrast with those of the present study, this discrepancy is likely a function of the different methodology employed to quantify behavior change in the different studies. While the earlier studies examined, and showed effects on, reduction in aggression in the group-level average at third grade, the present study utilized

multiple measurements over several years to examine systematic change at the level of the individual. With this more nuanced assessment of change, an overall reduction in aggressive behavior emerged. However, in this sample, it was not systematically different for children in the intervention and control conditions.

### **Moderation of Intervention Effect on Social Competence Growth**

The significant effect of intervention on social competence development also appeared to be moderated by several baseline child characteristics. Although children who started the intervention with varying levels of aggression experienced the positive effect of the intervention on social competence growth, this effect was stronger for individuals who started the intervention with higher levels of aggression. This finding, which is consistent with prior studies of Fast Track demonstrating strongest intervention effects for children with highest aggression at baseline (CPPRG, 2010b, 2011), indicates that the intervention most strongly benefitted children who had the highest levels of initial risk with regard to antisocial behavior. Given that young children with high levels of aggression commonly lack the set of social skills required to respond to everyday social challenges in socially competent ways, it is likely that promoting the development of these skills beginning at school entry was particularly useful for this group of children. In particular, teaching and reinforcing these social-emotional competencies, as facilitated by the Fast Track intervention, likely helped such children develop and use these skills in their everyday interactions and become increasingly socially adept over time, in a way that might have been more subdued for children with lower levels of initial risk.

The effect of intervention on social competence development also appeared to be moderated by initial level of social competence. However, unlike the moderation of intervention by initial aggression, which was unaffected by gender, the moderation of intervention by initial

social competence was only relevant for females. While males experienced the positive effect of the intervention on social competence growth regardless of their baseline levels of social competence, for females, only those who started the intervention with low levels of social competence experienced this intervention effect. Although males did show slightly lower levels of initial social competence, and therefore likely had more room to improve on social competence than females, the complete set of results indicates that this gender difference was not solely attributable to differences in initial levels of social competence. To be sure, moderation of intervention by initial level of social competence on social competence development was not significant, suggesting that the differing effects of intervention on social competence development for males and females resulted from factors other than the association between gender and baseline social competence.

The present finding of a positive intervention effect for individuals with lower levels of initial social competence parallels previous findings indicating that Fast Track most strongly benefitted those with the highest levels of initial risk (CPPRG, 2010b, 2011). However, in this case, the pattern of intervention solely befitting those at higher risk was unique to females. Given that males experience a greater number of risk factors for the development of poor social competence (e.g., reduced attentional focus and effortful control, greater impulsivity), (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006; Kochanska, Coy, & Murray, 2001), it may be that, even among boys with higher baseline levels of social competence, the intervention helped to improve other factors that contributed to their development of social competence. On the other hand, it may be that for girls beginning the intervention with high levels of social skills, there were fewer ways in which to improve their overall social competence.

The main findings regarding individual growth in social competence provide important

information about the way in which the Fast Track intervention functioned to decrease criminal outcomes in at-risk youth. In particular, the findings help to address questions of key interest and importance in intervention science, namely, how, and for whom, do interventions work? (Krull & MacKinnon, 2001; Raudenbush & Bloom, 2015). Understanding the mechanisms of action in an intervention, or “how” an intervention works, is of central importance as such information provides a way to test the intervention logic model and determine whether an intervention is operating according to the theoretical framework upon which it was founded. In the case of the present study, the findings confirm the idea that change in social competence is a sensitive measure of response to treatment that works for most children (i.e., boys with varying levels of social competence, girls with low social competence) and works particularly well for children with high levels of baseline aggression.

### **Social Competence Growth as Index of Treatment Responsivity**

An important methodological innovation in the current study was the focus on individual growth curves which measure change at the level of the individual (as opposed to change in group means). Estimates for intervention effects and mediation are comparable whether one assesses the growth curve of the group or the growth curves of the individuals comprising the group. However, a focus on individual growth provides the opportunity to conduct additional analyses examining the variation within the intervention group.

Using measures of individual growth, the study explored individual treatment responsivity through examining how the mediating mechanism of individual growth in social competence served as an index of ultimate response to intervention, as assessed by initiation of criminal activity by early adulthood. When included in an index with gender, race, and initial levels of social competence and aggression, individual growth in social competence predicted

crime outcome (i.e., differentiated between individuals who did and did not initiate crime by early adulthood) with moderate accuracy. These findings confirm the utility of individual growth in social competence as a meaningful, early index of ultimate responsivity to the Fast Track intervention.

It is also of note that, when individual growth in aggression was added to the index predicting crime outcome, it did not provide any further predictive value. This finding supports the idea that development of social competence, and not solely reduction in aggression, is a key mechanism in SEL-based violence prevention (Durlak, et al., 2011; Zins & Elias, 2006), with the results suggesting that change in social competence may be a more powerful predictor of ultimate intervention outcome. More broadly, such results support the role of social competence development in trajectories of positive adjustment among children at risk for antisocial outcomes (Jones et al., 2015).

### **Clinical Implications**

Existence of an early index of treatment responsivity, such as the one in the present study, has important implications for intervention implementation. Most notably, with the capacity to differentiate treatment responders from treatment non-responders at the individual level, such an index provides a tool for the assessment of ultimate treatment responsivity during the course of intervention. With such information, decisions could be made about which participants should remain in an intervention (i.e., identified treatment responders) and which participants likely necessitate an alternative course of intervention to achieve the target outcome (i.e., identified treatment non-responders). Depending upon the theoretical framework of the intervention model and resource availability, alternative intervention courses could include administration of different intervention dosages, a shift in focus to different intervention

components, or implementation of a different intervention entirely, with the goal of optimizing an individual's chances of achieving the target outcome. In the case of no alternative intervention course, removing identified non-responders from an intervention would still save time, money, and resources associated with the implementation of inefficacious intervention.

The use of early indices of treatment responsivity is particularly promising in the context of multi-year interventions, such as Fast Track, in which a proximal index of treatment responsivity may precede the ultimate intervention outcome by many years. In such cases, early identification of intervention non-responders would be especially cost-effective and provide maximal opportunity for identified non-responders to receive alternative, more useful forms of intervention.

Lastly, identification of treatment non-responders during intervention could facilitate a better understanding of differential treatment responsivity and thus a better understanding of how, and for whom, a given intervention operates. While typical interventions, which assess treatment responsivity exclusively at post-intervention, only allow for retrospective analysis of intervention non-response (i.e., why certain participants did not benefit), existence of an early index of treatment responsivity could provide an avenue for the concurrent investigation of factors that may be contributing to treatment non-response. In addition to providing practical information for intervention modification, exploration of concurrent influences on treatment non-response would also likely contribute to a greater understanding of intervention mechanisms and individual-level factors influencing those mechanisms.

### **Study Limitations**

The present study confirms that, for most children, change in social competence was a sensitive measure of response to the Fast Track intervention that showed predictivity to initiation

of crime by early adulthood. However, there may have been other intervention mechanisms representing useful indices of treatment responsivity that were not studied here. Given that Fast Track involved multiple intervention components, including parent training, home visiting, and academic tutoring, it is plausible that changes in proximal outcomes such as parent-child relationship quality, parent-school relationship quality, and child academic functioning may also have been important intervention mechanisms. Such mechanisms, when assessed early in intervention, similarly may have functioned as meaningful indices of ultimate treatment response.

Another limitation concerns the present study's use of teacher ratings of social competence. Given the aim of identifying a treatment responsivity index with utility for intervention implementation, teacher ratings were chosen on account of being brief, easy to administer, low-cost, and highly practical for school-based intervention. However, concerns have been raised about teacher ratings due to evidence of teacher bias (Lau et al., 2004; Tenenbaum & Ruck, 2007). While averaging across ratings from four different teachers (across four different years) likely minimized the problem of teacher bias in the present study, the issue surrounding the use of teacher ratings represents an inherent tradeoff between easy, cost-effective forms of assessment and those which are more comprehensive but more resource intensive (e.g., observational measures).

The present study's use of an at-risk sample, characterized by heightened levels of poverty and crime, provided a great opportunity to study intervention effects on crime by supplying rich data on antisocial behaviors and outcomes. As a result, however, this sample was not representative of the national population, and the degree to which the current findings are generalizable to populations with lower levels of risk is uncertain.

## **Future Directions**

While the present study demonstrated the utility of social competence development as an early marker of treatment outcome as indexed by criminal activity, the extent to which this marker is associated with other positive intervention outcomes remains an area for exploration. Consistent with other SEL-based prevention programs, Fast Track demonstrated effects on several outcomes apart from criminal activity, including effects on substance use, risky sexual behavior, and general well-being (CPPRG, 2015). Evidence that social competence development predicts positive treatment outcomes in these other domains would provide further support for the utility of such an index in the implementation of SEL-based violence prevention.

Although the findings of the present study validate the Fast Track logic model and specifically the way in which Fast Track reduced risk for criminal outcomes through its impact on social competence development, they still leave uncaptured the ways in which the development of social competence ultimately led to reductions in crime. Guided by developmental theory, future research should investigate this area by exploring subsequent mediating mechanisms, such as friendship formation, attachment to school, and academic success, that may help elucidate the developmental trajectories connecting social competence development to reduced risk for crime.

Future research should also continue to utilize individual growth curves as a means to explore mediating mechanisms in intervention, and in the case of individual growth curves demonstrating mediating effects, the extent to which they can function as indices of treatment responsivity should be explored. Further avenues of investigation could include whether, when used in the context of intervention, such indices provide reliable markers of treatment outcome, and whether they can be used to guide intervention modification successfully. With respect to

modeling of intervention mechanisms as individual growth curves, non-linear, as well as linear, patterns of growth should routinely be explored. In the case of non-linear patterns of change in the mediating mechanism, the nature of the change can be used to inform treatment modification not only for treatment non-responders, but for treatment responders as well. For example, in the case of steep increases in the mediating factor (e.g., skill development) in the initial phase of intervention, it may be cost-effective to limit the course of intervention to that initial phase. On the other hand, in the case of a mediating factor that shows very slow growth in the beginning of intervention, it could be useful to explore if increasing intervention dosage at the intervention outset fosters acceleration of treatment gains in a helpful manner. Broadly, future research utilizing individual growth curves to model change in intervention mechanisms should focus on exploring how such indices can best predict treatment responsiveness, as well as how they can best inform useful intervention modification.

The current study marks an important progression in the investigation of mechanisms in SEL-based violence prevention programs such as Fast Track, which are based on the central premise that antisocial behavior reduction is achieved through intervention impact on the development of social competence. Despite strong theoretical support for this intervention model, the present investigation is one of very few studies to experimentally test this premise by exploring the degree to which growth in social competence mediated the effect of SEL-based violence prevention on later reduction in crime. It is also the first, to the author's knowledge, to test this mediational pathway by assessing individual-level growth in social competence, as well as the first to examine the utility of individual behavior growth as a proximal index of ultimate treatment outcome.

Results of the study confirm the role of social competence development during the initial phase of Fast Track in the effect of the intervention on the reduction of crime by early adulthood. They also confirm the utility of individual growth in social competence as a meaningful index of responsiveness to the Fast Track intervention. Such results suggest that teacher ratings of social competence, when modeled as individual growth over time, can provide a simple and powerful index for assessing treatment responsiveness and informing treatment modifications during the initial phases of SEL-based violence prevention. Given the ubiquity of differential responsiveness to intervention, the ability to assess treatment responsiveness early during the course of intervention, especially in the context of multi-year interventions such as Fast Track, provides a promising avenue for developing programs that are both cost-effective and provide maximal opportunity for intervention benefit for individuals with differing intervention needs.

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### SELECTED PUBLICATIONS

- Kalvin, C.B., & Bierman, K.L. (2017). Child and adolescent risk factors that differentially predict violent versus nonviolent crime. *Aggressive Behavior* 43, 568–577.
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