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Testing Bidirectional Contextual Effects of Adolescent Risk Factors on Young Adulthood Outcomes: A Life Course Perspective to Gangs

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**TESTING BIDIRECTIONAL CONTEXTUAL EFFECTS OF ADOLESCENT RISK FACTORS ON
YOUNG ADULTHOOD OUTCOMES: A LIFE COURSE PERSPECTIVE TO GANGS**

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DEDICATION

To my parents, who taught me how to dream.

To my husband and son, who have made all my dreams come true.

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We are the products of our environments. With the deepest gratitude and admiration, I thank everyone who has stood alongside me on this incredible journey to earning a doctorate. Thank you to...

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My family, for being there for every “big” and “little” moment since I was born. Turns out, I learned a lot more during our times together than how to do long division - or the type of fish that Huey, Dewey, and Louie caught!

Blake Michael, for teaching me what life is really about and for your ability to eliminate stress with a simple smile. You are my world.

My parents, for everything. From securing bobby-pins at dance recitals to babysitting at professional conferences, you have been behind me every step of the way. I am able to take risks because I know that you are there to catch me if I fall. Thank you for teaching me when to *work* hard and when to *play* hard. You are my foundation and the reason for my success. Because you believe in me, I believe in myself (...and in my ability to make a proper birdhouse!)

And, mostly,

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Tuna fish pancakes and Pasha!

Thanks *y'all*!

ABSTRACT

Leading theories in developmental science emphasize the role of the individual as an active agent in shaping her or his environment. Yet, most empirical work has focused on unidirectional models, ultimately treating the individual as a passive recipient of environmental risk. Part of this gap between theory and analysis is methodological in nature – i.e., classical statistical methods typically do not allow for the modeling of bidirectional influences or complex longitudinal relations. Recent advancements in longitudinal methodologies, however, expand our ability to answer more nuanced developmental questions. In this dissertation, I demonstrate how advanced longitudinal methods could be used to better understand complex relations between the individual adolescent and naturally-embedded systems of ecological risk. I apply a novel statistical model that explores how familial response to gang initiation explains the pathway to young adulthood outcomes among high-risk youth. I examine bidirectional effects by estimating how individual behavior alters longitudinal trajectories of parenting risk; and, how this change, in turn, mediates and moderates long-term developmental outcomes. Data for this dissertation came from the Fast Track Project, a multi-site investigation of the development and prevention of conduct problems in a sample of high-risk youth. Given the quasi-experimental design of gang research, I matched gang members to non-gang members using balanced risk set matching, yielding a final sample of 404 youth matched on level of background risk. Results showed that, in this high-risk sample of

youth, there was no systematic change in parenting communication or monitoring over time, even after youth initiated into a gang. In terms of long-term outcomes of gang-involved youth, results show that, even after controlling for background risk, gang members were more likely to be arrested, engage in aggressive acts, and use more substances than non-affiliated counterparts. Additionally, gang members were more likely to utilize the health care system more frequently, suggesting that gang membership may carry an economic cost to society. Interestingly, gang membership was also associated with an increase in pro-social behavior during adulthood. Nonetheless, these relations between gang affiliation and young adulthood outcomes were not moderated or mediated by parenting risk. I conclude with a discussion of both the methodological and substantive contributions of this dissertation. Limitations and challenges of the method are discussed and areas for future work are suggested.

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CHAPTER 1

INTRODUCTION

A fundamental axiom of developmental science is that context matters. Leading theories in the developmental and health sciences emphasize the interactive role of the multiple contexts in which development takes place on the behavioral, emotional, and health outcomes of children (Bronfenbrenner, 1977, 1979, 1986; Bronfenbrenner, Morris, Lerner, & Damon, 2006; Ford & Learner, 1992; Pianta & Walsh, 1996). Risk factors, defined as factors that increase the likelihood of poor or undesirable outcomes, and protective factors, defined as those which promote resilience, exist in all major ecological domains – i.e., community, family, school, peer, and individual or biological systems – and play a role in the onset and maintenance of maladaptive behavior over time (Dodge et al., 2009; Hawkins, Catalano, & Miller, 1992; Luthar, 1993, 2006). Risk factors tend to be synergistic, such that the joint effect of multiple risk factors multiplicatively exceeds that of any one factor alone or the additive combination of multiple risks (Rutter, 1990). The particular outcome experienced by a child is contingent upon the interplay between individual characteristics and the constellation of risk to which the child is exposed (Bechtel & Churchman, 2002).

Despite intricate relations across systems of risk, prior research has largely examined the effects of contextual risks in fairly straightforward ways. The current

dissertation adopts a more holistic perspective by exploring how reciprocal relations across naturally-embedded ecological systems can explain the processes through which contexts shape development. An innovative method is applied to youth gang affiliation, a unique and powerful developmental risk that is both predicted by and predictive of exposure to other contextual risks. The specific aim is to examine how parental response to youth gang initiation explains differential pathways to young adulthood.

Environmental Risks

A central premise across ecological theories is that development is dynamic and interactive (Bechtel & Churchman, 2002; Bronfenbrenner, 1979; Bronfenbrenner et al., 2006; Pianta & Walsh, 1996). Data indicate that youth differ substantially in their response to environmental or contextual risks (Lamont, Van Horn, & Hawkins, in submission; Lanza & Rhoades, 2011; Schmiede, Levin, & Bryan, 2009; Schonberg & Shaw, 2007; Van Horn et al., 2008; Van Horn et al., 2009). Despite similar risk conditions, some children will display resilience and prosper, while others will show a maladaptive developmental response. Multifinality is the notion that one etiologic factor can lead to many different outcomes (Cicchetti & Rogosch, 1996). Transactions between the individual child and multiple contextual risks shape divergent developmental pathways over time. In this way, youth development is an active, reciprocal process whereby youth both *respond to* and *have influence upon* environmental risk.

Despite recognition of the active role of the individual child in the developmental process, remarkably few studies have systematically tested bidirectional influences on development (Boyce et al., 1998). Developmental studies typically focus on unidirectional models of risk – that is, contextual risks are modeled as exogenous

predictors of individual behavior. An implicit conceptual assumption in these models is that the child is a fairly passive recipient of contextual risk, essentially ignoring the role of the individual as an active agent in shaping her or his environment. This assumption is inconsistent with leading developmental theories and data showing individual differences in contextual effects. Few studies, if any, have examined reciprocal relations between youth behavior and risk conditions.

Part of the reason for the scarcity of research is methodological in nature. There is an apparent gap between sophisticated guiding developmental theories, and the analytic frameworks available to test these theories. Traditional statistical methods, such as OLS regression, have serious limitations for testing non-recursive or reciprocal processes. This is largely because traditional approaches typically make the assumption of independent and identically distributed observations, which is naturally violated in non-recursive models and will ultimately lead to biased parameter or standard error estimation (J. Cohen, Cohen, West, & Aiken, 2003). New statistical techniques are needed to handle the types of complex, reciprocal effects posited by leading developmental theories. The aim of this dissertation is to test an innovative technique for studying bidirectional developmental processes. This approach integrates various modern longitudinal methods into a single developmental model. Its utility will be demonstrated through an applied analysis of the long-term effects of youth gang membership.

This dissertation begins with a description of the methodological gap that has impeded a rich understanding of context-dependent developmental processes. This discussion is embedded within an introduction of newer methodologies that can be used to more accurately test developmental theory. These methodologies will be used jointly

to test the model proposed in this dissertation. After overviewing available methods, I will provide an overview of youth gang research and illustrate how these methods may contribute to our understanding of youth gangs. This introduction concludes with a more detailed description of the proposed study.

Methodological Overview

Development involves complex interrelations between contextual risks and individual factors over time (Bronfenbrenner, 1979). Traditional data analytic methods are ill-suited to accurately capture these multifaceted relations due to strong assumptions that are violated when examining non-recursive processes. This has limited our ability to answer complex developmental questions, such as the reciprocal interplay between ecological systems. As a result, the literature largely focuses on questions related to unidirectional risk (e.g., how community risk affects individuals), an approach that may or may not reflect the true relation between systems. Reliance on traditional methods has limited our knowledge of development-in-context, threatening the external validity of findings.

Recent advancements in the methodological literature open the door for a potentially deeper and more ecologically-valid understanding of the developmental process. These methods have started to be introduced to developmental science, which has changed the way we understand development from an ecological perspective. In this section, I provide an overview of two of these methods – i.e., latent growth models and third-variable (mediation, moderation) models – that offer promise for developmental science. These methodologies will ultimately be used as the component parts of the integrated, dual-process longitudinal approach presented in this dissertation.

Developmental Change and Latent Growth Models

There has been increased interest in understanding developmental processes over the past few decades. Across disciplines, questions related to the process of growth or developmental change arise: for instance, developmental scientists may ask questions about maturation, medical researchers may track the emergence of disease symptomology, and health researchers may examine changing food or exercise preferences across the lifespan. Analysis of these types of longitudinal questions requires a specialized set of data analytic tools. Traditional methods assume independence of error terms, which is violated in serially-dependent data collected from the same individuals over time. These methods make it impossible to examine this type of longitudinal change. In contrast, person-centered analyses are a modern methodological paradigm specifically designed to capture developmental changes. Unlike traditional variable-centered approaches, which primarily focus on interrelations between risk variables and assume homogeneity across persons, person-centered approaches examine the individual as a whole, and focus on patterns of characteristics or configurations of risk (Bergman & Magnusson, 1987).

One example of a person-centered approach is Latent Growth Modeling (LGM; Duncan, Duncan, & Strycker, 2006). LGM is an analytic strategy that utilizes a latent variable framework to estimate typical trajectories of intraindividual growth, or systematic change, over time (Lawrence & Hancock, 1998). An advantage of latent growth models over other longitudinal approaches, such as a panel analysis of lagged effects, is that LGMs capture both individual growth trajectories and variability in growth processes (Duncan et al., 2006). This permits a description of mean trajectories, as well

as the prediction of the rate of growth by exogenous variables. Applications of LGMs can be found across the developmental literature, and offer a rich and informative description of change across distinct periods of time (Benner & Graham, 2009; Costanzo et al., 2007; Lansford et al., 2006; Malone, Northrup, Masyn, Lamis, & Lamont, 2012; B. O. Muthén & Muthén, 2000; Pettit, Keiley, Laird, Bates, & Dodge, 2007).

Model specification. Parameters of interest in a LGM are the intercept and slope factors (referred to as growth factors), derived from imperfectly measured outcome variables over time. Estimation of a LGM is similar to the more general confirmatory factor analysis or structural equation modeling approaches, where the common variance of a set of observed variables is used to form an error-free latent construct. The major difference between LGM and other latent models is that in a LGM the indicators comprise the same variable measured at different measurement occasions across time, and the resultant latent variable is a measure of mean intraindividual change.

A general form of a latent growth model is presented in Figure 1. Mathematically, LGM with linear growth is represented using the following system of equations:

$$Y_t = F1 + L1(F2) + e_t \quad (1)$$

$$F_i = M_i + D_i \quad (2)$$

where Y_t is the observed value of the outcome at time t ; $F1$ and $F2$ are the intercept and linear slope parameters, respectively; and $L1$ is the factor loading which makes the growth parameters a function of time. The latent growth parameters $F1$ and $F2$ are defined by a mean, M_i , and variance/disturbance terms, D_i .

The shape (or functional form) of trajectories is defined by number of growth parameters and their respective factor loadings. A conventional model with an intercept and one slope estimates linear growth (though more complex variations may be considered, as well); additional growth parameters (e.g. quadratic or cubic slopes) can be added to estimate nonlinear trends. Factor loadings for the growth parameters are typically fixed by the analyst to define the shape of the curve; or, more generally, establish the relation of the variables to time. A conventional approach is to set factor loadings to reflect the amount of time between measurement occasions. Alternative non-linear specifications such as developmental stages, log-time, or non-polynomial functional forms (e.g., exponential decay) can also be used. Because the analyst generally fixes factor loadings, LGM can handle variability in time, and does not require the same time lapse between measurement occasions or across individuals. The best fitting shape of latent trajectories is tested using general latent variable measurement procedures (Duncan et al., 2006).

By convention, factor loadings for the intercept are fixed to one unit across indicators in order to establish an interpretable scale of time, such as the number of months or years since the study start. Interpretation of the intercept in a LGM is similar to that of a general regression analysis – i.e., the level of the outcome when the factor loadings for the slope(s) are equal to zero. An added benefit of LGM is that the analyst can set the intercept to any substantively interesting point in time. By strategically positioning the intercept at a particular time point, researchers can ask more nuanced questions. For example, an interventionist can set the intercept to the end of an intervention and examine trajectories over the course of the intervention or after

intervention completion; alternatively, the intercept can be set to a particular age or transitional life event, such as marriage or parenthood, and growth before and/or after these transitions can be estimated.

Assumptions. The basic assumption of latent growth models is that an individual's score on a latent growth factor can be expressed as mean growth (across all individuals) plus an individual deviation from this overall mean. Individual deviations from the overall mean (analogous to the sums of squares in an ANOVA context) are also assumed to have a mean of zero, but are free to vary across individuals in the sample (Duncan et al., 2006). LGMs additionally assume zero covariation between the means and variances of a latent factor; and, a zero covariation across all error variances and between errors and all variables in the model other than the measured variables to which they relate (Duncan et al., 2006). LGMs typically do not assume that the factor mean is zero, allowing for estimation of growth over time (an exception is the case where the indicators are latent, in which case the mean at zero-time is assumed to be zero for identification purposes).

The conventional LGM additionally assumes that individuals are derived from the same population and that a single growth curve trajectory accurately captures variability in the entire population (Duncan & Duncan, 2004; Reinecke & Seddig, 2011). Exogenous covariates are assumed to exert a homogenous effect across all individuals (Reinecke & Seddig, 2011). This conventional approach can be expanded to a Latent Growth Mixture model (LGMM), which estimates a separate trajectory for several empirically-derived subgroups within the population. For more information on Latent Growth Mixture Models, see B. O. Muthén et al. (2002); B. O. Muthén and Shedden (1999); and Reinecke and Seddig (2011).

Third-variable Models: Mediation and Moderation

Relations between contextual risk factors and observed developmental outcomes are typically more complex than simple bivariate associations. Rather, other (so called “third”) variables may explain observed associations between a predictor and criterion. This section provides a brief overview of two methods commonly used to test third-variable effects in the social sciences: mediation and moderation. This is followed by a discussion of the flexibility of these modeling approaches and ways in which they can further developmental science.

Mediation. Mediation analyses are set of statistical procedures that are intended to investigate the causal processes underlying the relationship between an independent variable and outcome (Baron & Kenny, 1986; MacKinnon, 2008; MacKinnon, Krull, & Lockwood, 2000). The third-variable in a mediation model is hypothesized to be an intervening or intermediate variable in the relation between a predictor and criterion. As displayed in Figure 2a, mediation analyses decompose observed relations into two component paths: the direct path, which links the predictor to the criterion directly; and the indirect path, which links the predictor to the criterion through effects on the mediator. The indirect pathway is such that an exogenous X predicts the mediator, which, in turn, impacts the outcome.

Early discussions of mediation present a series of causal steps involved in the estimation of the mediated effect (Baron & Kenny, 1986). An alternative approach tests the mediated effect by using the coefficients from the following equations (MacKinnon & Fairchild, 2009):

$$Y = \beta_{01} + \tau X + \varepsilon_1 \quad (3)$$

$$Y = \beta_{02} + \tau' X + \beta M + \varepsilon_2 \quad (4)$$

$$M = \beta_{03} + \alpha X + \varepsilon_3 \quad (5)$$

where Y is the outcome variable, M is the mediator, X is an exogenous covariate, τ is the direct effect of X on the Y , τ' is the partial effect of the X on Y conditional on M , and α is the effect of the predictor on the mediator, and $\varepsilon_{1,2,3}$ are residual errors. The point-estimate of the mediated pathway can be calculated through the method of the product of coefficients ($\alpha\beta$) or the difference in coefficients ($\tau - \tau'$). The product of coefficients tends to be more flexible and accurate under a range of model conditions (MacKinnon, 2008). Sobel (1982) derived the variance of the $\widehat{\alpha\beta}$ estimate:

$$S_{\widehat{\alpha\beta}} = \sqrt{S_{\hat{\alpha}}^2 \hat{\beta}^2 + S_{\hat{\beta}}^2 \hat{\alpha}^2} \quad (6)$$

However, this formulation used the normal-theory based multivariate delta method; and since the product of two normal distributions is non-normal, confidence limits and significance tests based on Sobel (1982) standard error may be problematic (MacKinnon, 2008). Alternative methods that use the asymmetric distribution of the product of two normally distributed variables or bootstrapping to calculate standard errors have been shown to be preferable (MacKinnon, 2008; Mallinckrodt, Abraham, Wei, & Russell, 2006).

Assumptions of mediation include the typical assumptions for OLS regression – i.e., correct specification of functional form, reliable measures, no omitted variables, and errors are independent and normally distributed with common variance (J. Cohen et al.,

2003). Additionally, mediation analysis assumes correct temporal ordering and no reverse causality (MacKinnon, 2008). Common applications of mediation typically also assume that there is no interaction between the predictor and mediator; however, this is not a required assumption for more general models of mediation (Preacher, Rucker, & Hayes, 2007)

Moderation. Moderation analyses examine whether the relationship between a predictor variable (X) and outcome (Y) differs across levels of a third-variable, the moderator (Z). A moderation model is presented in Figure 2b. The purpose of moderation is to test differential effects – i.e., does the magnitude and/or direction of a predicted effect depend on levels of another variable in the model? The traditional approach to modeling moderation is to include interaction terms in a single regression equation:

$$Y = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 XZ + \varepsilon \quad (7)$$

where β_1 is the partial main effect independent variable (X), and β_2 is the partial main effect of the moderator (Z). Significance of β_3 provides evidence of moderation or differential effects, which can be plotted for interpretability. Assumptions of this model are consistent with the assumptions for general OLS regression (J. Cohen et al., 2003). Alternative methods for testing moderation based on finite mixture models are currently being developed in the methodological literature (Aquilino & Supple, 2001; Mersky, Topitzes, & Reynolds, 2012; Van Horn et al., 2008).

Advancing moderation and mediation. Mediation and moderation are highly flexible statistical approaches; yet, applications of these models in the applied literature have rarely taken advantage of this inherent flexibility. For instance, researchers

typically define the third-variables in a relatively straightforward way – i.e., the third variable is *either* a moderator *or* a mediator. Recent methodological papers suggest that this mutual exclusivity may be unnecessary. Pearl (2012) and Preacher et al. (2007) describe a special case where one variable can function as both a mediator and a moderator. In this situation, one variable both explains the process through which an exogenous variable exerts its effect on the outcome, and simultaneously modulates direct effects of the predictor (see Figure 3). This dual-role of the third-variable has rarely been discussed in the methodological literature, and no applications were found in substantive realms. The feasibility of testing both moderating and mediating functions of a single third-variable with applied data remains an empirical question.

Another way in which third-variable models could be expanded in applied analyses pertains to variable selection. The typical approach to moderation and mediation is to use a measured variable (or a latent variable in a structural equation modeling framework). While this is often a reasonable approach, these models are not constrained to inclusion of measured variables. It is plausible that a developmental process may mediate the relationship between an early behavior and developmental outcome; alternatively, a parameter estimated in an earlier portion of the model can be used to mediate or moderate later outcomes. Integration of these non-traditional variables as mediators and moderators can provide a more nuanced and comprehensive understanding of the ways in which environments shape development.

Summary of Methodologies

Although traditional data-analytic methods have limitations for testing complex developmental processes, recent advances in longitudinal methodologies benefit such

developmental questions. Latent growth models are a person-centered approach for testing growth processes or developmental changes across time. Advancements in third-variable models permit investigation of the mechanisms through which risk factors exert their effect (mediation) or the presence of differential effects of risk across individuals (moderation). These are highly flexible and powerful approaches for exploring youth development.

Yet, substantive applications of these methods have been fairly conventional thus far, with most research examining each developmental process in isolation. Rarely have multiple developmental processes been tested simultaneously. As a result, we know little about the underlying mechanisms responsible for a particular developmental trajectory, or the ways in which developmental pathways depend on contextual risk. Combining multiple longitudinal processes into one integrated model can potentially offer a deeper, more ecologically-valid depiction of youth development.

An Overview of Youth Gang Research

Gang-related research has played an important role in shaping criminological theory since the early parts of the century. Since Thrasher (1927)'s seminal study of 1,313 gangs in Chicago, gang behavior has grabbed the attention and interest of scholars. Early work relied on observational or ethnographic methods to substantiate new or existing theoretical explanations of crime (A. Cohen, 1955; Klein, 1971; W. B. Miller, 1958; Moore, 1978; Short & Strodtbeck, 1965; Spergel, 1966). Despite decades of work, the gang problem did not become a major academic concern until the late 1980s, when community-wide social and economic conditions led to sharp growth in urban violence and gang activity (Klein, 1995). Methodological limitations hindered the generalizability

of early research to the changed ethnic and social composition of inner-city gangs (Hagedorn, 1998). There was a need for more in-depth analysis of the new gang problem. Researchers became specifically interested in understanding the nature of gangs and the characteristics of members, typically by employing existing observational or ethnographic methods (e.g. Campbell, 1987; Hagedorn, 1998; MacLeod, 1987; Short, 1990; M. Sullivan, 1990; Vigil, 1988), or through newly-adopted surveys methodologies (e.g. Bowker & Klein, 1983; Fagan, 1989; Klein, 1971; Morash, 1983).

Wide-spread academic, public, and media concern about gangs during the 1980s led to three federally-funded longitudinal studies aimed at identifying the causes and correlates of youth delinquency – the Rochester Youth Development Study (Thornberry & Burch, 1997), Denver Youth Study (Esbensen & Huizinga, 1993; Esbensen, Huizinga, & Weiher, 1993) and the Pittsburgh Youth Study (Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998a). Data from these three studies, coupled with the Seattle Social Development Project (a longitudinal study of positive and problem behavior among adolescence; Hill, Lui, & Hawkins, 2001), laid a strong foundation for much of what we know about contemporary gangs. One of the major contributions of this body of work was the longitudinal tracking of ecological risk and youth behavior. Data collected before, during, and after gang membership established early evidence of the risks, correlates, and consequences of youth gang involvement. A key finding was the apparent association between gang affiliation and delinquency (Esbensen & Huizinga, 1993; Thornberry, Krohn, Lizotte, Smith, & Tobin, 2003).

Still, these foundational studies were limited by the longitudinal methodology available at the time. Studies tended to rely on simple descriptive means, proportions, and

rates of delinquency without adjusting for measured or unmeasured factors that may confound the relationship between gang membership and youth behavior (Esbensen & Huizinga, 1993; Esbensen et al., 1993; Thornberry, Krohn, Lizotte, & Chard-Wierschem, 1993). To further strengthen causal inference, later studies used regression-based controls to account for known differences between gang-affiliated youth and non-affiliated counterparts (Gordon, Lahey, Kawai, Loeber, Stouthamer-Loeber, et al., 2004; Thornberry, 1998; Thornberry et al., 2003). The idea behind this methodological approach was that the ecology of risk for gang members differed from that of non-affiliated peers prior to gang entry, and these differences needed to be accounted for in order to avoid spurious relations between gang-affiliation and youth behavior. Inclusion of regression-based controls remained the status quo in gang research for nearly two decades. More recently, advanced causal methods have been introduced into the gang literature, providing a more rigorous analysis of the effect of gangs on development and opening the door to a rich area of future inquiry (Barnes, Beaver, & Miller, 2010; Melde & Esbensen, 2011; National Youth Gang Center, 1997).

Beginning in the early 1990s, the National Youth Gang Center (1997) initiated an annual survey of law enforcement agencies to track gangs over time. Though the prevalence of gang activity showed a downward trend from the mid-to late-1990s, there was a sharp resurgence in gang activity during the early 2000s, and rates have remained fairly stable at elevated levels ever since (Egley & Howell, 2012). At last enumeration, there were roughly 28,100 active gangs and 731,000 active gang members in the United States (Egley & Howell, 2012). Contemporary gangs are no longer considered solely a

“big city problem”, with smaller towns and rural communities reporting some gang activity, as well (Egley & Howell, 2012; Howell & Egley, 2005a; Klein, 1995).

Youth Gangs and Delinquency

Across time, geographical location, and study methodology, nearly all gang research converge on the same finding: gang members are more involved in crime and delinquent behavior than non-affiliated peers. Linkages between gang membership and delinquency have been described as, “perhaps the most robust and consistent observation in criminological research” (Thornberry et al., 2003, p. 1).

Youth gang members are disproportionately involved in all adolescent offending, including serious and violent crimes (Esbensen & Huizinga, 1993; Thornberry et al., 2003). Despite composing only about 33% of the sample, youth gang members in the Rochester Youth Development Study were responsible for 86% of all serious delinquent acts, 69% of violent offenses, and 70% of reported drug sales (Thornberry & Burch, 1997). Gang membership places youth at an increased risk of using and selling drugs, carrying a gun, and committing both violent and nonviolent crimes, as compared to non-affiliated counterparts (Alleyne & Wood, 2010; Barnes et al., 2010; Bjerregaard, 2010; Esbensen, Deschenes, & Winfree, 1999; Esbensen & Huizinga, 1993; Gatti, Tremblay, Vitaro, & McDuff, 2005; Thomas, Holzer, Wall, & Flaherty, 2003; Thornberry, 1998; Walker-Barnes & Mason, 2004).

The qualitative nature of delinquency may also differ between gang-affiliated and non-affiliated youth. Alleyne and Wood (2010) found that underlying cognitive processes associated with criminal behavior were fundamentally different between core gang

members, peripheral members, and non-affiliated youths. In particular, core gang members were more likely than non-affiliated youth to blame their victims for their actions and to use euphemistic language to minimize offenses, while peripheral gang members were more likely than non-affiliated youth to deflect blame to their superiors (Alleyne & Wood, 2010). Likewise, gang members in correctional facilities tend to maintain more favorable attitudes toward gangs, violent behavior, and deviant peers than non-affiliated peers also in correctional facilities (Bjerregaard, 2010). Related to drug sales, Bjerregaard (2010) showed that gang members earned a substantially higher income than non-affiliated youth. This difference could not be explained by greater rates of drug sales alone, indicating that gang members were selling more profitable drugs than their non-affiliated counterparts. Moreover, despite higher profitability and involvement with hard drugs, the magnitude of the relation between drug sales and violence was shown to be weaker for gang-affiliated youth than for non-affiliated youth (Bjerregaard, 2010). This suggests differential group processes surrounding sales. Gang membership seems to offer a degree of protection to youths involved in the drug trade, which decreases the likelihood of drug-related violence (Bjerregaard, 2010; Skolnick, 1990).

Selection versus facilitation. Gang membership exerts an impact on youth delinquency over and above what would be expected based on association with a criminogenic peer group alone (Battin, Hill, Abbott, Catalano, & Hawkins, 1998). The process through which gangs exert a *unique* effect has received considerable empirical attention. Three general frameworks – selection, social facilitation, and enhancement models – have been proposed in the scientific literature to understand the role of youth

gangs in predicting individual behavior (Gatti et al., 2005; Gordon, Lahey, Kawai, Loeber, Strouthamer-Loeber, et al., 2004; Thornberry et al., 1993).

The *selection* model is consistent with criminological theories that describe criminal behavior as a product of an individual's underlying propensity for crime (Glueck & Glueck, 1950; Gottfredson & Hirschi, 1990; Hirschi, 1969). This model posits that adolescents who are initiated into a gang have a proclivity toward delinquent behavior, regardless of gang membership. From this perspective, the relation between gangs and delinquency is spurious with no causal association. Rather, increased delinquency observed in gang groups points to the tendency for at-risk youth to associate together and engage in antisocial acts (Spergel, 1990). The heightened delinquency seen in gangs merely reflects the behavior of the 'type of youth' who is both attracted to gang life and likely to engage in delinquency.

The *social facilitation* model is congruent with social learning theory (Bandura, 1978) and suggests that delinquency in gang members is a product of socialization within the gang. From this view, youth gang members do not have any predisposition to crime prior to initiation but, once initiated, exposure to group processes and norms that favor antisocial behavior increase the risk of engaging in delinquent acts. Affiliation not only alters the attitudes, routine activities, and normative beliefs of youths, but also reduces opportunities for socialization with pro-social peers and institutions. Social facilitation suggests a causal association between gang membership and delinquent behavior, with rates of delinquency expected to be highest during years of membership.

Last, the *enhancement* model combines both selection and social facilitation frameworks (Thornberry et al., 1993). An enhancement model suggests that gangs may

attract and recruit youth with a high propensity to engage in antisocial behavior; however, active membership further exacerbates (or enhances) the risk of delinquency via gang socialization. Rates of delinquency consistent with an enhancement model would be elevated across time, with particular spikes in offending during years of active affiliation. The enhancement model has received considerable empirical support in American (Battin et al., 1998; Esbensen & Huizinga, 1993; Gordon, Lahey, Kawai, Loeber, Strouthamer-Loeber, et al., 2004; Thornberry et al., 2003) and international samples (Gatti et al., 2005), underscoring the importance of controlling for selection biases when testing the causal effects of gangs on youth behavior

Causal associations. Research suggests that the enhancement model most accurately captures the true relationship between gang affiliation and delinquency (Barnes et al., 2010; Esbensen & Huizinga, 1993; Gordon, Lahey, Kawai, Loeber, Strouthamer-Loeber, et al., 2004; Thornberry et al., 2003). Data indicate that youth who join gangs are more delinquent before joining the gang than those who do not join (due to selection); and, once a member, levels of delinquency further increase (due to socialization). Moreover, social changes associated with gang initiation (e.g. new friendship and changes in routine activities) have been shown to at least partially mediate the relationship between gang membership and subsequent behavior (Melde & Esbensen, 2011). This lends support to the notion that gang socialization plays a causal role in predicting youth delinquency.

Yet, most evidence for socialization effects is based on studies with non-equivalent, between-subjects designs that compare the behavior of youth involved in gangs to those not affiliated (exceptions include Eitle, Gunkel, & Van Gundy, 2004;

Gordon, Lahey, Kawai, Loeber, Strouthamer-Loeber, et al., 2004; Pyrooz, 2014; and Thornberry et al., 2003). This approach is problematic because gang membership cannot be randomized, rendering all studies quasi-experimental (at best). This creates a methodological challenge because differences in outcomes between gang members and non-affiliated youth are confounded by group differences in baseline covariates (i.e., the sources of selection) at the onset of the study.

Data show that youth who are attracted to gangs differ from other youth on a range of ecological factors (Alleyne & Wood, 2014; Hill, Howell, Hawkins, & Battin-Pearson, 1999; Howell & Egley, 2005b; Thornberry et al., 2003; Tita, Cohen, & Engberg, 2005; Yiu & Gottfredson, 2014). Correlates for gang affiliation include residing in a disadvantaged community, poor academic performance, association with an antisocial peer group, disorganized families marked by low attachment and control, and early conduct problems or delinquent behavior (Bjerregaard & Smith, 1993; Craig, Vitaro, Gagnon, & Tremblay, 2002; Dukes, Martinez, & Stein, 1997; Eitle et al., 2004; Hill, Howell, & Hawkins, 1996; Hill et al., 1999; Howell & Egley, 2005b; Lahey & Gordon, 1999; Le Blanc & Lanctôt, 1998; Sampson, Raudenbush, & Earls, 1997; Thornberry et al., 2003; Tita et al., 2005). These differences in ecological risk pose a challenge to the estimation of a “gang effect” on development because of the confounding influence of non-equivalent baseline groups. Put differently, the selection component of the enhancement model precludes accurate estimation of socialization effects.

Advancements in causal modeling techniques, such as propensity score matching (Harder, Stuart, & Anthony, 2010; Stuart et al., 2009), offer a new and promising direction for gang research. The aim is to create a scenario similar to randomization by

removing methodological confounds related to background risk. These methods provide a stringent test of the counterfactual by examining the influence of gangs, independent of selection effects.

Early studies employing advanced causal methods with gang data show general consistency to the findings of less rigorous work; however, this work suggests that the magnitude of effects reported in prior analyses may have been spuriously amplified due to methodological confounds (Barnes et al., 2010; Melde & Esbensen, 2011). Melde and Esbensen (2011) explicitly illustrated the amplification of effects due to unaccounted confounds in three models of increasing complexity. Results showed that the lagged effects of gang membership on levels of delinquency failed to reach significance in more rigorous analyses. A similar pattern was reported by Barnes et al. (2010), who, after matching on propensity for gang affiliation, reported significant *contemporaneous* associations between gang membership and crime, but failed to find substantial evidence for certain lagged effects. Still, other differences (e.g., educational attainment, police contact) between gang and non-affiliated peers may remain, even after propensity matching (Moffitt, 1993; Pyrooz, 2014). These studies highlight the need for continued examination of the gang effect on youth behavior using methodologically rigorous techniques, particularly in terms of long-term outcomes.

Life-course Perspective to Gangs

A life course perspective to crime (Laub & Sampson, 2003; Sampson & Laub, 2005) focuses on key contextual factors and experiences across the life span in order to explain variability in the persistence and desistance of crime. Central tenets of life course theory include 1) crime is most likely to occur when an individual's bond to pro-social

and conventional institutions is attenuated; and 2) experiences during adolescence may act as a “turning points” that shape later criminal trajectories (Laub & Sampson, 2003; Sampson & Laub, 1997, 2005). Turning points are critical experiences or transitional events that alter or deflect existing developmental pathways or behavioral trajectories (Sampson & Laub, 2005). The basic premise is that although childhood characteristics and experiences may be important for understanding an individual’s propensity for crime, adolescent experiences can redirect these early behavioral trajectories in either positive or negative ways. Changes in trajectories may explain the persistence or desistance of criminal behavior across the life span.

Mechanisms underlying shifts in developmental pathways are consistent with the general ideas of social control theory (Moffitt, 1993), and emphasize the role of informal social ties on the expression of criminal behavior. Sampson and Laub (2005) posit that all turning points involve, to some degree, an increase in opportunities for new social interactions, identify transformation, a change in routine activities, and a weakening of bonds to conventional society.

Gang initiation and disassociation can be considered salient turning points in the lives of youth (Hill et al., 2001; Melde & Esbensen, 2011). Initiation is linked to a “knifing off” (Moffitt, 1993) or weakening of previously held attachments with pro-social peers and institutions (Melde & Esbensen, 2011). Conventional social bonds are replaced with social ties to deviant peers, typically in unstructured and unsupervised settings (Melde & Esbensen, 2011). Gang rituals and behavioral expectations (e.g. a willingness to be involved in dangerous activities for the sake of the gang; J. Miller & Decker, 2001) reinforce identification to the group, and strengthen alignment to a non-conventional

belief system (Hirschi, 2006; Melde & Esbensen, 2011). These changes in social networks and routine activities upon gang entry alter the developmental pathway of the adolescent, making her or him more likely to engage in criminal behavior over time. In a similar frame, gang disassociation may be considered another turning point, which deflects maladaptive pathways by re-connecting ex-members with conventional social networks.

Life-course patterns of gang-related delinquency. Trends in rates of offending before, during, and after gang membership are generally consistent with what would be expected from a life-course perspective - i.e., initiation into a gang is consistently linked to a sharp increase in offending, while disassociation tends to correlate with a slight contemporaneous reduction in criminal behavior (Melde & Esbensen, 2011; Thornberry et al., 2003). Interestingly, however, post-disassociation reductions are generally fairly weak, and remain elevated as compared to delinquency levels before initial gang entry (Melde & Esbensen, 2014; Thornberry et al., 2003). This sustained effect is somewhat surprising, given that gang membership is a transient event for most youth. Nearly half of gang members disassociate within a year of initiation (Esbensen & Huizinga, 1993; Hill et al., 2001; Thornberry et al., 2003). One possible reason for lingering effects is that desistance may reflect a *process* of disassociation, rather than a ritualistic *event* (Esbensen et al., 1999; Melde & Esbensen, 2014; Pyrooz & Decker, 2011). De-identifying as a gang member does not necessarily imply a disconnection from other members or precarious social networks. Former gang members often maintain social and emotional ties to their ex-gang, with many reporting a willingness to retaliate or respond if their ex-gang were disrespected (Pyrooz & Decker, 2011). Maintained social bonds

with ex-gang members may result in a disruption of the re-connection with conventional systems that would be expected based on life-course theory (Melde & Esbensen, 2011). In this way, gang affiliation may exert a long-term impact on behavior, regardless of duration of membership.

Long-term effects. Scant research documents how the transition to gang life alters long-term developmental outcomes in adulthood. Descriptive data reported by Hagedorn (1998) revealed that by age 20 years roughly a third of male gang members received high school diploma, 60% had been incarcerated at least once, and sizable proportion continued to work in the drug trade as a source of income. Similar results were reported by Thornberry et al. (2003) who tested unadjusted differences in young adulthood outcomes between gang members and non-affiliated youth, and found that gang members were at an increased risk of being arrested as an adult and experiencing precocious developmental transitions, such as teenage parenthood or school drop-out. More recently, Krohn, Ward, Thornberry, Lizotte, and Chu (2011) tested a cascade model of the effect of gangs on criminal and noncriminal outcomes during adulthood. Findings showed that adolescent gang membership increased the likelihood of experiencing precocious transitions (e.g. early nest leaving, teen parenthood, school dropout, cohabitation), which resulted in economic hardship and family problems in adulthood. These economic hardships and family problems were, in turn, predictive of later criminal involvement and arrest patterns. Similarly, after matching on level of background risk, Esbensen et al. (1999) reported poorer functioning as adults among youth gang members than non-affiliated peers. Adults who were involved with gangs during adolescents

showed higher rates of crime, illegal income, incarceration, substance use, poorer health, lower educational attainment, and greater financial support (welfare).

Still, other work shows that certain associations between gang involvement and delinquency observed cross-sectionally may not hold when examined longitudinally. Barnes et al. (2010) who, after matching gang members and non-affiliated youth on one's propensity to join a gang, revealed greater contemporaneous involvement in both *violent* and *nonviolent* crimes among gang members; but only *violent* crimes when measured longitudinally. This is consistent with earlier work by Battin et al. (1998), who did not find substantial evidence to conclude that gang members had greater involvement in *nonviolent* crimes or specific drug behaviors after controlling for association with delinquent peers. Similarly, Melde and Esbensen (2011) reported a significant contemporaneous association between gang membership delinquency; but failed to find support of a significant lagged effect after matching gang members and non-members on levels of background risk. Last, Bjerregaard (2010) found that gang membership was only weakly associated with drug use and drug sales when examined longitudinally. Such data suggest that the effects of gang membership may gradually weaken over time; however, more work is needed to better understand the causal relation between gang involvement and long-term consequences.

Ultimately, there is likely multifinality of young adult outcomes associated with youth gang membership. Variability in long-term outcomes may be related to differential processes of gang influence (Walker-Barnes & Mason, 2001). Gangs are naturalistically embedded in a broader context of risk and protection. Other contextual risks may ameliorate and/or exacerbate gang risks. The joint effects of multiple risk conditions may

explain why some youth are able to rebound from gang affiliation and follow more conventional life-course trajectories into young adulthood, while others remain on criminogenic pathways throughout life.

The Role of Family Processes in Long-Term Gang Effects

Linkages between dysfunctional family processes and youth gang membership have been well-defined in the empirical literature (Dukes et al., 1997; Esbensen et al., 1999; Esbensen et al., 1993; Hill et al., 1996; Hill et al., 1999). Gang members tend to live with families characterized by low attachment or emotional bonding, poor parental monitoring, and high levels of conflict (Dukes et al., 1997; Eitle et al., 2004; Esbensen et al., 1999; Esbensen et al., 1993; Howell & Egley, 2005b; Thornberry, 1998; Thornberry et al., 2003). In particular, parenting styles characterized by high levels of psychological control (e.g. coercive, guilt-based parenting strategies) or low levels of behavioral control have been shown to increase the likelihood of gang entry (Walker-Barnes & Mason, 2001). Family risks exert an impact on gang initiation above and beyond the effects of exposure gang-involved peers alone (Walker-Barnes & Mason, 2001), and may be particularly salient for females (Esbensen et al., 1999). The constellation of risk associated with the typical family environment of a gang member has led to the portrayal of the gang as a surrogate family that provides emotional bonding and support for affiliated youth (Walker-Barnes & Mason, 2001).

Despite evidence that maladaptive family processes increase an individual's proclivity to join a gang, far less is known about the relationship between familial factors and youth behavior post-gang initiation. Harper and Robinson (1999) were the first to test the unique effects of family functioning on delinquency in the context of gangs. Results

showed a negligible effect of parenting on delinquency, after controlling for the effects of gang membership. This suggests that parents have a trivial influence over behavior once an adolescent is already been gang initiated. This finding is fairly inconsistent with what would be expected, given simultaneous parental and peer influences on problem behaviors more generally (Trucco, Colder, & Wieczorek, 2011); and, a related body of work showing a significant inverse relationship between parent-child relationship quality and substance use among gang-affiliated girls (Valdez, Mikow, & Cepeda, 2006). Further, research on offending behavior in a general population indicate that parental monitoring and parent-child relationships during adolescence continue to play an important role in young adulthood, even after taking adolescent delinquency and peer influences into account (Johnson, Giordano, Manning, & Longmore, 2011).

Synergistic effects. A growing body of literature on problem behaviors in a general population suggests that families not only have a unique effect on youth behavior, but may also impact youth outcomes through interactions with other environmental risks (Fallu et al., 2010; Farrell, Henry, Mays, & Schoeny, 2011; Farrington & Welsh, 2007; Gorman-Smith, Henry, & Tolan, 2004; Mason, Caucé, & Gonzales, 1997; Mason, Caucé, Gonzales, & Hiraga, 1996; Sampson & Laub, 1993; Schonberg & Shaw, 2007). It logically follows that family functioning would have a similar synergistic relationship with gangs, a peer risk factor. Modeling the main effects of families alone may misconstrue the relationship between families and gang-related outcomes. A moderation model may more accurately capture relations. Family factors may offset the relationship between gang affiliation and subsequent outcomes by buffering youth from (or exacerbating the effects of) gang-related risks.

Only one study identified to date has examined the joint effect of gangs and parenting on delinquent behavior. In their study of 300 ninth grade students, Walker-Barnes and Mason (2004) tested whether four dimensions of parenting (i.e., behavioral control, psychological control, mother-adolescent conflict, and warmth) moderated the relationship between gang involvement and three type of adolescent problem behavior (i.e., minor delinquency, major delinquency, and substance use). Across outcomes, results showed that behavioral control, which measured the degree to which parents were involved in decision-making about adolescent daily activities, weakened the relationship between gang involvement and problem behavior (Walker-Barnes & Mason, 2004). Conversely, and inconsistent with hypotheses, parental warmth increased the strength of the association between gang membership and minor delinquency and substance use (Walker-Barnes & Mason, 2004). This unexpected finding may be related to family enmeshment, which has been previously associated with increased problem behaviors (Barber & Buehler, 1996), or reflect a methodological artifact related to unmeasured confounding effects of pre-study behavior (Walker-Barnes & Mason, 2004).

From a slightly different vantage point, Melde and Esbensen (2011) specified a multivariate model in which parental monitoring (and other factors associated with developmental turning points; Sampson & Laub, 2005) mediated the relationship between gang involvement and subsequent behavioral outcomes. While results indicated a significant, *contemporaneous* effect of gang membership on reduced parental monitoring, there was insufficient evidence to conclude a lagged effect of gang membership on parental behavior, or an indirect effect of gang affiliation on delinquency through parental monitoring. Regardless, Melde and Esbensen (2011) note overarching

low levels of parental monitoring among gang-involved youth, and temper findings by suggesting that families may still be an important and malleable point of intervention.

Changes in family functioning over time. Gang-affiliation is a unique developmental phenomenon that is both *predicted by* and *predictive of* risk exposure (DeLisi, Barnes, Beaver, & Gibson, 2009; Taylor, Freng, Esbensen, & Peterson, 2008; Taylor, Peterson, Esbensen, & Freng, 2007). Despite an abundant literature on family risk factors for initial gang involvement, little is known about how these risk conditions change over time. Studies typically treat family functioning as a static or time-invariant variable. Families are observed to have a certain level or risk, which is assumed to remain constant across development. This assumption may not accurately capture the real-world, dynamic nature of families. Likely, there is a more complex interplay between youth behavior and family functioning. Gang initiation may act as a “shock” to the youth’s ecology to which parents must respond. This systematic parental response may partially explain divergent pathways to adulthood.

At least two primary systematic parental responses to youth gang entry are possible. First, gang membership (as conceptualized in life-course theory) should be associated with a weakening of conventional bonds and a knifing off (Moffitt, 1993) of previously held attachments with parents and other pro-social persons. The weakening of conventional bonds upon gang entry may synergistically exacerbate levels of risk. The particular combination of high levels of family risk before initiation (Hill et al., 1999) and a *lowering* of family attachment post-initiation may partially explain unique effects of gang-affiliation on development. Alternately, youth gang entry may disrupt the family system in a way that produces more adaptive functioning. Uneasiness associated with

their child being a gang member may spark changes in parenting practices. Although untested in the empirical literature, gang membership may additionally open the door to formal and informal mechanisms of parenting support, which may improve conditions of risk and positively impact youth outcomes. Alternatively, parents may not respond at all to gang initiation. This outcome would be likely if gang membership is done in secrecy and/or parental monitoring of behavior was low enough that parents were unaware of initiation.

Understanding the effects of parental response to gang initiation has important implications for gang-related policy and intervention. The traditional response to community gang activity is suppression by law enforcement, which is designed to remove the most influential gang members from the community and deter younger youths from initiating (Howell & Office of Juvenile Justice Delinquency Prevention, 2000). Attempts at suppression have had limited success. This is likely because models of suppression target the gang, rather than underlying causes of affiliation or mechanisms of risk. Alternatively, high-quality interventions for antisocial youth often focus on improving conditions of family risk (e.g. Henggeler, Schoenwald, Borduin, Rowland, & Cunningham, 1998). Even still, data suggests that these programs have abbreviated effects when youth are gang-involved (Boxer, 2011). Gang-affiliation, in some way, interferes with program outcomes. While this may be due to an overall lower level of functioning in gang families, it may also reflect differential risk processes between gang-affiliated and non-affiliated youth. There is a need to delineate these differential pathways to adulthood. Understanding the dimensions of parenting that specifically

offset the link between youth gang-affiliation and maladaptive developmental outcomes can be useful in informing more effective and sustainable points of intervention.

The Current Study

Development is a complex and dynamic process that involves the active interplay between the individual child and the environment within which she or he resides. This dissertation aims to further developmental science by presenting a statistical approach that captures multiple developmental processes within a single model. Specific aims are to 1) test the feasibility of a dual-process longitudinal model with applied data; 2) explore how familial response to gang initiation explains long-term developmental outcomes.

The model tested in this dissertation is an integration of existing data analytic approaches that have appeared in the methodological literature, but have been slow to emerge in substantive realms. Bidirectional effects between contextual risk factors and individuals will be explored by estimating how individual behavior alters longitudinal trajectories of environmental risk; and how this change, in turn, may mediate and moderate long-term developmental outcomes. The specific substantive aim of this dissertation is to map the interplay between youth gang affiliation and family functioning. It is likely that parent and youth behavior are highly intertwined, with each system adjusting and responding to the behavior of the other in a bidirectional system of influence. When youth behavior is a discrete event with powerful consequences, such as joining a gang, the systematic response of the family may be an important factor in determining long-term outcomes.

In this dissertation, I hypothesize that gang-initiation will disrupt long-term trajectories of parenting behavior; and that this disruption will play a role in the long-term, psychosocial outcomes of youth. Specifically, I examine how changes in parenting trajectories (or the degree of parental response to gang initiation) mediate and moderate the effect of gang membership on educational achievement, service utilization, pro-social behavior, and antisocial behavior during young adulthood. Adaptive responses to gang initiation (e.g. use of more effective parenting strategies; improved relationship with child) are expected to offset the effects of gang membership on young adulthood outcomes. Improved parenting is expected to act as the underlying mechanism through which positive psychosocial outcomes develop. Conversely, a maladaptive (or non-response) to initial gang entry is expected to result in less desirable outcomes during young adulthood. This will be among the first studies to test the processes underlying young adulthood outcomes of youth gang members.

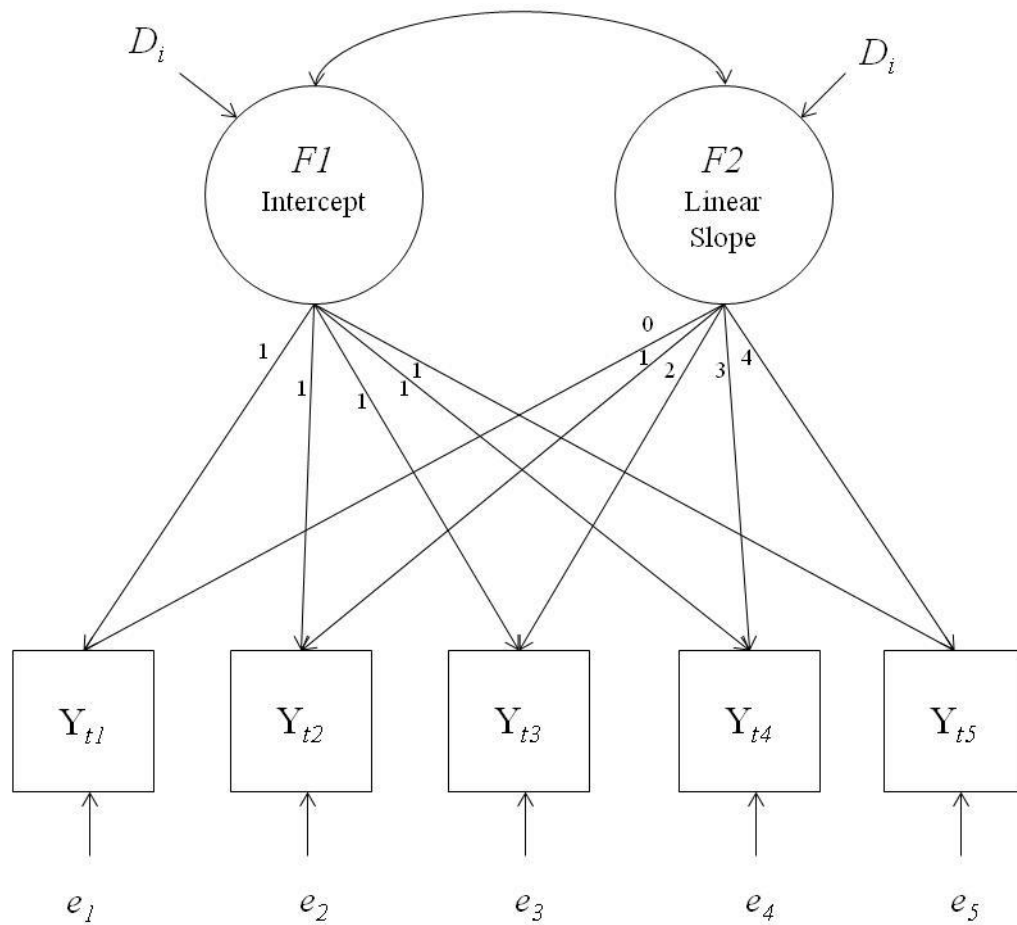
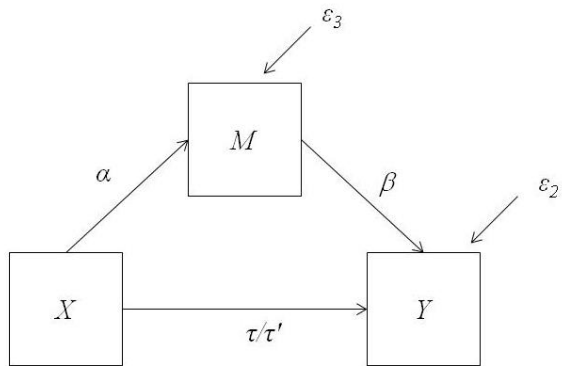


Figure 1.1. General latent growth model framework.

a.



b.

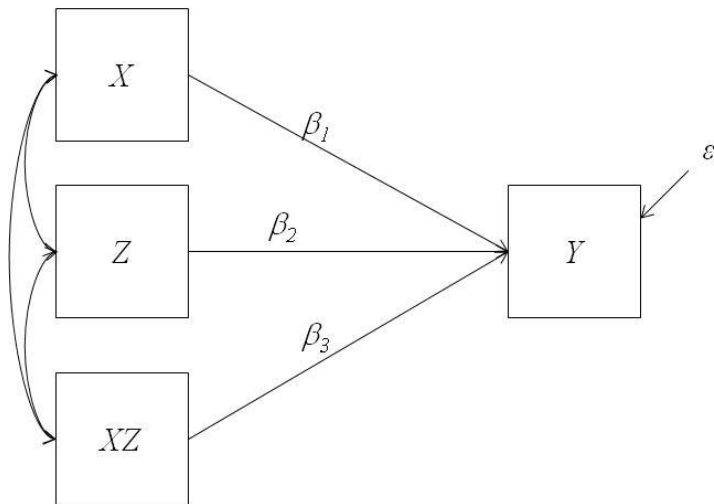


Figure 1.2. General models for mediation (1.2a) and moderation analyses (1.2b)

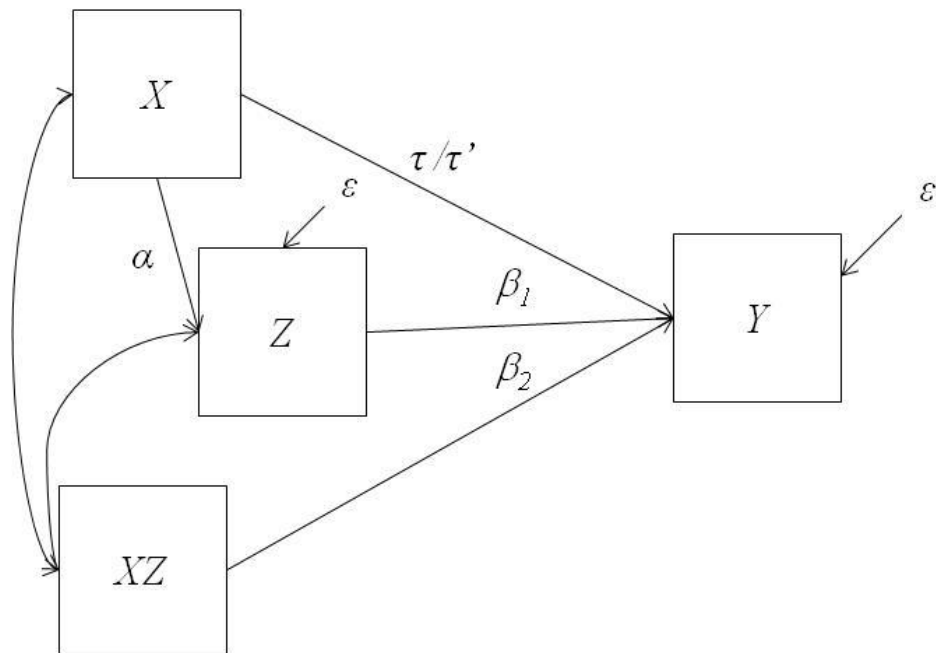


Figure 1.3. General model for a dual-role mediator and moderator (mediated moderation)

CHAPTER 2

METHODS

Data for this dissertation came from the Fast Track Project, a multi-site investigation of the development and prevention of antisocial behavior and related conduct problems in a sample of high-risk youth. Fifty-five schools from four distinct geographical areas (Durham, NC; Nashville, TN; Seattle, WA; and rural Pennsylvania) were identified as high-risk based on crime and poverty statistics in the neighborhoods they served. Within each geographical area, schools were divided into matched sets based on demographics (e.g., size, ethnic composition, and poverty level), and then randomized to treatment or control conditions. A multi-stage screening procedure of nearly 10,000 youth was used to recruit three consecutive cohorts of youth in the years 1991, 1992, and 1993. First, teachers rated students on classroom conduct problems using the Teacher Observation of Child Adjustment – Revised Authority Acceptance score (Werthamer-Larsson, Kellam, & Wheeler, 1991). Children within each cohort and geographical site who were rated in the top 40% by teachers were then screened for behavior problems in the home (via parental report). Ninety-one percent (n=3,274) of youth solicited for this second stage of screening participated. Teacher and parent ratings of youth behavior were standardized and summed, yielding a total risk score for the screening. Children in the top 10% of these combined teacher and parent ratings in their schools were targeted as being “high-risk” and invited to part of the study. Invitations to

participate began with the highest risk score and proceeded downwards until the desired sample size was reached within sites, cohorts, and pre-defined groups. A total of n=891 youth (n=446 control, n=445 intervention) participated.

An additional within-site stratified, normative sample of 387 children was included in the study. This normative sample was recruited from control schools (n=27), and contained roughly 10 children within each decile of behavior problems. These youth were selected to represent the population normative range of risk scores on the screening measures. Seventy-nine student were included in both the high-risk and normative sample; these youth represented the highest-risk deciles in their schools and were needed to fill the upper end of the distribution for the normative group (see Lochman, 1995 for further details).

The Fast Track Project was led by collaborators from Duke University, Pennsylvania State University, University of Washington, and Vanderbilt University. The study was approved and monitored by Institutional Review Boards at the four governing universities. Data were collected annually starting in the youth's kindergarten year and continuing through young adulthood. Attrition rates for the project were relatively low, with roughly 80% of the original sample re-interviewed 19 or 20 years later. Fast Track participation required active parental consent and youth assent (when age-appropriate). Families received modest financial incentives for participation. For more information regarding the Fast Track Project, see the detailed project website (<http://www.fasttrackproject.org>), or Conduct Problems Prevention Research Group (CPPRG; 1992, 1996). Use of the data is available for research purposes by application.

Participants

This dissertation used data from the control and normative samples (n=753). Intervention youth were excluded to reduce interference by intervention effects. The full sample comprised roughly 58% males and 42% females. Half (50%) identified as being White, 46% identified as Black, and the remaining 4% reported identification with another ethnicity. Permission to use these data was granted from the Principal Investigators of the Fast Track Project.

Measures

Gang Membership. Gang membership was assessed by asking youth to answer the following question: “In the past 12 months, have you been a member of a gang or posse?” Youth who indicated a positive response were classified as a gang member for that year. This item was administered in seventh, eighth, tenth, and eleventh grades in a self-administered audio-assisted format that was intended to increase privacy.

Youth self-report of gang membership has been shown to be a valid and reliable method of assessment (S. Decker, Pyrooz, Sweeten, & Moule, 2014; Horowitz, 1990; M. L. Sullivan, 2005; Thornberry et al., 2003). Self-nomination of gang-affiliation is the current standard in the literature, and corresponds to the practice of law enforcement officers who generally use youth report as evidence of membership (Deschenes & Esbensen, 1999; Esbensen, Winfree Jr, He, & Taylor, 2001). Alternative methods, such as reliance on objective criminal records, are considered less rigorous because they are subjected to jurisdictional variations in the definition of a youth gang and/or police knowledge of youth gang membership (S. H. Decker, Flannery, Vazsonyi, & Waldman, 2007).

Parenting Variables. Developmental trajectories of two parenting dimensions were modeled: parent-child communication and parental monitoring.

Parent-child communication. Parent-child communication was measured using the “Parent-Child Communication – Child” measure (CPPRG; 1994b), a 10-item scale designed to assess youth perceptions of parental openness to communication. This scale was adapted from the Revised Parent-Adolescent Communication Form of the Pittsburgh Youth Study (Loeber et al., 1998a; Thornberry, Huizinga, & Loeber, 1995). Youth report of parental behavior was selected for this study on the premise that it is likely youth *perceptions* of relationship quality that will impact behavior, regardless of parental perceptions or objective ratings; and, because of prior work indicating that youth report of parenting may be more predictive of youth behavior than parental report (Abar, Jackson, Colby, & Barnett, 2014).

The Parent-Child Communication scale comprises two subscales: A parent communication subscale (five items) that measures youth’s perceptions of how well the primary caregiver maintains open communication; and the child communication subscale (three items) that measures how often the child communicates her/his feelings and problems with her/his primary caregiver. Two items (“Some things I do not discuss with parents” and “Some things parents do not let me discuss”) did not load on either subscale. Higher scores indicate higher levels of parent-child communication. Psychometric work shows adequate reliability for both subscales. Coefficient alpha for the parent communication subscale range from .66 to .79 (an exception is in year five with alpha = .56; Pek, 2006); estimates of for the child communication subscale ranged from .75 to .86 (McCarty & Doyle, 2001; McMahon, Kim, & James, 1997; Rains, 2004). Results of a

confirmatory factor analysis conducted in year six of the study resulted in a CFI of .99, indicating satisfactory fit of the two factor model (McCarty & Doyle, 2001).

In this dissertation, I used data collected annually from fourth grade to eleventh grade, exclusive of sixth grade when this measure was not administered. A single, second-order factor was originally proposed (dissertation prospectus) to estimate trajectories of parent-child communication over time. However, due to problems with imputation of individual items (see below), the child communication subscale score was used to form trajectories. This subscale was selected due to the superior psychometric properties of child communication over the other subscale. See Appendix A for specific items.

Parental monitoring. Parental monitoring was assessed using the “Supervision” scale, an 18-item measure designed to assess youth perceptions of their primary caregiver's knowledge of youth's activities and companions. This measure is a revised version of the Supervision/Involvement scale (Loeber et al., 1998a) used in the Pittsburgh Youth Study. The scale comprises three subscales, with a few independent items that do not load onto any other dimension (Doyle & McCarty, 2001; Loeber et al., 1998a). The Supervision/Involvement subscale (five items) measures youth's perceptions of their parents' knowledge of their whereabouts, activities, and companions. The other two subscales, Daily Activities (two items) and Curfew Time (two items) assess youth's perceptions of the frequency of communication about daily activities, and the extent of parental regulations on the timing of these activities.

Psychometric properties of all subscales are favorable, especially considering the low number of items. Estimates coefficient alpha for the Supervision/Involvement

subscale range from .62 to .77 (Doyle & McCarty, 2000, 2001; Kersteter, 2004).

Reliability for Curfew Time (based on interitem correlations of the two items) has been shown to vary greatly over time, with estimates ranging from .36 to .95 (Doyle & McCarty, 2000, 2001; Kersteter, 2004). Higher reliability was observed in later years of administration. Reliability of the Daily Activities subscale has been calculated with two items (“In the past 6 months, how often did your parent talk to you about what you were going to do for the coming day?”; “In the past 6 months, how often did your parent talk with you about what you had actually done during the day?”) and three items (“How often did your caregiver ask about how things were going at school?” was added). Reliability estimates for the two item measure range from .34 to .62 (Doyle & McCarty, 2000, 2001), and .88 to .90 for the three item measure (Kersteter, 2004).

In this dissertation, I utilized data from fourth through eleventh grade, with the exception of sixth grade when data on this measure was not collected. The Supervision/Involvement subscale was used for developmental trajectories of parental monitoring, since problems with imputation (see below) precluded use of a second-order factor structure for trajectories.

Young adulthood outcomes. All young adulthood outcomes were measured at age 19 or 20, corresponding to two years after the individual’s 12th grade year for most youth. Young adulthood outcomes fall into five broad domains: Educational achievement; service utilization (used as a proxy of societal costs); pro-social behavior; Alcohol, tobacco, and other drug use (ATOD); and delinquency and crime.

Educational achievement. Educational achievement was measured through self-report of the highest grade completed. Responses were categorized as: 1) Did not complete high school (i.e., highest grade completed is 11th grade or less); 2) High school graduation or GED; 3) Attended some college (two or four year programs). This variable was modeled as an ordinal outcome.

Service utilization. Service utilization was included as a measure of non-criminal societal costs associated with gang membership. Both financial support services and health-related services were assessed. The rationale for including these dimensions is to understand the extent to which gang membership is taxing on the broader society and social systems in ways other than criminal justice costs.

Financial support. Utilization of financial support services will be measured via four items that asked respondents whether they receive income or support from the following sources: AFDC (Aid to Families with Dependent Children); TANF (Temporary Assistance for Needy Families); Welfare; SSI (Supplemental Security Income); Disability; Food stamps; and Housing assistance. A single dichotomous item was used as an indicator of any type of financial support.

Health-related services. Health-related service utilization was measured as a count variable that captured in-patient and out-patient service utilization in the past two years. This corresponds to post-high school service use for the current sample. Data will come from “The Service Assessment for Children and Adolescents (SACA): Adult and Child Reports” (Loeber et al., 1998a), a self-reported measure of mental health and other services utilization. Respondents answered whether they received a given set of in-patient services (e.g., stayed overnight in: a psychiatric hospital, general hospital, residential

treatment center, group home, foster home, emergency shelter, or another overnight facility) or out-patient services (e.g., mental health center services, day treatment services or partial hospitalization, drug & alcohol clinic services, home therapy or family preservation services, services from a counselor, therapist, or psychiatrist, services from an emergency room or urgent care facility, or services from a pediatrician or family doctor). Use of services for any physical or mental health reason was assessed. The decision to include services provided for any reason (not exclusive to mental health) was based on the notion that correlates to gang-affiliation – e.g., gun violence, aggression – may not be related to mental health needs per se, but still increase utilization of costly primary health care and emergency services. All items contained binary responses with a ‘1’ indicating past-two-year use of the respective service. Health service utilization was modeled as an ordinal variable, measured by the count of all services received. Due to heavy imbalance/skew, health related behavior was truncated such that the response levels were zero, one, two, and three or more services.

Pro-social behavior. Pro-social behavior was assessed using the Total Social Participation subscale on the “Prosocial Activities” measure (CPPRG; 1994b), a 17 item scale designed to assess involvement in pro-social activities outside of school or work. Respondents indicated on a 5-point scale (1= never; 2 = once in the past year; 3 = a few times in the past year; 4 = monthly; 5 = weekly; 6 = daily) how often they participated in religious activities (church participation), non-religious activities (such as a social club or organized sport), and civic volunteer activities (such as membership in a political, environmental, or human rights organization). Each sub-domain (religious, non-religious, civic activities) has been shown to have adequate internal consistency.

Estimates of coefficient alpha for church participation, non-religious participation, and civic volunteer have been shown to be .85, .77, and .79, respectively (Rains, 2010).

Coefficient alpha for all three sub-scales combined (“Total Social Participation” subscale) has been estimated at .65 (Rains, 2010). The “Total Social Participation” subscale was used as a manifest variable in the analyses, since a second-order factor structure for the latent variable was not supported by the data.

Delinquency and crime. Given strong links between gang membership and antisocial behavior (Thornberry et al., 2003), multiple types of delinquency and crime were assessed. Specific domains assessed were: Arrests, involvement in severe and/or violent crime, and aggression.

Arrests. Arrests during young adulthood was measured using a single binary item that asks respondents if they were arrested at any time during the past two years. Youth who provided an affirmative response were coded ‘1’.

Involvement in severe and/or violent crime. Frequency of involvement in serious and/or violent crimes was assessed using data from official court records of offenses for which youth were arrested, adjudicated, diverted at intake, or brought before the magistrate (Godwin, 2011). Severe crimes are crimes where no serious harm to a person is done, but the potential for serious harm existed and intent was unclear (Godwin, 2011). Examples include 2nd or 3rd degree assault, domestic violence, 1st degree or aggravated burglary, assault with a deadly weapon, child abuse, robbery, child pornography, weapon possession with intent, bomb threat, carjacking, and aiding and abetting in a kidnapping or armed robbery. Violent crimes are crimes where actual serious harm or threat of harm to someone’s physical or mental well-being was perpetrated, and the intent was to harm

(Godwin, 2011). Examples include murder, rape, kidnapping, aggravated robbery, sex offenses, aggravated assault, aggravated child abuse, armed robbery, 1st degree arson, sexual abuse, and 1st degree assault. A single binary score was used in the analysis. A code of '1' indicated that the subject engaged in at least one offense that was classified as severe and/or violent crimes in the past year.

Aggression. Aggression was assessed as an index of past year involvement in a set of antisocial behaviors from the Interpersonal Violence subscale on the "Self-Reported Delinquency" measure (Elliott, Huizinga, & Ageton, 1985). Respondents indicated whether or not in the past year they had: attacked another person with the intent to hurt them, hit another person with the intent to hurt, used a weapon to get money from another person, thrown objects at people, been involved in a gang fight, and had sex with someone against their wish. Item responses were coded '1' if youth engaged in the behavior and '0' if youth denied engaging in the behavior in the past year. Due to low cell counts, a single binary item that indicated if any items were endorsed was used as the outcome.

Alcohol, tobacco, and other drug use (ATOD). ATOD use during young adulthood was measured as a latent variable determined by self-reported frequency of past year ATOD use. Data came from the "Tobacco, Alcohol and Drugs - Revised" scale, a 142-item measure based on the National Longitudinal Study of Adolescent Health (Bureau of Labor Statistics, 2002), which was designed to tap into various dimension of ATOD-using behavior. This dissertation includes indicators of past year use of both licit drugs and illicit drugs. For the most commonly used substances – i.e., cigarette smoking, other tobacco products (i.e., cigars and chewing tobacco/snuff),

alcohol, and marijuana – respondents indicated the number of days (for tobacco and alcohol) or number of times (for marijuana) they used the drug in the past 12 months. This frequency was then made into an ordinal variable (zero days; less than once a month; 1-2 per month; at least two times per month but less than weekly; 1-2 per week; more than twice per week) due to low prevalence at higher frequencies and to balance the distribution. At the time of data collection, respondents were of legal age for tobacco use only. Lesser-used illicit substances, which include “hard drugs”, inhalants, and inappropriate use of prescription drugs, were also measured. Due to low prevalence of use on each individual drug, a single binary variable was used in analyses that indicated whether or not the individual used any of the following drugs in the past year: Stimulants/amphetamines, sedatives/tranquilizers, cocaine/crack, heroin, oxycotin, opiates, PCP/angel dust, ecstasy/MDMA, hallucinogens, amyl nitrate/poppers, inhalants, and rohypnol. Chewing tobacco and cigars were also included in this summary binary variable due to low endorsement of these tobacco products.

CHAPTER 3

DATA ANALYSIS

Data analyses for this dissertation took place in four stages. First, multiple imputation was implemented to account for missing data. Second, gang-affiliated and non-affiliated youth were matched on level of background risk. This strengthened the ability to make causal claims about the effects of gang membership on outcomes by removing the effects of baseline covariates. Third, latent growth models were used to describe developmental trajectories of parenting over time for all matched youth. Last, parental responses to gang initiation was modeled as a mediator and moderator in the relationship between gang affiliation and young adulthood outcomes.

Missing Data

Multiple imputation was used to account for missing data in this dissertation. Multiple imputation is a reliable approach to obtaining unbiased parameter estimates and standard errors in the context of missing data, when the missingness is assumed missing at random (i.e., the mechanism of missingness is related to other variables in the analysis model, but not the value of the missing data itself; Little & Rubin, 2002; Schafer, 1997). In this dissertation, I implemented the *chained equations* algorithm (also referred to as *sequential regression* or *fully conditional specification*) for imputations (Raghunathan, Lepkowski, Van Hoewyk, & Solenberger, 2001). *Chained equations* is a regression-

based approach that allows for variable-by-variable specification of the imputation model. This was very important in this study because of differing variable types and because of the high number of variables needed to be imputed. According to best practice, the imputation model should contain all variables in the analysis model, along with any additional variables that may improve the quality of the imputation, such as those that may strongly relate to missingness. Due to the high number of variables in the complete analysis model (i.e., all phases of propensity score derivation, estimation of parenting trajectories, prediction of outcomes), the inclusion of all variables was not possible because the number of parameters exceeded the sample size and the model would not converge. Thus, I employed a special analytic strategy to impute data. First, I imputed scale scores rather than individual items. This reduced the number of variables drastically, though convergence problems still remained. To address remaining convergence problems, I took advantage of the flexibility of the chained equation approach and strategically selected predictors for each missing variable in the dataset. Predictor selection was based on the following criterion: If the correlation between a target and predictor variable was greater than .02 *and* the proportion of usable cases was at least .01, the predictor was included in the imputation model. The proportion of usable cases measures the amount of cases with missing data on the target variable that have observed values on the predictor. A low proportion indicates that the same cases were missing on the target variable and the predictor variable, suggesting that the predictor contains little information about missingness and could be dropped from the imputation model for the target variable.

Sometimes the above criterion was not met, but the relation between the predictor and target variable were of substantive interest. To ensure that all variables that appear in each phase of the analysis model (phase 1: propensity score matching; phase 2: estimating parenting trajectories; phase 3: outcome analysis) are also included in the imputation model, the following constraints were placed on predictor selection (It is important to note that the purpose of these equations is to predict *missingness* on a particular variable; therefore, each predictor (or covariate) is used to explain why another variable is missing, not to denote causal relation between the constructs themselves, as a typical regression model would do):

- 1) Gang variables (i.e., dichotomous variables indicating whether the individual reported being in a gang in 7th, 8th, 10th, and 11th grade) were included as covariates to explain missingness on all other variables. All variables were included as predictors of missingness on gang membership.
- 2) Missingness on parenting indicators was predicted by all other parenting indicators, outcome variables, and gang status variables.
- 3) Missingness on outcomes was predicted by parenting variables, gang status variables, and all other outcomes.
- 4) To account for the multilevel data structure, the school id variable assigned during Year 1 of data collection was included as a predictor of missingness for all variables.

Ten imputations with 500 iterations were run. Ten imputations were selected due to long computational time (> 24 hours per imputation) and because previous work suggests that the procedure can be highly efficient with few number of imputation

(Rubin, 1987). Missing data handling was implemented using the mice package (van Buuren & Groothuis-Oudshoorn, 2011) in R statistical software version 3.0 (R Core Team, 2013).

Balanced Risk Set Matching

Since gang research data are inherently quasi-experimental, alternative methods (other than randomization) must be used to balance groups on observable baseline covariates at the onset of the study (Shadish, Cook, & Campbell, 2002). In this dissertation, I implemented a sophisticated causal modeling technique, *balanced risk set matching*, to equate levels of background risk between gang-affiliated and non-affiliated adolescents. Balanced risk set matching is a complex variant of traditional propensity score matching (Rosenbaum & Rubin, 1983), suitable for matching on a time-dependent grouping variable (Li, Propert, & Rosenbaum, 2001; Lu, 2005). This is particularly valuable in developmental research where the matching variable may occur later in development, such as gang membership. Balanced risk set matching allows for the matching of a gang member to a peer counterpart who will become a gang member in future years but was not yet affiliated at the time of matching.

Similar to propensity score matching, balanced risk set matching is done by assigning a numeric, scalar score – i.e., the propensity score – to each member of the sample, which represents the individual’s propensity or likelihood of experiencing a particular event. This can be represented as:

$$e_i(X) = P(W_i = 1 | X_i) \quad (8)$$

where W_i represents group membership and X_i represents a vector of observed covariates. It is the probability of experiencing an event, conditional on the covariates. Similar to other matching methods, balanced risk set matching assumes that group assignment is unconfounded with the outcome at each propensity score (i.e., stable unit treatment value assignment). If not violated, differences between groups on the outcome variable can be attributed to group effects and random error (Stuart & Rubin, 2007).

The propensity score is derived by taking the fitted values of a logistic regression predicting event occurrence based on a set of covariates. Propensity models assume that measured confounders were included in the propensity score estimation, and that there is no hidden bias due to unmeasured confounds. To the extent that this assumption holds, propensity score methods create a scenario similar to randomization. In this dissertation, a set of ecological risks were used to derive one's risk for gang initiation at each time point. A full list of background covariates used for the derivation of propensity scores for the current dissertation can be found in Appendix B.

In balanced risk set matching, the derivation of propensity scores and procedure is done iteratively. First, a propensity score that represent risk at the first time point is derived for each individual, and individuals are matched without replacement on this propensity. All unmatched individuals are then assigned a new propensity score, which represents the propensity of risk for the second time point, given that they were not matched at Time 1. Individuals are then matched for risk at Time 2. This procedure continues for all time points, or until all subjects are matched. An implication of this iterative procedure is that it is possible for a subject who experiences the event at a later

time point to be matched as a control at an earlier time point. In this study, this means that an adolescent who joins a gang later in life may be matched as a control subject in an earlier time period. This was the case for few ($n=42$) subjects in the sample.

A 1:1 matching process (where each case is matched to exactly one control) was implemented for these analyses. Although the reduced sample size is a limitation, 1:1 matching was selected over other methods, such as full matching (Stuart & Green, 2008) or 1:k matching, because balanced risk set matching necessitates a specified group of non-matched individuals at each iteration (so that there is an available match pool at later time points). Use of 1:1 matching increased the likelihood of having high-quality matches for later time points - i.e., to decrease the chances that the best matches were “used up” in early matching rounds, leaving large multivariate distances between cases and controls in later iterations of matching. Additionally, the nearest-neighbor matching method was used in this study. Nearest neighbor matching selects the control subject that has the nearest to the case subject on the distance measure. One potential limitation with nearest neighbor matching is that large distances (or differences in propensity) between case and control may persist, despite being the “closest” match. This problem was circumvented in this dissertation by setting a caliper of .02. This prevented any cases/controls from being matched if their propensity was more than a two percentage point difference.

The MatchIt (Ho, Imai, King, & Stuart, 2011) package in R software (R Core Development Team, 2012) was used for matching. This program was selected because of automated features that facilitate checks of the balance of measured covariates after matching, and the transparency of source code.

Matching with imputed data. Implementing a matching process with imputed data posed an additional challenge because between-imputation variability may yield different matched pairs across imputations. There is no established standard in the literature for dealing with this issue, so a specialized analytic procedure was developed. First, I needed to classify each youth as either a gang member or non-member across all imputations. Removing this between-imputation variability would prevent an individual youth being matched as a gang member in some imputations and a non-member in others. To accomplish this, I took the mean of the gang variables across imputations, yielding an estimate of the proportion of imputations that each individual was categorized as a gang member for each time point. This equaled ‘1’ or ‘0’ when gang membership was observed, and a proportion, $0 \leq x \leq 1$, in the context of missingness. This proportion was then entered into a randomizer that was used to assign each youth to either a “gang” (case) group or “nongang” (control) group, based on their probability of membership at each time point across imputations.

Duration of gang membership. Data show that youth gang membership is a transient event for nearly half of affiliated youth (Thornberry et al., 2003); thus, it is important to control for differences related to duration of membership, particularly when examining the effects of gang membership on distal outcomes. Initially, I planned to account for gang duration in this dissertation by dividing youth into three groups based on length of gang involvement: never affiliated, affiliated one year or less, affiliated for more than one year (using a mixture algorithm to group youth with censored data, when applicable), and maintaining these groups for all subsequent analyses. However, in practice, accounting for duration of membership was not possible due to small sample

sizes in each group (low cell counts in the joint distribution), particularly for stable members who joined gangs in later years. All youth initiated after 9th grade were grouped into a single group in order to have an estimable model. Consequentially, remaining analyses do not take duration of gang membership into account, and assume a lasting effect of gang membership regardless of length of involvement. Gang desistence is an area of active inquiry (Carson, Peterson, & Esbensen, 2013; Melde & Esbensen, 2014; O'Brien, Daffern, Chu, & Thomas, 2013; Pyrooz & Decker, 2011; Pyrooz, Decker, & Webb, 2014), and the implications of this assumption remain an empirical question.

Estimation of Parenting Trajectories

The next step of analysis involved estimating developmental trajectories of parental monitoring and parent-child communication using a latent growth modeling framework. Two separate growth models were estimated for monitoring and communication. Indicators of growth were the imputed scale scores from the communication and supervision scales, which were observed from 4th to 11th grade, exclusive of 6th grade. Factor loadings of the growth parameters were set to reflect timing between measurement occasions, with the intercept fixed at the year of initiation. Fixing the intercept at the year of initiation facilitates substantive interpretation of the models; regardless of age of initiation, the intercept of the model is the predicted score of parenting at the year of initiation. This is in contrast to the classical parameterization that sets the intercept to '0', a substantively meaningless point in this study. Growth was then defined as years past initiation, also allowing for meaningful interpretation of growth – i.e., growth post-initiation (rather than growth over age or year of data collection).

Nonlinear trends were tested by the inclusion of high-order growth parameters (e.g. slope, quadratic, cubic). Multiple information sources were used to guide final model selection. First, the Wald test was used to test if the placement of certain constraints (e.g. equal variances across classes) worsens model fit. This statistic was also used to test whether the addition of higher-order growth terms were warranted. The information obtained from these statistics was coupled with substantive theory and examination of plots (e.g. spaghetti plots) to ensure that final model selection was both data- and theory-driven.

Changes in parenting. One of the aims of this dissertation was to examine the extent to which gang initiation altered trajectories of parenting behavior. In order to obtain this estimate of change, latent growth models were parameterized such that there was a second growth parameter that captured changes in parenting after gang initiation (see Figure 3.1; Curran & Muthén, 1999). The shape (functional form) of this trajectory was tested using the same model fitting procedures as listed above. Significance of this growth parameter would be indicative of a change in parenting following initiation.

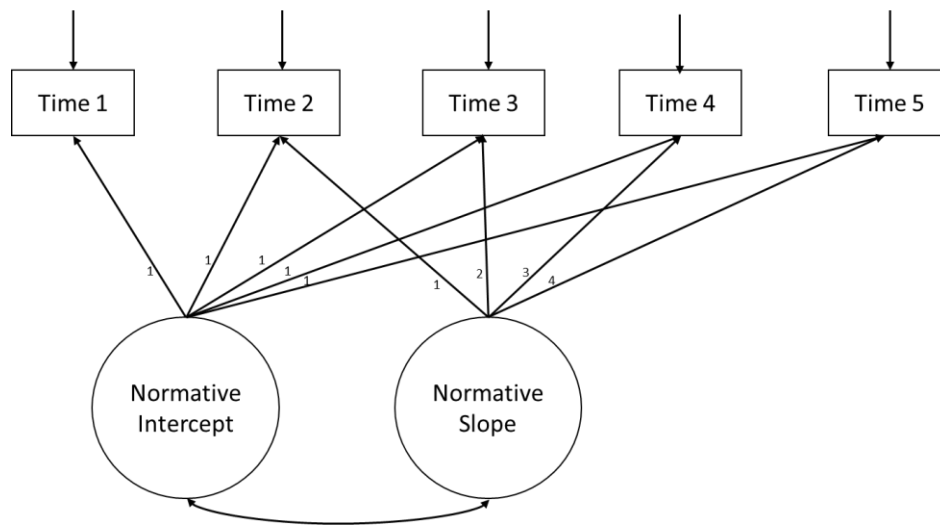
Growth models were estimated in a multiple group framework, with each group defined by the year of gang initiation (or initiation by the matched pair). Due to a low proportion of responders in 10th and 11th grade, all individuals who initiated after 8th grade – i.e., 9th grade (which was unmeasured), 10th grade, and 11th grade – were combined into a single group in the multiple group analysis. The multiple group analysis approach allowed for the added growth parameter to be estimated at the year of initiation.

Outcome Analysis

In the last stage of the analysis, I aimed to test how parenting mediated and moderated the relationship between gang affiliation and young adulthood outcomes. The approach used to test this research question depended on the results of the previous section. If a significant change in parenting was observed, then the degree of change will be used as the mediator/moderator; however, if no change was observed, the raw parenting variable will be included as the third-variable in the model. The latter approach answers the question, “does level of parenting risk mediate and moderate the effect of gang membership on long-term outcomes”, whereas the former asks, “does the parental response to gang initiation mediate/moderate long-term outcomes?” Both questions are important for understanding the interplay between gang affiliation and long-term outcomes.

A latent variable framework was used to estimate effects of gangs and parenting on long-term outcomes. Each outcome was estimated separately to avoid having an over-saturated model with no remaining degrees of freedom for hypothesis testing. When applicable, the logit link functions was used to estimate effects of a predictor on a dichotomous outcome. Communication and supervision were modeled separately to avoid problems with multicollinearity. All analyses were conducted in *Mplus* version 7.11 (L. K. Muthén & Muthén, 1998-2012).

a.



b.

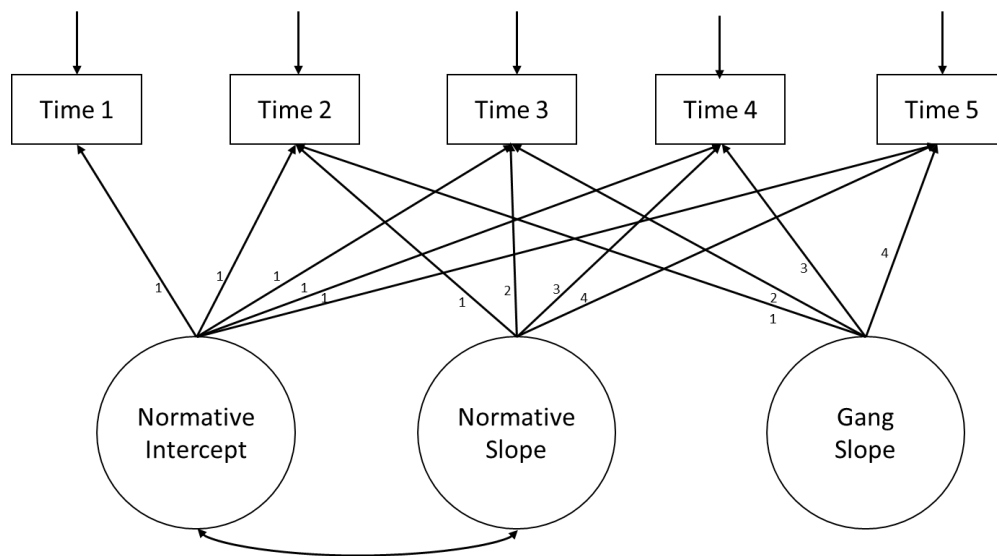


Figure 3.1. General path model for growth in the control (non-gang) group (3.1a) and in the gang group with a second growth parameter included (3.1b)

CHAPTER 4

RESULTS

Descriptive statistics for observed parenting and outcome variables appear in Table 4.1. The proportion of missing data ranged from zero (ethnicity, sex, severe and violent crimes) to .732 (prosocial behavior). The high level of missingness on prosocial behavior was related to strategic sampling of only the second and third cohorts for the high risk control sample and the normative sample in the fifteenth year of the study. The median proportion of missingness was .24. Missingness on observed gang status was relatively low. The proportion of missing data on the gang variable was .189 in 7th grade, .236 in 8th grade, .276 in 10th grade, and .287 in 11th grade.

A total of n=753 youth were eligible to be matched at the start of analyses. After the first round of matching (on risk of gang initiation in 7th grade), n=102 gang members were matched to non-affiliated youth. In round 2 (risk of initiation in 8th grade), an additional n=43 gang members were matched; and, in round 3, another n=43 were matched. The last round of matching (for risk of initiation in 11th grade) resulted in the addition of n=14 matches. The final sample (n=404) contained balanced groups of gang and non-affiliated youth. Three hundred and forty nine youth (n=296 non-affiliated youth and n=53 gang members) were not matched. Groups were deemed to be sufficiently balanced on background covariates based on examination of the distribution

of propensity scores (distribution of risk) between matched pairs of gangs and non-gang at each year of initiation (see Appendix C), and mean differences between gang and nongang groups on multivariate risk. The percent balance improvement was also examined, which indicated substantial improvement in reducing distributional differences between gang and nongang groups on background covariates. The final sample contained n=194 (48%) youth who identified as Black, n=194 (48%) youth who identified as White, and n=16 (4%) youth who identified as another ethnicity or were biracial. Two hundred fifty eight (64%) were male and n=146 (36%) were female.

How did parenting change in response to youth gang initiation?

The first aim of this dissertation was to examine the impact of gang initiation on child-reported communication with parents and parental supervision. Trajectories of parenting from 4th grade to 11th grade were estimated using a multiple group latent growth model (with groups defined by the gang member's year of initiation). Since we assumed no differences in parenting risk prior to gang entry (a natural consequence of balanced risk set matching), trajectories between matched pairs (cases/controls) were constrained to be equal up until the year of initiation. At the year of initiation, an added growth parameter was estimated for the gang group only; this additional parameter tested the magnitude of parenting change upon youth gang initiation.

Results for communication showed that the intercept-only model provided the best fit to the data (CFI=.979; TLI=.983; RMSEA=.031; SRMR=.153; $\chi^2=159.761$, df=150, p=.2776). The approximate fit indices of CFI, TLI, RMSEA, and χ^2 indicate good fit for the intercept only model; however, the high SRMR suggested less favorable

model fit based on commonly used guidelines of acceptable fit for this statistic (Hu & Bentler, 1999). These findings suggest that there is no sample-wide growth trend observed in the data.

The overall mean of communication differed depending on year of initiation (see Figure 4; Wald= 19.829, df=5, p=.0013); however, no mean differences between matched groups were observed (e.g., non-affiliated youth matched to gang members in 7th; Wald= 3.167, df=3, p=.367), lending further support to the quality of matching. Youth who were matched in 7th grade reported significantly lower scores on communication than those matched in 8th or later. No differences in communication scores were observed for youth who were matched in 8th grade or later (Wald=0.037, df=1, p=.8466).

When the additional growth parameter that reflected a change in slope at the year of initiation was estimated, model fit worsened. A series of model parameterizations were tested (e.g., linear growth, quadratic growth, freed factor loadings); however, none of these models provided adequate fit to the data. For example, the most general model with no normative slope (i.e., an intercept only model of the gang and nongang groups) and an additional growth parameter with freed factor loadings (which allowed the model to estimate the best fitting shape of growth post-gang initiation) provided poor fit to the data (CFI=.751; TLI=.816; RMSEA=.137; SRMR=.208; $\chi^2=388.415$, df=171, p=0.000). The poor fit precludes a formal test of the change in parenting; but provides further support for an overall lack of change in parenting (since the model including change does not represent the data well).

A similar pattern was observed for parental monitoring. The model that provided the best fit to the data was the intercept only model (see Figure 5; CFI=1.000; TLI=1.001; RMSEA=.000; SRMR=.202; $\chi^2=149.670$, $df=150$, $p=0.4922$). Similar to model fit for communication, the CFI, TLI, RMSEA, and χ^2 indicated good fit to the data, whereas the SRMR did not provide support for a good fitting model. This means that there is no systematic growth evidenced in the sample. For comparison, the model with the model with a normative intercept (no normative slope) and a free trajectory that captures change in parenting did not provide adequate fit to the data (CFI=.750, TLI=.816, RMSEA=.143, SRMR=.334, $\chi^2=405.650$, $df=171$, $p=0.000$).

Consistent with communication trajectories, no differences were observed between matched groups of gang and nongang youth (Wald=2.250, $df=3$, .5221); however, differences in monitoring were observed across years of initiation (Wald=22.641, $df=5$, $p<.05$). Youth who were matched in 7th grade reported significantly lower scores on parental monitoring than those who were matched in later years (Wald=11.642, $df=2$, $p<.05$). No differences in parental monitoring were observed between youth matched in 8th grade and those matched in later years (Wald=.034, $df=1$, $p=.855$).

Put together, these results do not provide evidence of any change in parenting as a response to youth gang initiation. In fact, in this sample of high-risk youth, we did not have sufficient evidence to conclude *any* systematic change in parenting communication and monitoring at all from 4th to 11th grade. As expected, however, youth who initiated into the gang in 7th grade came from families with the most risk (i.e., lowest scores on communication and parental monitoring).

How does parenting play a role in long-term outcomes associated with youth gang membership?

The last aim of this dissertation was to examine long-term (young adulthood) outcomes of gang-involved youth and to explore the role of parents on a range of psychosocial outcomes. A mediated moderation model (Preacher et al., 2007) was estimated, with parenting playing both a mediating and moderating role. Since no systematic change in parenting was revealed in the previous stage of analyses, I used observed raw parental monitoring and communication scores as the third-variable in this section. Each outcome was measure separately for identification purposes. Year of initiation (or year of match), and parenting ratings (supervision or communication) in during childhood (4th grade) were entered as covariates in the regression model. Other background covariates were assumed to be balanced across groups – a result of balanced risk set matching – and therefore left out of the regression equation. This assumption provided more degrees of freedom, increasing power to test the important theorized relations of this dissertation.

Parameter estimates from the path model for each outcome appear in Table 4.2. Estimates were calculated on the matched sample, yielding causal interpretations of results (to the extent that matching assumptions were met.) Results show that the strongest effects on arrests during young adulthood (standardized effects: communication model=.387, supervision model=.377) and aggression (standardized effects: communication model=.354, supervision model=.349). After removing effects of differential background risk, youth gang membership significantly increased the likelihood of being arrested or engaging in aggressive acts during young adulthood.

However, there was not sufficient evidence to conclude that gang membership increased the likelihood of committing a serious and/or violent crime. Gang members additionally reported engaging in more ATOD use as young adults (standardized effects: communication model=.308, supervision model=.301). In terms of societal costs, these results do not lend support to increased financial burden associated with gang membership; however gang members were more likely to utilize the health care system (standardized effects: communication model=.206, supervision model=.203), which may carry an economic cost. Somewhat surprisingly, gang membership also had a positive impact on pro-social behavior (standardized effects: communication model=.217, supervision model=.206), such that individuals who were gang members during adolescence were more likely to engage in pro-social behavior as young adults than non-affiliated peers. There was no evidence of a significant impact of gang membership on educational attainment after balancing gang and nongang groups on background risk (derived from all major ecological domains; see Appendix B).

The path model additionally tested whether the effect of gangs depended on or was mediated by parenting. Each outcomes was analyzed in a separate path model. Mediation was tested using the \widehat{ab} coefficient and bootstrapped standard errors; moderation was assessed through an interaction terms included in the model. Parameter estimates for the mediation and moderation of parenting also appear in Table 4.2. Tests of the direct effects of parenting did not provide evidence of a significant impact of parental monitoring or communication on young adulthood behaviors after accounting for covariates in this matched sample of youth. Additionally, parenting was not observed to

mediate or moderate the effect of gang membership among these high-risk youth (see Table 4.2).

Table 4.1. Descriptive statistics for observed variables – mean(sd) for continuous variables and cell distribution for categorical variables¹

	Full Fast Track sample	Matched gang members	Matched non-members	Proportion of missing data
Demographics				
Ethnicity	46.1% Black 49.9% White 4% Other	45.5% Black 50.5% White 4% Other	50.5% Black 45.5% White 4% Other	0.00
Sex	42% Female 58% Male	33% Female 67% Male	40% Female 60% Male	0.00
Parental Monitoring				
4 th	4.111 (.789)	4.086 (.838)	4.055 (.801)	.254
5 th	4.217 (.736)	4.170 (.790)	4.148 (.788)	.246
7 th	4.077 (.738)	3.931 (.792)	4.097 (.735)	.260
8 th	4.085 (.738)	3.990 (.758)	4.030 (.762)	.324
9 th	4.027 (.775)	3.881 (.857)	3.999 (.760)	.307
10 th	3.967 (.769)	3.812 (.798)	3.955 (.822)	.359
11 th	4.086 (.705)	4.084 (.732)	4.032 (.710)	.416
Parental Communication				
4 th	3.578 (1.075)	3.541 (1.146)	3.626 (1.101)	.135

5 th	3.579 (1.054)	3.602 (1.073)	3.539 (1.064)	.161
7 th	3.361 (1.024)	3.224 (.982)	3.323 (1.063)	.190
8 th	3.300 (1.028)	3.169 (1.019)	3.255 (1.041)	.238
9 th	3.296 (1.036)	3.145 (1.051)	3.218 (1.069)	.240
10 th	3.413 (.989)	3.384 (.994)	3.361 (1.020)	.275
11 th	3.439 (1.009)	3.471 (1.065)	3.358 (1.032)	.288

Outcomes (young adulthood)

Educational Attainment	36.0% No diploma 35.7% Diploma or GED 28.3% Some college	45.5% No diploma 22.8% Diploma or GED 31.7% Some college	35.1% No diploma 40.1% Diploma or GED 24.8% Some college	.227
Financial Support	19.3% Yes 19.3% No	15.8% Yes 84.2% No	20.3% Yes 79.7% No	.244
Health services	29.6% zero services 28.3% 1 service 15.8% 2 services 26.3% 3+ services	24.3% zero services 18.8% 1 service 13.4% 2 services 43.6% 3+ services	35.6% zero services 25.2% 1 service 12.9% 2 services 26.2% 3+ services	.247
Arrest	36.4% Yes 63.6% No	62.9% Yes 37.1% No	30.7% Yes 69.3% No	.250
Severe Crime	3.6% Yes 96.4% No	5% Yes 95% No	4.5% Yes 95.5% No	0.00
Prosocial Activities	30.244 (12.006)	33.842 (12.978)	28.386 (11.415)	.732
Aggression	26.3% Yes 73.7% No	49.5% Yes 50.5% No	21.8% Yes 78.2% No	.230

Cigarette use	1.561 (1.561)	1.960 (1.485)	1.503 (1.543)	.231
Alcohol use	1.451 (1.162)	1.887 (1.192)	1.314 (1.108)	.231
Marijuana use	.997 (1.170)	1.436 (1.230)	.936 (1.105)	.250
Other drug use	42.9% Yes 57.1% No	63.4% Yes 36.6% No	39.6% Yes 60.4% No	.232

¹ Averaged across 10 imputations

Table 4.2. Unstandardized parameter estimates for the outcome analysis on the matched sample of youth.

	Communication				Supervision			
	Estimate	SE	Z score	p-value	Estimate	SE	Z score	p-value
Indirect effect – ‘a’ path ¹								
Gang	.130	.157	.827	.408	.046	.140	.328	.743
Parenting, 6 th grade	.176	.073	2.420	.016*	.158	.065	2.415	.016*
Year of initiation	.059	.066	.897	.370	.046	.060	.763	.446
Educational Achievement								
Parenting, 11 th grade	.166	.090	1.843	.065	.074	.129	.572	.567
Gang	.079	.168	.472	.637	.100	.165	.605	.545
Parenting*Gang	-.246	.146	-1.681	.093	-.012	.230	-.051	.959
Parenting, 4 th grade	-.053	.061	-.863	.388	.085	.095	.889	.374
Year of initiation	.056	.077	.726	.468	.047	.077	.615	.538
Mediation	.021	.033	.633	.527	.001	.021	.030	.976

¹ Estimates for the ‘a’ path in the mediation model were slightly different for the pro-social activities model due to use of the ML estimator instead of the WLSMV estimator. Differences in estimates did not change the overall interpretation of the model.

Financial Support

Parenting, 11 th grade	-.023	.117	-.195	.845	.133	.167	.795	.427
Gang	-.071	.261	-.272	.786	-.084	.269	-.313	.754
Parenting*Gang	-.032	.179	-.179	.858	-.232	.281	-.825	.409
Parenting, 4 th grade	.050	.078	.638	.523	-.020	.107	.184	.854
Year of initiation	-.071	.108	-.661	.509	-.072	.110	-.658	.510
Mediation	-.004	.024	-.168	.867	.007	.027	.261	.794

Health outcomes

Parenting, 11 th grade	.115	.087	1.317	.188	.224	.132	1.703	.089
Gang	.424	.188	3.605	.000*	.417	.118	3.544	.000*
Parenting*Gang	-.181	.142	-1.272	.204	-.193	.231	-.836	.403
Parenting, 4 th grade	.062	.065	.964	.335	.068	.088	.772	.440
Year of initiation	-.021	.072	-.294	.768	-.020	.072	-.279	.780
Mediation	.014	.024	.579	.562	.011	.034	.322	.747

Pro-social activities

Parenting, 11 th grade	.376	1.182	.318	.751	-.056	1.546	-.036	.971
Gang	5.522	2.237	2.468	.014*	5.241	2.148	2.440	.015*
Parenting*Gang	-1.636	1.643	-.996	.319	-.581	2.712	-.214	.830
Parenting, 4 th grade	.749	.925	.810	.418	1.633	1.405	1.162	.245

Year of initiation	-.162	1.227	-.132	.895	-.137	1.218	-.113	.910
Mediation	.011	.114	.100	.921	-.017	.091	-.184	.854
Arrests								
Parenting, 11 th grade	-.089	.105	-.854	.393	-.092	.193	-.475	.635
Gang	.845	.139	6.101	.000*	.821	.141	5.840	.000*
Parenting*Gang	.048	.156	.309	.757	-.126	.222	-.569	.569
Parenting, 4 th grade	.094	.066	1.425	.154	.038	.102	.376	.707
Year of initiation	-.159	.084	-1.878	.060	-.146	.084	-1.747	.081
Mediation	-.013	.027	-.484	.628	.002	.031	.057	.954
Severe or Violent Crimes								
Parenting, 11 th grade	-.131	.466	-.280	.780	-.156	.398	-.391	.696
Gang	.097	.262	.372	.710	.043	.237	.183	.855
Parenting*Gang	.109	.650	.168	.867	.237	.515	.459	.646
Parenting, 4 th grade	.204	.148	1.375	.169	-.086	.163	-.526	.599
Year of initiation	-.207	.172	-1.201	.230	-.156	.166	-.939	.348
Mediation	-.016	.122	-.134	.894	-.002	.060	-.034	.973
Aggression								
Parenting, 11 th grade	.044	.109	.400	.686	.006	.177	.033	.974
Gang	.762	.138	5.525	.000*	.749	.137	5.452	.000*

Parenting*Gang	-.119	.153	-.779	.436	-.093	.190	-.490	.624
Parenting, 4 th grade	.081	.069	1.171	.241	.058	.102	.567	.571
Year of initiation	-.120	.080	-1.490	.136	-.105	.080	-1.320	.187
Mediation	.005	.019	.273	.785	.006	.023	.281	.778
ATOD use								
Parenting, 11 th grade	-.143	.097	-1.476	.140	-.261	.162	-1.609	.108
Gang	.653	.129	5.073	.000*	.641	.130	4.931	*.000
Parenting*Gang	.029	.142	.207	.836	.088	.237	.370	.711
Parenting, 4 th grade	.063	.060	1.048	.295	.125	.101	1.232	.218
Year of initiation	-.033	.071	-.461	.645	-.030	.070	-.426	.670
Mediation	-.019	.029	-.641	.522	-.009	.043	-.218	.828

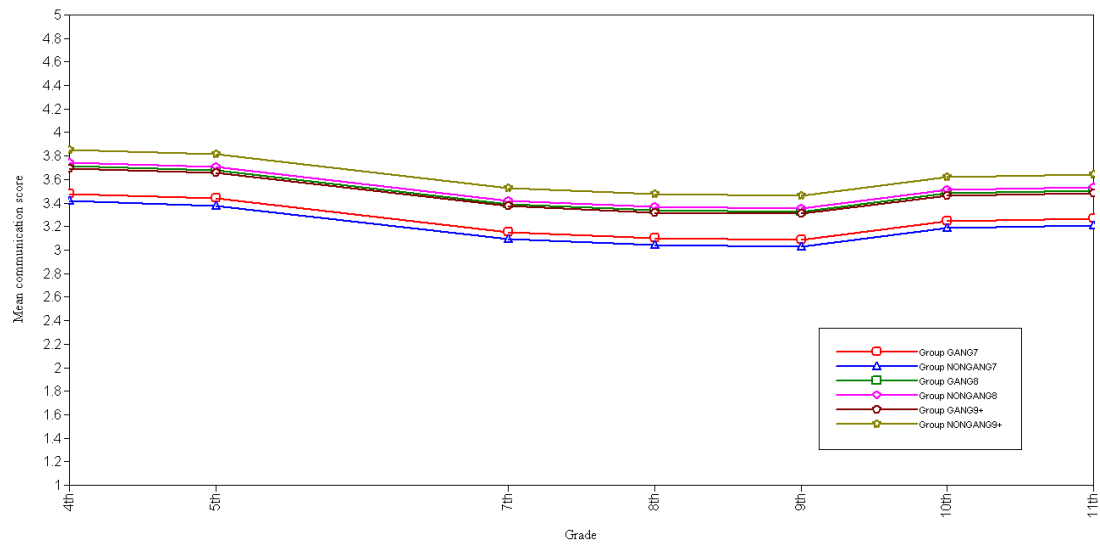


Figure 4.1. Estimated communication scores across time

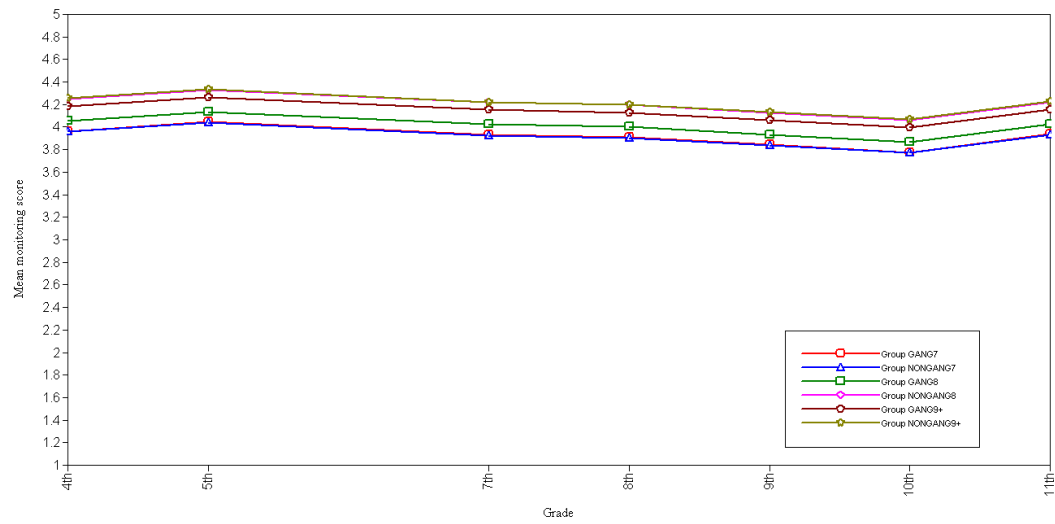


Figure 4.2. Estimated monitoring scores across time

CHAPTER 5

DISCUSSION

Leading theories in developmental science emphasize the role of the individual as an active agent in the developmental process, and highlight the importance of bidirectionality of contextual effects (Bronfenbrenner, 1979; Ford & Learner, 1992). However, to date, few studies in the developmental literature have specifically examined reciprocal relations across ecological systems; most often, the focus is on uni-directional models of risk. The result is a gap between guiding theories and empirical tests of these theories. Part of the reason for this gap is methodological in nature. Classic, variable-centered statistical models are ill-suited to test these types of developmental questions. Advances in the statistical and methodological literature, however, offer a promising new direction for developmental science. If applied to developmental data, newer methods that appear in the statistical and methodological literature may enhance our knowledge of the developmental process.

In this dissertation, I tested the feasibility of a novel method for testing bidirectional contextual effects using applied developmental data. The model presented in the current study integrates sophisticated latent growth modeling with a mediated moderation (third-variable) model to explore how trajectories of risk in family domains interact with other contextual risks to explain long-term developmental outcomes for

youth gang members. Since gang initiation is inherently quasi-experimental, I matched gang members to non-affiliated peers using a propensity score method designed for use with longitudinal data – i.e., balanced risk set matching – prior to outcome analysis. Matching reduced the multivariate distance on background risk factors between youth who join a gang and those who do not. This yielded a purer estimate of a “gang effect”, one that is not artificially inflated due to confounding effects of high ecological risk.

The substantive question I aimed to answer was, “how does familial response to gang initiation interact with gang membership to explain developmental pathways to young adulthood?” From a life-course perspective (Melde & Esbensen, 2011; Sampson & Laub, 1997, 2005), gang initiation can be conceptualized as a “turning point” or transitional event in adolescent development that may alter existing developmental pathways or behavioral trajectories. Initiation into a gang may further increase opportunities for social interactions with highly delinquent peers, transform identity by adopting allegiance to a gang, change routine activities, and weaken bonds to conventional society – all of which are characteristics of turning points. Thus, although gang members typically come from environments with high-levels of risk (Hill et al., 1999), initiation into a gang may disrupt the developmental process, potentially increasing the risk for maladaptive developmental outcomes beyond high-levels of ecological risk alone.

Specifically, I tested whether and how this turning point acts as a “shock” to the ecological system to which parents respond. Results showed that, in this sample of high risk youth, there were trivial amounts of change in parenting behavior over time, with no observed change at the year of initiation. This is a particularly interesting null effect.

While it is possible that null effects of parental response to gang initiation were power-related (see below), the results of this dissertation expand developmental science by showing: 1) that parental monitoring and communication remains stable over time in this high-risk sample; and 2) that there is no systematic parental response to youth initiation into a gang.

Stability of parenting over time. Despite robust and consistent data revealing linkages between parenting behaviors and developmental outcomes, surprisingly few studies have examined longitudinal trajectories of parental monitoring and communication during childhood and adolescence. Existing studies in the area typically focus on normative parenting patterns using community-based samples. Results generally show a subtle, normative decline in parenting during high school and the transition to adolescence (Keijsers & Poulin, 2013; Laird, Criss, Pettit, Bates, & Dodge, 2009; Laird, Pettit, & Bates, 2003; Laird, Pettit, Dodge, & Bates, 2003; Pettit et al., 2007), though the rate of this change may vary across developmental stage (Moilanen, Shaw, Criss, & Dishion, 2009). Less work is available that examines longitudinal parenting behaviors with at-risk youth. One exception is Fite, Colder, Lochman, and Wells (2006), who examined the stability of parenting in a sample of aggressive males from 4th to 8th grade, and found overall stability in parenting from 4th to 8th grade. The authors noted instability between 5th and 6th and 6th and 7th grades, and suggest that this may be due to a reduction in monitoring at this stage of development (Fite et al., 2006). They further suggest that 6th grade may be a particularly salient year for parenting transitions, which is slightly earlier than what has been observed in normative populations (Laird, Pettit, & Bates, 2003).

At first, the current findings appear inconsistent with this previous work – most notably in the presence of systematic change in parenting over time. However, after closer examination, the pattern of results in this dissertation generally fits with the findings of previous work in the area. First, my results correspond to the high stability of parenting behaviors reported in prior studies (Fite et al., 2006; Hamza & Willoughby, 2011). The lack of sample-wide trends observed in my data can be interpreted as mean-level stability, which is conceptually similar to the stability coefficients previously reported. Similarly, the particular combination of fit statistics for my final model – i.e., adequate CFI, TLI, and RMSEA (suggestive of good fit); non-significant chi-square (suggestive of good fit); and a high SRMR value (suggestive of poor fit) – imply high correlations among the raw data, which is also suggestive of the same types of stability observed elsewhere. Second, although previous authors found significant change over time, the magnitude of this change is modest at best (Barber, Maughan, & Olsen, 2005; Keijsers & Poulin, 2013; Laird, Pettit, & Bates, 2003; Pettit et al., 2007). For example, Barber et al. (2005) reported a significant mean decline of 2.84 (year 1) to 2.73 (year 4) on a three-point scale of mother-reported monitoring, bringing into question the clinical meaningfulness of this change. The extent to which systematic declines are large enough to have clinical utility is an open area of research, particularly in the context of other work indicating no sample-wide mean changes in parenting during high school years (Laird, Pettit, Dodge, et al., 2003) and our findings showing no systematic changes across childhood and adolescence.

Differences across studies in the identification of mean change may be related to disparate methodological features and design. The current study estimated long-term

trajectories of parenting that extended from childhood to late adolescence. Previous work tended to focus on relatively short periods of development, such as during the high school years only (e.g., Keijsers & Poulin, 2013; Laird, Pettit, & Bates, 2003; Pettit et al., 2007). It is possible that the subtle declines detectable in previous work were missed in the current study at the cost of understanding long-term trajectories. Modest deviations from the mean may have been treated as random noise rather than sample-wide trends in the data. Alternatively, differences across studies in informants may have an impact on results. Measures of parental monitoring may be too broad of a construct that conflates multiple dimensions, such as parental knowledge of and response to behavior (Kerr & Stattin, 2003). Parents acquire knowledge of youth behavior in many ways. Assuming that knowledgeable parents are also good monitors, and that this monitoring predicts youth behavior may be erroneous. Parental knowledge of behavior may be contingent upon youth disclosure of behavior, which may be related to other aspects of parenting (e.g., parental warmth, parent-child communication, acceptance, control). In this dissertation, I used measures of youth perceptions of parental monitoring in attempts to disentangle youth disclosure from monitoring. The underlying assumption was that youth know the degree to which parents are knowledgeable about their actual activities and whereabouts when they weren't home. This assumption may not necessarily be accurate, as some parents may have knowledge of youth behavior unbeknownst to the adolescent (e.g., parenting from "behind the scenes"); however, empirical data suggest that youth report is more predictive of antisocial behavior than parental report alone (Abar et al., 2014) and was therefore selected for use in this study. Future researchers should consider

using multiple informants to capture parenting behavior from both youth and parent perspective.

Heterogeneity in parenting. The primary interest in this study was on mean change over time (fixed effects); however, it is noteworthy that significant variability in the overall level (intercept) of parenting existed. Other researchers have also reported similar variability in both the intercept and growth parameters (Moilanen et al., 2009; Pettit et al., 2007). This suggests that trajectories differ across individuals. If variability in growth trajectories is systematic, then nominal levels of change in parenting behavior observed across studies may be a result of assuming homogeneity in the context of a heterogeneous process. Tobler and Komro (2010) examined longitudinal growth of parental monitoring and communication jointly in a sample of low-income, minority youth from 6th to 8th grade. Results show four distinct trajectories over time. The most common trajectory (76.4% of youth) stayed relatively stable at high levels of communication and monitoring over time. This is similar to what was observed in the current study (relatively high ratings of both parental communication and monitoring that did not change over the course of development). An additional 9.1% also showed a stable trajectory at a lower level of parenting, and only 6% of the sample showed a decreasing trajectory. The remaining 8.5% had an inconsistent pattern of parenting behavior over time. Laird, Pettit, and Bates (2003) also examined heterogeneity based on youth sex, and found that declines in parental monitoring during the high school years were only observed for males; in their study, monitoring of female adolescents remained stable during the high school years. However, as the authors suggest, the differences between genders was too modest to explain differences in subsequent rates of antisocial behavior

(Laird, Pettit, & Bates, 2003). Other studies have found similar types of heterogeneity based on a range of child characteristics and parenting behaviors, including adolescent beliefs about parental monitoring (Laird, Pettit, Dodge, et al., 2003), child temperament and proactive parenting (Pettit et al., 2007), and youth externalizing behavior (Moilanen et al., 2009).

The existence of heterogeneous growth processes determined by external factors has strong implications for future developmental work. The notion that parenting trajectories may depend on other systems of environmental risk underscores the importance of adopting an ecological approach to developmental science. The typical study examines a single risk domain (e.g., parenting), while holding risks in all other systems (e.g., community-level risks) constant. Isolating a single system may miss some important relations. A relatively large body of work shows that normative parenting is contingent upon the environment within which a family resides (Fursetenberg, 1993; Furstenberg, Cook, Eccles, Elder, & Sameroff, 1999; Garbarino & Sherman, 1980). Examining parenting behaviors outside of these important contextual influences may yield faulty conclusions, as the two systems of risk are naturally-embedded and intricately-related. Statistical models exist that allow for the examination of the joint influence of multiple systems of risk (e.g., trajectories of parental monitoring across levels of environmental risk); applied researchers are encouraged to collaborate with methodologists to test developmental theories in a more holistic way. Ultimately, there may be multiple “normal” trajectories of parenting, depending on the communities in which a family resides or other conditions of risk. Uncovering these differences may be an important future direction for prevention scientists and developmental

psychopathologists to help inform more ecologically-valid intervention and prevention strategies.

Parental response to gang initiation. Contrary to my hypothesis, this data suggest that there is no systematic parental response to gang initiation. Melde and Esbensen (2011) similarly tested lagged responses by parents after gang initiation; and, consistent with the current findings, found no systematic parental response to youth gang initiation. This was unexpected, given current evidence documenting parental monitoring as a reactive, *youth-driven* process, whereby parenting is determined by youth willingness to disclose information about behavior, and their behavior itself (Hamza & Willoughby, 2011; Kerr & Stattin, 2003; Laird, Pettit, & Bates, 2003). Greater involvement in delinquent behavior is theorized to reduce parental monitoring because youth are less likely to disclose information (since they have more to hide), or because parents may become discouraged and give up on monitoring (Fite et al., 2006; Kerr & Stattin, 2003; Kerr, Stattin, & Burk, 2010; Stattin & Kerr, 2000). From this perspective, one would expect that parental monitoring of gang members would decrease upon initiation. Both gang-related delinquency and secretive rituals of initiation would be expected to reduce levels of monitoring behavior. However, this is not was observed in the current study. This suggests that while gang initiation may be a robust transitional point in the life course of the adolescent, initiation may not disrupt the familial system or prompt a parental response.

Embedded in the broader developmental literature, this lack of parental response to gang initiation implies a need to rethink the way we conceptualize familial risk, particularly with high-risk populations. Of note, I found that parenting in my matched

sample was *not* markedly lower than the full Fast Track sample. Table 5.1 presents the means of the matched sample across time, as compared to the full Fast Track sample. As indicated, overall youth-ratings of parental supervision and communication was similar between the full sample and the subset of data used in this study. This is not what would be expected based on previous work linking gang membership and high-risk families (Dukes et al., 1997; Esbensen et al., 1999; Esbensen et al., 1993; Hill et al., 1999; Howell & Egley, 2005b; Thornberry, 1998; Thornberry et al., 2003), and the findings of Melde and Esbensen (2011), who, despite finding no change in parenting upon initiation, noted the overall low levels of monitoring of gang members.

Interpreted alongside the lack of evidence to support parental change, similarities between the full sample and matched sample generates two related hypotheses about the way we think about parental risk. First, we tend to think about parental risk as a static construct – i.e., low levels of parenting monitoring or communication leads to increased risk of gang membership and delinquency. This rather straightforward and *parent-driven* view of risk (and protection) may only partly capture the true nature of risk. Risk may also derive from deviations from normal *patterns* of parenting. Previous work shows a small, yet significant normative decline in parental monitoring and communication that occurs during the high school years (Laird, Pettit, & Bates, 2003; Moilanen et al., 2009; Pettit et al., 2007); yet, the current study shows that, among this high-risk group of youth, no change in parenting was observed. Thus, perhaps it is not *only* low levels of parental monitoring and communication that pose a risk to development; but, also, the lack of normative decline in parenting that poses a risk. Future researchers are encouraged to

draw upon advanced longitudinal methodologies, such as those implemented in this study, to explore how dynamic processes may act as risks to development.

The second hypothesis generated about our conceptualization of risk generated from these findings pertains to parental knowledge and permissiveness of behavior. Specifically, my findings suggest that the types of parenting risks associated with youth gang membership may not be only from lack of monitoring, as observed in previous studies – after all, the parents of gang members were reported to know as much about their child’s behavior as parents of non-affiliated peers, including those of lower overall risk. It may also be due to an overall level of parental permissiveness regarding the behavior. That is, even though the parents may have knowledge of child problem behavior, they may not act upon the knowledge, which, in turn, poses a risk. Affiliation may be deemed permissible (and, perhaps, even *acceptable* in some cases), thereby not resulting in any parenting change at the time of initiation. Similarities in parental monitoring and communication between the full and study sample additionally suggests that gang membership may not be done in secrecy. While parental permissiveness of behavior has been identified as a risk for development generally (Donenberg, Wilson, Emerson, & Bryant, 2002; Voisine, Parsai, Marsiglia, Kulis, & Nieri, 2008), the role of permissiveness with gang members needs to be better understood empirically. The developmental field should continue to move beyond the identification of broad environmental risks, and explore more nuanced relations underlying gang behavior. Broad-based constructs such as youth perceptions of monitoring may not be sensitive enough to understand the mechanisms behind parental risk. Other aspects of the parent-

child relationship, such as parental warmth or parental permissiveness, may better explain the mechanisms behind parental risk.

Methodological Contributions

If the model proposed in this dissertation was going to be of value to the literature, it was important to test how it performs with real-world samples. Thus, application of the model to gang data – a relatively rare developmental event – was an appropriate selection for testing the feasibility of the model. Gang data typically have many structural features that pose analytic challenges to the researcher (e.g., unbalanced groups, small n, lack of randomization). If this model performs sufficiently with gang data, then it is likely to also function well with other applied data, testing a range of developmental questions. Indeed, this study showed that the model performed reasonably well with real-world data. There were no problems with estimation nor any major analytic barriers. Applied developmental scientists are encouraged to disseminate the method across a range of developmental domains to better understand how reciprocal relations explain pathways to development. Examples of potential areas that this model may apply include health psychology (e.g., to examine long-term impacts of parental or peer responses to youth changes to longstanding health behaviors, such as moving from a sedentary lifestyle to being physically active on long-term diabetes risk) or the field of substance use (e.g., how parental or peer response to the initiation of substance use predicts long-term risk of problematic ATOD-using behavior). There is reason to believe that the model will be applicable to any area of research that examines how youth behavior alters long-term trajectories of another ecological system, and how this change predicts distal outcomes.

Researchers interested in applying this method should be aware of two potential challenges to the performance of the model before use. Both challenges are related to sample size – one related to sparsity of data in the joint distribution, the other related to power. First, one of the innovative features of the model, as originally proposed, was that both year of initiation and length of affiliation were to be taken into account when examining the effects of gang affiliation. By allowing a time-varying grouping variable in the matching process, this model maximizes sample size and maintains an unadulterated group of cases (i.e., all youth were actively experiencing the event). This is in contrast to the typical propensity score approach that selects a single time point for matching (Pyrooz, 2014), ultimately either deleting cases that do not experience the event in that year, or has some mixing of non-affiliated youth in the “gang” group (due to time of initiation). Unfortunately, the planned method of accounting for both age of initiation and duration of membership ran into problems with this sample due to scarcity of data in the joint distribution. Particularly, there were too few observations who initiated in later years and were stable members to estimate the model correctly, especially when trying to also take uncertainty of assignment into account. The problem was resolved in this dissertation by grouping all youth initiated after 9th grade into a single group, and ignoring duration of membership. Although this poses a limitation for substantive findings (since the length of time involved in a gang likely predicts long-term outcomes), this constraint was required for model estimation.

Regardless of problems encountered in this dissertation, there is reason to believe that this model (accounting for time of event occurrence, duration, and the uncertainty of both) would perform reasonably well for future applications, if the sample used has

sufficient sample sizes in all cells in the joint distribution. This suggests that applied researchers interested in testing this model should be planful in their data collection, and perhaps strategically sample individuals so that all cells of the joint distribution are sufficiently represented. An important point is that, while an increase in the total sample size may assist in model estimation, the real need is to ensure adequate sample size in all potential cells of the joint distribution.

The second issue worthy of discussion related to sample size is statistical power. Power in this model is unknown. A priori, a few considerations were made to boost power, such as using the matching process to establish a case/control design (*nb*: case/control designs have two groups that are similar on everything except the treatment or grouping (gang) variable, and can be a very powerful model), and by including a large number of time points for the latent growth model (*nb*: LGMs increase power by number of time points, rather than number of subjects). Regardless, power challenges remained. In particular, the estimation of the turning point, or deflection in trajectory at the year of initiation is relatively new to the literature, and power to detect this secondary growth parameter remains unknown. Similarly, the power to detect the effect of a single variable with both mediating and moderating functions is unknown. Thus, although the model includes a few features to support power to detect effects, it is possible that the current study was still underpowered, thereby contributing to the large number of non-significant findings reported in this study. Future simulation studies will help researchers better understand power in these types of designs.

Contributions to Gang Research

A major aim of this dissertation was long-term outcomes of youth gang members, which is surprisingly a relatively untouched area in the literature. Results showed that youth gang-affiliation has long-term impacts at both the individual and societal level. As young adults, youth who were involved in gangs were more likely to be arrested, use ATODs, and engage in aggressive acts than those who were not gang-involved during adolescence. This is consistent with previous work showing increased risks of arrests and aggression among gang members (Barnes et al., 2010; Thornberry et al., 2003). Unlike Krohn et al. (2011); Thornberry et al. (2003); Gilman, Hill, and Hawkins (2014); and Pyrooz (2014), we did not find evidence that gang membership resulted in less educational attainment, ATOD use, or financial hardships. Differences could be explained by differences in measurement – e.g., degree completion versus school drop-out, utilization of financial support services versus reported hardship or a specific service, more general ATOD using behavior –, statistical power, and/or adjustments for background risk.

These findings also support the notion that gang membership may pose an economic cost for society. Gang members reported a significantly higher level of health care utilization, when both mental and physical health were examined. This is consistent with long-term data from the Seattle Social Development Project, which indicates worse health outcomes during adulthood among gang-involved youth (Gilman et al., 2014)

Unexpectedly, I also found that not all gang effects were adverse. Findings show that gang members reported engaging in *more* pro-social activities (e.g., civic, religious, or non-religious activities) than non-affiliated peers. Although existing sociological work

suggests potential positive aspects of gang affiliation (Klein, 1995; Venkatesh, 2008), pro-social behavior among gang members has been generally overlooked in the empirical literature. This is potentially a rich area for future inquiry. Researchers should particularly examine differential impacts of gang depending on length of involvement. It is plausible that gang members who disassociate from their gangs (i.e., “transient” members) “give back” to younger youth who are at-risk of affiliation after they disassociate themselves. If this hypothesis is true, ex-gang members may be an innovative resource to tap into for gang naturally-embedded prevention initiatives.

This study did not find any evidence that parental communication or monitoring had a direct or indirect effect on long-term outcomes, nor did it moderate the impact of gang membership on outcomes. This finding is consistent with Melde and Esbensen (2011), who also did not find support for a mediated pathway between gang affiliation and psychosocial outcomes through parental monitoring; and Harper and Robinson (1999) who did not find a unique effect of family risk on delinquency in the context of gangs. Similarly, these findings correspond to evidence suggesting that the effect of parenting is attenuated among youth with callous-unemotional traits, which are common among gang-affiliated youth (Hawes, Dadds, Frost, & Hasking, 2011).

Despite replication across studies, the notion that parents do not play a role in the transmission of risk from gang membership to young adulthood outcomes is still surprising and opens an expansive area for future research. From an ecological perspective, parenting is one of the most proximal (and powerful) systems of risk; and, it is clear that there is a multifinality of developmental outcomes for youth gang members (Esbensen et al., 1999; Gilman et al., 2014). Yet, parents do not seem to play an

independent role in the mechanism of risk, and the pathways through which divergent outcomes among gang members develop remains unknown. Future research should consider how some of the other characteristics of turning points in the life course may play a role in explaining long-term outcomes youth gang members. In particular, the role of detachment from pro-social institutions post-initiation may play an integral role in explaining long-term outcomes. It is possible that youth who completely detach from pro-social institutions (e.g., schools, activities) upon gang initiation experience more maladaptive outcomes than those who maintain positive social bonds, despite gang involvement. Further, while parenting may not play an independent role when examined in isolation, parenting may play a role in the influence of other risks; for example, parental warmth and involvement may predict the degree of youth detachment from prosocial institutions; and this detachment, in turn, may explain long-term outcomes. Moreover, although in this study parenting monitoring and communication were not shown to mediate or moderate long-term outcomes, there may be other aspects of parenting that play a more salient role. For example, the emotional attachment between parent and child or quality of parent-child relationship may play a more important role than monitoring or communication itself. Monitoring and communication may not be robust enough indicators of parenting among high-risk youth, and other aspects of the parent-child relationship should be considered.

Yet, null findings of parenting effects in this dissertation may also be related to statistical power and therefore should be interpreted with caution. This study was likely sufficiently powered to detect normative growth (e.g., a LGM with an intercept and linear growth parameter). Power to detect growth processes in a LGM is determined by number

of time-points; thus, with seven time-points (spanning 4th grade to 11th grade) and 404 subjects, linear growth should have been detectable in this dissertation, if it were indeed present. However, as previously discussed, power to detect effects in a mediated moderation model remains unknown. Future researchers may consider exploring the mediated pathway from gang affiliation to parenting to long-term outcomes as a separate process than the moderation of gang affiliation by parenting – i.e., estimate two distinct models. This may provide some insight into how parenting and gang influences work together to predict long-term outcomes, while still being estimable with samples typically found in gang research.

Limitation and Future Directions

This dissertation fulfilled the aim of contributing to both the methodological and applied science by presenting a novel method for understanding long-term gang effects. The method used in this study furthers our ability to make causal claims about gang membership; however, there are a few notable limitations. First, in this dissertation, I utilized balanced risk set matching to balance groups on background risk. This method is intended to replicate the conditions of randomization (thereby allowing for causal inferences); however, the effectiveness of this matching procedure is contingent upon the quality of assumptions. If violated, the ability to make causal claims is limited. Diagnostic checks verified that the groups in this study were balanced on measured covariates (and similarity of parenting trajectories between matched pairs provided supporting evidence of the quality of the match); yet, there is no way to confirm balance on unmeasured covariates. Thus, despite the causal model estimated in this dissertation, causal relations between gang membership and outcomes should be subjected to further

testing before strongly inferred. Related, I used a caliper in the matching process to ensure that the covariate distribution between matched pairs was very similar. A cost of the use of calipers in matching is the potential for some individuals (particularly those at the highest or lowest propensity) may not be matched. This was the case for ten gang members in the current sample, and is a consequence of trouble matching at the higher end of the propensity score distribution. Unmatched gang members tended to have the highest propensity for membership; consequentially, the generalizability of causal relations to gang members of higher risk should be tested in future work.

Second, the sample used in this study came from a large multi-site longitudinal initiative. There are many unique features of this data (e.g., nationally representative, multiple sources of data on a range of psychosocial outcomes, annual data collection from childhood to young adulthood) that made it ideal for this study. At the same time, there are a few limitations of this sample are worth note. For example, many youth in this sample came from towns or smaller cities, rather than the type of large metropolis areas that are often considered when examining gangs. Similarly, the data are now relatively old (youth were in 7th grade during the years 1997-2000, and have been monitored to adulthood), and therefore analysis of childhood gang status may not be representative of current gang trends (e.g., Latino gang are a primary concern in recent years, but represent a small proportion of this sample). The extent to which the results are generalizable to newer samples the represent current gang remains unknown. Future researchers are encouraged to strategically sample high-risk youth to obtain samples with a high proportion of gang members in order to replicate the findings reported here. Despite these sample-related limitations, there are two notable strengths of the data used

in this study. First, the study was not restricted to males. Although males were disproportionately represented in the matched sample (as expected, given the overall gender distribution in gangs; Hill et al., 1999), females were also included in the sample, extending the generalizability of findings. Second, this study asked youth to report on parenting behaviors of their *primary caregiver*, this was not restricted to mothers. If another adult (e.g., father, grandmother) was identified as the primary caregiver, this data were used in analyses. Fathers are often overlooked in the parenting data; inclusion of fathers and other influential adults in this study represents a contribution to the literature by capturing parenting as it naturally exists, in many forms.

One of the challenges in this paper was incorporating gang duration into the model. To measure desistance, we used simple youth report of membership as evidence for association and disassociation. Gang dissociation as a developmental event is gaining traction in the literature (O'Brien et al., 2013; Pyrooz et al., 2014), with recent evidence suggesting that the operationalization of dissociation can have an important impact on results (Carson et al., 2013). Future work should focus on the act of dissociating, and on the validation of ways to measure the act.

Last, the methods proposed in this paper are still under development, and the application of this model to gang data helped to identify areas for future methodological research. Substantive conclusions should be interpreted with this in mind. For instance, there was no standard in the literature for matching with imputed data. The decision to use a randomization method and “hard assign” youth was developed in tandem with experts in longitudinal methods and matching (Patrick S. Malone, personal communication; Elizabeth A. Stuart, personal communication); however, the

performance of this technique should be empirically tested using simulation. Similarly, the method for predictor selection in the imputation process was developed to ease in estimation. Diagnostics suggest that the predictor selection did not weaken the quality of imputations. Yet, future methodological research should examine the impact of predictor selection on imputation quality in large, multi-phase models, such as the model proposed in this dissertation.

Table 5.1. Mean scores (imputed) of parenting for the full sample and the subset of matched data.

	Communication		Supervision	
	Full sample	Matched sample	Full sample	Matched sample
4 th grade	3.578	3.583	4.111	4.070
5 th grade	3.579	3.570	4.217	4.159
7 th grade	3.361	3.273	4.077	4.014
8 th grade	3.300	3.212	4.085	4.010
9 th grade	3.296	3.181	4.027	3.940
10 th grade	3.413	3.372	3.967	3.884
11 th grade	3.439	3.415	4.086	4.058

CHAPTER 6

CONCLUSIONS

The purpose of this dissertation was to employ a novel method designed to map the interplay between youth and their families in order to understand the pathways to young adulthood among youth gang members. Historically, gang research has struggled with methodological limitations that have precluded a deep understanding of the effects of gangs. However, modern methods are now available that circumvent previous limitations and allow for a deeper understanding of this high-risk population. This dissertation illustrates one way in which families and gangs jointly impact youth development. As demonstrated, gang affiliation has a long-term impact at both the individual and societal level, though parenting had a minimal impact in this long-term trajectory. This is a rather interesting finding from an intervention standpoint because leading treatments typically focus on parenting behavior as means to reduce the effects of gangs (Henggeler et al., 1998). Implementation of sophisticated methods in gang research can help us understand the phenomenon of gang-affiliation in a more holistic way, which may aid in the development of more targeted and effective intervention and prevention strategies. Given the long-term consequences of gangs on individuals and society, gang research should remain a research and prevention priority. (Abar et al., 2014)

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APPENDIX A

ITEMS MEASURING PARENTAL COMMUNICATION AND MONITORING

Items for the Child Communication subscale are: “Do you discuss your problems with your parent?”; “Do you think that you can tell your parent how you really feel about some things?”; “Can you let your parent know what is bothering you?”. Items for the Parent Communication subscale are: “Is your parent a good listener”; “Can your parent tell how you are feeling without asking you?”; “Does your parent try to understand what you think?”; “Does your parent insult you when she/he is angry with you?”; “Can you have your say even if your parent disagrees with you?”.

Items for the Supervision/Involvement subscale are: “If you did not come home by the time that you were supposed to be in, would your parent know?”; “Does your parent know who you are with when you are away from home?”; “When you are out, does your parent know what time you will be home?”; “When you and your parent are both at home, does she/he know what you are doing?”; “When your parent is not home, do you know how to get in touch with him/her?”. Items for Daily Activities are: “In the past 6 months, how often did your parent talk to you about what you were going to do for the coming day?” ;”In the past 6 months, how often did your parent talk with you about what you had actually done during the day?”. In the 10th and 11th grade, youth were also asked “How often did your caregiver ask about how things were going at school?”. Items

for curfew are: “Do you have a set time to be home on school nights?”; “Do you have a set time to be home on weekend nights?”.

APPENDIX B

VARIABLES USED FOR PROPENSITY SCORE DERIVATION

Neighborhood Risk Factors

Neighborhood quality. Neighborhood quality was measured using the *Neighborhood Questionnaire*, a 16-item measure that assesses neighborhood-level risk factors (Conduct Problems Prevention Research Group (CPPRG), 1991). During youth's kindergarten year, parents reported on a series of items that assessed family satisfaction with their neighborhood. I specifically used the "Neighborhood Safety" (n=5 items) and "Neighborhood Social Involvement" (n=4 items) subscales in this dissertation. The former taps into parental perceptions of neighborhood safety, violent crime rates, drug trafficking rates, and police involvement; the latter is a measure of parental involvement with neighbors, and parental participation in neighborhood organizations. Internal consistency, as measured by coefficient alpha, for these subscales previously shown to be reasonable on the Normative sample of the Fast Track project (alpha = .77 for neighborhood safety; alpha = .74 for social involvement; Pek, 2005). Mean response for each subscale was used in the propensity score analysis.

Family Risk Factors

Socioeconomic status. Family SES was derived from a composite of parental occupation status and education level.

Household structure. Household structure was assessed through parental report of the number of adults residing in the home when the target child was in kindergarten. Item responses were categorized to reflect 1) two (or more) adults in the home (e.g., two biological parents, one biological parent and one step parent); 2) one biological parent only in the home; or 3) adoptive/foster parents, relatives, or another adult in the home (no biological parents).

Family transitions. Family transitions was assessed using the *Life Changes* questionnaire (Dodge, Bates, & Pettit, 1990), which was administered during a summer interview with the parent after the child's fifth grade year. Items assessed stressful events experienced by the family in the past year. Events included divorce, pregnancies/miscarriages, legal problems, medical problems, and residential moves. Parents indicated if each event was a major stressor, minor stressor, or not experienced by their family. The mean of the items was used as a summary measure of cumulative stress in the past year.

Family financial stress. Financial stress was measured using the *Financial Stress Questionnaire* (Conduct Problems Prevention Research Group (CPPRG), 1994a), a nine-item scale developed for the Fast Track Project to assess parent-reported family financial stress. The scale assesses sources of household spending and adequacy of funds for paying bills. In this dissertation, I used items that asked parents to rate the affordability of seven spending sources in the household (home, clothing, furniture, car, food, medical care and leisure) on a scale that ranged from 1 (strongly agree) to 5 (strongly disagree). Coefficient alpha for this measure with the full Normative sample of

Fast Track was good ($\alpha=.89$). A mean score of financial stress from the youth's fifth grade year was used. Higher scores indicate more stress related to expenditures.

Attachment to family. Early family attachment was assessed in fifth grade using the Positive Representation of Parents subscale on the *People in My Life* (Cook, Greenberg, & Kusche, 1995) questionnaire. This 10-item measure asked youth to rate their perceptions of positive communication and level of acceptance by parents. Internal consistency, as measured by coefficient alpha, was previously shown to be good on the Normative sample of the Fast Track project (.86; Gifford-Smith, 2000)

Parental warmth. Parental warmth was assessed during Kindergarten using an adapted version of the *Interactions Ratings Scale* (Crnic & Greenberg, 1990). Child observers assessed the level of parental warmth during summer interviews. After the parent and child dyad completed each of four tasks (a Child's Game, a Parent's Game, a Lego Task, and Clean-Up), observers rated child's and parent's level of gratification, sensitivity, and involvement using a five-point scale with a value of 1 representing a low value and value of 5 representing a high or positive value. The Parental Warmth subscale was created by calculating the mean of mother's gratification on the Child's Game, Parent's Game, and Lego Task, mother's sensitivity on the Child's Game, and Lego Task, and mother's involvement on the Child's game. The Parental Warmth subscale has been shown to be a highly reliable measure with alpha coefficient ranging from 0.88 to 0.90 (Rains, 2002).

Parental discipline. Parental use of various disciplinary strategies was measured using the *Parenting (Primary Caregiver)* questionnaire (Conduct Problems Prevention

Research Group (CPPRG), 1994c) during the child's fourth grade year. Parents rated the frequency of use of eight different disciplinary strategies for an infraction of family rules, and the frequency with which they provide positive praise and support for positive youth behavior. All items were rated on a 5-point scale ranging from 1 (almost never) to 5 (almost always). Subscales were created by averaging items on dimensions of parental use of harsh discipline (e.g., spanking, slapping, locking child out of the house), appropriate discipline (e.g., calmly talking to child), positive attention (e.g., hugging, winking, smiling at child, praising child), and tangible rewards (e.g., giving privilege or present).

Additionally, use of verbal and physical punishment was assessed through interviews with parents during the child's kindergarten year. Parents were presented with a series of vignettes cover episodes of child misbehavior and the parent is asked to describe how they would respond in a similar situation. The interviewer rated whether or not the parent mentioned verbal or physical punishment strategies. Mean scores across vignettes were used in analyses.

Teenage parenthood. Mother's age at the time of the target child's birth was calculated. Dummy codes were included in the propensity that indicated if the mother was a teenager at the time of birth (coded '1' if mother was less than 20 years old at the time of the target child's birth; '0' if otherwise).

School Risk Factors

Academic achievement. Academic achievement was assessed in fifth grade using the *Woodcock-Johnson – Revised Test of Achievement* (Woodcock & Johnson, 1989), a

commonly used measure of scholastic abilities in school-aged children. The specific subtests used were Calculation, Passage Comprehension, and Letter-Word Identification, scored using Woodcock-Johnson standards for summary scores.

Special education status. Youth were classified as having a “special education status” if the presence of individualized education plans (IEP) was indicated on official school records during fifth grade, regardless of the type/quantity of services being received. This variable was dummy coded, with a ‘1’ indicating that the child received special education services.

Peer Risk Factors

Association with antisocial peers (youth report). Youth report of peer antisociality was measured during the summer of fifth grade using the 16-item *Things Your Friends Have Done* (Elliott et al., 1985) interview. Trained interviewers interviewed youth about peer behavior. Youth indicated how many (0=none, 1= “just some”, 2= “most”) of their peers engaged in various delinquent or substance using behaviors. The measure contains four subscales, all of which were included as separate variables in the propensity model: 1) Delinquency, 2) alcohol use, 3) tobacco use, and 4) other drug use (marijuana, heroin, crack, cocaine, LSD, or sniffing the fumes of harmful substances). Alcohol use, tobacco use, and other drug use was dichotomized because of low proportions of affirmative responses. Mean delinquency score was used.

Association with antisocial peers (parental report). Parental report of youth association with antisocial peers was measured using the *Influence of Friends* subscale of the *Supervision Questionnaire* (Loeber, Farrington, Stouthamer-Loeber, & Van

Kammen, 1998b), a 20-item parent-reported measure of supervision and involvement with children. The *Influence of Friends* subscale specifically assessed parental perceptions of how positive of an influence the youth's friends have on his/her behavior. Parents were asked the extent they felt their child's friends had a good and bad influence on their child's behavior. Items were scored on a 5-point scale ranging from '1 – Almost Never' to '5 – Almost Always'; the mean response was used in analysis.

Individual Risk Factors

Demographic variables. Youth self-reported sex and ethnicity were included as demographic variables. Additionally, the cohort of the study and study site were included in the propensity model.

History of delinquent behavior. Early delinquent behaviors was assessed using the youth reported *Things You Have Done* questionnaire (Conduct Problems Prevention Research Group (CPPRG), 1995), a 32-item survey administered during the youth's fifth grade year. *Things You Have Done* measures past year frequency of youth delinquency and substance use. Three of the eight subscales (general delinquency, alcohol use, and other drug use) were used in this study. Delinquency was assessed using the *General Delinquency* subscale, which included items related to involvement in theft, aggression, vandalism, organized crime, running away, and weapon carrying behaviors. The *Alcohol Use* and *Drug Use* subscale assessed youth report past year alcohol (beer, wine, or liquor) consumption, and marijuana/illicit drugs use, respectively. For each subscale, items were dichotomized (coded '1' for engagement in the behavior) prior to analyses to reflect whether the youth engaged in the behavior at least once in the past year. The sum of the

dichotomous items were used in the propensity models, creating a measure of the number of behaviors within each subdomain that the youth engaged in during the past year.

Hyperactivity. Youth hyperactivity was measured via parental and teacher report of the child's level of hyperactivity during Kindergarten (teacher) and first grade (parent) using the *ADHD Checklist* (DuPaul, 1990). This 14-item measure evaluates the frequency of ADHD symptoms in children. Each item is scored on a response scale from '0' to '3', where a score of '0' indicates that the item is "not at all" true, a score of '1' indicates the item is "just a little" true, a score of '2' indicates the item is "pretty much" true, and a score of '3' indicates that the item is "very much" true. The *Total Score* (including both inattention and impulsivity) were used in analyses. The *Total Score* has been previously shown to be internally consistent on the Normative sample of the Fast Track project (coefficient alpha = .91 for parents; coefficient alpha = .96 for teachers; Rains, 2005). Scores that exceed 1.5 standard deviations above the mean for age/sex are considered clinically significant. Teacher and parent ratings were included as separate variables in the propensity analysis.

Externalizing behavior. Youth conduct problems were assessed twice through parental report on the *Child Problem Behavior Checklist* (CBCL; Achenbach, 1991) – first during the first year of the project (Kindergarten) and then again during the summer after children completed fourth grade. The full CBCL is composed of 112 items designed to differentiate clinical and non-clinical youth populations, and is widely used in the field of child psychology. This study specifically used data from the broad band *Internalizing* and *Externalizing* problems scales. The *Internalizing* scale contains items from the

Withdrawn, Somatic Complaints, and Anxious/Depressed subscales. The *Externalizing* scale includes items from the *Delinquent Behavior* and *Aggressive Behavior* domains. Raw scores were used at the suggestion of Achenbach (1991) because the raw scores may be more precise at the high end of the distribution. Parents rated each item on a scale from '0' to '2' with a score of 0 indicating that the item was "not true" for their child" and a score of '2' indicating that the item was "very true or often true". Items were summed to scale scores.

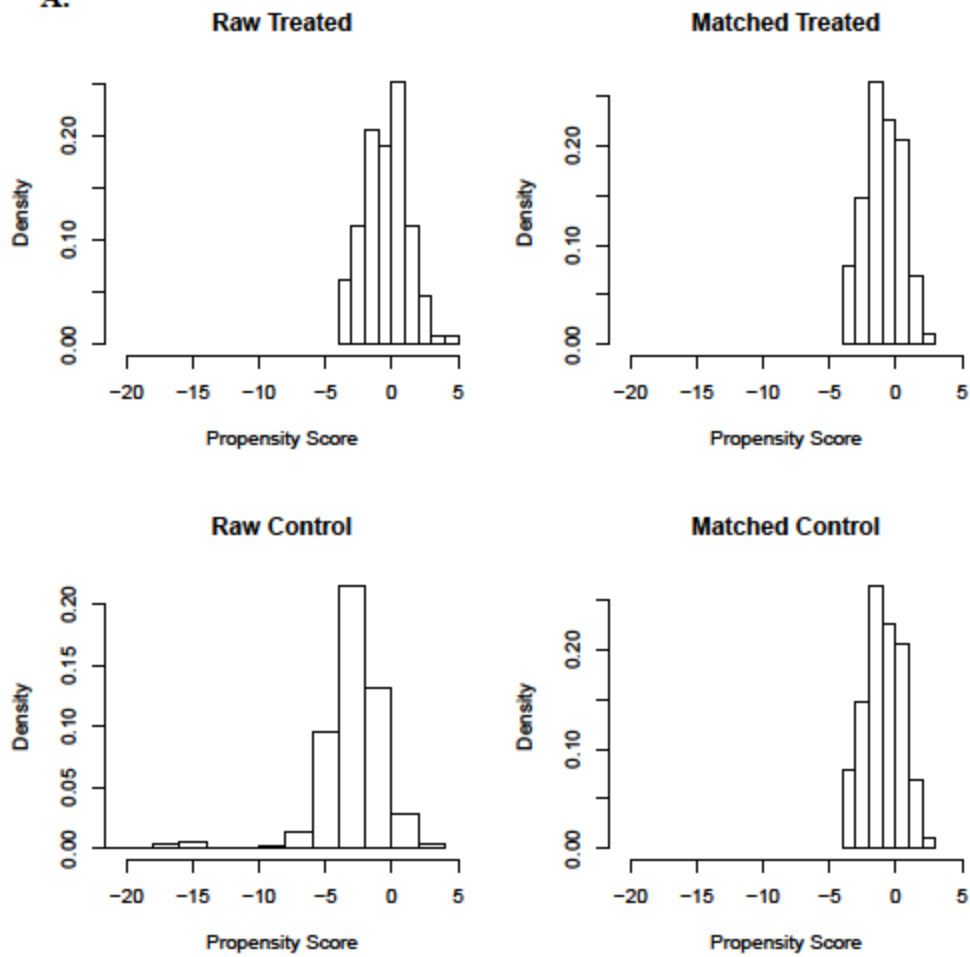
Antisocial beliefs. Antisocial beliefs were measured using the *Normative Beliefs About Aggression* questionnaire (Huesmann & Guerra, 1997), a 20-item, self-report measure that assesses a child's beliefs about the acceptability of specific aggressive behaviors in specific contexts. Previous reports show good internal consistency of the measure on the Normative sample of the Fast Track Project (coefficient alpha = .89; Rains, 2003). Fifth grade youth were presented with twenty different scenarios that varied in terms of the severity of provocation, severity of response, gender of provoker, and gender of responder. Following each of these scenarios, the interviewer first asks the respondent if it would be "Really Wrong (1)", "Sort of Wrong (2)", "Sort of OK (3)", or "Really OK (4)" to respond with verbal aggression and physical aggression. Mean response was used in propensity analyses.

APPENDIX C

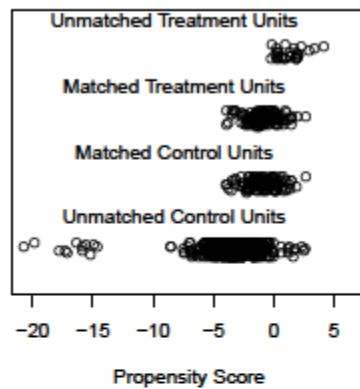
BALANCE DIAGNOSTICS

This appendix displays diagnostic plots used to assess the quality of the matching procedure in 7th grade (A), 8th grade (B), 10th grade (C), and 11th grade (D). Treated units are gang members; control units refer to the non-affiliated matched peers.

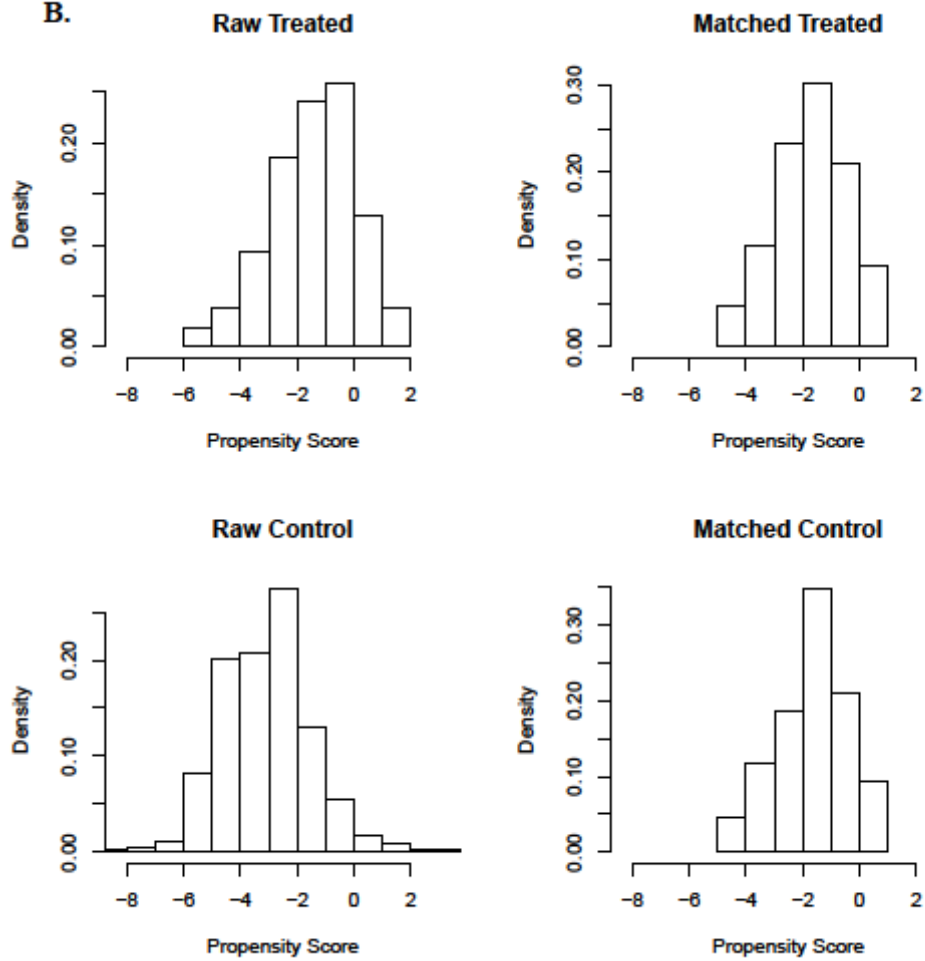
A.



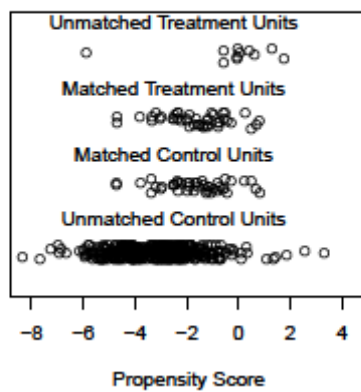
Distribution of Propensity Scores



B.

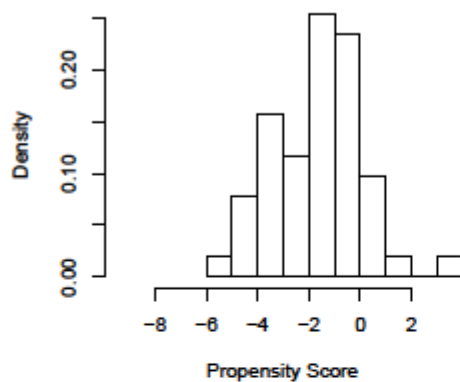


Distribution of Propensity Scores

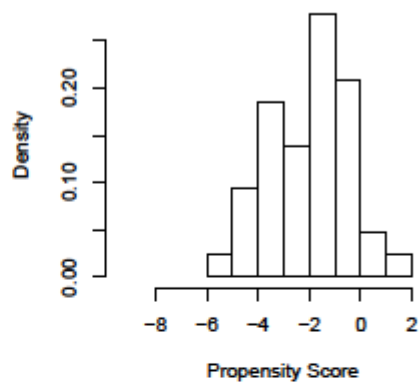


C.

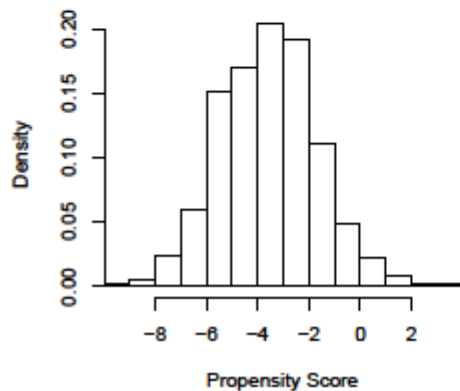
Raw Treated



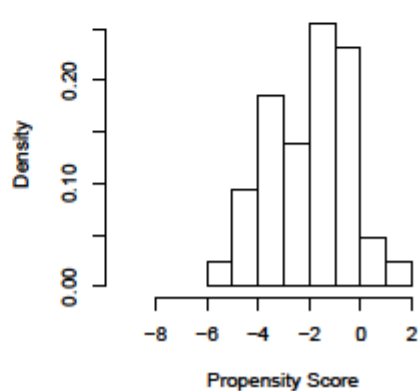
Matched Treated



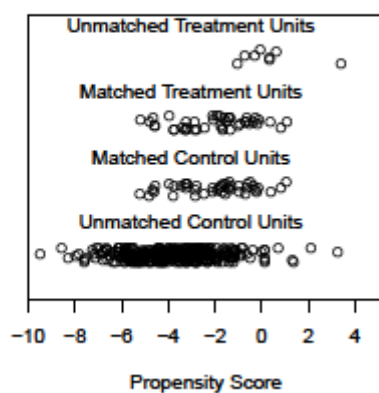
Raw Control



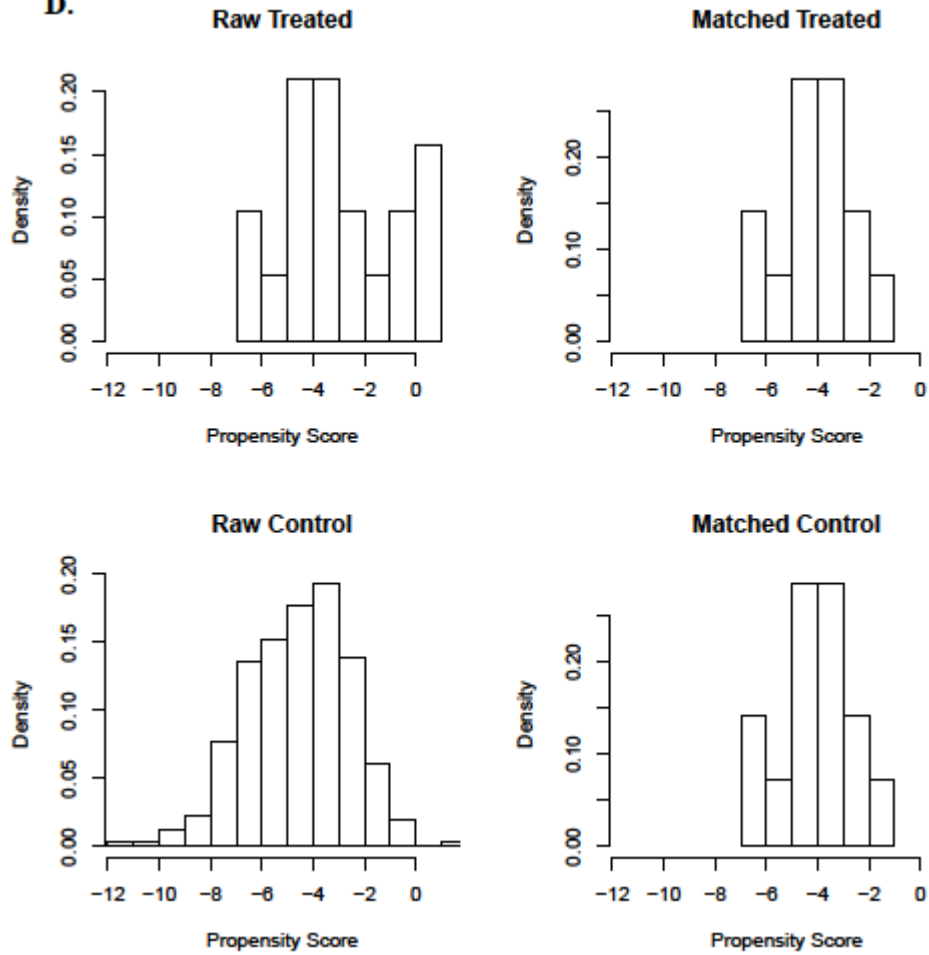
Matched Control



Distribution of Propensity Scores



D.



Distribution of Propensity Scores

