

EXPLORING THE ASSOCIATION BETWEEN CORPORAL PUNISHMENT AND  
TODDLERS' DEVELOPMENTAL TRAJECTORIES OF PHYSICAL AGGRESSION

By

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To my parents, for the unconditional love and encouragement with which they have always provided me, and to my husband, who is my best friend

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## LIST OF ABBREVIATIONS

CP	Refers to corporal punishment
HLM	Refers to hierarchical linear models
HOME	Refers to the Home Observation Measures of the Environment instrument (Caldwell & Bradley, 1984) designed to assess daily routines and activities within the home environment
HS	Refers to high school when referring to primary caregiver's level of education
NICHD	Refers to a 2004 study by the National Institute of Child Health and Development Early Child Care Research Network
PC	Refers to primary caregiver of the child
PC-CTS	Refers to the Parent-Child Conflict Tactics Scale (Straus & Hamby, 1997; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998). This instrument is intended to measure psychological and physical maltreatment and neglect of children by parents, along with the use of nonviolent alternatives.
PHDCN	Refers to the Project on Human Development in Chicago Neighborhoods, an interdisciplinary study of how parents, schools, and neighborhoods affect child and adolescent development. Data from the longitudinal cohort study component of the PHDCN was used for the present study.

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Both early childhood physical aggression and the parental use of corporal punishment have been linked to numerous negative outcomes, including internalizing and externalizing behavior problems. While these two constructs have been linked to similar outcomes, there is also a well-established link between corporal punishment and aggressive behavior. It has been hypothesized that experiencing more frequent or more severe forms of corporal punishment leads to more negative outcomes. Social learning theorists argue that corporal punishment models aggressive behavior for children. The link between corporal punishment and aggression has been made, however, using primarily cross-sectional and/or retrospective techniques.

Developmental researchers have examined physical aggression longitudinally, usually identifying three or four trajectories of aggressive behavior, with one group exhibiting persistently aggressive behavior over time. They assert that aggressive behavior begins earlier than modeling would have an impact. Despite the potential link between them, the bodies of research examining the development of aggressive behavior and the use of corporal punishment have been largely distinct.

This thesis examines the association between corporal punishment and trajectories of aggressive behavior. Data from the Project on Human Development in Chicago Neighborhoods is used to construct group-based trajectories. Two different measures of physical aggression both identify four trajectory groups: a low-stable group, a low-rising group or a modest group, a high-starting desisting group, and a high-rising group. The trajectories identified are consistent with existing developmental research. Multinomial logistic regression was attempted with several control variables, but due to a very small number of cases in the high-rising aggression groups, the models were oversaturated. Group profiles were created as an alternative method of examining the potential association of corporal punishment with trajectory group membership.

Children in the high-rising aggression group were more likely to be male, black or Hispanic, and to experience less warmth and more hostility from their primary caregivers. These characteristics of the high aggression group are consistent with previous research. The results of the present research indicate that the average frequency of corporal punishment was higher in the high aggression group. Significance tests performed for differences between the high-rising group and other groups on these measures were statistically significant. Regarding type of corporal punishment, those children who were in the high aggression group experienced more slapping or spanking and pushing, grabbing, or shoving by their primary caregivers than children in other groups. These results were also statistically significant. Although a functional relationship could not be established here, the results of the present study support additional research examining both frequency and type of corporal punishment as predictors of membership into a persistently high group of physical aggression.

## CHAPTER 1 INTRODUCTION

Early childhood physical aggression and parental corporal punishment have both been identified by psychologists, sociologists, and criminologists as risk factors for many negative developmental outcomes, including violence and aggression in adolescence and adulthood, physical and mental health problems, and criminal activity (Cote, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Gershoff, 2002; Hicks-Pass, 2009; Larzelere, 1996; Nagin & Tremblay, 1999; Nagin & Tremblay, 2001; Tremblay et al., 2004). Broadly defined, the term aggression implies harm done with malevolent intent (Hay, 2005). Physical aggression, which refers to physical acts that are directed at another person and that can potentially be harmful, is distinguished from other types of aggression, such as instrumental aggression (toward objects) and indirect or relational aggression such as rumor spreading (Cote et al., 2006). Corporal punishment has been defined as “the use of physical force with the intention of causing a child to experience pain, but not injury, for the purposes of correction or control of the child’s behavior” (Straus, 1994). The relationship between parental use of corporal punishment and physical aggression in young children has been a topic of longstanding debate among parents, teachers, researchers, and policy makers.

While researchers have examined both the developmental origins of aggression in children (Nagin & Tremblay, 1999; 2001; Tremblay et al., 2004; Tremblay & Nagin, 2005) and negative outcomes associated with the use of corporal punishment (see Gershoff, 2002), assessing how the use of corporal punishment on toddlers influences their developmental trajectories of physical aggression is a relatively unexplored area of empirical inquiry (Grogan-Kaylor, 2005). Developmental researchers assert that

aggressive behavior in humans begins as early as infancy and that children learn to control their aggressive behavior as they develop (Tremblay and Nagin, 2005). Corporal punishment researchers argue that aggressive behavior is modeled by parents and imitated by their children (Straus, 1994). Numerous observational studies have identified a relationship between the use of corporal punishment by primary caregivers and children's aggressive behavior (e.g. Gershoff, 2002; Larzelere, 1986). The effects of corporal punishment have also been examined using longitudinal data, and these studies show that corporal punishment can predict variation in aggressive behaviors between children at later stages of development (e.g. Mulvaney & Mebert, 2007) as well as changes in aggression within individuals over time (Grogan-Kaylor, 2005).

Despite the potential for physical aggression and other negative childhood outcomes, the use of corporal punishment in the United States remains quite prevalent, with 94% of parents reporting corporally punishing their child by 3 or 4 years of age (Straus and Stewart, 1999). More recent studies find that the use of corporal punishment is extremely common among parents of toddlers, with 29% of parents of 10-18 month olds and 64% of parents of 19-35 month olds reporting spanking their children (Regalado, Sareen, Inkelas, Wissow, & Halfon, 2004; Wissow, 2001). Despite the fact that toddlers are more likely to experience corporal punishment than any other age group (Gershoff, 2002), research on its use during toddlerhood has been limited (Berlin et al., 2009). At this age, children are becoming more mobile and autonomous, leading to an increase in discipline, and the possibility of forming patterns of noncompliance and aggression (Moffitt, 1993; Sroufe, Egeland, Carlson, & Collins, 2005).

While corporal punishment is a common form of parental discipline, it is clear that all children who experience corporal punishment do not grow up to be violent or aggressive adults. As mentioned, developmental researchers (Tremblay and Nagin, 2005) have emphasized that aggression begins at such young ages that it occurs before modeling would have an impact. In studying trajectories of aggressive behavior in children, Tremblay and Nagin (2005) have hypothesized that children learn to control their aggressive behaviors over time, rather than learning to exhibit these behaviors by modeling others. The argument made by Tremblay and Nagin (2005) is that if models of physical aggression have an impact, it is probably by reducing the speed at which children learn *not* to physically aggress. They cite a number of potential causes for the individual differences in frequencies of physical aggression, including environmental differences and parental care (Tremblay and Nagin, 2005). Tremblay and Nagin have identified three to four trajectory groups, with one group exhibiting persistently high levels of aggressive behavior. The trajectories indicate that despite an increase in children's exposure to aggressive behaviors as they grow older, the likelihood that they will exhibit aggressive behavior generally decreases.

Using prospective longitudinal data on toddlers from the Project on Human Development in Chicago Neighborhood (PHDCN), the first objective of this thesis is to use semi-parametric group-based trajectory models to essentially replicate the work of Tremblay, Nagin, and colleagues by identifying distinct trajectories of aggressive behavior in toddlers over a seven-year period (see Nagin, 2005). The second objective is to understand how the use of corporal punishment is associated with group membership in these aggression trajectories. To date, no study has examined the

association between corporal punishment and group-based trajectories of toddlers' physical aggression into mid-childhood. Given the research on corporal punishment and developmental trajectories of aggression, I hypothesize that those children who experience more frequent and certain types of corporal punishment (as opposed to customary spanking) are not learning to control their aggressive behavior and are among those individuals in the group that exhibits the most persistent physical aggression. I address the following question: Are the frequency and type of corporal punishment experienced during toddlerhood associated with membership in certain trajectory groups? Specifically, are the frequency and type of corporal punishment associated with membership into what Nagin and Tremblay have identified as a "high chronic" group for aggressive behavior?

## CHAPTER 2 LITERATURE REVIEW

### **An Overview of Corporal Punishment**

Despite the breadth of research on the parental use of corporal punishment, a consensus on its effects has yet to be reached (see Gershoff, 2002). Researchers from a variety of fields have investigated the potential effects of corporal punishment on a wide range of both short-term and long-term outcomes for those who experience it. These outcomes include compliance of the child, aggressive and antisocial behaviors, quality of the parent-child relationship, cognitive and emotional outcomes, and becoming a victim or perpetrator of physical abuse (e.g. Berlin et al., 2009; Gershoff, 2002; Paolucci & Violato, 2004; Simons, Johnson, & Conger, 1994; Smith and Brooks-Gunn, 1997; Straus, 1994; Straus, Sugarman, & Giles-Sims, 1997). While this project focuses on one outcome in particular, physical aggression, it is important to provide an overview of corporal punishment and its potential consequences.

As described above, Straus (1994) has defined corporal punishment as “the use of physical force with the intention of causing a child to experience pain, but not injury, for the purposes of correction or control of the child’s behavior”. Many researchers view corporal punishment as one point on a continuum of physical acts against children (e.g. Gelles & Straus, 1988). Several state laws similarly include qualifiers such as “excessive”, “cruel”, and “unreasonable” to distinguish everyday spanking from definitions of child maltreatment (Gershoff, 2002). A common criticism of the measurement of corporal punishment in social science research is that non-abusive corporal punishment is often confounded with behaviors that may be considered child abuse, thereby preventing accurate conclusions regarding non-abusive physical

punishment (Larzelere, 2000; Baumrind, 1996). Due to its wide acceptance, and for the purpose of comparisons across studies, Straus's (1994) definition will be used in the present study. His operationalization includes three corporal punishment items: slapping or spanking the child with an open palm, pushing, grabbing, or shoving the child, and throwing something at the child. Another measurement issue discussed in the corporal punishment literature is reliance on retrospective reports by either the child or parent. As direct observation is impossible in most cases, corporal punishment studies have typically relied on these forms of self-report (Gershoff, 2002). Some studies have utilized nightly phone calls (Holden, Coleman, & Schmidt, 1995) or detailed daily discipline dairies (Larzelere & Merenda, 1994) to increase validity, but these techniques have not been common. Measurement for the current study will be defined in more detail in later sections.

Gershoff (2002) cites that corporal punishment is viewed as most appropriate for children of preschool age and least appropriate for infants and children 5 years of age or older. Researchers of corporal punishment have hypothesized that its effects may differ depending on the age of the child (Gershoff, 2002; Larzelere, 1996; Paolucci & Violato, 2004). Straus (1994) has argued that the effect of corporal punishment on violent behavior is greatest when used with adolescents. His hypothesis is that the adolescent and teenage years involve the development of autonomy and a transition to adulthood; corporal punishment may stand in the way of identity formation, independence, and moral development (Straus, 1994). Contrary to this hypothesis, others have asserted that corporal punishment may have the greatest impact during toddlerhood (Berlin et al., 2009), as this is the period at which it is most likely to be

used. Toddlerhood is characterized by an increase in mobility and autonomy seeking, which will naturally lead to an increase in discipline. As cited above, the use of corporal punishment at this age may result in patterns of noncompliance and the development of externalizing behavior problems (Berlin et al., 2009). It may also be particularly important to study corporal punishment in young children due to the possibility for cumulative effects over time.

Research on the associations between corporal punishment and children's behavioral outcomes has been summarized in several meta-analytic studies (Gershoff, 2002; Larzelere 1996; Larzelere and Kuhn, 2005; Paolucci and Violato, 2004). As mentioned, the evidence regarding the effects of corporal punishment is somewhat conflicting. While both negative and positive outcomes have been found for children who experience corporal punishment, the research has been replete with methodological flaws. Larzelere (1996) addresses these flaws in his early meta-analysis. He examined 35 published articles that included at least one measure of non-abusive or customary physical punishment. The author defined an outcome as beneficial if physical discipline significantly predicted a desirable outcome in the child (such as immediate compliance). Similarly, an outcome was defined as detrimental if physical punishment significantly predicted a negative outcome (such as low self-esteem or an increase in delinquency) for the child. Of the 35 articles, 9 found primarily beneficial child outcomes, 12 found predominantly detrimental outcomes, and 14 found neutral outcomes.

Larzelere (1996) found that several factors, including the age of the child and measurement of physical punishment, differentiated studies with beneficial as opposed

to detrimental outcomes. The meta-analysis indicated that studies including adolescents and teenagers were more likely to report detrimental outcomes. He also found that certain measurement characteristics were more likely to be associated with beneficial outcomes, including discriminating between abusive and non-abusive physical punishment, controlling for pre-existing differences on child outcome variables, and taking family characteristics and parental variables into account. Prospective studies were also more likely to be associated with neutral or beneficial outcomes compared to retrospective studies (Larzelere, 1996). Larzelere (1996) also found evidence that less frequent and less severe forms of corporal punishment are more likely to be associated with beneficial or neutral outcomes compared to negative outcomes. He concluded his meta-analysis by stating that *how* parents use a given disciplinary technique is probably more important than which disciplinary technique they use (Larzelere, 1996). This hypothesis is supported in a later meta-analysis comparing the use of physical punishment and alternative disciplinary tactics (Larzelere & Kuhn, 2005). Larzelere and Kuhn (2005) found that only overly severe or a predominant use of physical punishment compared unfavorably with other disciplinary techniques, indicating that it is important to examine the frequency and severity of corporal punishment used.

Gershoff's (2002) meta-analysis included 88 studies spanning 62 years (1938-2000). To be included in the meta-analysis, the operationalization of corporal punishment was required to meet Straus's definition. Gershoff examined the effect of corporal punishment on several outcomes, including short-term and long-term, direct and indirect, and individual-level and relationship-level constructs. Among the

behaviors and experiences that are included are children's immediate compliance, moral internalization, aggression, delinquent, criminal, and antisocial behavior, mental health, and risk of injury as a victim of physical abuse. Associations between corporal punishment and long-term outcomes were also examined for aggression, delinquent, criminal, and antisocial behavior, mental health, and adult abuse of one's own children or spouse. Twenty-seven studies included in the analysis measured constructs in adulthood. Gershoff also included quality of the parent-child relationship. The age of the target children in the samples of the studies ranged from 1 to 16 years; however, only 25 of the 88 studies included children aged 5 years of age or younger and only 12 of the studies included children aged three years of age or younger. It is clear that the majority of these corporal punishment studies have focused on an age-group of adolescents or teenagers, rather than toddlers and younger children.

The results of Gershoff's meta-analyses for each of these constructs indicate that corporal punishment is significantly associated with all outcomes discussed; however, all but one of the associations are undesirable. According to Gershoff (2002), immediate compliance is the only desirable behavior with which corporal punishment is associated. Specifically relevant to the current research, which will examine longitudinal data and trajectories of behavior over time, is Gershoff's finding that parental corporal punishment is associated with both increased aggression in children and increased aggression as an adult. Additionally, Gershoff (2002) found that the mean age of the sample partially moderated the effect of corporal punishment on aggression, with the effect size for the middle school age group (10-12 years) being larger than that of the preschool (1-5 years), grade school (6-9 years), or high school (13-16 years) age-

groups. Again, it is important to note that less than one-third of the studies included in Gershoff's (2002) analysis examined children five years of age or younger.

Contrary to the evidence provided by Gershoff's (2002) study, the meta-analysis of Paolucci and Violato (2004) does not present results indicating negative outcomes for children who experience corporal punishment. This meta-analysis included 39 studies of children 12 years of age or younger and 18 studies of adolescents. Paolucci and Violato (2004) included a total of 70 studies published between 1961 and 2000 and examined affective, cognitive, and behavioral outcomes. Affective outcomes included psychological damage, low self-esteem, fear, low empathy and reaction levels, narcissism, distress, depression, and anxiety. Cognitive outcomes consisted of academic impairment or performance, suicidal ideations, attitudes toward violence and punishment, and pro- or anti-spanking attitudes. The behavioral outcomes examined in Paolucci and Violato's (2004) meta-analysis included fighting, disobedience, resistance or compliance, aggression, alcohol abuse, child abuse, spousal assault, antisocial behaviors, communication, apprehension, marital conflict, conduct disorder symptoms, oppositional defiant symptoms, externalizing behaviors, hyperactivity, peer conflict, and social skillfulness.

The effect sizes for affective and behavioral problems in this meta-analysis were very small, leading the authors to conclude that people who have experienced corporal punishment are at a slight risk for these types of outcomes. The effect size for cognitive problems was zero (Paolucci & Violatto, 2004). Due to a lack of data available in most of the studies included, the authors were unable to examine the potential of any moderator variables, including age at which corporal punishment was experienced and

the frequency with which it was used. They acknowledge, however, that for some levels of such moderators (at certain ages or high frequencies), the small effect size observed in their meta-analysis may be large (either positive or negative).

As noted by Larzelere (1996), the results of research on the effects of corporal punishment have been influenced by several methodological factors. The measures of corporal punishment used (and whether they are confounded with abusive behaviors) and the inclusion of moderating variables, such as child's age, have been shown to impact the results. Along with Gershoff (2002), Paolucci and Violatto call for the inclusion of potential moderating variables as essential in data collection and research on corporal punishment. As do Larzelere (1996) and Larzelere and Kuhn (2005), Paolucci and Violatto (2004) highlight the importance of the frequency and severity of physical punishment. Although the present study does not directly examine age of the child as a potential moderator for the effects of corporal punishment, it will focus on an age group (toddlers) that has rarely been included in the corporal punishment literature and look at effects over time. It will also examine the effect of the frequency and type of corporal punishment on developmental paths of aggression.

### **Corporal Punishment and Externalizing Behavior Problems**

While a growing body of research on corporal punishment examines its unintended negative outcomes, the strongest link may be between corporal punishment and externalizing behaviors (Mulvaney and Mebert, 2007). Although internalizing behaviors, such as depression, self-esteem, and cognitive impairment, have also been associated with parental use of corporal punishment, externalizing behaviors, especially aggression, are of particular concern to researchers. Receiving harsh physical

punishment as a child has been associated with childhood aggression, aggression later in life, and violence toward one's own spouse and children as an adult (Berlin et al., 2009; Cohen, Brook, Cohen, Velez, & Garcia, 1990; Straus, 1994; Gelles, 1974; Stacks, Oshio, Gerard, & Roe, 2009). Numerous studies have linked parental use of corporal punishment to aggressive behavior in children (Berlin et al., 2009; Eron, Huesman, & Zelli, 1991; Larzelere, 1986; Sears, Maccoby, & Levin, 1957; Stacks, Oshio, Gerard, & Roe, 2009; Strassberg, Z., Dodge, K.A., Pettit, G.S., & Bates, J.E., 1994; Straus, 1994; Straus, Sugarman, & Giles-Sims, 1997). If spanking and other legal forms of corporal punishment can be causally linked to aggressive behavior, tremendous policy implications would arise.

To better understand the link and potential causal effects of corporal punishment on children's externalizing behaviors, a review of the extant literature and its limitations is necessary. Although this review will include studies specific to physical aggression, externalizing behaviors will be generally discussed, due to a lack of distinction between these two concepts in prior research.

Early studies of corporal punishment on aggressive behavior of children (e.g. Larzelere, 1986) employed cross-sectional, correlational methods in their analyses. The lack of longitudinal studies on the effects of corporal punishment is evident in Gershoff's (2002) meta-analysis; again, only 12 of the 88 studies included in her analysis were longitudinal in nature. As is the case with most areas of research employing cross-sectional and correlational methods, these techniques have been largely criticized, as additional variables may be responsible for the observed relationship between corporal punishment and aggressive behavior.

Straus et al. (1997) attempted to deal with criticisms of the correlational studies by controlling for prior levels of the outcome of interest, thereby allowing more direct causal conclusions to be drawn regarding the relationship between corporal punishment and antisocial behavior in children. Even when controlling for previous levels of antisocial behavior, the researchers found that the more spanking experienced at the start of the study, the higher the level of antisocial behavior two years later. The authors conclude that the change in antisocial behavior is unlikely to be due to a predisposition towards antisocial behavior or to confounding with demographic characteristics, as these variables were statistically controlled (Straus et al., 1997).

An approach similar to, but more rigorous than, that of Straus et al. (1997) has been to conduct prospective longitudinal studies using multiple waves of data to examine a change in the behavior of interest (Berlin et al., 2009; Simons, Johnson, & Conger, 1994; Mulvaney & Mebert, 2007). For instance, Mulvaney and Mebert (2007) used data from a multisite, longitudinal study to examine the impact of corporal punishment on children's internalizing and externalizing behavior problems. In an attempt to address previous criticisms of the corporal punishment research, Mulvaney and Mebert (2007) tried to strengthen their study by using a measure of the presumed causal variable (corporal punishment) assessed prior to the outcome variables of interest. They also used a prior assessment of the respective outcome variable, internalizing or externalizing behavior problems, as a statistical control.

The researchers used two sets of hierarchical multiple-regression models. The first set of models assessed the impact of CP in infancy and toddlerhood by examining the associations between the 15-month CP variable and the 36-month internalizing and

externalizing behavior scores. Secondly, the associations between internalizing and externalizing behavior problems in the first grade and a composite CP variable (constructed from the 36-and 54-month assessments) were examined. Results indicate that corporal punishment was associated with both increased internalizing and externalizing behavior problems from 36 months of age to first grade. Although the examination of multiple waves of data allows researchers to control for the temporal ordering of events and to examine the relative change and stability in a behavior of interest, it does not allow for the examination of a developmental path.

Berlin et al. (2009) also examine the outcomes of corporal punishment on young children. This study is important to the corporal punishment literature, as it focuses on toddlers and is the first to use cross-lagged path models. These models attempt to disentangle directionality by simultaneously estimating effects of parental discipline on child behaviors and vice versa (Gershoff & Bitensky, 2007). It has been suggested that parental disciplinary techniques may be elicited by child behaviors and, conversely, that parental disciplinary techniques drive child outcomes (Gershoff, 2002).

The sample for the Berlin et al. (2009) study was obtained from the Early Head Start National Research and Evaluation Project and contained white, African-American, and Mexican-American toddlers. The mothers were interviewed when the children were approximately 1, 2, and 3 years of age, allowing the researchers to include 3 waves of data. Corporal punishment was measured by asking the mothers if they or anyone else in the household had spanked the child in the past week, and if so, how often. The outcome variable of aggressive behavior was measured using the Child Behavioral Checklist (Achenbach & Rescorla, 2000). Berlin et al. (2009) found that child fussiness

at age 1 predicted spanking at all three ages. The analyses of cross-lagged path models indicated that spanking at age 1 predicted aggressive behavior at age 2, but aggressive behavior did not predict later spanking. While the researchers were able to examine the existence of reciprocal effects with this technique, they were not able to capture intra-individual or intra-group change.

The use of hierarchical linear models (HLM) is one method that can be used to examine the effect that a set of independent variables has on within-individual change in an outcome variable over time. This technique has recently been employed by Grogan-Kaylor (2005) to examine the functional form of the relationship between corporal punishment and antisocial behavior, and it may be the only study to date that has examined the effect of corporal punishment on intra-individual changes in an externalizing behavior. He used data from five waves of the National Longitudinal Survey of Youth (from 1988 to 1998). The antisocial behavior subscale of the behavior problems index (BPI) was used as the measure of antisocial behavior. The measure of corporal punishment was derived from a question on the home observation measures of the environment (HOME) instrument asking the mother how many times she has spanked the child in the past week. This study sought to determine whether there were differences in the initial level of antisocial behavior and also to answer the question of whether corporal punishment had a relationship with the rate of growth of children's antisocial behavior.

The hierarchical linear models employed by Grogan-Kaylor (2005) allowed for an analysis of the effects that a set of independent variables has on the growth trajectories of the dependent variable of interest (antisocial behavior). Results indicated a clear

effect of the use of corporal punishment on the initial level of antisocial behavior. Children who experienced higher levels of corporal punishment exhibited higher levels of antisocial behavior than children who did not receive corporal punishment; however, the effect of the use of corporal punishment on antisocial behavior was not significantly different for children who entered the study with higher or lower levels of the behavior initially. To test whether corporal punishment had an impact on the rate of growth of children's antisocial behavior, the researcher created an interaction term between corporal punishment and age, which was significant and implied a greater effect of corporal punishment on antisocial behavior for older children. Overall, Grogan-Kaylor (2005) concludes that these results indicate that parental use of corporal punishment is associated with increases in children's antisocial behavior.

While this study is possibly the first to examine corporal punishment's effects on externalizing behaviors from a developmental perspective, it is not without its limitations. One of the major limitations of the use of HLM for the examination of behaviors such as antisocial behavior or aggression is that this technique assumes that individuals follow a process that increases or decreases over time in the general population. It is designed, therefore, to sort out factors accounting for variation about a population mean (Nagin, 2005). It is impractical, however, to assume a continuous distribution function for certain behaviors that are not the "norm" in the population. A more detailed discussion of the limitations of such techniques is discussed within Chapter 4 of this thesis. An additional limitation of Grogan-Kaylor's study is the measure of corporal punishment, as it asks about a short period of time and does not capture frequency or severity.

## **Theoretical Explanations of the Relationship between Corporal Punishment and Aggression**

The potential link between the experience of corporal punishment and aggressive behavior in children is guided by criminological theory. A brief overview of possible theoretical explanations is given in this section, although the present study is not a test of any particular one. All three of these theories could perhaps provide a mechanism as to why we would expect to observe an association between corporal punishment and aggressive behavior.

One well-established theoretical explanation for the link between violence in the family (including corporal punishment) and aggressive behavior is that of social learning (Akers, 1985; Gelles, 1982; Straus, R., Gelles, R., & Steinmetz, S., 1980; Straus, 1994). Specifically, it has been hypothesized that children imitate the aggressive behavior modeled by their parents' disciplinary strategy. Extending other aspects of Akers' social learning theory (see Akers et al., 1979; Akers, 1985) it can be argued that the experience of corporal punishment also occurs within the intimate group of the family (differential association), leads to definitions favorable to aggressive behavior, and leads to vicarious reinforcement (Akers, 1985).

Although they do not specifically discuss the effect of corporal punishment on aggressive behavior, Tremblay and Nagin (2005) state that they argue against a social learning theory of aggression. They assert that a social learning hypothesis argues that a human who has never witnessed physical aggression in his life could not use physical aggression (even under such circumstances as experiencing extreme anger) because he would not have learned to physically aggress. Tremblay and Nagin (2005) indicate that children do not need to have seen models of physical aggression in order to start

engaging in the behavior themselves. Developmental studies have shown that most humans have used physical aggression before 36 months of age, that the use of physical aggression is most common between 18 and 42 months of age, and that if humans are learning to physically aggress through imitation, it is happening within the first two years of life (Tremblay et al., 1999; Tremblay and Nagin, 2005). Tremblay and Nagin (2005) argue that instead of learning to physically aggress, modeling most likely affects the speed at which children learn *not* to exhibit physical aggression.

The above argument of Tremblay and Nagin further coincides with two concepts. First, the authors acknowledge that children are more likely learning not to exhibit aggressive behavior, rather than learning to engage in aggression. Akers' (Akers et al., 1979) social learning theory states that the same learning process produces both conforming and deviant behavior. Since controlling aggressive behavior, or not engaging in it, is viewed as conforming behavior, that is non-aggressive action and Tremblay and Nagin's (2005) argument would indeed be compatible with a social learning theory of aggression.

Second, Tremblay and Nagin (2005) discuss learning to "control" aggressive behavior, which is also compatible with Gottfredson and Hirschi's (1990) general theory of crime, or self-control theory. The basic premise of this theory is that the lower one's self-control, the greater his or her involvement in criminal behavior and acts analogous to crime. Gottfredson and Hirschi (1990) argue that self-control is developed at a young age, identifying the major cause of low self-control as ineffective child-rearing. In order for self-control to form, parents must be concerned for their child's welfare, monitor their child's behavior, recognize deviant behavior when it occurs, and correct such behavior.

Gottfredson and Hirschi (1990) assert that the results of these parenting conditions include a child more capable of delaying gratification, more willing to accept restraints on his activity, and less likely to use force or violence to obtain what he wants. On the other hand, hostile and ineffective parenting will result in low self-control. The authors also argue that self-control remains relatively stable over the life-course. These contentions of self-control theory would appear to coincide with the trajectories of aggressive behavior that have been found by developmental researchers; as previously mentioned, the majority of children decline in their level of aggression between childhood and adolescence, with the exception of a “persistently aggressive” group. According to Gottfredson and Hirschi’s theory, this group showing persistently aggressive behavior would most likely contain individuals exposed most frequently to erratic parental disciplining practices, including corporal punishment.

Agnew’s general strain theory is another alternate explanation for the relationship between the experience of corporal punishment and aggressive behavior. The main assertion of general strain theory is that the experience of strain, including negative treatment by others, leads to an increase in negative emotions such as anger and frustration, which lead to crime (Agnew 2001; 2006). Agnew (2006) states that not all strains result in crime and antisocial behaviors, providing the example of consistent and fair parental discipline. According to Agnew (2006), while children or juveniles may not like such discipline, research has shown that it reduces the likelihood of crime.

Alternatively, Agnew also identifies parental supervision that is erratic, excessive, or harsh and child abuse and neglect as strains likely to cause crime. A clear connection can be made between corporal punishment and aggression if the experience of being

corporally punished is viewed as negative or unfair treatment. The resulting anger and frustration may be exhibited through aggressive behaviors.

### **Developmental Studies of Aggression**

A crucial component of the present study involves group-based trajectory modeling of aggressive behavior. Some of the most influential research on the development of childhood behavioral problems has assessed how they may follow different developmental pathways of physical aggression (Nagin & Tremblay, 1999; 2001; Tremblay et al., 2004). Tremblay and Nagin (2005) criticize the criminological literature for largely neglecting individuals before the start of adolescence because they cannot yet be considered delinquent. They cite that research on the age-crime curve has indicated that violent offenses appear in pre-adolescence, increase sharply during adolescence, and then decrease slowly (Blumstein et al., 1986). However, research has shown that problematic levels of aggressive behavior in adolescence and adulthood can be identified in the preschool years (Keenan & Wakschlag, 2000).

Nagin and Tremblay have explored the origins of antisocial behavior by examining both trajectories of aggression in very young children (before school-age) and from early childhood through adolescence. Most parents report that their child has used some type of physical force to get what they want by 17 months of age (Tremblay & Nagin, 2005). Two different patterns of physical aggression trajectories have been identified, depending on the developmental period studied. Research has shown that levels of physical aggression increase during the preschool years (Tremblay et al., 2004), followed by a decline from preschool to adolescence (Nagin & Tremblay, 1999; NICHD Early Child Care Research Network, 2004). In most cases, several waves of data collection (four to seven) have been used to model these developmental

trajectories. Most studies of group-based modeling of physical aggression have resulted in three or four distinct trajectory groups.

Tremblay et al. (2004) sought to identify the trajectories of physical aggression during early childhood and antecedents of high levels of physical aggression early in life. A sample of 504 children was followed from 5 to 42 months of age, with data collection at 5, 17, 30, and 42 months. Physical aggression was measured using a three-item scale. Mothers indicated how often (never, sometimes, or often) the child “hits, kicks, or bites”, “fights”, and “bullies” others. Using a semi-parametric group-based mixture model, three distinct groups of physical aggression trajectories were identified which best fit the data. The first cluster identified children who exhibited little or no physical aggression and comprised approximately 28% of the sample. A second group followed a rising trajectory of modest aggression and contained approximately 58% of the sample. The third and smallest group displayed a rising trajectory of high physical aggression and contained only about 14% of the sample. Additionally, predictors for membership in the high physical aggression group were identified both before or at birth and at 5 months of age. The best predictors before or at birth were having young siblings, mothers with high levels of antisocial behavior before the end of high school, mothers who started having children early, families with low income, and mothers who smoked during pregnancy.

Interestingly, the best predictors at 5 months of age were mother’s coercive parenting and family dysfunction. It is important to note that the measure of coercive parenting included items relevant to the current study, including spanking the infant; however, corporal punishment was not specifically assessed. The authors

acknowledge that the two 5 month predictors are also both classic predictors of antisocial behavior in older children and adolescents. They discuss the strong impact of these variables as possible causal factors in aggressive behavior; not only are they occurring as early as the first year of life, but they are also likely to remain part of the child's environment throughout childhood and adolescence (Tremblay et al., 2004).

Cote et al. (2006) extend this research by examining the development of physical aggression from toddlerhood to pre-adolescence, also identifying risk factors distinguishing between typical and atypical patterns of this behavior. Ten cohorts of approximately 1000 children each were drawn from a nationally (Canadian) representative sample. The seven key age groups included in the sample were 0-11 months, 1 year, 2-3 years, 4-5 years, 6-7 years, 8-9 years, and 10-11 years. The measure of physical aggression for this study was similar to Tremblay et al (2004). This analysis also identified three trajectory groups, including a "low-desisting trajectory" (31.3% of the sample), which exhibited infrequent use of physical aggression in toddlerhood and practically no physical aggression by pre-adolescence; a "moderate-desisting trajectory" (52.2% of the sample), which was characterized by occasional use of physical aggression in toddlerhood, but low levels of physical aggression in pre-adolescence; and a "high-stable trajectory" (16.6% of the sample), which reflected high physical aggression over time. Unlike previous studies examining similar age ranges (Kingston & Prior, 1995; Munson et al., 2001), Cote et al. (2006) did not identify a trajectory group with rising rates of aggression. The authors attribute this divergence to methodological differences; Cote et al. (2006) did not include a range of externalizing

behaviors in their operationalization of aggressive behavior, but focused solely on physical aggression.

The authors conclude that a typical developmental trajectory of aggression is one characterized by occasional, and then declining, levels of physical aggression. As did Tremblay et al. (2004), they examine predictors of group membership for the “high-stable” or atypical group. Results indicate that this group has the highest prevalence of family risk characteristics, including low income, early motherhood, low maternal education, and a separated family. This group also possessed the highest scores on measures of hostile parenting and family functioning. Hostile parenting was measured using items reflecting how often the parent becomes annoyed with the child’s behavior, gets angry and punishes the child, and feels ineffective at managing the child’s behavior. A scale of items examining the quality of communication, problem resolution, control of disruptive behavior, and giving and receiving affection was used as a measure of family functioning.

These two studies are not the only ones to identify coercive and hostile parenting styles as predictors of membership in a “high-stable” aggression group. A study funded by the National Institute of Child Health and Human Development (NICHD) Early Child Care Research Network (2004) similarly found that along with poverty, low maternal education, and single-parenting, less sensitive and involved parenting were also associated with more stable trajectories of physical aggression.

In a study examining three problem behaviors in an older, all male sample, Nagin and Tremblay (1999) identified four developmental trajectories. The researchers examined physical aggression, opposition, and hyperactivity separately, as they argue

that previous research has confounded measures of these other behaviors with physical aggression. One of the goals of this study was to examine delinquent outcomes, and the authors argued that confounding the problem behaviors would provide poor predictions regarding the effects of the behaviors on delinquency. The sample included 1037 boys, who were rated by their teachers on the problem behaviors at age 6 and annually from age 10 to 15. Participants additionally self-reported their delinquency at 15, 16, and 17 years of age. The trajectories identified for the three externalizing behaviors were very similar, although boys who followed a particular trajectory for one behavior did not necessarily follow the same trajectory for the other two types of behavior. There was a group of “lows” who rarely displayed the problem behavior to any notable degree (about 15-25% of the sample); a group of “moderate-level desisters” who initially displayed moderate levels of the problem behavior, but desisted by age 10-12 (about 50% of the sample); a group of “high-level near desisters” who started off scoring relatively high on the problem behavior, but by age 15 scored far lower (about 20-30% of the sample); and a group of “chronics” who began by scoring high on the problem behavior and continued to score high over time.

As mentioned, the second stage of this project examined delinquent outcomes, including physical violence, serious delinquency (including some, but not all violent items), and theft, for the different trajectories. The strategy examined whether physical aggression added significant explanatory power to the model already including opposition and hyperactivity, and whether those two behaviors continued to provide independent explanatory power after controlling for aggression. Results indicated that physical aggression seemed to be a distinct predictor of self-reported physical violence

and serious delinquency, but not theft. In a follow-up to their 1999 study, Nagin and Tremblay (2001) used the same sample of boys to identify early predictors of physical aggression trajectories. The only characteristics that distinguished between membership in the “persistently high” over the “high-declining” group were mothers’ low education level and teenage onset of childbearing. As discussed above, more recent studies have included not only characteristics of the parents, but also variables related to parenting styles (Cote et al., 2006; Tremblay et al., 2004).

While parenting styles and family functioning have been included in some research on developmental trajectories of physical aggression, the use of physical discipline or corporal punishment has not been specifically assessed. At least some of the parenting measures used in previous studies have included spanking items as one item in a scale (Tremblay et al., 2004), however, there have not been any studies directly examining the impact of parental corporal punishment on trajectory group membership for physical aggression. Additionally, an overall lack of longitudinal studies relating corporal punishment to physical aggression (see Gershoff, 2002) indicates that this area of research is needed. Although exploratory in nature, this thesis attempts to add to the literature and fill a gap in the current research.

### **Significance of Current Research**

The major goal of this study is to examine the association between corporal punishment and aggressive behavior in a sample of toddlers, while addressing some methodological shortcomings of prior research. First, a significant amount of research on the outcomes of corporal punishment has focused on samples of adolescents, ranging from about 10 to 14 years of age. Corporal punishment, however, is viewed as

most appropriate for children of preschool age (Gershoff, 2002), making it imperative to examine this age group. Although there has been some research on corporal punishment's effects on toddlers' behavior, the literature in this area has focused primarily on the prevalence and predictors of corporal punishment (Regalado et al., 2004; Socolar & Stein, 1995; Wissow, 2001). The present study will examine the association between corporal punishment and aggressive behavior for a sample of toddlers, ranging from approximately two to four years at the beginning of the assessment period.

Secondly, it has been widely recognized that certain factors relating to the use of corporal punishment may impact its effects (Gershoff, 2002; Larzelere, 1996; Larzelere & Kuhn, 2005; Paolucci & Violatto, 2004). The first factor is the frequency with which corporal punishment is used. Research has indicated the use of corporal punishment as a frequent or primary disciplinary tactic may be associated with more detrimental outcomes (Larzelere, 1996; Paolucci & Violatto, 2004). To address this issue, the present study will examine the frequency of corporal punishment experienced across trajectory groups. Similarly, certain types of corporal punishment, such as hitting with an object, have been identified as more severe than customary spanking and have been associated with more negative outcomes (Larzelere & Kuhn, 2005; Straus, 1994). Three types of corporal punishment that have been identified in past research as varying in severity (Straus, 1994) will be examined across trajectory groups in the current study. The type of corporal punishment, rather than the severity, will be referred to here, as a consensus on determining which types of corporal punishment are the most severe has yet to be reached (Gershoff, 2002).

Finally, previous studies in the corporal punishment literature have either used cross-sectional data or analyzed change in aggression from one wave of data collection to the next. Prospective longitudinal studies, especially those inclusive of toddlers, have been rare (Berlin et al., 2009; Mulvaney & Mebert, 2007). Although wave-to-wave data analysis allows for temporal ordering and measurement of change in the outcome of interest, it is still based on individual points in time and differences between individuals. The only study to date that has examined corporal punishment's effect on intra-individual change (Grogan-Kaylor, 2005) possesses the limitation of using hierarchical linear models, which assume a continuous distribution function in the population. Considering the findings of distinct categories of aggressive behavior, a more appropriate examination of the impact of corporal punishment on the developmental paths of children would involve a group-based approach, which instead assumes a discrete or categorical distribution. This thesis will therefore use semi-parametric group-based trajectory models to identify trajectories of physical aggression in toddlers and examine the association between corporal punishment and group membership.

### **Research Questions and Hypotheses**

1. **Research question.** How many trajectories of physical aggression will be identified and how can these trajectories be described?

**Hypothesis.** It is hypothesized that developmental trajectories of aggression similar to those established by Tremblay and Nagin (Nagin and Tremblay 1999; 2001; Tremblay et al., 2004) will be identified (either three or four trajectory groups as described above).

2. **Research question.** Is the frequency of corporal punishment associated with membership in a “chronic high” aggression group?

**Hypothesis.** It is hypothesized that experiencing higher frequencies of corporal punishment will be associated with membership in a “chronic high” aggression group.

3. **Research question.** Is the type of corporal punishment experienced associated with membership in a “chronic high” aggression group?

**Hypothesis.** It is hypothesized that experiencing certain types of corporal punishment (other than customary spanking) will be associated with membership in a “chronic high” aggression group.

## CHAPTER 3 METHODS

### **Data**

Data used for the current study were obtained from the Project on Human Development in Chicago Neighborhoods (PHDCN), an interdisciplinary study of how families, schools, and neighborhoods affect the development of children and adolescents (Earls & Visher, 1997). The two main components of the PHDCN included an extensive study of Chicago neighborhoods and community conditions and a longitudinal cohort study, which collected three waves of data from children, adolescents, young adults, and their primary caregivers between 1994 and 2001.

A three-stage sampling technique was utilized to arrive at the cohorts included in the PHDCN (Earls & Visher, 1997). First, a stratified probability sample of 80 neighborhoods was collected from the 343 total neighborhood clusters within the city of Chicago. The neighborhoods were stratified based on racial/ethnic composition and socio-economic status. Following this step, block groups were randomly selected from each neighborhood and, within each block group, a complete list of dwelling units was assembled. The last stage of sampling included in-person screening, in which pregnant women, children, and young adults within six months of the seven age cohorts (birth (0), 3, 6, 9, 12, 15, and 18 years of age) were identified and asked to participate in the study. This sampling procedure resulted in over 6,000 randomly selected participants (Earls & Visher, 1997). The longitudinal cohort study administered multiple measurements and instruments to tap various aspects of human development. Due to the present study's focus on toddlers, only the three-year-old cohort will be examined here; however, data from all three waves of data collection will be included.

As with any longitudinal study, the PHDCN lost participants over time due to attrition. For the three-year-old cohort, the attrition rate was approximately 17.24% from wave 1 (n=1003) to wave 2 (n=830) and 8.9% from wave 2 (n=830) to wave 3 (n=756). Only cases that were present in all three waves of data collection (n=697) were included in the analysis sample. Finally, an additional 16 cases were dropped due to invalid responses (such as “I don’t know” or “Interviewer missed”) on the dependent variable (aggression). The resulting analysis sample included 681 cases.

Demographic characteristics of the analysis sample are very similar to those of the total sample for the three-year-old cohort. A comparison between these two groups can be seen in Table 3-1. The analysis sample was almost evenly composed of male (49.49%) and female (50.51%) children. The sample was predominantly Hispanic (49.14%) and had a mean age of 3.15 years at the first wave of data collection. The youngest participant was 1.84 years of age and the oldest participant was 4.91 years of age at wave 1. Primary caregivers of the children were mostly female (95.30%) with a mean age of 30.87 years at wave one. The average income of primary caregivers was between \$10,000 and \$19,999 per year. Approximately 39.80% had less than a high school diploma, 14.10% had no education beyond a high school diploma, and the majority, 46.11%, had some education beyond a high school diploma.

## **Measures**

### **Dependent Variable**

**Physical aggression.** Physical aggression is measured using items taken from Achenbach’s (1991;1992) Child Behavioral Checklist (CBCL). Due to the fact that reduced versions of the CBCL (Earls, Brooks-Gunn, Raudenbush, & Sampson, 1994)

were administered as part of the longitudinal cohort study at all three waves of data collection, not all of the measures widely used by Nagin and Tremblay (Cote et al., 2006; Nagin and Tremblay, 1999; 2001; Tremblay et al., 2004) were available. Additionally, the items included in the reduced CBCL varied from one wave of data collection to the next.

The primary caregiver was asked how often the child participates in the aggressive behaviors and responses were indicated on a 3-point ordinal scale: “not true” (0), “sometimes true” (1), or “very true” (2). In their construction of aggression scales, Nagin and Tremblay have typically summed the responses for the three items they have included. The aggression items in the present analysis were standardized to have a mean of 0 and a variance of 1 before the sum scale was created. Higher scores indicate more frequent engagement in physically aggressive behavior. Means and standard deviations of aggression scores by wave can be viewed in Table 3-2.

Two separate aggression scales were constructed for each of the three waves. One scale was created by summing all items administered as part of the CBCL that were relevant to physical aggression and that have been used in previous studies (Broidy et al., 2003; NICHD Early Child Care Research Network, 2004). This scale included behaviors such as destroying things belonging to oneself or others, threatening others, getting into many fights, and cruelty to animals and other people. The second scale was simply a sum of the only two physical aggression items that were consistently available across all three waves. These items were destroying things belonging to others and getting into many fights. Correlations between the two different scales were run for each wave and were 0.79, 0.88, and 0.84 (for waves 1, 2, and 3, respectively).

The first scale (including all of the items at each wave) has adequate reliability at all three waves, with Cronbach's alphas of 0.72, 0.72, and 0.66 for the three waves. The correlations between the two aggression items at each wave were 0.38, 0.33, and 0.37 respectively. A full list of items available at each wave is available in Appendix A. Missing data on any of the aggression items was addressed using the ICE command in STATA to impute the missing values<sup>1</sup>.

### **Independent Variable(s)**

**Corporal punishment.** Developed by Straus (1994), the corporal punishment scale for the current study consists of three items from the Parent-Child Conflict-Tactics Scale (Earls, Brooks-Gunn, Raudenbush, & Sampson, 1994; Straus et al., 1996), all of which ask how often a primary caregiver has engaged in the following disciplinary tactics in the past year: slapped or spanked the child with an open palm; pushed, grabbed, or shoved the child; and thrown something at the child. The original response categories were: never (0), once (1), twice (2), 3-5 times (3), 6-10 times (4), 11-20 times (5), and more than 20 times (6). For each subject, responses to items were summed and then an average item response was calculated. Higher scores indicate more

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<sup>1</sup> While the "impute" command in STATA continues to be operable, as of STATA 11, it is no longer an official part of STATA ([www.stat.com/help](http://www.stat.com/help)). This is the main reason why the ICE command was used. Additionally, the ICE command is user-written and imputes the value of a single variable using an appropriate regression model based on a set of predictor variables. In the present study, the regression model was an ordinal logit based on the ordinal nature of the aggression score. The predictors used for imputing a given aggression item included all risk factors discussed in the Measures section below, all other items in the aggression scale for the respective wave, and for waves 2 and 3, all aggression items from previous waves of data collection. ICE was used for a single imputation in the present study. Low income of the primary caregiver and Hispanic ethnicity were associated with missing data on the aggression variables. The amount of missingness varied by aggression item. In the worst case, 182 values were missing for a given item. This case of missingness occurred on the "cruelty to animals" item at the third wave of data collection. The only other item with a substantial amount of missing values (147 missing) was the "gets into many fights" item at wave 1. Most commonly, there were zero to two missing values for any given aggression item.

frequent use of corporal punishment. On average, primary caregivers reported using corporal punishment to discipline their child once in the past year. Table 3-3 presents the prevalence of corporal punishment by type for both the total and analysis samples.

Straus (1994) did not take the mean across these items, but rather classified a child as experiencing corporal punishment if any of the three tactics had been used in the past year. As previously mentioned, not all children who experience corporal punishment have negative outcomes. The rationale behind taking the mean of these responses is to include information about the frequency of these parental disciplinary tactics. It may be the frequency of corporal punishment that has an impact on children's outcomes, rather than whether or not the child has been corporally punished at all.

Although the corporal punishment scale shows only moderate reliability ( $\alpha = 0.54$ ), it is used in the present study for continuity with past research and due to the availability of the measures. On average, primary caregivers of the analysis sample reported corporally punishing their child once in the past year ( $\bar{x}=1.25$ ,  $SD=1.11$ ,  $min=0$ ,  $max=6.00$ ).

As hypothesized, type of corporal punishment may also have an impact on aggressive behavior. To examine this question, each of the three corporal punishment items are analyzed separately. Again, higher scores on each item indicate more frequent use of that type of corporal punishment. Primary caregivers most often reported never spanking their child in the past year ( $n=158$ ), with a median rate of spanking 3-5 times in the past year. The median and modal response for primary caregivers pushing, grabbing, or shoving the child was a frequency of zero times in the

past year. The same is true for throwing something at the child; both the median and mode are zero<sup>2</sup>.

### **Risk Factors**

All additional independent variables included in the analysis have been linked with parental use of corporal punishment, physically aggressive behavior in children, or both. Although most research on developmental trajectories of aggression has included variables relating directly to the mother (and, in some cases, the father), the PHCDN collected data on primary caregivers. This information was used in place of parental variables, as it is more likely that characteristics of the primary caregiver will be associated with child outcomes (if the primary caregiver is not a parent). In the majority of cases, however, the biological mother is the primary caregiver (92.22%). Missing data for these risk factors was very rare, as most of the information was collected as part of the demographic profile during the first wave. It was dealt with by mean or mode replacement.

**Gender of child.** Although developmental trajectories of physical aggression for girls have illustrated patterns similar to boys, research has shown that scores of females on aggression tend to be lower overall (Broidy et al., 2003), even as early as 17 months of age (Baillargeon et al., 2007). Regarding physical punishment, it has been consistently shown that boys are also more likely to be corporally punished than girls (Day et al., 1998; Straus et al., 1997; Straus & Stewart, 1999). The PHDCN collected demographic information at wave 1, including the child's gender. Gender was coded as

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<sup>2</sup> Overall, the corporal punishment items did not contain a large number of missing values (n=7). Missing values for these variables were replaced with the modal response

female (0) or male (1). The sample was split almost evenly between female (50.51%) and male (49.49%) children.

**Age of child.** As discussed in previous sections, a child's age has an impact on the likelihood that they will be corporally punished (Day et al., 1998; Regalado et al., 2004; Socolar & Stein, 1995; Wissow, 2001) and has also been linked to physical aggression (Cote et al., 2006; Nagin & Tremblay, 1999; 2001; Tremblay et al., 2004). The age of the child was measured as a continuous variable at wave 1. Although only the 3-year-old cohort is being used for the present study, some variation in age inevitably remains, with age at wave 1 ranging from 1.837 to 4.383 years. The mean age of the analysis sample at wave 1 was 3.15 years.

**Race/ethnicity.** Research has shown that corporal punishment is more common among certain ethnic groups (i.e. African Americans) than others (Berlin et al., 2009; Regalado et al., 2004; Wisslow, 2001). Data on the race/ethnicity of the child was also collected as part of the demographic profile at wave 1 and several indicator variables were created to include race/ethnicity in the model. The indicator variables were white (1 if yes, 0 if otherwise), black (1 if yes, 0 if otherwise), Hispanic (1 if yes, 0 if otherwise), and other race (1 if yes, 0 is otherwise). The other category included participants who described themselves as Asian, Pacific Islander, Native American, or other. The majority of the sample was Hispanic (49.19%), followed by black (33.19%), white (14.68%), and other (2.93%).

**Income.** Income is included as a measure of socio-economic status, which has been linked to the use of parental corporal punishment (Smith & Brooks-Gunn, 1997; Straus & Stewart, 1999; Wissow, 2001) and aggressive behavior in children (Cote et al.,

2006; Tremblay et al.; 2004). Annual income of the primary caregiver was also collected at wave 1 and was classified into ordinal categories: less than \$5,000 (1), \$5,000-9,999 (2), \$10,000-19,999 (3), \$20,000-29,999 (4), \$30,000-39,999 (5), \$40,000-49,999 (6), >\$50,000 (7). The median income for the sample was \$10,000 to \$19,999 per year.

**Age of primary caregiver:** Corporal punishment research has shown that younger parents are more likely to use corporal punishment on their children than older parents (Day et al., 1998; Berlin et al., 2009; Smith & Brooks-Gunn, 1997; Straus, 1994; Straus & Stewart, 1999). Age of the primary caregiver was obtained as part of the demographic characteristics at wave 1. The mean age of primary caregivers at the first wave of data collection was 30.87 years (SD=7.29, min=17.79, max=65.60).

**Relationship of primary caregiver.** While the majority of primary caregivers in the dataset are biological mothers (92.22%), the relationship of the primary caregiver to the child is also included. Primary caregivers included biological parents, step-parents, foster parents, adoptive parents, biological grandparents, siblings, aunts, and uncles. Indicator variables were created for biological mother (1 if yes, 0 if otherwise), biological father (1 if yes, 0 if otherwise), and other primary caregiver (1 if yes, 0 if otherwise).

**Gender of primary caregiver.** Research has shown that mothers are much more likely to corporally punish their children than fathers (Day et al., 1998; Straus, 1994; Straus & Stewart, 1999). For this reason, the gender of the primary caregiver will also be included as a risk factor. Gender was coded as female (0) or male (1). As the majority of primary caregivers were biological mothers, the majority of primary caregivers were also female (95.30%).

**Relationship status of primary caregiver.** Single-parenting is a risk factor for both the use of corporal punishment (Loeber et al., 2000; Regalado et al., 2004) and childhood physical aggression (NICHD, 2004). The marital status of the primary caregiver was measured as part of the demographic profile at wave 1. Indicator variables were created for whether the primary caregiver was married (1 if yes, 0 if otherwise), partnered (1 if yes, 0 if otherwise), or single (1 if yes, 0 if otherwise). The majority of primary caregivers in the sample were married (56.39%).

**Education level of the primary caregiver.** Low parental education has been linked to both use of corporal punishment (Day et al., 1998; Smith & Brooks-Gunn, 1997) and aggressive behavior in children (Cote et al., 2006; NICHD, 2004). Information regarding the education level of the primary caregiver was collected as part of the demographic profile at wave 1. Indicator variables were created for the maximum level of education being less than a high school diploma (1 if yes, 0 if otherwise), a high school diploma (1 if yes, 0 if otherwise), and some education beyond high school (1 if yes, 0 if otherwise). Most primary caregivers had some education beyond a high school diploma (46.11%), followed by less than a high school diploma (39.80%), and earning a high school diploma (14.10%).

**Parental (PC) hostility.** Research has shown an association between aggressive behaviors in children and parental hostility (Cote et al., 2006; NICHD, 2004; Tremblay et al., 2004). A scale of parental hostility was created for the present study by summing 6 dichotomous items that have been identified as a “lack of parental hostility” subscale (Fuligni, Han, & Brooks-Gunn, 2004; Han, Leventhal, & Linver, 2004; Linver, Brooks-Gunn, Cabrera, 2004) of the home observation for measurement of the

environment (HOME) instrument (Selner-O'Hagan & Earls, 1994). Examples of these items include whether the primary caregiver shouted at the child during the visit, scolded or criticized the child during the visit, or expressed annoyance with the child. Higher scores on this measure would therefore indicate a *lack* of parental hostility and lower scores would be equivalent to *more* parental hostility. A list of the items included in this scale is available in Appendix A. Again, it is important to note that the data included is that of the primary caregiver, which may not be a parent. The average score for lack of primary caregiver hostility was 4.86.

**Parental (PC) warmth.** Parental warmth has also been associated with corporal punishment and aggressive behavior (Berlin et al.; 2009, Stacks et al., 2009). As with other measures, the data included in this measure is that of the primary caregiver. A scale was constructed by summing 9 dichotomous items that have been identified as measuring parental warmth (Fulgini, Han, & Brooks-Gunn, 2004; Han, Leventhal, & Linver, 2004; Linver, Brooks-Gunn, Cabrera, 2004) from the HOME instrument (Selner-O'Hagan & Earls, 1994). Higher scores on this scale indicate more warmth from the primary caregiver. Examples of warmth items include speaking to child, praising the child, and showing physical affection toward the child during the visit. A full list of items included in the measure of warmth can be viewed in Appendix A. The average score for warmth of the PC toward the child was 7.24.

**Presence of siblings:** As previously mentioned, one of the best predictors of membership into the high physical aggression group in previous research was having siblings. This is not surprising because in order to be physically aggressive, one must have a target (Tremblay et al., 2004). Measures from an instrument regarding

household composition were used to construct an indicator variable for the presence of siblings (1) or the absence of siblings (0). The majority of the sample had at least one sibling present (86.34%).

Table 3-1. Demographic Information

<i>Continuous Variables</i>	<i>Total Sample</i>				<i>Analysis Sample</i>			
	M	SD	Min	Max	M	SD	Min	Max
Age of subject	3.15	0.32	1.84	4.91	3.15	0.32	1.84	4.91
Age of primary caregiver	30.61	7.59	15.00	68.50	30.87	7.29	17.79	65.60
<i>Categorical Variables</i>	Category			%	Category			%
Gender of subject	Female			49.75	Female			50.51
	Male			50.25	Male			49.49
Ethnicity of subject	Hispanic			48.24	Hispanic			49.19
	Black			33.90	Black			33.19
	White			14.34	White			14.68
	Other			3.51	Other			2.93
Relationship of primary caregiver to subject	Biological mother			88.12	Biological mother			92.22
	Biological father			6.30	Biological father			4.41
	Other			5.57	Other			3.23
Gender of primary caregiver	Female			93.21	Female			95.30
	Male			6.79	Male			4.70
Relationship status of primary caregiver	Married			54.00	Married			56.39
	Partnered			15.70	Partnered			13.80
	Single			30.29	Single			29.81
Income of primary caregiver	<5,000			13.76	<5,000			11.89
	5,000-9,000			14.18	5,000-9,000			12.48
	10,000-19,999			23.04	10,000-19,999			26.43
	20,000-29,999			15.43	20,000-29,999			15.57
	30,000-39,999			10.53	30,000-39,999			9.54
	40,000-49,999			8.34	40,000-49,999			8.22
Education level of primary caregiver	>50,000			14.70	>50,000			15.86
	Less than HS diploma			42.00	Less than HS diploma			39.80
	HS diploma			15.06	HS diploma			14.10
	More than HS diploma			42.93	More than HS diploma			46.11

\*Measure of average corporal punishment includes all three items from the PC-CTS.

Table 3-2. Aggression Measures

Wave	<i>All Aggression Items</i>				<i>Two Aggression Items</i>			
	M	SD	Min	Max	M	SD	Min	Max
Wave 1	-0.01	4.28	-3.98	21.36	-0.01	1.66	-1.19	4.84
Wave 2	-0.00	2.94	-2.18	12.57	0.00	1.63	-1.14	5.93
Wave 3	0.05	3.36	-1.90	22.39	-0.01	1.63	-0.95	7.02

Table 3-3. Prevalence of Corporal Punishment

	<i>Total Sample</i>				<i>Analysis Sample</i>			
	M	SD	Min	Max	M	SD	Min	Max
Average corporal punishment in past year*	1.23	1.09	0.00	6.00	1.25	1.11	0.00	6.00
Slap or spank with an open palm	2.62	2.02	0.00	6.00	2.68	2.01	0.00	6.00
Push, grab, or shove	0.93	1.63	0.00	6.00	0.95	1.66	0.00	6.00
Throw something	0.12	0.63	0.00	6.00	0.12	0.62	0.00	6.00

\* Average corporal punishment was calculated by taking the mean across 3 corporal punishment items as discussed in the Measures section.

## CHAPTER 4 ANALYTIC STRATEGY AND ANALYSIS PLAN

### **An Overview of Group-Based Modeling of Development**

The present study employs group-based developmental trajectory modeling to assess aggression trajectories of toddlers for an average age of development from approximately 3 to 8 years of age (Nagin, 2005). A developmental trajectory describes change in an individual over a period of time. The trajectory group was developed as a method for summarizing data that describes the behavior and characteristics of a set of individuals following approximately the same developmental course. It is evident from the existing research on trajectories of aggressive behavior that several categories of aggressive behavior can be identified, such as groups that increase or decrease in aggression and groups that are persistently low or high in aggression.

Although there are alternative methods which describe an individual's developmental path over time, such as hierarchical modeling (Bryk and Raudenbush, 1987; 1992, Goldstein, 1995) and latent curve analysis or standard growth-curve modeling (McArdle and Epstein, 1987), group-based developmental trajectory modeling is particularly well-suited for the research questions in the present study. It has been suggested (Piquero, 2008) that group-based trajectory modeling techniques are appropriate for studying violent and deviant behavior over the life-course because there may be different groups of offenders, their offending trajectories may exhibit different shapes at different ages, and they may be differentially affected by distinct factors.

While not all of the assumptions underlying the alternative methods of hierarchical modeling and standard growth curve modeling are common, one similarity is crucial. Both methods model the population distribution of trajectories based on continuous

distribution functions. In other words, an average trajectory of a behavior is identified and the goal is to identify factors that account for individual variability about that trajectory. Group-based methods of trajectory modeling, in contrast, identify clusters of individuals with similar developmental paths, thereby allowing differences that may explain, or at least predict, individual-level heterogeneity in terms of group differences (Nagin, 2005). Essentially, group-based procedures assume the underlying distribution is discrete or categorical, rather than continuous, and each category can be viewed as a source of support, or grouping, for the distribution of individual heterogeneity (Piquero, 2008). The model estimates a separate point of support for as many distinct groups as can be identified in the data (Piquero, 2008).

The appropriateness of each of these techniques may be best explained by an example. Raudenbush (2001) provides an ideal illustration. A typical application of growth-curve modeling is one in which members of the population follow a common developmental pattern, such as the process of language acquisition in children. Standard growth-curve modeling is well-suited for this type of analysis because it is reasonable to assume that most individuals experience a common process of growth: The vocabularies of all young children from normal populations increase with age. In this case, it makes sense to examine language acquisition in terms of variation about the population mean. On the other hand, it is not reasonable to assume that all individuals in a population follow a common developmental path for certain phenomena, such as depression (Raudenbush, 2001). Therefore, it makes no sense to characterize population differences in terms of variation about a mean trajectory of depression in the population. It is more reasonable to use a group-based approach, which may identify

qualitatively distinct trajectories (such as those who are never high in depression, those who are always high in depression, and those who are increasing in depression) to analyze individual heterogeneity in terms of group differences (Nagin, 2005; Raudenbush, 2001).

Certainly, aggressive behavior may be considered the exception, rather than the norm, within the general population. While physical aggression may be considered normative in toddlers, it generally declines by school-age (NICHD, 2004) and research has consistently shown that children follow qualitatively different trajectories of aggressive behavior. Groups of children exhibiting persistently high levels and persistently low levels of aggression have been consistently identified in previous research (Cote et al., 2006; NICHD, 2004; Nagin & Tremblay, 1999; 2001; Tremblay et al., 2004). As physical aggression generally declines by school-age, it is this persistently high group in which most research is interested. Depending on the length of follow-up, several other groups, either increasing or decreasing in aggression have also been identified (Cote et al., 2006; NICHD, 2004; Tremblay et al., 2004). Due to the existing empirical support for qualitatively different trajectories of aggressive behavior in children (Cote et al., 2006; NICHD, 2004; Nagin & Tremblay, 1999; 2001; Tremblay et al., 2004), group-based modeling approaches will be used in the present study.

### **Analysis**

The PROC TRAJ procedure in the SAS statistical package is used to estimate the trajectory groups. The analysis for the present study occurs in three main steps. First, the semi-parametric mixture model technique is applied to repeated measures of aggressive behavior to identify different developmental trajectories of physical aggression. To address the first research question for the present study, the best-fitting

trajectories are found using appropriate model selection criteria as outlined by Nagin (2005). Next, the features of the aggression trajectories (i.e. stable, increasing, declining) were identified and will be described in Chapter 5. Finally, profiles of the groups are created, which examine the association between group membership and type and frequency of corporal punishment experienced (research questions two and three).

### **Model Estimation Procedures**

The group-based trajectory model is an application of the statistical technique called finite mixture modeling, which is an extension of the conventional maximum likelihood model (Nagin, 2005). The identification of clusters of individuals with similar trajectories is the product of maximum likelihood estimation. While the specific form of the likelihood function to be maximized depends on the type of data being analyzed, the general form of the likelihood function is given by

$$P(Y_i) = \sum_j^J \pi_j P^j(Y_i), \quad (4-1)$$

where  $Y_i = \{y_{i1}, y_{i2}, \dots, y_{iT}\}$  denotes a longitudinal sequence of measurements on individual  $i$  over  $T$  periods (the aggressive behavior of an individual),  $P(Y_i)$  is the unconditional probability of observing individual  $i$ 's longitudinal sequence of behavioral measurements,  $Y_i$  equals the sum across the  $J$  groups of the probability of  $Y_i$  given  $i$ 's membership in group  $j$  weighted by the probability of membership in group  $j$ ,  $P^j(Y_i)$  denotes the probability of  $Y_i$  given membership into group  $j$ , and  $\pi_j$  denotes the probability of a randomly chosen population member belonging to group  $j$ .

The present study estimates trajectory models in which  $y_{it}$  is a censored variable: ratings of physical aggression from a psychometric scale in which there are

clusters of data at the minimum or maximum. For this type of data, adaption of the general form of the model (Equation 4-1) is necessary. Following an adaptation of a tobit model outlined by Nagin (2005), the link between age and aggressive behavior is modeled via a latent variable,  $y_{it}^*$ , as

$$y_{it}^* = \beta_0^j + \beta_1^j Age_{it} + \varepsilon_{it}, \quad (4-2)$$

where  $Age_{it}$  is individual  $i$ 's age at time  $t$ ,  $\varepsilon_{it}$  is a disturbance assumed to be normally distributed with mean zero and constant standard deviation  $\sigma$ , and  $\beta_0^j$  and  $\beta_1^j$  are parameters that determine the shape of the trajectory. It is important to note that in the current study, there are only three waves of data with which to estimate the trajectory groups, resulting in an important constraint that a linear equation will be defined for the trajectories. Therefore, directional changes (such as those that may be identified by using a quadratic equation) in aggressive behavior over time cannot be modeled. For instance, the quadratic form may capture trajectories that rise or fall without interruption, rise and then fall, or fall and then rise (Nagin, 2005).

To arrive at the appropriate number of groups for the data, the Bayesian Information Criteria (BIC) will be assessed (Nagin, 2005). The performance of the BIC in comparison to two other criteria, Akaike Information Criteria (AIC) and Integrated Classification Likelihood-BIC (ICL-BIC), has been assessed (Brame, Nagin, & Wasserman, 2004 as cited in Nagin, 2005). Brame, Nagin, and Wasserman (as cited in Nagin, 2005) evaluated the performance of these methods by utilizing simulated data for which the true model was known. They found that BIC is a conservative method, which unlike the AIC, varies with sample size. For a given model, BIC is calculated as

$$BIC = \log(L) - 0.5k\log(N), \quad (4-3)$$

where  $L$  is the model's maximized likelihood,  $N$  is the sample size, and  $k$  is the number of parameters in the model. For group-based trajectory modeling procedures, the estimation of models with varying numbers of groups and selection of the model with the largest BIC score is required (Nagin, 2005).

Once the appropriate number of groups is selected based on the BIC, a maximum-probability assignment rule will be used to assign each individual to the group for which they have the highest posterior probabilities of group membership. The posterior probabilities also allow the investigator to diagnose how well the model corresponds to the data. The average posterior probability of assignment for each group can be calculated by taking the mean posterior probability for membership in each of the groups for the individuals assigned to that group. Ideally, the assignment probability for each person should be 1. Nagin's (1999, 2005) rule-of-thumb, and the generally accepted cutoff, is 0.70.

### **Creation of Group Profiles**

The final step of the analysis examines the association between corporal punishment and membership into the high chronic physical aggression group. This occurs by constructing profiles of trajectory group membership for each of the groups identified by the model. These profiles are created by cross-tabulating individual-level trajectory group assignments with individual-level characteristics that might be associated with group membership. In the present study, the association between the frequency and type of corporal punishment with group membership will be examined, along with the additional risk factors (demographic and family characteristics) discussed in the measures section.

## CHAPTER 5 RESULTS

### **Bivariate Analysis**

Bivariate analyses of the variables included the study are presented in Appendix B. Relationships between the dependent and independent variables are presented in Tables B-1a and B-1b. With one exception, all pairwise correlations between aggression at all three waves, the average level of corporal punishment, and all three types of corporal punishment are low (0.07) to moderate (0.46), but highly significant ( $p \leq .01$ )<sup>3</sup>. A non-significant correlation is observed between throwing something at the child and aggressive behavior at wave 3 for the all-inclusive measure of aggression. The aggression scores for the all-inclusive measure at all three waves are moderately, but significantly ( $p \leq .01$ ) correlated with each other, with a correlation of 0.45 between aggression at wave 1 and wave 2, a correlation of 0.32 between aggression at wave 1 and wave 3, and a correlation of 0.44 between aggression at wave 2 and wave 3. For the two-item measure of aggression, the correlations are also moderate, but highly significant ( $p \leq .01$ ), with a correlation of 0.32 between aggression at wave 1 and wave 2, a correlation of 0.27 between aggression at wave 1 and wave 3, and a correlation of 0.43 between aggression at wave 2 and wave 3.

Several significant relationships are also observed between aggression and certain demographic and family characteristics. Aggression at all three waves is significantly related to the child's gender ( $p \leq .10$ ) and race ( $p \leq .05$ ), along with the income ( $p \leq .01$ ), relationship status ( $p \leq .10$ ), and education level ( $p \leq .01$ ) of the primary caregiver. The measures for PC lack of hostility ( $p \leq .01$ ) and warmth ( $p \leq .05$ ) are also

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<sup>3</sup> In STATA, pairwise correlations must be computed to obtain the significance level.

significantly correlated with aggression at all three waves. The significance of the correlations exists for both measures of aggression except for race (only significant at waves 2 and 3 for the two-item measure) and relationship status of primary caregiver (only significant at waves 1 and 3 for the two-item measure). The strength of these bivariate relationships may be viewed in a series of tables in Appendix B.

The correlations between the corporal punishment measures vary in level of strength. The highest correlation occurs between slapping or spanking a child with an open palm and pushing, grabbing, or shoving a child ( $r=0.46$ ,  $p \leq .01$ ). Correlations between aggression and corporal punishment are also significant ( $p \leq .01$ ). The strongest relationship is between the average level of corporal punishment and aggression at wave 1 for the all-inclusive measure ( $r=0.32$ ,  $p \leq .01$ ). Like the aggression measures, corporal punishment is also significantly associated with many demographic and family characteristics. The strength of these relationships may also be viewed in Appendix B. The average level of corporal punishment experienced by a child is significantly related to the child's gender ( $p \leq .01$ ) and race ( $p \leq .01$ ), along with the age of the primary caregiver ( $p \leq .01$ ), the primary caregiver's relationship to the child ( $p \leq .10$ ), and measures of lack of PC hostility ( $p \leq .01$ ) and PC warmth ( $p \leq .01$ ).

### **Identification and Description of Trajectory Groups**

As discussed, the first step in the analysis involves identifying the number of trajectories of physical aggression by invoking model fit criteria in a stepwise fashion using an iterative process. The BIC was assessed for this purpose and was maximized by a four-group model for both measures of physical aggression (the two items consistently available across waves and all of the items available at each wave). As discussed above, the model with the largest (least negative) BIC score should be

selected. The BICs for the two, three, and four group models for the all-inclusive measure of aggression were -5276.06, -5196.82, and -5173.76, respectively. For the two-item measure of aggression, the BICs were -3740.68, -3661.20, and -3628.68 for the two, three, and four group models, respectively. Again, the four-group model maximized the BIC in both cases. The models are largely consistent with prior research (Cote et al., 2006; Nagin & Tremblay, 1999; 2001; NICHD, 2004; Tremblay et al., 2004). Four groups were identified, with one group exhibiting persistent (increasing) aggression over time, which supports the first hypothesis of this thesis.

A graph of the four-group model identified by the all-inclusive measure is presented in Figure 5-1. The four groups identified can be described as low-stable aggressors, modest aggressors, high-starting desisters, and high-rising aggressors. The group of low-stable aggressors is characterized by low levels of physical aggression (less than 1 SD below the mean) in toddlerhood and levels of physical aggression which remain low (very close to the mean) throughout early childhood. This group contained approximately 78.7% (n=519) of the sample. The group of modest aggressors contained approximately 9.7% (n=55) of the sample and is characterized by moderate levels of physical aggression (approximately 1 SD above the mean) in toddlerhood, which continued throughout early childhood. The high-starting desisters group is characterized by high levels of aggression (approximately 2 SD above the mean) in toddlerhood, which declined steeply until about 5.5 or 6 years of age (to approximately 1 SD above the mean) and continued to decline throughout early childhood (reaching the mean level of aggression). This group contained approximately 10.5% (n=100) of the sample. The high-rising group is characterized by high levels of

physical aggression (approximately 2 SD above the mean at wave 1) in toddlerhood and a steep increase in aggression around 5.5 or 6 years of age. The levels of physical aggression exhibited by this group by age 8 (up to approximately 5 SD above the mean) are substantially higher than the levels of physical aggression exhibited by any other group at any point in time. This group contained approximately 1.0% (n=7) of the sample.

A graph of the four-group model identified by the two-item measure is presented in Figure 5-2. The trajectory paths identified by this model are slightly different than the ones discussed above. The four groups identified by this model can be referred to as low-increasing aggressors, low-stable aggressors, high-starting desisters, and high-rising aggressors. The low-increasing group contained approximately 9.9% (n=73) of the sample and is characterized by low levels of physical aggression (approximately the mean level) in toddlerhood, followed by a steady increase to high levels of physical aggression (approximately 2 SD above the mean) by 8 years of age. This group exhibits a different path than the group of modest aggressors in the first model, whose path remains relatively stable over time. The next group, referred to as the low-stable group, contained approximately 76.0% (n=509) of the sample. This group is characterized by low levels of physical aggression in toddlerhood and low levels of physical aggression throughout childhood (consistently less than 1 SD below the mean). The high-starting desisters group exhibited high levels of physical aggression (approximately 2 SD above the mean) in toddlerhood, which declined steadily throughout childhood (to almost the mean level of physical aggression). It contained approximately 11.9% (n=80) of the sample. The high-rising aggression group in this

model, similarly to the high-rising group identified in the first model, began with high levels of physical aggression (approximately 2 SD above the mean) in toddlerhood, which increased steadily throughout childhood (to approximately 3 SD above the mean). The high-rising group contained approximately 2.2% (n=19) of the sample.

As previously mentioned, the groups identified by these models can be validated by an examination of the average posterior probability of group membership for each group. Ideally, the assignment probability for each individual equals 1 and the average posterior probability also equals 1 (Nagin, 2005). For the first model (all-inclusive measure), the average posterior probabilities were 0.85, 0.97, 0.89, and 0.99 for groups one, two, three, and four, respectively. This means that for group one, the average probability of assignment to that group for all individuals was 0.85. For the second model (two-item measure), the average posterior probabilities of group membership were 0.85, 0.97, 0.89, and 0.91 for groups one, two, three, and four, respectively. All of these average posterior probabilities are well-above Nagin's (1999, 2005) cutoff of 0.70.

### **Creating Group Profiles**

One goal of this thesis is to examine corporal punishment as a risk factor for high levels of physical aggression. This thesis specifically examines the differences in frequency and type of corporal punishment experienced by toddlers on various trajectories of aggression, focusing on the high-rising aggression trajectory group relative to other groups. Following the identification of the trajectory groups, it was determined that multinomial logit regression was not an appropriate technique to examine the research questions at hand. An attempt to perform the regression resulted in oversaturation of the model due to the very low proportion of the sample in the high aggression group for either measure (1.0% or n=7 for the all-inclusive measure and

2.2% or n=19 for the two-item measure). There was not enough variability among the sample in the high group on key control variables. For example, the high group for the all-inclusive measure was composed of only black (n=4) and Hispanic (n=3) children and did not contain any white children or children who were identified as “other”. While removing variables would allow for model estimation, it would result in the removal of important controls and would, therefore, reduce the validity of the results.

As an alternative to performing multinomial logit regression, profiles of group membership were created using group assignments. Although creating group profiles does not establish a functional relationship between the probability of group membership and a set of predictors, it is a starting point for understanding how group membership may be linked to these variables (Nagin, 2005). Classification into the trajectory groups is determined based on posterior probabilities, allowing for the creation of group profiles by cross-tabulating individual-level trajectory group assignments and the individual-level variables that might be associated with group membership. In the present study, these variables include the frequency and types of corporal punishment experienced by a child and the risk factors which were to be included in the regression model (as controls). Significance tests were performed to determine risk factors for membership in the high-rising groups as opposed to any of the other trajectory groups. ANOVA tests were performed for associations between continuous and dichotomous variables. Fisher’s exact test was performed for associations between dichotomous variables due to the low frequencies in the high-rising aggression groups. The results of these group profiles are presented in Tables 5-1 and 5-2 for the two different models of physical aggression trajectories.

This exploratory analysis indicates that both the frequency and type of corporal punishment experienced may be risk factors for membership into a group characterized by persistently high levels of physical aggression. The two models of aggression lead to similar profiles. For both measures of aggression, the average frequency of corporal punishment was highest in the high-rising aggression group ( $\bar{x}=2.62$  for the all-inclusive measure,  $\bar{x}=2.17$  for the two-item measure). ANOVA tests reveal that average frequency of corporal punishment is a significant risk factor for membership into the high-rising aggression group for both aggression measures ( $p=0.00$ ). This observation supports the second hypothesis of this thesis: frequency of corporal punishment is associated with membership in a “chronic high” aggression group. On average, those in the low-stable, low-increasing, and modest aggression groups experienced the least corporal punishment.

The children in the high-rising aggression groups also experienced more slapping or spanking with an open palm ( $\bar{x}=4.86$  for the all-inclusive measure,  $\bar{x}=3.79$  for the two-item measure) and more pushing, grabbing, or shoving ( $\bar{x}=3.00$  for the all-inclusive measure,  $\bar{x}=2.36$  for the two-item measure) by their primary caregivers. ANOVA tests indicate that these associations are statistically significant ( $p=0.00$  for both associations). The frequency of the primary caregiver throwing something at the child was highest in the modest aggression group for the all-inclusive measure ( $\bar{x}=0.34$ ) and the high-rising aggression group for the two-item measure ( $\bar{x}=0.36$ ). The association between throwing something at the child and membership into the high-rising aggression group was only significant for the two-item measure of aggression ( $p=0.00$ ). These results partially support the third hypothesis of this thesis: type of corporal

punishment experienced (as opposed to customary spanking) may be associated with membership into a “chronic high” aggression group. These results highlight the importance of measurement of the aggression construct, as significance varies across the two different measures.

Several demographic and family characteristics were also tested as risk factors for membership into the high-rising aggression group. Results indicate very few significant associations; however, this could be due to the conservative nature of Fisher’s exact test and the sparseness of the data. Most associations between risk factors and group membership are consistent with prior research (Cote et al., 2006, Nagin & Tremblay, 1999; 2001; Tremblay et al., 2004) and prevalence of the risk factors occurs in the direction we would expect (increasing from low to high aggression groups).

The high-rising aggression groups for both measures were mostly male (86% for the all-inclusive measure, 71% for the two-item measure) and black (57% for the all-inclusive measure, 43% for the two-item measure) or Hispanic (43% for the all-inclusive measure, 57% for the two-item measure). Significance tests for gender as a risk factor were marginally significant ( $p=0.07$  for the all-inclusive measure,  $p=0.11$  for the two-item measure). Race was identified as marginally significant for the two-item measure of aggression ( $p=0.09$ ), but not for the all-inclusive measure. Primary caregivers of children in the low aggression groups had the highest average income ( $\bar{x}=4.05$  for the all-inclusive measure,  $\bar{x}=4.04$  for the two-item measure [\$30,000-\$39,999]). Income was significant for the two-item measure ( $p=0.03$ ), but not the all-inclusive measure ( $p=0.68$ ). On average, the primary caregivers of children in the high-rising aggression

groups were younger ( $\bar{x}=27.31$  for all-inclusive measure,  $\bar{x}=27.14$  for two-item measure) and more likely to be single parents (57% for the all-inclusive measure, 43% for the two-item measure), although these associations were not statistically significant. Relationship of the primary caregiver to the child was not significant for either measure, which could be due to the fact that 92.22% of all primary caregivers in the sample were biological mothers. Education of the primary caregiver was marginally significant ( $p=.09$ ) for the two-item measure of aggression, with primary caregivers in the low-stable group most likely to have some education beyond high school. On average, primary caregivers displayed the least hostility toward the child ( $\bar{x}=4.30$  for the all-inclusive measure,  $\bar{x}=4.26$  for the two-item measure). Primary caregivers in the lowest two groups displayed the most warmth towards their child ( $\bar{x}=7.40$  for the low-stable aggressors for the all-inclusive measure,  $\bar{x}=7.42$  for the modest aggressors group for the all-inclusive measure,  $\bar{x}=7.40$  for the low-stable aggressors for two-item measure). Both PC lack of hostility and PC warmth were significant risk factors for the two-item measure ( $p=0.01$ ,  $p=0.00$ , respectively). Only PC lack of hostility was significant for the all-inclusive measure ( $p=0.01$ ). Children in the high-rising aggression group were more likely than children in the other groups to have siblings present in the household, although this association was not significant for either measure of aggression.

### Trajectories of Physical Aggression in Toddlers

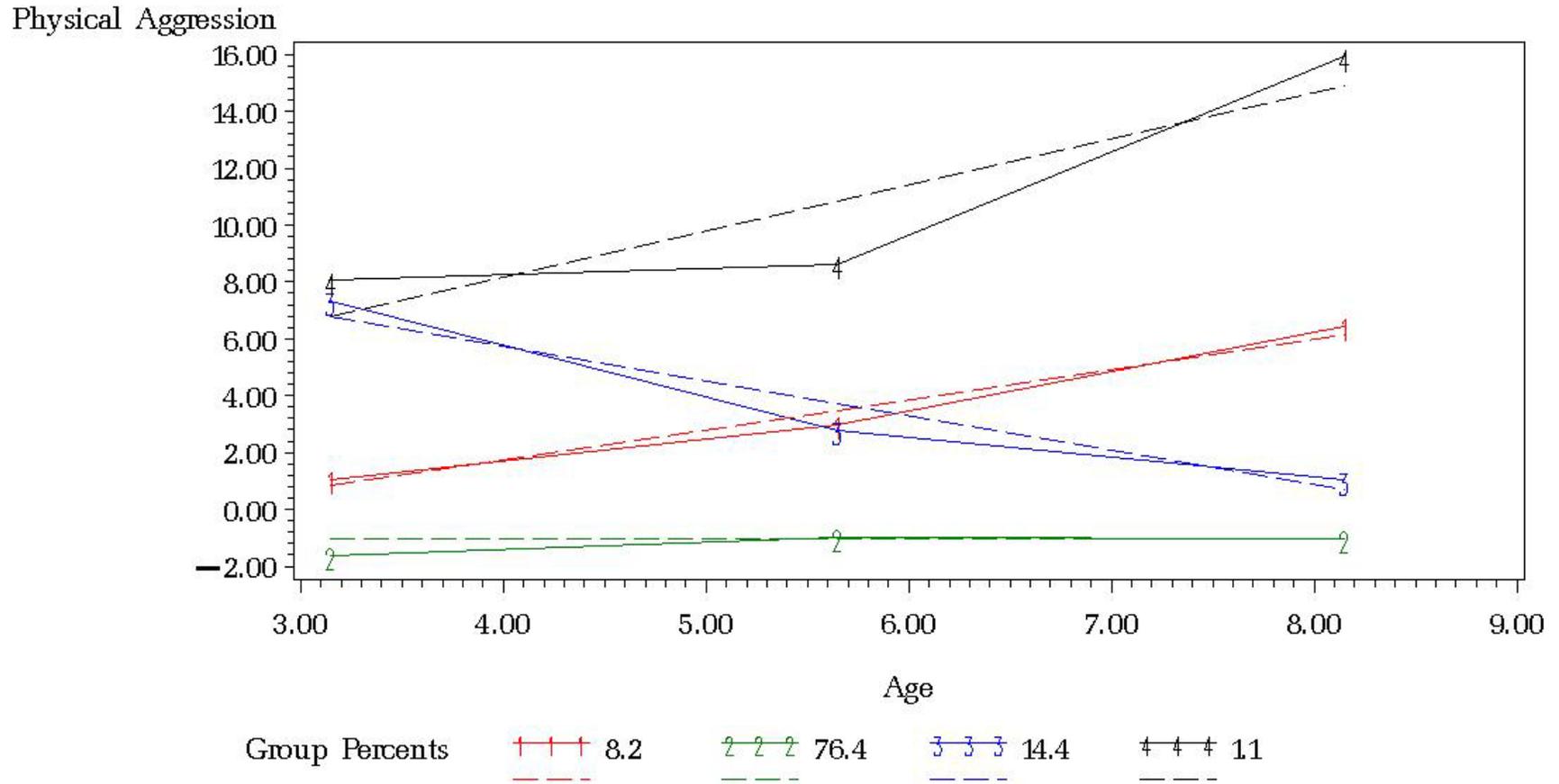


Figure 5-1. Groups identified by all-inclusive measures of physical aggression

### Trajectories of Physical Aggression in Toddlers

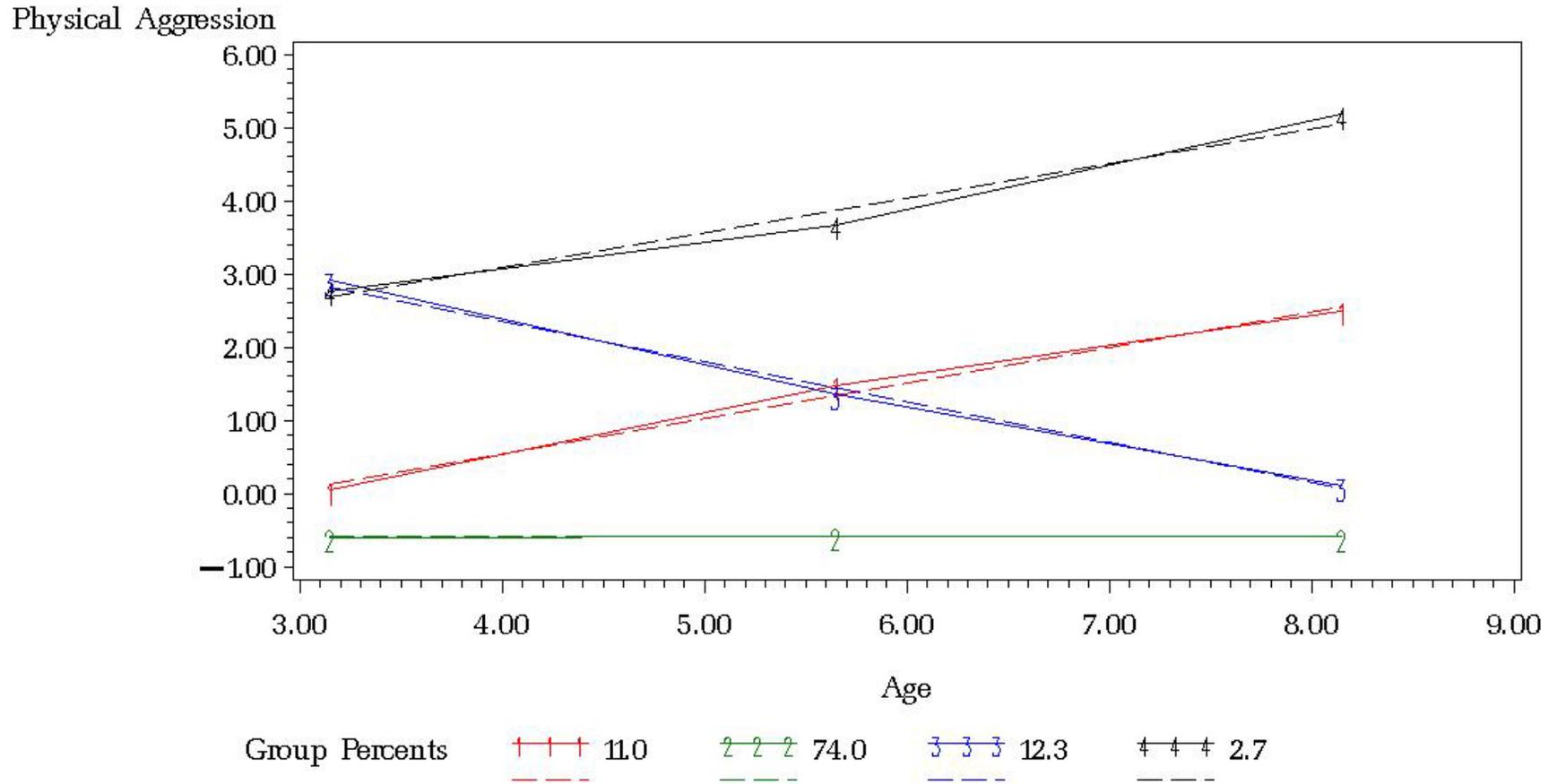


Figure 5-2. Groups identified by two-item measures of physical aggression

Table 5-1. Group Profiles for Model 1 (all-inclusive measure)

	Group 1 Low-stable aggressors	Group 2 Modest aggressors	Group 3 High-starting desisters	Group 4 High-rising aggressors	P-value on significance tests (High-rising vs. other groups)
Avg. frequency of corporal punishment	1.40	1.08	2.01	2.62	0.00
Slap or spank	2.49	3.15	3.54	4.86	0.00
Push, grab, or shove	0.77	1.53	1.61	3.00	0.00
Throw something	0.08	0.34	0.28	0.00	0.61
Male (%)	0.48	0.55	0.51	0.86	0.07
Age	3.06	3.15	3.18	2.92	0.06
White (%)	0.09	0.17	0.05	0.00	0.60
Black (%)	0.35	0.31	0.41	0.57	0.22
Hispanic (%)	0.53	0.48	0.52	0.43	1.00
Other (%)	0.04	0.04	0.02	0.00	1.00
Income	4.05	3.16	3.06	3.57	0.68
Age PC	32.34	31.19	28.65	27.31	0.19
PC mother (%)	0.94	0.91	0.92	1.00	1.00
PC father (%)	0.00	0.05	0.02	0.00	1.00
PC other (%)	0.05	0.03	0.06	0.00	1.00
PC married (%)	0.58	0.60	0.35	0.28	0.25
PC partner (%)	0.04	0.13	0.26	0.14	1.00
PC single (%)	0.38	0.26	0.39	0.57	0.21
PC education: Less than HS (%)	0.35	0.62	0.54	0.29	0.71
PC education: HS diploma (%)	0.14	0.10	0.19	0.14	1.00
PC education: More than HS (%)	0.50	0.27	0.26	0.57	0.71
Lack of PC hostility	3.91	4.30	3.73	3.00	0.01
PC warmth	7.40	7.42	6.32	6.43	0.27
Presence of siblings (%)	0.94	0.86	0.82	1.00	0.60

Note: Due to low cell counts, Fisher's Exact Test was conducted between two dichotomous variables. ANOVAs were conducted between continuous and dichotomous variables. Dichotomous variables are those with % denoted. Where % is not denoted, the mean of the continuous variable is given.

Table 5-2. Group Profiles for Model 2 (two-item measure)

	Group 1 Low-rising aggressors	Group 2 Low-stable aggressors	Group 3 High-starting desisters	Group 4 High-rising aggressors	P-value on significance tests (High-rising vs. other groups)
Avg. frequency of corporal punishment	1.56	1.10	1.83	2.17	0.00
Slap or spank	3.20	2.45	3.56	3.79	0.00
Push, grab, or shove	1.32	0.75	1.65	2.36	0.00
Throw something	0.12	0.09	0.29	0.36	0.00
Male (%)	0.51	0.47	0.62	0.71	0.11
Age	3.09	3.16	3.16	3.02	0.21
White (%)	0.09	0.17	0.10	0.00	0.09
Black (%)	0.38	0.31	0.39	0.43	1.00
Hispanic (%)	0.49	0.49	0.48	0.57	0.25
Other (%)	0.03	0.03	0.04	0.00	0.44
Income	3.52	4.04	3.23	2.93	0.03
Age PC	31.49	31.01	30.12	27.14	0.01
PC mother (%)	0.95	0.92	0.87	1.00	0.39
PC father (%)	0.00	0.05	0.06	0.00	1.00
PC other (%)	0.05	0.03	0.07	0.00	1.00
PC married (%)	0.55	0.59	0.45	0.36	0.24
PC partner (%)	0.09	0.13	0.23	0.21	0.32
PC single (%)	0.35	0.28	0.32	0.43	0.61
PC education: Less than HS (%)	0.48	0.36	0.51	0.64	0.15
PC education: HS diploma (%)	0.08	0.14	0.18	0.14	0.17
PC education: More than HS (%)	0.45	0.49	0.31	0.21	0.09
Lack of PC hostility	4.03	4.26	3.82	3.36	0.01
PC warmth	7.15	7.40	6.67	5.64	0.00
Presence of siblings (%)	0.89	0.86	0.86	0.93	0.50

Note: Due to low cell counts, Fisher's Exact Test was conducted between two dichotomous variables. ANOVAs were conducted between continuous and dichotomous variables. Dichotomous variables are those with % denoted. Where % is not denoted, the mean of the continuous variable is given.

## CHAPTER 6 DISCUSSION AND CONCLUSIONS

### **Summary of Findings**

Past research on the use of corporal punishment has shown a relationship between physical punishment and aggressive behavior (Berlin et al., 2009; Eron, Huesman, & Zelli, 1991; Larzelere, 1986; Sears, Maccoby, & Levin, 1957; Stacks, Oshio, Gerard, & Roe, 2009; Strassberg et al., 1994; Straus, 1994; Straus, Sugarman, & Giles-Sims, 1997). In the developmental literature, certain parenting styles, such as hostile and coercive parenting, have been identified as risk factors for persistent aggressive behavior over time (Cote et al., 2006; NICHD, 2004; Tremblay et al., 2004). The goals of this thesis were to identify trajectories of aggressive behavior in a sample of toddlers and examine the frequency and type of corporal punishment experienced as risk factors for membership into a high aggression group.

The results of the present study are largely consistent with those of previous research on trajectory groups of physical aggression (Cote et al., 2006; Nagin & Tremblay, 1999; 2001; NICHD, 2004; Tremblay et al., 2004). Previous research on group-based trajectories of physical aggression has resulted in similar trajectory paths based on the developmental period studied. Nagin and Tremblay (1999; 2001) identified four trajectories for a sample studied from 6 to 15 years of age: a low group (25% of the sample), a moderate-desisting group (46% of the sample), a high-desisting group (25%) of the sample, and a chronic high group (5%). Tremblay et al. (2004) found a low-stable group (28% of the sample), a modest-rising group (58% of the sample), and a high-rising group (14% of the sample) for a sample of 5-42 month olds. Cote et al. (2006) examine trajectories of aggression from toddlerhood to pre-

adolescence and found a low-desisting (31.1%), moderate-desisting (52.2%), and high-stable (16.6%) group. The general trend in aggressive behavior appears to be a peak during toddlerhood, followed by decreasing levels of aggression throughout childhood and adolescence (Cote et al., 2006; Nagin & Tremblay, 1999; 2001; Tremblay et al., 2004).

The first hypothesis of this thesis is partially supported. This study identified four aggression groups using two different measures of physical aggression, however, the distribution of the sample into these groups is quite different than what has been discovered in past research. Both models in the present study included a low-stable group, comprising the largest proportion of the sample, and a high-rising group, comprising a very small fraction of the sample (Tremblay et al., 2004). The paths of these trajectories are similar to those found in previous research. For instance, the high-rising group here exhibits a pattern of behavior similar to the high-rising group found by Tremblay et al. (2004). Like Nagin and Tremblay (1999; 2001), the high chronic group contained a very small percentage of the sample.

In the present study, however, the low-stable group included a much larger proportion of the sample than in previous studies. The distribution of the sample within each of the trajectory groups found here has implications for the assertions of developmental researchers like Tremblay and Nagin. They argue that aggression begins at a very young age (infancy) and peaks in toddlerhood, followed by a steep decline for most of the population. While toddlerhood was the peak age for physical aggression for about 10-12% of the sample here, results of the present study indicate that over 75% of the sample is never high in physical aggression. These findings stand

in contrast to Tremblay and Nagin's idea that most people are physically aggressive at a young age. The differences observed between the present study and research by Tremblay and Nagin could be due to several factors. There could simply be differences between the Montreal samples used in previous studies and the Chicago sample used here. Considering the very large proportion of children in the low-stable group, primary caregivers in the present study may have responded to questions regarding their child's physical aggression with some type of social desirability bias. Measurement of physical aggression may also contribute to these differences. Tremblay and Nagin consistently use three items of physical aggression across their studies. The measures of aggression used here differ from those typically used to model these trajectories.

The two models identified here also contained a modest and high-starting desisting group and a low-rising and high-starting desisting group. These trends in aggressive behavior also appear to be similar to those found in previous research (Cote et al., 2004; Tremblay et al., 2004), as Nagin and Tremblay (1999; 2001) found a high-desisting group and Tremblay et al. (2004) found a modest-rising group. The modest group which remained stable over time and the group which started low, but increased over time are not entirely consistent with the previous studies discussed here, but it is important to note that the number of groups identified and the paths the trajectories take may vary depending on many factors and will be discussed in more detail in the Limitations and Future Research sections below.

Although a functional relationship could not be established due to very small sample sizes in the high aggression groups, the results of this study indicate that further examination of corporal punishment as a predictor into a group of chronically high

physical aggression is warranted. Children in the high-rising aggression group experienced more corporal punishment on average than children in any of the other trajectory groups, supporting the second hypothesis of this thesis (association between frequency of corporal punishment and membership in a chronic high group of aggression). Additionally, type of corporal punishment may play a role in group membership. Children in the high physical aggression group were more likely to be slapped or spanked and more likely to experience pushing, grabbing, or shoving by their primary caregiver. Due to its relatively infrequent occurrence and lack of sample size in these high groups, it could not be determined whether throwing something at the child is associated with group membership. These findings partially support the third hypothesis of the study (association between type of corporal punishment and membership in a chronic high group of aggression).

These results add to the present literature on both corporal punishment and trajectories of aggressive behavior in children. Most corporal punishment research linking physical punishment to aggression has been cross-sectional in nature (Gershoff, 2002) and, to date, corporal punishment has not been linked to group-based models of trajectories. Additionally, research on developmental trajectories of physical aggression in children has found a link between harsh parenting and persistently aggressive behavior (Cote et al., 2006; NICHD, 2004, Tremblay et al., 2004). The results of this study identify a link between specific parenting practices (frequency and type of corporal punishment) and membership into a chronic high group of aggressive behavior.

Demographic and family characteristics of children in the high aggression group are also consistent with prior literature (Cote et al., 2006; Nagin & Tremblay, 1999;

2001; NICHD, 2004; Tremblay et al., 2004). On average, children in the high aggression group were more likely to be male, black or Hispanic, and to have siblings present in their household. The primary caregivers of these children were more likely to be younger than the primary caregivers of children in the other groups. Primary caregivers of children in the high aggression groups were also more likely to display less warmth and more hostility in their caregiving.

### **Limitations**

Although the present study adds to the literature on corporal punishment and aggressive behaviors, it is not without its limitations. This study was largely exploratory in nature and had several data limitations. The measures of physical aggression that were employed, while consistent with some research (NICHD, 2004), differ from those often used in group-based modeling of physical aggression trajectories in children (Cote et al., 2006; Tremblay et al., 2004). Due to the fact that reduced versions of the CBCL were administered throughout the PHDCN, there was not continuity in the aggression items that were available across the waves of data. While it is typically inappropriate to use the same measurement scale for a given trait over different stages of life (Nagin, 2005), the developmental period studied in this thesis is a relatively short one. Use of the same measures across waves, however, would have allowed for more direct conclusions to be drawn regarding the paths of the trajectories. By using the differing measures that were available across waves, we are presented with the potential limitation of determining whether change in a trajectory truly represents change in aggressive behavior or whether it is simply a reflection of the changing measures.

As with any longitudinal dataset, cases were also lost in the PHDCN due to attrition over time. While the trajectory modeling techniques used in the present study

can accommodate missing data (Nagin, 2005), due to the exploratory nature of the study and issues with other missingness across the dependent variable, these cases were simply dropped. The lack of cases may have contributed to the small number of individuals in the high aggression group, which prevented the use of multinomial logit regression to establish a relationship between corporal punishment and group membership.

It should also be acknowledged that the additional missingness on aggression items (beyond attrition) was not random, but was associated with race (Hispanic individuals were more likely to have missing data) and income (lower income individuals were more likely to have missing data). Given the patterns of missingness, imputation was employed in an attempt to replace the missing values using as much information as possible. All control variables and additional aggression items were included in the regression models used for imputing missing values. Using a single imputation has been shown to be more robust than listwise deletion and mean replacement in these types of cases (Allison, 2009).

An additional data limitation is the fact that only three waves of data were available. While this was a sufficient number to perform the technique used in this study, it only allowed for linear models of the trajectories. Previous research on trajectories of physical aggression has typically used between four and seven waves of data. In the four groups identified by Nagin and Tremblay (1999; 2001), several increases and decreases in aggressive behaviors occur within the general trends that are recognized. For example, in Nagin and Tremblay's (1999; 2001) sample, the chronic high group exhibits peaks in aggressive behavior at both 10 and 14 years of age, with

the lowest levels of aggression occurring in between, at age 12. Despite the fact that only three waves were available in the present study, the amount of time between waves allowed the available data to span a total of 7 years. In previous studies using less than four waves, the data collection period was much shorter (Tremblay et al., 2004).

Finally, it should be noted that the sample for the present study should not be generalized to other groups. The sample used here was composed of a specific age-group (3 to 8 years of age), from one city in the United States (Chicago), during a specific period of time (1994-2001). While there has been an extensive amount of research on different age groups from various locations (Cote et al., 2006; Nagin & Tremblay 1999; 2001, NICHD, 2004, Tremblay et al., 2004), this study is the first to examine the association between corporal punishment and trajectory group membership. Replication is necessary to confirm the results and extend them beyond a single sample.

Trajectory groups are very useful tools for summarizing complex longitudinal datasets (Nagin, 2005), however, the technique of group-based modeling of trajectories has not been without its criticisms. One limitation of this method is possible model misspecification in the event that the observed individual differences are actually drawn from a continuous distribution, rather than a discrete distribution (Piquero, 2008; Sampson, Laub, & Eggleston, 2004). A related criticism of the technique is the grouping of heterogeneous individuals into relatively homogenous groups and the concern that this raises in relation to interpretation of results. Specifically, concerns have included the misconceptions that individuals actually belong to a group and that

individuals within a group will actually follow the trajectory specified (Sampson, Laub, & Eggleston, 2004). The models identified using these techniques, including the models found in the present study, are not meant to identify the true number of groups present in a population, but to identify the simplest model that displays the distinctive features of the population distribution of trajectories (Nagin, 2005). For example, it is possible that a member of the high-rising group does not actually increase in aggression, but follows a stable path of high aggression. It must be remembered that this technique is meant to describe a more complex underlying reality (Nagin, 2005).

Additionally, Eggleston, Laub, and Sampson (2004) have recently questioned the use of group-based modeling techniques under several conditions, including length of follow-up time. They argue that a shorter follow-up period may impact the number of groups identified, the shapes of the trajectories, and assignment to groups. In relation to aggressive behavior, Nagin (2005) found that opposed to the four-group model identified in the Montreal study (Nagin & Tremblay, 1999), a three-group model would have been preferred based on the BIC had the length of follow-up been 6 to 13 years of age, rather than 6 to 15 years of age. Eggleston, Laub, and Sampson (2004) performed an analysis based on the classic data of Sheldon and Eleanor Glueck (1968). They found that when follow-up time was nearly doubled, the peak age of criminality and the group membership assignments were affected. It should be noted that the relatively short follow-up period of the present study is susceptible to similar limitations.

### **Future Research**

Given both the findings of the current study and the limitations presented above, there are several implications for future research on this topic. Previous studies have included sample sizes ranging from about 500 (Tremblay et al., 2004) to over 10,000

participants (approximately 1000 participants for several different age cohorts) (Cote et al., 2006). While the sample size of the present study falls within the low end of this range (n=681), it was limited by the small numbers of cases in the high aggression group. A larger sample size with more cases in the chronic high group would accommodate multinomial logistic regression, which is traditionally used to extend the analysis beyond examination of the bivariate associations between risk factors and group membership. This type of regression analysis examines certain risk factors as predictors of membership in a high aggression group by controlling for correlations between predictors and specifying the relationship between  $\pi_j$  (the probability that a randomly chosen population member belongs to group j) and each of the risk factors (Nagin, 2005).

As discussed in the literature review and throughout this thesis, the multinomial logistic regression analysis commonly follows the creation of group profiles and would be an important follow-up to the present study. To obtain a sample that can accommodate this type of regression analysis, it may be helpful to oversample those with known risk factors for a chronic high trajectory of aggression in an attempt to increase the number of cases in this group. Nevertheless, the profiles of group membership established in the present study are useful descriptions. The associations discovered here indicate that frequency and type of corporal punishment should be examined further as predictors of membership in the chronic high aggression group.

In addition to using a larger sample, examining a longer follow-up period would be helpful on several levels. First, it would assist in understanding the longer-term effects of corporal punishment on physically aggressive behavior. It has also been noted that

while the number of groups identified typically plateaus at a sample size of 200 (D'Unger et al., 1998), longer follow-up periods may impact the number of groups identified, the peak age of offending, and the individual-level group membership of several trajectory groups (Eggleston, Laub, & Sampson, 2004). The group in which we are most interested, the high-rising group, or the group which is still exhibiting the behavior of interest at the close of the follow-up period, is likely to be the one most affected by an extension of this timeframe (Nagin, 2005). The inclusion of more waves of data would also be advantageous. The trajectory modeling techniques used in this thesis allow the different trajectory groups to take on different shapes (Nagin, 2005). The inclusion of more points for follow-up would allow trajectory shapes based on quadratic or even cubic terms. As the follow-up period for these types of studies has not been extended past the teenage years, it is difficult to predict the behavioral patterns that we might observe in such a study. However, paths of violent offending may be similar to those observed for criminal careers, in which offending appears to decline as early adulthood approaches for all groups (Piquero, 2008).

Heterotypic continuity of physical aggression items should also be taken into consideration. Nagin, Tremblay, and colleagues (Cote et al., 2006, Nagin & Tremblay, 1999; 2001; Tremblay et al., 2004) have consistently used items regarding fighting with others, hitting, biting, or kicking others, bullying or intimidating others, and reacting with anger and fighting to measure physical aggression. The selection and inclusion of items measuring different manifestations of physical aggression over time would be of utmost importance, especially if the follow-up period were extended. For example, bullying or

intimidating others may not be an appropriate measure of physical aggression if the follow-up period were extended into adulthood.

The present study replicated and extended similar work by Tremblay, Nagin, and colleagues, but was largely exploratory in nature. Given some of the criticisms of the group-based approach, it is also important to examine the appropriateness of this technique for the research question at hand. Muthén (as cited in Piquero, 2008) has suggested that the standard HLM random effects model should be also be fitted, and ruled out, before group-based modeling techniques should be employed. If the HLM model fits better than the group-based model, there are not meaningful groups to be found. Muthén (as cited in Piquero, 2008) has also argued that it should also be shown that a more flexible model, such as Muthén's growth mixture model, does not fit better than the group-based model. Essentially, it is the responsibility of the researcher to show that the group-based model fits the data better than another technique.

In addition to methodological implications for future research, the results of the present study have implications for the extension of group-based modeling techniques to other outcomes of corporal punishment. The link between corporal punishment and externalizing behaviors has been one of the most prominent in the literature (Mulvaney & Mebert, 2007), however, research also suggests a potential link between the experience of corporal punishment and internalizing behavior problems. One area for future research involves identifying distinct trajectories of internalizing behaviors, such as depression, and examining corporal punishment as a predictor into problematic groups. The potential impact of corporal punishment on the cognitive development of

young children has also been brought to light (Straus and Paschall, 1998) and also has the potential to be examined using these techniques.

Besides modeling a single behavior of interest, Nagin (2005) has also outlined methods for dual trajectory analysis. It has been well-documented that the use of corporal punishment usually declines as children progress through adolescence (Gershoff, 2002; Straus & Stewart, 1999). While researchers have hypothesized that the use of physical punishment with younger children may have more negative outcomes due to the frequency of its use and the potential for cumulative effects (Berlin et al., 2009), it has also been hypothesized that the effect of corporal punishment on violent behavior may be greatest in older children (Straus, 1994). The simultaneous examination of trajectories of corporal punishment and trajectories of aggressive behavior would allow for the examination of the connections between the evolution of these two trajectories over time. Dual trajectory analysis may also be used to analyze the links between two outcomes that evolve over different time periods. Nagin and Tremblay (1999) have examined how group membership may impact a variety of delinquent outcomes. In the manner just discussed, dual trajectory analysis could also be used to examine trajectories of corporal punishment during childhood and criminal activity (such as violent offending) later in life.

APPENDIX A  
LIST OF SCALE ITEMS

**Aggression Scales**

Aggression Item	Wave 1	Wave 2	Wave 3
Destroys things belonging to others	Available	Available	Available
Gets into many fights	Available	Available	Available
Cruel to animals	Available	-----	Available
Cruelty, bullying, meanness to others	-----	Available	Available
Hurts people or animals without meaning to	Available	-----	-----
Hits others	Available	-----	-----
Threatens others	-----	Available	Available
Destroys his or her own things	Available	-----	-----
Physically attacks people	Available	-----	-----

**Lack of Parental (PC) Hostility Scale**

1. PC does not shout at subject during visit.
2. PC does not express overt annoyance with or hostility toward the subject during the visit.
3. PC does not scold or criticize or put down the subject more than once on the visit.
4. Subject is allowed to express negative feelings toward PC or can disagree with PC without harsh reprisal.
5. Subject is permitted to hit PC without harsh reprisal.

**Parental (PC) Warmth Scale**

1. PC talks to subject twice during visit (beyond introduction or correction).
2. PC responds to child's questions during interview.
3. PC encourages subject to contribute to the conversation during the visit by getting him/her to relate to an experience OR by taking time to listen to him/her relate an experience.
4. PC mentions a particular skill, strength, or accomplishment of subject during interview OR sets up the situation that allows the subject to show off during visit.
5. PC spontaneously praises child during visit.
6. PC uses some term of endearment or some diminutive for subject's name when talking about or to subject twice during visit.
7. When speaking of or to child, PC's voice conveys positive feelings.
8. PC caresses, kisses, cuddles, or hugs subject once during visit.
9. PC shows some positive emotional response to praise of subject offered by interviewer.

APPENDIX B  
BIVARIATE RELATIONSHIPS

Table B-1a. Bivariate relationships between dependent variables (all-inclusive measure) and independent variables

	Aggression wave 1	Aggression wave 2	Aggression wave 3	Average corporal punishment	Slap or spank	Push, grab, or shove	Throw something
Aggression wave 1	-----						
Aggression wave 2	0.45***	-----					
Aggression wave 3	0.32***	0.44***	-----				
Average corporal punishment	0.32***	0.25***	0.17***	-----			
Slap or spank	0.26***	0.19***	0.13***	-----	-----		
Push, grab, or shove	0.28***	0.23***	0.16***	-----	0.46***	-----	
Throw something	0.13***	0.11***	0.05	-----	0.16***	0.25***	-----

Note: Pairwise correlations were conducted.

\* $p \leq 0.10$ , \*\*  $p \leq 0.05$ , \*\*\* $p \leq 0.01$

Table B-1b. Bivariate relationships between dependent variables (two-item measure) and independent variables

	Aggression wave 1	Aggression wave 2	Aggression wave 3	Average corporal punishment	Slap or spank	Push, grab, or shove	Throw something
Aggression wave 1	-----						
Aggression wave 2	0.32***	-----					
Aggression wave 3	0.27***	0.43***	-----				
Average corporal punishment	0.29***	0.22***	0.16***	-----			
Slap or spank	0.22***	0.19***	0.11***	-----	-----		
Push, grab, or shove	0.25***	0.17***	0.15***	-----	0.46***	-----	
Throw something	0.15***	0.10***	0.07*	-----	0.16***	0.25***	-----

Note: Pairwise correlations were conducted.

\* $p \leq 0.10$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$

Table B-2. Bivariate relationships between aggression (all-inclusive measure) and risk factors

	Aggression wave 1	Aggression wave 2	Aggression wave 3
Aggression wave 1 ‡	-----		
Aggression wave 2 ‡	0.45***	-----	
Aggression wave 3 ‡	0.32***	0.44***	-----
Gender of the child ◇	6.21***	3.04*	10.34***
Age of the child ‡	-0.03	-0.08**	-0.06
White ◇	2.29	7.40***	5.63**
Black ◇	4.13**	0.72	4.97**
Hispanic ◇	0.71	1.60	0.00
Other race ◇	0.00	0.19	1.20
Income ‡	-0.16***	-0.16***	-0.12***
Age of primary caregiver ‡	-0.16***	-0.10***	-0.12
Gender of PC ◇	2.03	1.57	5.88**
PC mother ◇	0.09	1.69	0.66
PC father ◇	2.22	1.88	6.28***
PC other ◇	1.86	0.05	3.21*
PC married ◇	23.06***	2.69*	4.37**
PC partnered ◇	6.62***	2.82*	0.43
PC single ◇	10.32***	0.26	7.67***
PC education (Less than HS) ◇	9.04***	15.58***	6.99***
PC education (HS diploma) ◇	0.89	0.87	1.95
PC education (More than HS) ◇	13.14***	10.28***	2.60
PC Lack of hostility ‡	-0.18***	-0.19***	-0.12***
PC warmth ‡	-0.14***	-0.09***	-0.08**
Presence of siblings ◇	1.73	2.11	6.23***

Note: Chi-square tests were conducted to examine relationships between two dichotomous variables (denoted by ◇), ANOVAs were used to examine the relationships between dichotomous (◇) and continuous variables (denoted by ‡), and correlations were conducted to examine relationships between continuous predictors (‡).

\* $p \leq 0.10$ , \*\*  $p \leq 0.05$ , \*\*\* $p \leq 0.01$

Table B-3. Bivariate relationships between aggression (two-item measure) and risk factors

	Aggression wave 1	Aggression wave 2	Aggression wave 3
Aggression wave 1 ‡	-----		
Aggression wave 2 ‡	0.32***	-----	
Aggression wave 3 ‡	0.26***	0.43***	-----
Gender of the child ◇	6.35**	3.01*	5.47**
Age of the child ‡	-0.02	-0.07*	-0.04
White ◇	0.70	7.63***	10.83***
Black ◇	2.07	0.00	1.76
Hispanic ◇	0.67	5.34**	1.67
Other race ◇	0.03	1.45	0.45
Income ‡	-0.15***	-0.14***	-0.14***
Age of primary caregiver ‡	-0.14	-0.07***	-0.04
Gender of PC ◇	0.03	1.70	4.92**
PC mother ◇	1.01	2.48	1.40
PC father ◇	0.01	1.65	6.41***
PC other ◇	3.14	0.55	1.59
PC married ◇	15.41***	0.33	1.02
PC partnered ◇	4.61**	1.03	0.55
PC single ◇	6.80***	0.02	2.74*
PC education (Less than HS) ◇	9.94***	15.01***	13.35***
PC education (HS Diploma) ◇	0.99	0.34	0.35
PC education (More than HS) ◇	14.49***	11.44***	10.01***
PC Lack of hostility ‡	-0.21***	-0.15***	-0.12***
PC warmth ‡	-0.11***	-0.12***	-0.09**
Presence of siblings ◇	0.82	4.22**	7.43***

Note: Chi-square tests were conducted to examine relationships between two dichotomous variables (denoted by ◇), ANOVAs were used to examine the relationships between dichotomous (◇) and continuous variables (denoted by ‡), and correlations were conducted to examine relationships between continuous predictors (‡).

\* $p \leq 0.10$ , \*\*  $p \leq 0.05$ , \*\*\* $p \leq 0.01$

Table B-4. Bivariate relationships between corporal punishment and risk factors

	Average corporal punishment	Slap or spank	Push, grab, or shove	Throw something
Average corporal punishment ‡	-----			
Slap or spank ‡	-----	-----		
Push, grab, or shove ‡	-----	0.46***	-----	
Throw something ‡	-----	0.16***	0.25***	-----
Gender of the child	7.77***	6.47***	5.73**	0.18
Age of the child ‡	-0.03	-0.05	-0.01	0.00
White ◇	0.03	0.03	0.27	3.10*
Black ◇	9.12***	11.30***	2.82*	1.34
Hispanic ◇	6.94***	8.56***	3.80**	0.04
Other Race ◇	0.05	0.09	0.00	0.02
Income ‡	0.02	0.03	0.02	-0.08**
Age of primary caregiver ‡	-0.20***	-0.24***	-0.09**	-0.11***
Gender of PC ◇	0.82	0.28	0.65	1.27
PC mother ◇	2.47	4.07**	0.30	0.30
PC father ◇	0.26	0.00	0.38	1.19
PC other ◇	3.50*	10.67***	0.00	0.22
PC married ◇	1.73	0.98	1.92	0.16
PC partnered ◇	0.02	0.18	0.08	1.29
PC single ◇	2.31	0.57	2.96*	1.68
PC education (Less than HS) ◇	0.01	0.28	2.34	3.32*
PC education (HS Diploma) ◇	1.86	1.99	0.23	1.81
PC education (More than HS) ◇	1.08	0.22	3.37*	0.72
PC Lack of hostility ‡	-0.17***	-0.11***	-0.09**	-0.13***
PC warmth ‡	-0.14***	-0.07*	-0.09**	-0.05
Presence of siblings ◇	0.00	0.00	0.00	0.05

Note: Chi-square tests were conducted to examine relationships between two dichotomous variables (denoted by ◇), ANOVAs were used to examine the relationships between dichotomous (◇) and continuous variables (denoted by ‡), and correlations were conducted to examine relationships between continuous predictors (‡).

\* $p \leq .10$ , \*\*  $p \leq 0.05$ , \*\*\* $p \leq 0.01$

Table B-5. Bivariate relationships among risk factors

	1	2	3	4	5	6	7
1	-----						
2	1.60	-----					
3	0.58	3.94**	-----				
4	0.02	0.36	-----	-----			
5	0.07	7.74***	-----	-----	-----		
6	0.17	4.89**	-----	-----	-----	-----	
7	0.44	-0.02	117.83***	13.09***	17.99***	1.92	-----
8	0.00	0.03	18.14***	0.80	4.50**	0.00	0.28***
9	1.93	1.30	7.36***	0.06	2.95*	0.00	15.57***
10	0.41	1.47	0.80	8.17***	11.93***	0.14	7.35***
11	2.06	0.41	5.87**	0.14	1.97	0.02	18.04***
12	0.23	1.28	1.87	19.93***	11.50***	0.21	1.04
13	0.39	0.00	39.01***	108.37***	27.78***	0.11	108.31***
14	0.11	0.01	7.63***	0.04	2.26	0.67	6.65***
15	0.86	0.00	21.98***	124.16***	46.88***	0.95	81.77***
16	0.02	2.27	32.55***	15.84***	68.08***	1.88	90.01***
17	0.11	2.04	0.43	0.45	0.37	2.02	0.56
18	0.01	0.23	36.70***	19.13***	72.74***	0.13	98.53***
19	3.23*	-0.01	13.81***	15.56***	0.24	2.90*	0.21***
20	0.93	-0.04	8.11***	1.19	1.57	0.64	0.15***
21	0.44	9.34***	0.55	4.41**	2.61	0.23	0.45

Note: Chi-square tests were conducted to examine relationships between two dichotomous variables (denoted by  $\diamond$ ), ANOVAs were used to examine the relationships between dichotomous ( $\diamond$ ) and continuous variables (denoted by  $\ddagger$ ), and correlations were conducted to examine relationships between continuous predictors ( $\ddagger$ ).

\* $p \leq .10$ , \*\*  $p \leq 0.05$ , \*\*\* $p \leq 0.01$

Table B-5. Continued

	8	9	10	11	12	13	14
1							
2							
3							
4							
5							
6							
7							
8	-----						
9	14.39***	-----					
10	133.76***	397.86***	-----				
11	13.92***	636.48***	-----	-----			
12	165.35***	0.98	-----	-----	-----		
13	17.64***	8.44***	0.10	9.27***	7.84***	-----	
14	6.44***	0.55	0.30	0.38	0.42	-----	-----
15	6.78***	6.70***	0.00	8.03***	12.43***	-----	-----
16	12.42***	6.21***	3.17*	7.01***	0.30	0.84	4.74**
17	0.39	0.60	1.08	0.17	0.31	0.84	0.31
18	9.10***	3.63*	1.05	5.34**	0.87	2.38	6.39***
19	0.10***	0.17	0.00	0.02	0.02	30.25***	6.29**
20	0.03	6.53***	0.99	5.76**	2.12	9.02***	3.21*
21	20.36***	0.04	0.87	0.36	0.40	0.02	0.07

Note: Chi-square tests were conducted to examine relationships between two dichotomous variables (denoted by  $\diamond$ ), ANOVAs were used to examine the relationships between dichotomous ( $\diamond$ ) and continuous variables (denoted by  $\ddagger$ ), and correlations were conducted to examine relationships between continuous predictors ( $\ddagger$ ).

\* $p \leq .10$ , \*\*  $p \leq 0.05$ , \*\*\* $p \leq 0.0$

Table B-5. Continued

	15	16	17	18	19	20	21
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15	-----						
16	0.42	-----					
17	0.33	-----	-----				
18	0.06	-----	-----	-----			
19	15.97***	7.39***	0.04	7.95***	-----		
20	3.58*	17.60***	0.01	17.51***	0.17***	-----	
21	0.00	13.32***	1.56	7.36***	2.51	3.01*	-----

Note: Chi-square tests were conducted to examine relationships between two dichotomous variables (denoted by  $\diamond$ ), ANOVAs were used to examine the relationships between dichotomous ( $\diamond$ ) and continuous variables (denoted by  $\ddagger$ ), and correlations were conducted to examine relationships between continuous predictors ( $\ddagger$ ).

\* $p \leq .10$ , \*\*  $p \leq 0.05$ , \*\*\* $p \leq 0.0$

### List of Variables for Table B-5

1. Gender of the child ◇
2. Age of the child ‡
3. White ◇
4. Black ◇
5. Hispanic ◇
6. Other race ◇
7. Income ‡
8. Age of the primary caregiver ‡
9. Gender of PC ◇
10. PC mother ◇
11. PC father ◇
12. PC other ◇
13. PC married ◇
14. PC partnered ◇
15. PC single ◇
16. PC education (Less than HS) ◇
17. PC education (HS Diploma) ◇
18. PC education (More than HS) ◇
19. Lack of PC hostility ‡
20. PC warmth ‡
21. Presence of siblings ◇

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