

Aggressive Students and High School Dropout: An Event History Analysis

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ABSTRACT

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Aggressive students often struggle in multiple domains of their school functioning and are at increased risk for high school dropout. Research has identified a variety of warning flags which are strong predictors of high school dropout. While it is known that aggressive students exhibit many of these warning flags, there is little research which identifies the paths aggressive students take towards high school dropout.

This study attempts to better characterize the relationship between aggression and dropout using a sample of students (N=685) from two middle schools in an urban, low income school district in the Northeastern United States. This study utilizes survival analysis, a longitudinal data analysis strategy for examining event occurrence. The sample was followed over a course of seven years, spanning from when students start middle school in the sixth grade through their expected on time-graduation year in the twelfth grade. In this study, hazard and survivor functions, key components of survival analysis, were utilized to examine the timing of high school dropout and compare timing of dropout for students characterized as aggressive vs. not aggressive. Discrete time hazard models using logistic regression were analyzed to determine how well aggression as rated by teachers and peers as well as a variety of educational and demographic variables predict high school dropout.

Hazard and survivor functions showed that for this sample, aggressive students were at increased risk of dropout through the course of their educational careers. Their pattern of risk, i.e. grades in which they were at a lower or higher risk for dropout, however, was similar to that of non-aggressive students. Peer-rated aggression was related to each of the dropout warning variables as aggressive students were absent more often, had lower GPA's, accumulated more suspensions and were more likely to be retained at some point during their educational careers. Results of discrete time hazard models showed that aggression was no longer a significant predictor of dropout when other educational "warning flag" variables were included in models. A discrete time hazard model including the effects of time, Age for Grade status and Retention status produced the best goodness of fit measures amongst a host of models that were analyzed. In all models that were analyzed, time was a significant predictor, indicating that dropout is not time invariant and a student's grade must be considered when determining the effect of any of the hypothesized predictors on dropout. Implications of these results for schools, specifically regarding effective management of aggressive behavior in schools, are discussed.

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Chapter One:

Introduction

Longitudinal studies examining the developmental of trajectories of aggressive behavior show that there is a small group of individuals who are consistently rated as aggressive through childhood, adolescence and into adulthood (Bongers, Koot, Ende, & Verhulst, 2004; Brame, Nagin, & Tremblay, 2001; Broidy et al., 2003; Campbell, Spieker, Burchinal, & Poe, 2006; Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Nagin & Tremblay, 1999). Being a member of this “high stable aggressive” or “chronically aggressive” group is associated with a host of negative outcomes including later delinquency and criminality (Broidy et al., 2003). These children must attend school and negotiate the myriad of social and academic challenges that schools represent.

Aggressive students often do not fare well in school, struggling in multiple domains of school functioning. Aggressive students have more difficulties with their peers (Fite, Hendrickson, Rubens, Gabrielli, & Evans, 2013; Graham, Bellmore, & Mize, 2006; Risi, Gerhardstein, & Kistner, 2003) and teachers (Stipek & Miles, 2008), accumulate discipline referrals and suspensions (Kupersmidt & Coie, 1990; Petras, Masyn, Buckley, Ialongo, & Kellam, 2011; Reinke, Herman, Petras, & Ialongo, 2008), are absent more often (Lounsbury, Steel, Loveland, & Gibson, 2004; Maynard, Salas-Wright, Vaughn, & Peters, 2012; Vaughn, Maynard, Salas-Wright, Perron, & Abdon, 2013; Wagner, 1995; Wood et al., 2012), have lower grades (Brook & Newcomb, 1995; Busby, Lambert, & Ialongo, 2013; Jiang, Mermin, Perry, & Hesser, 2013; Kokko & Pulkkinen, 2000; Lounsbury, Sundstrom, Loveland, & Gibson, 2003; Masten et al., 2005; Thalji, 2010) and perform poorly on standardized tests (Deitch Feshbach & Feshbach, 1987). Aggressive students are also at high risk for being retained (Bierman et al.,

2013; Jimerson et al., 1997; Jimerson & Ferguson, 2002; Ledingham & Schwartzman, 1984), an educational outcome strongly predictive of school failure (Bowers, Sprott, & Taff, 2013; Jimerson et al., 2002; Jimerson, 1999; Kaufman & Bradbury, 1992). Most importantly, aggressive students are at a higher risk for high school dropout (Cairns, Cairns, & Neckerman, 1989; Ensminger & Slusarcick, 1992; French & Conrad, 2001; Kokko et al., 2006).

High school dropout has been described as a gradual process of cumulative student disengagement instead of a one-time event. Researchers have identified three key factors – attendance, behavior and course performance - that are better predictors of student outcomes than students demographics or their scores on standardized tests (Bruce, Bridgeland, Fox, & Balfanz, 2011). Studies investigating variables which are the most powerful warning flags of dropout have shown that a significant proportion of dropouts can be identified in middle school, as early as the 6th grade (Casillas, Robbins, Allen, Hanson, & Schmeiser, 2012; Logan, 2010; Mckee, 2009; Silver, Saunders, & Zarate, 2008; Wilburn, Lamkin, & Weaver, 2009). In these studies, excessive absences, failing grades, student behavior problems and grade retentions in middle school were all predictive of who would eventually dropout.

There is also research which attempts to capture the longitudinal nature of student disengagement, identifying the points along a student's academic career at which they are at the highest risk of dropping out and which variables best predict dropout at these critical junctures (Bowers, 2010, Pharris-Ciurej et al., 2012). There is evidence suggesting that different educational variables are predictive of dropout at different time points along a student's educational career. Thus, these variables are differentially related to dropout based on the timing of when a student drops out.

To this date, there is still little research which examines aggressive students as a sub-category of dropouts. While it is clear that aggressive students are more often absent, get into more trouble, are more likely to be previously retained and get worse grades than non-aggressive students, there is no research to date which compares the paths of disengagement taken by aggressive students as compared to non-aggressive students. The aim of this study is to characterize the paths taken by aggressive students towards high school dropout or completion, pinpointing the time periods where aggressive students are most likely to dropout, identifying which variables best predict dropout and also when along a student's educational career these variables are most predictive. This study will employ the longitudinal risk design of survival analysis in order to capture the longitudinal nature of a student's path towards high school completion or dropout beginning in the 6th grade. Utilizing survival analysis, the year by year dropout risk for aggressive and non-aggressive students can be compared, and the time points at which aggressive students are at the highest risk for dropout can be pinpointed. Using discrete time hazard modeling, multiple time variant variables including attendance, GPA and incidents of exclusionary discipline as well as time invariant variables such as the 6th grade variables of levels of aggression and being over age for grade will be analyzed for their ability to predict student risk of dropout over the length of their time in school.

Chapter 2:

Literature Review

Decades of research have revealed that aggressive students struggle in school. Students who exhibit aggressive behavior are more likely to drop out of school than non-aggressive students (Cairns, Cairns, & Neckerman, 1989; Ensminger & Slusarcick, 1992; French & Conrad, 2001; Kokko & Pulkkinen, 2000), an outcome associated with a wide array of negative consequences (Rumberger, 1987). Since the advent of comprehensive student-level data systems, educators are able to track a student's progress through school. Research has identified the variables most directly tied to eventual graduation, allowing schools to develop early warning systems which identify students at high-risk for eventual dropout at different time points through their schooling (Allensworth, 2013; Neild, 2009; Neild, Balfanz, & Herzog, 2007). While research has identified student-level warning signs, referred to as "red flags," for future dropouts and has shown that aggressive students have many of these red flags, there is little research on the educational experiences of aggressive students, how aggression moderates the relationship between these red flags and dropout or examines whether there are unique patterns of risk for children who exhibit aggressive behavior as compared to non-aggressive students. As important, there is little research on the educational experiences of aggressive students who are successful in school. As aggressive students are at such a high risk for falling off-track and eventually dropping out, identifying experiences which aid in keeping them on-track would be beneficial to schools and guide the development of strategies for ensuring this group's success.

This literature review first gives a broad definition of aggressive behavior and its sub-categories. Studies which identify the developmental trajectories of aggressive behavior are then reviewed, with a focus on the trajectories of individuals who exhibit consistently high levels of

aggressive behavior throughout development. Next, research is reviewed which explores how aggressive children and adolescents struggle in school. This review focuses on the educational experiences of aggressive students in terms of objective educational outcome variables such as dropout, retention, attendance, grades and suspensions. As the goal of this investigation is to track the educational experiences of students, both aggressive and non-aggressive, on the path towards high school dropout or completion, background literature on how schools can most effectively track student progress is reviewed. More specifically, studies which identify variables which best predict high school dropout or completion, are reviewed. In addition, there is a review of studies which look at the variables that influence the timing of dropout. This review then concludes with an integrative summary of what is known about the educational experiences of aggressive students and discusses how this knowledge can be advanced. This section discusses the need for a more detailed examination of the paths aggressive students take towards high school completion, an analysis which details which variables best predict final outcomes and also captures the timing of the impact of these variables.

Background

Aggressive Behavior Definition. Aggression is a complex, heterogeneous condition with various presentations that cannot be adequately defined by one term (Connor, 2002). As defined in the Webster Dictionary, aggression is a “an act of hostility, an assault” (Morehead & Morehead, 1995). Researchers have expanded on this definition and have further categorized human aggression into multiple subtypes based on a variety of factors (Anderson & Bushman, 2002). Aggression is classified into more homogenous categories using statistical techniques such as factor analysis. Aggression is categorized as “overt” or “covert.” Overt aggression is

defined as an openly confrontational act of physical aggression and includes physical fighting, bullying, usage of weapons to hurt others and open defiance of rules and authority figures (Connor, 2002). Hidden acts of aggression including stealing, fire setting, truancy and running away from home are defined as covert aggression. Aggressive behavior can also be categorized as physical or non-physical. Physically aggressive behaviors are intended by the perpetrator to cause physical harm while non-physical aggressive behaviors have other intended harmful effects. Examples of physically aggressive behaviors include punching, shoving, kicking and throwing objects. Non-physical aggressive behaviors can be verbal such as threatening, teasing, taunting, profanity and direct insults (Infante & Wigley, 1986).

Aggressive behavior is also categorized into reactive and pro-active aggression.

Proactive aggression is defined as pre-meditated harmful behavior used as a means of obtaining a secondary goal other than harming the victim. Also referred to as instrumental aggression, it occurs in the absence of direct provocation and is a goal-oriented behavior aimed at the acquisition of a valued resource. For example, a robbery, which has the goal of obtaining profit, would be classified as proactive aggression. On the other hand, reactive aggression, also called hostile aggression, is conceptualized as being impulsive, thoughtless, unplanned, driven by anger, and has the ultimate goal of harming the target. In contrast to instrumental aggression, reactive aggression is a reaction to a perceived provocation. Reactive aggression can result in sudden, heightened, enduring or inappropriate aggressive responses, and probably accounts for most societal problems that are associated with aggression. However, proactive aggression receives more media attention as higher profile incidents such as mass killings, genocides or assassinations may be rooted in more instrumental goals (Nelson & Trainor, 2007). Other distinctions among aggressive behavior include offensive vs. defensive aggression which

distinguishes between unprovoked attacks on another vs. responding to a threatening situation with aggression and relational aggression defined as harming another's friendships or inclusion in a peer group (Connor, 2002).

This literature review focuses on studies which examine overt forms of aggression, both physical and verbal. Aggressive behaviors measured in these studies include overt physical aggressive behaviors such as fighting, hitting, kicking and shoving and overt verbally aggressive behaviors such as threatening and insults. Overt aggressive behaviors will be the main focus of this literature review instead of covert aggressive behaviors since there is extensive research documenting the relationship between overt aggressive behavior and educational performance while there is considerably less research which examines the relationship between covert forms of aggression and educational performance. The following section reviews studies that examine the developmental trajectories of aggressive behaviors from early childhood through adolescence.

Development of Aggressive Behavior

Researchers have consistently found that aggressive behaviors change significantly in both frequency and form of expression over the course of development and therefore there is a growing consensus that aggressive behavior needs to be studied from a developmental perspective (Bongers et al., 2004). Studies utilizing a person-centered research paradigm have revealed that the development of aggressive behaviors from infancy to adulthood may follow several distinct trajectories. In general, these studies have revealed at least three trajectories: a) a group with stable, low levels of aggression over time; b) a group exhibiting a moderate level of aggressive behavior that declines through middle childhood and adolescence; and c) a group with

high, stable levels of aggression over time (Di Giunta et al., 2010). This section describes the findings of these studies and details the distinct trajectories they revealed.

Aggression is a heterogeneous concept with multiple subtypes. It is therefore important to consider how researchers define aggression in their studies in order to determine which aspects of aggression they are measuring. In this section, which reviews studies that identify the developmental trajectories of aggressive behavior, details on how researchers defined and measured aggression are also provided. Most of these studies focus on measuring physically aggressive behaviors such as hitting, kicking or shoving. However, included in their measure of physically aggressive behaviors, researchers sometimes measured behaviors that could be categorized as verbally aggressive such as threatening, intimidating or bullying others. A few of these studies also examine trajectories of oppositional behavior. Details on how researchers measure oppositional behavior will also be provided as these measures capture some aspects of aggression such as disobedience and temper tantrums. Also reviewed will be findings from these studies on the trajectories of oppositional behavior. At the conclusion of this section, common findings across studies will be discussed, highlighting the consistent finding that across most samples, there exists a small group which exhibits chronically high levels of aggressive behavior across development.

Nagin and Tremblay studies. In 1999, Nagin and Tremblay conducted a longitudinal study of white, French-speaking males from low-socioeconomic neighborhoods in Montreal (N=1,037). They used the Social Behavior Questionnaire (Tremblay et al., 1991) to collect teacher ratings of physical aggression at ages six, ten and fifteen and analyzed this data using a group based trajectory statistical modeling procedure. Physical aggression was assessed with

three items: a) kicks, bites, hits other children; b) fights with other children; and c) bullies or intimidates other children. Their analysis revealed that the development of childhood aggressive behavior in their sample followed four distinct trajectories. The first group called “lows” was composed of individuals who displayed little or no physically aggressive behavior. This group comprised 15% of the sample, a second group, labeled “moderate declining” accounted for 50% of the sample. Boys in this group displayed a modest level of physical aggression at age 6, but by age ten they had largely desisted. A third group, that comprised about 30% of the sample, was distinguished as “high declining.” This group was high on physical aggression at age six but was rated much less aggressive by age fifteen. Despite the decline, at age fifteen they continued to display a modest level of physical aggression. Lastly, there was a small group labeled “chronics,” who comprised less than 5 % of the population, and displayed high levels of physical aggression at each time point throughout the longitudinal study. This “chronic” group was particularly important as they found that their chronic childhood aggressive behavior placed them at significant risk for later delinquency.

In a 2001 longitudinal study using the same sample, findings indicated that levels of physical aggression in both childhood and adolescence showed little stability over time and instead followed a trajectory (Brame et al., 2001). Physical aggression in childhood was rated by teachers at ages 6, 10, 11, 12 and 13 using 3 items: a) kicks, bites, hits other children; b) fights with other children; and c) bullies or intimidates other children. Aggression in adolescence, measured at ages 13, 14, 15, 16, and 17 was measured by self-report, asking subjects how often they have been involved in these activities over the past 12 months: a) gang fighting; b) using a deadly weapon; c) attacking someone who had done nothing to you; and d) throwing rocks, bottles, or other objects at someone. Three trajectories were present during childhood (high,

medium and low) while four trajectories were present in adolescence. A small group of subjects exhibited a high and stable level of aggression in both childhood and adolescence. In examining the connection between childhood and adolescent levels of aggression, researchers found that boys with higher childhood physical aggression trajectories were far more likely to be part of a higher-level adolescent aggression trajectory than boys from lower childhood physical aggression trajectories. There was little evidence of movement from a low physical aggression trajectory in childhood to a high trajectory in adolescence, giving the researchers little evidence of any late onset of physical aggression.

Multi-site, cross-national study of development of aggression. In 2003, a six site, three country, cross-national study of children from the USA, Canada and New Zealand analyzed whether physical aggression generally develops in accordance with the four-group trajectory model previously identified by Nagin and Tremblay in 1999 (Broidy et al., 2003). This study also examined the connections between a trajectory of physical aggression and violent and non-violent delinquency in adolescence. Based on teacher reports of aggressive behaviors, they found that at each of the six sites, a three- or four-group model best represented developmental trajectories of physical aggression. Each site used a short measure of teacher-rated physical aggression that ranged from two to five items in length. Items included cruelty/bullying/meanness to others; fights with others; threatens people; hits or physically fights with other students; starts a physical fight over nothing. At each site, there was a small group of boys, less than 10% of the sample, who consistently engaged in high levels of physical aggression. At all six sites, most boys followed a longitudinal pattern of either very little physical aggression or a low level of physical aggression. The trajectories of physical aggression never crossed one

another, suggesting that even if boys' physically aggressive behavior changes over time, their comparative ranking within the population remained constant. The findings for girls were similar, except for the expected finding that girls had consistently lower mean levels of aggression than their male counterparts. In summary, this study found that physical aggression from school entry to early adolescence was rare. However, among both boys and girls, a small group of children presented as considerably more physically aggressive than their peers throughout childhood. For boys, chronic physical aggression in elementary school increased the risk for both continuing violence and non-violent delinquency in adolescence.

This study also measured trajectories of oppositional behavior in childhood as a control for potentially co-morbid disruptive behaviors in order to determine the independent effect that physical aggression has on later delinquency. Oppositional behavior was measured by items including irritable; often disobedient; defiant; impudent; stubborn; uncooperative. Results indicated that only physical aggression and not oppositional behavior or hyperactivity independently predicted aggressive behavior in adolescence and that when trajectories of oppositional behavior and hyperactivity are controlled for, physical aggression in the elementary school years is still associated with delinquency in adolescence.

As stated in the section of this literature review which reviews the definition of aggression, when reviewing studies on the development of aggression it is important to consider items used by these studies to measure aggression and determine which subtypes of aggression are actually being measured. Commonly used measures of aggression include both physical and verbal overt forms of aggression. Many studies include forms of verbal aggression, such as threatening and insults in their definitions of "physical" aggression. Therefore, even though many studies are examining "physical" aggression, it is important to recognize that items

assessing verbal aggression are also included in the measures they use and are included in their definition of physical aggression.

Bongers Dutch study. In a 2004 study, Bongers and colleagues studied the developmental trajectories of aggression, opposition, property violations, and status violations by analyzing parent reports of externalizing behaviors on a Dutch longitudinal cohort of 2,076 children aged four to eighteen years (Bongers et al., 2004). The sample was representative of the Caucasian population in the Netherlands. The occupational levels of the parents were 34%, 32%, and 34% for low, middle, and high status occupational levels, respectively, which was a distribution representative of the Netherlands. Externalizing behaviors were measured using the Child Behavioral Checklist (CBCL) (Achenbach, 1991a). CBCL items assessing aggression included: a) cruelty/bullying/meanness to others; b) gets in many fights c) physically attacks people and d) threatens people. Items assessing opposition included: a) argues a lot b) disobedient at home c) disobedient at school d) stubborn, sullen or irritable e) sulks a lot f) teases a lot and g) temper tantrums or hot temper. They identified three trajectories for aggression. All three trajectories indicated decreasing levels of reported physically aggressive behaviors. They found that physically aggressive behavior was most prevalent in younger children and then decreased over time. Levels of aggressive behavior were nearly twice as high for males than for females in childhood, but there was no significant difference by gender in late adolescence. As found in previous studies, there was a group of children whose aggressive behavior deviated from average development. This “high decrease” group showed serious aggressive behavior through all time points in the study, including late adolescence. In contrast to the most aggressive children in the studies previously described, a group whose level of aggressive behavior

remained chronically high, the most aggressive group in this study showed a decrease in their level of aggressive behavior. With regards to oppositional behavior, there were six trajectories. Four of these trajectories showed a decreasing level of opposition through development. A small group showed a chronically high level of opposition while a different small group showed an increase of opposition that was on average still much lower compared to the chronically high group.

Cote Canadian study. A 2006 study also modeled the developmental trajectories of physical aggression, examining trajectories of aggressive behavior of a nationally representative sample of Canadian children (N=10,658) from toddlerhood through pre-adolescence (Côté et al., 2006). Physical aggression was measured using three items: 1) kicks, bites, hits other children; 2) gets into many fights and 3) reacts with anger and fighting. Three groups of children, with distinct developmental trajectories, between two and eleven years of age were identified. One third of the children followed a low desisting trajectory. The majority of subjects followed a moderate desisting trajectory, occasionally exhibiting physical aggression in toddlerhood and rarely showing aggression by pre-adolescence. As in previous studies, a small group which followed a high stable trajectory of physical aggression was also revealed.

NICHD Study of Early Child Care and Youth Development. A study examining trajectories of aggression from twenty-four months through nine years of age identified five trajectories of physical aggression (Campbell et al., 2006). Data was collected from the NICHD Study of Early Child Care and Youth Development. The sample (N=1,195) was described as ethnically and socioeconomically diverse: 24% of the sample was ethnic minority and 11% of

the subjects' mothers had not completed high school. This study also examined the connection between aggression trajectory and adjustment through the early adolescent ages of nine to twelve. For this analysis, researchers focused on overt, physical aggression to people, animals and objects and assessed it using these six mother-reported items from the CBCL: 1) destroys own things, 2) destroys others' things, 3) gets in many fights, 4) hits others, 5) physically attacks people, and 6) cruel to animals. The adjustment of subjects in school was measured using teacher reports of Internalizing and Externalizing symptoms using the *Achenbach Systems of Empirically Based Assessment's (ASEBA) Teacher Report Form (TRF)* (Achenbach, 1991b), teacher reports of symptoms of DSM-IV Disruptive Behavior Disorders rated using the *Disruptive Behavior Disorders Questionnaire (DBD)* (Pelham, Gnagy, Greenslade, & Milich, 1993) and teacher reports of social competence using the *Social Skills Rating System (SSRS)* (Gresham & Elliot, 1990). They found that children on a high- stable aggression trajectory showed the most severe adjustment problems, including poorer teacher-rated social skills, and higher levels of teacher-rated externalizing problems.

DiGiunta Italian study. A study in 2010 using a nationally representative sample from Italy (N=439) examined the relationship between both parent and self-reports of aggressive behavior and later anti-social behavior. Aggressive behavior was measured using items assessing physical aggression from the *Physical and Verbal Aggression Scale* (six for children, five for mothers) (Caprara & Pastorelli, 1993). Based on self and mother reports of physical aggression collected on a sample of adolescents at different time points from the ages of eleven to fourteen years, researchers identified four trajectories based on mother ratings and three trajectories based on self-ratings of physical aggression. As in previous studies, levels of aggressive behavior

desisted for most of the sample except for a small group of children with high stable levels of aggression. In examining the connection between aggression trajectory and anti-social behavior at age eighteen, belonging to the high stable aggression group was associated with higher overt and covert antisocial behavior (Di Giunta et al., 2010).

Pignault Quebec study. A longitudinal study published in 2013, using a sample of French-speaking, kindergarten aged children from Quebec (N=2,741) examined the connections between childhood hyperactivity, inattention, aggression and later criminality measured at age twenty-five. Three items, rated by both parents and teachers were used to assess physical aggression: 1) fights with other children 2) bullies other children 3) kicks, bites, or hits other children. The study which assessed hyperactivity, inattention, and physical aggression through mother and teacher reports annually between the ages of six and twelve years, revealed four trajectories of development of physical aggression (high mother and teacher, descending, high mother only, low), including a group, which represented roughly 10% of the sample, that exhibited high stable levels of aggression as rated by both parents and teachers. The study also revealed four trajectories for development of hyperactivity (high mother and teacher, descending, high mother only, low), including a small group (about 14% of the sample) that exhibited high stable levels of parent and teacher rated hyperactivity.

This study used survival analyses to examine which of the developmental trajectories were at the highest risk for obtaining a criminal charge up until the age of twenty-five. After having controlled for family adversity as well as trajectories of inattention and physical aggression, only two out of three childhood hyperactivity trajectories made a small significant contribution to the prediction of criminality. Conversely, physical aggression was the most

consistent behavioral predictor of criminality. Participants in the high mother/teacher trajectory of physical aggression, which made up only 9.5% of the sample, represented 28.2% of all the participants with a criminal record. In addition, this group was responsible for 45.9% of all recorded criminal charges and 57.4% of the violent ones. Results indicated that inattention showed no significant correlation with later criminality (Pingault et al., 2013).

Project Northland Chicago studies. In a study published in 2012, researchers identified trajectories of aggression from the 6th through 8th grade for a sample of African American and Hispanic urban adolescents (Reingle, Maldonado-Molina, Jennings, & Komro, 2012). Data was obtained from participants in Project Northland Chicago (N = 3,038), an alcohol prevention program implemented in the 6th through 8th grades in schools in Chicago, IL. This cohort was 57% African American and 43% Hispanic and came pre-dominantly from low income families. Three self-report items were used to measure aggressive behavior in the previous month including: 1) How many times have you pushed, shoved, pulled someone's hair, or grabbed someone? 2) How many times have you kicked, hit, or beat up another person? 3) How many times have you told someone you were going to hit or beat them up? Researchers utilized trajectory modeling to examine the development of aggression from baseline, the beginning of 6th grade, through the middle school years. Results of the trajectory modeling suggest four distinct profiles of aggression. Among African Americans, 7.9% were in the low- aggression group, 19.5% were escalators, 8.4% had moderate- consistent aggression patterns, and 64.0% were in the consistent aggressive group. Among Hispanics, 17.1% were in the low- aggression group, 18.1% were desistors, 21.6% were escalators, and 43.3% were in the consistent aggression group. Similar to previous studies that examine the developmental trajectory of

aggressive behavior, this study identifies four distinct trajectories. These results also suggest that in comparison to Hispanics, African American students were more likely to participate in aggression and less likely to be rated as non-aggressive (Reingle et al., 2012).

A study published in 2010, which also utilized data from Project Northland Chicago, focused in on the developmental trajectories of physical aggression in Hispanic adolescents (N=731) (Maldonado-Molina, Reingle, Tobler, Jennings, & Komro, 2010). This study followed their cohort from the 6th through 12th grades, collecting self-report data in the 6th, 7th, 8th and 12th grades. They measured physical aggression using three self-report items: “During the last month, how many times have you: (1) pushed, shoved, pulled someone’s hair, or grabbed someone? (2) kicked, hit, or beat up another person?; and (3) taken part in a fight, where a group of your friends were against another group?” This study also measured frequency of physical threats as a risk factor for physical aggression using this item: “During the last month, how many times have you told someone you were going to hit or beat them up?” Results indicated that the development of aggression from the 6th through 12th grades followed five distinct developmental trajectories. The five groups were: non-aggressive (13.7%), stable low aggression (22.7%), escalators (16.5%), early high aggression and rapid desistors (25.9%), and high aggression-moderate desistors (21.2%). Frequency of threatening to fight was associated with an increased risk for physical aggression.

In summary, numerous studies have revealed that the presence of overt aggressive behavior is expected in early childhood but then fades over the course of early development. Although most children show only low to moderate levels of aggression that decrease with age, a group of children can be identified within each study sample whose aggression remains well above normal levels across development. This group, referred to as the “high stable” group

varies in size based on the cultural and socio-economic makeup of the study sample. Research shows that this group is at serious risk for adjustment difficulties in middle childhood, adolescence, and even young adulthood, including an increased risk for future delinquency. This current study attempts to identify the most aggressive students in a cohort of urban adolescents, a group with a profile of overt aggressive behavior similar to the chronically aggressive groups identified in the developmental trajectory studies reviewed previously. The next section of this literature review focuses on this group of consistently aggressive students and how they are at risk for negative educational outcomes.

Aggressive Behavior and Educational Outcomes

Early, persistent aggression also has been associated with numerous negative educational outcomes including school failure and dropout. Given the high risk associated with this group of aggressive children it is important to further understand the paths this group takes towards these negative outcomes. The following section begins by reviewing the research on associations between overt forms of aggressive behavior and future dropout and then examines associations between aggressive behavior and the educational variables that research has shown to be powerful predictors of dropout. Numerous studies examine the connection between aggressive behavior in childhood and educational outcomes. Educational outcomes analyzed include high school dropout and other objective measures of academic performance including attendance, GPA, course performance, performance on standardized achievement tests, grade retention, student behavior and exclusionary discipline practices such as suspension and expulsion. The following sections review this research with a focus on describing how the most aggressive students may fare in terms of their educational outcomes.

High school dropout. The consequences of not completing high school are profound. A student who does not complete high school can expect to earn considerably less over a working career and to have far fewer educational and employment opportunities from which to choose than a student who has completed high school (Lamont, 2013). Dropouts are less likely to participate in the labor force than other adults, and they often become mired in low-wage jobs with few advancement opportunities (Rumberger, 1987). Dropouts have poorer mental and physical health and an increased probability of being incarcerated for committing criminal acts or of becoming dependent on government programs (Rumberger, 1987). Multiple studies have found that childhood aggressive behavior is associated with an increased risk for dropping out of high school.

A longitudinal study in 1989 using a sample of 475 students from three middle schools in three different communities in the United States examined the behavioral, cognitive and demographic factors associated with school dropout (Cairns et al., 1989). The subjects in the study came from a wide variety of socio-economic backgrounds ranging from parents who were professionals to parents who were chronically unemployed. The sample was roughly 70% White. The study followed students beginning in the 7th grade and found that students most likely to dropout were characterized in grade 7 by high levels of aggression and low levels of academic performance.

A 1992 longitudinal study compared African American graduates to non-graduates (N=1,242) from an urban, impoverished neighborhood in the South-Side of Chicago (Ensminger & Slusarcick, 1992). Researchers found that when compared as far back as the first grade both low grades and aggressive behavior led to dropout for males.

Anti-social behavior and low achievement, measured in 8th and 10th grade, also predicted dropout in a sample of predominantly White students (N=516) from a suburban Pacific Northwest school district (French & Conrad, 2001). It is noteworthy that in this study, anti-social behavior included rule infractions, physical aggression, and aspects of relational aggression such as lying to get others in trouble, blaming and teasing. A 2006 longitudinal study of French-speaking male students (N=1,025) from low socio-economic neighborhoods in Montreal examined students' trajectories of physical aggression and pro-social behavior between the ages of six and twelve and then sought out connections between these trajectories and later school dropout (Kokko et al., 2006). Analysis revealed three trajectories of physical aggression (low, moderate and high declining). The study found that physical aggression predicted school dropout. It was shown that school dropout at age seventeen was strongly related to being aggressive as the boys on the highly aggressive trajectory between the ages of six and twelve were about six times more likely to drop out of school compared to the non-aggressive boys.

A 2015 longitudinal study examined the association between peer aggression measured at the age of fourteen and educational outcomes at the age of twenty using a sample of 1003 adolescents from Western Australia (Moore et al., 2015). Peer aggression was assessed through a self-reported questionnaire that began with the statement, "Bullying is when someone is picked on by another person, or a group of people say nasty things to him or her. It is also when someone is hit, kicked, threatened, sent nasty notes or when no one talks to them." Perpetrators of peer aggression were those participants who stated 'yes' to having perpetrated this behavior at school. The researchers stated that even though the term "bullying" was used, "peer aggression" best describes the behavior best described by the statement as the definition provided to the participants does not refer to a power differential or repetition of the behavior, two necessary

characteristics for the behavior to be considered bullying. Results indicated that participants involved in any form of peer aggression were less likely to complete secondary school.

A 2015 longitudinal study utilized latent profile analysis to identify groups of 6th graders based on teacher-reported assets and maladaptive behaviors and then compare dropout rates between these groups (Orpinas, Raczynski, Peters, Colman, & Bandalos, 2015). The sample was 675 racially diverse students who attended public schools in Northeast Georgia. Aggressive behavior was assessed using the Aggression subscale of the Behavior Assessment System for Children – Teacher Rating Scales (BASC). Latent profile analysis identified seven groups of students. Among these groups, the group characterized as *Severe Problems*, had the highest proportion of students rated as high in aggression by teachers (84%). This group had the highest dropout rate as 58% of the students in this group eventually dropped out.

In summary, these studies show that aggressive students are at an increased risk for eventually dropping out of school. As high school dropout has been conceptualized as the final stage in a cumulative process of gradual student disengagement from school, instead of a one-time event, there is a considerable amount of research which identifies the educational outcome variables that best predict dropout. Research on the predictive power of these variables in identifying future dropouts will be summarized later in this literature review. In the following sections, studies which examine the association between aggressive behavior and these educational outcomes predictive of high school dropout are reviewed.

Course performance and academic achievement. There are multiple studies which find an association between aggressive behavior and course performance. A 1995 longitudinal study of predominantly White children (N=412) from a suburban New York neighborhood found

that parent-rated aggression at age five was connected to a latent variable measuring academic orientation at age fifteen (Brook & Newcomb, 1995). This latent variable included the subject's GPA and a measure of educational aspirations. Aggression was measured by creating a latent variable from five different scales measuring a) anger, b) aggression towards siblings c) non-compliance d) temper and e) non-conforming behavior. High levels of childhood aggression were associated with lower academic orientation in adolescence. A longitudinal study using a sample (N=311) of children from both urban and suburban neighborhoods of a medium-sized town in Finland found that aggressive behavior at age eight was associated with school maladjustment at age fourteen (Kokko & Pulkkinen, 2000). This measure of school adjustment included GPA as well as truancy and teacher reports of a student's interest in school work. A longitudinal study published in 2005 examined the connection between self and teacher reported measures of internalizing and externalizing symptoms and measures of academic competence including GPA, attendance, standardized test scores and office disciplinary referrals in an ethnically diverse sample of children (N=205) attending schools in both low and middle socioeconomic neighborhoods of Minneapolis (Thalji, 2010). This study collected data on students starting at age eight and then followed up with them seven, ten and twenty years later. Results indicated that externalizing problems, including aggression and delinquency present at age eight, were related to lower academic achievement by adolescence, which in turn contributed to internalizing problems in young adulthood.

A 2010 study of middle school students from a large school district in the southeastern United States (N=341) examined the utility of measures of psychopathology in predicting student's subsequent academic performance and in-school behavior (Masten et al., 2005). The sample was 55.43% Caucasian, 14.08% African American and 12.61% Latino with roughly one-

quarter of the students coming from a low socio-economic background. Externalizing symptoms were assessed by parental report using the *Developmental Questionnaire*, a symptom checklist which the authors stated contained a high degree of overlap with the CBCL. Data analysis revealed that externalizing symptoms including aggressive and rule-breaking behavior, were negatively correlated with GPA and positively correlated with the numbers of absences and office disciplinary referrals one year later.

A recent study based on self-reports of high school students found an association between a self-report of aggressive behavior and academic performance. Data were collected from a representative sample of 9,384 adolescents in grades nine through twelve in the state of Rhode Island (Jiang et al., 2013). Male students who reported having a physical fight were 3.4 times more likely to report that they obtained grades of D and F than students without a physical fight. The relationship was similar for females. Aggressive behavior in the 7th grade mediated the association between exposure to community violence measured in the 6th grade and 8th grade academic functioning in a community sample of 491 African American adolescents from a low-income urban community (Busby et al., 2013).

There is a current line of research dedicated to examining how personality traits in adolescents can predict academic success in adolescence as well as future job performance in young adulthood. Various studies have found that aggression, considered a narrow personality trait within the Big Five Personality model, is associated with measures of academic success such as grade point average (GPA). A 2003 study of 7th and 10th graders from a large school district in the southeastern United States investigated which of the Big Five personality traits along with the narrow traits of aggression, optimism and work drive were associated with academic success in adolescents (Lounsbury et al., 2003). The sample consisted of 220 7th

graders and 290 10th graders. The school district from which the sample was obtained was predominantly Caucasian. Results indicated that a self-report of aggression as measured by the Adolescent Personal Style Inventory was negatively correlated with GPA in both the 7th and 10th grade.

Self-reported physical aggression accounted for 16% of variance in GPA in a study of predominantly Caucasian high school students (N=992) in grades nine through twelve from a south-eastern state in the United States (Loveland, Lounsbury, Welsh, & Buboltz, 2007). After controlling for levels of physical aggression as measured by the Adolescent Personal Style Inventory, the Big Five personality traits agreeableness, openness to experience, conscientiousness, neuroticism and extraversion added only 1.5% to the prediction of GPA. Gender differences were also found as significantly more variance in GPA was predicted by physical aggression for females than for males. A separate study conducted by the same research group and using the same methodology revealed that their previous findings are consistent across age ranges as aggression was more highly correlated with GPA compared to any of the other Big Five personality traits in their sample, a predominantly Caucasian (83% Caucasian, 14% African American) group of 491 8th graders from a southeastern U.S. school district (Barthelemy & Lounsbury, 2009).

Another line of research has identified profiles of academic and social risks in elementary school, and investigated their association with future mental health and academic difficulties in adolescence. A longitudinal study published in 2005 examined profiles of individual, academic, and social risks in elementary school, and their association with adolescent mental health and academic difficulties (Valdez, Lambert, & Ialongo, 2011). This study followed a cohort of students (N=574) who were first assessed in the 1st grade and then followed up in adolescence

when they were in grades six through nine. The cohort was predominantly African American and 68% received free or reduced lunch. Children that exhibited a risk profile consisting of high levels of aggressive behavior as rated by peers using the *Peer Assessment Inventory* (PAI) (Pekarik, Prinz, Leibert, Weintraub, & Neal, 1976), low academic achievement assessed using the *Comprehensive Test of Basic Skills 4* (CTBS) (Alberti, 1990), and low peer acceptance as rated by peers also using items from the PAI, exhibited high levels of conduct problems and academic difficulties in adolescence. It is noteworthy that conduct problems were operationalized as a DSM-IV diagnosis of Conduct Disorder, a diagnosis associated with high levels of aggressive behavior. A 2013 longitudinal study utilizing the same sample followed students from the 1st through the 12th grade and investigated the connection between 1st grade academic and behavior problems and 12th grade outcomes (Darney, Reinke, Herman, Stormont, & Ialongo, 2013). Students with co-occurring academic and behavior problems in the 1st grade had greater risk for future negative outcomes such as high school dropout and poor academic achievement in the 12th grade in comparison to children with academic or behavior problems alone. Having only academic or only behavior problems was also associated with long-term negative outcomes. Boys having behavior problems only, were more likely to have been diagnosed with conduct disorder in high school, more likely to receive special education services, and more likely to have been arrested as a juvenile or adult in comparison to a group of children with academic problems only. Boys in the academic problems only group were less likely to graduate from high school than boys without academic or behavior problems. Girls in the academic problems only group were more likely to receive special education services and more likely to be suspended from school than girls without academic or behavior problems.

A longitudinal study of African American and Hispanic middle school students in Chicago (N=3,038) revealed four distinct trajectories of self-reported aggressive behavior. Results indicated that low academic achievement was associated with membership in a trajectory characterized by high stable levels of aggression for both African American and Hispanic students (Reingle et al., 2012).

A recent intervention study by Bierman et al (2012) also investigated the impact of aggressive-disruptive behaviors and school readiness skills at the age of first-time school entry on high school graduation as well as academic progress and educational placements during elementary school (Grades 1–4) and during the secondary school years (Grades 7–10). The sample consisted of 9,594 kindergartners from fifty-five schools in four demographically diverse locations (Nashville, TN; Durham, NC; Seattle, WA; and rural central PA). These sites were identified as high risk based on crime and poverty statistics. Results showed that teacher reported aggressive and disruptive behavior problems assessed in kindergarten predicted school difficulties including low grades, grade retention, placement in a self-contained classroom, and behavior disorder classification, throughout elementary and secondary school. Teacher reported aggressive and disruptive behavior problems were also predictive of failure to graduate from high school.

There are also studies which reveal an association between aggressive behavior and standardized measures of academic achievement. A study published in 1987 examined the links between academic achievement, empathy, depressive affectivity, and aggression of children aged eight through eleven based on teacher and self-reports (Deitch Feshbach & Feshbach, 1987). They found that initial levels of teacher-reported aggression, measured by the *Aggression Rating Scale* were inversely related to reading achievement as measured by the *Wide Range*

Achievement Test (WRAT) for both boys and girls, and to spelling and math achievement scores for girls only assessed two years later. Interestingly, none of the self-report measures correlated with subsequent achievement.

Attendance. Student attendance is related to a number of critical educational outcomes including school dropout (Henry, Knight, & Thornberry, 2012) and student achievement (Monk, 2013). Studies have also found a positive correlation between aggressive behavior and truancy (i.e., intentional, unauthorized or illegal absences from compulsory education). There is a considerable amount of research that examines truancy and how it is associated with measures of delinquency or conduct problems. As measures of delinquency often contain items that assess aspects of aggressive behavior, a few studies which examine the relationship between delinquency and truancy are reviewed in this section.

Results from The Cambridge Study in Delinquent Development, a prospective longitudinal survey of the development of offending and antisocial behavior in boys found that youth with high truancy rates at ages 12–14 were more likely to engage in violence as adolescents and adults (Farrington, 1989). A study published in 2004 searched for connections between the Big Five and narrow personality traits and absences for students in the 7th, 10th or 12th grades (Lounsbury et al., 2004). The sample was predominantly Caucasian and consisted of 248 7th graders, 321 10th graders, and 282 12th graders. Self-reported aggression, as measured by the *Adolescent Personal Style Inventory* was positively related to absences for students in the 7th, 10th, and 12th grades.

A study published in 2012 examined the reciprocal influences between absenteeism and youth psychopathology in three separate longitudinal samples (Wood et al., 2012). The first

sample came from the nationally representative National Longitudinal Study of Adolescent Health (N=20,745), the second from nineteen schools in Baltimore's demographically diverse Eastern district (N=2,311), and the third from twelve public schools in Eugene, Oregon located in neighborhoods with high levels of juvenile arrests relative to the local area (N=671). Subjects were assessed longitudinally from the 1st through 12th grade based on self, parent and teacher reports. As different scales were used at each site to measure youth psychopathology, the authors of this study created two latent pathology constructs; conduct problems and anxiety and depression. Results of cross-lagged regression analyses revealed that middle school students with high levels of absenteeism tended to have higher levels of teacher-reported conduct problems the following school year after concurrent residual correlations between absenteeism and psychopathology at the time of assessment were held constant. The opposite direction of effects (i.e., high levels of conduct problems predicted high levels of absenteeism), was also seen. These results led researchers to conclude that absenteeism and conduct problems may act as reciprocal risk factors for one another. (Wood et al., 2012).

A 2012 study examined the heterogeneous profiles of truant youth. Data from a nationally representative sample of truant adolescents in the United States (N=1,646) revealed that students who chronically skipped school were more likely than other students to report marijuana use, theft, selling drugs and fighting (Maynard et al., 2012). A study published in 2012 examined the inter-relationships among multiple domains of psychosocial functioning in chronically truant youths, including substance use, mental health, and delinquency (Dembo et al., 2012). Subjects (N=219), recruited from a South Florida truancy intake center, were between the age of eleven and fifteen, and had reported past use of alcohol or drugs. The sample was 65% male, 39% White, 27% Hispanic and 25% African American. These truant youth reported high

levels of self-reported delinquency, including high levels on a measure of crimes against persons such as fighting, aggravated assaults and robberies.

A recent study using data from a nationally representative sample of adolescents aged twelve to seventeen (N = 17,482), examined the correlates and causes of truancy (Vaughn et al., 2013). Researchers found large effect sizes for self-reported aggressive behaviors including getting into serious fights at school or work and violent aggression for highly truant youth who had skipped more than four days of school in the past thirty days. A 1995 report which described the high school performance of students with a special education classification of a serious emotional disturbance, often characterized by frequent aggressive behavior, revealed that this group of students was frequently absent, missing on average more days in comparison to any other category of classified students (Wagner, 1995). Students classified as having a serious emotional disturbance were also more likely to dropout than the general population, had lower GPA's, and failed more courses than both students with other disability classifications and the general population.

Course performance and attendance are educational outcome variables highly predictive of high school dropout and often used to track a student's progress (Bruce et al., 2011). Numerous studies have shown that students rated as aggressive by their parents and teachers are absent more often from school and have lower grades in comparison to their non-aggressive peers at different points throughout their educational careers. Dropout has been described as a cumulative process of gradual disengagement. Low grades and absences can be used as warning flags for when a student is becoming disengaged from school and at risk for dropout. While it is known that aggressive kids get lower grades and are more frequently absent, there is little

research which examines the path aggressive students take toward disengagement and specifically analyzes when in the course of their educational careers aggressive students are more frequently absent and when their academic performance begins to decline.

Peer and teacher relationships. There is also research that examines the effect of aggressive behavior on peer and teacher relationships and whether the impact of aggressive behavior on these relationships explains the association between aggression and negative educational outcomes.

A 1990 longitudinal study examined the efficacy of measures of preadolescent aggressive behavior, peer rejection, and school functioning in predicting adolescent delinquency and school maladjustment (Kupersmidt & Coie, 1990). The sample consisted of 112 5th graders followed for seven years from 5th grade through the end of high school. The sample was 69% White and 31% African American. Peer-rated aggression, as reported by a student's classmates, along with frequent school absences, was a significant predictor of early school withdrawal. A longitudinal study from 2006 investigated the pathways students rated as aggressive by their peers take towards school maladjustment (Graham et al., 2006). The sample (N=1,985) was recruited from eleven different middle schools in Los Angeles and was 46% Latino, 26% African American, 11% Asian and 9% White. Sixth grade students rated as aggressive by their peers were at risk for various school problems. Children viewed as aggressors tended to perceive the school rules as unfair and this perception was related to low GPA and teacher reported student disengagement.

A 2003 study examined the link between peer relationships and educational outcomes (Risi et al., 2003). The sample (N=524) came from eight different elementary schools in a small

metropolitan community in the Southeastern United States. Subjects came from both low and middle SES backgrounds. Only Caucasian and African American students were included. Subjects were followed for ten years beginning in the grades 3, 4 or 5 through high school graduation. Results showed that lower social preference and elevated aggression were both associated with lower graduation rates. However, after previous academic achievement and being over age for grade were included in statistical models, only peer-rated aggression significantly added to the prediction of high school dropout.

A recent study examined how reactive and proactive aggression are uniquely related to academic performance (Fite et al., 2013). The sample (N=147), consisting of students attending a community-based after school program, was predominantly African American, from low income families and ranged from ages five to thirteen. Reactive aggression as rated by a director of after-school programming was negatively correlated with academic performance while proactive aggression was not. Additionally, levels of peer rejection, also rated by an after school director, accounted for the link between reactive aggression and levels of academic performance.

A longitudinal study published in 2008 examined different explanations for the negative association between aggression and academic achievement (Stipek & Miles, 2008). Subjects were followed from kindergarten or first grade through 5th grade. The sample (N=403) was 35% African American, 34% White, and 28% Latino and came from families whose income level was below the federally established poverty line. Growth curve analyses were used to test the hypothesis that the effect of aggression on achievement is mediated by teacher-student relationships. The growth curve analyses showed that changes in aggression significantly predicted changes in the amount of teacher-child conflict, which in turn predicted changes in students' engagement, which predicted changes in students' achievement. These results support

the hypothesis that aggressive children tended to develop negative relationships with their teachers, and that these conflictual relationships as reported by teachers, partially mediate the link between aggression and academic achievement.

Student misbehavior and exclusionary discipline. As expected, aggressive students are also more frequently subjected to exclusionary discipline practices, including suspensions and expulsions. Children rated as aggressive by their peers in the 5th grade were at higher risk for a non-specific negative outcome in high school including suspension from school for disciplinary reasons, truancy, grade retention, as well as early school withdrawal (Kupersmidt & Coie, 1990). A 2008 study used a sample (N=678) of predominantly low-income African American children attending Baltimore public schools to examine the connection between academic and behavior problems in elementary school and outcomes in the 6th grade (Reinke et al., 2008). Results indicated that students rated as having behavior problems by their teachers in elementary school, including being aggressive towards their peers, were seven times more likely to be suspended from school in the 6th grade as compared to students without behavior problems. In a separate study of Baltimore students (N=1,339), researchers investigated the effect of aggressive behavior and classroom behavioral context, assessed in the 1st grade, on the timing of first school removal across Grades 1–7 (Petras et al., 2011). Aggression was positively related to the odds of being suspended. Interestingly, the study found that aggressive students in classrooms characterized by low levels of aggression had higher odds of being suspended in comparison to aggressive students in classrooms characterized by high levels of aggression. Researchers attributed this unanticipated finding to the possibility that teachers in classrooms

composed of highly aggressive students develop higher tolerances or have a higher threshold for what is considered “removable” behavior.

In summary, these studies reveal that children who are aggressive in schools have difficulty in their relationships with peers and teachers, are more likely to get in trouble at school and exhibit deficits in academic achievement. Some of these studies have shown that even after controlling for being age for grade and academic ability, being seen as aggressive by peers is related to academic achievement and risk for dropout. There is extensive research which investigates how difficulty in relationships with peers and teachers are related to student disengagement and eventual dropout, yet these variables have not been examined as part of a detailed analysis of the paths of student disengagement taken by aggressive students who eventually dropout.

Grade retention. Grade retention refers to the practice of non-promotion of students to the next grade level upon completion of the school year (Jimerson, Carlson, Rotert, Egeland, & Sroufe, 1997). School districts utilize grade retention with the idea that giving students increased time to master skills and concepts needed in later grades allows them to mature socially, and perform better academically (Natale, 1991). Research has been conducted which identifies factors associated with the decision to retain children. Academic performance and the cognitive ability of the child, the adults involved in making the decision to retain, demographic factors, and parent characteristics are all factors involved in the decision to retain. There is also a substantial amount of research on the association between a child’s behavior problems and retention. In a 1984 study, researchers found an elevated risk for grade retention and special education placement among aggressive elementary school aged children (Ledingham & Schwartzman,

1984). Children rated by peers as aggressive-withdrawn or aggressive were more likely to have failed a grade or to be placed in a special education class compared to withdrawn children or controls. A 1997 study of children in Minneapolis, compared a group of elementary school students who had been retained (N=29) to a group of students with similar levels of achievement and intelligence that had not been retained (low achieving, promoted group) as well as to a control group (Jimerson et al., 1997). The sample was predominantly White. In comparison to the low achieving, promoted group, the retained students were rated by their teachers as showing significantly more maladaptive classroom behaviors and were ranked lower in terms of emotional health, peer acceptance and popularity. In addition, the retained children missed a significantly greater proportion of school days. The researchers suggested that perhaps the students were perceived as poor students because of their maladaptive behavior in the classroom. A 2002 longitudinal study by the same author which followed a sample of students from a small rural predominantly White county in Wyoming, compared the characteristics of students who were retained early in their academic careers and subsequently dropped out as compared to students who are retained and did not drop out (Jimerson, Anderson, & Whipple, 2002). Subjects were students who had been retained in Kindergarten, first or second grade (N=58). The social-emotional characteristics of these students were rated by teachers in Kindergarten, the 2nd grade and the 8th grade. Data revealed that the retained group who dropped out displayed more aggression in the 2nd grade in comparison to the retained group that did not drop out. The retained group who dropped out also was rated by teachers as more aggressive in the 8th grade.

A recent analysis of longitudinal data on 9,594 kindergartners from fifty-five schools in four demographically diverse locations (Nashville, TN; Durham, NC; Seattle, WA; and rural central PA), found that even after controlling for cognitive skills and attention levels, levels of

aggression in kindergarten contributed uniquely to retention in the secondary grades as well as uniquely predicting placement in a self-contained special education classroom and being classified as having a Behavior Disorder (Bierman et al., 2013).

In summary, research has consistently revealed a link between measures of aggressive behavior and educational outcomes even when controlling for cognitive levels and attentional factors at the beginning of formal schooling. Aggressive children are at a high risk for negative educational outcomes including poor grades and low academic achievement, chronic absenteeism, behavior problems and suspensions, grade retention and ultimately school dropout. Negative peer and teacher relationships have been identified as potential mediating variables which explain the link between aggression and negative educational outcomes. While the research shows that aggressive students are at risk for a host of negative educational outcomes, less is known regarding when in an aggressive student's educational career these warning flags first appear, although one large study did find that increased levels of aggression were predictive of school difficulties as early as kindergarten (Bierman et al., 2013), and which of these warning flags best explain the link between aggression and school dropout. Also, to this date, there is no research identifying which of these variables may moderate the risk for dropout amongst aggressive students.

Educational Factors Related to Dropout/Completion

Development of early warning systems. As previously described, the consequences for dropping out of high school are immense on both an individual and societal level. Motivated by the desire to reduce the profound impact of the national dropout crisis in the United States, researchers have searched for warning signs within data routinely collected by school districts

that identify students who are gradually falling behind and likely to drop out of high school. By identifying these students as early as possible, schools can then provide them with appropriate supports and sustain these supports in order to keep these students on-track towards earning a high school diploma (Bruce et al., 2011). A recent push by schools, especially over the past decade, to use data collection and analysis to influence student outcomes has aided schools in identifying which students are on track to graduate, and those who are falling behind, early enough to provide appropriate interventions. Analysis of this data has revealed that a student's decision to drop out of high school is a slow process of disengagement over the years and that warning signs are detectable well before students decide to dropout (Bruce et al., 2011). This section reviews studies which identified variables most predictive of dropout and describes how researchers have used these variables to create systems that use data readily available to schools to predict which students are at high risk for dropping out.

Based on their work starting in the mid 1990's, researchers from the Consortium on Chicago School Research, the Center for Social Organization of Schools at Johns Hopkins University, and the Philadelphia Education Fund have identified the variables that best predicted future high school dropout. Based on their findings, they developed the Early Warning Indicator and Intervention Systems (EWS) that use data to identify students who are off track for high school graduation, so that educators can appropriately support them in promotion from grade to grade, and eventually in graduating from high school with their class (Bruce et al., 2011). This group of researchers identified three key variables – attendance, behavior, and course performance that were better predictors of outcomes than student demographic variables or their scores on standardized tests. These findings have been validated in longitudinal studies using

data from states and large school districts. Researchers have also identified consistent thresholds for these indicators (Bruce et al., 2011).

In 2005, researchers at the University of Chicago Consortium on Chicago School Research (CCSR), led by Elaine Allensworth and John Easton, published a report describing their findings based on longitudinal research of students from the Chicago Public School System. This report described how they developed an indicator of whether students were on track to graduate at the end of their first year in high school. For a cohort of students who entered a Chicago Public Schools high school in 1999, 81% of the students who were classified as “on-track” at the end of 9th grade graduated after four years, while only 22% of the “off-track” students graduated in four years. Eighty-five percent of the students who were “on-track” graduated after five years compared to 28% of the “off-track” students. This “on-track indicator” was a measure which included two variables: whether students had gained sufficient credits to move on to 10th grade and had failed no more than one semester of a core course (Allensworth & Easton, 2005). This simple on-track indicator was a better predictor of eventual graduation than standardized test scores. It was also a better predictor than many student demographic characteristics that research has shown are strongly associated with educational outcomes. In fact, this on-track indicator was a better predictor of who graduated from Chicago schools than a statistical model that included 8th-grade reading and math test scores, gender, race, age when students entered high school, socio-economic status, and student mobility during middle school as predictors of high school graduation. While the on-track indicator was a powerful predictor of who would graduate, it could only categorize students as on-track or off-track and therefore lacked the necessary details to aid in development of tailored intervention plans for struggling students (Allensworth & Easton, 2007).

A second report by the same researchers in 2007 showed that certain student behaviors, especially course attendance, could explain why a youth went off-track. Their research showed that students failed classes because they did not attend or put forth the necessary effort. This finding was true for students with both high and low test scores, and students from both high and low-poverty neighborhoods. They also found that GPA was as powerful of a predictor as the on-track indicator. A student's GPA, course failure rates, and absences in the 9th grade were all highly predictive of graduation four years later. The researchers described how this information is more useful than the dichotomous on-track indicator alone as data on grades are available after the first quarter of a school year, and attendance from the first week so schools could identify students at risk for dropout well before the end of the school year, when it may already be too late (Allensworth & Easton, 2007).

In 2006, Ruth Curran Neild and Robert Balfanz, both researchers at the Center for Organization of Schools at Johns Hopkins University, published a report which detailed their research examining the dropout crisis in Philadelphia's public schools from the years 2000 through 2005. This report focused on 9th grade as a critical juncture on the path towards high school graduation. These studies found that 9th grade was a "make-or-break" year for many, even after accounting for a variety of 8th grade risk factors related to a student's social background, previous academic performance, and school engagement. They also found that more dropouts left during the 9th grade than in any other grade level. However, fewer than 5% of dropouts left during their first year in high school, indicating that most dropouts had been retained at one point and spent more than one year in the 9th grade; the most common number of years spent in the 9th grade by dropouts was three years. The study found that risk factors such as being over age for grade, having reading and math scores significantly below grade level, poor

8th grade attendance, and having failed courses in middle school all increased the likelihood that the students would not pass the 8th grade. However, the number of times a student was absent during the first thirty days of 9th grade better predicted future dropout than any of the previously mentioned 8th grade factors (Neild & Balfanz, 2005).

Subsequent analysis of data from this Philadelphia cohort was conducted to identify middle school risk factors for falling off-track and to see how early in their academic careers middle school students could be identified as high risk for falling off-track in the 9th grade (Neild et al., 2007). Students were followed longitudinally from the 6th grade through one year following their on-time high school graduation date. The impact of “high-yield” risk factors, defined as factors for which more than 75% of students over a certain threshold for this factor did not proceed to 12th grade on time, was examined. Results indicated that four of the 6th grade risk factors; low attendance (80 % or lower), a failing mark for classroom behavior, a failing grade in math, and a failing grade in English predicted that students would fall off-track to graduation and that 6th graders with any one of those risk factors had only a 10% chance of graduating on time and at least a three in four chance of dropping out of high school. Using these previously identified risk factors, they found that they could predict nearly half of Philadelphia’s dropouts by the 6th grade.

Researchers at the Center for Social Organization of Schools at Johns Hopkins University, using data collected while working with middle and high schools that serve low-income students throughout the United States, have repeatedly found that the transition to middle school is a critical and often perilous transition (Balfanz, Herzog, & Mac Iver, 2007). They found that students who did not successfully transition into middle school, as evidenced by poor and declining attendance, behavior problems and/or course failure in the 6th grade, rarely

graduated. For every hundred sixth graders who failed Math or English, only 11% graduated on time, and only 27% graduated after two additional years. Researchers concluded that a student's middle school experiences strongly affected their odds of graduating from high school. They stated that middle-schoolers, especially those who attended high poverty urban schools, are the "underperformers of the educational system" and it is during the middle school years that many of them fall behind academically compared to their peers from more socio-economically advantaged neighborhoods and begin to show signs of behavioral and emotional disengagement from school.

Beginning in 1999, researchers at Johns Hopkins University followed the pathways taken by students in the Baltimore public school system, focusing on a cohort of students (N=8,560) who were 6th graders in the 1999-2000 school year (Mac Iver, Durham, Plank, Farley-ripple, & Balfanz, 2008). Of these students, 85.7 % were African American, 12.9 % were White, and less than 1 % were from Asian, Hispanic, and "other" racial/ethnic groups and a majority of the students (85.4%) qualified for free and reduced lunch. They found that just one in three of the students in 6th grade in 1999-2000 graduated on-time from the district seven years later. They also concluded that chronic absenteeism played a critical role. They defined chronic absenteeism as a student missing at least one-ninth of the school days in which they were on a school's attendance roll and defined a more severe level of chronic absenteeism as when a student missed at least two-ninths of the school days. Among the 4,893 youth who were absent at the two-ninths level, only 16.5% graduated on-time. For the 2,244 members of the 6th grade cohort who were never absent at the one-ninth or two-ninths levels, 54.1% graduated on time. Surprisingly, the 1,423 cohort members chronically absent at the one-ninth level were more likely than the "never chronically absent" youth to have graduated on time. This surprising result led

researchers to conclude that normal academic progress is more important than chronic absenteeism, suggesting that academically talented students could slide through if they passed classes and got promoted, even if they skipped large amounts of school.

In a separate report, researchers from Johns Hopkins focused in on students who dropped out of Baltimore city schools from the 2008-09 school year to identify how they were similar (Mac Iver, 2010). They analyzed student-level data files on attendance, test scores, suspensions, and high school credits from 2008-2009 and the seven previous years going as far back as the 2001-2002 school year. They found that close to half (49.9%) of the dropouts enrolled in the district three years prior to their first 9th grade year were chronically absent, compared to 20.2% of graduates. With regards to the academic skills of the dropouts in the middle grades, results from standardized achievement tests indicated that only about one in four dropouts scored at proficient or above in reading compared to 54% of students who graduated. In mathematics, only one in ten dropouts scored at least proficient, compared to 30% of graduates.

The National High School Center, a research organization based at the American Institutes for Research, developed with the purpose of creating tools that can be used for high school improvement, has developed tools called the Early Warning System Middle Grades Tool and the Early Warning System High School Tool. Both can be used to identify students at risk for dropping out of high school in middle school and high school respectively (Heppen & Therriault, 2008). These tools use variables previously identified by research to be powerful in predicting which students eventually drop out of high school, including attendance and course performance. With regards to attendance, the early warning system monitors absences for 9th graders students based on a twenty day count and then quarterly. At any of these time points, students who miss more than 10% of instructional time are flagged for possible early

intervention. With regards to course performance, data on course failures, grade point average and the previously described dichotomous on-track indicator are utilized. This warning system flags students with one or more F's in any course for possible early intervention, and considers students with a GPA of 2.0 or less at the end of their first year of high school as at risk for dropping out. Finally, students who fail one or more core courses or accumulate fewer credits than required for promotion to 10th grade are considered off track for graduation. Students identified as off track at the end of their first year of high school are considered at risk for dropping out of high school and are targeted for intervention.

In summary, research on the development of early warning systems has proven that using readily available data, educators can identify students who are at risk for dropout very early in their academic careers. Researchers have consistently identified chronic absenteeism, GPA and course failures in English or Math as highly reliable predictors of dropout that can predict a significant proportion of students who will eventually dropout as early as the 6th grade. This research has spear-headed numerous similar studies using data from school districts with varying demographic characteristics across the country which identifies the variables that schools can use to identify students who are becoming disengaged and at-risk for dropping out. Studies which examine how middle school educational outcomes can be used to identify students who are becoming disengaged and are at-risk for future dropout are reviewed in the next section.

Middle school indicators of student disengagement and dropout. The relationship between measures of middle school performance and 9th grade attendance GPA and course completion was analyzed in a sample of 416 students transitioning from middle school to a large suburban high school in a 2009 study (Mckee, 2009). The high school which the subjects

transitioned into identified 35 % of students as an ethnic minority, including 16% Asian-American, 16% Hispanic, and 3% African- American. Approximately 25% of the students received free or reduced lunch. This study examined the relationship between twelve different middle school indicators and attendance, course completion and GPA in the 9th grade, three factors proven to be powerful predictors of high school dropout. These twelve middle school warning indicators were the student's grade-point average, the number of D and F grades they received, number of suspensions and expulsions, attendance rate, scores on *Oregon's Assessments of Knowledge and Skills* (OAKS), which are state-wide assessments in reading and math and scores on four *ACT Explore* tests, which is a national assessment program that assesses 8th and 9th grade students in English, Mathematics, Reading and Science. Students were categorized as at-risk vs. non-risk based on cut-offs for the twelve middle school academic indicators. Students with six or more at-risk indicators were identified overall as at-risk for school failure. The study described which middle school indicators predicted the three 9th grade variables separately. For 9th grade attendance, there were three predictors: middle school attendance, middle school grade-point-average, and scores on the ACT math exam. Of these three predictors, middle school attendance was the strongest predictor of 9th grade attendance as students who had an attendance rate lower than 90%, were also found to have difficulty with high school attendance. Receiving a middle school grade of D, middle school grade-point-average, and ACT math exam scores were all significant predictors of 9th grade course failure, with receiving a middle school grade of D as the strongest predictor. The three strongest predictors of 9th grade GPA were receiving a middle school grade of D, middle school grade-point average, and middle school attendance. There were significant differences in the 9th grade outcomes between students who had been suspended or expelled in middle school and those who

had not. Suspended students earned a 1.814 grade-point average while non-suspended students earned a 3.084 average. They also found a marginal difference in attendance rates as suspended students attended nearly 94 % of the time while non-suspended students attended nearly 97 %. In summary, this study found that middle school grade point average, earning a D in middle school courses and standardized math achievement scores were all strong predictors of 9th grade performance that could help identify students who are at-risk for failure upon transitioning to high school.

Using a sample of 10,093 6th grade students during the 2001-2002 school year in Florida's Duval County Public school system, researchers aimed at isolating the academic and social factors that may be used as "flags" to identify which 6th grade students are at high risk for future dropout (Wilburn et al., 2009). These students were followed longitudinally through the end of the 2007-2008, which was their 12th grade school year. The ethnic breakdown of students was 47.7% White, 44.3% African-American, 3.7% Hispanic, 2.8% Asian-American, and 1.3% Multi-racial. Data for 5,015 of the students indicated that 94% qualified for free or reduced lunch. Results from the study identified five reliable indicators that either alone or in combination predicted 81.52% of the 6th grade cohort that did not graduate on-time. Standardized math and reading test scores, failing course grades in Mathematics, failing course grades in English/Language Arts and excessive absences were all statistically significant predictors even after controlling for other factors. Results indicated that 30.2% and 28.1% of 6th graders who failed a Mathematics or English/Language Arts course, respectively in the 6th grade failed to graduate on time. With regards to school attendance, 12.2% of the 6th graders who did not graduate on-time were absent more than 20% of the scheduled school days. Serious "code of conduct violations" were defined as behaviors that involve physical assault, weapons and the use

and/or possession of illegal drugs which in the vast majority of cases, resulted in either automatic suspension, removal from home school or assignment to an alternative school for a period of forty-five to ninety days. This flag only identified 6.7% of the 6th graders who failed to graduate on-time. However, since there were very few of these violations occurring in 6th grade for this sample, only 3% of the sample had one of these violations, it was expected that the percentage of students that could be flagged by this indicator would be relatively small. The researchers concluded that many 6th graders show signs of school disengagement, and that there is an ample amount of routinely collected data from schools that can validly flag 6th graders who are at risk of failing to graduate high school on time.

Data from a sample of 340 students from a school system in northwest Georgia who entered 9th grade in 2005 was analyzed to determine if a student's dropout status could be predicted by a set of 8th grade variables (Logan, 2010). This sample of students was from a county whose population, according to the 2009 census, was predominantly Caucasian (95.1%) and whose median household income was slightly below the state average. The 8th grade predictor variables analyzed included scores on the *Criterion-Referenced Competency Test* (CRCT) which is a series of standardized tests used by Georgia to assess academic achievement in math, reading, language arts, science, and social studies; gender; final course grade for math; final course grade for English; whether a student is in special education classes, gifted classes or neither; number of absences; number of discipline referrals; number of times a student has been retained; and enrollment in a free/reduced meals program. Results revealed that the number of years retained was the most powerful for predicting high school dropouts in logistic regression models. While not as highly correlated with graduation status, the number of discipline referrals demonstrated a high predictive power in logistic regression models containing the other predictor

variables. Absences were also highly correlated with graduation status. Absences, however, were not significant in logistic regression models containing the other predictors. Logistic regression analyses produced a final model with a 91.5% classification rate for predicting the outcome variable of the study; high school graduation or dropout. The model included six significant predictor variables, ordered here in descending significance: the number of years retained, number of discipline referrals, enrollment in the free/reduced meals program, 8th grade final math grade, CRCT math score, and absences. This study provides further evidence that readily attainable middle school data, in this case data from the 8th grade, can be effective in identifying which students have fallen off track and are at risk for dropping out.

In a 2012 report, researchers described the development and validation of a measure of academic behavior designed to determine a student's level of academic risk (Casillas, Robbins, Allen, Hanson, et al., 2012). This measure assessed key elements of academic behavior including motivation, social engagement, and self-regulation. Using a sample of 4,660 middle school students from twenty-four schools and thirteen districts, the researchers attempted to model 9th grade GPA based on multiple middle school predictors in addition to their assessment of academic behaviors. A majority of the participating students spoke English as their primary language (98%) and were Caucasian (62%). The majority of the students were enrolled in 8th grade (83%), with the remainder enrolled in 7th grade. The predictor variables analyzed were placed into five categories: a) prior academic achievement including course grades and scores on standardized achievement tests, b) academic behaviors including motivation, social engagement, and self-regulatory factors, c) observable behavioral indicators including time spent on homework, absenteeism, school mobility and number of times a student was retained, d) school factors including average class size and percent of students eligible for free/reduced lunch, and e)

demographic factors including gender, race/ethnicity, and parental education. The effect of these variables on high school performance, operationalized as grade point average in the 9th or 10th grade, was measured. Results from linear regression analyses indicated that middle school grades and standardized achievement scores were the most powerful predictors of high school academic success. A measure of academic behaviors added substantial incremental validity to the prediction of academic success in high school as did demographic and school level factors. In a linear regression model containing all of the predictor variables, prior grades and standardized achievement scores were the most powerful predictors of high school GPA. These results provide further evidence that middle school academic performance is a powerful predictor of a student's high school success and also suggest that academic behaviors, which can be improved through intervention, are also useful in predicting high school performance.

In a study published in 2008, Silver and colleagues analyzed district data from the Los Angeles schools to track the educational progress of students (N=48,561) from the 6th grade through to their expected graduation date and identify the school-related factors related to high school persistence and graduation (Silver et al., 2008). The results were consistent with previous research which revealed that there are various indicators present in middle school that determine if a student is on track for graduation. In summary, they found that academic experiences and school factors are far more important than student demographics in predicting graduation rates. Additionally, some schools are better than others in graduating populations of students whose odds of graduation are typically quite poor. Specifically, the study found that students who attended middle schools where more than one-fifth of the teachers were not fully certified, graduated from high school at lower rates (51%) than did students who attended middle schools without such severe shortages of fully certified teachers (63%). With regards to academics,

students who failed a core academic middle school course demonstrated lower rates of high school completion. For attendance, students that dropped out of high school were absent, on average, twice as often when they were 7th and 8th graders compared to students who graduated on time (14-15 days compared to seven days per year). Performance on middle school standardized tests was positively related to high school graduation rates. Mobility was also a significant predictor as students who changed schools between 6th and 7th or 7th and 8th grades had considerably lower graduation rates from high school than students who did not change middle schools. In addition, graduation rates were close to half as less for those students who were over age for grade when they entered the 9th grade. In conclusion, researchers have shown that poor grades, absences, previous grade retentions, and behavior problems in middle school are all warning flags for student disengagement and are highly predictive of continued problems in high school and eventual dropout.

Timing of student disengagement and dropout. While numerous studies examine predictors of future dropout, not all of these studies capture dropout as a process of student disengagement that occurs over time or analyze the timing of when a student drops out as a significant variable. The next studies that will be summarized in this review have taken into account the timing of when a student falls off-track. They investigate not only which factors predict dropout but also the timing of these factors.

In a study published in 2010, Bowers utilized the statistical procedures of survival analysis and discrete time hazard modeling to account for the longitudinal nature of a student's decision to drop out of school (Bowers, 2010). The study used teacher assigned grades from grades one through twelve to predict which students were at risk of dropping out and identify the

time points when students are most at risk of dropping out. Teacher assigned grades were calculated as non-cumulative GPA by calculating the mean GPA for all subjects within each grade level. Non-cumulative GPA was used instead of cumulative GPA as the researchers hypothesized that cumulative GPA does not capture the inherent variation in data that could occur within any one year, which indicates that a student is having difficulty at that time point in school. The efficacy of other time variant variables such as retention and the number of low and failing grades as predictors was also compared to how well teacher assigned grades predicted dropout. Time invariant variables such as gender, ethnicity and school district were controlled for. The sample for this study was 193 students from two schools located in the Midwestern United States whose on-time graduation date was the year 2006. One of the schools was 70% economically disadvantaged, with an ethnic breakdown of 50% Hispanic, 30% European American, and 15% African American. The other school was 50% economically disadvantaged, with an ethnic breakdown of 50% European American, 20% Hispanic, and 15% African American.

Hazard estimates of dropping out indicated that no students dropped out until grade seven, at which point the probability of dropping out rose to 2.6%. The percentage of students at risk of dropping out increased year after year, leveling off across Grades 8–10 at about 4%, reaching its highest at 9.4% in grade eleven and then dropping to 3.6% in Grade twelve. Grade eight and grade eleven were found to be the two years with the highest risk of dropping out with hazard estimates of 4.4% and 9.4%, respectively. The most important finding of the study was that non-cumulative GPA accounted for much of the variance in the probability of a student dropping out of school, more so than grade level, gender, ethnicity, district, or total number of D and F grades that the student received. A logistic regression model containing non-cumulative

GPA and whether or not a student had been retained as predictors explained over 50% of the variance in the probability of a student dropping out of school. This model did not include any time-point parameters, indicating that at any grade level a student's risk of dropout in this sample can be predicted by the student's retention status and noncumulative GPA. Retention was a powerful predictor as results revealed that after the 6th grade, students retained at any time were 10.2 times more likely to dropout than were students who are not retained. The researchers concluded that non-cumulative GPA, examined from Grades 7–12 is a significant and effective predictor of student dropout.

A 2012 study also utilized survival analysis to identify key predictors of high school graduation for a sample of 8,948 first time 9th graders from a large West Coast metropolitan school district (Pharris-Ciurej, Hirschman, & Willhoft, 2012). The sample included four cohorts of students who first enrolled in the 9th grade from 1996 to 1999, and were tracked for at least six years after entering 9th grade. The ethnically diverse sample was 57% White, 20% African American, 15% Asian, with the rest of the sample consisting of Hispanics, American Indians, and Pacific Islanders. Roughly 42% of the sample was from homes with family incomes of less than 185% of the federal poverty level. Researchers analyzed the effect of social, demographic, and economic risk factors on the level and timing of high school attrition. Schooling variables including prior school retention, 8th grade GPA, and educational placement by type of English class (honors, special education, ESL or regular) were added into regression models as covariates to measure how much prior educational experiences mediated variability in high school graduation. Data analysis revealed two major findings; a high prevalence of failure in high schools and that early academic failure, termed the “9th grade shock” was predictive of on-time graduation. Analysis of yearly enrollment data showed that only 45.7% of the sample graduated

“on time” four years later. About one-third or more of retained students did not enroll the next year (35% of expected 10th graders, 41% of expected 11th graders, and 34% of expected 12th graders). Students who managed to remain on-track for four years, had more than 90% probability of graduating in four years. Ninth grade GPA had a very strong impact for on-time high school graduation as it added significantly to the predictive power of a regression model that contained all of the variables previously described. Students with a GPA between 1.0 and 1.99 had one-seventh the odds of graduating compared to students with a GPA greater than 3.0. Ninth grade GPA mediated the effects of social factors and prior school experience (measured by 8th grade GPA), but also had a powerful direct effect on high school graduation. This finding led researchers to conclude that the transition to high school is a shock to many students as the data showed that many who performed well in 8th grade still failed in the 9th grade.

A study published in 1995 examined middle school individual and institutional level predictors of dropping out in middle school (Rumberger, 1995). Data for the study came from the National Education Longitudinal Survey of 1988 (NELS:88), a comprehensive survey of students, teachers, schools, and families. The nationally representative sample for this study (N = 17,424) consisted of students who were surveyed in the base year of 1988, when the students were enrolled in the 8th grade and then were re-surveyed in 1990, their expected 10th grade year. Students that either were still enrolled or had dropped out before 1990 were re-surveyed. Individual-level academic background variables analyzed included whether the student had ever been held back in school, the number of times that the student had changed schools since first grade, and whether the student had “stopped out of school” between the 8th and 10th grade (defined as dropped out or had an unexcused absence of 20 days or more, but returned to school). In addition, a measure of academic engagement was created using 8th grade

measures of student attitudes, behaviors, and academic performance measured by GPA and a composite of standardized test scores in reading and math. Other individual-level variables analyzed included student demographics and family background variables. School-level variables measured included student composition of schools the subjects attended, structural characteristics of their schools including school size and student-teacher ratio, and school organization and climate variables, including the mean student report of teacher quality, the mean hours of homework students report, the percentage of students taking algebra or other advanced math courses, the mean level of parental participation, the percentage of students who felt unsafe in the school, and the percentage of students who felt the discipline is fair.

Hierarchical logistic regression modeling was used to measure what factors influence a student's decision to drop out of middle school. Amongst the school level variables, the mean socio-economic status of the school's students and a dichotomous variable indicating that the school population had a high percentage of minorities were predictive of dropout. Additionally, a variable that measured the percent of students who reported that they thought the discipline policy in the school was fair was predictive of dropout. They found that a one-standard deviation increase in the proportion of students who report a fair discipline policy reduced the mean odds of drop-out by 21%, suggesting that attending a school where students feel that the discipline policy is fair lowers the odds of dropout. At the individual level, academic variables were highly predictive of 8th grade dropout. Retained students were more than eleven times more likely to drop out than non-retained students. Eighth grade academic performance predicted dropout, as having a one-point higher grade point average reduced the predicted dropout rate by more than 70%, and a one-standard-deviation increase in test scores reduced the odds of dropping out by

more than two thirds. After controlling for student demographics, moderate and high absenteeism, and behavior problems, grades remained highly predictive of dropping out.

Researchers investigated the timing and reasons for high school dropout in a study of all students who dropped out of North Carolina public schools during the 1998 school year including 9th, 10th, 11th and 12th graders (Stearns & Glennie, 2006). Data was not available on the socioeconomic status for this sample of dropouts. Data analyzed included gender and ethnicity, their school, age, and grade at the time of dropout, and the student's reasons for dropping out. Reasons for dropping out, as determined by school records, included: academic problems, disciplinary problems (suspensions, expulsions, and incarcerations), employment, family reasons (pregnancy, marriage, and caring for children), and attendance. Academic and disciplinary problems were categorized as push-out factors, which are factors that discourage students from continuing with their education, while employment, family, and moving reasons were pull-out factors, factors involved in a student's cost-benefit analysis of their economic interest to remain in or leave school. Hierarchical logistic modeling, which accounted for the clustering of students within schools, was used to examine the extent to which the reasons for dropping out varied by ethnicity and gender, grade level, and age. Dropout rates for each demographic group were highest in the 9th grade. Females had relatively constant dropout rates across the 9th, 10th, and 11th grades, which then fell off significantly in the 12th grade. The effect of academic factors on dropout became more significant later in students' high school careers, as only 6.54% of dropouts left the 9th grade because of academic reasons, while 10.44% of dropouts left the 12th grade because of academic reasons. Students were more likely to drop out in later grades than earlier grades for the reason of seeking employment. Dropout due to disciplinary reasons was most frequent in the 9th grade. Of the 9th grade dropouts, 10.66% left

for disciplinary reasons, while 4.30% of 12th graders dropped out for this reason. Family, moving, and attendance reasons were consistent through the high school career. African American males were more likely to be excluded from school for disciplinary reasons compared to any other ethnic or gender group in the 9th, 10th, and 11th grades. Latin American females in every grade were most likely to leave for family reasons. In the 9th, 10th, and 11th grades, Latino males and White males most frequently left school for employment reasons. Academic reasons led to dropout more frequently for White males than other ethnic and gender groups in the 9th, 10th, and 12th grades, but Latino males and females left for academic reasons more frequently in the 11th grade. With regards to dropping out for disciplinary reasons, there was a steady decline in percentage of African American and White male dropouts who leave school for disciplinary reasons as they get older. Among 16 year-old African American male dropouts, 22.13% left for disciplinary reasons, compared to 9.51% of African American eighteen year-old males. White females were less likely than White males to dropout for academic reasons. Contrary to their original hypotheses, researchers found that African American males and females were also less likely than White males to leave for academic reasons. Disciplinary reasons caused African American to dropout more frequently than White males, yet all groups of females were less likely than White males to dropout due to disciplinary reasons. In summary, pull-out factors such as employment and family reasons became more important as students got older and progressed through grade levels. Disciplinary reasons, a push-out factor, were most significant in the 9th grade and for African American males.

A 2011 study collected self-report data on grades and affective and behavioral educational outcomes for 3,312 students from rural North Carolina over a three and a half year period starting when the students were either in the 6th 7th or 8th grade (Witherspoon & Ennett,

2011). The sample consisted of students from nine different schools in two districts. The sample was 46% White and 54% African American, and as a measure of socio-economic status, 55% of students reported that their parents had graduated from college. Data collected included self-reports of grades, a measure of school belonging, perceptions on value of education, and self-reports of school misbehavior and participation in extracurricular activities. The study aimed to examine the trajectories of grades and affective and behavioral educational outcomes taken by these students from the middle school through the end of high school. The data indicated that levels of school belonging declined during middle school and across the transition to high school, then increased during 12th grade. Self-reported participation in deviant acts at school rose over time. Thirty-six percent of 6th graders as compared to 61% of 12th graders reported some form of school misbehavior. Self-reported grades and perceptions on the value of education remained fairly stable throughout the whole time period of the study.

In summary, there is evidence of an interaction between time and educational outcomes in predicting student dropout. There is evidence that different factors (i.e., push-out vs. pull-out factors), contribute to disengagement and dropout early in a student's academic career as compared to factors which predict later dropout. Ninth grade represents a difficult challenge, a time juncture where many students become disengaged and cannot recover. Previous grade retention has been repeatedly identified as a variable which is highly predictive of dropout.

Student behavior and exclusionary discipline. Many studies investigated the relationship between a student's behavior in school and educational outcomes. There is substantial evidence suggesting that a student's behavior problems and instances of being subjected to exclusionary discipline such as suspension or expulsion are powerful predictors of

high school dropout (Bowditch, 1993; Ekstrom & Rock, 1986; Lee, Cornell, Gregory, & Fan, 2011). Analysis of longitudinal data on dropout predictors for students attending Philadelphia public schools, found that a student's behavior, grades, as well as number of out of school suspensions, are highly predictive of drop-out (Garriot, 2007). Seventy-one percent of students who received one or more poor final behavior grades failed to graduate on time or one year after. Students who received one or more out-of-school suspensions rarely graduated on time (on average only two in ten). A student's risk of dropping out increased if they received more than one suspension. In a sample of students from a large southeastern school district, approximately one-third (35.2 %) of 9th grade dropouts had received a suspension of more than ten days in either 8th or 9th grade, compared with only 2.4 % of students who did not drop out (Sparks, Johnson, & Akos, 2010).. Also, 74.3 % of the long-term suspended students who dropped out had also been suspended for a short term.

In a 1996 study, Tobin and Sugai reviewed the middle school discipline records of 526 students from a predominantly White, working class suburban neighborhood in order to determine which types of discipline problems best predicted further discipline problems in high school and school failure (Tobin & Sugai, 1996). They collected data on multiple predictor variables including gender, grades, type of behavior problems (physical vs. verbal aggression), and consequences such as suspensions, special education status, and interventions used. Regression analyses were conducted using these predictor variables to examine their efficacy in predicting high school outcomes. They found that males with more than two incidents of violent, fighting type behaviors in the 6th grade and females with just one incident of violent, harassing type behaviors were not likely to be on track for on-time graduation. Discipline referrals early in middle school were effective in predicting school failure and identifying

students likely to have continued discipline problems through high school. Based on these results the authors recommended that a discipline referral in Grade 6, for either violent or nonviolent behavior, should prompt immediate intervention. Using a sample of 181,897 9th graders from the state of Florida, researchers found that suspensions attained in the 9th grade were directly related to students' high school and post-secondary outcomes (Balfanz & Fox, 2014). Results indicated that being suspended even once in 9th grade was associated with a two-fold increase in the risk for dropping out. Results also indicated that most of the students who were suspended were also either chronically absent in the 9th grade or experienced course failure, and continued to do so in the upper high school grades. The researchers interpreted these results to mean that for many students who are suspended in the 9th grade, the suspension is part of a broader array of indicators that the student has fallen off the path to high school graduation. In summary, these studies show that discipline problems in school as well as suspensions should be considered warning flags for student disengagement and are predictive of dropout.

Grade retention. There is also substantial amount of research which examines the efficacy of grade retention in promoting better student outcomes. Results are mixed and numerous studies have shown a connection between grade retention and future failure in school. A literature review of seventeen studies that examined high school dropout demonstrated that grade retention is one of the most powerful predictors of high school dropout (Jimerson et al., 2002). A separate literature review of thirty-six studies which focused on the most accurate predictors of dropout found that while there were many students in these studies who had dropped out and not been retained, the majority of the students who had been retained did dropout. For this reason, researchers described grade retention as a dropout predictor which has

high precision (Bowers, Sprott, & Taff, 2013). The National Center for Education Statistics gave a detailed report on characteristics of students from an 8th grade cohort in 1988 who were at-risk for school failure (Kaufman & Bradbury, 1992). This report found that students who had repeated an early grade (kindergarten through fourth grade) were nearly five times more likely to drop out between the 8th and 10th grades in comparison to those students who had not been retained. Students who were retained in the 5th through 8th grades were nearly eleven times more likely to drop out between the 8th and 10th grades in comparison to those students who had not repeated these grades. Jimerson (1999) followed a sample of 190 children from Minneapolis for twenty-one years into young adulthood and compared the educational outcomes of those students who had been retained once in either kindergarten, first, second or third grade to the outcomes of low-achieving students who still managed to get promoted (Jimerson, 1999). They found that the retained students had poorer outcomes in adolescence. Retained students had lower levels of academic adjustment at the end of 11th grade, were more likely to drop out of high school by age nineteen, were less likely to receive a diploma by age twenty, received lower education/employment status ratings and were paid less per hour compared to the group of low-achieving students that had never been retained..

Similarly, in a sample of 1,052 students from Fall River, Massachusetts, grade retention between the 1st and 6th grades was positively associated with drop out even after controlling for differences in background, post-retention grades, and attendance (Roderick, 1994). Students who ended the 6th grade over age for grade exhibited significant levels of disengagement during middle school. Nearly one quarter of the retained students dropped out, and retained students who remained in school had exhibited significant declines in attendance. In conclusion, retention at any point in a student's academic career puts students at-risk for future dropout.

Difficulties with Transitioning from Middle to High School

Multiple studies have shown that student grades drop as they transition from middle school into high school (Benner, 2011). Levels of school engagement also drop during this transition. Adolescents become less involved in school-related extracurricular activities, are absent more often, report greater academic hassles and are rated by their teachers as more disruptive and less academically engaged (Benner, 2011). Data from the Philadelphia Education Longitudinal Study (PELS) revealed that the 9th grade is a critical year in determining whether or not a student will graduate high school. About one third of the first-time freshmen in the Philadelphia public schools fail to accumulate the required number of credits to be promoted to the next grade (Neild & Balfanz, 2005). Sixty percent of the students who dropped out six years after starting high school did not get promoted after their 1st year in the 9th grade, compared to just 8% of those who graduated. Only 20% of the students who spent more than one year as 9th graders completed high school in six years (Neild, Stoner-Eby, & Furstenberg, 2008).

The transition from middle school to high school is sometimes referred to as the “9th grade shock” a phrase which captures the sudden changes in school environment which adolescents face when they make this transition. Middle school and high school environments are markedly different. Adolescents are undergoing many pubertal changes and also are expected to be much more independent by their parents at the time of this transition. There are multiple hypothesized explanations for why the transition into high school is difficult for so many students. One hypothesis is that many incoming students lack the necessary academic and social skills to meet the demands of high school. Many 9th graders in urban high schools enter with academic skills that are several years below grade level (Neild & Balfanz, 2006).

Compounding the problem, teachers certified in secondary school education, may

specialize in teaching advanced subjects such as algebra and literature, yet lack the training, materials and desire needed to teach students basic literacy and arithmetic skills (Balfanz, McPartland, & Shaw, 2002). Also, this transition disrupts prior relationships with teachers and peers. Students are pressured to make important academic and social decisions that influence their chances of getting into college, going directly into the workforce, or dropping out of high school. Students are less supported while making these decisions as high schools are often large, chaotic and impersonal as compared to middle schools which are more personal, supportive and structured (Cohen & Smerdon, 2009).

Integrative Summary

Longitudinal studies which examine the developmental trajectories of aggressive behavior consistently show that there is a small group of individuals who are consistently rated as aggressive through childhood, adolescence and into adulthood (Bongers et al., 2004; Brame et al., 2001; Broidy et al., 2003; Campbell et al., 2006; Côté et al., 2006; Nagin & Tremblay, 1999). Being a member of this “high stable aggressive” or “chronically aggressive” group is associated with a host of negative outcomes including later delinquency and criminality (Broidy et al., 2003). These children must attend school and negotiate the novel social and academic challenges that schools represent.

Aggressive students often do not fare well in school as research has indicated that they struggle in multiple domains of school functioning. Aggressive students have more difficulties with their peers (Fite et al., 2013; Graham et al., 2006; Risi et al., 2003) and teachers (Stipek & Miles, 2008), accumulate discipline referrals and suspensions (Kupersmidt & Coie, 1990; Petras et al., 2011; Reinke et al., 2008), are absent more often (Lounsbury et al., 2004; Maynard et al.,

2012; Vaughn et al., 2013; Wagner, 1995; Wood et al., 2012), have lower grades (Brook & Newcomb, 1995; Busby et al., 2013; Jiang et al., 2013; Kokko & Pulkkinen, 2000; Lounsbury et al., 2003; Masten et al., 2005; Thalji, 2010) and perform poorly on standardized tests (Deitch Feshbach & Feshbach, 1987). Aggressive students are also at high risk for being retained (Bierman et al., 2013; Jimerson et al., 1997; Jimerson & Ferguson, 2002; Ledingham & Schwartzman, 1984), an educational outcome strongly predictive of high school failure (Bowers, Sprott, & Taff, 2013; Jimerson et al., 2002; Jimerson, 1999; Kaufman & Bradbury, 1992). Most importantly, aggressive students are at a higher risk for high school dropout (Cairns, Cairns, & Neckerman, 1989; Ensminger & Slusarcick, 1992; French & Conrad, 2001; Kokko et al., 2006).

High school dropout has been described as a gradual process of cumulative student disengagement instead of a one-time event. The development of early warning systems allows schools to track student progress using readily available data and identify students who are showing signs of disengagement and are at risk of eventually dropping out. Researchers have identified three key factors – attendance, behavior and course performance - that are better predictors of student outcomes than students demographics or their scores on standardized tests (Bruce et al., 2011). Studies investigating variables which are the most powerful warning flags of dropout have shown that a significant proportion of dropouts can be identified in middle school, as early as the 6th grade (Casillas, Robbins, Allen, Hanson, et al., 2012; Logan, 2010; Mckee, 2009; Silver et al., 2008; Wilburn et al., 2009). In these studies, excessive absences, failing grades, student behavior problems and grade retentions in middle school were all predictive of who would eventually dropout.

There is also research which attempts to capture the longitudinal nature of student disengagement, identifying the points along a student's academic career at which they are the

highest risk of dropping out and which variables best predict dropout at these critical junctures. A student's 9th grade year, a year in which students are faced with numerous challenges associated with transitioning to high school (Benner, 2011) has been identified as a year in which many students who eventually drop-out struggle significantly and is considered a "make or break" year. Many students decide to drop out during their 9th grade year. The term "9th grade shock" has been used to describe the academic failure seen in many students across districts when they enter the 9th grade (Allensworth & Easton, 2007; Neild & Balfanz, 2005; Pharris-Ciurej, Hirschman, & Willhoft, 2012). There is evidence suggesting that the educational variables which are predictive of dropout are differentially related to dropout based on the timing of when a student drops out. Academic and disciplinary problems categorized as push-out factors, discourage students from continuing with their education and were more strongly associated with early high school dropout while employment, family, and moving reasons categorized as pull-out factors, were associated with later drop out.

To this date, there is still little research which examines sub-categories of dropouts and no research which examines aggressive dropouts as a sub-category. While we know that aggressive students are more often absent, get into more trouble, are more likely to be previously retained and get worse grades than non-aggressive students, there is no research to date which compares the paths of disengagement taken by aggressive students as compared to non-aggressive students. We do not know when aggressive students begin to show signs of disengagement in comparison to non-aggressive students. We also do not know if, attendance, grades, behavior problems or previous retentions are differentially predictive of dropout for aggressive students than they are for non-aggressive students. Aggressive students are more likely than non-aggressive students to have behavior problems and be subjected to exclusionary

discipline than non-aggressive students. Research has not yet examined if the suspensions accumulated by aggressive students or a possible interaction between suspensions and attendance or suspensions and grades account for their higher levels of dropout. Additionally, there is no research to date which examines the sub-category of aggressive students who graduate school on time. Examination of this group would be crucial in order to determine which educational variables moderate the risk for dropout associated with being aggressive.

In conclusion, every school will be faced with the challenge of educating a certain number of aggressive students, a group at high risk for negative outcomes and who often have difficulties with their peers and teachers. Due to the advent of early warning systems, schools will be able to identify students who are showing signs of disengagement and provide the necessary interventions. Knowledge of the unique patterns of risk for aggressive students, however, will help schools be prepared and intervene with this group in advance of the junctures where aggressive students may be more likely to fall off-track or intervene with regards to the variables that are most predictive of dropout for aggressive students.

Chapter 3:

Research Questions, Data Analysis Plan and Hypotheses

In this section, overall research questions examined in this study are proposed. For each research question, the methods of analyses are presented based on the hypotheses formulated for each research question.

Research Questions

Research Question I. What is the relationship between aggressive behavior and dropout?

The association between teacher and peer-rated aggression in the 6th grade, and dropout will be examined to determine the odds that participants categorized as aggressive will dropout in comparison to participants categorized as non-aggressive. This study will also examine the timing of high school dropout for aggressive students. The risk of dropout for aggressive participants will be compared to the dropout risk for non-aggressive participants in each year of the study to determine if risk for dropout is different year by year.

Research Question II. Which of the educational variables significantly correlated with dropout including absences, grade-point average, suspensions, retentions after the 6th grade and being Age for Grade upon entering the 6th grade are the most significant predictors of dropout after controlling for demographic variables such as gender, race and the middle school which the student attended? Is 6th grade aggression still a significant predictor of dropout after controlling for these educational variables which research has proven to be the most consistent predictors of dropout?

Research Question III. Are there any statistical interactions between 6th grade peer or teacher rated aggression and either absences, grade point average, suspensions, retentions or Age for Grade which are significant predictors of dropout? Are there any interactions between peer or teacher-rated aggression and demographic variables such as gender, race and middle school attended which are significant predictors of dropout?

Data Analysis Plan

Statistical methods selected to address RQ I and the rationale for the selection. In order to describe the nuanced relationship between aggressive behavior and high school dropout, a statistical method which could provide information as to whether and when high school dropout occurs and what leads to dropout was needed. Survival analysis (Singer & Willett, 2003), which is a longitudinal data analysis strategy that examines event occurrence (high school dropout) sequentially among students eligible to experience the event at discrete points of time (academic years), was chosen in order to describe this relationship.

To correctly use a survival analysis approach, a target event, a clear beginning of time when no one in the data set has yet to experience the target event, and a metric for clocking time, a meaningful scale in which event occurrence is recorded, all have to be established. These basic components of survival analysis are clearly defined in this study. The target event is high school dropout. The beginning of time where no one in the data set has yet to experience the event is the beginning of the 6th grade (Year 1). The metric for clocking time for this study will be complete academic school years. Each academic school year, seven in total, will be considered a discrete time interval with the end of the academic year marking the end of the time interval. Although a subject could dropout at any time point during an academic year, dropout is

conceptualized as an event that happens during the particular time interval in which the event occurs (the academic year the subject drops out).

Survival analysis examines the risk of event occurrence for individuals still at risk of the event during each discrete time interval instead of aggregating all years in the dataset. Censoring is used to remove participants no longer at risk of experiencing the event from the dataset. For this study, participants who have dropped out and are therefore no longer at risk of dropout in subsequent discrete time intervals are censored. Censoring will also account for participants who transfer to different school districts according to enrollment files. Participants for whom there is no longer data on enrollment after a certain year for unknown reasons are also censored.

The life table will be used to describe the sample distribution of dropout. The life table tracks the event histories of participants from the beginning of time of the study (6th grade, Year 1) through the end of data collection. The life table is divided into a series of rows which represent each time interval and columns which provide information on the number of participants who entered the interval, experienced the target event during the interval, and the number of participants who were censored at the end of the time interval. In this study, data will be collected at seven different discrete time points representing seven time intervals corresponding to seven academic years (6th grades through 12th grade) for which data was collected. The number of participants who entered each time interval equals the number of participants from the original sample still enrolled in school at the beginning of the academic year. The number of individuals who experienced the target event during the interval is equal to the number of students who dropped out. Finally, the number of participants censored at the end of the time interval equals the number of participants who dropped out as well as participants

who transferred to a different school district or participants for whom there was no enrollment information provided after they year they were censored.

To create life tables, the data set was first converted from a person-oriented dataset in which all of each individual's data is in a single row into a person-period dataset in which there is a separate row for each time interval when a subject is enrolled and therefore at risk for dropout. In this study, each subject could have a maximum of seven records corresponding to the seven time intervals in which data was collected. If a subject was censored from the study, due to either dropping out or transferring and thus leaving the data set, they would have data records through the year they were censored from the study. For example, if a subject dropped out in Year 4 of the study they would have four data rows. In the person-period dataset each individual has a separate record for each discrete time period when they were at risk of event occurrence. For this study, in which 685 participants were followed for a maximum of seven years, there were a total of 3954 data records.

Using the person-period data set, values for all rows and columns of the life table are calculated by running a cross-tabulation of the variables *PERIOD* (year of the study) and *EVENT* (dichotomous variable coded 1 if subject dropped out in that year or 0 if they did not). Cross-tabulation of these two variables in the person-period dataset calculates the number of participants who experienced the event in each time period, the number of participants who did not experience the event and the number of participants at risk for experiencing the event in that time period.

The next step within survival analysis involves calculating the hazard and survivor function. The hazard function is the conditional probability that a subject will experience the

target event in a particular time interval given they did not experience the event in a prior time period. The hazard ratio represents the risk of event occurrence in each time period among those eligible to experience the event. In this study, the hazard ratio is used to describe whether and when dropout occurs. The estimated hazard probability shows the proportion of participants in each year still at risk of dropping out (i.e., all students who were still enrolled at the beginning of that academic school year) who did drop out of school within that time interval. This hazard ratio represents the percentage risk of dropout in each year of the study. The hazard function was graphed to facilitate identification of the trend of students experiencing dropout across years of the study. The hazard ratio is described as an “estimate” as it is an inferential statistic calculated based solely on the number of subjects who dropout in each year of this sample. The hazard ratio also does not take into account differences in hypothesized predictors and treats the sample as a homogeneous group of individuals. For these reasons the hazard ratio and survival probability, described below, are considered estimates.

The survivor function cumulates period by period risks of event occurrence together to calculate the probability that an individual will not experience the event or “*survive.*” The survival probability for each time interval is defined as the probability that an individual will survive past this time period. In years in which there is no censoring, the survival probability for a time interval can be calculated by taking the proportion of subjects who have not experienced the target event at the end of this interval over the total number of participants in the dataset. The survival probability cannot be calculated in this manner after participants have been censored. The estimated survival probability for a given year can also be calculated by multiplying the estimated survivor probability for the previous year by one minus the estimated hazard probability for that year.

Hazard and survivor functions for participants categorized as aggressive vs. non-aggressive will then be compared. This comparison will determine if the relative level of hazard is different for participants categorized as aggressive in the 6th grade compared to non-aggressive participants. Changes in the level of hazard can be identified by location of distinct peaks and troughs in the hazard function. Peaks will represent years of the study in which there is elevated risk of dropout while troughs represent periods of low risk. This analysis will help identify time periods in which aggressive students are most at-risk of dropout.

Statistical methods selected to address RQ 2 and the rationale for the selection.

Analysis of life tables and hazard plots will help pinpoint when aggressive students are most at risk for dropout. In order to better understand why risk of dropout may be higher for aggressive students, discrete time hazard modeling using logit regression is utilized. Discrete-time hazard models using logit regression are an effective strategy for analyzing data for this study. First, the outcome variable, dropout, is a dichotomous outcome variable, a feature necessary for the use of discrete time hazard models. Second, discrete time hazard models can include the effect of time on dropout risk. This study assumes that students experience school in discrete time periods, one year at a time, rather than as a continuous change over time. In summary, this study will use discrete-time hazard models to model dropout risk over a seven year period and analyze how aggression, as well as a variety of educational and demographic variables, differentially predict if and when participants dropout.

The predictors hypothesized to be related to dropout in this study are time, modeled as seven discrete time periods, each corresponding to a complete school year; the demographic variables ethnicity, gender, and middle school attended in the 6th grade; peer-rated aggression in

the 6th grade, teacher- rated aggression in the 6th grade, Age for grade prior to 6th grade and grade point average, suspensions, absences and retentions over all seven years of the study.

Grade point average, suspensions, absences and retentions are time-varying predictors that take on different values in each year of the study. Ethnicity, gender, middle school attended in the 6th grade, Age for Grade and both peer and teacher rated aggression are time-invariant predictors that have the same value in each period.

Discrete time hazard models are created to analyze how these variables predict dropout risk. The discrete time-hazard model for this study is best described by this following equation:

$$\text{Logit } h(t_{ij}) = [\alpha_1 D_{1ij} + \alpha_2 D_{2ij} + \alpha_3 D_{3ij} + \alpha_4 D_{4ij} + \alpha_5 D_{5ij} + \alpha_6 D_{6ij} + \alpha_7 D_{7ij}] + \beta_{\text{LATINO}} \text{ X LATINO}_i + \beta_{\text{FEMALE}} \text{ X FEMALE}_i + \beta_{\text{MIDDLESCHOOL1}} \text{ X MIDDLESCHOOL1}_i + \beta_{\text{PEERAGGRESSION}} \text{ X PEERAGGRESSION}_i + \beta_{\text{TEACHERAGGRESSION}} \text{ X TEACHERAGGRESSION}_i + \beta_{\text{OLDFORGRADE}} \text{ X OLDFORGRADE}_i + \beta_{\text{GPA}} \text{ X GPA}_{ij} + \beta_{\text{SUSPENSIONS}} \text{ X SUSPENSIONS}_{ij} + \beta_{\text{ABSENCES}} \text{ X ABSENCES}_{ij} + \beta_{\text{RETAINED}} \text{ X RETAINED}_{ij}$$

The population value of discrete time hazard, h , for person i in time period j is the probability of dropout in that discrete time period of the study. The equation's left side represents a transformed version of hazard. The value of hazard is transformed using a *log odds* or *logits* transformation. This transformation is made because the outcome variable of this study, dropout, is categorical, and there cannot be a linear relationship between the variables. The logit transformation converts a binary variable into a continuous one. This is done by first calculating the odds of the event happening for different levels of each independent variable, then calculating the ratio of those odds and computing the logarithm of that ratio.

The right side of the model includes two sets of terms separated by brackets. The series of D variables are “time indicators,” dummy variables coded as 1 for the time period it represents and 0 in all other years.(Singer & Willett, 2003) They are used to measure the effect of time on dropout. The terms inside this bracket are intercept parameters (α) multiplied by their respective time indicators. These values combine to create the baseline logit hazard function which represents logit hazard in that time period for individuals in the “baseline” group, i.e. when the value for all of the other predictors in the model are 0.

The terms outside of the brackets are the slope parameters, β , multiplied by their respective predictors. The slope parameters, β , assess the effect of a one unit difference in that predictor on event occurrence, statistically controlling for the effects of all other predictors in the model.

In comparison to linear regression models, this discrete time hazard model does not contain a single stand-alone y-intercept value. The α parameters function as multiple intercepts. These parameters can be interpreted as intercepts due to the specific manner in which the time indicator variables, D, have been defined. The time indicators for each year of the study are coded as 1 only in the year which they represent. For each year of the study, all of the other time indicator variables equal 0 and therefore all of the other terms disappear when the model is computed, leaving the population value of logit hazard to be the α value multiplied by the time indicator value which is equal to 1 (Singer & Willett, 2003). For example, in Year 4 of the study, only $D_4 = 1$ and D_1, D_2, D_3, D_5, D_6 and $D_7 = 0$. In the equation, all of the terms in the baseline model will then equal 0 except the term multiplied by D_4 . Therefore the population value of logit hazard in Year 4 will be α_4 .

To analyze the effect of time and educational variables on dropout, the method of maximum likelihoods is used to estimate the parameters, α and β , which maximize the likelihood of observing the data collected for this study (Singer & Willett, 2003). Maximum likelihood estimates of these parameters are obtained by running a logistic regression in which the dropout variable (EVENT) is regressed on the time indicators (D_1 through D_7) as well as the educational and demographic variables hypothesized to predict dropout. This regression will be completed using the person-period dataset.

A variety of data analysis strategies will be used to determine which models best predict who drops out in this sample. The goodness of fit of alternative models can be compared. Parameter estimates can be examined and used to calculate effect size. Following the identification of significant parameters, hazard functions at selected values of significant predictors can be calculated and graphed. These hazard functions can then be analyzed to see how patterns of dropout risk vary year by year based on the level of the predictor variable.

Statistical methods selected to address RQ 3 and the rationale for the selection. Two independent variables interact if the effect of one of the variables differs depending on the level of the other variable. Preliminary analyses will be completed to identify if participants categorized as aggressive based on peer or teacher ratings of aggression are more likely to dropout at different levels of the other hypothesized predictors. If potential interactions are identified, the effects of these interactions will be explored by including interaction terms in the discrete time hazard models in addition to the main effects of the individual variables in the model.

Hypotheses

Hypotheses related to Research Question I

Hypothesis IA. Teacher and peer-rated aggression in the 6th grade will be positively associated with dropout. Participants categorized as aggressive based on their ratings on both teacher and peer rated aggression will drop-out at a higher rate in comparison to participants categorized as non-aggressive.

Hypothesis IB: Aggressive students who drop-out will do so, on average, significantly earlier in their academic career than non-aggressive students who drop-out. Hazard functions, which show the risk of dropping out for participants eligible to drop-out in each year of the study will show that the hazard probabilities for dropping out in the early years of high school (9th and 10th grades) will be considerably higher for aggressive than non-aggressive students.

Hypotheses related to Research Question II

Hypothesis II: For the entire sample, being over Age for grade prior to entering the 6th grade and retentions during middle school and high school will be the most significant predictors of dropout.

Hypotheses related to Research Question III

Hypothesis III: After controlling for absences, grade point average, suspensions, being age for grade prior to the 6th grade, and retentions, aggression will not be a significant predictor of dropout. Relatedly, it is hypothesized that the interaction between aggression and absences and between aggression and grade point average will be a significant predictor of dropout, after

controlling for the 6th grade variables listed above. Aggressive students with high GPA's who attend school regularly will have lower odds of dropout as compared to aggressive students with low GPA's who are chronically absent.

Chapter 4:

Methods

Participants

The current study utilizes data collected during a three year longitudinal study, starting in the Fall of 1999, of modifiable risk factors for middle school violence as well as data obtained from school administrative records on the same cohort for the following four years until their date of expected on-time high school graduation in the Spring of 2006. Two middle schools from an urban, low income school district in the Northeastern United States (School A and School B) agreed to participate. Wave one of the study, which was the 6th grade year, included 732 regular education students (all of the participants entered middle school in regular social studies and language arts classes, i.e., not special education). For the purposes of this current study, data was analyzed on a total of 685 students for which data on aggressive behavior as rated by teachers and peers in the 6th grade as well as enrollment status for Years 1 through 7 of the study was available. Table 1 in the Appendix provides data on demographic variables for the 685 study participants.

Procedure

A series of individual measures, in questionnaire format, were administered in classrooms over a two-day period (approximately 45 minutes per day) once a year for three years. The researchers described the purpose of the study and explained to the students that the information was going to be used to gain a better understanding of relationships between students and their peers, teachers, and parents. Students were told that they would be answering

questions about their friendships, relationships with teachers and parents, and their feelings about themselves. The students were told that their responses were confidential and ID codes were used instead of names, to ensure confidentiality. A key to the ID codes was maintained on one hard copy and a password protected file. Students were told that if their responses indicated harm to themselves, the primary project investigator would ask to speak with them to assess their risk, and refer them to the school psychologist if she deemed necessary. This information was provided on a consent form that the students were asked to sign if they agreed to participate in the study. The questionnaire was also translated into Spanish reflecting usage in Western Massachusetts. Reliability analyses on the translated version of the questionnaire indicated minimal differences in coefficient alphas, thus suggesting no need to analyze data separately. Questionnaires of students, whose responses seemed questionable (i.e., they responded all true to a scale with reverse coded items) and who seemed to be distracted or not paying attention during the administration, were flagged and reviewed carefully for their validity. After careful examination, no students' questionnaires were eliminated, as responses appeared valid and reliable. The administration of the questionnaires (over the course of two days) was approximately 1 ½ hours.

Additional data on the students' functioning in the classroom and school was collected. Students' grade point averages, as well scores from standardized achievement tests and discipline records were all collected at the end of each year of the study. Data on the participants' attendance was also collected at the end of each year of the study. The district also provided the researchers with data on the participants' enrollment status for the Fall of 1999 through the Spring of 2006. This data provided the current grade of each student at the beginning of each academic year, which was used to identify which participants had passed on to

the next grade and which were retained and also gave details on events such as transfers and drop-outs, indicating the reason and date and of these events as well as the age of the subject when they dropped out. Data was also provided by the district on student's enrollment histories extended through the Spring of 2008. This data allowed researchers to determine whether students who were retained had eventually earned their diplomas. This enrollment data was coded to determine each subject's enrollment status (i.e., whether they passed on to the next grade, dropped out, transferred or were retained) at the end of each academic year.

In addition, language arts teachers at School A and social studies teachers at School B were asked to complete short questionnaires about their perceptions of the classroom competence, classroom engagement and behavior of the students in their classes (the school principals determined which teachers would do the ratings). Teachers were paid one dollar for each student questionnaire completed.

Measures

Revised Class Play – Peer Report. Social reputation of students based on peer reports was assessed using a modified version of the *Revised Class Play (RCP)* (Masten, Morrison, Pellegrini, 1985) which has been used widely in the field. Students were asked to imagine that they were directing a play, and that they were required to cast their classmates in the most appropriate roles. A total of thirty roles were given. The students were provided with a class list and asked to identify up to three individuals who they felt best suited the role that was listed. Students were informed that a classmate could be selected for more than one role; however, students were not allowed to pick themselves for any role listed. Students who were not originally on a class list, but were new members on a class, were manually added on the day of

data collection, to ensure that they could be selected by their peers. It is important to note that there are no published confirmatory factor analyses for this measure. Scores for each item were determined based on the total number of votes they received for that item within their class. Each student's score for an individual item is the proportion of votes they received by their classmates to the total number of votes in the class for that item. A three-item Overtly Aggressive/Disruptive subscale was created for the purposes of this study. This subscale is comprised of three items including a) loses temper easily b) pick on other kids and c) gets into a lot of fights. Internal consistency alphas revealed good internal reliability for the three-item Overtly Aggressive/Disruptive subscale measured in the 6th grade (Cronbach's alpha = .787). The Overtly Aggressive/Disruptive subscale was also significantly correlated with teachers' ratings of aggression ($r=0.461$).

Achenbach System of Empirically-based Assessment (ASEBA) – Teacher Report Form (TRF) - Aggression subscale. Teacher ratings of student aggression were obtained using the 19 items from the Aggressive Behavior subscale of the ASEBA, *Teacher's Report Form* (TRF) (Achenbach, 1991b). The TRF is a behavior rating scale designed to elicit standardized descriptions of students' behavior in the classroom. Teachers rate the frequency of a number of problem behaviors according to a Likert Scale ranging from 0 (Not True) to 2 (Very True or Often). Teachers were directed to describe the student's behavior "now or within the past 2 months." At one of the schools, Language Arts teachers rated their students. At the other school, Social Studies teachers completed the rating forms. Examples of items include: "Argues a lot," "Destroys property belonging to others," and "Stubborn, sullen, or irritable." As reported in the ASEBA manual, test-retest reliability for the Aggressive Behavior subscale over a 15-day period was high ($r=.91$). (Achenbach, 1991b), with inter-teacher agreement for the Aggressive

Behavior subscale at .64 for boys, .74 for girls, and .68 combined. Internal consistency for the subscale in this sample for 6th grade was .96. Scores were transformed into z scores by classroom to control for rater style. For data analysis, both total scores and a dichotomy analysis of students above or below the At-Risk/Clinical range were used. For a dichotomy analysis, participants were considered aggressive if they are in the At-risk (T score of 65 to 69) or Clinical range (T score of 70 and above) for their age and gender using the standardization norms for the ASEBA TRF (raw scores of 23 and above for males, and 18 and above for females).

Categorization of peer and teacher aggression. As one goal of this study is to compare dropout risk for aggressive vs. non-aggressive students, it was necessary to categorize which participants were aggressive and which were non-aggressive based on the teacher and peer rated measures of aggression. Ideally, this study would be able to identify participants who exhibit chronic levels of aggression throughout development. However, data on aggression is only available for participants from the 6th, 7th and 8th grades. Also the teacher and peer measures of aggression were not obtained for the most aggressive students in the 7th or 8th grade as many of them were either retained, placed in special education programs or placed in alternative programs and could not be included in data collection. Considering these limitations it was not possible to identify which students exhibited chronic high levels of aggression through the study.

A literature review of studies identifying trajectories for the development of aggressive behavior revealed that in every sample there was a group of children which exhibited consistently high levels of aggression compared to the rest of the sample. In these studies, this high level of aggression either remained stable through development or lessened, however the level of aggression for this group remained higher than for the rest of the sample. The

percentage of participants who were in the “high stable” or “chronic” aggressive groups varied by study and ranged from as low as 3% of the sample to as high as 16.6%. Based on this past research, it is anticipated that the percentage of participants who exhibit high levels of aggressive behavior will be in the range of 3 to 20% of the entire sample.

The distributions for both teacher and peer ratings of aggression were positively skewed. Therefore most of the participants were not rated as aggressive, many obtaining scores of zero for peer and teacher ratings of aggression. Given the finding that the distributions are positively skewed, it would be difficult to divide the levels of aggressive ratings into any more than 3 equal groups. Dividing them into groups of four for example would require dividing the groups of participants who did not receive any ratings of aggressive behavior from teachers or peers.

For the purpose of categorization, participants in the top 15% of values for peer and teacher rated aggression (N=103) were categorized as aggressive. This cutoff value is at the higher end of the estimated range of 3-20% of participants expected to be aggressive according to studies on the developmental trajectory of aggressive behavior. For the peer rating of aggression, the top 15% of scores corresponded to a score greater than or equal to 8.32. The values for the peer ratings are the averages of the proportions of nominations received on the three items which make up the Overtly Aggressive/Disruptive Scale. For example, the value of 8.32 on the peer rating of aggression means that on average the subject received 8.32% of the possible nominations for these 3 items from their classmates. For the teacher ratings of aggression, the top 15% of scores corresponded to a score greater than or equal to 0.68. 0.68 corresponded to a raw score of 13 on the ASEBA-TRF.

Grade point average (GPA). GPA was calculated for each subject for the 6th, 7th and 8th grades, based on administrative records provided by the district at the end of each school year. GPA was calculated for each subject for the 9th through 12th grade from administrative records obtained by the district after the onset of this study. Students' final semester grades in four academic core participants (Language Arts, Math, Social Studies, Science) were coded F=55 to A=98. Letter grades were given the following numerical values that factored into the calculation of grade point average: A=98, A- = 93, B+ = 88, B=83, B- = 78, C+ = 74, C=71, C- = 68, D+=65, D=61, D- = 57, F=55. Overall grade point average (GPA) represents the mean of those scores for each student and was calculated for each year of the study.

Absences. Total number of absences were calculated for each subject from administrative records on absences for the 6th, 7th and 8th grades, provided by the district at the end of each school year. A total number of absences were calculated for each subject for the 9th through 12th grade from administrative records obtained by the district after the onset of this study.

Suspensions. Total number of suspensions were calculated for each subject from administrative records on discipline incidents for the 6th, 7th and 8th grades. Total number of suspensions was calculated for each subject for the 9th through 12th grade from administrative records obtained by the district after the onset of this study.

Enrollment status by year. Enrollment status at the end of each academic year was determined from enrollment files provided by the district. Participants began the 6th grade in the Fall of 1999 and ended the 12th grade in the Spring of 2006 if they had not been previously retained or earned enough credits to skip a grade if they had been previously retained. The enrollment files provided by the district identified which grade the student was enrolled in at the

beginning of each school year. These files also provided “leave codes” which gave information on when a subject left school including the date, and reason for dropout. The leave codes specified if a student had transferred and further specified if the transfer was to another school in the district, a non-public school, or to a school outside of the district. The leave codes also specified reasons for why the subject decided to leave school including academic reasons, pregnancy, to seek employment or for an unknown reason.

Coding of Event and Censor. In order to complete a survival analysis of this data, as suggested by Willett and Singer, (Singer & Willett, 2003) two dichotomous variables were coded, “Event” and “Censor” for each year, Years 1 through 7 of the study. The variable Event is a dichotomous variable which identifies whether or not a student dropped out during a particular year of the study. For each year of the study, Event was coded as 1 if it could be confirmed from the enrollment data that a subject had dropped out during that year.

The subject was coded as 1 for Event in the year that the Leave Code was entered even if the accompanying Leave Date was during the summer months. In situations where the Leave date was during the summer months it may be assumed that the subject did complete the school year. However, since many students in the district attended summer school and there was no confirmation that the subject was enrolled in the subsequent year, it is assumed that participants with Leave Codes during the summer months did indeed leave during that school year. The subject was coded as 0 for Event if there were no leave codes indicating that the subject left during the school year.

The variable Censor is a dichotomous variable which identifies whether or not a student was removed from the dataset during that year for reasons other than dropping out. Participants

were coded as 1 for Censor for that year of the study if it was determined that they transferred during the school year. Student transfers were determined by Leave codes indicating that a student had transferred.

Participants were not coded 1 for Censor if the leave code indicated that the subject had transferred to another school within the district. The enrollment files also included three types of leave codes that did not give a reason for why the subject left school. For participants that had these leave codes, they were coded as 1 for Censor for that year. They were coded as Censors and not dropouts due to there not being a Leave code which confirmed that the subject did indeed dropout.

According to the enrollment files, certain participants were no longer enrolled at the beginning of a year of the study, however no Leave code was provided. In these situations, the subject was coded as 1 for Censor for the first year in which they were no longer enrolled. They were coded as Censors and not dropouts due to there not being any Leave Code which confirmed that the subject did indeed dropout. They were coded as 1 for Censor in the first year they were not enrolled and not in the previous year due to the lack of a Leave Code confirming that they left the dataset in the previous year.

If enrollment files indicated that a subject had been retained, (i.e. enrollment files indicated that the subject was in the same grade in consecutive years), the subject was not considered a dropout nor were they censored from the data set. Therefore for that particular year in which they were retained they were coded as 0 for Event and Censor.

In certain cases participants had left school or transferred, and were coded as dropouts or censored from the dataset (coded as 1 for Event or Censor) and then later re-enrolled during a different year of the study. In these cases the participants did not re-enter the dataset, and the first Event or Censor coding remained intact.

Retain. The variable Retain was coded based on the enrollment files. The variable Retain is a dichotomous variable which identifies whether or not a student was retained in a particular year of the study. If a subject was in the same grade in consecutive years, the variable Retain was coded as 1 for the year in which they repeated the grade. For example, if a subject was in 6th grade in Year 1 of the study and in 6th grade in Year 2 of the study, the variable Retain was coded as 1 for Year 2 of the study. After a subject was retained for the first time they were coded as 1 for the variable Retain for the remainder of the years that they were enrolled, i.e. remained in the dataset. The continuous coding of the variable Retain as 1 maintains identification of the subject as having been retained at one point in the study. If the participants who had been retained did not transfer or dropout before Year 7 and were still enrolled in school at the end of Year 7, the participants were coded as 1 for Censor for Year 7.

Dropout. Dropout was coded as a dichotomous variable to identify participants who had dropped out in any year of the seven years of the study. While the variable *EVENT* was time variant and also identified the year in which a subject dropped out, the variable Dropout was used to identify anyone who dropped out at any point of the study. Dropout was coded using Enrollment files. Any subject who had a Leave code indicating the dropped out in any year of the study was coded as 1 for dropout. Participants who did not have any Leave Code indicative of dropouts were coded as 0 for “did not dropout.”

Age for Grade. In order to determine if a subject had ever been retained prior to entering the 6th grade, a simple calculation was made using the subject's birthdate. In order to be eligible to enter kindergarten in a given school year in the district in which the study was conducted, students must be five years old by September 1. Thus, any student born between September 2, 1987 and September 1, 1988 would be of reasonable age for grade in the current sample. Students born on or before September 1st could be expected to have begun kindergarten before the current cohort and thus it is reasonable to believe they were retained prior to sixth grade or were delayed from beginning kindergarten by family, cultural or other factors. Age for grade was coded as a dichotomous variable. Participants were coded as either 0 for "Age for grade" or 1 for "Old for grade" in 6th grade.

Chapter 5:

Results

Preliminary Data Analysis

Relationship between dropout and demographic variables. Preliminary analyses were completed to explore the relationship between the dependent variable of this study, dropout, and the demographic variables of Gender, Ethnicity and Middle School Attended. For these preliminary analyses, the variable Dropout, a categorical variable of whether or not a subject had dropped out at any point during the seven years of the study was utilized instead of analyzing the number of dropouts over each year of the study separately. Ninety-eight of the 685 participants (14.31%) were confirmed as dropouts. The frequency and percentage of dropouts for each category of the demographic variables were compared. Chi-square tests were completed to determine if there was a significant relationship between dropout and these demographic variables. A summary of these results is presented in Table 2.

Gender. Results indicate that there are more female dropouts than male dropouts. These differences are not statistically significant, however.

Ethnicity. Table 2 presents frequencies and percentages of participants from each category of ethnicity (Latino, African American, Asian, White, Bi-Racial and None of the Above) who were either Dropouts or Non-Dropouts. Results indicate that of the three ethnic groups with the highest membership within the sample (Latinos, African-American and White) Latinos make up the highest percentage of dropouts (53.1%).

Of these three ethnic groups, Latinos are the only group with a higher percentage of participants who are dropouts (53.1%) compared to non-dropouts (40.5%). There is roughly an equal percentage of African-Americans among the dropouts (17.3%) and non-dropouts (17.4%). There is a lower percentage of Whites who are dropouts (18.4%) compared to non-dropouts (29.0%). This result suggests that Latino and White ethnicity may be related to dropout. To further analyze this relationship, ethnicity was collapsed into two separate dichotomies, Latino and Not Latino and White and Not White. The frequency and percentages of dropouts for each category of these ethnicity dichotomies are presented in Table 3. Chi-square tests were also completed to determine if there was a significant relationship between dropout and these ethnicity dichotomies.

Results indicate that there is a significant association between ethnicity dichotomized as Latinos vs. Not Latinos and dropout, $\chi^2(1) = 5.389, p < 0.05$. Latinos dropped out at a higher rate in comparison to non-Latinos. While Latinos make up 42.3% of the total sample, 53.1% of the participants who dropout are Latinos. Fifty-two out of the 290 Latino participants dropout (17.93%), while only 46 out of 395 (11.65%) Non-Latino participants dropout.

Results also indicate that there is a significant association between ethnicity dichotomized as Whites vs. Not Whites and dropout, $\chi^2(1) = 5.707, p < 0.05$. White students dropout out at a lower rate in comparison to non-White students. Seventeen out of the 187 White participants dropout (9.1%), while eighty out of 496 (16.1%) Non-White participants dropout. Based on this result, both ethnicity dichotomies will be utilized in discrete time hazard analysis.

Middle School Attended. Table 2 presents frequencies and percentages of participants from each middle school who are dropouts and non-dropouts. Results of Chi-square tests reveal that there is no significant association between middle school attended and dropout.

Relationship between dropout and time invariant predictors. Preliminary analyses were also completed to explore the relationship between dropout and the substantive time-invariant predictor variables, Age for Grade and peer and teacher rated aggression, measured in the 6th grade. A comparison of descriptive statistics for dropouts and non-dropouts on these variables is presented in Table 4.

Age for Grade. The frequency and percentage of participants either Age for Grade or Old for Grade who are dropouts or non-dropouts is presented in Table 4. Compared to their percentage within the entire sample (15.6%), participants who are Old for Grade make up 31.6% of the Dropouts. Results indicate that there is a significant association between Age for Grade status and dropout $\chi^2(1) = 19.148, p < 0.001$. Participants who were Old for Grade were more likely to dropout than participants who were Age for Grade entering the 6th grade.

Peer-rated Aggression. Table 4 also presents a comparison of descriptive statistics on peer aggression for dropouts and non-dropouts. As expected based on past research, the dropouts had higher mean ratings of both peer aggression in comparison to the whole sample and to the non-dropouts. On average, dropouts had higher peer ratings of aggression (M=5.41, SD=7.91) in comparison to the ratings for non-dropouts (peer: M=3.97, SD=5.53). The difference in peer ratings of aggression between dropouts and non-dropouts was significant $t(683) = -2.223, p < 0.05$.

Teacher-Rated Aggression. Dropouts had higher mean ratings of teacher aggression in comparison to the whole sample and to the non-dropouts. On average, dropouts had higher ratings of teacher aggression ($M=0.32$, $SD=0.46$) in comparison to the ratings for non-dropouts, ($M=0.26$, $SD=0.40$). However, the difference in ratings of aggression between dropouts and non-dropouts was not significant, $t(683) = -1.439$, $p>0.05$.

Relationship between dropout and time variant predictors. A preliminary analysis of descriptive data was completed to determine if there were any associations between dropout and the hypothesized time variant predictors GPA, Absences, Suspensions and Retain. Table 5 presents the number of valid cases and the values of the mean and standard deviation for the time variant predictors GPA, absences and suspensions for both dropouts and non-dropouts. Independent sample t-tests were run to identify significant differences in means between dropouts and non-dropouts. These significance levels are noted by asterisks in Table 5. Table 6 presents the frequency and percentages of participants who were retained and not retained for both dropouts and non-dropouts.

GPA. Congruent with findings from past research, across most years of the study, dropouts had significantly lower mean values of GPA compared to non-dropouts. Results of t-tests show that differences in GPA were significant at a $p<.001$ level in every year of the study except for Year 2. For example, in Year 6 dropouts had a mean GPA of 58.58 while non-dropouts had a mean GPA of 71.58.

Absences. Also congruent with findings from past research, differences in mean values of absences were significant at a $p<.001$ level in every year of the study, with dropouts averaging

more absences per year. This difference was the greatest in Year 6 where dropouts averaged 50.79 absences for the year while non-dropouts averaged 19.84 absences.

Suspensions. In each year of the study, the mean value of suspensions was higher for dropouts in comparison to non-dropouts. This difference was only significant in Year 3, however, in which dropout averaged 0.76 suspensions while non-dropouts averaged 0.37 suspensions.

Retain. Results presented in Table 6 indicate that in each year of the study, a higher percentage of dropouts had been retained at any point in Year 2 or after in comparison to non-dropouts. These results were not calculated for Year 1 as Year 1 was considered to be the beginning of the study and therefore no subject could be retained before the completion of a full school year. By Year 6, there were fifty-eight participants who would eventually dropout that did not dropout yet. Forty-six of these fifty eight (79.3%) eventual dropouts had already been retained. Results of Chi- square tests indicate that in every year of the study after Year 1 there is a significant association ($p < 0.001$) between having been retained at any point in Year 2 or after and dropout.

Missing Data Analysis

Multiple participants were missing data for the time invariant predictor Age for Grade or the time variant predictors, GPA, Absences and Suspensions from one or more years of the study. Table 7 provides the frequency and percentages of missing values for these variables for all seven years of the study. The frequencies of missing values for each year of the study are for participants who have not yet been censored from the dataset. Therefore these values do not

include missing values for variables corresponding to years after the subject left the dataset. The table also compares frequencies and percentages of missing values for dropouts and non-dropouts.

Age for Grade. Within the total sample, 5.4% of the participants are missing values for Age for Grade. None of the participants who drop out are missing values for Age for Grade.

GPA. GPA is the variable for which there are the highest percentages of participants who are missing values. In Year 5, there is the highest percentage of participants who are missing a value for GPA (17.16%). In Year 6, 37.93% of the participants who are eligible for dropout and do eventually dropout are missing data on GPA. This high percentage of missing data is problematic for inclusion of this variable in discrete time hazard models.

Suspensions. More than half of the participants are missing data on suspensions in Year 4. This is problematic for inclusion of this variable in discrete time hazard models. There is not data missing on suspensions for Years 1, 2, 3, 6 and 7. In Year 5, only 1.11% of the participants are missing data on suspensions.

Absences. The percentages of participants missing values for Absences are lower than for GPA. The highest percentage of all participants missing values for Absences is in Year 4. In Year 5, there is the highest percentage of dropouts missing data on absences (8.62%).

Correlations of Primary Variables

Pearson correlation coefficients (r) among the variable of Dropout and hypothesized predictors are presented in Table 8. In addition to the correlation coefficients, Table 8 provides

the number of participants (N) for which data on both variables was available. If the value of N for a variable combination was less than 685, this indicates that participants were missing data for either one of the two variables for which the correlation coefficient was calculated. Instead of presenting the correlations for the time variant predictors over all seven years of the study, mean values of GPA, absences and suspensions over the seven years of the study were calculated for the purpose of correlational analyses.

Based on the correlation coefficients, teacher aggression, ethnicity dichotomized as African American vs. Not African American and middle school attended were not significantly correlated with dropout. The two most highly correlated variables with dropout were Age for Grade, Retain, mean GPA, mean number of days absent and mean suspensions. Peer rated aggression was positively correlated with dropout such that the higher the participants' rating of aggression, the more likely they were to dropout. Peer-rated aggression was significantly correlated with all of the other predictor variables which suggests the possibility that peer aggression may interact with other variables to predict dropout.

Descriptive Stats on Peer and Teacher Rated Aggression

Table 9 in the Appendix presents a summary of descriptive data on both teacher and peer ratings of aggression for demographic subgroups. It also compares data on aggressive behavior for participants who were Old for Grade vs. Age for Grade. Results indicate that the mean value of both peer aggression and teacher rated aggression is significantly higher for males than it is for females. On average male participants were rated as more aggressive by both their peers ($M = 4.96$, $SD = 6.90$) and teachers ($M = 0.34$, $SD = 0.47$) in comparison to female participants.

This difference was significant for peer ratings, $t(683) = 3.653$, $p < .001$, and for teacher ratings as well $t(683) = 4.771$, $p < .001$.

Comparison of mean ratings of aggression for different ethnic groups reveals that African American participants received the highest mean ratings of peer aggression and the second highest mean rating of teacher aggression behind a small group of eight participants who were coded as None of the Above for race. To further explore the relationship between African American ethnicity and aggression, ethnicity was dichotomized into African American and Not African American. An Independent Samples t-test was then run to see if there was any significant difference in the mean ratings of aggression between the two groups. These results are presented in Table 9.

On average, African American participants were rated as more aggressive by their peers ($M=5.92$, $SD=6.71$) and teachers ($M=0.30$, $SD=0.44$). The difference in mean ratings of aggression between African American and non-African American participants was significant for peer ratings, $t(683) = 3.55$, $p < 0.001$, however, not significant for teacher ratings $t(683) = 0.958$, $p > 0.05$. On average, White participants were rated as less aggressive by their peers ($M=2.55$, $SD=4.60$) and teachers ($M=0.20$, $SD=0.34$). The difference in mean ratings of aggression between White and non-White participants was significant for both peer ratings, $t(683) = -4.43$, $p < 0.001$, and teacher ratings $t(683) = -2.76$, $p < 0.05$. The difference in mean ratings of aggression between Latino and non-Latino participants was not significant for peer ratings, $t(683) = 1.049$, $p > 0.05$, or teacher ratings $t(683) = 1.071$, $p > 0.05$.

The difference in means between Middle School 1 and Middle School 2 also was not significant for peer $t(683) = -1.930$, $p > 0.05$ and teacher ratings $t(683) = -.848$, $p > 0.05$. On

average participants who were Old for Grade entering the 6th grade had higher ratings of both peer (M = 5.50, SD = 6.75) and teacher rated (M = 0.36, SD = 0.48) aggression in comparison to peer ratings (M = 3.92, SD = 5.70) and teacher ratings of aggression (M = 0.25, SD = 0.40) for participants who were Age for Grade. This difference was significant for peer $t(646) = -2.568$, $p < 0.05$ and teacher ratings $t(646) = -2.455$, $p < 0.05$.

Events per Variable Analysis

Over the course of the study, there were 98 total dropout events recorded. The literature was reviewed to determine the maximum number of hypothesized predictors that could be included in discrete time hazard models and still obtain reliable parameter estimates. There is disagreement in the literature regarding how many events are needed per variable in order to obtain reliable parameter estimates. The general rule of thumb is that logistic regression models should be used with a minimum of ten events per predictor (Concato, Peduzzi, Holford, & Feinstein, 1995; Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). In a 2010 review on survival analysis, Allison reported that there should be at least five events for each parameter in the model, in order for maximum likelihood estimates to have reasonably good properties (Allison, 2010). In a 2011 article, researchers question this number and suggest that other factors including correlations between predictor variables should be considered in determining how many events are needed per variable. For the purpose of this study the general rule of thumb of ten events per predictor was considered. In this sample there were 98 dropout events. Using a rule of at least ten events per predictor, no more than nine predictors should be included in any model. Given that some researchers state that five events per variable is sufficient,

inclusion of a tenth predictor in certain models, which would make the number of events per predictor to be slightly less than 10 (9.8) was also considered.

Survival Analysis of Student Dropout in Full Dataset

In order to describe patterns of dropout risk for students rated as aggressive, survival analysis was utilized. Survival analysis allows for analysis of dropout risk among participants still eligible to dropout in each year of the study. In order to do this, participants who dropout or are censored are removed from the dataset in each year of the study. The life table details dropout event histories and reports the number of participants at risk for dropout, the number of participants who dropped out during the school year and the number of participants censored at the end of the school years. The life table also gives the proportion of participants who drop out during the year and the proportion of participants still enrolled at the end of the school year. A life table which provides this information for all 685 participants over the seven years of the study is presented in Table 10.

In Year 1 of the study, there were no dropouts, however, ten participants were censored from the dataset because they either transferred or left the dataset for an unknown reason. In subsequent years of the study, there was an increasing number of participants who dropped out or were censored from the dataset. The highest number of dropouts occurred in Year 6 of the study in which forty-two participants dropped out. In Year 7, of the 367 participants still at risk of dropping out, 351 participants did not dropout. All of these 351 participants were censored at the end of Year 7. It is noteworthy that some of these censored participants were transfers while some had no leave code and did graduate at the end of the 7th year. Also, among these 351 censored participants are students who even though they did not dropout or transfer, did not

necessarily graduate and needed to remain in school in order to graduate. As this survival analysis is examining the event occurrence of dropout, even though some of these participants did not graduate on time and many did eventually dropout, they did not have dropout codes for Years 1 through 7 of the study and were therefore not removed from the dataset at any point.

The proportions calculated in the last two columns of Table 10 are also utilized in survival analysis. The proportion of participants at the beginning of the school year who dropped out before the start of the next school year represents the hazard ratio. Hazard ratio is interpreted as the percentage risk of experiencing the target event (dropout) in each year of the study. The proportion of all participants still enrolled at the end of each school year is the survival function. The survival function is cumulative and describes the percentage of the full sample that survives and does not experience the event in that year of the study.

Hazard and survival functions were plotted and examined for peaks and troughs to determine time periods in which risk for event occurrence is at its highest or lowest. The hazard function and survivor function for all 685 participants for all seven years of the study is presented in Figure 1. In Year 1 of the study, since there were no dropouts the probability of dropping out was 0. Following Year 1, the risk of dropout rose until Year 6 and then decreased in Year 7. Year 6 presents the year with the highest probability of dropout as 9.31% of the participants still enrolled in school and therefore at risk for the target event, dropout. The risk of dropout appears to increase steadily between Years 2 and 4 and then there is a dramatic increase in dropout risk between Years 4 (0.83%) and Years 5 (5.9%). There is another large increase between Years 5 and Year 6 as risk of dropout in Year 6 is 9.31%.

The survivor function for all 685 participants for all seven years of the study is also presented in Figure 1. The survival probability in Year 1 of the study is 1.00 as no participants dropped out. The survivor function decreases slightly between Years 2 and 4 of the study and then dips to 92.85% in Year 5 of the study. The survival probability then dramatically dips to 84.21% in Year 6 of the study. As survival probability is a cumulative measure over the seven years of the study, as expected the survival probability is lowest in Year 7 of the study at 80.54%.

Hypothesis Testing

Survival analysis was utilized to test hypotheses. Patterns in dropout risk over the seven years of the study were compared for aggressive vs. non-aggressive students using life tables and hazard/survivor functions to see if aggressive students took unique paths towards dropout. Discrete time hazard models using logistic regression were run in SPS 22.0 for IBM to determine which variables best predicted dropout.

Hypothesis I - Survival analysis of student dropout: Comparing aggressive vs. non-aggressive participants. In order to see if there were differences in patterns of dropout risk between aggressive and non-aggressive participants, life tables, and hazard and survivor functions for participants categorized as aggressive vs non-aggressive were compared.

Tables 11 and 12 present the life tables for participants categorized as aggressive (top 15%) and not aggressive, respectively based on peer ratings. Figure 2 presents the hazard and survivor function for these two groups. None of the aggressive participants dropped out until Year 4. For the aggressive participants, risk of dropout increases each year and is highest in

Year 7. For the non-aggressive participants, dropout risk is highest in Year 6 and then steadily declines in Year 7. In Years 4 through 7, years in which there are aggressive participants who dropout, risk of dropout is higher in each year for aggressive participants. The survival function presents the percentage of the full sample that did not leave school and graduated on time. Comparison of these functions for aggressive vs. non-aggressive students shows that non-aggressive students have a higher probability of survival in every year following Year 4.

Tables 13 and 14 present the life tables for participants categorized as aggressive (top 15%) and not aggressive, respectively based on teacher ratings. Figure 3 presents the hazard and survivor function for these two groups. The hazard functions for aggressive and non-aggressive participants have similar shapes, as risk increases through Year 6, when it is at its highest and then decreases in Year 7. Similar to the hazard function for peer ratings of aggression, participants categorized as aggressive based on teacher ratings had higher risk of dropout in Years 4 through 7 of the study. Comparison of survival functions shows that similar to the function for peer ratings, non-aggressive students have a higher probability of survival in every year following Year 4.

In summary, these results show that for most years aggressive participants, categorized based on peer and teacher ratings, are at higher risk of dropout in every year of the study in which there is risk of dropout, a finding congruent with previous research studies. Results did not support Hypothesis IB that differences in dropout risk would be greater in early high school years, Years 4 and 5. While dropout risk was higher for aggressive participants in each year, the pattern of dropout risk as identified by peaks in the hazard function was similar for aggressive and non-aggressive participants. The only difference in pattern of risk was in Year 7 for peer

rated aggression in which dropout risk increased for aggressive participants from Year 6 to 7 and decreased for non-aggressive participants.

Hypothesis II - Discrete time hazard models of dropout - A series of discrete time hazard models were fit to the data in order to analyze the effect of hypothesized predictors on dropout risk. In these models, the effect of time was measured as parameters were computed for each discrete time period (year) of the study. Parameters were also estimated for a series of time variant and time invariant predictors hypothesized to be related to dropout. These parameters were estimated using logistic regression.

As there were no dropouts in Year 1 of the study and therefore no risk of dropout, parameters for Year 1 of the study could not be estimated. The beginning of time for the model needed to be adjusted and the first year for which there was risk of dropout was considered to be the beginning of time (see Bowers, 2010). Therefore Year 2 of the study, the first year in which there was risk of dropout was considered to be the beginning of time for the model. The time indicator variables were adjusted so that D_1 originally representing the time effect of Year 1 for the study, now represented the time effect of Year 2. D_2 , originally representing the time effect of Year 2 for the study, now represented the time effect of Year 3 and so forth.

Table 15 presents the results of a series of discrete time hazard models fit to the data. This table includes parameter estimates and their significance levels, standard errors for each parameter estimate (in parentheses), the number of parameters used in each model, the overall N of cases analyzed from the person-period dataset and goodness of fit measures including -2 log likelihood, chi square, Cox and Snell R^2 and Nagelkerke R^2 . These goodness of fit measures were subsequently utilized to compare models and determine which models best predict dropout.

The time variant predictors GPA and suspensions were not included in the models presented in Table 15. When models were run which included the variable GPA, a solution for the model could not be found, even when all other parameters except for the time point parameters were removed. Different strategies for handling of missing data were considered, however, at the time of this analysis an effective strategy had not yet been finalized. The variable Suspensions was not included in this analysis due to the high percentage of participants missing values (over 50%) in Year 4 of the study. As all of the missing values for suspensions were present in one year of this study it could not be assumed that this data was missing at random and therefore was not included in the analysis. As with GPA, different strategies for handling of missing data were considered, however, at the time of this analysis an effective strategy had not yet been finalized.

Each model is identified by a letter at the top of each column in Table 15. Model A includes only the time parameters for each time point (D_1 through D_6). Each time point parameter was significant at a $p < 0.001$ level. This result is interpreted as each year beginning in Year 2 of the study is a significant predictor of dropout risk.

Models B1 and B2 include the time point parameters as well as the time-invariant demographic variables, gender, ethnicity and middle school attended. Results of preliminary analyses indicated that of these demographic variables only ethnicity, dichotomized as both Latino vs. Not Latino and White vs. Not White was significantly associated with dropout. Model B1 included ethnicity dichotomized as Latino vs. Not Latino while Model B2 included ethnicity dichotomized as White vs. Not White. Results of these models are congruent with preliminary

data analyses as only ethnicity was a significant predictor, $p < 0.05$, along with the time point parameters.

Model comparisons were completed using differences in $-2 \log$ likelihood which have a χ^2 distribution. If the $\Delta - 2 \log$ likelihood is greater than the critical value for a χ^2 distribution at k degrees of freedom than the null hypothesis that there is no difference between the models can be rejected. The degrees of freedom are equal to the number of parameters by which the models differ. For example, Models B1 and B2 differ from Model A by three parameters. Models B1 and B2 include gender, ethnicity and middle school in addition to the six time points while Model A only includes the six time point parameters. Therefore in order to determine if the models are different the $\Delta - 2 \log$ likelihood will have to be greater than the critical value of χ^2 at 3 degrees of freedom which at a probability of 0.05 is 7.82. The $\Delta - 2 \log$ likelihood for Models A and B1 is 7.129, and therefore the difference between Models A and B1 is not significant. The $\Delta - 2 \log$ likelihood for Models A and B2 is 8.38, which is greater than the 5% critical value and therefore the difference between Models A and B2 is significant.

Models C1 and C2 include the effect of Age for Grade, in addition to the time point parameters and demographic variables. With the addition of Age for Grade, the demographic variables including ethnicity were no longer significant. In subsequent models, these demographic variables were not included as they were non-significant and would make the models less parsimonious. This result indicates that Age for Grade status explains more variance in a subject's dropout risk than gender, ethnicity and middle school attended. In comparison to Model A which just included the time parameters, the $\Delta - 2 \log$ likelihood was less for Models C1 and C2 and this difference was statistically significant, $\Delta - 2 \log$ likelihood (4) = 30.461,

$p < 0.001$ and $\Delta - 2 \log \text{likelihood} (4) = 30.5$, $p < 0.001$, respectively. The Chi-square value for Model C1 and C2 did not increase, however, in comparison to Model A.

Model D includes the effect of peer and teacher rated aggression in addition to the time point parameters and Age for Grade. The demographic variables were not included in this model. Peer-rated aggression was significant in addition to Age for Grade and the time point parameters. Interestingly, teacher-rated aggression was not a significant predictor and was therefore left out of subsequent models. Model D was significantly different from Model A, $\Delta - 2 \log \text{likelihood} (3) = 32.495$, $p < 0.001$. Similar to Models C1 and C2, the chi square value did not increase.

Model E includes parameters for the variable Retain in addition to peer rated aggression, Age for Grade and the time point parameters. There was a significant decrease in the $\Delta - 2 \log \text{likelihood}$ value in comparison to Model A, $\Delta - 2 \log \text{likelihood} (3) = 102.049$, $p < 0.001$. The Chi-square value also increased in comparison to all of the other models indicating that Model E fits the data better than the other models. In Model E, peer-rated aggression was no longer significant. The time point parameters as well as Age for Grade and Retain remained significant. In Model F, peer-rated aggression was removed from the model ran in Model E. There was a decrease in the Chi-square value and a slight increase in $- 2 \log \text{likelihood}$, however this change was not significant. As Model F has less parameters than Model E and does not have significantly different goodness of fit statistics, it is considered a more parsimonious model than Model E.

Model G includes parameter estimates for the variable Absences in addition to the time point parameters, Age for Grade and Retain. In comparison to the other models, there is a

significant decrease in $-2 \log$ likelihood and increase in the Chi-square value. In Model G, the time point parameters, Age for Grade, Retain and Absences are all significant predictors of dropout risk. Using the Cox & Snell R^2 statistic, Model G explains close to 70% of the variance in the probability of a student dropping out of school (Cox & Snell $R^2 = 0.698$). Using the Nagelkerke R^2 statistic, Model G explains 93% of the variance in the probability of a student dropping out of high school (Nagelkerke $R^2 = 0.931$).

Model G best fits the observed data. Additional models were run including only Absences as a predictor and Absences combined with either Age for Grade or Retained. The goodness of fit statistics for these models were not as good and it can therefore be determined that the parameters included in Model G best predict the risk of dropout. Past research has shown that all of these predictors are related to dropout.

The logit parameter estimates in Model G were transformed to odds to better interpret the effect of each predictor on dropout risk. For the categorical predictors, Age for Grade and Retain, these odds ratios are the ratio of the odds of event occurrence for the two levels of the variable – Age for Grade and Old for Grade and Not Retained vs. Retained, respectively. The odds ratio of 2.669, 95% CI [1.583, 4.500] for the variable Age for Grade indicates that in every year of the study, the odds of dropout are 2.7 times higher for participants who were Old for Grade entering the 6th grade in comparison to those who were Age for Grade. The odds ratio of 4.139, 95% CI [2.454, 6.982] for the variable Retain indicates that participants who had been retained after the 6th grade, had 4.14 times greater risk of dropout compared to participants who had not been retained.

For the continuous predictor in this model, Absences, the odds ratio represents the ratio of the odds of event occurrence for a one unit increase in the predictor. The odds ratio for the variable Absences, 1.023, 95% CI [1.016, 1.031], is interpreted as the odds of dropout are 1.023 times higher for participants for every day they are absent. As a one unit increase in Absences is not meaningful, (one more day absent), this increment can be increased and the odds ratio shifted accordingly. If a one unit increase in absences was considered to be ten days, the odds ratio would be 1.698. This is interpreted as the odds of dropout are 1.698 times higher in each year for every 10 days that a subject is absent.

While addition of both time-variant and time-invariant predictors lead to decreases in the $-2 \log$ likelihood value and increases in the Chi-square value both which indicate better fitting models, the Cox and Snell R^2 and Nagelkerke R^2 values did not increase. In Model A which just included time parameters, the Cox and Snell $R^2 = 0.68$ and the Nagelkerke $R^2 = 0.914$ which means that Model A explained 68.5% and 91.4% of the variance in the probability of a subject dropping out respectively. Model G, which had improved goodness of fit measures had a Cox and Snell $R^2 = 0.698$ and explained 69.8% of the variance in the probability of a student dropping out. For Model G, the Nagelkerke $R^2 = 0.931$ and explained 93.1% of the variance. Therefore in comparison to Model A, Model G only explains roughly an additional 1.5% of the variance according to the Cox and Snell R^2 and an additional 1.7% according to the Nagelkerke R^2 statistic. In every model that was analyzed, the time point parameters were significant. This result suggests that a student's risk of dropout was time variant, changed year by year, and that dropout risk at any grade level could not solely be explained by any of the predictor variables included in the models.

In summary, results from the discrete time hazard models indicate that Age for Grade status, retentions following the 6th grade and absences were the best predictors of dropout. These results provide partial support for Hypothesis II which stated that being over Age for grade prior to entering the 6th grade and retentions during middle school and high school would be the most significant predictor of dropout. Results indicate that in addition to these variables, Absences are a significant predictor of dropout risk.

Hypothesis III – Inclusion of interaction terms in discrete time hazard models of dropout. Results from a power analysis revealed that there were not enough dropout events to include interaction terms in the discrete time hazard models. Therefore Hypothesis III could not be tested.

Fitted Hazard and Survivor Functions for Different Levels of Significant Predictors

In order to display patterns of dropout risk over the years of the study, fitted hazard and survivor functions for combinations of values of the significant predictors, Age for Grade, Retain and Absences were computed by substituting parameter estimates back into Model G and obtaining predicted values of hazard and survival probability. These hazard functions are presented in Figure 4. In total, twelve different functions were computed, corresponding to twelve different combinations of values of the predictors. These twelve combinations include two levels of the predictor Age for Grade (Age for Grade and Old for Grade), two levels of the predictor Retain (Retained and Not Retained) and three levels of the predictor Absences (0-19 days absent, 20-39 days absent, and 40+ days absent). Instead of calculating a hazard and survivor function for each value of Absences, absences were categorized into these groups using

a classification system by which absences are often categorized in research (Mac Iver et al., 2008).

Figure 4 shows that the twelve different functions aggregate into four different groups with similar values of hazard in each year. The shape of all of the functions is similar with hazard being the highest in Year 5 and then decreasing in Year 6. The group of functions with the highest values of hazard in each year includes the function for students who were Old for Grade, had been retained after Year 1, and were absent for at least more than 20% of the school year (40+ absences), students who were Old for Grade, had been retained after Year 1, and were absent for at least more than 10% of the school year (20-39 absences) and students who were Old for Grade, had been retained after Year 1, and were absent 0-19 times during the school year. This result shows that regardless of how often you were absent, if a student was Old for Grade and had been retained after the 6th grade their risk of dropping out was significantly higher. The group of functions with the lowest hazard rate included functions for students who were Age for Grade, had not been retained and had forty or more absences, students who were Age for Grade, had not been retained and 20-39 absences, and students who were Age for Grade, had not been retained and had forty or more absences. This result indicates that regardless of the number of absences, subjects who had never been retained at any point of their educational career had the lowest risk of dropout. The group of functions for subjects who were Age for Grade and Retained had higher values of hazard compared to the group of functions for subjects who were Old for Grade but did not get retained after the 6th grade. This result suggests that being retained after the 6th grade has more of an effect on dropout risk compared to being retained early in a student's academic career, prior to the 6th grade.

Figure 5 shows that the twelve different survival functions aggregate into four different groups. These groups are the same as for the hazard functions. The group of functions for students who were Old for Grade and Retained had the lowest survival probability in each year of the study regardless of number of absences. Students who were Age for Grade and Not Retained had the highest probability of not dropping out of high school. Taken together these results suggest that regardless of how many times a student was absent in each year, having been retained after the 6th grade and being Old for Grade to a lesser degree increased risk of high school dropout and lowered the chances that a subject would complete school without dropping out.

Tests of Discrete Time Hazard Model Assumption Violations

There are multiple assumptions associated with discrete time hazard models including linear additivity, proportionality and no unobserved heterogeneity. These assumptions were tested, results are presented in the following sections.

Linear Additivity. The Linear Additivity Assumption stipulates that a predictor's effect is additive and does not depend on the values of other predictors in the model and also that the effect of the predictor is linear. To test if the effect of each predictor in Model G (Age for Grade, Retention and Absences) is additive and not dependent upon the value of the other predictors, interaction terms were created between each of the predictors and a model was run which tested for the main effects of each variable and the effects of the interaction terms. This model therefore included the six time indicators, the variables Age for Grade, Retain and Absences and interaction terms Age for Grade X Absences, Age for Grade X Retain and Retain X Absences. Goodness of fit measures were compared for the model run with and without the interaction

terms. If the model's goodness of fit measures were significantly improved it would be assumed that there was a significant interaction. It is noteworthy that with the addition of the three interaction terms there are twelve parameters in this model. Reliability of the parameter estimates for this model should be interpreted with caution as having twelve parameters and only 98 dropout events violates the rule of thumb of having at least ten events per predictor variable.

In this model, the interaction term for absences and retentions was significant. There was also a significant decrease in the $\Delta - 2 \log$ likelihood value for this model in comparison to Model G, $\Delta - 2 \log$ likelihood (3) = 11.101, $p < 0.05$. This result suggests that the effects of the Retain and Absences variables were not additive and that there is an interaction between retained status and the number of absences. To further characterize this interaction retained students were categorized into three groups based on the number of absences they had accumulated in each year (0-10, 20-39, or 40+). Hazard ratios were calculated for each group and compared. Amongst the retained students, hazard ratios for the 0-19 absences group were the lowest, followed by the 20-39 absences group, followed by the 40+ absences group. This result suggests that being retained has a greater effect on dropout risk for students who are absent more often.

In order to determine if a continuous variable such as Absences in this study has a linear effect on dropout risk, Willett and Singer suggest categorizing the continuous variable into a small number of groups, creating a series of dummy variables representing group membership, running a model including these dummy variables and then examining the pattern of parameter estimates (Singer & Willett, 2003). To determine if the effect of absences on dropout is linear, absences were categorized into three groups: 0-19 absences, 20-39 absences and 40+ absences. Dummy variables were created for each group and a model was run including these three dummy

variables in addition to the time indicators, Age for Grade, Retained and Absences. Analysis of the parameter estimates for the dummy variables revealed that Absences behaved in a linear manner and therefore it has a linear effect on dropout risk.

Proportionality. The proportionality assumption stipulates that each predictor has an identical effect in every time period of the study. To test this assumption, Willett and Singer suggest analyzing a model which includes interaction terms between the time terms and the predictor variables (Singer & Willett, 2003). If this model which includes interactions with time has significantly improved goodness of fit measures it can be assumed that the proportionality assumption is being violated. To test this assumption, discrete time hazard models were ran which included the time indicators, the variables Age for Grade, Retain, and Absences and interaction terms between these variables and the time indicators respectively. Results indicated that the interaction terms in these models were not significant. These models also produced goodness of fit measures which were not significantly better than Model G and therefore proportionality was assumed.

Unobserved Heterogeneity. The no unobserved heterogeneity assumptions stipulates that the hazard functions depends solely on its predictor variables i.e. covariates included in each model account for all variation. As per Willett and Singer, unobserved heterogeneity asserts a consistent effect over time which leads to hazard functions that appear to decline over the length of the study (Singer & Willett, 2003). In this study, the hazard function increased over time and therefore unobserved heterogeneity assumption was not considered to be problematic.

Analysis of deviance residuals. To ascertain how well Model G performed for individual cases, an analysis of residuals was completed. For discrete time hazard models,

analyzing residuals as a simple difference between an observed value and a model based “expected” value does not suffice, because each participant will have a set of outcomes for each time period they were at risk for dropout instead of a single outcome. Also, while the expected value, predicted hazard probability, lies somewhere between 0 and 1, the observed outcome in every period will be either 0 or 1. As a result, the models under-predict when the event occurs and over-predict when it does not occur making it problematic to define a residual as the difference between observed and expected values (Singer & Willett, 2003). Willett and Singer suggest analyzing deviance residuals. The value of a deviance residual indicates how well the model fits that person’s data for that period. Large values indicate that outcomes were poorly predicted. When Model G was analyzed, there were not many cases with high outlier deviance residuals which suggests that the model fits the data well.

Chapter 6:

Discussion

Summary of Findings

In order to better understand the relationship between aggressive behavior and high school dropout, a survival analysis of high school dropout was completed using a sample of students from two middle schools in an urban, low income school district in the Northeastern United States. This analysis aimed to characterize the timing of dropout, calculating its probability in each year in which members of the sample dropped out. This analysis also compared how well a host of variables including teacher and peer rated aggression predict high school dropout. It was hypothesized that aggressive students would have a higher probability of dropping out than non-aggressive students and will dropout earlier than non-aggressive students. It was also hypothesized that after controlling for educational variables which research has shown to be highly predictive of dropout, aggression would no longer be a significant predictor. Of these educational variables, it was hypothesized that being Age for Grade and retentions would be the most significant predictors.

In comparison to non-aggressive students, students categorized as aggressive had a higher risk of dropout. This finding is consistent with past research (Ensminger & Slusarcick, 1992; French & Conrad, 2001; Kokko et al., 2006). Hazard functions, which show risk of dropout in each year of the study, reveal that dropout risk is higher in all years for aggressive students. The shape of the hazard functions for aggressive and non-aggressive students are similar, with risk of dropout increasing each year, peaking at Year 6 (Grade 11) and then decreasing in Year 7 (Grade 12).

A discrete time hazard model including the effect of time, Age for Grade, retention status and absences was the best predictor of dropout. Aggression was no longer a significant predictor of dropout when these variables were included in the models. The effect of time was significant in every model which suggests that in this sample, dropout is time variant and can therefore never be predicted without consideration of a student's grade.

In this sample, ninety-eight out of the 685 participants (14.31%) dropped out. It is noteworthy that this rate is most likely an underestimation of the number of students who dropped out as some of the students censored from the study most likely dropped out as well. As per the National Center for Education Statistics, in 2012, the national "status dropout rate" defined as the percentage of sixteen through twenty-four year-olds who are not enrolled in school and have not earned a high school credential, was 6.6%. In 2006, the on-time graduation year for this sample which started the 6th grade in 1999, the national "status dropout rate" was 9.3% (Stark, Noel, & McFarland, 2015). It is noteworthy that the dropout rate calculated in this study includes students who may have later received a GED. In the "status dropout rate" calculations, students who receive a GED are considered high school completers. A number of the ninety-eight dropouts in this study may have eventually received a GED and therefore "status dropout rate" for this sample would most likely be lower than 14.31%.

As reported in the 2006 Graduation Rate Report on the Massachusetts Department of Elementary and Secondary Education website, 33.9% of the 1812 students enrolled in the school district from which this sample was recruited, dropped out (Massachusetts Department of Elementary and Secondary Education, 2006). It is noteworthy that this district dropout rate is calculated for a cohort of students based on when they first enter the 9th grade. The 2006 cohort represents students who entered the 9th grade at the beginning of the 2002-2003 school year.

This is noteworthy as the sample for this study was followed beginning in the 6th grade and a number of students in this sample were retained prior to entering the 9th grade. Therefore the 2006 district cohort dropout rate would not include students from this sample who did not begin the 9th grade in 2002-2003, i.e. students who were retained prior to the 9th grade. The district cohort dropout rate of 33.9% is significantly higher than the rate of 14.31% calculated for this sample. A variety of reasons may explain this difference in dropout rates. This sample attended only two of multiple middle schools in the district. While there were no significant differences in dropout rates between the two middle schools that students from this sample attended, there may be differences in dropout rates between these two schools and other middle schools in the district. This sample also included only regular education students while the cohort dropout rate for the entire district includes both regular and special education students. Additionally, a number of the students censored after Year 7 of this study were still enrolled in school following Year 7. In this study, dropout rates were calculated using dropout events that only occurred during the seven years of the study. The 2006 district cohort dropout rate also counts students who dropped out following their expected graduation year (Year 7 of this study), which explains the higher rate of dropout in comparison to the dropout rate for this study.

The hazard function for the entire sample displayed a trend in dropout risk in which risk rose steadily from Year 2 (on-time 7th Grade if student was not retained) through Year 6 (on-time 11th grade if student was not retained), with risk being highest in Year 6 (Grade 11) and then decreasing in Year 7 (Grade 12). There was a larger increase in dropout risk between Years 4 (Grade 9) and 5 (Grade 10) and between Years 5 and 6. In 2009-2010, nationally, as per the National Center for Education Statistics, dropout rates by grade were as follows: 2.6% in Grade 9, 3.0% in Grade 10, 3.3% in Grade 11 and 5.1% in Grade 12 (Stetser & Stillwell, 2012). The

national dropout rate per grade shows a pattern of increasing dropout rate with a larger increase between Grades 11 and 12. The pattern of dropout risk for this sample indicates that Year 6 (on-time Grade 11) is the year with the highest risk, followed by a decrease in risk in Year 7 (on-time Grade 12). Other studies which utilized survival analysis to examine high school dropout, showed different patterns of dropout risk. In a 2010 study, described in the literature review, the hazard function for dropout risk was similar in shape to the hazard function for this sample, with Grade 11 being the year with the highest risk, followed by a decrease between Grades 11 and 12 (Bowers, 2010). In this study, dropout risk decreased between Grades 9 and 10 and then rose again between Grades 10 and 11, which was a different pattern of risk compared to this sample in which dropout risk rose steadily through Year 6. A 2001 study which examined dropout longitudinally, calculated risk of dropout at intervals based on a student's age instead of grade. In this study, dropout risk increased as the students got older with age, seventeen being the age at which most students dropped out. In this study, dropout risk did not peak and then decrease as with the sample described in this dissertation (Vitaro, Larocque, Janosz, & Tremblay, 2001). A 2005 study, which also utilized survival analysis found that dropout risk steadily increased with age, peaking at the age of eighteen (Vizcain, 2005).

For this sample, students who were confirmed as dropouts performed worse on all of the educational variables identified as the best warning flags of dropout. Compared to students who did not dropout, dropouts were more likely to be Old for Grade or retained at one point in the study, had lower GPAs, were absent more often and accumulated more suspensions. This finding is consistent with past research on dropout warning flags which finds that attendance course performance and behavior are better predictors of student outcomes than student demographics (Bruce et al., 2011) or their scores on standardized tests and that these variables

can identify a significant proportion of dropouts in middle school (Casillas, Robbins, Allen, Kuo, et al., 2012; Logan, 2010; Mckee, 2009).

Hypothesis IA – Is aggression positively associated with high school dropout?

Correlational analyses revealed that peer rated aggression but not teacher rated aggression was positively correlated with dropout. Comparison of hazard functions for students categorized as aggressive vs. non-aggressive on both peer and teacher rated aggression revealed that in every year in which there were dropouts for each category, dropout risk was higher for aggressive students.

Hypothesis IB – Is there a difference in timing of dropout for aggressive vs. non-aggressive students? Comparison of hazard functions for students categorized as aggressive vs. non-aggressive showed that aggressive students had higher risk of dropout. For peer-rated aggression the shape of the hazard functions were similar except for one difference. For aggressive subjects, dropout risk increased from Year 6 to Year 7. For non-aggressive subjects, dropout risk decreased from Year 6 to Year 7. This result suggests that there is a difference in timing of dropout for aggressive students as rated by peers. For teacher-rated aggression, the shape of hazard functions for aggressive and non-aggressive students was the same with dropout risk increasing from Year 4 to Year 6 and then decreasing in Year 7. This result suggests that there is no difference in timing of dropout for aggressive students. It was originally hypothesized that the shape of hazard functions for aggressive and non-aggressive students would be different, with aggressive students tending to dropout earlier than non-aggressive students. If this hypothesis were true, the difference in hazard ratios in the early years of high school, 9th and 10th grade, would have been larger than the results indicated and the shapes of the hazard functions would have been different. This hypothesis was not supported by the results.

Hypothesis II – Which variables best predict dropout? Goodness of fit measures for discrete time hazard models containing different predictors were compared to find which variables best predicted dropout in this sample. A model measuring the effect of time, Age for Grade, retentions and absences produced the best goodness of fit measures. This result suggests that being Old for Grade prior to entering the 6th grade, retentions from the 6th grade on and absences are the best predictors of dropout. Time was a significant predictor of dropout in every model which suggests that any variable tested cannot predict dropout without considering the year in a student's educational career.

Additional Findings. Interestingly, peer rated aggression appeared to be a stronger predictor of dropout than teacher rated aggression. Correlational analyses revealed that teacher rated aggression was not significantly related to dropout. In a discrete time hazard model including the effect of time, Age for Grade and both peer and teacher rated aggression, peer-rated and not teacher-rated aggression was a significant predictor of dropout. This result was counter-intuitive as it was assumed that a teacher's perception of a student's level of aggression would have more of an impact on dropout risk than a peer's perception as teachers are responsible for producing measures of educational performance such as GPA which research has shown is related to dropout. There is research which suggests that negative peer relationships are associated with dropout (French & Conrad, 2001). This study's finding that peer-rated aggression is related to dropout is consistent with these findings.

In every discrete time hazard model analyzed in this study, time was a significant predictor. Therefore dropout was not time invariant and could not be predicted solely by the hypothesized predictors analyzed in this study without considering the year of the study. In past research, when GPA was included in discrete time hazard models with the effect of time, time

was no longer a significant predictor (Bowers, 2010) and it was therefore concluded that at any time point a student's GPA along with retention status could explain a student's risk of dropout. Due to missing data, the effect of GPA on dropout risk could not be analyzed in this study. It would be interesting to see if GPA was included in discrete time hazard models for this sample if the effect of time would no longer be significant.

Strengths of the Study

A strength of this study is related to the use of survival analysis and how it accounted for students who left the dataset due to reasons other than dropout through the use of censoring. According to enrollment files, multiple students left each year because they transferred. Additionally, multiple students left the dataset and could not be confirmed as dropouts. The use of survival analysis in this study allowed for dropout to be examined among the students in each grade level still at risk of leaving school and not graduating on time, rather than aggregating all years in the data set. In this study, if all years were aggregated, and dropout risk was not calculated on a year to year basis after censoring students no longer at risk of dropout, dropout risk would have been under-estimated.

A second strength of this study is related to how dropout was coded based on enrollment files. Students were counted as dropouts only if enrollment files indicated that the student dropped out and a code providing a reason for dropout was provided. Students for whom there were missing enrollment files after a given year and for whom there was no record of transfer, were not considered dropouts and instead were censored from the dataset. It is possible that a number of these subjects missing enrollment data were indeed dropouts. It was decided,

however, to measure dropout conservatively and only classify students as dropouts if it was confirmed by enrollment files. This conservative approach to classifying dropouts is a strength of this study, as it prevents students from being misclassified as dropouts.

Limitations of the Study

While this study provides interesting findings on the relationship between high school dropout and aggression, there are limitations of the study which should be considered. One limitation is related to the manner in which dropout was calculated. According to enrollment files provided by the school district in which the study took place, a number of students left school that were not confirmed as either dropouts or transfers. A conservative approach to measuring dropout was utilized and these students who could not be confirmed as either dropouts or transfers were not counted as dropouts and were censored in the year in which they no longer were enrolled. A number of these students most likely dropped out and therefore the number of dropouts in this study is an underestimation of the number of students who dropped out in this sample. A consequence of this underestimation of the number of dropouts is that there were fewer dropout events and therefore not enough statistical power needed to model the effect of the hypothesized predictors and interactions between these variables on dropout.

The lack of dropout events was a major limitation of the study. Due to the lack of dropout events, specifically in the early years of the study, there was not enough statistical power to model the effect of interactions between aggression and the educational variables. Another limitation of this study was the amount of missing data for two key variables, GPA and

suspensions. Due to missing data, these variables could not be included in discrete time hazard models to see if they were significant predictors of dropout.

Implications for Schools

In various discrete time hazard models which modeled the effect of time, and combinations of aggression and multiple educational and demographic variables, being Old for Grade prior to entering the 6th grade and retentions after the 6th grade were significant predictors of dropout in all models in which they were included. Fitted hazard functions showed that subjects who were both Old for Grade and retained after the 6th grade, meaning they had been retained more than one time in their educational career, had higher risk of dropout in each year of the study. This result is consistent with previous research which identifies retention as a warning flag for dropout and an ineffective practice for schools to utilize (S. R. Jimerson et al., 2002). Research has also shown that multiple retentions significantly increase the likelihood that a student will drop out of school. Results from this study support the current movement away from retention as an intervention for failing students as it is such a strong predictor of high school dropout.

Results of this study indicated that none of the variables, including Age for Grade and retentions, could predict high school dropout without considering the effect of time, i.e. the student's current grade in their educational career. This result suggests in developing early warning systems which identify the variables which best predict dropout, schools also need to consider a student's grade and recognize that the effect of variables on dropout may differ based on a student's grade.

Due to limitations of sample size and lack of dropout events, the effect of statistical interactions between teacher and peer-rated aggression and dropout warning flags on dropout risk could not be analyzed. Results of this study, however, did show that aggressive students exhibited many of the warning flags related to high school dropout. In every year of the study aggressive students had lower GPA's, more absences and were more likely to be Old for Grade and retained; all variables which predict dropout.

As many studies have shown that all samples will have a small group of individuals who exhibit chronic levels of high aggression throughout development, it should be assumed that every school will have a small group of students who will exhibit aggressive behavior in school, possibly as early as elementary school. This study and many previous studies have shown that aggressive students are more likely to dropout and will exhibit all of the warning flags related to dropout. It is the responsibility of schools to keep these students on-track towards graduation. Given that research shows that aggressive students will exhibit these warning flags, early warning systems should be in place which identify when students are beginning to exhibit these warning flags and schools should then intervene immediately. Examples of tools which can be used to identify students who are falling off-track are the Early Warning System Middle Grades Tool and the Early Warning System High School Tool developed by the National High School Center (Heppen & Therriault, 2008). These tools use attendance and course performance data to identify who is at risk of dropping out and target these students for immediate intervention.

Schools should also be equipped to manage a student's aggressive behavior using practices other than exclusionary discipline. If a school's initial and only response to an aggressive act is to suspend a student, they will be initiating the warning flags that lead to a student eventually dropping out. School suspension is not effective as it does not teach students

more effective ways to handle conflict and regulate emotions that may lead them to act out aggressively. Instead, it results in a loss of academic instructional time for a subgroup of students who need it most.

In a 2012 review on the use of exclusionary discipline practices in schools, Maag recommends strategies schools can use to move away from the use of exclusionary discipline strategies and towards the use of more positive behavior supports (Maag, 2012).

Recommendations for school administrators include establishing a collaborative school climate where there is shared ownership for student learning and promoting prosocial behaviors, and requiring teachers to receive additional training on classroom management and be actively involved in at least one professional learning community that focuses on behavioral issues. It is also recommended that schools adopt a multi-tiered approach to school discipline, which acknowledges that one strategy will not work for all students and allows for modification of practices and addition of extra supports for students exhibiting the most challenging behaviors.

One example of this approach is School-Wide Positive Behavior Interventions and Supports (SWPBIS). SWPBIS is a multi-tiered framework that guides the organization of behavior support within a school with the goal of improving both behavior and academic outcomes for all students. SWPBIS involves clearly defining, teaching, and reinforcing school-wide expectations; making data-based decisions to monitor intervention implementation and student response; differentiating levels of support in response to student need; and establishing systems to sustain implementation. Behavior interventions are organized into three tiers of support. Tier 1, also called universal or school-wide support, is designed for all students and staff and is available across all settings within a school. Tier 2, or targeted, small group support, addresses the needs of subgroups of students who require additional support. Support is given in

specific areas such as study skills, social skills, behavior, attendance, or dropout. Tier 3, or individualized support, is provided to students who need intensive individualized supports such as individualized behavior plans or wraparound supports. A 2015 study explored the links between implementation of SWPBIS and academic, attendance, and behavior outcome measures across a large sample of high schools from 37 states. Results indicated that implementation of SWPBIS with fidelity was associated with reductions in Office Discipline Referral rates and increases in attendance rates; however, there was no effect on academic performance (Freeman et al., 2015).

There is also a movement toward the usage of restorative justice practices as an alternative to exclusionary discipline. Restorative responses to misbehavior can take a variety of forms that are centered on several core principles including: 1) focus on relationships first and rules second; 2) give voice to the person harmed and the person who caused the harm; 3) engage in collaborative problem-solving; 4) enhance personal responsibility; 5) empower change and growth; and 6) include strategic plans for restoration/repairation. These strategies offer students a way to make amends and repair the harm caused by their behavior. An assumption underlying restorative responses is that "justice" is not just about punishing but rather about repairing the harm caused to victims, offenders and community. Achieving school discipline in a restorative way suggests that holding students accountable for their aggressive behavior is not about asking them to "take the punishment," but rather about ensuring that they take responsibility by making amends to their victims and the community harmed. There is evidence that restorative approaches to school discipline can result in reduced suspension and expulsion, decreased disciplinary referrals, improved academic achievement, and other beneficial results (Schiff, 2013).

School districts should also take a preventative approach to reducing aggressive and disruptive behaviors by emphasizing social-emotional learning in every year of a student's schooling. There is extensive research which shows that mastery of social-emotional competencies is associated with better school performance while lack of competency in these areas can lead to a variety of personal, social, and academic difficulties. Social-emotional learning is defined as the process of acquiring core competencies to recognize and manage emotions, set and achieve positive goals, appreciate the perspectives of others, establish and maintain positive relationships, make responsible decisions, and handle interpersonal situations constructively. The goals of social-emotional learning programs are to foster development of these competencies. These competencies should then provide a foundation for better adjustment and academic performance, more positive social behaviors, fewer conduct problems, less emotional distress and improved test scores and grades. Social-emotional learning programs include instruction in processing, integrating, and selectively applying social and emotional skills in developmentally, contextually, and culturally appropriate ways. Social-emotional learning skills are taught, modeled, practiced, and applied to a variety of situations so that students can utilize them in a variety of situations. Social-emotional learning programming also seeks to establish safe, caring learning environments involving peer and family initiatives, improving classroom management and teaching practices, and whole-school community building activities. A 2011 meta-analysis of 213 school-based social-emotional learning programs involving 270,034 students in grades ranging from Kindergarten through high school, showed that compared to controls, students who participated in social-emotional programs demonstrated significantly improved social and emotional skills, attitudes, behavior, and academic performance (Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger,

2011) These findings provide evidence for the efficacy of social-emotional learning programs. A school district's emphasis on social emotional learning from when student's first enter elementary school may improve the ability of chronically aggressive students' ability to manage their emotions and handle conflicts appropriately thus preventing problem behaviors in the long run.

Future Directions

This dissertation, consistent with prior research shows that aggressive students are at higher risk of dropout at every point along their educational career and at higher risk for accumulating all of the warning flags for dropout. A future direction for research would be to further examine this relationship and find out why aggressive students show all of these warning flags.

Studies subsequent to this dissertation should be directed at further examining the relationship between aggressive behavior and dropout warning flags such as retentions, absences, GPA and suspensions. Data should be analyzed on these variables for aggressive students to determine when these warning flags begin to accumulate. It is important that this analysis be completed when students first enter elementary school. This study showed that by the 6th grade, aggressive students were already absent more often, getting poorer grades and were more likely to be Old for Grade, all indicators that they were already off track towards high school graduation. Extension of this analysis into elementary school could help determine when aggressive students first begin to fall off-track. An analysis of attendance patterns for aggressive students would determine if aggressive students are absent more often than non-

aggressive students from when they first begin elementary school or if an increase in absences occurs gradually. Understanding of these patterns would allow school personnel to foresee a potential increase in absences and intervene proactively. An analysis of grades for aggressive students would determine if aggressive students get lower grades in academic subjects from when they first start school, if these grades gradually decline or dropout off significantly at any one point. Analysis of suspension data can be used to determine the point at which aggressive students are first subjected to exclusionary discipline. These analyses are a crucial next step in characterizing the relationship between aggressive behavior and dropout as it would allow researchers to understand patterns in how aggressive students accumulate the warning flags for dropout. This knowledge would be helpful for schools as they can proactively plan interventions prior to time points in an educational career where aggressive students are expected to fall off-track to graduation with regards to a specific warning flag.

It was the goal of this study to examine interactions between aggression and attendance, GPA, suspensions and retentions. Due to limited sample size, this analysis could not be completed. A similar analysis should be completed using a larger sample to determine if any of these interactions were strong predictors of dropout. This analysis would help schools understand which of these warning flags were the most predictive of dropout for aggressive students and direct their limited resources at interventions aimed at these specific warning flags.

Future analyses should also attempt to control for individual factors such as a student's academic ability. It would be interesting to see if aggressive students exhibit all of these warning flags despite having the requisite academic skills necessary to get satisfactory grades. Analysis of these students' data in elementary school could determine when these students fall behind

national norms for these skills or if they do maintain these skills what other factors lead to them falling off-track.

Given the result that peer-rated aggression was a better predictor of dropout than teacher-rated aggression, it would be interesting to further examine this sample's peer relationships to determine if they had any relationship with the student dropping out. Past research has shown that peers who are anti-social and rejected by peers are at higher risk of dropout (French & Conrad, 2001). It would be interesting to see if the students rated as aggressive by their peers in this sample also felt rejected by peers leading to their lack of engagement in school. The students rated as aggressive by their peers may have also been involved in acts of delinquency or substance abuse which may have led to their difficulties in school. It would be worthwhile to further examine the connection between peer-rated aggression and dropout to better understand the students who are rated as aggressive by peers and what about their school experience may lead to them dropping out.

Conclusions

The goal of this study was to better characterize the relationship between aggressive behavior and dropout using survival analysis. In this sample, aggressive students had a higher risk of dropout and exhibited all of the warning flags related to dropout as early as the 6th grade. While aggressive students were at higher risk of dropout at every point in their educational career, their pattern of dropout timing was no different than for non-aggressive students. Aggression as rated by peers and teachers did not predict dropout above and beyond a student's Age for Grade and retention status or the number of absences in each year. Interactions

between aggression and these variables could not be analyzed for their predictive power due to limited statistical power. In conclusion, this dissertation showed that aggressive students are at higher risk of dropout and will perform poorer on all measures of educational performance which predict dropout. Therefore continued studies which examine the educational paths taken by aggressive students longitudinally are necessary to determine exactly when and why they fall off-track towards graduation.

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Appendix:
Tables and Figures

Table 1		
<i>Frequencies for each category of demographic variables</i>		
	<i>Overall</i>	
<u>Variable</u>	<u>N</u>	<u>%</u>
<u>Overall</u>	685	
<u>Gender</u>		
<i>Male</i>	356	52.0%
<i>Female</i>	329	48.0%
<u>Ethnicity</u>		
<i>Latino/Hispanic</i>	290	42.3
<i>Black/African American</i>	119	17.4
<i>Asian</i>	18	2.6
<i>White</i>	188	27.4
<i>Bi-racial</i>	62	9.1
<i>None of the Above</i>	8	1.2
<u>Middle School Attended in 6th Grade</u>		
<i>Middle School 1</i>	292	42.6%
<i>Middle School 2</i>	393	57.4%

Table 2

Descriptive Statistics on Demographic Variables for Dropouts vs. Non-Dropouts

	<u>Total Sample</u> <u>(n=685)</u> <u>n, %</u>	<u>Dropouts (n = 98)</u> <u>n, %</u>	<u>Non-dropouts(n=587)</u> <u>n, %</u>
<u>Gender</u>			
Male	356, 52%	46, 46.9%	310, 52.8%
Female	329, 48.0%	52, 53.1%	277, 47.2%
<u>Race</u>			
Latino	290, 42.3%	52, 53.1%	238, 40.5%
African American	119, 17.4%	17, 17.3%	102, 17.4%
Asian	18, 2.6%	3, 3.1%	15, 2.6%
White	188, 27.4%	18, 18.4%	170, 29.0%
Bi-Racial	62, 9.1%	8, 8.2%	54, 9.2%
None of the Above	8, 1.2%	0, 0%	8, 1.4%
<u>Middle School Attended</u>			
Middle School 1	292, 42.6%	45, 45.9%	247, 42.1%
Middle School 2	393, 57.4%	53, 54.1%	340, 57.9%

Table 3

Descriptive Statistics on Ethnicity Dichotomies for Dropouts vs. Non-Dropouts

	<u>Total Sample</u> <u>(n=685)</u> <u>n, %</u>	<u>Dropouts (n = 98)</u> <u>n, %</u>	<u>Non-dropouts(n=587)</u> <u>n, %</u>
<u>Race</u>			
Latino	290, 42.3%	52, 53.1%	238, 40.5%
Not Latino	395, 57.7%	46, 46.9%	349, 59.5%
White	187, 27.3%	17, 17.3%	170, 29.0%
Not White	498, 72.7%	81, 82.7%	417, 71.0%

Table 4

Descriptive Statistics on Time Invariant Variables for Dropouts vs. Non-Dropouts

	<u>Total Sample</u> <u>(n=685)</u> <u>n, %</u>	<u>Dropouts (n = 98)</u> <u>n, %</u>	<u>Non-dropouts(n=587)</u> <u>n, %</u>
<u>Age for Grade</u>			
Age for Grade	541, 79.0%	67, 68.4%	474, 86.2%
Old for Grade	107, 15.6%	31, 31.6%	76, 13.8%
Missing	37, 5.4%		
<u>Aggression</u>			
	<u>N, Mean, SD</u>	<u>N, Mean, SD</u>	<u>N, Mean, SD</u>
Peer	685, 4.17, 5.94	98, 5.41, 7.91	587, 3.97, 5.53
Teacher	685, 0.27, 0.41	98, 0.32, 0.46	587, 0.26, 0.40

Table 5

Descriptive Statistics on Time Variant Variables for Dropouts vs. Non-Dropouts

	<u>Total Sample</u>			<u>Dropouts</u>			<u>Non-dropouts</u>		
	<u>n</u>	<u>Mean</u>	<u>SD</u>	<u>n</u>	<u>Mean</u>	<u>SD</u>	<u>n</u>	<u>Mean</u>	<u>SD</u>
<u>GPA</u>									
Year 1	626	73.83	11.75	88	66.86***	9.35	538	74.97	11.71
Year 2	582	73.50	10.35	82	72.64	10.29	500	73.64	10.36
Year 3	535	72.76	11.14	76	64.04***	7.18	459	74.20	11.02
Year 4	532	69.68	12.44	89	61.37***	8.41	443	71.35	12.45
Year 5	449	69.94	11.94	64	60.89***	8.88	385	71.45	11.72
Year 6	381	70.35	11.68	36	58.58***	6.75	345	71.58	11.40
Year 7	326	73.93	11.46	6	56.83***	2.40	320	74.25	11.31
<u>Absences</u>									
Year 1	685	12.73	12.19	98	20.13***	16.60	587	11.49	10.83
Year 2	655	27.98	25.21	96	43.72***	26.46	559	25.28	23.99
Year 3	613	27.61	26.88	95	47.98***	37.16	518	23.88	22.66
Year 4	539	23.30	23.04	90	44.19***	30.86	449	19.11	18.52
Year 5	497	25.06	24.50	83	49.72***	34.39	414	20.11	18.43
Year 6	406	23.88	22.09	53	50.79***	34.78	353	19.84	16.04
Year 7	335	18.13	18.33	15	36.87***	26.57	320	17.25	17.42
<u>Suspensions</u>									
Year 1	685	.22	.79	98	.26	.89	587	.21	.78
Year 2	675	.27	.88	98	.41	.97	577	.25	.86
Year 3	634	.37	1.20	97	.76***	1.60	537	.30	1.10
Year 4	165	1.94	1.85	46	2.20	2.00	119	1.84	1.79
Year 5	519	.62	1.39	89	.83	1.33	430	.58	1.40
Year 6	424	.50	1.17	58	.74	1.37	366	.46	1.13
Year 7	342	.26	.73	16	.38	.89	326	.25	.73

Note: *p<.05, **p<0.01, ***p.001.

Table 6

Retain status for Dropouts vs. Non-Dropouts for Years 1 through 7

	<u>Total Sample</u>			<u>Dropouts</u>			<u>Non-dropouts</u>		
	<u>Retained</u>	<u>Not yet retained</u>		<u>Retained</u>	<u>Not yet retained</u>		<u>Retained</u>	<u>Not yet retained</u>	
	<u>n</u>	<u>n, %</u>	<u>n, %</u>	<u>n</u>	<u>n, %</u>	<u>n, %</u>	<u>n</u>	<u>n, %</u>	<u>n, %</u>
Year 1	685	NA	NA	98	NA	NA	587	NA	NA
Year 2	675	42, 6.2%	633, 93.8%	98	15, 15.3%	83, 84.7%	577	27, 4.7%	550, 95.3%
Year 3	634	76, 12.0%	558, 88.0%	97	27, 27.8%	70, 72.2%	537	49, 9.1%	488, 90.9%
Year 4	600	77, 12.8%	523, 87.2%	95	33, 34.7%	62, 65.3%	505	44, 8.7%	461, 91.3%
Year 5	542	187, 34.5%	355, 65.5%	90	61, 67.8%	29, 32.2%	452	126, 27.9%	326, 72.1%
Year 6	451	160, 35.5%	291, 64.5%	58	46, 79.3%	12, 20.7%	393	114, 29.0%	279, 71.0%
Year 7	367	115, 31.3%%	252, 68.7%	16	14, 87.5%	2, 12.5%	351	101, 28.8%	250, 71.2%

Table 7

Missing Data Analysis

	<u>Total Sample</u>			<u>Dropouts</u>			<u>Non-dropouts</u>		
	<u>n</u>	<u>n missing values</u>	<u>% missing values</u>	<u>n</u>	<u>n missing values</u>	<u>% missing values</u>	<u>n</u>	<u>n missing values</u>	<u>% missing values</u>
<u>Age for Grade</u>	685	37	5.4%	98	0	0	587	37	6.3%
<u>GPA</u>									
Year 1	685	59	8.61%	98	10	10.2%	587	49	8.35%
Year 2	675	93	13.78%	98	16	16.33%	577	77	13.34%
Year 3	634	99	15.61%	97	21	21.65%	537	78	14.53%
Year 4	600	68	11.33%	95	6	6.32%	505	62	12.28%
Year 5	542	93	17.16%	90	26	28.89%	452	67	14.82%
Year 6	451	70	15.52%	58	22	37.93%	393	48	12.21%
Year 7	367	41	11.17%	16	10	62.5%	351	31	8.83%
<u>Absences</u>									
Year 1	685	0	0%	98	0	0%	587	0	0%
Year 2	675	20	2.96%	98	2	2.04%	577	18	3.12%
Year 3	634	21	3.31%	97	2	2.06%	537	19	3.54%
Year 4	600	61	10.16%	95	5	5.26%	505	56	11.09%
Year 5	542	45	8.30%	90	7	7.78%	452	38	8.41%
Year 6	451	45	9.98%	58	5	8.62%	393	40	10.18%
Year 7	367	32	8.71%	16	1	6.25%	351	31	8.83%
<u>Suspensions</u>									
Year 1	685	0	0%	98	0	0%	587	0	0%
Year 2	675	0	0%	98	0	0%	577	0	0%
Year 3	634	0	0%	97	0	0%	537	0	0%
Year 4	600	435	72.5%	95	49	51.58%	505	386	76.44%
Year 5	542	23	4.24%	90	1	1.11%	452	22	4.88%
Year 6	451	27	5.99%	58	0	0%	393	27	6.87%
Year 7	367	25	6.81%	16	0	0%	351	25	7.12%

<u>Variable</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>
<u>1. Dropout</u>	r 1	.041	-.089*	.091*	-.001	-.027	.172**	.324**	.085*	.055	-.305**	.443**	.147**
	N 685	685	685	685	685	685	648	685	685	685	667	685	685
<u>2. gender</u>	r .041	1	-.010	.091*	-.049	.031	-.107**	-.033	-.138**	-.180**	.057	.085*	-.114**
	N 685	685	685	685	685	685	648	685	685	685	667	685	685
<u>3. Ethnicity – Latino</u>	r -.089*	-.010	1	-.525**	-.391**	-.063	-.103**	-.257**	-.040	-.041	.279**	-.197**	-.177**
	N 685	685	685	685	685	685	648	685	685	685	667	685	685
<u>4. Ethnicity – White</u>	r .091*	.091*	-.525**	1	-.280**	-.031	.129**	.262**	.167**	.105**	-.332**	.213**	.193**
	N 685	685	685	685	685	685	648	685	685	685	667	685	685
<u>5. Ethnicity – African American</u>	r -.001	-.049	-.391**	-.280**	1	.021	.016	.015	-.134**	-.037	.026	.013	-.003
	N 685	685	685	685	685	685	648	685	685	685	667	685	685
<u>6. Middle School</u>	r -.027	.031	-.063	-.031	.021	1	-.082*	-.093*	.074	.032	.129**	-.152**	-.052
	N 685	685	685	685	685	685	648	685	685	685	667	685	685
<u>7. Age for Grade</u>	r .172**	-.107**	-.103**	.129**	.016	-.082*	1	.131**	.101*	.096*	-.228**	.215**	.098*
	N 648	648	648	648	648	648	648	648	648	648	639	648	648

Table 8 (Continued):

Correlation Matrix for Hypothesized Predictors and Dropout (N=685)

<u>Variable</u>		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>
<u>8. Retained</u>	r	.324**	-.033	-.257**	.262**	.015	-.093*	.131**	1	.169**	.152**	-.568**	.504**	.412**
	N	685	685	685	685	685	685	648	685	685	685	667	685	685
<u>9. Peer Aggression</u>	r	.085*	-.138**	-.040	.167**	-.134**	.074	.101*	.169**	1	.461**	-.257**	.228**	.366**
	N	685	685	685	685	685	685	648	685	685	685	667	685	685
<u>10. Teacher Aggression</u>	r	.055	-.180**	-.041	.105**	-.037	.032	.096*	.152**	.461**	1	-.230**	.215**	.379**
	N	685	685	685	685	685	685	648	685	685	685	667	685	685
<u>11. GPA (mean)</u>	r	-.305**	.057	.279**	-.332**	.026	.129**	-.228**	-.568**	-.257**	-.230**	1	-.523**	-.391**
	N	667	667	667	667	667	667	639	667	667	667	667	667	667
<u>12. Absences (mean)</u>	r	.443**	.085*	-.197**	.213**	.013	-.152**	.215**	.504**	.228**	.215**	-.523**	1	.389**
	N	685	685	685	685	685	685	648	685	685	685	667	685	685
<u>13. Suspensions</u>	r	.147**	-.114**	-.177**	.193**	-.003	-.052	.098*	.412**	.366**	.379**	-.391**	.389**	1
	N	685	685	685	685	685	685	648	685	685	685	667	685	685

Note. * $p < .05$. ** $p < .01$. *** $p < .001$

Table 9

Descriptive Data on Aggressive Behavior for Different Demographic Groups

		<u>Peer-Rated Aggression</u>	<u>Teacher-Rated Aggression</u>
		<u>N, Mean, SD</u>	<u>N, Mean, SD</u>
<u>Gender</u>			
	Male	356, 4.96, 6.90	356, .34, .47
	Female	329, 3.32, 4.55	329, .19, .32
<u>Race</u>			
	Latino	290, 4.45, 6.06	290, .29, .44
	African American	118, 5.92, 6.71	118, .30, .44
	Asian	18, 2.17, 3.24	18, .16, .44
	White	187, 2.55, 4.60	187, .20, .34
	Bi-Racial	62, 4.59, 6.26	62, .32, .39
	None of the Above	8, 7.90, 9.70	8, .55, .57
	Latino	290, 4.45, 6.06	290, .29, .44
	Not Latino	395, 3.97, 5.85	395, .25, .39
	White	187, 2.55, 4.60	187, .20, .34
	Not White	498, 4.78, 6.27	498, .29, .44
	Black	118, 5.92, 6.71	118, .30, .44
	Not Black	567, 3.80, 5.71	567, .26, .41
<u>Age for Grade</u>			
	Age for Grade	541, 3.91, 5.70	541, .25, .40
	Old for Grade	107, 5.50, 6.75	107, .36, .48

Table 10

Life Table for the Event Histories for Student Dropout of the Sample of 685 Participants

<i>Year</i>	<u>N</u>				<u>Proportion</u>	
	<i>Enrolled at the End of the School Year</i>	<i>Dropped out during the school year</i>	<i>Censored during the school year</i>	<i>Total removed from the data set by end of school year</i>	<i>Participants at the beginning of the school year who dropped out before the start of the next school year</i>	<i>All participants still enrolled at the end of the school year</i>
1	685	0	10	10	0.0000	1.0000
2	675	1	40	41	0.0015	0.9985
3	634	2	32	34	0.0032	0.9950
4	600	5	53	58	0.0083	0.9867
5	542	32	59	91	0.0590	0.9285
6	451	42	42	84	0.0931	0.8421
7	367	16	351	367	0.0436	0.8054

Table 11

Life Table for the Event Histories for Student Dropout of the Sample of Participants Rated as Aggressive by Peers (top 15%)

<i>Year</i>	<u>N</u>				<u>Proportion</u>	
	<i>Enrolled at the End of the School Year</i>	<i>Dropped out during the school year</i>	<i>Censored during the school year</i>	<i>Total removed from the data set by end of school year</i>	<i>Participants at the beginning of the school year who dropped out before the start of the next school year</i>	<i>All participants still enrolled at the end of the school year</i>
1	103	0	0	0	0	1
2	103	0	10	10	0	1
3	93	0	5	5	0	1
4	88	1	12	13	0.0114	0.9886
5	75	7	18	25	0.0933	0.8964
6	50	7	9	16	0.1400	0.7709
7	34	5	29	34	0.1471	0.6575

Table 12

Life Table for the Event Histories for Student Dropout of the Sample of Participants Rated as Not Aggressive by Peers (< top 15%)

<i>Year</i>	<u>N</u>				<u>Proportion</u>	
	<i>Enrolled at the End of the School Year</i>	<i>Dropped out during the school year</i>	<i>Censored during the school year</i>	<i>Total removed from the data set by end of school year</i>	<i>Participants at the beginning of the school year who dropped out before the start of the next school year</i>	<i>All participants still enrolled at the end of the school year</i>
1	582	0	10	10	0	1
2	572	1	30	31	0.0017	0.9983
3	541	2	27	29	0.0037	0.9946
4	512	4	41	45	0.0078	0.9868
5	467	25	41	66	0.0535	0.9340
6	401	35	33	68	0.0873	0.8525
7	333	11	322	333	0.0330	0.8425

Table 13

Life Table for the Event Histories for Student Dropout of the Sample of Participants Rated as Aggressive by Teachers (top15%)

<i>Year</i>	<u>N</u>				<u>Proportion</u>	
	<i>Enrolled at the End of the School Year</i>	<i>Dropped out during the school year</i>	<i>Censored during the school year</i>	<i>Total removed from the data set by end of school year</i>	<i>Participants at the beginning of the school year who dropped out before the start of the next school year</i>	<i>All participants still enrolled at the end of the school year</i>
1	103	0	2	2	0	1
2	101	0	8	8	0	1
3	93	0	5	5	0	1
4	88	3	13	16	0.0341	0.9659
5	72	5	10	15	0.0694	0.8989
6	57	8	7	15	0.1404	0.7727
7	42	3	39	42	0.0714	0.7175

Table 14

Life Table for the Event Histories for Student Dropout of the Sample of Participants Rated as Not Aggressive by Teachers (<top15%)

<i>Year</i>	<u>N</u>				<u>Proportion</u>	
	<i>Enrolled at the End of the School Year</i>	<i>Dropped out during the school year</i>	<i>Censored during the school year</i>	<i>Total removed from the data set by end of school year</i>	<i>Participants at the beginning of the school year who dropped out before the start of the next school year</i>	<i>All participants still enrolled at the end of the school year</i>
1	582	0	8	8	0	1
2	574	1	32	33	0.0017	0.9983
3	541	2	27	29	0.0037	0.9946
4	512	2	40	42	0.0039	0.9907
5	470	27	49	76	0.0574	0.9338
6	394	34	35	69	0.0863	0.8532
7	325	13	312	325	0.04	0.8184

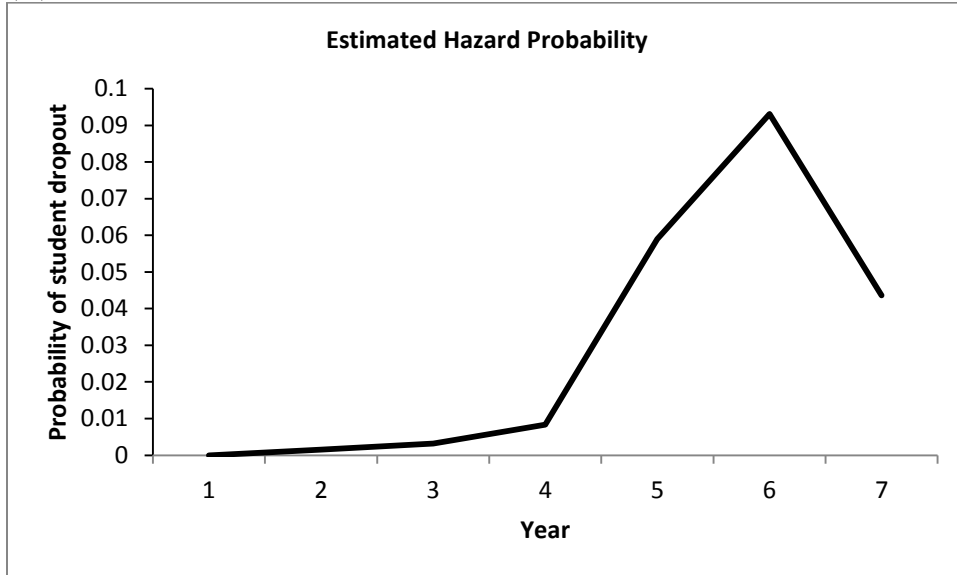
Table 15									
<i>Fitting of Discrete Time Hazard Models by Logistic Regression for Students at Risk of Dropout</i>									
Model	A	B1	B2	C1	C2	D	E	F	G
Parameter Estimates and asymptotic standard errors									
Year 2 – D ₁	-6.513*** (1.001)	-6.938*** (1.018)	-6.526*** (1.013)	-7.252*** (1.026)	-6.898*** (1.021)	-7.078*** (1.013)	-7.237*** (1.016)	-7.084*** (1.011)	-8.060*** (1.050)
Year 3 – D ₂	-5.756*** (0.708)	-6.183*** (0.733)	-5.771*** (.726)	-6.539*** (0.743)	-6.183*** (0.736)	-6.360*** (0.725)	-6.744*** (0.735)	-6.592*** (0.728)	-7.604*** (0.792)
Year 4 – D ₃	-4.779*** (0.449)	-5.205*** (0.487)	-4.788*** (.476)	-5.551*** (0.501)	-5.191*** (0.490)	-5.365*** (0.473)	-5.776*** (0.489)	-5.621*** (0.478)	-6.181*** (0.516)
Year 5 – D ₄	-2.769*** (0.182)	-3.195*** (0.262)	-2.778*** (.242)	-3.513*** (0.283)	-3.155*** (0.264)	-3.296*** (0.222)	-4.230*** (0.286)	-4.098*** (0.273)	-4.672*** (0.316)
Year 6 – D ₅	-2.276*** (0.162)	-2.685*** (0.244)	-2.268*** (0.228)	-2.944*** (0.259)	-2.591*** (0.245)	-2.714*** (0.193)	-3.636*** (0.259)	-3.540*** (0.253)	-3.898*** (0.273)
Year 7 – D ₆	-3.088*** (0.256)	-3.497*** (0.316)	-3.077*** (0.303)	-3.733*** (0.328)	-3.377*** (0.316)	-3.492*** (0.276)	-4.394*** (0.328)	-4.308*** (0.324)	-4.521*** (0.341)
Gender		.159 (0.210)	.105 (0.211)	.330 (0.217)	0.266 (0.217)				
Race Latino		.484* (0.210)		0.405 (0.213)					
Race White			-.663* (0.275)		-0.510 (0.279)				
Middle School		.248 (0.211)	.226 (0.211)	0.192 (0.213)	0.175 (0.213)				
Age for Grade				1.231*** (0.240)	1.198*** (0.241)	1.176*** (0.236)	.967*** (0.244)	0.976*** (0.243)	0.982*** (.266)
Peer aggression						.045*** (0.017)	.031 (0.017)		
Teacher aggression						.134 (0.134)			

Table 15 (continued)

Fitting of Discrete Time Hazard Models by Logistic Regression for Students at Risk of Dropout

Model	A	B1	B2	C1	C2	D	E	F	G
Parameter Estimates and asymptotic standard errors									
Retained							1.914*** (0.249)	1.964*** (0.247)	1.420*** (0.267)
Absences									0.023*** (0.004)
<i>N</i>	3269	3269	3269	3237	3237	3237	3237	3237	3027
<i>n</i> parameters	6	9	9	10	10	9	9	8	9
-2 log-likelihood	753.954	746.825	745.574	723.493	723.454	721.459	651.905	655.072	570.169
X^2	3777.842	3784.971	3786.222	3763.942	3763.980	3765.976	3835.530	3832.363	3626.144
Cox & Snell R^2	.685	.686	.686	.687	.687	.688	.694	.694	.698
Nagelkerke R^2	.914	.914	.915	.917	.917	.917	.926	.925	.931
<i>Note.</i> * $p < .05$. ** $p < .01$. *** $p < .001$									

(A)



(B)

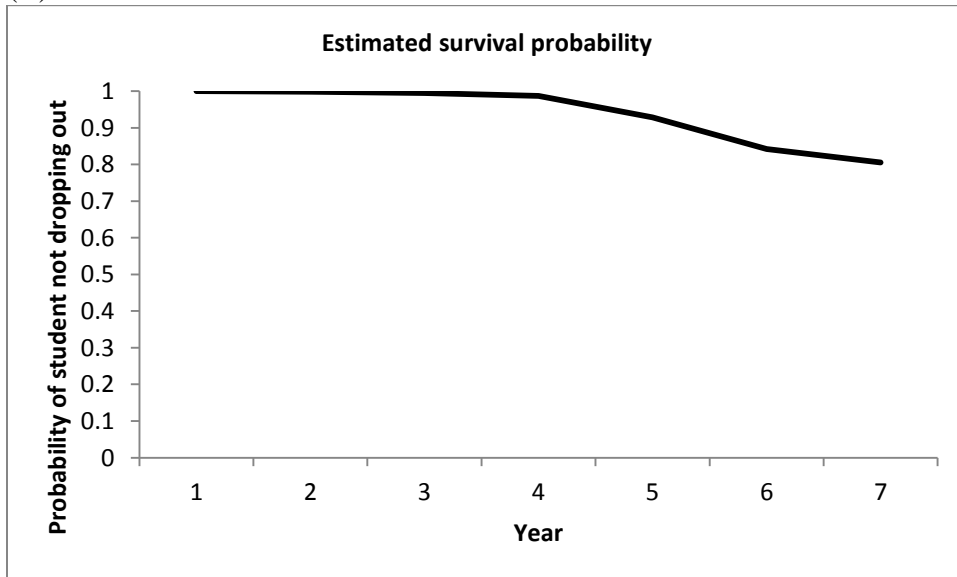
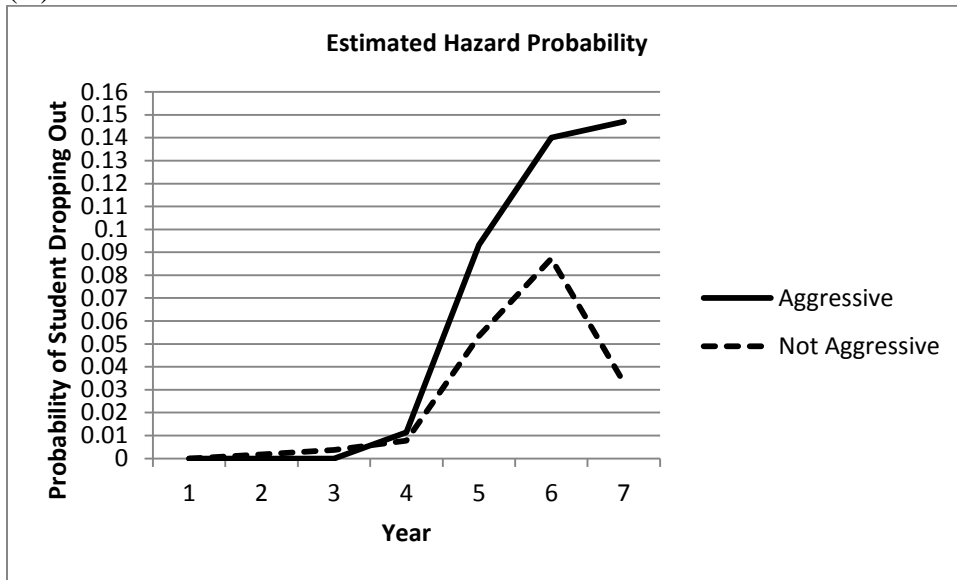


Figure 1: Estimated hazard (A) and survival functions (B) for the overall data set

(A)



(B)

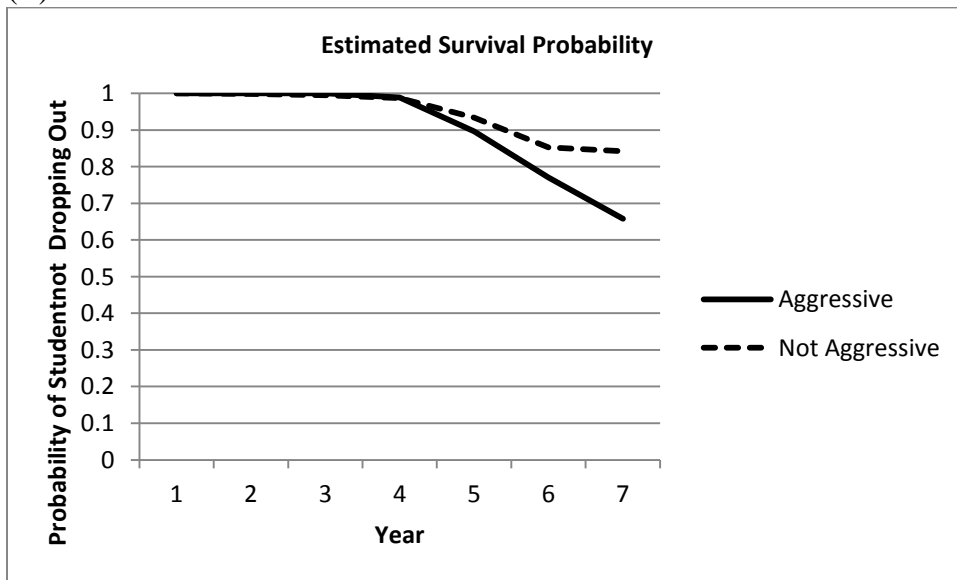
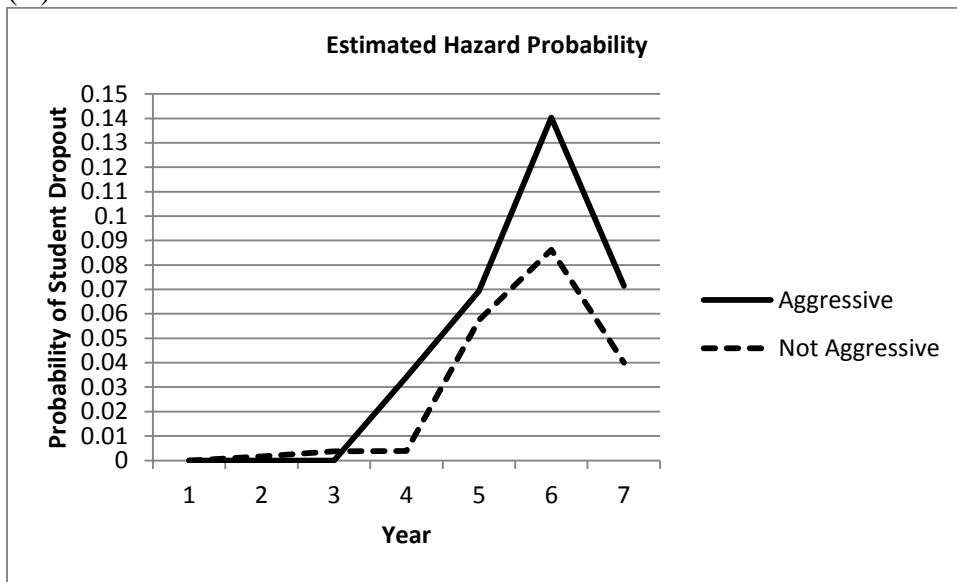


Figure 2: Estimated hazard (A) and survival functions (B) for the aggressive (top 15%) and non-aggressive participants as rated by peers

(A)



(B)

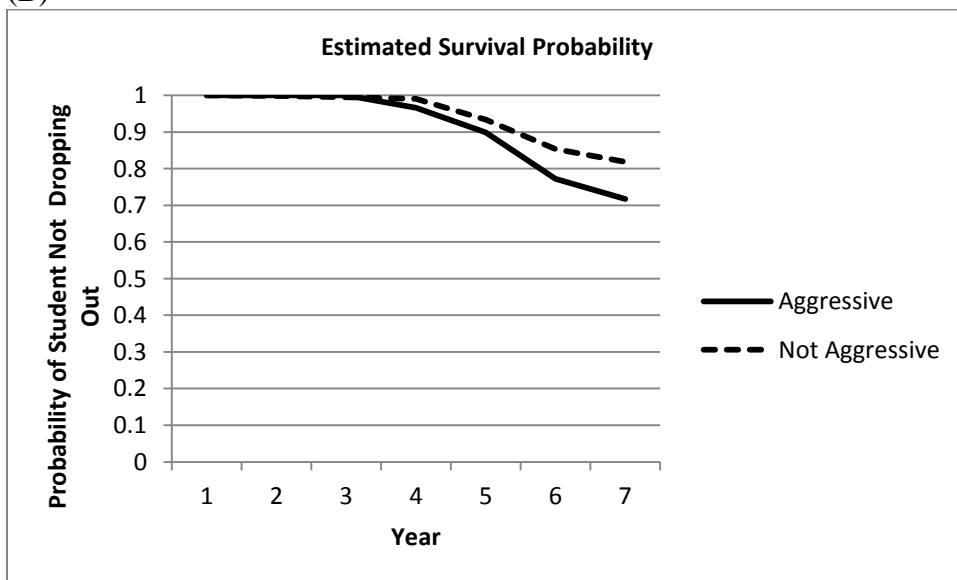


Figure 3: Estimated hazard (A) and survival functions (B) for the aggressive (top 15%) and non-aggressive participants as rated by teachers

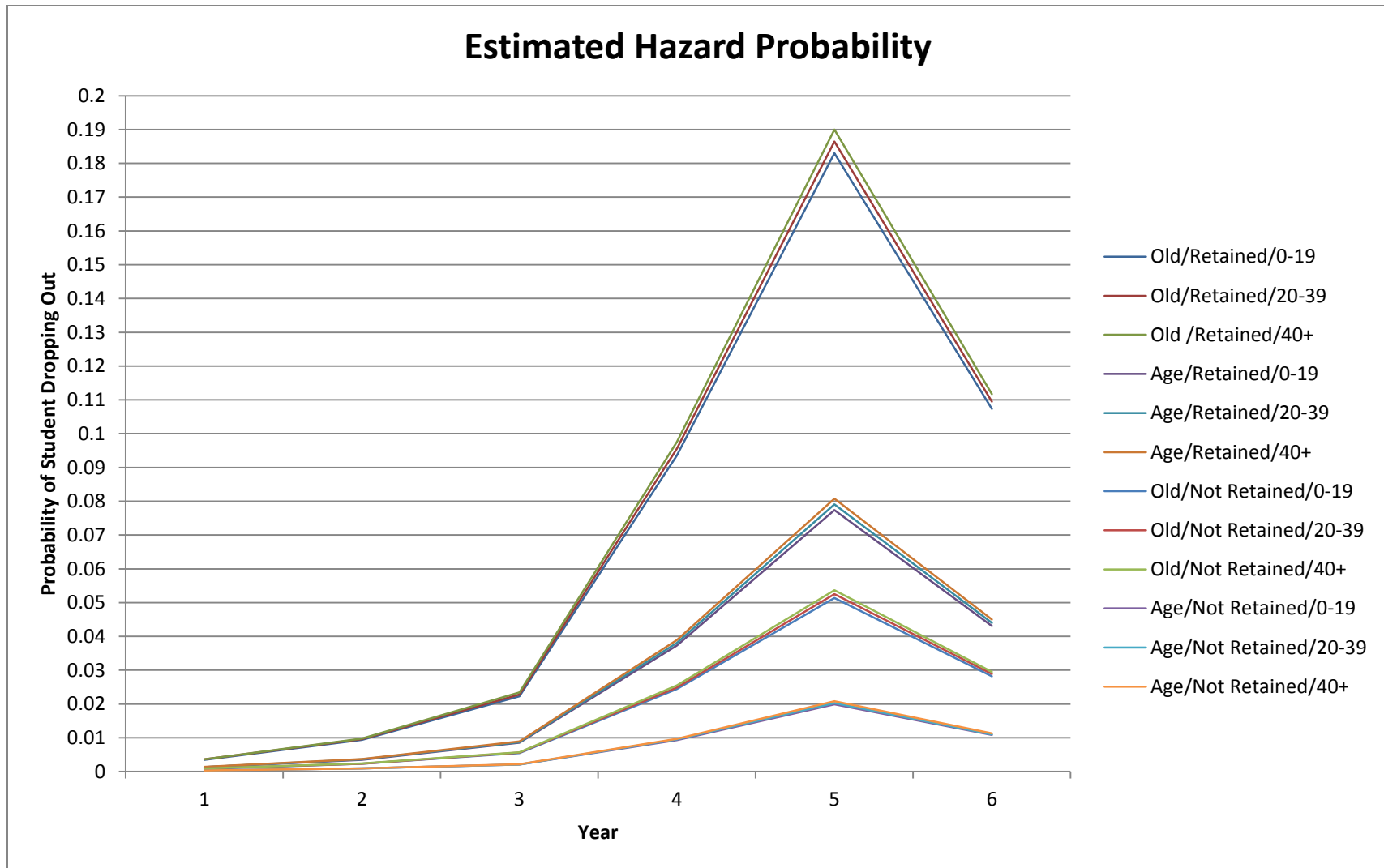


Figure 4: Fitted hazard functions for different categories of Age for Grade, Retain and Absences variable.

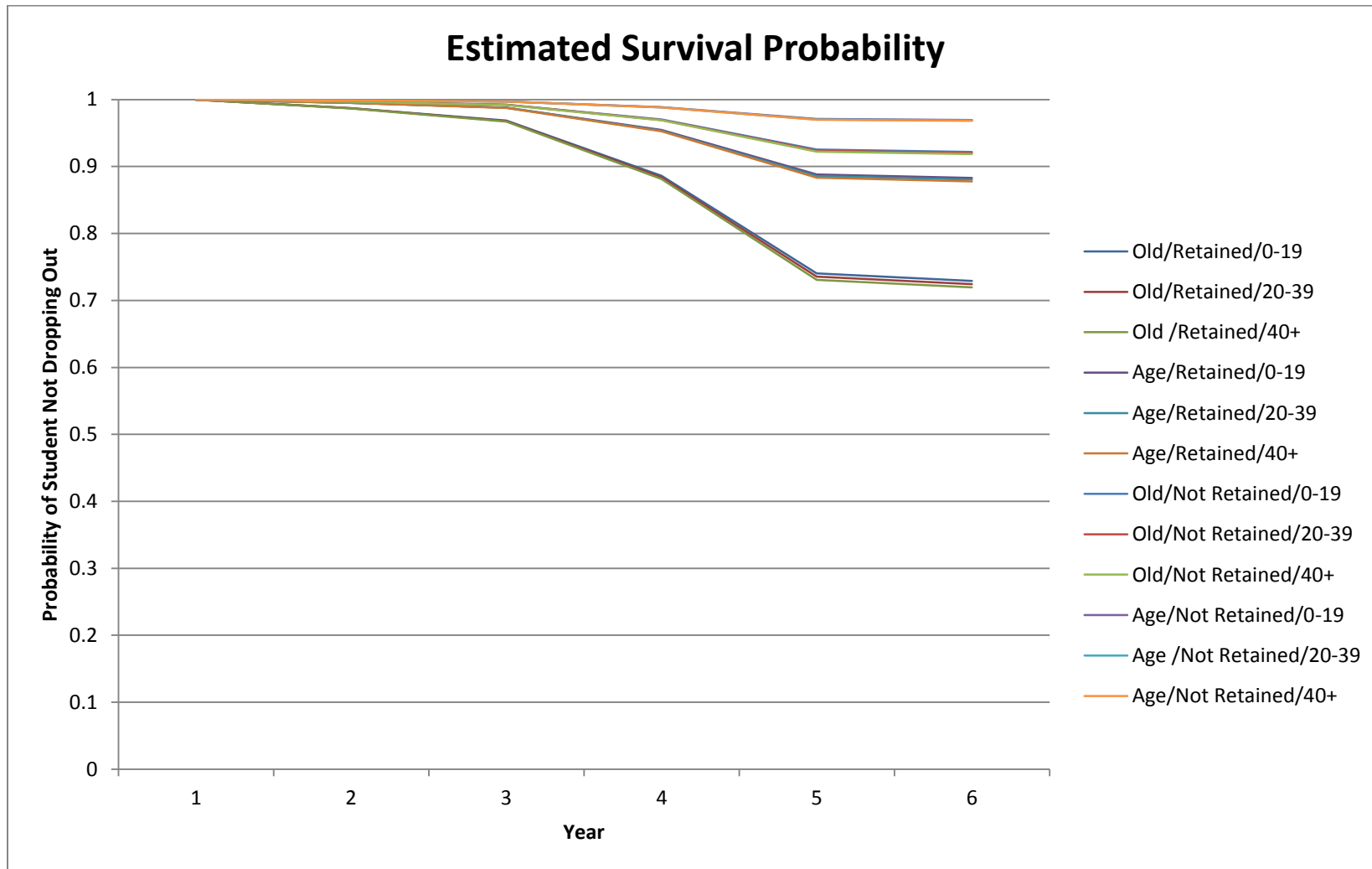


Figure 5: Fitted survivor functions for different categories of Age for Grade, Retain and Absences variable.