

AN ABSTRACT OF THE THESIS OF

Michaella A. Sektnan for the degree of Master of Science in Human Development and Family Studies presented on December 10, 2007.

Title: Early Family Risk and Children's Academic Achievement.

Abstract approved:

Megan M. McClelland

Children who have multiple family risk factors are at increased risk for poor developmental outcomes, including poor academic achievement. The present study focused on charting the pathways through which early family risk – as indexed by ethnic minority status, low maternal education, low family income, and chronic maternal depressive symptoms – influences academic achievement in first grade using data on 1,364 children from the NICHD Study of Early Child Care and Youth Development. In addition, the mediating role of children's social competency and behavioral regulation at 54 months was explored.

Structural equation modeling indicated that family risk factors during early childhood negatively influenced social competency, behavioral regulation, and academic achievement in first grade, but the mechanisms by which each risk factor exerted influence on academic achievement varied. Child's ethnicity emerged as being significantly and directly related to lower achievement. Maternal education and average family income-to-needs ratio were primarily associated with lower achievement directly with a small indirect effect through behavioral regulation. In contrast, maternal

depression had a modest indirect effect through behavioral regulation, such that as the number of time points a mother showed significant depressive symptoms increased, children's behavioral skills decreased, which, in turn, was related to lower academic achievement in first grade.

In addition, behavioral regulation significantly predicted better reading, mathematics, and vocabulary achievement in first grade after controlling for early family risk factors. Results suggest that strengthening a child's behavioral regulation skills prior to school entry may help to compensate for early exposure to family risk factors and decrease the likelihood of poor academic adjustment and later academic failure.

©Copyright by Michaella A. Sektnan
December 10, 2007
All Rights Reserved

Early Family Risk and Children's Academic Achievement

by
Michaela A. Sektnan

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Presented December 10, 2007
Commencement June 2008

Master of Science thesis of Michaella A. Sektnan presented on December 10, 2007.

APPROVED:

Major Professor, representing Human Development and Family Studies

Chair of the Department of Human Development and Family Sciences

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Michaella A. Sektnan, Author

ACKNOWLEDGEMENTS

The author expresses sincere appreciation for all those that have provided support, guidance, and walked beside me down this road to a Master's degree. First of all, I want to thank my major professor, Dr. Megan McClelland, for her endless support, guidance, and assistance. Secondly, I would like to thank Dr. Alan Acock for so freely sharing his time and knowledge of statistics with me. In addition, I would like to acknowledge the support of all the friends who have been beside me in this process. Thank-you for enduring long hours in the library, listening when I needed someone to bounce ideas off, and sharing in many times of laughter through it all. You have been a constant source of encouragement, accountability, and friendship. And lastly, I would not be here today without the support, love, and guidance of my parents, sister, and extended family; to you I am forever grateful.

TABLE OF CONTENTS

	<u>Page</u>
Introduction	1
Importance of Early Skill Development on Academic Achievement	2
Influence of Risk Factors	5
Ethnicity	7
Maternal education and family income	7
Maternal depression	9
Risk, Social Competency, and Academic Achievement	11
Risk, Behavioral Regulation, and Academic Achievement	15
Purpose	19
Hypotheses	20
Direct effects between family risk, social competency, behavioral regulation, and academic achievement	21
Indirect effects between family risk, social competency, behavioral regulation, and academic achievement	22
Method	25
Study Design	25
Participants	25
Measures	27
Family risk factors	28
Social competency	31
Behavioral Regulation	31
Achievement in first grade	32

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Data Analysis Plan	33
Results	37
Structural Equation Model	38
Direct Effects between Family Risk, Social Competency, Behavioral Regulation, and Academic Achievement	39
Family risk, social competency, and behavioral regulation	39
Reading	40
Mathematics	40
Vocabulary	41
Indirect Effects between Family Risk, Social Competency, Behavioral Regulation, and Academic Achievement	42
Reading	42
Mathematics	43
Vocabulary	43
Comparing Social Competency and Behavioral Regulation	44
Discussion	68
Multiple Pathways to First-Grade Academic Achievement	68
Comparing Behavioral Regulation and Social Competency	73
Practical Implications	76
Limitations and Future Directions	78

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Conclusion.....	81
References.....	82
Appendices.....	90
Appendix A: Full Mplus Text Output.....	91
Appendix B: Items Used to Measure Children’s Behavioral Regulation at 54-Months.....	106
Appendix C: Items Used to Measure Children’s Social Competency at 54-Months.....	109

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Means, Standard Deviations, and Range of Predictor, Mediator, and Outcome Variables	46
2. Correlations between Predictor, Mediator, and Outcome Variables	48
3. Difference in Means and Standard Deviations for Depressed and Non-Depressed Mothers at 54 months and Children's Behavioral Regulation and Social Competency at 54 months	52
4. Reading in First Grade: Unstandardized Coefficients, Standard Errors, and Standardized Coefficients of Direct and Indirect Paths	53
5. Mathematics in First Grade: Unstandardized Coefficients, Standard Errors, and Standardized Coefficients of Direct and Indirect Paths	58
6. Vocabulary in First Grade: Unstandardized Coefficients, Standard Errors, and Standardized Coefficients of Direct and Indirect Paths	63

LIST OF FIGURES

<u>Figures</u>	<u>Page</u>
1. Model of First-Grade Academic Achievement	24
2. Results of Structural Equation Modeling of First-Grade Reading Achievement	56
3. Results of Structural Equation Modeling of First-Grade Mathematics Achievement.....	61
4. Results of Structural Equation Modeling of First-Grade Vocabulary Achievement.....	66

Early Family Risk and Children's Academic Achievement

Introduction

Early childhood is a critical time for the development of skills that help a child to be successful in school. In order to understand children's development, attention must be given to specific aspects of the child's environment that can contribute to or threaten the successful mastery of these skills. In particular, children's experiences within their family during early childhood and the transition to school have been shown to be strong predictors of pre-academic skills and later academic achievement (Estrada, Arsenio, Hess, & Holloway, 1987; Morrison & Cooney, 2002). Identifying risk factors or aspects of the child, family, and environment that increase the likelihood of poor developmental outcomes is especially important. Risk is defined as an "elevated probability of a negative or undesirable outcome in the future" (Masten & Gewirtz, 2006, p. 24). In a developmental sense, risk implies a threat to child development and can result in poor developmental outcomes.

Children who have multiple risk factors within the family sphere are at increased risk for poor developmental outcomes, including poor academic achievement (Huffman, Mehlinger, & Kerivan, 2000; Luster & McAdoo, 1994). Although these family risks have been shown to impact early academic success, it is important to consider mechanisms by which these risks can be mediated by other developmental processes. Two such processes that could impact early academic success are a child's social competency skills and their level of behavioral regulation. Behavioral regulation is defined as the ability to apply cognitive skills, such as attention and inhibitory control,

to behavior and includes skills such as focusing and maintaining attention on tasks, following instructions, and inhibiting inappropriate actions (McClelland, Cameron, Wanless et al., 2007; Morrison, Ponitz, & McClelland, 2007). Social competency includes skills, such as getting along with others, asserting oneself by initiating conversations and interactions with adults and peers, and the ability to communicate effectively with others. The purpose of this study is to identify pathways to academic success by exploring the relation between early family risk, social competence, behavioral regulation, and early achievement.

Importance of Early Skill Development on Academic Achievement

It has been well-established that having a good foundation in early childhood and the first few years of school is important for later success. Early childhood is a critical time when the development of important cognitive, literacy, and language skills is taking place (Morrison & Cooney, 2002). However, individual differences in these skills are evident in preschool as well as at school entry (Denton & West, 2002) and many children enter school without the skills necessary for a successful transition (Alexander, Entwisle, & Dauber, 1993; Rimm-Kaufman, Pianta, & Cox, 2000). The development of these skills is not only important for successful transition to school, but also for later academic achievement since trajectories for future educational attainment are formed and shaped during a child's early educational experience (Hamre & Pianta, 2001; Chen, Lee, & Stevenson, 1996). For example, children who have difficulty during the first few years of school have more problems with later behavioral, emotional,

academic, and social adjustment and are at increased risk of dropping out prior to the completion of formal schooling (Alexander, Entwisle, & Kabbani, 2001; Gutman, Sameoff, & Cole, 2003). As a result, it is important to understand the sources of influence that interact to shape a child's academic trajectory.

A number of factors in a child's life can account for this variation in the development of early social, academic, and cognitive skills. According to an ecological perspective, developmental processes, including academic achievement, occur within several nested layers of environmental influence, of which the child is the center. The surrounding layers are comprised of biological and environmental factors that influence and are influenced by the developing child (Bronfenbrenner, 1979). The first, most proximal level to the child, includes factors that are biological in nature and often are present at birth, such as gender, health, physical characteristics, and temperament. Proximal factors comprising the second level of influence impact development through interpersonal relationships and processes. A child's family members and his or her interactions with family members are some of the most influential relationships in early childhood. The third level of influence includes social structure, for factors such as education, social status, and wealth are unequally distributed among families in society (Amato & Ochiltree, 1986). At the fourth and final level, the surrounding culture or way of life can influence a child's development. It is the complex combination and interaction between these levels that shape the developmental trajectory of a child.

Although all levels are important in shaping the development of children, more proximal processes have been shown to be among the best predictors of children's cognitive, social, and academic skill development (Burchinal, Peisner-Feinerg, Pianta, & Howes, 2002; Estrada et al., 1987; NICHD Early Childhood Research Network [NICHD], 2000; NICHD, 2001a; NICHD, 2005). Although there is evidence of shared genetic variance between children and families, factors within the family context have been found to shape a child's skill development and the behavioral manifestation of these skills (Deater-Deckard, Petrill, Thompson, & DeThorne, 2006). Thus, although the importance of genetics is acknowledged, the present study will explore risks within the family environment associated with poor social, regulatory, and academic skill development.

While much research has focused on the impact of individual aspects of the family contexts, little research has explored how factors on multiple levels combine in complex ways to shape a child's early academic achievement. In addition, according to Bronfenbrenner and Morris (2006), the power of proximal processes may be stronger for those living in disadvantaged environments. Therefore, the present study focuses on proximal influences in the family, with particular focus on aspects of the family environment that place children at risk for poor developmental and academic outcomes. More specifically, this study seeks to expand the current knowledge about family-child relations by asking whether relations between family characteristics and early academic

achievement are mediated by individual differences in children's behavioral regulation and social competency.

Previous studies have combined the two skill sets involved in behavioral regulation and social competency in learning contexts to create a construct called learning-related skills (McClelland, Acock, & Morrison, 2006; McClelland, Morrison, & Holmes, 2000). When these skills were looked at together, studies found that learning-related skills predicted later academic achievement as well as mediated the relationship between family characteristics and achievement (McClelland, Kessenich, & Morrison, 2003). In combination, these skills have been found to be important for academic success, however, few studies have attempted to separate these skills and compare the relative strength between the two pathways to determine which more strongly links early family risk to early academic achievement. Therefore, this study also aims to examine whether behavioral regulation or social competency more strongly link early family risk to early academic achievement.

Influence of Risk Factors

Children who experience risk factors within the family context during early childhood are at increased risk of starting school unprepared, which can result in later school failure (Burchinal, Roberts, Zeisel, Hennon, & Hooper, 2006; Gutman et al., 2003; Huffman et al., 2000). This is particularly evident for children who experience multiple risk factors as well as those who experience chronic risk conditions during early childhood. Research has found that the more risk factors a child experiences, the

greater the probability a child will have academic problems or fall behind as they transition through the first several years of school (Huffman et al.). For example, one study of African American children age six to nine found that as the number of risk factors increased the more likely the child was to experience academic or behavioral problems (Luster & McAdoo, 1994). Therefore, it is not one single risk factor, but the combination of several risk factors and accumulation of risk over time that produces the most vulnerability for poor developmental outcomes in young children (Huffman et al., 2000; Laucht, Esser, & Schmidt, 1997; Rutter, 1979; Wachs, 2000). In light of this, the current study considers the presence of multiple risk factors over the first four-and-a-half-years of life as important predictors for early academic achievement.

Risk factors for a difficult transition into school are defined as “variables that predict early school failure and may be causally related to the onset and continuation of emotional, social, and academic difficulties in school” (Huffman et al., 2000, p. 5). Previous research has identified many influential family characteristics as adversely affecting the development of early academic skills, including ethnic minority status, marital status and family composition, low level of maternal education, parental substance abuse, parental psychopathology, problematic maternal social relationships, poor parenting practices, maltreatment, insecure attachment, and low socioeconomic status (Huffman et al.). Although all of these are risk factors for poor academic achievement, factors such as low socioeconomic status (including maternal education and family income), ethnicity of the child (with particular focus on ethnic minority

status), and maternal depression, have emerged as being especially important (Burchinal et al., 2002; Huffman et al.). Thus, in the following sections, current literature about the impact of these risk factors on academic achievement, social competency, and behavioral regulation will be reviewed.

Ethnicity. Significant racial differences in academic skills have been found among children during early childhood as well as in later school years (Alexander, Entwisle, & Kabbani, 2001; Huffman et al., 2000). Not only has research found that minority children score below the national average, there is also a significant gap between the achievement of minority children and their majority counterparts (Jencks & Phillips, 1998a). More specifically, studies by Denton and West (2002) and Chatterji (2006) found that children belonging to racial minorities scored below average in reading and mathematic skills in first-grade. In addition, Jencks and Phillips (1998a) found that African Americans score consistently lower academically than European Americans from kindergarten through adulthood. The source of this test score gap is difficult to determine (Jencks & Phillips, 1998b), however, socioeconomic status may account for some of the differences in test scores among minority children (Magnuson & Duncan, 2006) and therefore is another important risk factor influencing a child's academic achievement.

Maternal education and family income. Low socioeconomic status is commonly composed of education, family income, and occupational status and has been identified as another risk factor in research on children's early achievement. Previous research

indicates that socioeconomic status is a significant predictor of early academic skills (Chen et al., 1996; Fowler & Cross, 1986; Huffman et al., 2000; Sameroff & Seifer, 1983) as well as highlights the importance of considering the effects of each socioeconomic component separately (Magnuson & Duncan, 2006). Therefore, rather than looking at socioeconomic status as a whole, this study will focus on the specific effects of maternal education and family income because they have each been closely associated with poor academic outcomes (Amato & Ochiltree, 1986; Downer & Pianta, 2006). Low maternal education has been identified as a risk factor for poor educational outcomes throughout elementary school. In particular, children whose mothers had lower educational attainment had significantly lower scores on reading, mathematics, and vocabulary in the early elementary years (Luster & McAdoo, 1994). In one study looking at family predictors of academic skills from preschool to second grade, children had more advanced receptive language, math, and reading skills if mothers were more educated (Burchinal et al., 2002).

Family income is another component of socioeconomic status impacting families. Research has found that children living in poverty are at increased risk of poor achievement outcomes (Chatterji, 2006; Denton & West, 2002; Huffman et al., 2000). Based on data from the Early Childhood Longitudinal Study, Kindergarten Class 1998-1999 (ECLS-K), Denton and West (2002) found that children whose families had income below the poverty threshold scored about half a standard deviation below the national average on reading and mathematics and that the achievement of poor children

was significantly lower than that of non-poor children in both kindergarten and first-grade. In addition, the length of time a child experiences poverty can influence how family income effects academic achievement. In particular, children in persistent poverty have lower academic achievement than children in transient poverty, with children in both poverty groups scoring lower than children who have never been poor (McLoyd, 1998). Therefore, the time period in which a child experiences poverty can have an important impact on academic achievement at school entry and beyond. The proposed study will examine how average family income over early childhood, with particular focus on low income, influences the development of behavioral regulation, social competency, and academic skills.

Maternal depression. In addition to ethnicity and socioeconomic status, research has shown that maternal depressive symptoms are linked to young children's cognitive functioning and academic achievement. It is important to note that in much of the current literature, maternal depression refers to the presence of depressive symptoms rather than a diagnosis of a clinical disorder. Therefore, higher depression scores indicate higher levels of depressive symptomology.

Maternal depressive symptoms can be related to parenting behaviors, such as emotional unavailability, lack of responsiveness, inconsistency, inattentiveness, and increased negativity that may place children at risk for a variety of developmental problems, including poor academic achievement (NICHD, 1999). This is especially evident for children of mothers who have chronic depressive symptoms. For example, a

study by the NICHD Early Child Care Research Network (1999) found that children of mothers who experienced depressive symptoms chronically or some of the time had significantly lower verbal comprehension and school readiness skills at 36 months than children of mothers that never reported experiencing depressive symptoms. Another study found that maternal depression assessed during a child's kindergarten year predicted school achievement problems at the end of first grade (Greenberg et al., 1999). However, little research has taken into account how the presence of chronic maternal depression over early childhood affects both children's social and regulatory skills development prior to school entry as well as children's early academic achievement in first grade. This will be a focus of the present study.

Although each of these risk factors has been found to have a distinct effect on early academic achievement, they are also interrelated. For example, NICHD Early Child Care Research Network (2001b) found that African-American and Hispanic populations were over-represented in low income groups, which shows that ethnicity and income are significantly related. This study also found that children in poverty were more likely to have mothers with lower education and were more likely to be cared for by intermittently or chronically depressed mothers. Each risk factor not only influences the presence and intensity of other risk factors, but also affects the impact of the other risk factors on the outcomes. The present study will account for the interrelationships of these risk factors.

A large body of research has shown that risk in early childhood is related to children's early academic achievement. However, this research is limited in several ways. First, most studies only assess characteristics of family risk at one point in time, whereas this study aims to elucidate the specific pathways through which risk across time, including family income and maternal depression, influences early academic achievement. Second, few studies have incorporated varying dimensions of children's skill development, including development in social, regulatory, and academic arenas, in a comprehensive model of the relation between risk and achievement. It is important to understand how both experiences of family risk and characteristics of the child can lead to success in the first years of schooling. Experiencing risk factors during early childhood may jeopardize children's academic achievement by compromising the skills that have been shown as important for school success, namely behavioral regulation and social competency skills. The following sections outline current research on the possible role of social competency and behavioral regulation in pathways to academic achievement.

Family Risk, Social Competency, and Academic Achievement

Since family risk factors influence academic success in young children, it is important to consider mechanisms through which these risks can be mediated by other developmental processes. One such process that is related to both risk and academics is a child's development of social competence. A consistent definition of social competence is lacking, but many researchers agree that social competence refers to a

child's effective use of skills and behaviors in social interactions (Fabes, Gaertner, & Popp, 2006). These skills include getting along with others, asserting oneself by initiating conversations and interactions with adults and peers, and the ability to communicate effectively with others.

The family context plays an influential role in the development of social competency in young children. Children are influenced by both their parents' actions and behaviors as well as by the dynamics of the parent-child relationship. Parents and other influential adults teach children appropriate social behaviors directly through instruction on social rules and expectations, by talking about appropriate behavior, and by facilitating children's experiences with peers. According to Fabes and colleagues (2006), children also learn appropriate social behaviors from observing interactions within family relationships, including models of conflict resolution and appropriate emotional regulation. In addition, the family context provides a means through which cultural norms regarding social behaviors are transferred to the child (Fabes et al.).

Because it is within the family context that most children's early social experiences occur, family risk factors can have a significant impact on the development of social competence by interfering with parent's ability and opportunity to teach, model, and guide appropriate social interactions. For example, research has found that children who experience family risk in early childhood have lower levels of social competency prior to school entry and in the early school years (Burchinal et al., 2002; Burchinal et al., 2006; NICHD, 2003a). In particular, one study found that children of

mothers with lower education and higher depressive symptoms had lower levels of social competence at 54 months. In addition, this study also found that children's social competence remained stable from 54 months through first grade highlighting the importance of skill development prior to school entry (NICHD, 2003a). Other studies have found that children of depressed mothers demonstrate lower social competence prior to school entry than children of non-depressed mothers (Gross, Conrad, Fogg, & Willis, 1995; NICHD, 2001a). Based on this research, it is clear that risk in early childhood can predict varying levels of a child's social competency.

In addition, as part of a learning-related skills construct, social competence in learning contexts has been found to be important for children's early academic skills (McClelland et al., 2000). Many children enter school without the social skills necessary to succeed, including following directions and working independently (Rimm-Kaufman et al., 2000). The ability to be cooperative, assertive, and independent in kindergarten has been linked to kindergarten academic achievement (Ladd, Birch, & Buhs, 1999) and future academic success through sixth grade (McClelland et al., 2000; McClelland et al., 2006).

Family characteristics and resources play an important role in the development of both academic and social competence (Amato & Ochiltree, 1983). Although the links from family risk to social competency and from social competency to academic achievement have been relatively well-established, little research has specifically looked at social competency as a mediator through which family risk exerts its

influence on achievement. It is possible that family risk interferes with a parent's role in facilitating the development of their children's social skills, which in turn contributes to early academic success or failure. Understanding the relationship between social competency and the forces that shape the skills necessary to succeed in school is key to improving academic achievement. The present study seeks to fill this gap by specifically exploring the role that children's social competency plays as a mediator between family risk experiences in early childhood and the development of academic competence.

For this study, social competency is included in the model as a latent variable. A latent variable is defined as a hypothetical variable formed by combining several related observed variables (NICHD, 2004). A latent variable allows the empirical data of the observed variables to be used as an estimate of the effects of the unmeasured theoretical construct (Cohen, Cohen, West, & Aiken, 2003). According to McClelland, Cameron, Wanless, and Murray (2007) aspects of social competency important for school success include the domains of cooperation, independence (or assertion), and responsibility. Therefore, the latent variable for social competency in the present study includes three aspects of social competence, including cooperation (helping behaviors, getting along with others, using time appropriately), assertion (initiating behaviors, such as starting conversations, joining group activities), and responsibility (ability to communicate with adults, asking appropriate questions) (Gresham & Elliott, 1990).

Family Risk, Behavioral Regulation, and Academic Achievement

Another mechanism not widely investigated in current research is the relationship between early family risk, children's behavioral regulation, and their early academic achievement. Behavioral regulation is defined as the ability to deliberately apply cognitive skills, such as attention, working memory, and inhibitory control, to behavior (McClelland, Cameron, Wanless et al., 2007; Morrison et al., 2007) and includes skills such as focusing and maintaining attention on tasks, following instructions, and inhibiting inappropriate actions, all of which are important for success in school (Blair & Razza, 2007; Cameron et al., in press; McClelland, Cameron, Connor et al., 2007). Recent research has pointed to attention and inhibitory control as particularly important for early academic success (Blair & Razza, 2007); therefore, these two domains will be a focus of the present study.

Like emotion regulation, the ability to regulate behavior falls under the broader construct of self-regulation. According to Calkins (2007), self-regulation can be described as an interactive model in which physiological, attentional, and emotional regulation early in life form a person's reactive and regulatory tendencies. It is from these tendencies that later cognitive and behavioral regulation emerges. Neurological and other biological forces, such as aspects of a child's temperament and executive functioning abilities, also underlie and influence the development of this regulatory system (Calkins, 2007; Deater-Deckard, Petrill, Thompson, & DeThorne, 2005; McClelland, Cameron, Connor et al., 2007; Morrison et al., 2007). Therefore,

physiological and psychological predispositions interact with context and experience to shape how a child learns to control their behavioral responses (Calkins, 2007; Shonkoff & Phillips, 2000).

The present research focuses primarily on contributions from within the early family environment. Although behavioral regulation has underlying biological and physiological components, the early family environment has been found to be an important context for the development of regulatory skills (Calkins, 2007; Deater-Deckard et al., 2006). Behavioral regulation skills can be acquired and fine-tuned through a child's social experiences and interactions within the family. Parents play an important role in modeling, encouraging, facilitating, and rewarding appropriate self-regulatory behaviors (Martinez-Pons, 2002). It is through this socialization that children begin to internalize behavioral expectations of the family and culture. These internal standards are then used to guide future regulatory behaviors (Bronson, 2000). Therefore, children's ability to regulate themselves partially depends on responsive and consistent parenting and opportunities to practice regulatory skills, which may often be absent in high risk contexts, such as poverty or maternal depression (Sroufe, 1996).

Because behavioral regulation is influenced by the family context, early experiences within the family have a significant impact on the development of behavioral regulation in young children. For example, in one study of five- to eight-year-olds, Howse, Lange, Farran, and Boyles (2003) found that children from low socioeconomic families had lower levels of attention than children from economically

not-at-risk families. In another study, Wanless, Sektnan, and McClelland (2007) found that risk associated with being a Spanish-speaker and having a parent with low education was related to low behavioral regulation in preschool and kindergarten. Therefore, children who are exposed to family risk factors may not fully develop the ability to control, plan, and direct behavior.

In addition, behavioral regulation has been found to be a significant predictor of children's academic achievement (NICHD, 2003b). Skills related to behavioral regulation are important learning and functioning in the classroom environment and have been found to predict achievement even after controlling for IQ (Blair & Razza, 2002; McClelland et al., 2000). In one study, kindergarteners who exhibited greater regulation in the classroom had higher achievement scores in both literacy and math, whereas children who were not able to regulate their behaviors in kindergarten were at higher risk for poor academic achievement (Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003; Ladd et al., 1999). In another study, McClelland, Cameron, Connor et al. (2007) found that behavioral regulation in preschool significantly predicted literacy, mathematics, and vocabulary skills. In addition, gains in behavioral regulation over the preschool year predicted gains in reading, mathematics, and vocabulary (McClelland, Cameron, Connor et al., 2007).

These results suggest that behavioral regulation plays an important role in the development of early academic skills and is important as children prepare to enter formal schooling. To be successful in school settings, it is essential that children

determine what is important to focus on, while tuning out other irrelevant information at the same time. It is also important for children to inhibit the tendency to respond too quickly or to be distracted by other stimuli (NICHD, 2003b). Children who fail to regulate the behaviors needed to complete activities successfully are less likely to master skills necessary for academic achievement, both in the early school years and beyond. For example, McClelland, Acock, and Morrison (2006) found that kindergarten behavioral regulation, as part of a larger learning skill construct, predicted mathematics and reading between kindergarten and sixth grade and growth in achievement from kindergarten through second grade.

These findings provide a framework for exploring the pathways in which risk in the family environment influences achievement through its impact on a child's behavioral regulation skills. Positive family environments encourage children to develop strong self-regulatory skills and, in turn, children's ability to regulate their behavior facilitates their ability to learn. Although recent research (NICHD, 2003b) found that sustained attention partially mediated the relation between the family environment and children's achievement outcomes in preschool, little research has considered the possible mediating role of behavioral regulation, including aspects of both attention and inhibitory control, on early elementary school academic outcomes.

The present study assesses a child's behavioral regulation using a latent variable comprised of two components of behavioral regulation. These include attention focusing and inhibitory control. Attention focusing is defined as the "capacity to

maintain attentional focus on task-related channels”, whereas inhibitory control captures the “capacity to plan and to suppress inappropriate approach responses under instructions or in novel or uncertain situations” (Rothbart, Ahadi, Hershey, & Fisher, 2001, p.1406).

Purpose

This study aims to provide a greater understanding of how to enhance the academic performance of children with multiple family risk factors by examining the relationship between a child’s early family risk experience from 1 to 54 months, social competence and behavioral regulation skills at 54 months, and academic achievement in first grade. Thus, the goals of this study are threefold: first, to chart the multiple pathways (both direct and indirect) between family risk and first-grade academic achievement; second, to examine whether behavioral regulation and social competency at 54 months are significant mediators between early risk and children’s achievement; and third, to compare the relative strength and importance of these two mediated pathways.

Figure 1, on page 24, depicts the conceptual model explored in this analysis. As shown, the model includes the family risk factors of ethnicity of child (Black or Hispanic), maternal education, income-to-needs ratio, and maternal depression as well as the child factors of social competency and behavioral regulation as predictors of children’s first-grade academic achievement, including reading, mathematics, and vocabulary. Given that the purpose of this study is to examine the multiple pathways

between risk and achievement, family risk variables and academic outcome variables are included in the model as single indicator, observed variables rather than as latent variables. Using this conceptualization, the varying patterns between specific risk factors and the endogenous variables can be evaluated and discussed. In addition, the behavioral regulation and social competency variables are included as separate latent constructs, rather than as one latent variable which was done in previous research (McClelland et al., 2006; McClelland et al., 2000). This allows for examination and comparison of these two constructs to determine which pathways more strongly links early family risk to academic achievement in first grade.

In Figure 1, observed variables are represented with rectangles, whereas the latent variable constructs are represented by circles. In addition, a bidirectional arrow signifies a correlation, whereas a unidirectional arrow denotes a hypothesized direct link. Measurement and residual errors, correlations between the exogenous variables, and correlations between the three endogenous outcomes variables are not shown in the model for the sake of clarity in presentation.

Hypotheses

The current study focuses on charting the pathways through which early family risk – as indexed by ethnic minority status, low maternal education, low family income, and chronic maternal depressive symptoms – influences academic achievement in first grade. Both the direct and indirect relationships between the predictors and outcomes are explored in this analysis.

Direct effects between family risk, social competency, behavioral regulation, and academic achievement. The first step in this process is to examine the direct relationships between family risk during early childhood, social competency at 54 months, behavioral regulation at 54 months, and academic achievement in first-grade. Based on research finding that children who experience risk factors in early childhood are more likely to have lower levels academic achievement (Burchinal et al., 2006; Gutman et al., 2003; Huffman et al., 2000), it is expected that family risk over the first four-and-a-half-years of life will have a significant direct, negative effect on a child's academic achievement in first grade. In other words, it is predicted that as the severity of family risk increases, first grade achievement in reading, mathematics, and vocabulary will decrease.

In addition, research has found that family risk is associated with lower behavioral regulation (Howse, Lange et al., 2003; Wanless et al., 2007) and lower levels of social competency (Burchinal et al., 2002; Burchinal et al., 2006; Gross et al., 1995; NICHD, 2003a). Family risk may interfere with the parent's ability to teach, model, and facilitate appropriate social and regulatory behaviors as well as the child's ability to internalize and reproduce these behaviors on their own. Thus, it is anticipated that risk within the family will have a direct negative effect on both children's social competency and behavioral regulation at 54 months. This means that higher rates of risk over early childhood will be related to lower levels of behavioral regulation and social competency at four-and-a-half-years. In summary, it is expected that early family risk

will have significant negative effects on various aspects of a child's skill development, including social competency at 54 months, behavioral regulation at 54 months, and academic achievement in first-grade.

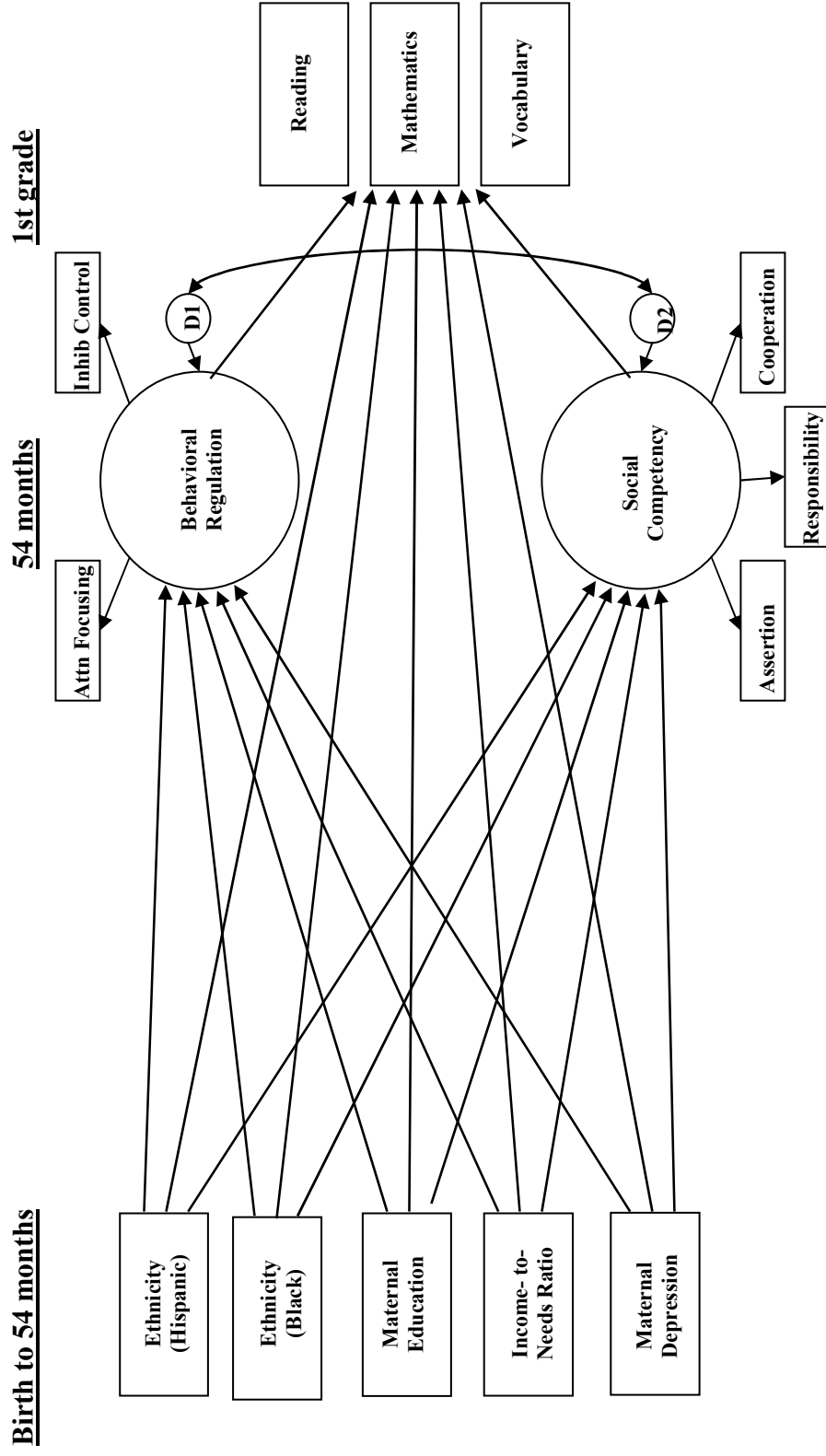
Academic success is also influenced by a child's social and regulatory skills. Based on current literature outlining the direct contribution of a child's skills, such as behavioral regulation and social competency, on academic success (Howse, Calkins et al., 2003; Ladd et al., 1999; McClelland, Cameron, Connor et al., 2007; McClelland, Cameron, Wanless et al., 2007; McClelland et al., 2006; NICHD, 2003a; NICHD, 2003b), it is expected that children's social competency and behavioral regulation at 54 months will have significant positive effects on children's first-grade academic achievement. In order to be academically successful, children must be able to regulate their own behaviors as well as interact appropriately with teachers and peers. Therefore, higher levels of these skills are expected to be related to higher levels of academic achievement.

Indirect effects between family risk, social competency, behavioral regulation, and academic achievement. The second goal of this study is to assess the indirect pathways from family risk – through social competency and behavioral regulation – to first-grade academic achievement. As a combined construct, studies have found that behavioral regulation and social competency in learning contexts predicted later academic achievement as well as mediated the relationship between family characteristics and achievement (McClelland et al., 2003). Therefore, it is anticipated

that a significant indirect or mediation effect will be found for both social competency and behavioral regulation. More specifically, children with more family risk are expected to have significantly lower levels of both social competency and behavioral regulation. In turn, lower social competency and behavioral regulation at 54 months are expected to predict significantly lower levels of academic achievement in first-grade. This will show that a child's social competency and behavioral regulation prior to school entry have significant mediating effects between early family risk and first-grade reading, mathematics, and vocabulary achievement.

Finally, it is anticipated that the path through behavioral regulation will be a stronger predictor of first-grade academic skills than the path through social competency. Behavioral regulation may be a more important pathway because aspects of behavioral regulation, such as attention and inhibitory control, are more closely related to specific skills required to be academically successful than are the components of social competency (Calkins, 2007; McClelland, Cameron, Connor et al., 2007). Thus, it is possible that social competency is a broader set of skills that are important for overall functioning within the school setting, but are less closely linked to achievement in first grade.

Figure 1. Model of First-Grade Academic Achievement



Note: Measurement errors, correlations between exogenous predictor variables, correlations between endogenous outcome variables, and disturbance terms for outcome variables are not included in model for clarity of presentation.

Method

Study Design

The present study utilizes data from phase I and phase II of the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (see <http://secc.rti.org>). The NICHD study is a multi-site, prospective longitudinal study of 1,364 children and their families in the United States. The present analysis follows children from birth through first grade.

Participants

Children and families were recruited during the first 11 months of 1991 from hospitals in or near 10 locations across the United States (Little Rock, Arkansas; Irvine, California; Lawrence, Kansas; Boston, Massachusetts; Philadelphia, Pennsylvania; Pittsburg, Pennsylvania; Charlottesville, Virginia; Morganton, North Carolina; Seattle, Washington; and Madison, Wisconsin). Of the 8,986 mothers who gave birth during the sampling period, 5,416 (60%) agreed to be followed up with a telephone call. Eligibility requirements at birth included that the mother was over the age of eighteen, the mother spoke English, the mother was healthy, the baby was not a multiple birth or released for adoption, the family lived within one hour of research site, and the family's neighborhood was safe. Of those eligible, a conditionally random sample (to assure adequate representation of single women, mothers without high school diplomas, and ethnic minority mothers) of 3,015 (56%) were selected to receive a telephone call at two weeks.

Of these, 1,364 families (58%) with healthy newborns completed an interview when the child was one month old and were enrolled in the study, with approximately equal numbers of families at each site. The enrolled families varied in ethnic background, socioeconomic status, and family composition. For example, the sample is considered ethnic diverse with approximately 25% of the families belonging to ethnic minorities. Approximately 75% identified as White and Non-Hispanic, 13% Black and Non-Hispanic, 7% Hispanic, and approximately 5% identified themselves as Asian, Native American, or other ethnicities. In addition, the mean maternal education level was 14.2 years with 10% completing less than 12th grade, 21% graduated high school, 33% had some college, 21% had a bachelor's degree and 15% completed a graduate or professional degree. The mean household income of the sample when the children were one month old was \$37,781.28 (Median = \$30,000) with almost 19% of the families on public assistance and 14% of the mothers were single.

Although the sample is not a nationally-normed sample, families in the study represent a diverse range of socioeconomic and sociocultural backgrounds. Compared to US Census Bureau information for births during 1991, children in this sample are more likely to come from a family with lower mean household income (\$37,781.28 in sample vs. \$39,264.12 for census tract), higher maternal education (68.5% vs. 52% had some college or higher), yet are also more likely to receive public assistance than US families in general (18.8% vs. 6%) (NICHD, 2001a). In addition, although the sample is considered ethnically diverse, it is also important to note that White children are

somewhat overrepresented in the sample compared to the national patterns (75% vs. 64.9%) (NICHD, 2001a).

The present analysis includes all 1,364 children and their families. Of these, 1,019 had complete data for the first-grade child outcome variables in this study. The children who dropped from the study or had data missing for academic outcomes differed from the initial sample in that they were more likely to be Black, $t(1296) = -3.15, p < .01$, and have a lower income-to-needs ratio ($M = .65$ vs. 1.01), $t(1353) = 7.04, p < .001$. In addition, mothers of those who dropped from the study were more likely to have lower education levels ($M = 13.63$ vs. 14.44 years of education), $t(1361) = 5.20, p < .001$. There was no difference between the groups on behavioral regulation skills (attention focusing, $t(1021) = 1.14, p > .10$; inhibitory control, $t(1059) = 0.84, p > .10$), social competency skills (cooperation, $t(1053) = -1.57, p > .10$; assertion, $t(1053) = -0.79, p > .10$; responsibility, $t(1053) = -0.41, p > .10$), or maternal depression ($t(1361) = -1.81, p > .05$). Since the present study uses full information maximum likelihood estimation, data on all 1,364 children and families are used in the present analysis.

Measures

Data for the present study were obtained during face-to-face interviews in the home and laboratory settings when the children were 1, 6, 15, 24, 36, and 54 months. Data on ethnicity and mother's education were collected at the one month interview, whereas data on family income and maternal depression were collected via interview and questionnaire at all six time points from 1 to 54 months. Child data on behavioral

regulation and social competency was collected by questionnaire completed by mothers at 54 months and assessment of reading, mathematics, and vocabulary achievement was completed in a laboratory setting in first grade.

Family risk factors. Because this study aims to look at risk over time, family data (income and maternal depression) were estimated over the six assessment points during early childhood. This reflects the view that a child's development is the result of the accumulation of experiences that have occurred up until that time (Lanchet et al., 1997, NICHD, 2003a). Averaging income and maternal depression over time allows this data to be used as an estimate of early childhood experience from 1 to 54 months. *Early family risk* is used in the next sections in reference to all family risk variables, including the time-constant ethnicity and maternal education variables as well as the measures of income and maternal depression that have been estimated over time.

During home interviews at one month, the mother reported her own *education* and the *child's race or ethnicity*. Mothers reported their education in years of schooling completed. As noted above, the average level of education for mothers in this analysis was 14.2 years. Of children included in this analysis, 75% were reported as White and Non-Hispanic, 13% Black and Non-Hispanic, 7% Hispanic, and 5% reported other ethnic affiliations. Children who were described as having other ethnic affiliations (Asian (1.4%), American Indian (.2%), or Other (3.4%)) were not included in this analysis because the ethnicity was not specified or the sample so small that meaningful

analysis could not be made. Therefore, two dummy variables were created to represent Black and Hispanic ethnic minorities for the current analysis.

Family income information was obtained during maternal interviews at 1, 6, 15, 24, 36, and 54 months. An *income-to-needs ratio* was computed for each assessment point by dividing total family income (including government assistance) by the appropriate yearly poverty threshold for household size and number of children under 18. In general, higher scores indicate greater financial resources. For example, a score of 1.0 indicates income equal to the poverty threshold, whereas a score of 3.0 indicates income three times the poverty threshold. More specifically, an income-to-needs ratio of less than 1.0 indicates poverty, a ratio from 1.0 and 1.7 indicates near poverty, and a ratio greater than or equal to 1.8 indicates that the family is not poor (NICHD, 1997; Research Triangle Institute [RTI], 1998a).

Since family income often fluctuates over time, averaging measures of income over multiple time points can provide a more accurate portrayal of a family's access to financial resources than basing assessment on income at a single time point (Magnuson & Duncan, 2006). Therefore, to represent a family's average financial situation over the first 54 months of the child's life, the income-to-needs ratios was averaged over the six time points (NICHD, 2001b). Correlations between time points ranged from .53 to .83. Of the families in the analysis, 13% had an average income-to-needs ratio less than 1.0, 16% between 1.0 and 1.7, and 71% averaged over 1.8 from 1 to 54 months. In addition, the mean income-to-needs ratio from 1 to 54 months was log transformed for the

analysis to normalize the distribution pattern (Kline, 2005, RTI, 1998a).

Maternal depressive symptoms (referred to in this paper as *maternal depression*) were assessed using the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) at 1, 6, 15, 24, 36, and 54 months. This self-report measure is designed to assess depressive symptoms in the general population with higher scores indicating more depressive symptomology. This questionnaire asked mothers to rate the frequency of 20 symptoms during the past week on a 4-point scale ranging from *rarely* to *most of the time*. A general cutoff score of 16 is used to define potentially serious “clinical levels” of depression (Radloff, 1977). Correlations between maternal depression variables ranged from .39 to .56 over the six assessment periods. Cronbach’s alphas for the NICHD study ranged from .88 to .91 (NICHD, 1999, RTI, 1998b).

For this analysis, binary variables were created for depression at each time point from 1 to 54 months, indicating if the mother was above the 16-point cut off. The percentage of mothers above the cut off at any given time point ranged from 17 to 26% of all mothers. These binary variables were averaged across the six time points and then multiplied by six to create a scale ranging from 0 to 6. This represents the average number of time points in which the mother was depressed. Mothers with higher scores had high levels of depressive symptoms over more time points during their children’s first four-and-a-half-years of life.

Social competency. A latent variable for social competency at 54 months was composed of three subscales of the Social Skills Questionnaire of the Social Skills

Rating System (SSRS; Gresham & Elliott, 1990). Mothers completed the instrument about their children at 54 months by indicating how often their child demonstrated each behavior on a three-point scale ranging from *never* to *very often*. Social competency includes the mean score of 10-items measuring each of the following subscales: cooperation (helping household members, keeping room clean and neat, and using time appropriately), assertion (initiating behaviors, such as starting conversations with others and joining in group activities), and responsibility (demonstrate ability to communicate with adults, such as asking appropriate questions and asking permission before using others property) (Gresham & Elliott). See Appendix B for complete list of items used to measure social competency. Higher scores indicate higher levels of perceived social competence. Cronbach's alphas for the NICHD sample were: cooperation = .72, assertion = .74, responsibility = .63 (RTI, 1999a). For this analysis, the latent variable representing social competency at 54 months is defined by SSRS assertion (loading = .68), SRSS responsibility (loading = .76), and SSRS cooperation (loading = .74) subscale scores. All of the loadings of the measured variables on the latent variable were significant ($p < .001$).

Behavioral regulation. A latent variable for parent-rated behavioral regulation at 54 months was composed of two subscales from the Child Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001). Mothers completed the CBQ when their child was 54 months old by rating their child's behavior on a seven-point likert scale ranging from *extremely untrue of your child* to *extremely true of your child*. The

latent variable includes the mean score from the following two subscales: *inhibitory control* (capacity to plan and to suppress inappropriate approach responses under instructions or in novel or uncertain situations; 10 items) and *attentional focusing* (capacity to maintain attentional focus on task-related channels; 8 items) (Rothbart et al.). See Appendix C for complete list of items used to measure behavioral regulation. Cronbach's alphas for the NICHD sample were .75 for inhibitory control and .74 for attentional focusing (RTI, 1999b). Higher scores indicate higher levels of parent-rated behavioral regulation. For this analysis, the latent variable representing behavioral regulation at 54 months is defined by CBQ inhibitory control (loading = .75) and attentional focusing (loading = .71) subscale scores. All of the loadings of the measured variables on the latent variable were significant ($p < .001$).

Academic achievement in first grade. Achievement in first grade was measured using subtests from the Woodcock-Johnson Psycho-Educational Battery—Revised (WJ-R) (Woodcock & Johnson, 1989) administered during the Spring of the child's first grade year. *Reading* achievement at first grade was assessed through the Letter-Word Identification subtest. The first five items involve symbolic learning or the ability to match a pictographic representation of a word with an actual picture of the object. The remaining items measure the child's ability to identify isolated letters and words. The Cronbach's alpha coefficient for the NICHD sample is .92 (RTI, 2000).

Mathematics achievement in first grade was assessed through the Applied Problems subtest. This measures the child's skill in analyzing and solving practical

problems in mathematics. In order to solve problems, the child must recognize the procedure to be followed and then perform the relatively simple calculations. The Cronbach's alphas for this NICHD study sample is .83 (RTI, 2000).

Vocabulary at first grade was assessed through the Picture Vocabulary subtest. This test measures the ability to recognize and name pictured objects. Six of the beginning items are in a multiple choice format that requires pointing only; the remaining items require the child to name familiar and unfamiliar objects and measures verbal comprehension. The Cronbach's alpha coefficient for the NICHD study sample is .72 (RTI, 2000).

Raw scores on all three academic outcomes were converted into *W*-scores for use in this model, which have similar properties to the Rasch ability scale including equal-interval measurement characteristics. For example, a 10-point increase in subtest score between two time points indicates the same increase in achievement as a 10-point increase in score between two other time points (NICHD, 2007). *W*-scores are based on a centered score of 500, which is the average achievement level for a 10-year-old child (Mather & Woodcock, 2001).

Data Analysis Plan

The current study aims to identify the direct and indirect pathways from early family risk to academic success. More specifically, one goal of this study is to determine whether early family risk characteristics and academic achievement at first grade are mediated by individual differences in children's behavioral regulation and

social competency at 54 months. Another goal is to examine which mediated pathway more strongly links family risk to early academic achievement.

Structural Equation Modeling (SEM) was used to examine the relationship among early family risk factors from 1 to 54 months, social competency and behavioral regulation at 54 months, and first-grade reading achievement. SEM is a statistical technique that allows multivariate analysis of associations between multiple predictors and outcomes, including latent variables (Kline, 2005). The proposed structural equation model is diagrammed in Figure 1. According to interclass correlations, the extent to which the outcomes varied by site were minimal. The interclass correlations were 0.00 for the social competency variables, 0.00 to 0.02 for the behavioral regulation variables, and 0.00 to 0.06 for the academic outcomes. Therefore, site was not included as a cluster variable.

Structural equation models consist of two main components: a measurement model and a structural model. The measurement model assesses the fit of latent variables. Latent variables are hypothetical variables formed by combining several related measured variables (NICHHD, 2004). In this model, two latent variables – for social competency and behavioral regulation – were used in the analysis.

The structural model assesses how well the hypothesized model fits the data as well as estimates the proposed parameters, or paths, between variables. To evaluate the structural model, multiple goodness-of-fit statistics were reported and interpreted. These include the overall chi-square statistic, comparative fit index (CFI), root mean square

error of approximation (RMSEA), and the standardized root mean square residual (SRMR). The overall chi-square statistic is referred to as a “badness-of-fit” index because higher values indicate a worse fit between the model and the data. However, it is important to note that the chi-square is highly influenced by large sample size and model complexity, making a low chi-square value rare in these instances (Cohen et al., 2003).

Therefore, several other fit indices that are less sensitive to model misspecification and large sample size were also evaluated. The RMSEA and SRMR are both absolute fit indexes. The RMSEA is also a “badness-of-fit” index, but is less sensitive to measurement model misspecification, with values of 0.06 or less indicating a good fit (Hu & Bentler, 1999). The SRMR is less sensitive to latent structure misspecification and indicates how well the sample covariance structure fits the covariance structure of the proposed model. SRMR values less than 0.08 represent a good fit (Hu & Bentler). The CFI compares the specified model to a baseline model in which it is assumed that none of the variables are correlated. According to Hu and Bentler (1999), a CFI of 0.95 or greater is considered a good fit. A good overall fit is desired, as this indicates that the proposed model more closely reproduces the observed correlations or covariances of the data.

To address missing data and strengthen power of the analysis, data were analyzed using full informational maximum likelihood (FIML) estimation. This estimation utilizes all of the available information for each of the 1,364 cases (Kline,

2005) and has been shown to produce parameter estimates that are more accurate than listwise deletion, pairwise deletion, or mean imputation (Enders, 2001).

Results

The present study sought to chart the multiple pathways between early family risk and first-grade academic achievement. Descriptive statistics for the variables used in this analysis are listed in Table 1 and 2. Table 1 shows means, standard deviations, and range for the observed variables (see page 46). Table 2 lists the correlations between all predictor, mediator, and outcome variables (see page 48). As expected, early family risk factors (including Black ethnicity, maternal education, income-to-needs ratio, and maternal depression) were significantly correlated with reading, mathematics, and vocabulary, with higher risk indicating lower achievement. In addition, early family risk factors were significantly correlated with 54-month behavioral regulation and social competency, in that higher risk was related to lower skill levels. Components of behavioral regulation and social competency were also positively correlated to achievement.

Since parental reports of children's skill levels can be influenced by a parent's state of well-being, the relations between maternal depression and outcome variables were examined. Children of mothers who were depressed at 54 months had significantly lower scores on social competency and behavioral regulation than did children of mothers who were not depressed at 54 months, although the difference in means was small to moderate (*Cohen's D* = .16-.37; $p < .001$). Means, standard deviations, and effect size of differences in children's 54-month behavioral regulation and social competency for depressed and non-depressed mothers at 54 months are displayed in

Table 3 (see page 52). It is possible that maternal depression can influence a parent's perception and ability to accurately report their children skills (NICHD, 2003a). However, it may also indicate that children of mothers who are chronically depressed have lower skill levels than their peers whose mothers are not depressed.

Structural Equation Model

To identify the direct and indirect pathways between early family risk factors and first-grade academic achievement and examine the mediating role of social competency and behavioral regulation at 54-months, one structural equation model was tested (see Figure 1 on page 24). Both the measurement model and the structural model for all outcomes were evaluated simultaneously using Mplus 4.2 software program (Muthén & Muthén, 2006). Early family risk factors, including ethnicity of the child, maternal education, average income-to-needs ratio, and maternal depression, explained 13% of the variance in 54-month social competency as well as 19% of the variance in 54-month behavioral regulation. Early family risk factors, social competency, and behavioral regulation accounted for 16% of the variance in first-grade reading achievement, 23% of the variance in first-grade mathematics achievement, and 28% of the variance in first-grade vocabulary achievement (Mplus output is included in Appendix A). The correlation between the residuals of the behavioral regulation and social competency latent constructs was .45 ($p < .001$).

In this analysis, multiple goodness-of-fit statistics were reported because the overall chi-square statistic is affected by the large sample size. The chi-square value for

the model was statistically significant ($\chi^2(28) = 150.69, p < .001$), and therefore less useful in assessing model fit with this data. Other measures of fit, including the comparative fit index ($CFI = .95$) and the standardized root mean square residual ($SRMR = .03$), indicated a good model fit. The root mean square error of approximation (RMSEA) in this analysis indicated a close approximate fit at .06, with a 90% confidence interval of .05 – .07. Despite the significant chi-square, fit indices indicated an excellent fit of the model to the data (Hu & Bentler, 1999; Kline, 2005).

Direct Effects between Family Risk, Social Competency, Behavioral Regulation, and Academic Achievement

The first goal of this study was to examine the direct relationships between family risk during early childhood, social competency and behavioral regulation at 54 months, and reading, mathematics, and vocabulary achievement in first grade (see Tables 4-6, and Figures 2-4, starting on page 53).

Family risk, social competency, and behavioral regulation. A number of direct relations were observed between the early family risk factors and measures of social competency and behavioral regulation at 54 months (see Table 4 on page 53). For the most part, child's ethnicity did not significantly contribute to a child's behavioral regulation or social competency, although there was a small trend for Hispanic children to have lower social competency skills ($\beta = -.06, p < .10$). Higher maternal education was associated with higher behavioral regulation skills ($\beta = .18, p < .001$), but not higher social competency skills ($\beta = .05, p > .10$). Children in families with a higher average income-to-needs ratio from 1 to 54 months had both higher behavioral

regulation skills ($\beta = .13, p < .05$) and higher social competency skills ($\beta = .15, p < .01$) at 54 months. Maternal depression predicted both 54-month behavioral regulation ($\beta = -.22, p < .001$) and social competency skills ($\beta = -.22, p < .001$), with more time points of serious depressive symptoms leading to lower skill levels.

Reading. The structural equation model provided evidence supporting various direct links from early family risk factors, behavioral regulation, and social competency to reading achievement in first grade (see Table 4 and Figure 2 on pages 53-57). As depicted in Figure 2, children of mothers with higher education and more financial resources, as identified by higher income-to-needs ratio, had significantly higher reading achievement in first grade ($\beta = .14, p < .001$; $\beta = .13, p < .01$). In addition, black ethnicity was related to lower reading achievement scores at first grade ($\beta = -.10, p < .01$) with Black children scoring approximately 7 points lower than White children on reading ($B = -6.82$). No direct path to first-grade reading achievement was noted for Hispanic children ($\beta = -.02, p > .10$) or for children of depressed mothers ($\beta = -.01, p > .10$). Children's behavioral regulation at 54 months was significantly related to reading achievement ($\beta = .16, p < .01$), but the path from social competency to reading was not statistically significant ($\beta = .02, p > .10$).

Mathematics. Overall, the direct effect results for mathematics achievement in first grade were similar to those for reading (see Table 5 and Figure 3 on pages 58-62). As Figure 3 illustrates, higher maternal education and higher average income-to-needs ratio were positively associated with children's mathematics achievement ($\beta = .19, p <$

.001; $\beta = .15, p < .001$), but the direct path between maternal depression and mathematics did not reach significance ($\beta = .01, p > .10$). In contrast to reading, however, ethnicity played a different role for mathematics achievement. Both Black and Hispanic children had significantly lower mathematics performance in first grade, with the effect being stronger for Black children ($\beta = -.19, p < .001$) than for Hispanic children ($\beta = -.06, p < .05$). Results indicate that Black children scored approximately 9 points lower than White children ($B = -8.75$) and Hispanic children scored approximately 4 points lower than White children on mathematics ($B = -4.11$). As with reading, children's behavioral regulation at 54 months was a significant predictor of first-grade mathematics achievement ($\beta = .12, p < .05$), with higher levels of regulation skills related to higher mathematics achievement. The direct path from social competency at 54 months to mathematics in first grade was not statistically significant ($\beta = .04, p > .10$).

Vocabulary. As Table 6 and Figure 4 indicate, direct effects from early family risk factors, behavioral regulation, and social competency to first-grade vocabulary achievement displayed similar patterns to reading and mathematics (see page 63-67). Having a mother with higher education was positively linked to vocabulary achievement ($\beta = .24, p < .001$), with the effect being stronger for vocabulary than for reading or mathematics. Similarly, the average family income-to-needs ratio from 1 to 54 months significantly predicted a child's vocabulary performance ($\beta = .16, p < .001$), with more financial resources predicting higher vocabulary achievement. Here again,

identification as Black was significantly related to lower vocabulary performance ($\beta = -.20, p < .001$) with Black children scoring approximately 7 points lower than White children on vocabulary ($B = -7.10$), whereas identification as Hispanic had no significant effect on first-grade vocabulary ($\beta = -.02, p > .10$). As with reading and mathematics, 54-month behavioral regulation was associated with higher vocabulary achievement ($\beta = .12, p < .05$), but social competency did not directly predict vocabulary performance ($\beta = .07, p > .10$).

Indirect Effects between Family Risk, Social Competency, Behavioral Regulation, and Academic Achievement

The second goal of this study was to explore whether a child's social competency and behavioral regulation at 54 months mediated the relationship between early family risk and reading achievement in first grade.

Reading. Results indicated that early family risk factors were related to first-grade reading achievement through a child's behavioral regulation skills at 54 months, although the size of the indirect effects were quite small (see Table 4 on page 53). For example, higher maternal education was associated with higher first-grade reading performance, in part through its contribution to better behavioral regulation skills at 54 months ($\beta = .03, p < .05$). Likewise, more assessment points with maternal depression was associated with lower ratings of behavioral regulation skills and, subsequently, lower reading scores in first grade ($\beta = -.03, p < .01$). There was also a trend for higher average income-to-needs ratio to predict higher behavioral regulation at 54 months, which then predicted higher reading achievement ($\beta = .02, p < .10$). However, although

statistically significant, the magnitude of the effects was very small. In contrast to behavioral regulation, all indirect pathways from early family risk factors through 54-month social competency to first-grade reading achievement were not significant (see Table 4).

Mathematics. Results for mathematics revealed a virtually identical pattern of indirect pathways from early family risk factors to first-grade mathematics achievement (see Table 5 on page 58). First, higher maternal education was associated with stronger behavioral regulation skills, which, in turn, was associated with better math performance in first grade ($\beta = .02, p < .05$). Second, longer periods of maternal depression was related to lower behavioral regulation skills at 54 months, which then was associated with lower mathematics performance in first grade ($\beta = -.03, p < .05$). In addition, there was a small trend that indicated higher average income-to-needs ratio from 1 to 54 months, was related to better behavioral regulation, which, in turn, was associated with higher first-grade mathematics achievement ($\beta = .02, p < .10$). Although statistically significant, all indirect effects through behavioral regulation to mathematics were weak. Similar to children's reading, none of the indirect pathways through a child's social competency at 54 months to first-grade mathematics achievement reached significance (see Table 5).

Vocabulary. As seen in Table 6, the indirect effects for vocabulary achievement in first grade were similar to the results found for both reading and mathematics. Behavioral regulation at 54 months was found to be a significant mediator of several

early family risk factors, although the strength of these relations were weak. For example, maternal education was associated with better vocabulary, in part, through its contribution to better behavioral regulation skills at 54 months. ($\beta = .02, p < .05$). The indirect path from maternal depression to 54-month behavioral regulation was also significant ($\beta = -.03, p < .05$), such that as the number of time points a mother showed significant depressive symptoms increased, children's behavioral skills decreased, which, in turn, was related to lower academic performance. A trend existed for higher income-to-needs ratio to predict higher behavioral regulation, which was associated with better vocabulary performance ($\beta = .02, p < .10$). Social competency at 54 months was not a significant mediator for any of the indirect pathways from early family risk to first-grade vocabulary achievement (see Table 6 on page 63).

Comparing Social Competency and Behavioral Regulation as Mediators

The third goal of the study was to compare the strength of social competency and behavioral regulation as mediators of first-grade academic achievement. Although it was hypothesized that both aspects of a child's skill development at 54 months would be significant mediators, only behavioral regulation proved to have a significant contribution to academic outcomes and was a mediator between early family risk factors and all three outcomes.

Despite the weak overall strength of the indirect relations, the pattern was nearly identical for reading, mathematics, and vocabulary. Higher maternal education was significantly related to children's behavioral regulation at 54 months, which, in turn,

was associated with better performance in reading ($\beta = .03, p < .05$), mathematics ($\beta = .02, p < .05$), and vocabulary ($\beta = .02, p < .05$). Likewise, behavioral regulation mediated the relation between maternal depression and academic achievement, such that as the number of time points a mother showed significant depressive symptoms increased, children's behavioral skills decreased, which, in turn, was related to lower reading ($\beta = -.03, p < .01$), mathematics ($\beta = -.03, p < .05$), and vocabulary ($\beta = -.03, p < .05$) achievement. In addition, a trend indicated that more financial resources over early childhood, as identified by higher income-to-needs ratio, was related to higher behavioral regulation, which was then associated with higher reading ($\beta = .02, p < .10$), mathematics ($\beta = .02, p < .10$), and vocabulary ($\beta = .02, p < .10$) achievement in first grade. Taken together, behavioral regulation is a mediator between family risk and achievement, but the strength of all indirect effects was weak and not substantively significant.

Table 1

Means, Standard Deviations, and Range of Predictor, Mediator, and Outcome Variables (N = 1,364)

Variables	<i>M</i>	<i>SD</i>	<i>Range</i>
Predictor Variables			
Hispanic child ^a	.06	.24	0–1.00
Black child ^b	.13	.34	0–1.00
Maternal Education	14.23	2.51	7.00–21.00
Income-to-Needs Ratio ^c	3.39	2.69	.13–23.79
Maternal Depression ^d	1.22	1.70	0–6.00
Mediator Variables at 54 months			
SSRS Social Skill: Cooperation ^e	1.22	.29	.30–2.00
SSRS Social Skill: Assertion ^e	1.43	.30	.20–2.00
SSRS Social Skill: Responsibility ^f	1.05	.29	0–1.90
CBQ: Inhibitory Control ^f	4.64	.78	2.00–6.70
CBQ: Attention Focusing ^f	4.68	.86	1.25–6.89
Outcome Variables at First Grade			
Reading: WJR Letter-Word Identification ^g	451.73	24.14	356–517
Mathematics: WJR Applied Problems ^g	469.34	15.71	408–516
Vocabulary: WJR Picture Vocabulary ^g	483.34	12.40	434–519

Table 1 *Continued*

^aChild Ethnicity: 0 = Non-Hispanic, 1 = Hispanic. ^bChild Ethnicity: 0 = Non-Black, 1 = Black. ^cIncome-to-needs ratio averaged over the six time points from 1 to 54 months, prior to log transformation. Score of 1.00 indicates income at poverty threshold.

^dMaternal depression represents the average number of time points in which the mother was depressed from 1 through 54 months. ^eSSRS = Social Skills Rating System, average of 10 items on a scale from 0-2. ^fCBQ = Child Behavior Questionnaire, average of 8 items (attention) and 10 items (inhibitory control) on a scale from 1-7.

^gWJR = Woodcock-Johnson Psycho-Educational Battery – Revised

Table 2

Correlations between Predictor, Mediator, and Outcome Variables (N = 1,364)

Variables	1	2	3	4	5	6	7
Predictor Variables							
1. Hispanic child	—						
2. Black child	-.10***	—					
3. Maternal Education	-.12***	-.21***	—				
4. Average Income-to-Needs Ratio: 1–54 mo. ^a	-.10***	-.40***	.61***	—			
5. Chronic Maternal Depression: 1–54 mo. ^b	.03	.19***	-.28***	-.37***	—		
Mediator Variables at 54 months							
6. SSRS: Cooperation ^c	-.06	-.09**	.11***	.15***	-.22***	—	
7. SSRS: Assertion ^c	-.08*	-.16***	.14***	.21***	-.23***	.45***	—
8. SSRS: Responsibility ^c	-.06	-.08*	.20***	.24***	-.20***	.55***	.52***
9. CBQ: Inhibitory Control ^d	-.03	-.09**	.21***	.23***	-.27***	.45***	.21***

^a $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 2 Continued

Variables	1	2	3	4	5	6	7
10. CBQ: Attention Focusing ^d	-.04	-.19***	.29***	-.27***	-.20***	.35***	.19***
Outcome Variables at First Grade							
11. WJ-R: Reading ^e	-.05	-.21***	.31***	.32***	-.18***	.14***	.14***
12. WJ-R: Mathematics ^e	-.09**	-.30***	.37***	.39***	-.19***	.13***	.17***
12. WJ-R: Vocabulary ^e	-.06	-.33***	.42***	.43***	-.19***	.14***	.21***

^f $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 2 *Continued*

Variables	8	9	10	11	12	13
Predictor Variables						
1. Hispanic child						
2. Black child						
3. Maternal Education						
4. Average Income-to-Needs Ratio: 1–54 mo. ^a						
5. Chronic Maternal Depression: 1–54 mo. ^b						
Mediator Variables at 54 months						
6. SSRS: Cooperation ^c						
7. SSRS: Assertion ^c						
8. SSRS: Responsibility ^c	—					
9. CBQ: Inhibitory Control ^d	.34***	—				
10. CBQ: Attention Focusing ^d	.26***	.53***	—			

^a $p \leq .10$, ^b $p \leq .05$, ^c $p \leq .01$, and ^d $p \leq .001$.

Table 2 *Continued*

Variables	8	9	10	11	12	13
Outcome Variables at First Grade						
11. WJ-R: Reading ^e	.15***	.18***	.25***	—		
12. WJ-R: Mathematics ^e	.17***	.18***	.24***	.58***	—	
12. WJ-R: Vocabulary ^e	.21***	.19***	.29***	.40***	.50***	—

^a Income-to-needs ratio averaged over the six time points from 1 to 54 months, correlations reflect log transformation. ^b Maternal

depression represents the average number of time points in which the mother was depressed from 1 to 54 months. ^c SSRS =

Social Skills Rating System. ^d CBQ = Child Behavior Questionnaire. ^e WJR = Woodcock-Johnson Psycho-Educational Battery –

Revised.

[†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 3

Difference in Means and Standard Deviations for Depressed and Non-Depressed Mothers at 54 Months and Children's Behavioral Regulation and Social Competency at 54 Months

	Depressed at 54 months			Non-Depressed at 54 months			Effect Size of Difference	
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>p-value</i>	<i>Cohen's D^a</i>
Behavioral Regulation at 54 months								
Inhibitory Control	223	4.40	.79	827	4.73	.76	<.001	.37
Attention Focusing	213	4.47	.85	800	4.77	.84	<.001	.33
Social Competency at 54 months								
Assertion	223	1.15	.30	821	1.24	.28	<.001	.17
Cooperation	223	1.37	.34	821	1.46	.28	<.001	.16
Responsibility	223	.98	.31	821	1.08	.28	<.001	.18

Note: Depressed indicates CES-D score was greater than 16, Non-Depressed indicates CES-D score was less than 16.

^aCohen's D less than .20 indicates a small effect, less than .50 indicates a medium effect (Cohen, 1988).

Table 4

Reading in First Grade: Unstandardized Coefficients, Standard Errors, and Standardized Coefficients of Direct and Indirect Paths

	Social Competency (54 months)		Behavioral Regulation (54 months)		Reading (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
<i>Direct Paths</i>						
Hispanic child	-.05(.03)	-.06 [†]	-.03(.09)	-.01	-2.26(3.05)	-.02
Black child	-.02(.03)	-.03	-.08(.07)	-.05	-6.82(2.44)	-.10**
Maternal Education	.00(.00)	.05	.04(.01)	.18***	1.37(.37)	.14***
Income-to-Needs Ratio: 1-54 months	.04(.01)	.15**	.09(.04)	.13*	3.89(1.28)	.13**
Maternal Depression: 1-54 months	-.03(.01)	-.22***	-.08(.02)	-.22***	-.18(.50)	-.01
Social Competency: 54 months					1.97(5.62)	.02
Behavioral Regulation: 54 months					6.43(2.26)	.16**

[†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 4 Continued

	Social Competency (54 months)		Behavioral Regulation (54 months)		Reading (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
<i>Indirect Paths</i>						
Hispanic child						
→ Social Competency→Reading					-.10 (.30)	-.00
→ Behavioral Regulation→Reading					-.17(.58)	-.00
Black child						
→ Social Competency→Reading					-.04(.11)	.00
→ Behavioral Regulation→Reading					-.52(.50)	-.01
Maternal Education						
→ Social Competency→Reading					.01(.02)	.00
→ Behavioral Regulation→Reading					.28(.12)	.03*

† $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 4 Continued

	Social Competency (54 months)		Behavioral Regulation (54 months)		Reading (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
Income-to-Needs Ratio						
→ Social Competency→Reading					.08(.23)	.00
→ Behavioral Regulation→Reading					.59(.31)	.02 [†]
Maternal Depression						
→ Social Competency→Reading					-.05(.16)	-.00
→ Behavioral Regulation→Reading					-.49(.19)	-.03**

[†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

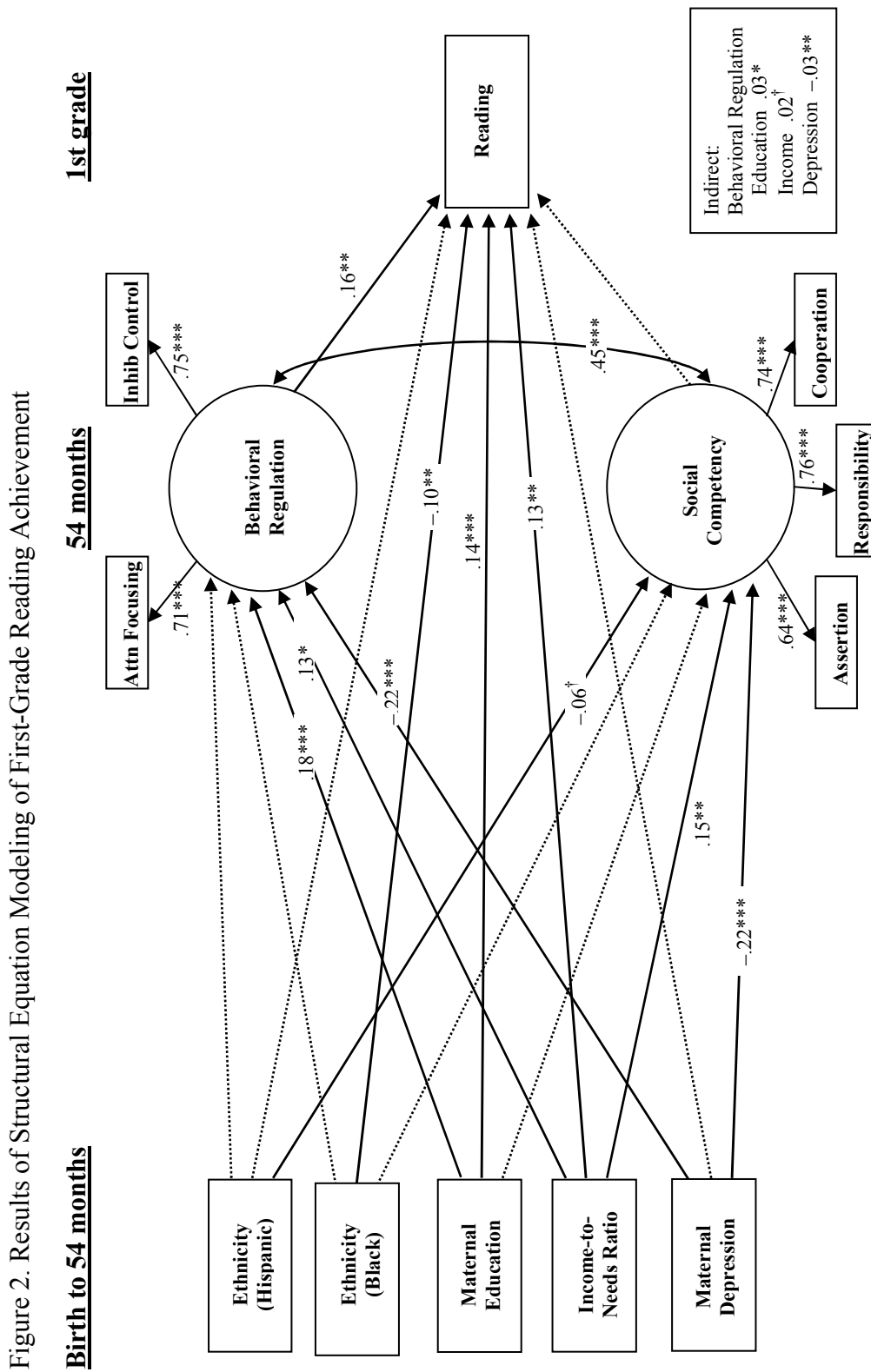


Figure 2. Results of Structural Equation Modeling of First-Grade Reading Achievement

Figure 2 Continued

Note: Model is simplified to show results for Reading only. Measurement errors, correlations between exogenous variables, and correlations between endogenous outcome variables are not included for clarity of presentation. Bidirectional path represents correlated residuals. $^{\dagger} p \leq .10$, $* p \leq .05$, $** p \leq .01$, and $*** p \leq .001$.

$\chi^2(28) = 150.69, p < .001$; CFI = .95; RMSEA = .06, 90% CI = .05 - .07; SRMR = .03.

Table 5

Mathematics in First Grade: Unstandardized Coefficients, Standard Errors, and Standardized Coefficients of Direct and Indirect Paths

	Social Competency (54 months)		Behavioral Regulation (54 months)		Mathematics (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
<i>Direct Paths</i>						
Hispanic child	-.05(.03)	-.06 [†]	-.03(.09)	-.01	-4.11(1.91)	-.06*
Black child	-.02(.03)	-.03	-.08(.07)	-.05	-8.75(1.51)	-.19****
Maternal Education	.00(.00)	.05	.04(.01)	.18****	1.19(.23)	.19****
Income-to-Needs Ratio: 1-54 months	.04(.01)	.15**	.09(.04)	.13*	2.76(.80)	.15****
Maternal Depression: 1-54 months	-.03(.01)	-.22****	-.08(.02)	-.22****	.08(.31)	.01
Social Competency: 54 months					2.58(3.48)	.04
Behavioral Regulation: 54 months					3.16(1.38)	.12*

[†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and **** $p \leq .001$.

Table 5 Continued

	Social Competency (54 months)		Behavioral Regulation (54 months)		Mathematics (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
<i>Indirect Paths</i>						
Hispanic child						
→ Social Competency→Reading					-.13 (.20)	-.00
→ Behavioral Regulation→Reading					-.09(.29)	-.00
Black child						
→ Social Competency→Reading					-.05(.09)	-.00
→ Behavioral Regulation→Reading					-.26(.26)	-.01
Maternal Education						
→ Social Competency→Reading					.01(.02)	.00
→ Behavioral Regulation→Reading					.14(.07)	.02*

† $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 5 Continued

	Social Competency (54 months)		Behavioral Regulation (54 months)		Mathematics (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
Income-to-Needs Ratio						
→ Social Competency→Reading					.10(.14)	.01
→ Behavioral Regulation→Reading					.29(.17)	.02 [†]
Maternal Depression						
→ Social Competency→Reading					-.07(.10)	-.01
→ Behavioral Regulation→Reading					-.24(.11)	-.03*

[†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Figure 3. Results of Structural Equation Modeling of First-Grade Mathematics Achievement

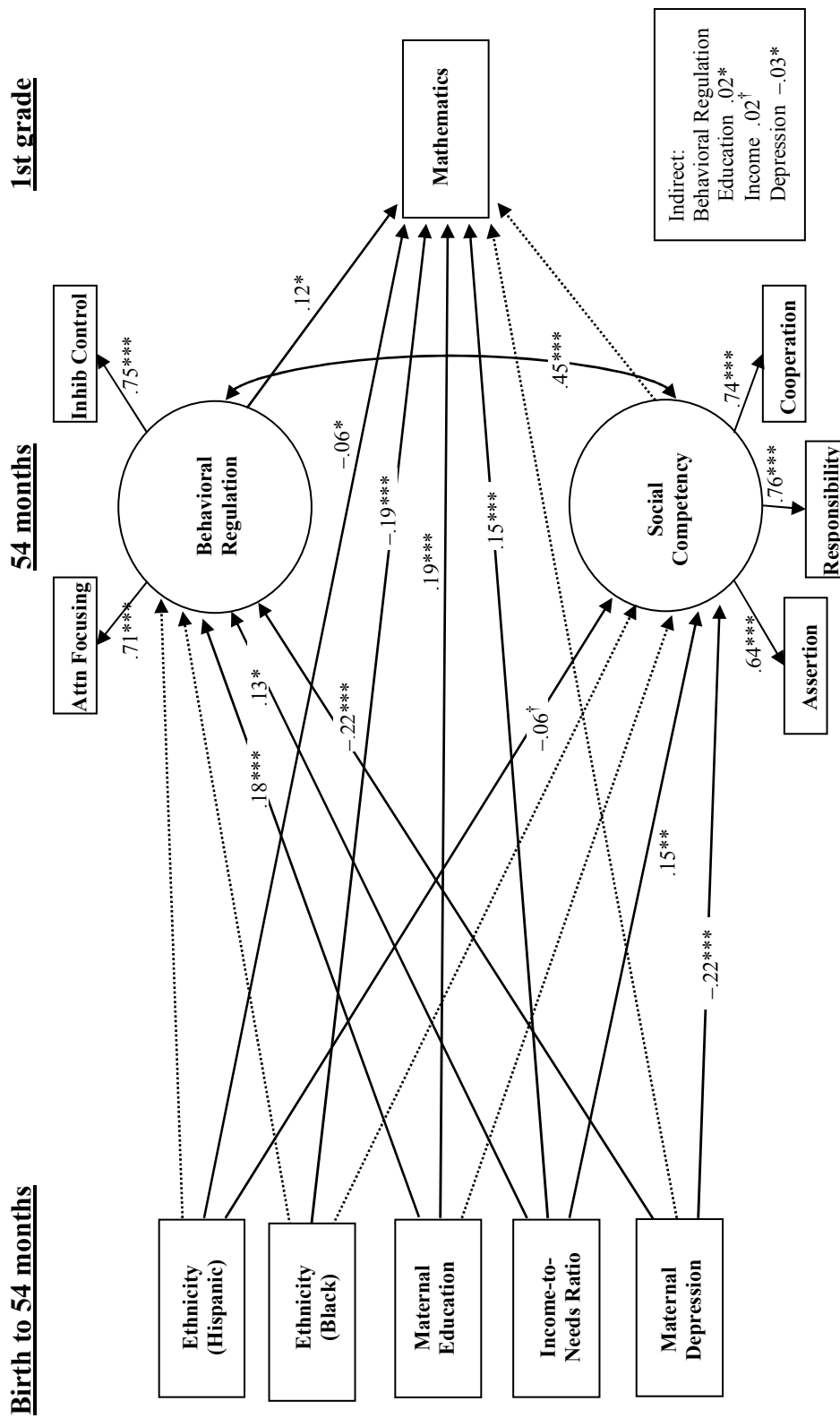


Figure 3 Continued

Note: Model is simplified to show results for Mathematics only. Measurement errors, correlations between exogenous variables, and correlations between endogenous outcome variables are not included for clarity of presentation. Bidirectional path represents correlated residuals. [†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

$\chi^2(28) = 150.69, p < .001$; CFI = .95; RMSEA = .06, 90% CI = .05 - .07; SRMR = .03.

Table 6

Vocabulary in First Grade: Unstandardized Coefficients, Standard Errors, and Standardized Coefficients of Direct and Indirect Paths

	Social Competency (54 months)		Behavioral Regulation (54 months)		Vocabulary (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
<i>Direct Paths</i>						
Hispanic child	-.05(.03)	-.06 [†]	-.03(.09)	-.01	-1.10(1.44)	-.02
Black child	-.02(.03)	-.03	-.08(.07)	-.05	-7.10(1.15)	-.20***
Maternal Education	.00(.00)	.05	.04(.01)	.18***	1.16(.18)	.24***
Income-to-Needs Ratio: 1-54 months	.04(.01)	.15**	.09(.04)	.13*	2.37(.61)	.16***
Maternal Depression: 1-54 months	-.03(.01)	-.22***	-.08(.02)	-.22***	.25(.24)	.04
Social Competency: 54 months					3.91(2.68)	.07
Behavioral Regulation: 54 months					2.53(1.08)	.12*

[†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 6 Continued

	Social Competency (54 months)		Behavioral Regulation (54 months)		Vocabulary (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
<i>Indirect Paths</i>						
Hispanic child						
→ Social Competency→Reading					-.20(.19)	-.00
→ Behavioral Regulation→Reading					-.07(.23)	-.00
Black child						
→ Social Competency→Reading					-.07(.11)	-.00
→ Behavioral Regulation→Reading					-.21(.21)	-.01
Maternal Education						
→ Social Competency→Reading					.02(.02)	.00
→ Behavioral Regulation→Reading					.11(.05)	.02*

† $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 6 Continued

	Social Competency (54 months)		Behavioral Regulation (54 months)		Vocabulary (Grade 1)	
	B(SE)	β	B(SE)	β	B(SE)	β
Income-to-Needs Ratio						
→ Social Competency→Reading					.16(.12)	.01
→ Behavioral Regulation→Reading					.23(.13)	.02 [†]
Maternal Depression						
→ Social Competency→Reading					-.11(.08)	-.02
→ Behavioral Regulation→Reading					-.19(.09)	-.03*

[†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Figure 4. Results of Structural Equation Modeling of First-Grade Vocabulary Achievement

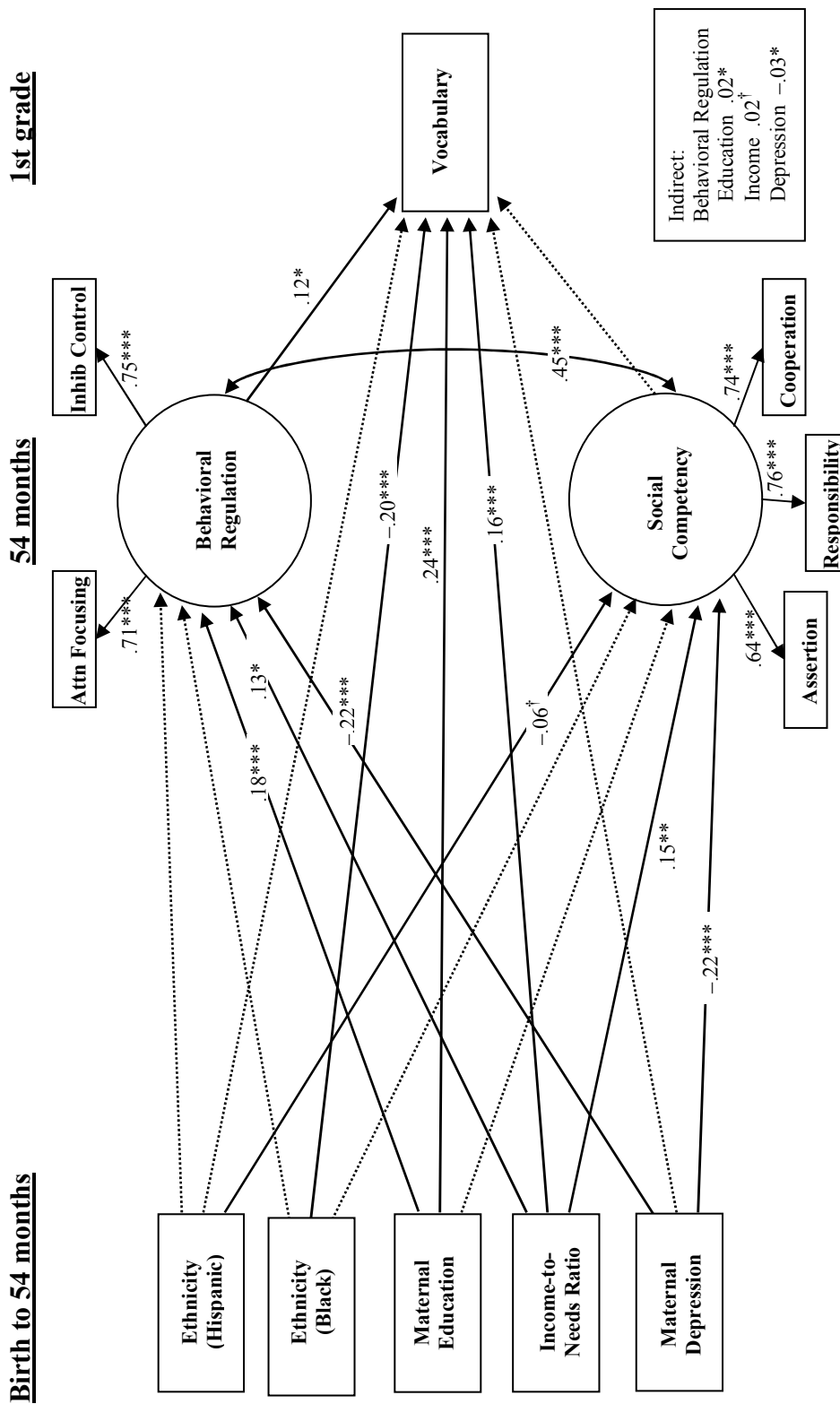


Figure 4 Continued

Note: Model is simplified to show results for Vocabulary only. Measurement errors, correlations between exogenous variables, and correlations between endogenous outcome variables are not included for clarity of presentation. Bidirectional path represents correlated residuals. [†] $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

$\chi^2(28) = 150.69, p < .001$; CFI = .95; RMSEA = .06, 90% CI = .05 - .07; SRMR = .03.

Discussion

Early childhood is a critical time in which children develop the skills necessary for academic success. This study adds to research on the importance of the family environment and children's social and regulatory skills by developing and testing a comprehensive model of how early family risk influences children's achievement. More specifically, this study explored the interplay of factors that create pathways to first-grade academic achievement and examined the relative strength of two indirect pathways between early risk, children's behavioral regulation and social competency, and early achievement. Findings demonstrated that early childhood risk (as indexed by ethnic minority status, low maternal education, low family income, and high maternal depressive symptoms) negatively effected achievement in first grade both directly and indirectly via pathways through a child's behavioral regulation skills.

Multiple Pathways to First-Grade Academic Achievement

One of the main aims of the study was to examine the multiple pathways – both direct and indirect – through which early family risk, 54-month social competency, and 54-month behavioral regulation influence reading, mathematics, and vocabulary achievement in first grade. Results of this study highlighted a number of complex pathways through which early family risk factors shaped the growth of behavioral regulation, social competency, and early academic skills.

A number of the family risk factors (ethnicity, maternal education, income-to-needs ratio, and maternal depression) showed important relations to children's

behavioral regulation, social competence, and early achievement. Specifically, ethnicity emerged as being significantly related to lower achievement, although no significant indirect effects were found through behavioral regulation or social competence (aside from a trend for Hispanic children to have lower social competency at 54 months). Children who were Black were significantly more likely to have lower academic performance in all three outcomes – reading, mathematics, and vocabulary – with stronger findings for mathematics and vocabulary, than for reading. Moreover, being Hispanic was directly related to lower mathematics, but not lower reading or vocabulary performance in first grade. It is important to note that Hispanic children and their mothers had to speak English to be enrolled and participate in this study. Therefore, it is possible that this sample may represent Hispanic children with less risk for academic problems, than if the sample also included primarily Spanish-speaking children and their families. However, it is unclear if higher levels of risk in the Hispanic children may have led to lower levels of vocabulary and reading achievement in first grade. Future research should include Spanish-speaking children and families to better address this issue.

The presence of a direct relation between ethnic minority status and academic achievement is consistent with previous research (Denton & West, 2002; Chatterji, 2006) which found that children belonging to racial minorities score below average on academics in first grade. Jencks and Phillips (1998a) also found that African-American children scored lower than European-American children from kindergarten to

adulthood, which could indicate that these children will continue to score lower than their non-minority peers in the future. In addition, the present study adds to the current literature regarding ethnicity and academic achievement, by exploring and finding a significant relation between being Hispanic and mathematics achievement in first grade.

In addition to ethnicity, maternal education level had a primarily direct effect on first-grade academic achievement. Specifically, higher maternal education was related to higher reading, mathematics, and vocabulary achievement in first grade. These findings are congruent with previous research showing that children had more advanced receptive language, math, and reading skills from preschool to second grade, if mothers were more educated (Burchinal et al., 2002). Alternatively, children whose mothers had lower educational attainment had significantly lower scores on reading, mathematics, and vocabulary in the early elementary years (Luster & McAdoo, 1994).

Unlike previous research that found children of mothers with lower education had lower levels of social competence at 54 months (NICHD, 2003a), this study did not find a significant link between maternal education and social competency skills. However, this study did find that a mother's education predicted a child's behavioral regulation skills, with children of more educated mothers being rated better on behavioral regulation skills at 54 months. This confirms and adds to previous research findings that indicate that having a parent with low education is related to low behavioral regulation skills in preschool and kindergarten (Wanless et al., 2007). The

relation between maternal education and behavioral regulation then led to a significant but weak indirect path from maternal education to 54-month behavioral regulation to academic achievement for all three outcomes. Overall, findings of the current study support the hypothesis that low maternal education is directly related to both lower behavioral regulation skills prior to school entry and lower academic performance in first grade.

A higher average income-to-needs ratio over early childhood significantly predicted stronger first-grade academic achievement. By averaging the family income-to-needs ratio over the six time points from 1 to 54 months, this captures a more accurate portrayal of family financial resources than assessment of income at a single time point (Magnuson & Duncan, 2006). Results of this study are similar to previous research findings that a family's income directly contributes to academic achievement (Chen et al., 1996; Huffman et al., 2000; Sameroff & Seifer, 1983). More specifically, Denton and West (2002) found that children whose families had income below the poverty threshold scored significantly lower than non-poor children in both kindergarten and first-grade. This, along with results of this study, supports the notion that children living in poverty are at increased risk of poor achievement outcomes.

In addition, higher income-to-needs ratio was related to better behavioral regulation at 54 months. This supports previous research finding that children from low socioeconomic families have lower levels of attention than children from economically not-at-risk families (Howse, Lange et al., 2003). There was also a trend for an indirect

pathway from average income-to-needs ratio to first-grade academic achievement through behavioral regulation. However, since this did not reach statistical significance and the size of the effect was very small, no firm conclusions can be drawn.

Unlike ethnicity, maternal education, and average income-to-needs ratio, maternal depression did not directly contribute to first-grade academic achievement, but instead, significantly impacted children's 54-month behavioral regulation and social competency, with a modest indirect relation to achievement through a child's behavioral regulation at 54 months. More specifically, mothers with more time points of serious depressive symptoms had children with lower behavioral regulation and social competency at 54 months. The relation between maternal depression, social competency, and behavioral regulation supports previous research showing that children of depressed mothers had lower levels of social competence prior to school entry (Gross et al., 1995; NICHD, 2001a) as well as adds to existing literature by linking maternal depression to lower behavioral regulation at 54 months.

Although previous research has found a direct relation between maternal depression and early academic skills (NICHD, 1999), little research has examined the effects of having a mother who was depressed over multiple time points on her children's early social, regulatory, and academic skills. Results of the present study suggest that children living with mothers who were depressed at more time points were more likely to have lower inhibitory control and attention skills prior to school entry. In addition, an indirect relation was found from maternal depression through behavioral

regulation to achievement, although the magnitude of the mediation effect was weak. It is important to note that mothers who were depressed at 54 months did rate their children's behavioral regulation skills significantly lower than non-depressed mothers. However, the effect size for this difference indicates that this is a moderate effect, and therefore should be considered when viewing these findings, but may be less practically significant (See Table 3).

Comparing Social Competency and Behavioral Regulation

Although a goal of this study was to examine behavioral regulation and social competency as mediators between early family risk and academic achievement, the most significant findings are related to the direct paths to and from behavioral regulation. This study found that behavioral regulation was a more powerful predictor of academic achievement in first grade for all three outcomes –reading, mathematics and vocabulary – than was social competency. In addition, behavioral regulation was a significant mediator between maternal education, income-to-needs ratio, and maternal depression and first-grade achievement, although the magnitude of the mediation effects was quite weak and not substantively significant.

The latent constructs of social competency and behavioral regulation are clearly related, with moderately correlated residuals ($r = .45$). This is consistent with previous research which combined social competency and behavioral regulation into one learning-related skills construct (McClelland et al., 2000; McClelland et al., 2006). As

one construct these skills predicted academic achievement directly as well as indirectly linked family characteristics to early academic achievement (McClelland et al., 2003).

In this study, behavioral regulation and social competency, as separate constructs, were both predicted by early family risk factors. Maternal education, average income-to-needs ratio and maternal depression significantly contributed to children's 54-month behavioral regulation and social competency, with more risk related to lower skills levels. This is consistent with previous research which found that that family risk is associated with lower behavioral regulation (Howse, Lange et al., 2003; Wanless et al., 2007) and lower levels of social competency (Burchinal et al., 2002; Burchinal et al., 2006; Gross et al., 1995; NICHD, 2003a).

In addition, behavioral regulation significant predicted reading, mathematics, and vocabulary achievement in first grade, whereas social competency did not. The relation of behavioral regulation to academic achievement is consistent with previous research showing that children who fail to regulate the behaviors needed to successfully complete activities are less likely to master skills necessary for academic achievement, both in the early school years and beyond (Howse, Calkins et al., 2003; McClelland et al., 2006; NICHD, 2003b). It is especially noteworthy that behavioral regulation accounted for unique variance in academic achievement above and beyond the effects of the family factors in this model. Hence, skills related to behavioral regulation, such as determining what is important to focus on, tuning out other irrelevant information,

and inhibiting impulses or being distracted by other stimuli, seem to be important for learning and functioning in the classroom environment.

Although previous research has found social competency in learning contexts to be a significant predictor of early academic achievement (McClelland et al., 2000; McClelland, Cameron, Wanless et al., 2007), this study did not find that social competence significantly predicted academic achievement. One possibility for the difference in results is related to the items on the parent-form of the Social Skills Rating System measuring assertion, responsibility, and cooperation. Previous research finding that social competence predicted achievement (as part of a learning-related skills construct; McClelland & Morrison, 2003) used the teacher-form of the SSRS for social competence, which includes questions about social competence in learning contexts. In contrast, the parent version of the SSRS used in the present study is more specific to interpersonal skills and social competence in family settings. This aspect of social competence may be less closely related to academic achievement, than social competence in learning contexts.

Overall, the current analysis shows that while behavioral regulation and social competency are related, they also have differing predictive power and play different roles in the relationship between early family risk factors and first-grade academic outcomes. Although early family risk factors loaded equally on behavioral regulation and social competency, behavioral regulation was more strongly linked to academic achievement than was social competency. Taken together, findings support the family

context as important for the development of regulatory skills and reinforce previous research linking behavioral regulation to academic achievement in the early school years (Howse, Calkins et al., 2003; McClelland, Cameron, Connor et al., 2007).

Practical Implications

This study extends previous research by illuminating mechanisms by which early risk influences early academic achievement. Results add specificity to the growing body of evidence regarding the importance of family contexts for children's academic achievement, especially for children who are exposed to multiple family risk factors. It is important to keep in mind that although results were statistically significant, many of the effects were small to moderate. However, researchers have argued that small findings should not be discounted and may have important practical implications (NICHD, 2007).

Despite small effect sizes, results suggests that facing multiple risk factors over early childhood jeopardizes children's academic achievement both directly as well as by compromising the skills that have been shown as important for school success, namely behavioral regulation skills. These patterns provide guidance in how to lessen the impact of early family risk on children's academic achievement by highlighting possible means of interventions.

First, several risk factors – ethnic minority status of the child, maternal education, and family income – showed direct relations to academic achievement in first grade. This could imply that interventions aimed at directly improving children's

academic skills are beneficial for ethnic minority children, children of mothers with low education, and children living in low income households and provides support for many programs already in place in schools. Continuation of these programs could possibly decrease the gap in academic achievement and change future trajectories. Results also provide continued support for education and interventions aimed towards parents or caregivers of at-risk children prior to school entry in an attempt to assist the family with directly addressing the risk factors in the home environment.

Second, this study emphasizes the role that early behavioral regulation plays in children's academic development. Behavioral regulation directly contributed to academic achievement in first grade after controlling for early family risk factors. Together with research on the significant effects of behavioral regulation on early academic success (Howse, Calkins et al., 2003; McClelland, Cameron, Connor et al., 2007; NICHD, 2003b), this study provides support for interventions specifically focusing on strengthening children's attention and inhibitory control. Such interventions, especially during preschool and the early school years, may decrease the likelihood of poor academic adjustment and later academic failure.

Third, this study highlights early childhood as an important time for development of skills necessary for success in school. Findings indicate the importance of considering the early family environment and children's behavioral regulation when looking at school readiness and early academic success. Since the foundation of behavioral regulation and social competency is laid down during early childhood,

interventions during this time that are multi-faceted, and include family and child components, would be particularly crucial.

Limitations and Future Directions

Although this study provides important information about pathways from early family factors to academic achievement in first grade, there were several limitations. First, the nature of the recruited sample suggests that families with multiple or more severe risk factors were under-represented. The NICHD study aimed to assess normative development, therefore, the sample enrolled in the study did not include children who were unhealthy at birth, children of adolescent or non-English speaking mothers, or those that lived in neighborhoods deemed unsafe. Also, children who dropped from the study or had data missing for academic outcomes were more likely to be Black, to live in a household with a lower income-to-needs ratio, and to have mothers with lower education levels than the original sample. Therefore, because of these sample characteristics, this sample does not represent a large number of at-risk children and families, which could have restricted the ability to detect associations and contributed to small effect sizes. However, it is notable that significant results were found given this limited variability.

Second, ratings of children's behavioral regulation and social competency at 54 months were based on maternal report, which may be influenced by parent perceptions and well-being, rather than reflect actual child behavior (McClelland & Morrison, 2003; McClelland, Cameron, Connor et al., 2007). In this study, children of mothers who were

depressed at 54 months had lower scores on social competency and behavioral regulation skills than children of mothers who were not depressed, but the difference in means was small to moderate. It is possible that characteristics of the parent, such as maternal depression, can influence a parent's perception and ability to accurately report their children's skills (NICHD, 2003a). Future studies would benefit from exploring other means of assessing behavioral regulation and social competency skills, such as direct observational measures (Cameron et al., in press).

A third limitation speaks to the complexity of the characteristics of the child, family, and broader environmental contexts in which the child is embedded. Children's development is often the result of the complex interplay of factors that are constantly changing. This study does not account for all of the influences affecting a child's early academic trajectory. Thus, despite significant findings, a great deal of variance was left unexplained by the current model. Future research is needed to identify other mediating factors as well as further explore the relations between risk factors during early childhood and academic achievement during the first years of formal schooling. In addition, the role of the father and paternal characteristics were not included in this model. Inclusion of father characteristics as well as identification of other mediating factors would contribute to a greater understanding of the relationships between the biological, family, and environmental factors that surround the developing child. Despite these limitations, this study contributes to the growing body of literature on the

complex interrelations between family characteristics, child's skills development prior to school entry, and early academic achievement.

Conclusion

The present study found that family risk factors shape a child's first-grade academic skill development in a variety of ways. Ethnicity significantly predicted first-grade achievement directly, but not through behavioral regulation or social competence. Maternal education and family income had primarily a direct effect as well as a small indirect effect through behavioral regulation. In contrast, maternal depression had only a modest significant indirect effect through behavioral regulation, but did not impact academic achievement directly. Most importantly, behavioral regulation significantly contributed to a child's academic achievement after controlling for the effects of early family risk factors.

The current study sheds light on the sources and influences that shape a child's early academic achievement. Understanding the precise mechanisms through which early family risk influences achievement is essential for developing interventions that will increase the likelihood that at-risk children will be academically successful both in the transition to school and beyond.

References

- Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (1993). First-grade classroom behavior: Its short- and long-term consequences for school performance. *Child Development, 64*, 801-814.
- Alexander, K. L., Entwisle, D. R., & Kabbani, N. S. (2001). The dropout process in life course perspective: Early risk factors at home and school. *Teachers College Record, 103*(5), 760-822.
- Amato, P. R., & Ochiltree, G. (1986). Family resources and the development of child competence. *Journal of Marriage & the Family, 48*(1), 47-56.
- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*(2), 647-668.
- Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In W. Damon & R. M. Lerner (Series Eds.) & R. M. Lerner (Vol. Ed.), *Handbook on child psychology: Vol. 1. Theoretical models of human development* (6th ed., chapter 14; pp. 793-828). New York: Wiley.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, Mass.: Harvard University Press.
- Bronson, M. B. (2000). *Self-regulation in early childhood: Nature and nurture*: Guilford Press.
- Burchinal, M. R., Peisner-Feinberg, E., Pianta, R., & Howes, C. (2002). Development of academic skills from preschool through second grade: Family and classroom predictors of developmental trajectories. *Journal of School Psychology, 40*(5), 415-436.
- Burchinal, M., Roberts, J. E., Zeisel, S. A., Hennon, E. A., & Hooper, S. (2006). Social risk and protective child, parenting, and child care factors in early elementary school years. *Parenting: Science and Practice, 6*(1), 79-113.
- Calkins, S. D. (2007). The emergence of self-regulation: Biological and behavioral control mechanisms supporting toddler competencies. In C. A. Brownell & C. B. Kopp (Eds.), *Socioemotional development in the toddler years: Transitions and transformations* (pp. 261-284). NY: Guilford.

- Cameron, C. E., McClelland, M. M., Jewkes, A.M., Connor, C. M., Farris, C. L. & Morrison, F. J. (in press). Touch your toes! Developing a direct measure of behavioral regulation in early childhood. *Early Childhood Research Quarterly*.
- Chatterji, M. (2006). Reading Achievement Gaps, Correlates, and Moderators of Early Reading Achievement: Evidence From the Early Childhood Longitudinal Study (ECLS) Kindergarten to First Grade Sample. *Journal of Educational Psychology, 98*(3), 489-507.
- Chen, C., Lee, S. Y., & Stevenson, H. W. (1996). Long-term prediction of academic achievement of American, Chinese, and Japanese adolescents. *Journal of Educational Psychology, 88*(4), 750-759.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.
- Cohen, J, Cohen, P., West, S., Aiken, L. (2003). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Publishers.
- Deater-Deckard, K., Petrill, S. A., Thompson, L. A., & DeThorne, L. S. (2005). A cross-sectional behavioral genetic analysis of task persistence in the transition to middle childhood. *Developmental Science, 8*(3), F21-F26.
- Deater-Deckard, K., Petrill, S. A., Thompson, L. A., & DeThorne, L. S. (2006). A longitudinal behavioral genetic analysis of task persistence. *Developmental Science, 9*(5), 498-504.
- Denton, K., & West, J. (2002). Children's reading and mathematics achievement in kindergarten and first grade. (NCES 2002-125). Washington, DC: National Center for Educational Statistics.
- Downer, J. T., & Pianta, R. C. (2006). Academic and Cognitive Functioning in First Grade: Associations with Earlier Home and Child Care Predictors and with Concurrent Home and Classroom Experiences. *School Psychology Review, 35*(1), 11-30.
- Enders, C. K. & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling, 8*(3), 430-457.

- Estrada, P., Arsenio, W. F., Hess, R. D., & Holloway, S. D. (1987). Affective quality of the mother-child relationship: Longitudinal consequences for children's school-relevant cognitive functioning. *Developmental Psychology*, 23(2), 210-215.
- Fabes, R. A., Gaertner, B. M., & Popp, T. K. (2006). Getting along with others: Social competence in early childhood. In K. McCartney & D. Phillips (Eds.), *Blackwell handbook of early childhood development*. (pp.297-316). Malden, MA: Blackwell Publishing.
- Fowler, M. G., & Cross, A. W. (1986). Preschool risk factors as predictors of early school performance. *Journal of Developmental & Behavioral Pediatrics*, 7(4), 237-241.
- Greenberg, M. T., Lengua, L. J., Coie, J. D., Pinderhughes, E. E., Bierman, K., Dodge, K. A., et al. (1999). Predicting developmental outcomes at school entry using a multiple-risk model: Four American communities. *Developmental Psychology*, 35(2), 403-417.
- Gresham, F. & Elliot, S. (1990). *Social skills rating system*. Circle Pines, MN: American Guidance Service.
- Gross, D., Conrad, B., Fogg, L., & Willis, L. (1995). A longitudinal study of maternal depression and preschool children's mental health. *Nursing Research*, 44(2), 96-101.
- Gutman, L. M., Sameroff, A. J., & Cole, R. (2003). Academic growth curve trajectories from 1st grade to 12th grade: Effects of multiple social risk factors and preschool child factors. *Developmental Psychology*, 39(4), 777-790.
- Hamre, B. K., & Pinata, R. C. (2001). Early teacher-child relationships and the trajectory of children's school outcomes through eight-grade. *Child Development*, 72(2), 625-638.
- Howse, R. B., Calkins, S. D., Anastopoulos, A. D., Keane, S. P., & Shelton, T. L. (2003). Regulatory contributors to children's kindergarten achievement. *Early Education and Development*, 14(1), 101-119.
- Howse, R. B., Lange, G., Farran, D. C., & Boyles, C. D. (2003). Motivation and self-regulation as predictors of achievement in economically disadvantaged young children. *Journal of Experimental Education*, 71(2), 151-174.

- Hu, L. & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55.
- Huffman, L. C., Mehlinger, S. L., & Kerivan, A. S. (2000). Risk factors for academic and behavioral problems at the beginning of school. In *Off to a good start: Research on the risk factors for early school problems and selected federal policies affecting children's social and emotional development and their readiness for school*. Chapel Hill, N. C.: University of North Carolina, FPG Child Development Center.
- Jencks, C., & Phillips, M. (1998a). *The Black-White test score gap*: Brookings Institution.
- Jencks, C., & Phillips, M. (1998b). The black-white test score gap. *Education Week, 18*(4).
- Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: The Guilford Press.
- Ladd, G. W., Birch, S. H., & Buhs, E. S. (1999). Children's social and scholastic lives in kindergarten: Related spheres of influence? *Child Development, 70*(6), 1373-1400.
- Laucht, M., Esser, G. n., & Schmidt, M. H. (1997). Developmental outcome of infants born with biological and psychosocial risks. *Journal of Child Psychology and Psychiatry, 38*(7), 843-853.
- Luster, T., & McAdoo, H. P. (1994). Factors related to the achievement and adjustment of young African American children. *Child Development, 65*(4), 1080-1094.
- Magnuson, K. A., & Duncan, G. J. (2006). The role of family socioeconomic resources in the black-white test score gap among young children. *Developmental Review, 26*(4), 365-399.
- Martinez-Pons, M. (2002). Parental Influences on Children's Academic Self-Regulatory Development: Parental Influences on Children's Academic Self-Regulatory Development. *Theory Into Practice, 41*(2), 126.
- Masten, A. S. & Gewirtz, A. H. (2006). Vulnerability and resilience in early child development. In K. McCartney & D. Phillips (Eds.), *Blackwell handbook of*

early childhood development. (pp.22-43). Malden, MA: Blackwell Publishing.

Mather, N., & Woodcock, R. W. (2001). Examiner's manual. *Woodcock-Johnson III Tests of Achievement.* Itasca, IL: Riverside Publishing.

McClelland, M. M., Acock, A. C., & Morrison, F. J. (2006). The impact of kindergarten learning-related skills on academic trajectories at the end of elementary school. *Early Childhood Research Quarterly, 21*(4), 471-490.

McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology, 43*(4), 947-959.

McClelland, M. M., Cameron, C. E., Wanless, S. B., & Murray, A. (2007). *Executive function, self-regulation, and social-emotional competence: Links to school readiness.* In O. N. Saracho & B. Spodek (Eds.), *Contemporary Perspectives on Research in Social Learning in Early Childhood Education.*

McClelland, M. M., Kessenich, M., & Morrison, F. J. (2003). Pathways to early literacy: The complex interplay of child, family, and sociocultural factors. In *Advances in child development and behavior, Vol. 31.* (pp. 411-447): Academic Press.

McClelland, M. M., & Morrison, F. J. (2003). The Emergence of Learning-related Social Skills in Preschool Children *Early Childhood Research Quarterly, 18,* 206-224.

McClelland, M. M., Morrison, F. J., & Holmes, D. L. (2000). Children at risk for early academic problems: The role of learning-related social skills. *Early Childhood Research Quarterly, 15*(3), 307-329.

McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53*(2), 185-204.

Morrison, F. J., & Cooney, R. R. (2002). Parenting and academic achievement: Multiple paths to early literacy. In J. Borkowski, S. Ramey, & M. Bristol-Powers (Eds.), *Parenting and the child's world: Influences on academic, intellectual, and social-emotional development.* (pp. 141-160): Mahwah, NJ: Lawrence Erlbaum Associates.

- Morrison, F. J., Ponitz, C. C., & McClelland, M. M. (2007). *Self-regulation and academic achievement in the transition to school*. In M. Posner (Series Ed.) & S. Calkins & M. Bell (Vol. Eds.), *The Developing human brain: Development at the intersection of emotion and cognition*. Washington, D.C.: American Psychological Association. Manuscript in review.
- Muthén, B. O., & Muthén, L. K. (2006). Mplus (Version 4.2). Los Angeles: Muthén & Muthén.
- NICHD Early Child Care Research Network. (1997). Poverty and patterns of child care. In C. Duncan & J. Brooks-Gunn (Eds.), *Consequences of growing up poor* (pp. 100-131). New York: Russell Sage Foundation.
- NICHD Early Child Care Research Network. (1999). Chronicity of maternal depressive symptoms, maternal sensitivity, and child functioning at 36 months. *Developmental Psychology, 35*(5), 1297-1310.
- NICHD Early Child Care Research Network. (2000). The interaction of child care and family risk in relation to child development at 24 and 36 months. *Applied Developmental Science, 6*(3), 144-156.
- NICHD Early Child Care Research Network. (2001a). Non-maternal care and family factors in early development: An overview of the NICHD Study of Early Child Care. *Journal of Applied Developmental Psychology, 22*(5), 457-492.
- NICHD Early Child Care Research Network. (2001b). Before head start: Income and ethnicity, family characteristics, child care experiences, and child development. *Early Education and Development, 12*(4), 545-576.
- NICHD Early Child Care Research Network. (2003a). Social functioning in first grade: Associations with earlier home and child care predictors and with current classroom experiences. *Child Development, 74*(6), 1639-1662.
- NICHD Early Child Care Research Network. (2003b). Do children's attention processes mediate the link between family predictors and school readiness? *Developmental Psychology, 39*(3), 581-593.
- NICHD Early Child Care Research Network. (2004). Multiple Pathways to Early Academic Achievement. *Harvard Educational Review, 74*(1), 1-29.

- NICHD Early Child Care Research Network. (2005). Predicting Individual Differences in Attention, Memory, and Planning in First Graders From Experiences at Home, Child Care, and School. *Developmental Psychology*, *41*(1), 99-114.
- NICHD Early Child Care Research Network. (2007). Age of entry to kindergarten and children's academic achievement and socioemotional development. *Early Education and Development*, *18*(2), 337-368.
- Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385-401.
- Research Triangle Institute. (1998a). *Child care data report – 204: Income-to-needs ratios based on total family income*. North Carolina: Author.
- Research Triangle Institute. (1998b). *Child care data report – 204: Income-to-needs ratios based on total family income*. North Carolina: Author.
- Research Triangle Institute. (1999a). *Child care data report – 209: Child's social skill development, fifty-four month Social Skills Rating System*. North Carolina: Author.
- Research Triangle Institute. (1999b). *Child care data report – 243: Children's Behavior Questionnaire, fifty-four month mother/alternate caregiver questionnaire*. North Carolina: Author.
- Research Triangle Institute. (2000). *Child care data report – 294: Child's cognitive and achievement scales, first grade Woodcock-Johnson Psycho-Educational Battery – Revised*. North Carolina: Author.
- Rimm-Kaufman, S. E., Pianta, R. C., & Cox, M. J. (2000). Teachers' judgments of problems in the transition to kindergarten. *Early Education and Development*, *15*, 147-166.
- Rothbart, M. K., Ahadi, S. A., Hersey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. *Child Development*, *72*(5), 1394-1408.
- Rutter, M. (1979). Protective factors in children's responses to stress and disadvantage. In M. W. Kent & J. E. Rolf (Eds.), *Primary prevention of psychopathology: Vol. 3. Social competence in children* (pp. 49–74). Hanover, NH: University Press of New England.

- Sameroff, A. J., & Seifer, R. (1983). Familial risk and child competence. *Child Development, 54*(5), 1254-1268.
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy Press.
- Sroufe, L. A. (1996). *Emotional development: The organization of emotional life in the early years*: Cambridge University Press.
- Wachs, T. D. (2000). *Necessary but not sufficient: The respective roles of single and multiple influences on individual development*: American Psychological Association.
- Wanless, S. B., Sektnan, M., & McClelland, M. M. (2007). *Growth in behavioral self-regulation during the transition to kindergarten for English and Spanish-speaking children*. Poster presented at the biennial meeting of the Society for Research in Child Development, Boston, MA.
- Woodcock, R. W., & Johnson, M. B. (1989). *Woodcock-Johnson Psycho-Educational Battery – Revised*. Allen, TX: DLM.

APPENDIX

Appendix A Full Mplus Text Output

Mplus VERSION 4.2
MUTHEN & MUTHEN
06/13/2007 12:04 PM

INPUT INSTRUCTIONS

```

Title: Thesis TOGETHER - full maximum likelihood NO CLUSTER
      (WITHOUT SELF-CONTROL, CHRONDEP)
Stata2Mplus conversion for
  \\onid-fs\sektnanm\NICHD\thesis\thesisDATA\thesis_data.dta.dta
List of variables converted shown below

id : site/loc/subject id
site : location of data collection
meducm01 : mother's education
  12: 12. high school grad or GED
  14: 14. some college, but no degree, AA degree or vocational school
  16: 16. Bachelor's degree from college or university
  18: 18. Some grad work or a Master's degree
  19: 19. Law Degree (LL.b or J.D.)
  21: 21. Ph.D, Ed.D, M.D., more than one master's degree
cbqafm54 : cbq(mom/altcg)-attn focusing 54m:w/o pwt
cbqicm54 : cbq(mom/altcg)-inhib cntrl 54m:w/prop wt
cooper54 : ssrs cooperation mean score-mom/altcg 54m
assert54 : ssrs assertion mean score-mom/altcg 54m
respon54 : ssrs responsibility mean score-mom/altcg 54m
slfcon54 : ssrs selfcontrol mean score-mom/altcg 54m
vocab : wjr picture vacabulary w score,      g1
reading : wjr letter-word ident w score,      g1
math : wjr applied problems w score,      g1
csex_m01 : Child's gender: 0=male, 1=female
  0: 0. male
  1: 1. female
mdepl_54 : mean maternal depression 1-54mo
chrondep : Mat.Depress. Chronic over 6 timepoints
categdep : Mat.Depress. Never, Sometimes, Chronic
  0: 0. Never
  1: 1. Sometimes
  2: 2. Chronic
income : Log of mean income-to-needs 1-54mo
h_dummy : Hispanic race dummy, White as reference
b_dummy : Black race dummy, White as reference

Data:
  File is \\onidfs\sektnanm\NICHD\thesis\thesisDATA\thesis_data      .dta.dat
  ;
Variable:
  Names are
    id site meducm01 cbqafm54 cbqicm54 cooper54 assert54 respon54 slfcon54
    vocab reading math csex_m01 mdepl_54 chrondep categdep
    income h_dummy b_dummy;

```

```

USEVARIABLES are meducm01 cbqafm54 cbqicm54 cooper54 assert54 respon54
    chrondep income reading math vocab h_dummy b_dummy ;

Missing are all (-9999) ;
Analysis:
    TYPE = general missing h1 ;
Model:
! LATENT VARIABLES (SOCIAL EMOTIONAL COMPETENCY & SELF-REGULATION)
    social BY cooper54 assert54 respon54 ;
    selfreg BY cbqicm54 cbqafm54 ;
    social WITH selfreg ;

! DIRECT EFFECTS
    reading ON h_dummy b_dummy meducm01 income chrondep social selfreg ;
    math ON h_dummy b_dummy meducm01 income chrondep social selfreg ;
    vocab ON h_dummy b_dummy meducm01 income chrondep social selfreg ;
    social ON h_dummy b_dummy meducm01 income chrondep ;
    selfreg ON h_dummy b_dummy meducm01 income chrondep ;

!CORRELATE ERRORS
    h_dummy WITH b_dummy ;
    h_dummy WITH meducm01 ;
    h_dummy WITH income ;
    h_dummy WITH chrondep ;
    b_dummy WITH meducm01 ;
    b_dummy WITH income ;
    b_dummy WITH chrondep ;
    meducm01 WITH income ;
    meducm01 WITH chrondep ;
    income WITH chrondep ;

! INDIRECT EFFECTS
Model indirect:
    reading ind h_dummy ;
    reading ind b_dummy ;
    reading ind meducm01 ;
    reading ind income ;
    reading ind chrondep ;
    math ind h_dummy ;
    math ind b_dummy ;
    math ind meducm01 ;
    math ind income ;
    math ind chrondep ;
    vocab ind h_dummy ;
    vocab ind b_dummy ;
    vocab ind meducm01 ;
    vocab ind income ;
    vocab ind chrondep ;

Output:
    standardized sampstat ;

INPUT READING TERMINATED NORMALLY

Thesis TOGETHER - full maximum likelihood NO CLUSTER
(WITHOUT SELF-CONTROL, CHRONDEP)
Stata2Mplus conversion for

```

\\onid-fs\sektname\NICHD\thesis\thesisDATA\thesis_data.dta.dta
List of variables converted shown below

id : site/loc/subject id
site : location of data collection
meducm01 : mother's education
12: 12. high school grad or GED
14: 14. some college, but no degree, AA degree or vocational school
16: 16. Bachelor's degree from college or university
18: 18. Some grad work or a Master's degree
19: 19. Law Degree (LL.b or J.D.)
21: 21. Ph.D, Ed.D, M.D., more than one master's degree
cbqafm54 : cbq(mom/altcg)-attn focusing 54m:w/o pwt
cbqicm54 : cbq(mom/altcg)-inhib cntrl 54m:w/prop wt
cooper54 : ssrs cooperation mean score-mom/altcg 54m
assert54 : ssrs assertion mean score-mom/altcg 54m
respon54 : ssrs responsibility mean score-mom/altcg 54m
slfcon54 : ssrs selfcontrol mean score-mom/altcg 54m
vocab : wjr picture vocabulary w score, g1
reading : wjr letter-word ident w score, g1
math : wjr applied problems w score, g1
csex_m01 : Child's gender: 0=male, 1=female
0: 0. male
1: 1. female
mdepl_54 : mean maternal depression 1-54mo
chrondep : Mat.Depress. Chronic over 6 timepoints
categdep : Mat.Depress. Never, Sometimes, Chronic
0: 0. Never
1: 1. Sometimes
2: 2. Chronic
income : Log of mean income-to-needs 1-54mo
h_dummy : Hispanic race dummy, White as reference
b_dummy : Black race dummy, White as reference

SUMMARY OF ANALYSIS

Number of groups	1
Number of observations	1364
Number of dependent variables	8
Number of independent variables	5
Number of continuous latent variables	2

Observed dependent variables

Continuous					
CBQAFM54	CBQICM54	COOPER54	ASSERT54	RESPON54	READING
MATH	VOCAB				

Observed independent variables

MEDUCM01	CHRONDEP	INCOME	H_DUMMY	B_DUMMY
----------	----------	--------	---------	---------

Continuous latent variables

SOCIAL	SELFREG
--------	---------

Estimator	ML
Information matrix	OBSERVED

Maximum number of iterations 1000
 Convergence criterion 0.500D-04
 Maximum number of steepest descent iterations 20
 Maximum number of iterations for H1 2000
 Convergence criterion for H1 0.100D-03

Input data file(s)
 \\onid-fs\sektnam\NICHD\thesis\thesisDATA\thesis_data.dta.dat

Input data format FREE

SUMMARY OF DATA

Number of patterns 25

COVARIANCE COVERAGE OF DATA

Minimum covariance coverage value 0.100

PROPORTION OF DATA PRESENT

	Covariance Coverage				
	CBQAFM54	CBQICM54	COOPER54	ASSERT54	RESPON54
CBQAFM54	0.750				
CBQICM54	0.750	0.778			
COOPER54	0.743	0.771	0.773		
ASSERT54	0.743	0.771	0.773	0.773	
RESPON54	0.743	0.771	0.773	0.773	0.773
READING	0.696	0.723	0.718	0.718	0.718
MATH	0.695	0.721	0.717	0.717	0.717
VOCAB	0.694	0.719	0.715	0.715	0.715
MEDUCM01	0.750	0.778	0.773	0.773	0.773
CHRONDEP	0.750	0.778	0.773	0.773	0.773
INCOME	0.749	0.777	0.773	0.773	0.773
H_DUMMY	0.718	0.744	0.740	0.740	0.740
B_DUMMY	0.718	0.744	0.740	0.740	0.740

	Covariance Coverage				
	READING	MATH	VOCAB	MEDUCM01	CHRONDEP
READING	0.751				
MATH	0.750	0.750			
VOCAB	0.747	0.746	0.748		
MEDUCM01	0.751	0.750	0.748	0.999	
CHRONDEP	0.751	0.750	0.748	0.999	0.999
INCOME	0.751	0.749	0.747	0.993	0.993
H_DUMMY	0.717	0.716	0.714	0.951	0.951
B_DUMMY	0.717	0.716	0.714	0.951	0.951

	Covariance Coverage		
	INCOME	H_DUMMY	B_DUMMY
INCOME			
H_DUMMY			
B_DUMMY			

INCOME	0.993			
H_DUMMY	0.945	0.952		
B_DUMMY	0.945	0.952	0.952	

SAMPLE STATISTICS
ESTIMATED SAMPLE STATISTICS

Means		CBQAFM54	CBQICM54	COOPER54	ASSERT54	RESPON54
1		<u>4.679</u>	<u>4.644</u>	<u>1.216</u>	<u>1.429</u>	<u>1.050</u>
Means		READING	MATH	VOCAB	MEDUCM01	CHRONDEP
1		<u>451.726</u>	<u>469.335</u>	<u>483.338</u>	<u>14.234</u>	<u>1.217</u>
Means		INCOME	H_DUMMY	B_DUMMY		
1		<u>0.923</u>	<u>0.064</u>	<u>0.134</u>		
Covariances		CBQAFM54	CBQICM54	COOPER54	ASSERT54	RESPON54
CBQAFM54		<u>0.733</u>				
CBQICM54		0.358	<u>0.611</u>			
COOPER54		0.086	0.101	<u>0.084</u>		
ASSERT54		0.050	0.050	0.038	<u>0.089</u>	
RESPON54		0.066	0.076	0.046	0.046	<u>0.085</u>
READING		5.074	3.334	0.961	0.984	<u>1.054</u>
MATH		3.268	2.259	0.587	0.796	<u>0.779</u>
VOCAB		3.081	1.805	0.492	0.760	<u>0.740</u>
MEDUCM01		0.632	0.408	0.083	<u>0.107</u>	<u>0.145</u>
CHRONDEP		-0.297	-0.359	-0.109	-0.117	<u>-0.100</u>
INCOME		0.193	0.149	0.036	0.051	<u>0.059</u>
H_DUMMY		-0.008	-0.006	-0.004	-0.006	<u>-0.004</u>
B_DUMMY		-0.054	-0.024	-0.009	-0.016	<u>-0.007</u>
Covariances		READING	MATH	VOCAB	MEDUCM01	CHRONDEP
READING		<u>582.756</u>				
MATH		221.238	<u>246.657</u>			
VOCAB		118.338	96.744	<u>153.830</u>		
MEDUCM01		18.513	14.590	12.978	<u>6.307</u>	
CHRONDEP		-7.274	-4.950	-3.908	-1.203	<u>2.905</u>
INCOME		6.414	5.025	4.349	1.252	<u>-0.515</u>
H_DUMMY		-0.312	-0.347	-0.172	-0.076	<u>0.014</u>
B_DUMMY		-1.705	-1.624	-1.384	-0.178	<u>0.111</u>

	Covariances		
	INCOME	H_DUMMY	B_DUMMY
INCOME	0.679		
H_DUMMY	-0.020	0.060	
B_DUMMY	-0.111	-0.008	0.116

	Correlations				
	CBQAFM54	CBQICM54	COOPER54	ASSERT54	RESPON54
CBQAFM54	1.000				
CBQICM54	0.534	1.000			
COOPER54	0.347	0.449	1.000		
ASSERT54	0.194	0.214	0.445	1.000	
RESPON54	0.264	0.335	0.546	0.524	1.000
READING	0.246	0.177	0.138	0.137	0.150
MATH	0.243	0.184	0.129	0.170	0.170
VOCAB	0.290	0.186	0.137	0.206	0.205
MEDUCM01	0.294	0.208	0.114	0.143	0.199
CHRONDEP	-0.204	-0.270	-0.220	-0.230	-0.200
INCOME	0.274	0.231	0.150	0.208	0.244
H_DUMMY	-0.039	-0.030	-0.059	-0.078	-0.055
B_DUMMY	-0.186	-0.089	-0.089	-0.157	-0.075

	Correlations				
	READING	MATH	VOCAB	MEDUCM01	CHRONDEP
READING	1.000				
MATH	0.584	1.000			
VOCAB	0.395	0.497	1.000		
MEDUCM01	0.305	0.370	0.417	1.000	
CHRONDEP	-0.177	-0.185	-0.185	-0.281	1.000
INCOME	0.322	0.388	0.425	0.605	-0.367
H_DUMMY	-0.053	-0.090	-0.057	-0.124	0.033
B_DUMMY	-0.207	-0.304	-0.328	-0.209	0.191

	Correlations		
	INCOME	H_DUMMY	B_DUMMY
INCOME	1.000		
H_DUMMY	-0.097	1.000	
B_DUMMY	-0.396	-0.102	1.000

MAXIMUM LOG-LIKELIHOOD VALUE FOR THE UNRESTRICTED (H1) MODEL IS -
22145.914

THE MODEL ESTIMATION TERMINATED NORMALLY

TESTS OF MODEL FIT

Chi-Square Test of Model Fit

Value	150.688
Degrees of Freedom	28
P-Value	0.0000

Chi-Square Test of Model Fit for the Baseline Model

Value	2720.488
Degrees of Freedom	68
P-Value	0.0000

CFI/TLI

CFI	0.954
TLI	0.888

Loglikelihood

H0 Value	-22221.258
H1 Value	-22145.914

Information Criteria

Number of Free Parameters	76
Akaike (AIC)	44594.517
Bayesian (BIC)	44991.098
Sample-Size Adjusted BIC	44749.677
($n^* = (n + 2) / 24$)	

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.057	
90 Percent C.I.	0.048	0.066
Probability RMSEA \leq .05	0.101	

SRMR (Standardized Root Mean Square Residual)

Value	0.028
-------	-------

MODEL RESULTS

	Estimates	S.E.	Est./S.E.	Std	StdYX
SOCIAL BY					
COOPER54	1.000	0.000	0.000	0.213	0.735
ASSERT54	0.892	0.056	15.863	0.190	0.637
RESPON54	1.043	0.061	17.123	0.222	0.761
SELFREG BY					
CBQICM54	1.000	0.000	0.000	0.587	0.751
CBQAFM54	1.039	0.078	13.318	0.609	0.712

SOCIAL ON					
H_DUMMY	-0.052	0.031	-1.647	-0.244	-0.060
B_DUMMY	-0.018	0.025	-0.703	-0.083	-0.028
MEDUCM01	0.004	0.004	1.091	0.019	0.047
INCOME	0.040	0.013	3.114	0.187	0.154
CHRONDEP	-0.028	0.005	-5.466	-0.129	-0.221
SELFREG ON					
H_DUMMY	-0.027	0.089	-0.302	-0.046	-0.011
B_DUMMY	-0.082	0.072	-1.138	-0.139	-0.047
MEDUCM01	0.043	0.010	4.172	0.073	0.184
INCOME	0.091	0.036	2.503	0.156	0.128
CHRONDEP	-0.076	0.015	-5.148	-0.129	-0.220
READING ON					
SOCIAL	1.972	5.624	0.351	0.419	0.017
SELFREG	6.428	2.259	2.846	3.772	0.156
MATH ON					
SOCIAL	2.578	3.480	0.741	0.548	0.035
SELFREG	3.164	1.377	2.299	1.857	0.118
VOCAB ON					
SOCIAL	3.914	2.679	1.461	0.833	0.067
SELFREG	2.533	1.077	2.352	1.487	0.120
READING ON					
H_DUMMY	-2.255	3.048	-0.740	-2.255	-0.023
B_DUMMY	-6.823	2.436	-2.801	-6.823	-0.096
MEDUCM01	1.372	0.370	3.707	1.372	0.143
INCOME	3.893	1.283	3.033	3.893	0.133
CHRONDEP	-0.181	0.499	-0.362	-0.181	-0.013
MATH ON					
H_DUMMY	-4.109	1.907	-2.155	-4.109	-0.064
B_DUMMY	-8.746	1.514	-5.778	-8.746	-0.190
MEDUCM01	1.192	0.230	5.191	1.192	0.191
INCOME	2.760	0.798	3.460	2.760	0.145
CHRONDEP	0.081	0.310	0.261	0.081	0.009
VOCAB ON					
H_DUMMY	-1.102	1.435	-0.768	-1.102	-0.022
B_DUMMY	-7.097	1.154	-6.152	-7.097	-0.195
MEDUCM01	1.159	0.176	6.567	1.159	0.235
INCOME	2.368	0.611	3.873	2.368	0.157
CHRONDEP	0.254	0.238	1.066	0.254	0.035
SOCIAL WITH					
SELFREG	0.056	0.006	8.843	0.449	0.449
H_DUMMY WITH					
B_DUMMY	-0.008	0.002	-3.622	-0.008	-0.101
MEDUCM01	-0.077	0.017	-4.456	-0.077	-0.125
INCOME	-0.020	0.006	-3.440	-0.020	-0.097
CHRONDEP	0.014	0.012	1.162	0.014	0.033

B_DUMMY WITH					
MEDUCM01	-0.180	0.024	-7.426	-0.180	-0.210
INCOME	-0.111	0.008	-13.248	-0.111	-0.397
CHRONDEP	0.111	0.016	6.729	0.111	0.191
MEDUCM01 WITH					
INCOME	1.251	0.066	19.094	1.251	0.605
CHRONDEP	-1.203	0.120	-9.991	-1.203	-0.281
INCOME WITH					
CHRONDEP	-0.515	0.041	-12.621	-0.515	-0.367
MATH WITH					
READING	150.565	10.822	13.913	150.565	0.397
VOCAB WITH					
READING	57.052	7.711	7.399	57.052	0.190
MATH	47.787	4.898	9.756	47.787	0.245
Means					
MEDUCM01	14.234	0.068	209.278	14.234	5.668
CHRONDEP	1.217	0.046	26.353	1.217	0.714
INCOME	0.923	0.022	41.279	0.923	1.120
H_DUMMY	0.064	0.007	9.442	0.064	0.262
B_DUMMY	0.133	0.009	14.147	0.133	0.391
Intercepts					
CBQAFM54	4.070	0.155	26.289	4.070	4.757
CBQICM54	4.050	0.140	29.017	4.050	5.185
COOPER54	1.161	0.049	23.539	1.161	4.011
ASSERT54	1.382	0.044	31.175	1.382	4.641
RESPON54	0.994	0.052	19.250	0.994	3.411
READING	425.975	4.876	87.358	425.975	17.643
MATH	449.145	3.027	148.361	449.145	28.595
VOCAB	463.658	2.334	198.661	463.658	37.370
Variances					
MEDUCM01	6.307	0.242	26.111	6.307	1.000
CHRONDEP	2.905	0.111	26.097	2.905	1.000
INCOME	0.679	0.026	26.070	0.679	1.000
H_DUMMY	0.060	0.002	25.473	0.060	1.000
B_DUMMY	0.116	0.005	25.384	0.116	1.000
Residual Variances					
CBQAFM54	0.361	0.029	12.287	0.361	0.493
CBQICM54	0.266	0.026	10.335	0.266	0.436
COOPER54	0.039	0.003	13.810	0.039	0.460
ASSERT54	0.053	0.003	18.152	0.053	0.594
RESPON54	0.036	0.003	12.859	0.036	0.420
READING	491.130	22.049	22.274	491.130	0.842
MATH	189.917	8.504	22.333	189.917	0.770
VOCAB	111.093	4.993	22.251	111.093	0.722
SOCIAL	0.039	0.004	11.177	0.872	0.872
SELFREG	0.280	0.029	9.543	0.814	0.814

R-SQUARE

Observed Variable	R-Square
CBQAFM54	0.507
CBQICM54	0.564
COOPER54	0.540
ASSERT54	0.406
RESPON54	0.580
READING	0.158
MATH	0.230
VOCAB	0.278

Latent Variable	R-Square
SOCIAL	0.128
SELFREG	0.186

QUALITY OF NUMERICAL RESULTS

Condition Number for the Information Matrix (ratio of smallest to largest eigenvalue)	0.534E-08
------------------------------------------------------------------------------------------	-----------

TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT EFFECTS

	Estimates	S.E.	Est./S.E.	Std	StdYX
Effects from H_DUMMY to READING					
Total	-2.531	3.050	-0.830	-2.531	-0.026
Total indirect	-0.276	0.652	-0.423	-0.276	-0.003
Specific indirect					
READING					
SOCIAL					
H_DUMMY	-0.102	0.298	-0.343	-0.102	-0.001
READING					
SELFREG					
H_DUMMY	-0.174	0.578	-0.301	-0.174	-0.002
Direct					
READING					
H_DUMMY	-2.255	3.048	-0.740	-2.255	-0.023
Effects from B_DUMMY to READING					
Total	-7.382	2.439	-3.027	-7.382	-0.104
Total indirect	-0.559	0.505	-1.108	-0.559	-0.008
Specific indirect					
READING					
SOCIAL					
B_DUMMY	-0.035	0.111	-0.315	-0.035	0.000

READING					
SELFREG					
B_DUMMY	-0.524	0.502	-1.045	-0.524	-0.007
Direct					
READING					
B_DUMMY	-6.823	2.436	-2.801	-6.823	-0.096
Effects from MEDUCM01 to READING					
Total	1.656	0.362	4.574	1.656	0.172
Total indirect	0.284	0.110	2.580	0.284	0.030
Specific indirect					
READING					
SOCIAL					
MEDUCM01	0.008	0.023	0.333	0.008	0.001
READING					
SELFREG					
MEDUCM01	0.276	0.119	2.326	0.276	0.029
Direct					
READING					
MEDUCM01	1.372	0.370	3.707	1.372	0.143
Effects from INCOME to READING					
Total	4.558	1.277	3.571	4.558	0.156
Total indirect	0.665	0.300	2.221	0.665	0.023
Specific indirect					
READING					
SOCIAL					
INCOME	0.078	0.225	0.349	0.078	0.003
READING					
SELFREG					
INCOME	0.587	0.309	1.902	0.587	0.020
Direct					
READING					
INCOME	3.893	1.283	3.033	3.893	0.133
Effects from CHRONDEP to READING					
Total	-0.721	0.485	-1.487	-0.721	-0.051
Total indirect	-0.541	0.161	-3.364	-0.541	-0.038
Specific indirect					
READING					
SOCIAL					
CHRONDEP	-0.054	0.155	-0.350	-0.054	-0.004

READING					
SELFREG					
CHRONDEP	-0.486	0.188	-2.584	-0.486	-0.034
Direct					
READING					
CHRONDEP	-0.181	0.499	-0.362	-0.181	-0.013
Effects from H_DUMMY to MATH					
Total	-4.328	1.909	-2.267	-4.328	-0.067
Total indirect	-0.219	0.358	-0.613	-0.219	-0.003
Specific indirect					
MATH					
SOCIAL					
H_DUMMY	-0.134	0.197	-0.677	-0.134	-0.002
MATH					
SELFREG					
H_DUMMY	-0.086	0.285	-0.300	-0.086	-0.001
Direct					
MATH					
H_DUMMY	-4.109	1.907	-2.155	-4.109	-0.064
Effects from B_DUMMY to MATH					
Total	-9.050	1.517	-5.966	-9.050	-0.196
Total indirect	-0.304	0.273	-1.115	-0.304	-0.007
Specific indirect					
MATH					
SOCIAL					
B_DUMMY	-0.046	0.090	-0.509	-0.046	-0.001
MATH					
SELFREG					
B_DUMMY	-0.258	0.256	-1.010	-0.258	-0.006
Direct					
MATH					
B_DUMMY	-8.746	1.514	-5.778	-8.746	-0.190
Effects from MEDUCM01 to MATH					
Total	1.338	0.225	5.952	1.338	0.214
Total indirect	0.146	0.064	2.297	0.146	0.023
Specific indirect					
MATH					
SOCIAL					
MEDUCM01	0.010	0.017	0.611	0.010	0.002
MATH					
SELFREG					
MEDUCM01	0.136	0.068	1.998	0.136	0.022

Direct						
MATH						
MEDUCM01	1.192	0.230	5.191	1.192	0.191	
Effects from INCOME to MATH						
Total	3.152	0.794	3.972	3.152	0.165	
Total indirect	0.391	0.169	2.313	0.391	0.021	
Specific indirect						
MATH						
SOCIAL						
INCOME	0.103	0.142	0.721	0.103	0.005	
MATH						
SELFREG						
INCOME	0.289	0.169	1.710	0.289	0.015	
Direct						
MATH						
INCOME	2.760	0.798	3.460	2.760	0.145	
Effects from CHRONDEP to MATH						
Total	-0.229	0.301	-0.762	-0.229	-0.025	
Total indirect	-0.310	0.095	-3.258	-0.310	-0.034	
Specific indirect						
MATH						
SOCIAL						
CHRONDEP	-0.071	0.096	-0.736	-0.071	-0.008	
MATH						
SELFREG						
CHRONDEP	-0.239	0.111	-2.149	-0.239	-0.026	
Direct						
MATH						
CHRONDEP	0.081	0.310	0.261	0.081	0.009	
Effects from H_DUMMY to VOCAB						
Total	-1.373	1.444	-0.951	-1.373	-0.027	
Total indirect	-0.271	0.318	-0.854	-0.271	-0.005	
Specific indirect						
VOCAB						
SOCIAL						
H_DUMMY	-0.203	0.185	-1.094	-0.203	-0.004	
VOCAB						
SELFREG						
H_DUMMY	-0.069	0.229	-0.300	-0.069	-0.001	
Direct						
VOCAB						
H_DUMMY	-1.102	1.435	-0.768	-1.102	-0.022	

Effects from B_DUMMY to VOCAB					
Total	-7.373	1.161	-6.351	-7.373	-0.203
Total indirect	-0.276	0.246	-1.122	-0.276	-0.008
Specific indirect					
VOCAB					
SOCIAL					
B_DUMMY	-0.069	0.109	-0.634	-0.069	-0.002
VOCAB					
SELFREG					
B_DUMMY	-0.207	0.205	-1.010	-0.207	-0.006
Direct					
VOCAB					
B_DUMMY	-7.097	1.154	-6.152	-7.097	-0.195
Effects from MEDUCM01 to VOCAB					
Total	1.283	0.173	7.408	1.283	0.260
Total indirect	0.124	0.053	2.346	0.124	0.025
Specific indirect					
VOCAB					
SOCIAL					
MEDUCM01	0.016	0.018	0.872	0.016	0.003
VOCAB					
SELFREG					
MEDUCM01	0.109	0.054	2.030	0.109	0.022
Direct					
VOCAB					
MEDUCM01	1.159	0.176	6.567	1.159	0.235
Effects from INCOME to VOCAB					
Total	2.755	0.610	4.517	2.755	0.183
Total indirect	0.387	0.146	2.657	0.387	0.026
Specific indirect					
VOCAB					
SOCIAL					
INCOME	0.156	0.117	1.326	0.156	0.010
VOCAB					
SELFREG					
INCOME	0.231	0.133	1.739	0.231	0.015
Direct					
VOCAB					
INCOME	2.368	0.611	3.873	2.368	0.157

Effects from CHRONDEP to VOCAB					
Total	-0.045	0.232	-0.196	-0.045	-0.006
Total indirect	-0.299	0.077	-3.878	-0.299	-0.041
Specific indirect					
VOCAB					
SOCIAL					
CHRONDEP	-0.108	0.076	-1.422	-0.108	-0.015
VOCAB					
SELFREG					
CHRONDEP	-0.192	0.086	-2.220	-0.192	-0.026
Direct					
VOCAB					
CHRONDEP	0.254	0.238	1.066	0.254	0.035

Beginning Time: 12:04:32
Ending Time: 12:04:35
Elapsed Time: 00:00:03

MUTHEN & MUTHEN
3463 Stoner Ave.
Los Angeles, CA 90066

Tel: (310) 391-9971
Fax: (310) 391-8971
Web: www.StatModel.com
Support: Support@StatModel.com

Copyright (c) 1998-2006 Muthen & Muthen

Appendix B
Items Used to Measure Children's Social Competency at 54-Months

Taken from the Social Skills Rating System (Gresham & Elliott, 1990):

All items were scored:

0 – Never

1 – Sometimes

2 – Very Often

Items for Assertion:

1. The child will participate in organized group activities.
2. The child will introduce herself or himself to new people without being told.
3. The child will start conversations rather than wait for others to talk first.
4. The child will appropriately express feelings when wronged.
5. The child will show interest in a variety of things.
6. The child will make friends easily
7. The child will receive criticism well.
8. The child will be self-confident in social situations such as parties or group outings.
9. The child will join group activities without being told.
10. The child will be liked by others.

Items for Cooperation:

1. The child will help with household tasks without being asked.
2. The child will attempt household tasks before asking for parental help.
3. The child will use free time at home in an acceptable way.
4. The child will volunteer to help family members with tasks.
5. The child will keep her or his room clean and neat without being reminded.
6. The child will complete household tasks within a reasonable amount of time.
7. The child will put away toys or other household property.
8. The child will congratulate family members on accomplishments.
9. The child will follow household rules.
10. The child will communicate problems to parents.

Items for Responsibility:

1. The child will appropriately question household rules that are unfair.
2. The child will give compliments to friends or other children in the family.
3. The child will politely refuse unreasonable requests from others.
4. The child will ask permission before using another family member's property.
5. The child will invite others to her or his parents' home.
6. The child will answer the phone appropriately.
7. The child will compromise in conflict by changing his or her own ideas to reach agreement.

8. The child will congratulate family members on accomplishments.
9. The child will attend to speakers at meeting such as church or youth groups.
10. The child will ask sales clerks for information or assistance.

Appendix C
Items Used to Measure Children's Behavior Regulation at 54-Months

Taken from the Children's Behavior Questionnaire (Rothbart, Ahadi, Hershey, & Fisher, 2001):

All items were scored:

- 1 – Extremely untrue of your 4½ year-old
- 2 – Quite untrue of your 4½ year-old
- 3 – Slightly untrue of your 4½ year-old
- 4 – Neither true nor false of your 4½ year-old
- 5 – Slightly true of your 4½ year-old
- 6 – Quite true of your 4½ year-old
- 7 – Extremely true of your 4½ year-old

Items used for Inhibitory Control:

- 1. Can lower his/her voice when asked to do so.
- 2. Has a hard time following directions. (reversed)
- 3. Can wait before entering into new activities if she/he is asked to.
- 4. Has difficulty waiting in line for something (reversed)
- 5. Has trouble sitting still when s/he is told to (at movies, church, etc.). (reversed)
- 6. Is able to resist laughing or smiling when it isn't appropriate.
- 7. Is good at following instructions.
- 8. Approaches places s/he has been told are dangerous slowly and cautiously.

9. Can easily stop an activity when s/he is told “no”.
10. Is usually able to resist temptation when told s/he is not supposed to do something.

Items used for Attentional Focusing:

1. When practicing an activity, has a hard time keeping his/her mind on it.
(reversed)
2. Will move from one task to another without completing any of them. (reversed)
3. When drawing or coloring in a book, shows strong concentration.
4. When building or putting something together, becomes very involved in what s/he is doing, and works for long periods.
5. Has difficulty leaving a project s/he has begun.
6. Is easily distracted when listening to a story. (reversed)
7. Sometimes becomes absorbed in a picture book and looks at it for a long time.
8. Has a hard time concentrating on an activity when there are distracting noises.
(reversed)