EARLY RISK, EMERGENT SKILLS, AND FIRST TO THIRD GRADE
ACHIEVEMENT: AN OPPORTUNITY-PROPENSITY ANALYSIS

A Dissertation
Submitted to
The Temple University Graduate Board

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in Partial Fulfillment
of the Requirements for the Degree
DOCTOR OF PHILOSOPHY

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by
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May, 2011

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ABSTRACT

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by Julia Alexander

Doctor of Philosophy

Doctoral Advisory Committee Chair: James Byrnes, Ph.D.

The purpose of this study is to examine the role of center-based care and children's school readiness in predicting their first and third grade reading and mathematics achievement.   Predictions derived from an opportunity-propensity theoretical framework applied to data from the Early Childhood Longitudinal Study-Kindergarten Class of 1998-99. The study examined the impact of antecedent factors (e.g., socioeconomic status, parental expectations), opportunities to learn (e.g., center-based care), and children's propensities to learn (emergent reading and mathematics skills, approaches to learning) on first and third grade reading and mathematics assessment scores, and whether center-based care moderates the impact of multiple health and environmental risks for vulnerable children.

ACKNOWLEDGEMENTS

DEDICATION

This dissertation is dedicated to children and families at risk.

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CHAPTER 1

INTRODUCTION

Research performed over the past two decades consistently links young children's exposure to multiple sociodemographic and biomedical risk factors and poor school outcomes. Poverty, single parent households, birth risks, low parental educational achievement and exposure to harsh discipline are among the many child and family-level factors associated with early school failure (Gershoff, 2000; Hill, Yeung, & Duncan, 2001; Minde, 2000; Oxford & Spieker, 2006; U.S. Department of Education, National Center for Education Statistics (NCES), 2004). These factors are also associated with developmental delays among infants, toddlers and young children (Aber, Jones & Cohen, 2000), increased risk of internalizing and externalizing problems (Bolger & Patterson, 2001; Cicchetti & Toth, 1995), language acquisition and cognitive delays (Amster, 1999; Jaudes & Shapiro, 1999), and difficulties adapting to the socioemotional and academic demands of formal classroom instruction (Anderson et al., 2003; Rogosch, Cicchetti, & Aber, 1995).

Children from some ethnic minority groups and children whose home language is not English are particularly vulnerable to poor academic outcomes (Barton & Coley; 2009; National Assessment of Educational Progress (NAEP), 2007). A closer look reveals that struggling students are often disproportionately exposed to risks associated with poor early adjustment to school and persistently low academic achievement (Duncan, Brookes-Gunn, & Klebanov, 1994; Kozol, 2005; NCES, 2006). These achievement gaps may appear early. An analysis of the Early Childhood Longitudinal Study-Kindergarten (ECLS-K, National Center for Educational Statistics (NCES), 2001) Class of 1998-99 found that children living in poverty and who were African-American performed poorer on kindergarten reading

assessments, and that the performance disparity significantly increased by the end of first grade (Chatterji, 2006). For this reason, it is imperative for education administrators and researchers to understand the complex of risk factors that attend early academic problems, the impact of these risks on young children's readiness for formal classroom instruction, and learning opportunities that most effectively promote early school success.

In response to increasing concern that not all students were succeeding in school, legislative support increased focus nationally on early childhood education and school readiness. *Goals 2000: Educate America Act* (P.L. 103-227) was signed into law in 1994 and explicitly relates wellbeing during infancy and the toddler years with readiness to learn. The first National Education Goal was aimed at ensuring children arrive at school with the prerequisite skills and knowledge necessary to succeed in the classroom, and encompasses improved health, immunizations, family literacy activities and increased participation in early care and education. This legislation and appropriation launched a number of efforts nationally to improve the quality of early childhood education programs and promote participation by preschool-age children (La Paro & Pianta, 2000). A 1999 progress report on implementation cited statistically significant levels of improvement nationally with fewer children born with one or more health risks (no or minimal prenatal care, low maternal weight gain, smoking during pregnancy and prenatal exposure to alcohol), higher rates of immunizations by age two years, increased numbers of families reading to their young children, and higher preschool participation by low income children (National Education Goals Report, 1999).

Additional legislative support is driven by the *No Child Left Behind Act of 2000* (NCLB, P.L. 107-110). NCLB has as its chief goal elimination of achievement

disparities among children of different ethnic and socioeconomic backgrounds by third grade. Other mandates include increased accountability of school administrators and teachers for children's outcomes, school choice, and a strong emphasis on reading proficiency. Although controversial among educators for system and school-level sanctions for students' failure to meet proficiency goals, strengths of the law include appropriation for evidence-supported early literacy early care and education programs to help children gain the preacademic skills necessary for school success. Children who arrive at grade one with high levels of emergent literacy skills are less likely to have reading problems (Snow, Burns, & Griffin, 1998), and are more likely to derive early benefit from formal reading instruction, to read earlier and demonstrate greater knowledge growth in many subjects from increased exposure to information through reading (Anthony, Lonigan, Burgess, Driscoll, Phillips, & Cantor, 2002). Both NCLB and Goals 2000 were driven by recognition on the part of legislators, educators and policy makers of the relationships between early school success and later achievement, and the role of preschool experience in children's development and readiness to learn at school age.

School readiness consists of the preacademic cognitive skills and socioemotional characteristics of children assessed prior to beginning first grade (La Paro & Pianta, 2000). *Emergent literacy and numeracy,* defined as the precursor skills and behaviors that precede acquisition of formal reading and mathematics, are critically important to children's early achievement and later school success. Emergent literacy is facilitated in linguistically-rich environments that offer generous scaffolding of language and meaning by adults and other more skilled individuals. While the relationship of early environment, children's language

development and reading outcomes is well established in the literature (Hart & Risley, 1995; Murray, Fees, Crowe, Murphy, & Henriksen, 2006), far fewer studies map the trajectories from early environment to emergent numeracy and mathematics achievement. Nevertheless, emerging quantitative competencies are understood to be facilitated by caregivers' use and explanation of numeric procedures and concepts in young children's daily lives (Charlesworth, 2005).

Many studies examining emergent reading and mathematics place relatively greater emphasis on the relationship of environmental factors, such as family socioeconomic status, and children's early school success (Barton, 2003; Duncan & Brooks-Gunn, 2000). Research has identified consistently strong relationships among children's exposure to environmental risks (e.g., poverty, low maternal education, etc.), low levels of precursor skill development and later reading and mathematics problems (Brooks-Gunn & Markman, 2005; Magnuson & McGroder, 2002; Meisels, 1998). Many of these studies highlight not only the harmful effects of poverty on development but the additional disadvantage imposed by inadequately resourced schools (Klebanov, Brooks-Gunn, McCanton, & McCormick, 1998; Kowaleski-Jones, Dunifon, & Ream, 1998). Another line of investigation examines the contributions of individuals' characteristics such as self-regulation, intelligence, and motivation to children's school success. These studies typically examine the relationship of academic skills assessed at one point in time and later academic achievement, the relationship of specific cognitive abilities and general intelligence to achievement, and the impact of socioemotional characteristics on children's adjustment to school (Duncan, Claessens et al., 2007; Luster, Lekskul, & Oh, 2004; Sternberg, Grigorenko, & Bundy, 2001; Taub, Floyd, Keith, & McGrew, 2008). Other approaches to studying factors related to children's reading and

mathematics achievement examine both environmental influences and the impact of children's cognitive and socioemotional characteristics. The ecological/transaction view (Bronfenbrenner, 1979; Cicchetti & Lynch, 1993; Sameroff & Chandler, 1975) holds that environment and child-level characteristics operate in a mutually interactive way to influence development including school readiness, and are essential for a full picture of how children develop competencies in varied environments (McWayne, Fantuzzo & McDermott, 2004). Meisels (1998) argues in favor of a bidirectional interactionist view of school readiness, a particular application of the ecological model to education. According to this view, readiness is not an attribute of either children or contexts but an effect of the continuous interaction of children's characteristics and experiences provided by family, community and educational contexts. From this perspective, it becomes equally important to examine not only the impact of children's experiences during the preschool period on development, but the role of home and classroom environments once children reach school, and the interaction of children's characteristics with these contexts (Sameroff, 2000; Sameroff & MacKenzie, 2003).

The present study drew from multiple levels of the ecological/transactional model to conduct an *opportunity-propensity analysis* (Byrnes & Miller, 2007) of factors related to children's school readiness and early reading and mathematics achievement. The opportunity-propensity (O-P) framework predicts that children will have higher achievement when they have genuine opportunities to acquire and practice skills in a subject area, and have the propensities (skills, motivation and self-regulation) necessary to take advantage of learning opportunities. The contributions of antecedent factors occurring before children's entry to formal learning contexts (socioeconomic status, parental expectations of children's

educational outcomes, ethnicity, home language, gender); early care and education learning opportunities (center-based care); and, child-level characteristics (approaches to learning, attention, emergent reading and mathematics skills) were analyzed using hierarchical regression. The study examined the effects of center care attendance on children's emergent reading and mathematics skills assessed at the beginning of kindergarten to clarify for whom and under what conditions early care and education may be associated with higher levels of skill at the start of kindergarten and higher reading and math achievement at the end of first and third grade. This study goes further than previous opportunity-propensity analyses by including additional child and family-level characteristics (gestational age at birth, maternal age, parenting behavior such as discipline and cognitive stimulation) to test new links between antecedent and propensity factors, children's readiness to learn at school age, and early achievement.

The educational research literature confirms a strong relationship between children's school readiness (emergent reading and math skills, self regulation, etc.) and later reading and mathematics achievement. For example, Byrnes (2001) reviewed several studies examining the relationships among global school readiness measures and grade one reading scores, and found correlations ranging from .34 and .76, with an average correlation of .62. Similarly, the relationship between measures of reading readiness and reading scores at the end of grade one was found to be .56 averaged across 21 studies (Snow, Burns & Griffin, 1998). Given the positive relationships among global school readiness indicators, reading readiness and later school success, the literature on school readiness was reviewed in more detail in the following chapter.

CHAPTER 2

REVIEW OF THE LITERATURE

As noted in Chapter 1, a central goal of the proposed study is to consider which factors predict children's achievement in the first few years of school. It is well known that children in some groups, such as those living in poverty or who are exposed to other risk conditions, are more vulnerable to poor school outcomes such as failure to achieve proficient-levels in reading and mathematics. For this reason, it is critical for educational researchers to investigate factors that are likely to influence children's achievement. One of the most important of these is school readiness. The following review will discuss how school readiness has been defined in the scholarly literature, identify school readiness component skills (cognitive, socioemotional), and the relationships between young children's component skills and early school success. Two theoretical models (ecological/transactional, opportunity-propensity) that highlight the role of both environment and child-level factors in children's development will be discussed in detail, followed by the study variables and rationale for their inclusion. Lastly, a detailed examination of the experimental and observational research on center-based care will conclude with a summary of the literature and research questions.

What is School Readiness?

School readiness encompasses a broad range of characteristics. The view promulgated by the National Educational Goals Panel (1998) encompasses health, socioemotional development (i.e., self-regulation), language acquisition and communication skills, cognitive development and skills, and approaches to learning. A meta-analysis performed by La Paro and Pianta (2000) reviewed 70 longitudinal studies examining the

relationships between measures of school readiness taken during the preschool period and kindergarten, and later school achievement. The effect size for cognitive predictor scores obtained in kindergarten and outcome scores obtained in first and second grade was moderate (.51), although La Paro and Pianta note that nearly half of the variance in achievement is explained by factors other than what is tapped by cognitive domain assessments. Other studies of school readiness place relatively more emphasis on contextual (e.g., socioeconomic status, maternal education, single parent family, etc.) rather than child-level cognitive characteristics (Brooks-Gunn & Markman, 2005; Gershoff, 2003; Magnuson & Mc Groder, 2002; Meisels, 1998).   Contextual factors such as poverty status and maternal education have consistently strong relationships with children's readiness to learn and academic achievement (Shonkoff & Phillips, 2000). A developmental perspective maintains that child-level characteristics and the contexts in which children develop jointly influence children's outcomes and is essential for a full picture of children's emerging competencies in diverse environments (McWayne, Fantuzzo & Mc Dermott, 2004). Research examining both child-level characteristics and contextual factors associated with school readiness, as well as their interactions, will be reviewed in this chapter.

School Readiness and Emergent Literacy

School readiness is a multifaceted construct that is comprised of component skills. One key component of school readiness is emergent literacy. Emergent literacy is in turn composed of components such as knowledge of letters, vocabulary (facilitates mapping of phonological codes onto the meanings of known words), syntax, narrative structure, decontextualized language skills (understanding that words may be used to reference objects and events not immediately observable), metalinguistic awareness (the capacity to reflect on and manipulate language), phoneme-grapheme correspondence, emergent reading (pretending to read and recognizing labels and signs suggesting an understanding of functions of print), emergent writing (pretending to write and practice writing letters), and print motivation (Whitehurst & Lonigan, 1998).

Among the several dimensions comprising emergent literacy, differences between children in phonological awareness have been found to be causally related to the rate at which reading skills are acquired (Anthony et al., 2002). Phonological awareness is children's understanding that oral language contains many levels of individual phonological elements ranging from words, syllables, onsets and rimes, and finally, phonemes. Children's appreciation for rhyme and alliteration in nursery rhymes and Dr. Seuss stories read aloud, for example, appear to be early signs of phonological awareness. Assessments of phonological awareness are reported to be strong predictors of children's reading ability (Hulme et al., 2002). Juel (1988) found that children who entered first grade with poor phonological processing abilities were very likely to be poor readers by the end of grade one with a high likelihood of remaining poor readers through grade four.

A beginning reader must have an adequate and age-appropriate fund of knowledge and receptive language capacity for good comprehension of both oral and written communication. Children must understand sound-symbol relationships, quickly decode letters and words, map orthographic representations onto word meanings and make use of syntax to understand the relationships among words and larger components of texts (Konold, Juel, McKinnon & Deffes, 2003). The emergent literacy research confirms that children develop oral language capacity, and precursor reading and writing skills concurrently in contexts such as family and other social settings outside of formal classroom instruction. These findings suggest that infants, toddlers and young children benefit from home and community environments that facilitate the continuum from early language precursor behaviors that begin to map pragmatics (e.g., patterns of engagement and disengagement, face-to-face transactions, etc.) to *recasting* (repeating and elaborating upon children's verbal expressions) and scaffolding during spoken verbal exchanges.

Two lines of investigation are most common in studies of emergent literacy. The first line of investigation is educationally-focused and looks for relationships among components of emergent literacy knowledge and skills and children's later school achievement (Rimm-Kaufman & Pianta, 2000). The second is developmentally oriented and looks for relationships between transactions within home and community environments, and the emergence of precursor skills (Gunn, Simmons & Kameenui, 1995; Whitehurst & Lonigan, 1998). Examples of the first line of investigation, as discussed above, confirm relationships

between emergent literacy knowledge and skills and children's early academic success. The second line of investigation will be discussed later in this chapter during review of studies linking specific risk factors to learning and behavioral difficulties in school, and the role of center-based care in moderating the impact of those risks.

In addition to precursor literacy skills, children develop early mathematics from infancy onward prior to the start of formal classroom instruction in first grade. Far fewer studies within the two broad categories of child development and educational research have examined the impact of early environment on emergent numeracy skills, nor the relationships among emergent literacy, numeracy and the preschool and school-age experiences that best facilitate growth. A growing body of literature, however, strongly suggests that infants in the first year of life may possess rudimentary quantitative skills that may be part of a continuum of numeracy skills leading to formal mathematics. It is to this literature that the discussion now turns.

Emergent Numeracy

Numeracy has been described as quantitative literacy, or the ability to use mathematics in the activities of daily life requiring quantitative skills, and the capacity to reason mathematically when information is presented in quantitative form (Anning & Edwards, 1999; Berch, 2005). For infants, toddlers and young children, the environment is replete with quantitative information and activities experienced through multiple sense modalities including days, hours and minutes, telling time, dollars and cents, counting objects, height and weight, smaller and larger and so on. Children appear to be much quicker at learning numerical language than numerical concepts. For example, child will learn to recite strings of numbers and count objects before they abstract the cardinal and ordinal

principles (Anning & Edwards, 1999). Through repeated hands-on experiences of counting sets of objects of varying sizes, children gradually acquire quantitative concepts such as more than, less than, and equal. Children's counting activities and their emerging conceptual knowledge sets the foundation for conservation of number, achieved when children understand cardinal value.

Research suggests that infants less than one year old demonstrate a rudimentary quantitative ability. Three paradigms have been developed to test the quantitative knowledge of infants - *habituation of looking time, cross modal transfer* and *violation of expectation* (Brannon, 2002). *Habituation studies* typically present the infant with a visual display, such as a series of slides all with images of two objects, for example, and subsequently include a slide with a different number of objects and measure the duration of the infants' visual fixation on the new slide. Infants tend to look longer at the new slide, suggesting that infants may have an implicit ability to *subitize,* defined as the ability to directly perceive the number of items in a display without counting, and that subitization may be a precursor to counting (Starkey & Cooper, 1980). An alternative explanation is that infants do not subitize but merely gaze longer at perceptual displays that are different from displays to which they have become habituated (Xu & Spelke, 2000).

Cross modal transfer studies are based on the assumption that infants possess an integrated perceptual field facilitating transfer of information obtained through one sense modality to another. In this type of study (see Moore, Benenson, Reznick, Peterson, & Kagan, 1987 for discussion), infants are presented with two slides concurrently, one of which contains an image of two objects and the other an image of three objects. Presentation of the slides is paired with an audio taped presentation of either two or three drum beats. The

dependent variable is the duration of infants' fixation on the visual stimuli after cessation of the auditory stimulus, with the expectation that infants would gaze longest at the visual stimulus that matched the auditory. The results across studies are mixed and suggest that infants may show a preference for congruent visual and auditory displays, but that features of the visual stimuli and their presentation may influence the duration of infants' visual fixation (Moore et al., 1987).

Wynn (1992) used a *violation of expectations* paradigm to study the possibility that five-month old infants can discriminate sets containing different numbers of objects and perform addition and subtraction. In these experiments, a single object was placed before each infant, after which a screen was placed between the infant and the object. A second object was shown to the infant, and then placed behind the screen and the infant shown the empty hand. Next, the experimenter removed the screen and displayed either one or two of the objects. Infants gazed longer at the displays containing only one of the two objects, suggesting that the display had violated their expectations that two objects would appear from behind the screen. This finding would support the conclusion that infants are capable of some rudimentary calculations involving very small numbers. Other research finds that infants' numerical abilities are inconsistently displayed, supporting alternative arguments that infants' apparent numerical abilities can be explained by the operation of cognitive and perceptual capacities that are not necessarily numerical (Feigenson, Carey & Spelke, 2002), that infants are representing individual objects, not numbers of objects (Uller et al., 1999), and that quantitative skills develop gradually throughout infancy and early childhood (Wakeley, Rivera & Langer, 2000; Wood & Spelke, 2005).

An additional paradigm explored infants' knowledge of ordinal relations. Infants aged 10 to 12 months were shown quantities of crackers placed into two containers, and then allowed to crawl over to the containers of their choice and remove the crackers. When the crackers were all the same size, infants selected the larger number of crackers when the comparisons were 1 versus 2 and 2 versus 3 only. When comparisons were 3 versus 4 or other, infants selected randomly, meaning that size of the numbers rather than their ratios determined the responses (Feigenson, Carey & Hauser, 2002). This study and others examining infants' earliest numeracy conclude that infants represent only very small numbers of objects through subitization, although others argue that the evidence supports the operation of a visual tracking system that excludes cardinal value but includes assessment of several cues based on number, density and amount of space covered by visual displays (Xu & Spelke, 2000). While there is no consensus in the literature on the cognitive processes that may underlie the capacity of infants to discriminate between small numbers of objects, the ability to make discriminations does improve over the course of children's development (e.g., can discriminate between quantities with smaller ratios, etc.) (Spelke & Kinzler, 2007; Xu, Spelke, & Goddard, 2005).

The question that these studies leave unanswered is whether there is developmental continuity from numeracy observed during infancy, if early numeracy represents precursors of later emerging abilities, and what is the typical knowledge trajectory. The literature on early numeracy in relation to mathematics achievement is sparse. A few studies have looked at relationships among children's cognitive, health and sociodemographic characteristics believed to covary with early school success to determine those that contribute the most variance to mathematics achievement. For example, an analysis of the ECLS kindergarten

cohort examined recognition of numbers and shapes, and children's grasp of ordinality measured at kindergarten. Almost all children entered kindergarten with knowledge of numbers and shapes (94%), while more than half (58%) understood the concepts of relative size, sequence patterns and rank order. Children from two-parent families with a relatively more educated mother had the highest levels of early numeracy skills (NCES, 2000). Other studies have confirmed the relationships between executive functioning and early mathematics achievement (Bull, Espy, & Wiebe, 2008), emergent numeracy skills such as counting and number recognition and mathematics achievement (Floyd, Hojnoski, & Key, 2006), and children's early *number sense* (the ability to make magnitude comparisons, interpret and apply quantitative information, etc.), and later achievement (Berch, 2005). Although fewer studies linking child-level and environmental risk factors to mathematics achievement are found in the education and child development literature, research consistently finds that risk exposure is negatively related to early mathematics as it is for language development (Chard et al., 2008; Clarke, Baker, Smolkowski, & Chard, 2008).

The studies reviewed on early academic achievement focused on child-level cognitive and environmental factors, but school readiness also encompasses socioemotional characteristics that emerge on a continuum from dependence on a caregiver for emotional regulation to independent self-regulation (Rouse, Brooks-Gunn & McLanahan, 2005). Prizant, Wetherby, and Roberts (2000) note that socioemotional and cognitive development are closely intertwined during infancy. Caregivers' responses to soothe, and provide stimulation and physical care, accompanied by vocalizations to help focus the infant's attention on the caregiver's face, converge to form the foundations of verbally-mediated learning.

Socioemotional Development and Self-Regulation

Emotional regulation and behavioral control are understood to be strongly influenced by caregiver-child interactions, and emerge within the matrix of early relationships. Emotional regulation is a key factor in the ability to tolerate frustration and delay gratification, and to moderate aggressiveness, attention and impulsivity. Bowlby (1969) argued that the infant-caregiver relationship has a direct impact on the maturation of children's biologically-based stress regulation mechanisms (Schore, 2001). Early attachment is frequently described by scholars and clinicians as an affect regulatory system consisting of caregivers' efforts to help infants modulate levels of stress that it is beyond an infant's capacity to manage independently (Kochanska, Coy & Murray, 2001; Stifter, Spinrad & Braungart-Rieker, 1999). Enduring patterns of impulsive behavior have been found to have antecedents in early emotional dysregulation (Caspi, 1998). Signs of poorly modulated arousal that persist beyond the toddler years are indicators of risk for long-term behavioral, interpersonal and academic problems (Aguilar, Sroufe, Egeland & Carlson, 2000).

Kopp and Neufeld (2003) provide an overview of how emotional regulation is defined in the scholarly literature. Many definitions agree on the adaptive role of self regulation in modulating *reactivity* and enhancing functioning. Reactivity is the characteristic degree of autonomic arousability displayed through the infant's affective and motor responses, whereas regulation refers to the voluntary processes that underlie the capacity for modulation of arousal (attention, self-soothing, etc.). Modulation of arousal in infancy is adaptive, reducing negative affective states and maintaining arousal to within an optimal, performance enhancing range (Braungart-Rieker & Stifter, 1996). Other findings (Rose, Futterweit & Jankowski, 1999; Rothbart & Bates, 1998) confirm a relationship

between strongly negative emotional states and interference with learning; among self-regulation, executive functions and language competence (Giancola & Mezzich, 2000); and, self-regulation, executive functioning and early mathematics achievement (Bull, Espy, & Wieke, 2008). Stifter and Braungart (1995) note that as infants and toddlers develop greater independent regulatory capacity, they begin to display preferred control strategies, such as distracting themselves and focusing on external objects, understood to be precursors of regulatory behaviors that appear later in development. These strategies serve an adaptive role in preserving relationships (for example, an infant or toddler unable to delay gratification or tolerate frustration risks rejection by caregivers), and promote a neutral affective state that supports learning. A young child in an overly aroused state has a diminished ability to attend to stimuli and minimize distractions.

The research literature on the co-occurrence of poor self-regulation and achievement problems reports a mix of findings. There is a substantial literature linking young children's poor self-regulation to later academic problems (Aguilar, Sroufe, Egeland & Carlson, 2000; National Institute of Child Health and Development (NICHD), 2004), but a number of other studies identify early academic failure as a precursor to later conduct problems. Regardless of the direction of effects, most discussions of school readiness highlight the importance of both cognitive and socioemotional characteristics to academic success (La Paro & Pianta, 2000; Lonigan et al., 1999; Shonkoff & Phillips, 2000). For example, Duncan and colleagues (2007) argue based on their research that cognitive and socioemotional characteristics are inextricably linked and jointly set the foundation for later school success, but that research needs to identify which domain-specific skills and characteristics have the strongest relationships with achievement (Duncan, Claessens et al., 2007).

Byrnes and Wasik (2009) conclude in another study that self-regulation and cognitive precursor skills together contribute most of the variance to early mathematics achievement. Learning behaviors, an observable set of behaviors that includes motivation and attention/persistence (aspects of self-regulation), are positively related to achievement and negatively related to school failure and psychopathology (Fantuzzo, Perry, & McDermott, 2004). Duncan and colleagues found that children's capacity to sustain attention, in addition to early mathematics and language skills, was positively related to reading and mathematics achievement in grade three (Duncan et al., 2007).

Socioemotional and cognitive characteristics, and the degree to which early academic and age-appropriate self-regulation emerge by the start of formal classroom instruction, are affected in numerous ways by characteristics of the caregiving environment and children's health status. While the scholarly literature consistently documents relationships among children's characteristics and early school success, characteristics of caregiving and other environment factors are similarly related to academic outcomes. Further, child-level vulnerabilities such as birth risks can be either moderated or the effects exacerbated through transactions with the environment. To understand the ways in which environmental factors play a role, it is useful to examine theoretical models that devote considerable attention to such factors.

<div align="center">Two Comprehensive Theoretical Models</div>

In the literature, there are some theoretical models that give prominence to child factors, and others that give prominence to environmental factors. In what follows, two comprehensive models will be discussed that give appropriate attention to both sets of factors: The Ecological/Transactional Model, and the Opportunity-Propensity Framework.

The Ecological/Transactional Model

The ecological/transactional model has been widely used in educational and child development research to generate questions and hypotheses about the characteristics and processes that lead to particular outcomes. An early line of educational research influenced by the transactional model examines the *Matthew effect*, based on the New Testament scriptural passage, "To the man that has more, more will be given…the man who has not will lose what little he has (Matthew 25:29) (Walberg & Tsai, 1983). In educational research, the Matthew effect predicts that individuals who have higher levels of knowledge and skill in a domain will have substantially more knowledge growth by the end of an educational experience compared to those who start with less knowledge and skill. The Matthew effect also predicts that small initial differences, such as between kindergarteners in early literacy skills, will increase over time (Walberg & Tsai, 1983), with cumulative advantage and disadvantage increasing due not only to child-level differences but differential responses of the environment (e.g., ability grouping, etc.) (Hallam & Ireson, 2003). The Matthew effect is an example of a *deviation amplifying process* in which environmental responses to initial small differences help create increased deviation over time (Sameroff & MacKenzie, 2003). Other areas of research influenced by the ecological/transactional model include studies of child maltreatment and onset of psychopathology (Cicchetti & Toth, 1995), the impact of domestic violence on children (Fantuzzo & Perlman, 2007), and maternal language facilitation and children's reading (Fewell & Deutscher, 2004).

Despite the wide application of the transactional model to educational and other areas

of research (e.g., developmental psychopathology, center-based care and achievement, etc.),

studies examining transactional processes have been criticized for measurement and

methodological issues, and how constructs are defined and operationalized across studies

(Luthar, Cicchetti, & Becker, 2000; Sameroff, 2000; Sameroff & MacKenzie, 2003). For

example, efforts to quantify processes occurring across levels of the ecological model often

require that researchers dichotomize constructs and create static measurement models

unlikely to capture the complex nature of transactions (Sameroff & MacKenzie, 2003).

Study findings based on these analyses tended to be correlational and descriptive of

interactions between levels of the ecological model (e.g., maternal education and children's

language skills, etc.), rather than clarifying the mechanisms by which changes may occur in

an outcome, and the complex manner in which systems at different levels of the ecology

exert mutual influence (Luthar, Cicchetti, & Becker, 2000). Rutter and colleagues note that

due to the complex interplay among factors in the ecology, efforts to isolate causal influences

to test competing hypotheses have tended to favor construction of methodologies over

validity of findings (Rutter, Pickles, Murray & Eaves, 2001). Baron and Kenny (1986)

advanced studies of the ecological model through use of regression analysis to identify

mediator and moderator variables. These procedures brought greater precision and more

adequately captured process by distinguishing intervening variables from primary predictors.

Kraemer and colleagues (2001, 2002) introduced stepwise multiple regression to differentiate

mediators and moderators in clinical research, and delineated the temporal placement of

intervening variables and their relationships with treatment assignment (Kraemer, Stice, Kazdin, & Kupfer, 2001; Kraemer, Wilson, Fairburn, & Agras, 2002). Despite these advances, research based on the ecological/transactional model has been criticized as having limited empirical support given the inherent methodological challenges in capturing reciprocal processes (Sameroff & MacKenzie, 2003).

In addition to measurement and methodological issues, research based on the ecological/transactional model has also been criticized for lack of precision in defining and operationalizing key terms such as *resilience*, *adversity* and *protective factor,* with different researchers using these constructs to refer variously to attributes, main effects or interactions depending on the studies (Luthar, Cicchetti, & Becker, 2000). Garmezy (1991) defined *resilience* as an individual's capacity to successfully adapt and function well despite experiencing severe or protracted hardship. More recent discussions have developed the concept of resilience from an individual-level trait to a state resulting from the interplay of the person and environment (Curtis & Cicchetti, 2003). *Adversity* conditions have been variously defined as unique stressful events, such as war or sexual assault, but also as exposure to multiple risk conditions simultaneously, such as poverty and poor health (Luthar, Cicchetti, & Becker, 2000). Defining what constitutes positive adaptation has varied from a standard of excellence in all domains (Tolan, 1996), to excellence in one domain and at least average adjustment in all others (Luthar, Doernberger, & Zigler, 1993). Contributing to individual differences in outcomes relative to risks are moderating factors serving protective functions (Rutter & Sroufe, 2000). *Protective factors* increase children's resilience in high risk circumstances and help to avert the onset of psychopathology (Masten & Coatsworth, 1998). Like risk factors, protective factors may be child-level (e.g., good health, etc.), in the

caregiving context (e.g., educated parent, etc.) and/or in the community (e.g., low crime, etc.) (Beckwith, 2000). Such divergence in defining and operationalizing constructs has led to questions about construct validity and additional measurement problems, such as estimating rates of resilience within groups of individuals (e.g., maltreated children, etc.) and the mechanisms by which protective factors moderate risk (Cicchetti & Rogosch, 1997).

The Opportunity-Propensity Framework

An emerging line of inquiry in educational research has begun to address some of the measurement and methodological issues noted above. These strategies involve integrating a far broader set of factors that are well-grounded in educational and child development theory and research with strong empirical support in the scholarly literature. In an effort to achieve parsimonious explanations, educational researchers typically constrain the number of factors studied to those of interest and which are believed to be particularly relevant (e.g., poverty, ethnicity, etc.). However, the factors influencing academic achievement are extensive with complex interactions in relation to academic outcomes. Including a far broader range of variables that theory and research would suggest are related to achievement while statistically controlling the impact of other the predictors is essential to the task of understanding the role of powerful, authentic predictors (Byrnes & Miller, 2007). The increase in number of predictors and intervening variables is balanced by constraining the outcome of interest to focus on multiple sources of direct and indirect influence. An example of this approach is the *opportunity-propensity (O-P) framework* (Byrnes & Miller, 2007). The O-P framework integrates a broader range of child-level and contextual factors than generally found in educational research to determine what factors contribute the most variance to children's mathematics achievement.

Factors in the O-P framework are organized into three primary categories. The first category – *antecedent* factors- generally consists of characteristics of both children and their environments that temporally precede children's entry to formal learning environments. Included in this category are socioeconomic status, gender, ethnicity and parental expectations of children's long-term educational achievement (i.e., expected degree). These factors occur earlier in time and enable the emergence of more proximal factors related to achievement. *Opportunity factors* is the next category of factors consisting of environmental influences from both formal and informal learning contexts that precede and occur during children's school years. When a child has had learning opportunities, it is understood that he or she has been placed in contexts in which he or she was allowed to acquire information or practice skills. Lastly, *propensity factors* are child-level factors consisting of the cognitive and socioemotional characteristics that children bring to learning opportunities. As noted, the opportunity-propensity framework predicts that children will achieve the most academically when two conditions are met – that they have genuine opportunities to acquire and practice skills in a subject area; and, have the skills, motivation and self-regulation necessary to take advantage of learning opportunities in school and the community. Differences in achievement between groups of children would be explained by differences in both learning opportunities and children's propensities to take advantage of those opportunities (Byrnes & Wasik, 2009).

The opportunity-propensity framework has generated research studies examining factors predictive of high school and elementary school achievement (Byrnes, 2003; Byrnes & Miller, 2007; Byrnes & Wasik, 2009). An early iteration of the O-P framework (then known as the *3 conditions* or 3C model) examined 12th grade mathematics achievement

among African-American, Caucasian, and Latino students to see what role ethnicity may have in predicting National Assessment of Educational Progress (NAEP) mathematics proficiency scores (Byrnes, 2003). Predictors included antecedent demographic factors (parent education, family structure); learning opportunities (high school program, number and types of mathematics courses completed, etc.); and, child-level motivation/aptitude (ratings of relevance, liking and ability). Hierarchical multiple regression analyses confirmed that demographic factors accounted for 10.6% of math proficiency scores. Adding exposure to learning opportunities accounted for an additional 26.3%. Motivation/aptitude accounted for 8.0% (total = 44.9%). Ethnicity, when controlling for demographics, exposure to learning opportunities and motivation, accounted for only 2.9% of the variance (total = 47.8% explained variance). Finding that exposure to learning opportunities accounted for so much variance for 12th grade students, and is a modifiable factor, is good news for educators planning interventions targeting those aspects of students' experiences (e.g., more exposure to math coursework, extra support, etc.) (Byrnes, 2003).

Subsequent iterations of the O-P framework included a retrospective longitudinal design and tested the model using structural equation modeling (SEM). These modifications organized the framework according to both logical and chronological relationships among empirically-supported factors, and permitted simultaneous testing of all predictors and paths (Byrnes & Miller, 2007). Secondary analyses of the National Educational Longitudinal Study (NELS-88) dataset confirmed that distal antecedent factors such as socioeconomic status and parents' and students' educational expectations accounted for 41.7%-43% of variance in high school math scores, and 28.8%-29.8%-of the variance in high school science

scores. Opportunity factors accounted for 11.2% of the variance in math scores, and 1.5-.9% of the variance in science. Propensity factors, however, accounted for 21.9%-27.5% of variance in math and 24.9-27.6 in science scores. Despite the comparatively small contributions of opportunities to variance in achievement, especially science, SEM analyses confirmed that distal factors had direct effects on math and science achievement, and indirect effects through learning opportunities including higher level math courses, and student-level propensities (e.g., prior achievement, efficacy for graduation, etc) to take advantage of learning opportunities.

The most recent study testing the O-P framework was a secondary analysis of the ECLS-K (NCES, 2006). Antecedent factors included SES, parental expectations, gender and ethnicity. Child-level propensity factors included *approaches to learning*, a composite score reflecting teachers' ratings of children's attentiveness, task persistence, eagerness to learn, learning independence, flexibility and organization (NCES, 2006). Children's mathematics scores at the beginning of each grade provided an index of *cognitive propensity* and were also included among propensity factors in the design. Opportunity factors were level of content-exposure (1 through 4 reflecting ascending levels of complexity), and four categories reflecting the degree to which reforms promulgated by the National Council for Teachers of Mathematics were integrated to classroom instruction (*reform, traditional, balanced*, and *other*). SEM confirmed that elementary school children had higher mathematics achievement when they began the academic year with higher mathematics and approaches to learning scores. Pathways from antecedent factors such as socioeconomic status through opportunity factors to end-of-year mathematics achievement were not significant for elementary school children. These findings strongly suggest that SES and the opportunities

this may afford to children matter little if children lack the emergent skills, motivation and self-regulation to derive benefit. Policy implications of this study are a further impetus to provide young children, especially those growing up in circumstances associated with higher risk, early opportunities to develop skill and enhance socioemotional development in center-based care. Byrnes and Wasik (2009) suggest that in addition to cognitive skills and approaches to learning, other intermediary factors linking socioeconomic status and other antecedent factors to achievement need to be discovered to explain the direct and indirect pathways to academic outcomes.

The present study provides this follow-up investigation by including additional child-level and environmental factors in a secondary analysis of the ECLS-K dataset and extends the outcome of interest to reading achievement in addition to math. Poverty is understood to be a potent threat to children's development and was included among the antecedent factors. The intermediary antecedent factors included in this study and hypothesized to link poverty to propensities include gestational age at birth, family structure, maternal age at the time of first birth, domestic violence, the presence of harsh discipline, and level of cognitive stimulation in the home. Center care was included as a learning opportunity due to the extensive research literature confirming a role promoting school readiness for some groups of children (reviewed later in this chapter) to test its validity in an O-P analysis. Center-based care has been found to offer children enriched language environments comparable to those of middle to upper income homes (Murray et al., 2006). However, children living in poverty or who are members of some ethnic minority groups may not evidence an enduring impact on

academic achievement. This study explored whether children who are living in poverty experience a higher impact of center care in the presence of relatively higher levels of cognitive stimulation in children's home, and in the absence of harsh parental discipline.

O-P Factors in the Present Study

Socioeconomic Status & the Impact of Poverty (Antecedent Factor)

Numerous studies confirm that infants and toddlers are especially vulnerable to the effects of poverty compared to individuals who experience poverty at later stages of development (Brooks-Gunn & Duncan, 1997; Duncan, Brooks-Gunn & Klebanov, 1994). Definitions of poverty most often refer to the condition of having insufficient income to meet needs for adequate housing, nutrition, health care and other necessities of life (Aber, Jones & Cohen, 2000). The 2008 U.S. Health and Human Services (DHHS) poverty income guidelines set $21,200 as poverty level for a family of four (DHHS, 2008). Nationally, 21% of children under age six years in 2007 lived in families whose income was below the federal poverty level, with 43% of children under age six living in households whose income was 200% of the poverty guidelines (i.e., are low income) in 2007 (National Center for Children in Poverty, 2008). Poverty is related to a range of problems including impaired cognitive development, and academic and behavioral problems (Duncan & Brooks-Gunn, 2000). Young children growing up in poverty are more than twice as likely to have cognitive delays, experience poorer physical and emotional health, and behavioral problems in school that place children at greater risk of lower academic achievement. (Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997; Leventhal & Brooks-Gunn, 2000).

Research examining the pathways or mechanisms through which poverty may operate to increase the risk of poor school outcomes for children has identified both person-level and family-level mechanisms. These mechanisms include low birth weight, premature birth, single parent households, adolescent motherhood, domestic violence, and harsh discipline (Aber, Jones & Cohen, 2000; Zeanah, Boris & Larrieu, 1997). However, studies that have controlled for these mechanisms as poverty covariates and examined the impact of income alone on children's outcomes have provided support to the argument that income level also has direct effects on children's wellbeing. One study demonstrated that children in sibling groups who were born after family incomes had substantially increased had better educational outcomes than children born earlier (Duncan, Yeung, Brooks-Gunn, & Smith, 1998). Another group of studies using randomized trials provided treatment group families with income subsidies and found improvements in children's nutrition and school achievement in locations with the highest numbers of young children living in the most impoverished circumstances (Brooks-Gunn & Duncan, 1997).

Despite evidence that income has direct effects, identification of poverty mechanisms and how they increase risks to infants', toddlers' and preschool age children development is an important step in the direction of creating prevention and intervention programs (Aber, Jones & Cohen, 2000). Family characteristics that consistently have the strongest relationships with poverty among children age five years and younger are parents' education

level, marital status and employment (Brooks-Gunn & Duncan, 1997). The present study will examine the relationships among socioeconomic status among other antecedent factors discussed below in a series of hierarchical regression analyses, and examine the question of whether center-based care including Head Start may be a genuine opportunity factor that is associated with higher reading and mathematics achievement measured at the beginning of kindergarten and end of grade one.

Gestational Age at Birth and Prematurity (Antecedent Factor)

Prematurity, defined as birth occurring before the end of the 37th gestational week, accounts for approximately 60% of low birth weight perinatal outcomes. An extensive literature links prematurity to a range of long-term developmental effects. Most premature infants admitted to neonatal intensive care are discharged free of serious long-term physical health sequelae, but may display persistent behavioral health problems and poorer cognitive and academic outcomes into adolescence (Breslau et al., 1996; Hack et al., 2002). A meta-analysis of case-control studies found that children born premature have lower cognitive test scores and higher rates of attention deficit hyperactivity and other behavioral disorders (Bhutta, Cleves, Casey, Cradock, & Anand, 2002). Differences in educational outcomes among those born premature may persist into adolescence with young adults born premature having lower intelligence and achievement test scores, and higher rates of dropping out of high school (Hack et al., 2002). Other studies suggest that preterm birth can be directly related to reductions in brain development. For example, imaging studies of 8 year olds who had been born prematurely found smaller volumes in the sensorimotor, parietal-occipital and mid temporal cortices (Peterson, Anderson et al., 2003). A sample of adolescents born between 28 and 35 weeks gestation had imaging study findings of low levels of activation in

the inferior frontal, anterior cingulate and parietal regions related in other studies to higher levels of inattention and poor inhibitory control (Carmody et al., 2006; Bunge, Dudukovic et al., 2002). Taken together, these studies suggest that compromised development related to prematurity places children at long-term risk of cognitive and behavioral problems. This is particularly the case for children exposed to multiple environmental risks including poverty (Carmody et al., 2006).

Family Structure and Single Parent Families (Antecedent Factor)

A sizeable body of research confirms that growing up in a single parent household is linked to considerable environmental risks and may substantially increase children's likelihood of unfavorable academic and behavioral outcomes (Amato, 2000; Kalil, Rosenblum, Eccles, & Sameroff, 1998). Single parent families are more likely to experience financial problems, have low parental education and fewer social resources (e.g., number and quality of supportive relationships, frequency of contacts with friends and acquaintances, etc.) compared to two-parent families (Amato, 2000; Thomas & Sawhill, 2005). Children of single parents have poorer early language development related to caregivers' low levels of involvement in their children's schools (Arnold, Zeljo, Doctoroff, & Ortiz, 2008), placing these children at greater risk of poor reading achievement and other academic problems (Snow, Burns, & Griffin, 1998). Several studies have confirmed a relationship between growing up in single parent families and higher rates of delinquent behavior, substance abuse, failure to complete high school and teen pregnancy (Hill, Yeung, & Duncan, 2001; Spencer, 2005). However, other researchers find that the direct effects of single parent exposure on children's development are minimal; rather, problematic family and other social factors contribute most of the variance to children's poor outcomes (Fergusson, Boden, &

Horwood, 2007; Lipman, Boyle, Dooley, & Offord, 2002). In order to better understand these relationships, single parent family was included in the present study to examine the effects of family structure on children's outcomes. However, as noted above, it is important to include other factors in a comprehensive analysis to see which factors are authentically related to early school readiness and which are spurious as single parenthood and other factors introduced in sections to follow seem to be.

Maternal Age at First Birth and the Impact of Adolescent Parenthood (Antecedent Factor)

For over three decades, studies have consistently reported that children born to adolescent mothers do not perform as well on tests of cognitive functioning compared to children of adult mothers (Dubow & Luster, 1990; Kellam, Ensminger, & Turner, 1977; Oxford & Spieker, 2006; Wadsworth, Taylor, Osborn, & Butler, 1984). Differences in the outcomes of children born to adolescent and adult mothers may persist into adulthood, with overall poorer psychosocial adjustment and academic achievement. These differences are especially apparent when examining the language development of children born to adolescent mothers. Several studies found children of adolescent mothers performing at least one standard deviation below the mean on standardized language tests (Luster & Vandenbelt, 1999). Research has identified two parenting behaviors – maternal sensitivity and intrusiveness – that explain the relationship of teen parenting and children's poor language development (Keown, Woodward, & Field, 2001). Parenting behaviors such as responsiveness and providing cognitive stimulation also vary by both maternal age and socioeconomic status (Keown, Woodward & Field, 2001). Adolescent parenthood is far more likely among young women who are exposed to intergenerational risks including poverty, harsh discipline and maltreatment, and low maternal education, all of which are

associated with poor language development (Oxford & Spieker, 2006). Other research suggests that the quality of the caregiver-child relationship has an impact on both cognitive and socioemotional development indirectly through environmental risks including poverty transmitted through parenting behaviors (Prizant, Wetherby & Roberts, 2000; Querido, Warner & Eyberg, 2002; Sameroff & Fiese, 2000).   The unique contributions of adolescent parenthood to children's early literacy and mathematics in the present study, and the protective effects of center-based, care were examined in regression models that controlled for other risks and interactions among risks.

Parenting Behavior (Antecedent Factors)

   Harsh Parental Discipline. The detrimental effects of harsh parental discipline on children's behavior are well-documented in the child development literature. Despite a sizable body of research linking physical punishments to externalizing problems in children (Criss et al., 2002; Kim & Cicchetti, 2003), a high proportion of United States children is exposed to aversive discipline (Ateah & Parker, 2002; Strauss & Kaufman Kantor, 1994; Strauss & Stewart, 1999). A meta-analysis of 88 studies examining the effects of corporal punishment on children's wellbeing found positive correlations with onset of aggression and other delinquent behaviors, poor parent-child relationships, and child maltreatment (Gershoff, 2002). Harsh verbal discipline (e.g., name calling, threats, screaming, etc.) is not as well researched as physical punishment but may occur more frequently and is associated with both internalizing and externalizing problems (McKee et al., 2007; Strauss & Field, 2003). Some studies found that physical punishment disrupted the parent-child relationship by eliciting fear and avoidance in the child, who would subsequently lose opportunities to learn from the parent (see Gershoff, 2002, for review). Although some researchers conclude

that physical discipline has a neutral effect on children's development, especially when administered in a context of supportive parenting, and has some possible protective effects on urban children from minority backgrounds (Larzelere, 2000), the relationship of physical discipline among other forms of harsh discipline to internalizing and externalizing problems is strong enough to support a conclusion that harsh discipline is a high-risk, child-endangering parenting behavior. Theodore and colleagues (2005), in an epidemiologic examination of maternal self-reporting of harsh discipline used in families, concluded that surveying discipline practices is more likely to produce accurate estimates of true maltreatment incidence.

As to specific effects of maltreatment, toddlers who were maltreated and followed through kindergarten in one study were assessed as more irritable, oppositional, distractible and aggressive compared to a comparison group of children who had not been maltreated (Erickson, Egeland & Pianta, 1989). Abused and neglected children were found by Allen and Wasserman (1986, cited in Eigsti & Cicchetti, 2004), to be ignored by their mothers more often, and less likely to have mothers name objects, ask questions and explain the environment. Children who experience maltreatment also have an increased likelihood of experiencing other types of traumatic events, such as exposure to domestic violence, and have difficulties with relationships, emotional regulation and self-development (Kaufman & Henrich, 2000).

Domestic Violence. As noted in the section above, children who are exposed to harsh discipline and maltreatment are often exposed to other risks including domestic violence. Estimates of prevalence vary depending on how domestic violence is defined. Commonly, the literature defines domestic violence exposure as a child having visually observed or

overheard violence exchanges, injuries, property damage or police intervention (Guterman, 2004: Holden, 1998). An estimate based on the Adverse Childhood Experiences (ACE) study found that 24% of respondents recalled having observed fathers or stepfathers having grabbed, slapped, pushed or verbally threatened mothers or stepmothers (Dong et al., 2004). The U.S. Department of Justice estimated that between one quarter and one third of women will experience domestic violence in their lifetimes, with women from ethnic minority groups and women who are poor suffering disproportionately higher rates (Finley, 2010). Substance abuse, physical health problems and other pathologies are often associated with domestic violence, further raising the risk to children in afflicted families (Gregory et al., 2010). Children who are exposed to domestic violence are more likely to present with poor behavioral and emotional self-regulation (Cummings, Davies & Campbell, 2000; Maughm & Cicchetti, 2002). In light of the association of domestic violence and children's development in the literature, domestic violence was included as a risk factor in the present study.

Cognitive Stimulation. The degree of cognitive stimulation in children's homes tends to covary with socioeconomic status, and these differences contribute to the initial disparities in children's school readiness (Votruba-Drzal, 2003). Parents play a pivotal role in structuring children's environments and shaping the behaviors children display in response to cues. Reading to children, helping children learn the alphabet and numbers, singing songs, playing games and so on are important stimuli for children's cognitive and socioemotional development and preacademic skills (Baharudin & Luster, 1998). Limited financial resources make it more difficult to purchase children's books and computers, take children on trips to museums, arts performances and other community events. In addition to these direct effects of income on the level of cognitive stimulation, other family characteristics

have indirect effects. Single parent families typically have fewer socioemotional and financial resources, and may experience substantially higher levels of caregiver stress (Beharudin & Luster, 1998). The quality and quantity of spoken language in the home is an important factor in children's cognitive growth, and this varies with both maternal education and socioeconomic status (Hart & Risely, 1995; Hoff, 2003: Oxford & Spieker, 2006). For these reasons, socioeconomic status is understood to also have indirect effects on children's school readiness and later achievement, with low levels of cognitive stimulation representing a risk to children's development.

In the child development and education literature, any factors that are predictive of negative outcomes are often called risk factors. As such, the aforementioned factors, such as single parent family, adolescent parenthood, and so on fall into the risk factor category. The same literature, however, also identifies protective factors that may promote positive outcomes, or at least ameliorate the effects of risk exposure. Interventions that aim to provide developmentally appropriate stimulation, and promote cognitive and socioemotional development, have demonstrated positive impacts on early academic success. In the next section, the role of center-based care including Head Start as proposed opportunity factors in the O-P analysis will be discussed, and the conditions under which it may be most protective for vulnerable children.

Is Center-Based Care a Genuine Learning Opportunity for Children At-Risk?

Given concerns that children were arriving at their first grade classrooms without the necessary knowledge and skills needed to succeed, Goals 2000 (P.L. 103-227) set access to quality center-based care programs as a primary objective (Committee for Economic Development, 2006). A substantial evidence-base links center care to

cognitive and early academic advantages for children (Fantuzzo et al., 2005; Kolker, Osborne, & Schnurer, 2004; National Research Council, 2001; NICHD, 2005). In contrast to care provided in child care homes, center care is more likely to have curriculum-based instruction, trained staff and other characteristics likely to promote children's development (NICHD, 2005). Formal child care gives children opportunities to experience structure, cognitive stimulation, predictability and limits, experiences that help young children develop skills, internalize order and sequential events, and prepare them to adapt more readily to the classroom at school age (Musick & Stott, 2000).

Experimental studies provide the strongest evidence supporting center-based early education (Campbell & Ramey, 1995; Schweinhart, Barnes, & Weikart, 1993, 1998; Shonkoff & Phillips, 2000). The most well-known experimental studies examine the High/Scope Perry Preschool and have reported outcomes through age 40 years for the original 1962 cohort. The program was developed for children living in poverty whose families had several characteristics associated with school failure (e.g., limited parental education, single parent families, etc.). The treatment group members compared to controls had significantly higher rates of high school graduation, employment and earnings, and significantly fewer arrests and less use of social services. Cost-benefit analyses determined that the program returned $16.14 for every dollar spent, with savings in special education, social services and criminal justice spending, and increased taxes paid out of higher earnings (Schweinhart, 2000). The Carolina Abecedarian Project is another randomized control trial of an intervention for children exposed to multiple risks including poverty and low maternal education. In addition to education programs, treatment group children received nutritional, health and social services. Children in the

control group were provided the adjunct services but not education. What is most striking about early treatment and control group comparisons is the typical developmental trajectories for infants' in both groups during their first nine months. After nine months, control group performance on developmental assessments showed a steep decline and continued to drop through the preschool period, with control IQ test scores averaging 14 points lower than treatment group scores (Ramey & Ramey, 2004). Through grade 12, treatment group participants had significantly higher reading and math scores and fewer special education assignments. By early adulthood, treatment group members had significantly higher participation in post-secondary education and skilled employment (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002). Like other early education programs studied using experimental methods (e.g., the Infant Health and Development Project for low birth weight and premature infants), the High/Scope Perry Preschool and Abecedarian projects were small, intensive demonstration projects serving few children relative to the numbers in need of such services (Campbell & Ramey, 1995; Ramey et al., 1992; Schweinhart, Barnes, & Weikart, 1993).

Experimental research arguably meets the highest standard of evidence, but observational studies are far more common in educational program evaluation. Observational studies typically look at early education programs that serve large numbers of children (e.g., Head Start, publicly funded pre-kindergartens, etc.) (Magnuson & Waldfogel, 2005). Of non-experimental studies using representative samples of United States children, the NICHD Early Child Care Research Network reported greater gains in cognitive development among children receiving center-based care (NICHD, 2000, 2005). Children attending center care at ages three and four years gained between

.22.and .33 standard deviations more on measures of academic achievement compared to

children in parental and other informal care (NICHD, 2005). A study of ECLS

participants found that center care was associated with higher reading and mathematics

achievement even after controlling for family characteristics usually associated with

selection into early childhood education and higher school achievement. Magnuson and

colleagues reported that children in the ECLS kindergarten cohort with the highest level

of risk exposure (e.g., family poverty, single parent family, etc.) derived the most benefit

from formal center-based child care including prekindergarten, with effect sizes ranging

from .20 to .30 for reading skills compared to effect sizes of .15 for the full sample

(Magnuson, Meyers, Ruhm, & Waldfogel, 2004). In particular, early childhood education

programs targeting children at high risk of delays have demonstrated the long-term

protective effects on children's cognitive and socioemotional development (National

Research Council, 2001; Ramey, Campbell & Ramey, 1999).

Head Start is the largest of programs developed for at-risk children to improve school

outcomes, and is the most extensively studied early care and education program in the United

States. A study comparing the outcomes of individuals who attended Head Start and those

of siblings who did not attend found that non-Hispanic Caucasians who attended were 22%

more likely to complete high school and 19% more likely to have had college-level course

work. The academic outcomes for African-Americans were not significant, but individuals

who attended were 12% less likely to be arrested and charged with a crime (Garces, Thomas,

& Currie, 2002). Elsewhere, an academic impact for African-American and Caucasians has

been found at the population-level with increases in years of education completed associated

with higher Head Start funding and utilization in impoverished counties (Ludwig & Miller, 2005). Reduced grade retentions, fewer special education placements and lower child mortality have also been associated with Head Start participation, establishing that early education programs may not need to be exclusive, intensive and costly to benefit children at risk (Ludwig & Phillips, 2007).

More recent Head Start evaluation has employed both random sampling and randomized control group assignment (the study was mandated by1998 Head Start reauthorization). The goals of the study were twofold. The first is to understand the impact of Head Start on participating children's school readiness compared to a control group of children who do not participate. The second goal is to understand the conditions under which participating children derive the most benefit (DHHS, 1999). First year findings of the *National Head Start Impact Study* identify small to moderate statistically significant impacts in four out of six cognitive outcomes for three and four year old children, closing the gap in emergent reading between Head Start participants and the national average for three and four year olds by 45% (DHHS, 2005; Yoshikawa, 2005). When cost-benefit analyses are examined, Head Start and other early care and education programs would return between $2 and $4 for every dollar spent through participants' improved outcomes including higher academic achievement, fewer grade retentions and special education assignments, lower likelihood of being a victim of child maltreatment, of committing a crime, or becoming

welfare dependent (Committee for Economic Development, 2006). Overall, the research examining the protective effects of center care and early education consistently suggests that children with the highest risk exposure benefit the most. However, children from economically disadvantaged communities are far less likely to attend early care and education programs, and both Head Start and the availability of financial subsidies to working poor families have not kept up with the growing need (Kagan & Neuman, 2000).

Despite the sizable literature supporting the role of early education in school achievement, the research is not unequivocal. For example, Fantuzzo and colleagues (2005) note that NICHD findings on the relationship of center-based early education and children's higher cognitive and socioemotional outcomes might not be generalizable due to exclusion criteria that eliminated children born to adolescent mothers, children whose home language was not English, who were adopted or who lived in high-crime neighborhoods (Fantuzzo et al., 2005). These exclusion criteria would tend to result in a sample of children with relatively less exposure to sociodemographic and health risks associated with poorer school outcomes. Controversy surrounding Head Start effects ensued soon after its implementation with the 1969 Westinghouse report stating that Head Start cognitive benefits begin to dissipate after first grade (Williams & Evans, 1969). A meta-analysis sponsored by the DHHS completed in 1985 found that the both the cognitive and socioemotional effects did not provide a long-term advantage, although a subset of studies found that participating children were more likely to be promoted and less likely to be assigned to special education classes (McKey, 1985).

Head Start has also been criticized for failing to have a lasting impact on the IQ test scores and academic achievement of African-American children (Barnett, 1992; Currie & Thomas, 1995). Enduring concerns about the persistence of Head Start impacts contributed to the shift in program focus from broad health and development objectives to cognitive development and pre-academic skills, and gave impetus to the reauthorization directive to conduct randomized control trials, and the introduction of high stakes testing of Head Start participants (Haskins, 2004; Ludwig & Miller, 2005). Studies comparing the outcomes of children who participated in Head Start and their siblings who did not participate have been criticized for possibly measuring changes in families over time (e.g., move to better neighborhood, increased income, etc.) or initial child-level differences rather than program effects. The Head Start Impact Study has the potential to help answer questions about treatment effects and for whom the intervention is most effective. For example, children from some minority groups and those living in poverty may have experiences in their homes and communities that differ markedly from experiences in school (e.g., language/dialect differences, household and community organization, etc.), and have more difficulty deriving full benefit from learning opportunities (Byrnes & Wasik, 2009; Okagaki, 2001). However, other researchers have argued that characteristics of classroom instruction may fail to build on preschool age competencies for a more lasting academic impact (Byrnes & Wasik, 2009: Magnuson, Ruhm, & Waldfogel, 2007).

Summary of the Literature

The legislation and studies discussed in this review provide important legal, child development and educational context for the present study. Federal efforts to drive education policy and practice to improve outcomes for children include NCLB (2000), with explicit

requirements that school systems eliminate achievement disparities among children from diverse socioeconomic and ethnic backgrounds. Children who experience family poverty, whose home language is not English, and who are members of some ethnic minority groups in the United States appear to be most vulnerable to poor academic outcomes. A strong evidence-base in the child development research confirms relationships among child and family characteristics and children's development. Family socioeconomic status has a particularly strong relationship with children's school outcomes, and tends to covary with other characteristics such as family structure, maternal age and children's health status at birth. Child development research that includes data on risk exposures and learning opportunities hypothesized to be protective has an important role in identifying children who may benefit most from interventions.

A strong evidence-base has also been confirmed for the relationship of precursor academic skills and achievement. Most of this support is found in research linking emergent literacy and reading achievement. Less support is found in the literature for relationships among mathematics precursor skills and early mathematics achievement, especially in studies examining infants' rudimentary quantitative skills. According to the O-P framework, neither family characteristics, nor precursor skills, nor socioemotional characteristics are expected to adequately explain early mathematics achievement without considering multiple influences on outcomes. Research based on the O-P framework confirmed relationships among early mathematics skills, family characteristics, socioemotional characteristics such as attention and persistence, opportunities to learn and practice skills and children's mathematics achievement. The present study extends the O-P model to examine the impact of learning opportunities and risk exposures (physical discipline, domestic violence,

prematurity) that occur before first grade. For children exposed to multiple risks, center-based care and Head Start may provide the genuine opportunities to promote cognitive and socioemotional development, as well as opportunities to practice and develop skills. The inclusion of learning opportunities that occur prior to grade one in models based on the O-P framework will permit study of how these experiences may add to the prediction of achievement controlling for other factors.

Research Questions

1. Does exposure to risk factors such as poverty, maternal first birth before age 18 years, single parent family and exposure to harsh discipline predict precursor reading and math skills measured at the start of kindergarten? Is this predictive relationship attenuated when ethnicity, home language, and gender are controlled?

2. In the ECLS-K, is there evidence comparable to that of the NICHD study that children show higher levels of emergent reading and math skills when they attend center based care than when they do not?

3. Do emergent reading and mathematics skills assessed when children are in Fall kindergarten predict their reading and math in first and third grade?

4. Do children's socioemotional characteristics indexed by approaches to learning scale measured in fall kindergarten predict reading and mathematics achievement in first and third grade?

5. Do parenting behaviors (discipline, presence of domestic violence, warmth and cognitive stimulation predict) predict reading and mathematics achievement in first and third grade?

CHAPTER 3

METHOD

Participants

As noted earlier, data for the study were drawn from the Early Childhood

Longitudinal Study – Kindergarten (ECLS-K) Fifth Grade Public Use longitudinal data

file (NCES, 2006). The ECLS is sponsored by the United States Department of

Education and the National Center for Educational Statistics. The sample is nationally

representative of all United States children who were in kindergarten during the 1998-99

school year, and in first grade during the 1999-2000 school year. The kindergarten base

year file contains information about more than 22,000 students attending nearly 1,000

United States public, private and parochial schools. Data were obtained on base year

kindergarten students in the fall of 1998, the spring of 2000 when children were in first

grade (included freshened first graders who were not part of the base year sample), in the

spring of 2001 when students were in third grade, and in the spring of 2004 (grade 5).

The most recent data collection took place in the spring of 2007 when students were in

the eighth grade. The ECLS has examined the participating children's development

across several domains including cognitive, socioemotional, physical and academic

achievement from kindergarten through grade eight, as well as the characteristics of their

schools, families and communities, and the relationships among family characteristics,

early care and education experiences and children's developmental status at the start of

kindergarten.

Participants included in the present study were members of the ECLS kindergarten class of 1998-99 who were in kindergarten for the first time during the base year data collection and who were promoted to first grade. Only first grade students who were part of the base year data collection (not freshened students) were included in the present study. Students who were repeating grade one during the1999-2000 school year were excluded. Kindergarten students who were in their second year of kindergarten during 1998-99 were also excluded. The present study included only students who entered the study in the fall of 1998. This limit permits an examination of children's status at the beginning of kindergarten in relation to spring first grade achievement. The exclusion of students who were repeating either kindergarten or first grade was intended to eliminate the influence of practice effects from previous exposure to kindergarten and first grade curricula. The number of spring first grade children who were also part of the round one base year sample was 15,848.

Procedure

The ECLS-K used several stages to obtain a nationally representative sample of children enrolled in US kindergartens in 1998-99. The first stage involved selection of counties and groups of counties to create primary sampling units based on 1990 Metropolitan Statistical Areas. Population data from the resulting 100 primary sampling areas were updated with the most recent Census Bureau estimates of numbers of five year old children by race and ethnicity. At stage two, public and private schools with kindergartens were sampled. Information about the schools was obtained from the Common Core of Data Public Education Agency Universe (1995-96), the Private School Universe Survey (1995-96), Department of Defense and Office of Indian Education

Programs Education Directory. The total base year school sample size was 1277, of

which 914 were public and 363 were private (religious and non-sectarian) schools. The

number of participating schools during the base year was 944. At the third stage,

children within schools were sampled resulting in a total number of 22,666 children in

the base year sample attending public (n=17,777 children) and private (n= 4,889

children) schools. For the present study, variables were selected from the K-5 child

catalogue and extracted into SPSS 15. The final sample of 15,491 participants was

created by excluding children who joined after round one, and who were not in their first

year of kindergarten.

Measures

     Assessments. The ECLS consists of four components. The *direct child*

assessment examined children's cognitive status including general knowledge, language

development and literacy, and quantitative abilities. Non-cognitive domains assessed

included gross and fine motor skills, height and weight, and socioemotional development.

Measures were obtained through untimed one-on-one assessments of participating

children. Information was also obtained from *parents and guardians* and included family

characteristics, income, and child health. These measures were obtained through

interviews using the telephone and computer. *Teachers* provided information about the

sampled children's abilities and behavior, and the teachers' classroom practices and

environment. These data were obtained through questionnaires. Finally, *school*

administrators completed questionnaires about school-level characteristics such as

programs, budget and instructional practices (NCES, 2006). The result of obtaining

multi-level data is an ecological view allowing modeling of children's characteristics and

a range of proximal and distal influences on development and achievement.   For the present study, only child and family-level data were included.

Socioeconomic status. The composite variable for SES in the ECLS database was computed by NCES using several source variables. The source variables provided information about parents' or other participating caregivers' education, occupation and income relative to household size using 1998 U.S. Census Bureau poverty thresholds. Source variable data for this composite were collected during participating children's kindergarten year and represents the socioeconomic status of households in the spring of 1999. Where source variables had missing information, imputation procedures were used to compute missing values. The composite variable for continuous SES was used. Higher values denote higher SES.

Demographics. Demographics including children's race/ethnicity, gender and home language were represented in this analysis by composite variables.

Family structure.   Information about household structure for round one participants was obtained from the fall kindergarten parent questionnaire. The variables capture focal children living with two parents with and without siblings, and focal children living with a single parent with and without siblings (NCES, 2006). The variable was recoded so that *1* = child resides in a single parent family, and, *0* = child does not reside in a single parent family.

Maternal age. Information about mother's age at first birth is captured in the fall kindergarten parent questionnaire. While the mother might no longer be an adolescent parent, first birth before age 18 years is understood to be a proxy for the presence of intergenerational risk factors that bear on the mother's capacity to parent.

Gestational age. Prematurity was assessed by items in the parent questionnaire under children's health and wellbeing. Items assessing prematurity include *was child born more than two weeks early*? Response options were *1 =* yes, and *2 =* no. A *yes* response to this item was used to indicate the presence of preterm birth. Response options were coded as *1 =* yes, *0 =* no.

Parenting Behaviors. Questions examining parent's use of physical discipline, domestic violence, cognitive stimulation provided by book reading were included in the spring kindergarten parent questionnaire. Parental warmth was included to determine if this would moderate any negative relationship between physical discipline, domestic violence and children's outcomes. These items assess the parents' perceptions of how much difficulty they experience expressing warmth and closeness toward the focal child with response options ranging from completely true = *1* (parent reports having difficulty expressing warmth and closeness to the child), through not at all true = *4* (parent has no difficulty expressing closeness and warmth to the child); and the number of times physical discipline was used in the past week with response options that may take any positive whole number value. The respondent also has the option of noting that the focal child is never physically disciplined. Domestic violence is assessed by a single dichotomous item asking if parent and partner hit each other. The level of cognitive stimulation is indexed by the frequency of book reading to the child, with response options ranging from *1* (never), to *4* (everyday). These variables were included among antecedent factors.

Parental educational expectations. Parents' expectations of their children's educational achievement were assessed using a 5-point scale during round one of the kindergarten year. The parents were asked to state whether they expected their child to achieve less than a high school diploma (*1*), to graduate from high school (*2*), attend 2 or more years of college (*3*), to complete a college degree (*4*), earn a master's or equivalent, or Ph.D. or M.D. (*6*). This item was included among antecedent factors in the models.

Emergent cognitive skills. Children's cognitive skills at the beginning of kindergarten were evaluated using the reading and math assessments. These assessments were developed by a panel of experts in child development, education and test methodologies to capture the knowledge and skills typically taught in formal educational settings and mastered by children at particular grade levels (NCES, 2001). The assessments were also constructed to capture children's knowledge and skill development over time. Each subject domain consists of 50-70 items individually administered to each child. The reading portion assesses print familiarity, letter recognition, beginning and ending sounds, rhyming words, word recognition, receptive vocabulary and passage comprehension. The math portion assesses conceptual knowledge of mathematics, procedural knowledge and problem solving (NCES, 2001). Item Response Theory (IRT) reading and math scores were used in analyses. IRT scores are preferred as these facilitate comparisons over time when the items in recurring assessments do not entirely overlap (Byrnes & Wasik, 2009). As noted in the previous chapter, children's cognitive assessment scores represent propensities to take advantage of formal learning opportunities according to the O-P framework.

Kindergarten approaches to learning. Information about children's fall kindergarten motivation and self-regulation are indexed by the Approaches to Learning Scale. This instrument is based on the Social Skills Rating System (SSRS, Gresham & Elliott, 1990). The Approaches to Learning Scale measures children's attentiveness, task persistence, eagerness to learn, learning independence, flexibility and organization. Children are rated on a scale of 1 (never, to 4 (very often) (NCES, 2006). Included in the present study will be the teachers' ratings as their impressions are based on children's presentation in the classroom rather than home and other contexts. Approaches to learning scores will be included as a predictor among propensity factors of kindergarten, first and third grade reading.

First and third grade cognitive outcomes. In the spring of first and third grades, the direct child assessments were repeated. These outcomes were examined in relation to children's precursor skills and approaches to learning measured in the fall of kindergarten, and antecedent factors (SES, gender, ethnicity, etc.).

Center-based care and Head Start the year before kindergarten. The data collection instruments ask the responding parent or other caregiver about children's participation in a range of non-parental care experiences. Center care experiences are captured by questions about Head Start and other center-based care. Included in the analysis is number of hours the year before kindergarten in Head Start and other center care per week.

Analysis

Relatively higher numbers of child-level vulnerabilities and environmental risk factors increase the likelihood of a range of unfavorable outcomes. The hypothesized

moderating role of center-based care within an O-P framework in promoting emergent literacy and numeracy, and first and third grade reading and mathematics achievement will be examined using a retrospective longitudinal design. A series of hierarchical multiple regression analyses will examine the impact of antecedent, opportunity and child-level propensity factors on precursor reading and mathematics skills measured at the beginning of kindergarten, and reading and math achievement in first and third grade in models that also include previous achievement. The antecedent factors included in block one are SES, maternal age at first birth, single parent family (yes or no), parental educational expectations, cognitive stimulation (book reading), family violence (physical discipline and domestic violence), gestational age at birth, gender, ethnicity and home language. Center care and Head Start comprise the proposed opportunity factor entered in block two of the analyses. Block three consists of child-level propensities indexed by the approaches to learning scale and, in analyses examining grades one and three outcomes, previous reading and math achievement. These analyses will help to answer questions about for whom center care and Head Start may be a genuine opportunity to learn and enhance propensities to take advantage of subsequent learning opportunities. This will also help establish the utility of the O-P model in framing new questions about a range of children's experiences before beginning first grade and the short and long-term impacts on children's achievement.

Missing Data

Missing data are common in longitudinal research and may contribute to bias and misleading conclusions. *Wave nonresponse,* whereby study participants are available for some but not all rounds of data collection, is unavoidable in research requiring responses on multiple occasions. *Attrition*, a type of wave nonresponse, occurs when participants

become unavailable for all subsequent rounds of data collection. *Item nonresponse* occurs when participants fail to answer particular questions for reasons including fatigue, disinterest or the sensitive nature of the questions (e.g., income, sexuality, etc.) (Graham & Donaldson, 1993; Jelicic, Phelps & Lerner, 2009).

Missing data may assume one of three characteristic patterns, or *missingness mechanisms.* Data *missing completely at random* (MCAR) is a pattern of randomly distributed missingness. MCAR is the least likely missing data pattern. When data are MCAR, missingness is not related to the values of either the missing or measured variables. For example, items skipped accidentally by participants in a survey would produce a MCAR pattern (Schafer & Graham, 2003). Cases with missing data would not differ significantly from a sample of randomly selected cases drawn from the data set (i.e., would have homogeneous means and covariances) (Yuan, 2009). Data *missing at random* (MAR), on the other hand, are not related to the unmeasured values of missing data, but are related to one or more *auxiliary variables* (i.e., not of focal interest but related to the missingness pattern) (Schlomer, Bauman, & Card, 2010). For example, if a researcher was surveying high school students on their interest in team sports participation in relation to academic achievement, and noticed that females did not respond at the same rate as males to an item about participation in football, the pattern of missed responses would be MAR if missingness were randomly distributed for both males and females. That is, the missed item may be related to the auxiliary variable (gender) but not academic achievement or level of interest in team sports participation. Finally, data *not missing at random* (NMAR) is a pattern of missing data that is related to the value of the missed items (Schafer & Graham, 2003). To continue the example above,

if the surveyed high school students with relatively lower academic achievement skipped an item asking about grade point average, the missingness would not be random. In this case, the unmeasured value would be related to a variable of focal interest.

Missing data may pose serious threats to the validity of a study if ignored or addressed improperly. This is clearly problematic in clinical trials, where the reason for attrition may be closely related to the phenomenon under study (Schafer & Graham, 2002). However, longitudinal studies in education may be equally affected, and lead to misinterpretations of intervention effects and other relationships among covariates and outcomes. A number of strategies have been developed to minimize the impact of missing data on parameter estimates and study conclusions. The following section will provide an overview of these strategies.

Common missing data methods include deletion, nonstochastic imputation (mean and regression substitution), expectation maximization and multiple imputation. Deletion methods include *complete case analysis* (Pigott, 2001), or *listwise deletion,* in which only cases with complete data are included in analyses. Listwise deletion excludes all cases with missing values from all analyses. Complete case analysis assumes that missing data are MCAR, and that missingness in covariates is unrelated to the outcome variables. If data are not MCAR, and cases excluded differ from those retained, the resulting subsample is unlikely to be representative of all cases and analyses will be biased. Even in datasets with a MCAR mechanism, listwise deletion methods may reduce statistical power and raise the likelihood of Type II errors through smaller samples (Schlomer, Bauman, & Card, 2010). In contrast, *available case analysis* (Pigott, 2001) or *pairwise deletion,* maximizes the use of available data by excluding cases only when they are

missing observations on variables necessary for particular analyses. For example, univariate analyses (e.g., means, variances, etc.) are performed only on cases with complete observations on the variable of interest, and bivariate statistics (e.g., covariances, correlations, etc.) only on cases with complete observations on both variables of interest (Little & Rubin, 1989). In addition to reduced power, limitations of available case analysis include subsamples that contain different cases from one analysis to the next making it difficult to calculate standard errors, determine degrees of freedom and compare estimates (Schafer & Graham, 2002).

Nonstochastic imputation strategies replace missing values with probable substitute values based on observations. One of the most common is *unconditional mean substitution*. Unconditional mean substitution replaces the missing value with the mean calculated on the nonmissing values of the variable (Little & Rubin, 1989). *Conditional mean substitution* techniques such as nonstochastic regression substitution replace missing data by using nonmissing observations to predict an expected value (Dow & Eff, 2009). Nonstochastic imputation appears to overcome some of the limitations of deletion since all cases are retained and the same sets of units can be included in all analyses. While these approaches satisfactorily estimate means, they also constrict estimates of variability, may distort correlations and covariances, and lead to biased estimates unless data are MAR or MCAR (Schaffer & Graham, 2002).

Despite the limitations of deletion and nonstochastic imputation, these methods are still widely used in medical and psychological research. An examination of 100 studies testing multivariate survival models in seven peer reviewed cancer journals identified 81 studies with missing data. In only 32 of these 81 studies could the authors

identify the methods used to address missing data. For those studies reporting missing data approaches, listwise and pairwise deletion and single imputation were the approaches used (Burton & Altman, 2004). An examination of peer reviewed developmental psychology journals found that of 100 studies examined, the majority (82%) had missing data and used listwise and pairwise deletion (Jelicic, Phelps & Lerner, 2009). These findings suggest that researchers may not be aware of or adequately experienced using more principled methods that do not have the drawbacks of deletion and single imputation. Two of these methods will be discussed in the next section.

Expectation maximization (EM) and *multiple imputation* (MI) are two stochastic approaches to missing data that improve the accuracy of parameter estimates. The EM algorithm (Dempster, Laird, & Rubin, 1977) is a type of *maximum likelihood estimation* (MLE)., an approach to parameter estimation and inference that fits statistical models to data by estimating the parameter values that makes the observed values most likely (Myung, 2003). EM has two steps. The expectation step uses linear regression to impute a probable value predicted from observed covariate data. The maximization step recalculates the means, variances and covariances based on the observed and imputed values, and re-estimates the missing values calculated in the first step. The two steps are continued until the estimated values converge on an optimal set of substitute values that change only slightly through subsequent iterations (Little & Rubin, 1989; Schafer & Graham, 2002). MI, rather than converging on a single set of optimal values, generates several new data sets. Nonmissing observations are the same in each dataset. Substitute values for missing data are drawn randomly from distributions of plausible substitute values. Each data set contains slightly different substitute values. The differences and

similarities among substitute values converge on optimal substitute values while permitting calculation of standard errors that better capture uncertainty. The result is a less biased solution than is possible with a single set of imputed values (Jelicic, Phelps & Lerner, 2009; Widaman, 2006). Other strengths of MI include robustness to departures from normality and the capacity for valid solutions even when data missingness is nonignorable (i.e., data are not missing at random).

Due to the many advantages over other methods, MI is the best choice of method to address missing data in the present study. Review of the literature on missing data finds deletion strategies to be most problematic with a higher likelihood of biased estimates, reduced statistical power and Type II errors. Nonstochastic imputation methods, by constricting variability, distort bivariate statistics and introduce bias into derivative estimates unless data are MAR or MCAR. EM helps improve accuracy by re-calculating and finally converging on a best set of substitute values but overestimates the accuracy of substitute values and underestimates standard error (Acock, 2005). MI achieves both superior precision in calculating substitute values and variability with the least risk of introducing bias. MI is especially indicated in longitudinal studies with large numbers of variables because it is often difficult in such investigations to completely determine how missingness is related to all study variables (Widaman, 2006). However, SPSS does not combine the multiple estimates generated by MI procedures. For this reason, EM was selected as it produces one seta set with substitute values, eliminating the need to combine estimates. The following section will describe the EM procedures and other details of data preparation.

Data Preparation

   Expectation Maximization. EM was performed in *SPSS 18 Missing Values Analysis* to obtain maximum likelihood estimates of the unknown values. All continuous and categorical predictors and outcomes were included. After EM, analyses were performed on the new dataset that included substitute imputed values for the missing values. The exception was descriptive statistics. Descriptive values were based on pre-imputation values. Variables whose proportions of missingness were too large were either discarded (e.g., number of hours per week in early care and education programs), or combined to create new variables (e.g., *Hispanic* and *Other* ethnicity categories). Many variables have high proportions of planned missingness. After imputation was completed, zeros were entered into fields with planned missingness.

   Weights. The ECLS-K data set contains longitudinal weights to facilitate comparisons of children's development from one year to the next. Longitudinal weights were normalized by dividing individual longitudinal weights by their means. The parent panel weight *C124PWO* was used in all analyses.

CHAPTER 4

RESULTS

The results are organized into two main sections: In the first section, descriptive statistics on all study variables are presented. Analyses of the primary research questions are presented in the second section. In addition to reporting the results of the hierarchical multiple regression analyses for each question in section two, effects sizes will be reported using procedures outlined in Cohen (1992). The convention of indexing small, medium and large effects sizes by the values .02, .15 and .35, respectively, will be used throughout the discussion except where otherwise noted (Cohen, 1992). Finally, stepwise multiple regression will be performed for exploratory purposes to identify the predictors contributing the most variance to reading and math outcomes. These exploratory analyses will follow the results of hierarchical regression analyses of questions two through four.

In the interests of placing descriptive statistics within the content of general population values, descriptive statistics are supplemented by data from Census 2000 (U.S. Census Bureau, 2001, 2002) on gender, race, home language, poverty, center-based care and family structure. Information about Head Start enrollment was obtained from the U.S. Department of Health and Human Services (DHHS, 2002). Birth data were obtained from reports issued by the U.S. Department of Vital Statistics (2008). Additional information about parents' educational expectations and book reading to their children was obtained from the U.S. Census Bureau Survey of Income and Program Participation (SIPP, 2003). SIPP data are obtained using stratified random sampling, so the reported value is likely different from the population parameter. Inclusion of Census

Bureau and other supplemental data will not only place ECLS sample values in context, but also highlight discrepancies between sample and population values due to over-sampling of ECLS participants from racial and ethnic minority groups, and those living in poverty. All supplemental data are presented in the third column titled *Population.*

Descriptive Statistics

Tables 1, 2 and 3 present descriptive statistics on the predictor and outcome variables in the study. Information presented about frequencies and proportions of missing data is based on the sample values before imputation was performed. Note that many of the study questions have planned missingness (i.e., questions were not applicable such as that assessing the presence of prematurity). Where this is the case, zeros were entered in the final imputed data set. The first table displays information about antecedent f actors that serve as predictors in the hierarchical models. The second table displays information on opportunity factors. The third table describes reading, math and approaches to learning scores at fall kindergarten and spring first and third grade. Tables four through nine display zero-order correlations for predictors and outcomes.

A few caveats need to be noted. Some of the ethnicity categories with comparatively fewer frequencies had to be combined to facilitate expectation maximization. The categories (1) *Hispanic, Race Specified,* and (2) *Hispanic, Race Unspecified*, were combined to form one category (*Hispanic*). The categories (1) *Asian,* (2) *Native Hawaiian/Other Pacific Islander,* (3) *Native American/Alaska Native,* and, (4) *More Than One Race, Not Hispanic,* were also combined to form one category (*Other*). Due to the number of diverse cultural and language groups collapsed into the category

Other, and the impossibility of offering meaningful interpretations of findings related to this category, the values of the source variables will be included in Table I but will not be included in sections describing results of analyses.

Three categories of parenting behavior factors were collapsed after expectation maximization was performed. Each level of *parental expectations* (e.g., that child would achieve a Bachelor's degree, etc.), *frequency read to children* (e.g., daily, etc.) and *parental warmth* had been dummy coded prior to imputation. These variables were recoded and collapsed into their original ordinal scale using an SPSS syntax command. Values that had been imputed prior to recoding to ordinal scale variables could not be retained. For this reason, the *n* for analyses 3 through 8 is reduced from 15,491 to 15,164.

Lastly, the results of analyses that include Head Start attendance need to be interpreted with caution. Questions about Head Start attendance resulted in large amounts of missing data, planned and otherwise. Children who attended Head Start at any time during the preschool period were included in analyses of the relationship of Head Start and achievement. Due to the high proportion of missing data for the Head Start questions, planned and otherwise, it was not possible to impute values for data missing in response to questions asking for more specific information (e.g., whether the child attended the year before kindergarten, number of hours attended per week, etc.). Further, Head Start attendance is very likely to be confounded with poverty. Concerns with Head Start results will be discussed in more detail later in this chapter.

Table 1. *Antecedent Factors*

	Frequency	Percent	Sample-Population
Gender			
Males	7833	50.6%	49.1%[1]
Females	7647	49.4 %	50.9%
Missing (not ascertained/total)	11	0.1%	
Race & Ethnicity			
White	8645	55.8%	75.1%
Black	2164	14%	12.3%
Hispanic	2723	17.6	12.5%[2]
Asian	1020	6.6%	3.6%
Native Hawaiian, Pacific Islander	191	1.2%	0.1%
Native American or Alaska Native	289	1.9%	0.9%
More Than One Race, Non Hispanic	423	2.7%	2.4%
Missing (not ascertained/total)	36	.2%	
Single Parent Family			
Yes	3044	19.7%	28%[3]
No	11,094	71.6%	72%
Missing (system/total)	1354	8.7%	
Premature (born before 37 weeks gestation)			
Yes	958	6.2%	11.6%[4]
No	1369	8.8%	88.4%
Missing (system/total)	13,164	85.0%	
Home Language English			
Yes	12,854	83%	82%[5]
No	2061	13.3%	18%
Missing (not ascertained)	27	.2%	
Missing (system)	549	3.5%	
Missing (total)	576	3.7%	

[1] Population value is from Census 2000.

[2] Census 2000 race and ethnicity values for population do not add up to 100% due to the method used to collect information on Hispanic origin. Respondents who indicated Hispanic origin were asked to select one of the race/ethnicity categories (e.g., White, Two or more races, etc.).

[3] Population proportions from Census 2000 reference only households with children under 18 years. The proportion of families not headed by single parents in Census 2000 represents households with children under 18 headed by married parents.

[4] Population values for 2000 birth data were obtained from National Vital Statistics Reports (CDC, 2002).

[5] Population value is from Census 2000.

Table 1. *Antecedent Factors, continued*

	Frequency	**Percent**	**Sample**	**Population**
Cognitive Stimulation: Read to Child				
Not at all	160	1.0%	7.4% [6]	
Once or twice a week	2550	16.5%		
3 to 6 times per week	5104	32.9%	81%	
Everyday	6552	42.3%		
Missing (not ascertained)	8	.1%		
Missing (don't know)	15	.1%		
Missing (system)	1102	7.1%		
System (total)	1199	7.7%		
What Degree Expected of Child?				
Less than high school	35	.2%		
Graduate high school	1205	7.8%		
Two plus years college	2002	12.9%	14.2 [7]	
College degree	7406	45.5%	57.8	
Master's degree/equivalent	1921	12.4%		
M.D., Ph.D.	2083	13.4%		
Missing (not ascertained)	7	.0%		
Missing (don't know)	87	.6%		
Missing (refused)	3	.0%		
Missing (system)	1102	7.1%		
Missing (total)	1199	7.7%		
Often Have Warm, Close Time with Child				
Completely true	10,560	68.2%		
Mostly true	2911	18.8%		
Somewhat true	670	4.3%		
Not true at all	17	.1%		
Missing (not ascertained)	41	.3%		
Missing (don't know)	23	.1%		
Missing (refused)	20	.1%		
Missing (system)	1074	6.9%		
Missing (total)	1333	8.6%		

Income Below Poverty Threshold

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[6] Population percent is a U.S. Census Bureau Survey of Income and Program Participation sample value representing the proportion of children ages 3 to 5 years who were never read to, read to 3 or more times per week in 2000.

[7] Population percent is a U.S. Census Bureau SIPP sample value representing parental educational expectations of children under 18 years in 2000. An additional 28% of parents said that they expected their children to pursue education and training after college.

Table 1. *Antecedent Factors, continued*

	Frequency-Percent Sample-Population		
Yes	3,099	20%	11.3%
No	12,392	80%	88.7%
	Mean	**Range**	**SD**
Mother's age first birth	23.9	12-46	5.5
System missing - 1388 (9.0%)			
Number of times spanked in the last week	.51	0-10	1.0
Don't know - 44 (.3%)			
Refused - 31 (.2%			
Never - 2930 (18.0%)			
System missing- 1074 (6.9%)			
Total missing - 4121 (26.6%)			

Table 2. *Early Care and Education Opportunity Factors*

	Frequency-Percent of Sample-Population		

Descriptive Analyses: Opportunity Factors

Head Start

Yes	2220	14.3%	4.5%[8]
No	12,133	78.3%	95.5%
Missing (not ascertained)	14	.1%	
Missing (don't know)	21	.1%	
Missing (refused)	1	.0%	
Missing (system)	1102	7.1%	
Missing (total)	1138	7.3%	

Center Care (non-Head Start)

Yes	8402	54.2%	18.9%[9]
No	1204	7.8%	78.1%
Missing (not ascertained)	15	.1%	
Missing (don't know)	5	.0%	
Missing (not applicable)	4763	30.7%	
Missing (system)	1102	7.1%	
Missing (total)	5885	38%	

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[8] Percent represents proportions of all children under age 5 years participating in Head Start in 2000. This value was derived from total U.S. Head Start enrollment for federal fiscal year 2000 and Census 2000 values for total population under age 5 years (DHHS, 2004).

[9] Percent represents proportions of all children under age 5 years participating in center care in 1999.

Table 3. *Propensity Factors*

	Mean	Range	SD
Fall Kindergarten			
Reading IRT score	29.6	14.8 – 124	10
Missing (not ascertained) – 33 (.2%)			
Missing (not applicable) – 1144 (7.4%)			
Missing (system) – 313 (2.0%)			
Missing (total) – 1490 (9.6%)			
Math - IRT score	22.9	7.5 -88.7	8.9
Missing (not ascertained) – 358 (2.3%)			
Missing (not applicable) – 318 (2.1%)			
Missing (system) – 676 (4.4%)			
Approaches to learning	3.0	1 – 4	.67
Missing (total) – 369 (2.4%)			
Spring First Grade			
Reading – IRT score	71.89	19.26 – 163.12	22.36
Missing (not ascertained) - 834 (5.4%)			
Missing (not applicable) - 279 (1.8%)			
Missing (total) – 1113 (7.2%)			
Math - IRT score	57.65	10.92-120.50	16.86
Missing (not ascertained) – 831 (5.4%)			
Missing (not applicable) – 30 (.2%)			
Missing (total) – 861 (5.6%)			
Approaches to learning	3.05	1 – 4	.70
Missing (total) - 2241 (14.5%)			
Spring Third Grade			
Reading – IRT score	118.39	45.51-178.92	24.95
Missing (not ascertained) – 8 (.1%)			
Missing (not applicable) – 279 (8.1%)			
Missing (system) – 826 (5.3%)			
Missing (total) – 1113 (7.2%)			
Math - IRT score	92.39	32.11-146.59	21.46
Missing (total) – 2878 (18.6%)			
Approaches to learning	3.06	1 – 4	.68
Missing (total) – 5184 (33.5%)			

Table 4. *Correlations - Predictors and Outcomes*						
	K Reading	**1st Reading**	**3d Reading**	**K Math**	**1st Math**	**3d Math**
Male	-.056**	-.074**	-.086**	.023**	.052**	.094**
Maternal Age	.320**	.290**	.340**	.337**	.295**	.329**
Single Parent	-.137**	-.156**	-.188**	-.170**	-.167**	-.186**
Premature	-.033**	-.043**	-.022**	-.041**	-.039**	-.033**
Home English	.174**	.140**	.156**	.184	.125	.107
SES	.400**	.370**	.428**	.435**	.381**	.407**
DV	-.042**	-.046**	-.069**	-.047**	-.042**	-.055**
White	.217**	.211**	.298**	.291**	.281**	.298**
Black	-.087**	-.124**	-.199**	-.155**	-.205**	-.249**
Hispanic	-.201**	-.153**	-.167**	-.219**	-.146**	-.133**
Other	.012	.003	-.036**	-.009	-.026**	-.016*
Spank Child	.066**	-.080**	-.104**	-.077**	-.082**	-.095**
Frequency Read	.190**	.179**	.193**	.187**	.157**	.186**
Parental Warmth	.035**	.023**	.039**	.037**	.035**	.027**
Parental Expect	.130**	.136**	.137**	.126**	.110**	.122**
Head Start	-.186**	-.191**	-.235**	-.211**	-.197**	-.243**
Center Care	.131**	.123**	.136**	.137**	.118**	.143**
Approaches	.365**	380**	.400**	.409**	.392**	.382**

*p < .05, **p < .01.

Table 5. *Correlations - Opportunity Factors*

	Head Start	**Center Care**
Head Start	1.00	-.326**
Center care	-.326**	1.00

*p < .05, **p < .01.

Table 6. *Correlations - Opportunity Factors and SES*

	SES
Head Start	-.301**
Center care	.188**

*p < .05, **p < .01.

Table 7. *Correlations - Outcomes and Approaches to Learning*

	Approaches	K Reading	1st Reading	3d Reading	K Math	1st Math	3d Math
Approaches	1.00	.365**	.380**	.400**	.409**	.392**	.382**
K Reading		1.00	.688**	.577**	.729**	.565**	.538**
1st Reading			1.00	.751**	.659**	.677**	.642**
3d Reading				1.00	.638**	.661**	.747**
K Math					1.00	.726**	.688**
1st Math						1.00	.783**
3d Math							1.00

*p < .05, **p < .01.

Table 8. *Correlations - Antecedent and Opportunity Factors*

	Head Start	Center Care
Male	-.008	.009
Maternal age	-.273**	.191**
Single parent family	.208**	-.099**
Home language	-.050**	.009
Socioeconomic status	-.301**	.188**
Premature	.020*	-.062**
Domestic violence	.017*	-.013
White	-.253**	.108**
Black	.242**	-.102**
Hispanic	.068**	-.102**
Other	.038**	-.030**
Spank child	.080**	-.027**
Frequency read to child	-.097**	.058**
Parental warmth	-.026**	.019*
Parental expectations	-.063**	.041**

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

Table 9. *Correlations - SES and All Other Antecedent Factors*

	SES
Male	.000
Maternal age	.504**
Single parent family	-.221**
Home language	.200**
Premature	.000
Domestic violence	-.066**
White	.296**
Black	-.171**
Hispanic	-.239**
Other	.033**
Spank child	-.108**
Frequency read to child	.256**
Parental warmth	.042**
Parental expectations	.228**

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

Kindergarten Reading and Math

To address the first research question of whether children's emergent reading and math skills at the start of kindergarten would be associated with the presence of risk exposures, and whether the predictive relationship would be attenuated by controlling for ethnicity, home language and gender, two hierarchical multiple regression analyses were performed. In these analyses, the following antecedent factors were entered in the first block: SES, mother's age at first birth, single parent family status (yes or no), number of times the child was spanked in the past week, exposure to domestic violence (yes or no), and prematurity (yes or no). In order to determine whether ethnicity, gender and home language would attenuate the relationship of family variables, premature birth and outcomes, these additional antecedent factors were entered in the second block.

Antecedent Factors and Kindergarten Reading. Inspection of Table 4 covariate values shows that SES, gender, mother's age at first birth, single parent family, number of times spanked in the past week, birth before 37 weeks gestation, the ethnicity categories Black and Hispanic, and home language English were all significant predictors of fall kindergarten emergent reading achievement. Children from higher SES backgrounds, who used English at home and whose mothers were relatively older tended to have higher reading achievement at the start of kindergarten. Children from single parent families, who were spanked relatively more frequently, and who were Black, Hispanic, male and who were born before 37 weeks gestation tended to have lower reading achievement.

Block one antecedent factors (excluding ethnicity, gender and home language) explained 18.1% of the total variance in fall kindergarten reading achievement. Cohen's

f² was calculated resulting in an effect size of .22, placing the strength of the observed

relationships in the medium range. After entering ethnicity, gender and home language

in the second block, the total variance explained by the model was increased to 20%, F

$(11, 15,479) = 351.688, p < .001$. By including ethnicity, gender and home language, the

proportion of variance explained by the final model increased by an additional .19%. In

order to determine the magnitude of the R² change, Cohen's f² was calculated. The

obtained value of f² = .02 places the magnitude of differences between the variance

contributed by the first block of antecedent factors and that contributed by the second in

the small range. Using Cohen's *naked eye of a careful observer* standard (Cohen, 1992),

the two reported effect sizes suggest that an observer would be very likely to see

differences in emergent reading skills based on SES, mother's age at first birth, single

parent family status, number of times the child was spanked in the past week and birth

before 37 weeks gestation, but would be less likely to detect differences based on gender,

home language and ethnicity.

    Antecedent Factors and Kindergarten Math. In order to determine whether risk

exposures would predict fall kindergarten math scores, and whether gender, home

language and ethnicity would attenuate the relationships of other antecedent factors and

children's outcomes, hierarchical multiple regression was performed using the model

described above. The results of the hierarchical multiple regression analysis of fall

kindergarten math achievement closely follow the pattern of kindergarten reading results.

SES, gender, mother's age, single parent family, the number of times spanked in the past

week, birth before 37 weeks gestation, the ethnicity categories Black and Hispanic, and

home language English all contributed significant variance to fall kindergarten math

achievement. Children tended to have higher math achievement when they come from higher SES backgrounds, were male, had mothers who are older, and spoke English at home. Children tended to have poorer math achievement when they were from single parent families, were Black and Hispanic, were spanked relatively more frequently, and were born before 37 weeks gestation.

The variance in fall kindergarten math scores explained by block one antecedent factors was 21.3%. The effect size based on Cohen's f² was .27, placing the strength of the relationships between the antecedent factors and emergent math in the medium to high range. Including ethnicity, gender and home language in block 2 of the model increased the proportion of variance explained to a total of 24%, F (11, 15,479) = 443.461, p <.001, an increase of .027% (see Table 5). The magnitude of the R² change was determined by again calculating Cohen's f². The obtained value of f² was .034, placing the magnitude of differences between the variance contributed by the first block and that contributed by the second in the low range range. As found with kindergarten reading, a careful observer would be likely to see differences in children's emergent math achievement measured at the start of kindergarten based on SES, mother's age at first birth, single parent family status, number of times the child was spanked in the past week and birth before 37 weeks gestation, but unlikely to find differences based on gender, home language and ethnicity.

To address the second through fourth research questions of whether children who have risk exposures would have higher levels of emergent reading and math skills at the start of kindergarten when they attended center care or Head Start, and whether children's cognitive self-regulation skills indexed by the Approaches to Learning Scale would

predict fall kindergarten reading and math scores, another set of two hierarchical multiple regression analyses were performed. Following the logic of the O-P model, antecedent factors were entered in the first block as these factors precede exposure to opportunities and emergence of child-level propensities. The antecedent factors, as noted above, included a range of family variables: SES, home language English, ethnicity, whether or not the family is headed by a single parent, frequency the child was spanked in the past week, exposure to domestic violence, child's gender plus gestational age at birth. The second set of analyses also examined the relationships of book reading to children, parents' expectations of their children's educational achievement and parental warmth to outcomes.   These parenting factors were included in block 1. Opportunity factors occurring during the preschool period (center care and Head Start), were entered as predictors in the second block. Propensity factors indexed in the Approaches to Learning Scale were entered in the third block. This scale includes items accessing attentiveness, task persistence, organization, learning independence, flexibility and eagerness to learn (NCES, 2006). According to the logic of the O-P model, genuine opportunities would help foster propensities to learn and chronologically precede, or be coincident with, children's participation in cognitive assessments.

Table 10. *Factors Predicting Fall Kindergarten Reading (N = 15,491)*

Variable	B	SE B	Beta
Block 1			
Maternal age	.270	.015	.149***
Single parent family	-.896	.182	-.038***
Socioeconomic status	3.904	.122	.278***
Premature	-1.289	.272	-.034***
Domestic violence	-.352	.310	-.008
Spank child	-.241	.100	-.018*
Block 2			
Home language English	2.115	.270	.070***
Male	-1.062	.141	-.054***
Black	-.555	.220	-.021*
Hispanic	-2.051	.234	-.818***
Other	-.134	.279	-.004

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

Table 11. *Factors Predicting Fall Kindergarten Math (N = 15,491).*

Variable	B	SE B	Beta
Block 1			
Maternal age	.214	.013	.132***
Single parent family	-.911	.158	-.044***
Socioeconomic status	3.751	.106	.299***
Premature	-1.447	.236	-.043***
Domestic violence	-.320	.269	-.008
Spank child	-.254	.087	-.021**
Block 2			
Home language English	1.728	.235	.024***
Male	- 2.319	.191	-.096***
Black	-2.319	.182	-.074***
Hispanic	-2.699	.203	-.120***
Other	-1.378	.243	-.042***

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

Opportunities, Propensities and Fall Kindergarten Reading. Inspection of the covariate values in Table 6 finds that SES, mother's age at first birth, single parent family status, home language English, gestational age at birth and the ethnicity category Hispanic contribute significant variance to children's emergent reading achievement. Among the parenting behaviors entered with antecedent factors in the first block, parents' expectations of relatively higher academic achievement and more frequent book reading to children were significant predictors. Both early care and education opportunity factors were significant. Child-level propensities to take advantage of learning opportunities indexed by the Approaches to Learning Scale also contributed significant variance to fall kindergarten emergent reading achievement. This analysis finds that children entered fall kindergarten with higher emergent reading achievement when they were from relatively higher socioeconomic backgrounds, had parents with higher educational expectations of their children, were read to relatively more frequently, had mothers who were relatively older, used English at home, attended center care and had higher levels of propensities to learn as indexed by the Approaches to Learning Scale (attentiveness, task persistence, etc.). In contrast, children from single parent families who were born before 37 weeks gestation, who were spanked relatively more frequently, who were Hispanic, and who attended Head Start tended to have lower reading achievement.

The total variance in fall kindergarten reading achievement explained by the antecedent factors in block 1 was 20.6%. After entering early care and education opportunity factors (Head Start and center care), the total variance explained by the model was 20.9%, an increase of .3%. At step 3, child-level propensity factors indexed by the approaches to learning scale were entered. With the inclusion of approaches to

learning in block 3, the total variance in fall kindergarten reading achievement explained by the model increased to 27.9%, F (17, 15,147) = 343.999, p <.001. By including the propensity indices, the proportion of variance explained by the final model increased by an additional .7% (see Table 6). The effect size calculated with the R^2 value for block 1 antecedent factors was .26, placing the strength of relationships among the predictors and children's fall kindergarten reading in the medium to high range. Cohen's f^2 was next calculated to examine the magnitude of differences between the three obtained R^2 values. The f^2 value calculated based on the R^2 difference between blocks 1 (antecedent) and 2 (opportunity) = .003, placing the magnitude of differences in the very low range. Likewise, the f^2 value calculated using the R^2 values for blocks 2 and 3 (propensity) = .09, an effect size in the low to medium range. Thus, a careful observer is likely to find differences in emergent reading skills based on demographic and other background characteristics, but not based on exposure to center care and Head Start and propensities to learn measured at the start of kindergarten.

For exploratory purposes, a stepwise multiple regression analysis was performed to identify the factors contributing the highest amounts of variance to fall kindergarten reading. All of the 11 models constructed by SPSS reached significance ($p < .000$). For this reason, effect sizes were calculated to determine the magnitude of the R^2 changes. In the first model, SES was identified as the factor contributing the most variance to children's fall reading (f^2 = .18) with an effect size in the medium range. In the second, children's approaches to learning was identified as the next factor with the strongest association to kindergarten reading (f^2 = .09), with an effect size in the low to medium

range. Thereafter, additional predictors had small effect sizes falling below .02 and

unlikely to be visible to the careful observer (Cohen, 1992).

One caveat regarding exposure to opportunity factors was explored. Head Start is

a program intended to serve primarily children living in poverty. For this reason, it may

be assumed that poverty and Head Start attendance would be confounded. However,

previous research has confirmed that substantial numbers of nonpoor children are also

admitted due to statutory exceptions (e.g., children who are in foster care, who are

enrolling for a subsequent year, etc.) and a variety of other reasons (Besharov & Morrow,

2007). In order determine the degree and strength of association between poverty and

Head Start attendance in present sample, a phi coefficient was performed. The analysis

found a significant association between income poverty status and Head Start attendance,

$phi = .28,\ n = 15,492, p < .000$. The phi coefficient also serves as a measure of effect

size, and places the magnitude of the relationship between income poverty and Head Start

attendance close to the medium range as defined by Cohen (1988) for product moment

correlations (.10 for small, .30 for medium and .50 for large effect sizes). For this reason,

the ability to interpret the relationship of Head Start and reading and math achievement

may be limited even with SES controlled. The implications of confounded Head Start

attendance and poverty for will be presented in the next chapter.

Table 12. *Opportunity Factors Predicting Fall Kindergarten Reading (N = 15,164).*

Variable	*B*	*SE B*	*Beta*
Block One			
Male	-.095	.139	.005
Maternal age	.205	.015	.113***
Single parent family	-.352	.178	-.015*
Home language English	2.077	.266	.068***
Socioeconomic status	3.039	.124	.216***
Premature	-.716	.263	-.019**
Domestic violence	-.002	.300	.000
Black	.002	.219	.000
Hispanic	-2.027	.227	-.080***
Other	.229	.272	.006
Spank child	-.046	.097	-.003
Frequency read to child	.669	.091	.054***
Parental warmth	.063	.123	.004
Parental educational expectations	.403	.065	.046***
Block 2			
Head Start	-.652	.203	-.025***
Center care	.790	.209	.028***
Block 3			
Approaches to learning	4.101	.107	.279***

*p < .05. **p < .01. ***p < .001

Table 13. *Opportunity Factors Predicting Fall Kindergarten Math (N = 15,165).*

Variable	B	SE B	Beta
Block One			
Male	1.668	.118	.095***
Maternal age	.153	.013	.095***
Single parent family	-.368	.151	-.017*
Home language English	1.867	.226	.068***
Socioeconomic status	2.966	.105	.236***
Premature	-.846	.223	-.025***
Domestic violence	-.003	.255	.000
Black	-1.821	.186	-.075***
Hispanic	-2.631	.193	-.117***
Other	-1.104	.231	.033***
Spank child	-.060	.082	-.005
Frequency read to child	.354	.077	.032***
Parental warmth	.174	.105	.011
Parental educational expectations	.392	.055	.050***
Block 2			
Head Start	-.499	.172	-.022**
Center care	.500	.177	.020**
Block 3			
Approaches to learning	4.351	.091	.333***

*p < .05. **p < .01. ***p < .001

Opportunities, Propensities and Fall Kindergarten Math. Consistent with previous analyses of emergent cognitive skills at the beginning of kindergarten in the present study, SES, single parent family status, home language English, mother's age at first birth, child's birth before 37 weeks gestation, ethnicity categories Black and Hispanic and gender contributed significant variance to fall kindergarten math achievement. Frequency of reading to children and parental expectations of children's academic achievement were also significant antecedent factors. Center care, Head Start and Approaches to Learning also contributed significant variance. Overall, the final model for fall kindergarten math finds that children entered fall kindergarten with higher emergent math achievement when they were from relatively higher socioeconomic backgrounds, were male, had parents with higher educational expectations, had mothers who were relatively older, used English at home and attended center care. Children had lower emergent kindergarten math achievement when they were from single parent families, were born before 37 weeks gestation, were Hispanic, Black, and attended Head Start.

The total variance in fall kindergarten math achievement explained by the antecedent factors was 24.5%. After entering early care and education opportunity factors (Head Start and center care), the total variance explained by the model was 24.7%, an increase of .2%. At step 3, child-level propensity factors indexed by the approaches to learning scale were entered. With the inclusion of approaches to learning in block 3, the total variance in fall kindergarten reading achievement explained by the

model was 34.6%, F (17, 15,147) = 332.778, $p <.001$. By including the Approaches to Learning, the proportion of variance explained by the final model increased by an additional .98%. See Table 7.

As indicated by the differences in proportions of variance explained by the blocks of antecedent, opportunity and propensity factors (24.5%, 24.7% and 34.6%, respectively), children achieved most in first grade when they brought higher levels of characteristics such as attentiveness and persistence (as measured by the Approaches to Learning Scale) to fall kindergarten. Opportunities contributed significantly but in much smaller proportions than propensities.

Cohen's f^2 calculated on the R^2 value for block 1 antecedent factors was 32.4, a value bordering on the high range. However, the f^2 value calculated for the R^2 difference between antecedent and opportunity factors was .002, placing the magnitude of these differences in the very low range. Cohen's f^2 value calculated for the opportunity and propensity factors was .15 and in the medium range of magnitude. Therefore, a careful observer, such as a teacher, would be likely to see differences in emergent math achievement based on the antecedent factors (e.g., SES, ethnicity, etc.), and child-level propensities to take advantage of learning opportunities, but not based on early care and education opportunity factors. Once children are in first and third grades, the effect size values for children's propensities to learn begin to rise to very high levels that would be visible to a careful observer. These findings will be presented in the sections to follow addressing the third and fourth research questions.

An exploratory stepwise multiple regression analysis was performed to identify the factors contributing the highest amounts of variance to fall kindergarten math. As was found for reading, each of the 14 models constructed by SPSS reached significance ($p < .000$). In order to determine the strength of the relationship between the predictors identified in the models and math outcomes, Cohen's f^2 was calculated. SES was identified in the first model as the factor contributing the most variance to children's fall reading ($f^2 = .23$) with an effect size in the medium to high range. In the second, children's approaches to learning was identified as the factor with the next strongest association to kindergarten reading ($f^2 = .16$), with an effect size in the medium range. Thereafter, additional predictors had small effect sizes falling at .02 or below, unlikely to be visible to the careful observer.

To address the third and fourth research questions of whether children's reading, math and approaches to learning scores in fall kindergarten predict their spring first and third grade reading and math achievement, four hierarchical multiple regression analyses were performed. These analyses included antecedent factors as in the previous analyses, and early care and education opportunity factors (center care and Head Start) in addition to child-level propensities measured in fall kindergarten (reading, math and approaches to learning).

First and Third Grade Reading

Spring first grade reading. Antecedent factors (family variables, gender and gestational age at birth) were entered in block 1, early care and education opportunity factors (center care and Head Start) in block 2, and child-level propensity factors (fall kindergarten reading and approaches to learning) in block 3. The antecedent factors SES,

mother's age, single parent family, home language English, child's birth before 37 weeks gestation, Black ethnicity, frequency of book reading and parental educational expectations contributed significant variance to spring first grade reading. Center care and Head Start significantly predicted reading scores. Both propensity factors (fall kindergarten reading and approaches to learning) also contributed significant variance. In general, children had higher spring first grade reading achievement when they came from higher SES families, had relatively older mothers, used English at home, were read to relatively more frequently, started kindergarten with higher reading and Approaches to Learning scores, and had parents with higher academic expectations of their children. Conversely, children tended to have poorer spring first grade reading when they were from single parent families, were born before 37 weeks gestation, were Black, and attended Head Start (see Table 8).

The total variance in spring first grade reading achievement explained by the antecedent factors was 18%. Opportunity factors hypothesized to enable child-level propensities entered in block 2 (Head Start, center care) increased the total variance explained by the model to18.3%, an increase of .3% over the variance explained by the antecedent factors alone. With the inclusion of propensity indices in block 3, the total variance in spring first grade reading achievement explained by the model was 50.6%, F (18, 15,146) = 863.081, p <.001. By including the propensity indices, the proportion of variance explained by the final model increased by an additional 32.3%.

The magnitude of the block 1 R^2 and the R^2 changes after entering opportunity and propensity factors were calculated using Cohen's f^2. Based on the R^2 value for the antecedent factors, f^2 = .219, the effects size was in the medium to high range. The f^2

values based on the difference between the R² values for block 1 antecedent and block 2

opportunity factors, f² = .004, placing the magnitude of differences in the very small

range. This means that a careful observer, such as a teacher, would be likely to note

differences in children's first grade reading achievement based on the antecedent factors

but not based on children's exposure to center care and Head Start. However, the

obtained f² of .65 based on the R² values for opportunity and propensity factors places the

magnitude of differences in the very high range. An effect size of this magnitude suggests

that the observer would be highly likely to notice differences in first grade reading

achievement based on children's fall kindergarten reading achievement and Approaches

to Learning scores.

     An exploratory stepwise multiple regression analysis was performed to identify

the factors contributing the highest amounts of variance to spring first grade reading

achievement. SPSS constructed 12 models, each significant ($p < .001$). In contrast to the

previous stepwise analyses, fall kindergarten reading was identified in the first model as

the factor associated with the most variance in children's spring first grade reading (f² =

.90), with an effect size in the very high range. In the second model, children's

approaches to learning was identified as the factor with the next strongest association to

first grade reading (f² = .037), with an effect size in the low range. Thereafter, additional

predictors beginning with SES had miniscule effect sizes falling at .004 and below, and

would likely not be visible to the careful observer. This analysis suggests that once

children are exposed to first grade reading instruction, child-level characteristics, and not

antecedent background factors, have the strongest relationship with children's reading

development.

Spring third grade reading. The model for third grade reading had the same antecedent, opportunity and propensity factors as the first grade model. Antecedent factors (family variables, gender and premature birth) were entered in the first block, center care and Head Start in the second, and fall kindergarten reading and approaches to learning in the third block. Inspection of the final model for spring third grade reading finds that most of the antecedent factors entered in the first block were significant predictors of spring third grade reading achievement. As in previous analyses of reading achievement, children from relatively higher socioeconomic backgrounds, who were female, whose parents had higher educational expectations of their children, who were read to more frequently, whose mothers were relatively older, who began kindergarten with higher emergent reading and Approaches to Learning scores and whose home language was English tended to have higher third grade reading achievement. In contrast, children from single parent families who attended Head Start, who were born before 37 weeks gestation, who were Black, Hispanic, male, exposed to domestic violence and whose parents spanked relatively more frequently tended to have lower reading achievement.

The total variance in spring third grade reading achievement explained by the antecedent factors was 25%. After entering early care and education opportunity factors, the total variance explained by the model was 25.4%, an increase of only .4% over the variance explained by the antecedent factors. With the inclusion of propensity indices, the total variance in spring third grade reading achievement explained by the model was 44.1%, F (18, 15,146) = 665.063, p <.001, an increase of 18.7% (see Table 8). These findings suggest that children achieved most in third grade when they brought higher

levels of early reading skills and characteristics such as attentiveness and persistence (as measured by the Approaches to Learning Scale) to fall kindergarten. While SES, ethnicity and gender were significant predictors of kindergarten achievement, the pathway through child-level propensity factors in their analysis was the most significant and directly linked children's achievement to SES and parental expectations.

In the present analysis, opportunities contributed significantly to variance in children's spring third grade reading scores, but in much smaller proportions than propensities. In order to determine the magnitude of the variance contributed by the antecedent factors, and of differences between the variance contributed by antecedent, opportunity and propensity factors, Cohen's f^2 was calculated. The f^2 calculated based on the R^2 values for antecedent factors was .33, an effect size bordering on the large range. This finding suggests that an observer would be highly likely to discern differences in children's third grade reading achievement based on differences in SES, family structure, prematurity, maternal age, and exposure to family violence (DV and spanking). The f^2 obtained for the R^2 difference between antecedent and opportunity factors was 005, placing the magnitude of differences in the very small range and suggesting that differences in children's achievement based on opportunities would likely not be detected. However, the effect size calculated using the R^2 values for the propensity factors was .33, placing the magnitude of differences between the variance contributed by opportunity factors and variance contributed by propensity factors in the borderline high range. These findings suggest that an observer would be highly likely to detect differences in third grade reading achievement based on antecedent and propensity factors only.

Exploratory stepwise multiple regression analysis was again performed to identify the factors contributing the highest amounts of variance to spring third grade reading achievement. SPSS constructed 15 models, each of them significant ($p < .000$). Fall kindergarten reading was again identified in the first model as the factor associated with the highest amount of variance in children's 3d grade reading ($f^2 = .50$), with an effect size in the very high range. In the second model, SES was identified as the factor with the next strongest association to kindergarten reading ($f^2 = .07$), with an effect size in the low to medium range. The third model identified fall kindergarten approaches to learning as the factor with the next strongest association to spring 3d grade reading, with an effect size of .06, in the low to medium range. Thereafter, additional predictors beginning with had small effect sizes falling at .02 and below, and would likely not be visible to the careful observer.

Spring First and Third Grade Math

Spring first grade math. The model for spring first grade math follows the previous examples. Among antecedent factors entered in the first block, child's gender, SES, and ethnicity categories Black and Hispanic were significant predictors of spring first grade math achievement. Neither of the early care and education opportunity factors predicted first grade math achievement. However, fall kindergarten math and approaches to learning scores were significant predictors. Overall, children from higher socioeconomic backgrounds, who were male, and who started kindergarten with relatively higher math and Approaches to Learning scores tended to have higher first grade math achievement. Children tended to have lower math achievement when they were Hispanic and Black. Block 1 antecedent factors contributed 19.9% of the variance

to spring first grade math achievement. Block 2 opportunity factors added .01% additional variance to bring the total variance accounted for to 20%. Child-level propensity factors added an additional 35.3 percent to the explained variance bring the total to .553, $F(18, 15,146) = 1042.202$, $p < .001$.

To determine the magnitude of R^2 values due to the association of antecedent, opportunity and propensity factors to outcomes, Cohen's f^2 was again calculated. The effect size calculated using the R^2 values for antecedent factors was .25, an effect size in the medium to high range. The f^2 calculated based on variance contributed by opportunity factors was .001, placing the magnitude of differences in the very small range. However, the f^2 calculated based on the contribution of propensity factors was .79, placing the magnitude of differences between the variance associated with opportunity factors and the variance associated with propensity factors in the very high range. These findings suggest that an observer would be very likely to detect differences in spring first grade math achievement based on antecedent and propensity factors, but would be unlikely to see differences in children's first grade math achievement based on opportunity factors.

Exploratory stepwise multiple regression analysis resulted in 7 statistically significant models ($p < .000$). Fall kindergarten math was identified in the first model as the factor associated with the most variance in children's spring first grade math

achievement (f^2 = .90), with an effect size in the very high range. In the second model,

children's approaches to learning was identified as the factor with the next strongest

association to first grade reading (f^2 = .02), with an effect size in the low range.

Thereafter, additional predictors beginning with SES had miniscule effect sizes falling at

.015 and below, and would be unlikely to be noticed by an observer.

Spring third grade math. As before, antecedent factors (family variables, gender

and premature birth) were entered in the first block, early care and education opportunity

factors (center care and Head Start) in the second and child-level propensity factors (fall

kindergarten math and Approaches to Learning scores) in the third block. Examination

of Table 8 covariate values confirms that children from higher socioeconomic

backgrounds, who were male, who had relatively older mothers and whose parents had

relatively higher educational expectations of their children tended to have higher third

grade math achievement. Children tended to have lower math achievement when they

were female, Black, Hispanic, were exposed to domestic violence, and attended Head

Start.

The total variance in spring third grade math achievement explained by the

antecedent factors was 23.9%. Opportunity factors hypothesized to enable child-level

propensities (Head Start, center care) were entered at step two, bringing the total variance

explained by the model to 24.4%, an increase of .5% over the variance explained by the

antecedent factors alone. At step 3, child-level propensity factors were entered (fall

kindergarten math and approaches to learning scores). With the inclusion of propensity

indices, the total variance in spring third grade math achievement explained by the model

was 52.9%, F (18, 15,146) = 946.754, p <.001. By including the propensity indices, the proportion of variance explained by the final model increased by an additional 28.5%.

The Cohen's f² based on the R² for antecedent factors was .31, an effect size in the medium to high range. For opportunity factors, the f² was .007, placing the magnitude of differences in the very small range. The f² calculated using the R² values for the propensity factors was .60, placing the magnitude of differences between the variance contributed by opportunity factors and variance contributed by propensity factors in the very high range. Once again, these findings suggest that an observer would be highly likely to detect differences in third grade math achievement based on antecedent and propensity factors, but would be unlikely to see differences based on exposure to opportunities.

A final exploratory stepwise multiple regression was conducted, resulting in 10 significant models (p <.001). Kindergarten math was identified in the first model as the factor associated with the most variance in spring 3d grade math. The effect size was .90, in the very high range. The second model identified Black ethnicity as the factor with the next strongest association with spring 3d grade math. The effect size for this factor was .04, in the low range suggesting that an observer would be unlikely to notice differences in children's 3d grade math achievement based on the presence of Black ethnicity. Subsequent models identified factors with effect sizes of .02 and lower. It is noteworthy that across all models generated in the stepwise multiple regression analyses, antecedent and propensity factors were consistently identified as having the strongest relationships with children's outcomes. These findings are consistent with those resulting from the hierarchical regression analyses.

The fifth and final research question concerns risk-exposed children who experienced a positive impact of center care and Head Start on first grade reading and math, and whether or not parenting factors such as parental educational expectations of their children's educational achievement, book reading and other parenting behaviors would be related to a sustained positive impact of center care on third grade achievement. This research question attempts to capture the interaction of formal educational opportunities and children's experiences in their homes. As shown in Table 8, controlling for exposure to risks such as single parent family, birth before 37 weeks gestation, and so on, as well as parenting behaviors hypothesized to be protective (e.g., higher educational expectations, more frequent book reading, etc.), center care was not associated with higher reading and math achievement in either first or third grade as it was in fall kindergarten. Head Start was associated with poorer reading and math achievement at all assessment points even after controlling for SES, family structure and other antecedent factors. This latter finding will be discussed at greater length in the chapter to follow.

Table 14. *Factors Predicting Spring First and Third Grade Reading (N = 15,165).*

Variable	Spring First Grade			Spring Third Grade		
	B	*SE B*	*Beta*	*B*	*SE B*	*Beta*
Block One						
Male	-.489	.2654	-.011	-1.223	.315	-.024***
Maternal age	.077	.029	.095***	.248	.034	.053***
Single parent	-1.089	.337	-.020***	-1.124	.402	-.019**
Home English	1.785	.504	.025***	3.029	.603	.038***
SES	2.140	.239	.066***	5.222	.285	.144***
Premature	-1.400	.223	-.025***	.452	.595	.005
DV	-.625	.568	.006	2.268	.678	-.020***
Black	-1.888	.414	-.030***	-7.690	.495	-.110***
Hispanic	-.307	.431	-.005	-3.146	.515	-.048
Other	-.589	.514	-.007	-5.662	.615	-.059***
Spank child	-.354	.083	-.011	-.701	.219	-.020***
Frequency read	.469	.173	.017**	.398	.207	.012
Warmth	-.418	.233	.010	.246	.279	.00
Parental ex.	.617	.124	.031***	.783	.148	.035***
Block 2						
Head Start	-1.263	.349	-.021***	-2.329	.459	-.035***
Center care	.211	.395	.593	.150	.471	.002
Block 3						
Approaches	4.385	.212	.131***	6.968	.254	.185***
K Reading	1.336	.015	.584***	1.004	.018	.391***

*p < .05. **p < .01. ***p < .001

Table 15. *Factors Predicting Spring First and Third Grade Math (N = 15,165).*

Variable	Spring First Grade			Spring Third Grade		
	B	*SE B*	*Beta*	*B*	*SE B*	*Beta*
Block One						
Male	2.153	.189	.064***	4.662	.249	.107***
Maternal age	.037	.020	.012	.149	.027	.038***
Single parent	.124	.240	.003	.207	.316	.004
Home English	-.264	.359	-.005	-.873	.473	-.013
SES	1.514	.171	.063***	2.589	.225	.084***
Premature	-.467	.354	-.007	-.204	.467	-.002
DV	-.127	.404	-.002	-1.278	.532	-.013*
Black	-3.951	.295	-.085***	-7.044	.389	-18***
Hispanic	-.639	.308	-.015*	-.951	.405	-.017*
Other	-2.326	.366	.036***	-2.492	.482	-.030
Spank child	-.168	.130	-.007	-.330	.172	-.011
Frequency read	-.080	.123	-.004	.115	.162	.004
Warmth	.222	.166	.007	-.102	.219	-.003
Parental ex.	.152	.088	.010	.385	.116	020***
Block 2						
Head Start	-.155	.273	-.003	-2.254	.360	-039***
Center care	-.228	.281	-.005	.345	.370	.006
Block 3						
Approaches	3.022	.155	.120***	4.129	.204	.128***
K Math	1.201	.013	.626***	1.358	.017	.551***

*p < .05. **p < .01. ***p < .001

CHAPTER 5

DISCUSSION

The present study focused on the important construct of school readiness and the antecedent factors associated with readiness. After reviewing various findings and theoretical models, the Opportunity-Propensity framework was selected as the guiding model for a secondary analysis of the ECLS-K database.   The primary objectives of the present study were to (a) determine the impact of SES, gestational age at birth and parenting behaviors on children's emergent reading and math achievement measured at the start of kindergarten, and whether the relationship of these predictors and achievement would be attenuated when ethnicity, home language and gender are controlled, (b) determine whether center care and Head Start participation predict higher levels of reading and math achievement at the start of kindergarten, controlling for other factors, (c) determine whether early reading and math measured at the start of kindergarten predict reading and math achievement in first and third grade, (d), determine whether children's cognitive self-regulation skills as indexed by the Approaches to Learning Scale at the start of kindergarten predict reading and math achievement in first and third grade, and, (e) determine whether parenting behaviors are related to a sustained impact of early care and education opportunity factors on achievement through grade three.   The study was also intended to extend the O-P model to examine the relationship of early care and education factors including exposure to early childhood education programs, mother's age, prematurity, harsh discipline, domestic violence, and children's reading outcomes.

To answer the study questions, the ECLS-K database was extensively reviewed to identify variables that indexed antecedent factors (sociodemographic, child health, parenting behaviors), opportunity factors (exposure to early childhood education programs), and child-level propensity factors (achievement, attentiveness, persistence, etc.) during the preschool period through third grade. Previous research on the O-P model, ecological-transactional model and school readiness was used to guide selection of variables representing potential risks to children's development (e.g., single parent families, premature birth, harsh discipline, etc.), opportunity factors identified in educational research as potentially protective (center care and Head Start), and those indexing children's propensities to take advantage of learning opportunities (reading and math achievement and approaches to learning). It was expected, based on previous research, that antecedent factors such as SES, family structure and parenting behaviors would contribute significantly to reading and math achievement. It was also expected, particularly based on previous research on the O-P model, that individual differences among children in their propensities to take advantage of learning opportunities would contribute significantly to school readiness indexed by fall kindergarten reading and math assessments, and would continue to predict achievement in first and third grade. The present study confirmed that antecedent factors such as SES and parenting behaviors do predict children's reading and math achievement in kindergarten through third grade, and also confirms that children's individual differences in propensities contribute significant variances to reading and math scores.

In order to test whether center care and Head Start represent genuine learning opportunities, and whether participation would predict reading and math achievement, the hierarchical multiple regression analyses described in the previous chapter examined the impact of participation on achievement with all other sources of variance controlled. As expected, center care predicted higher reading and math achievement at the beginning of kindergarten, but these benefits appeared to dissipate by the time reading and math achievement were assessed in the spring of first and third grade. Head Start participation, on the other hand, appeared to offer no benefits and was associated with lower reading achievement at all assessment points and lower math achievement at the start of kindergarten and spring of third grade. This negative predictive relationship occurred even though potential confounds such as SES and parenting behaviors were statistically controlled. As noted in the previous section, however, it is difficult to disentangle poverty and Head Start attendance because they are so closely confounded (e.g., affluent children do not attend Head Start by definition). In the sections to follow, the implications of these findings are discussed.

The Role of Antecedent Factors

Recall that in the O-P framework, variables are categorized as either opportunity factors (e.g., quality teaching, center care, etc.), propensity factors (e.g., prior knowledge, motivation), or antecedent factors (e.g., SES). Antecedent factors serve to explain why opportunities and propensities emerge in development. As such, the role of antecedent factors will be explained first, followed by opportunity factors and propensity factors in turn.

SES, Maternal Age and Family Structure. Across all models and assessment points in the present study, SES and mother's age at first birth predicted reading and math achievement. This confirms extensive educational and child development research reviewed in the first chapter on the relationship of sociodemographic factors and children's developmental outcomes including academic achievement. The child development and educational research literature has consistently linked poverty to impaired cognitive development, poor health and behavioral problems that place children at higher risk of school failure (Bradley & Corwyn, 2002; Leventhal & Brooks-Gunn, 2000). In contrast, children growing up in higher SES environments generally demonstrate higher levels of language development, in part due to differences in their mothers' speech but also the influence of their higher SES peers (Arriaga, Fenson, Cronan, & Pethick, 1998; Byrnes & Wasik, 2009; Hoff-Ginsberg, 1998). The literature points consistently to the links between SES and children's performance on a range of indicators of achievement including standardized tests, grades and degrees attained. It is important to note that the findings of the present study were obtained with several other sources of variance controlled, including parental book reading to children, single parent status, children's propensities and birth status. This finding suggests that community, family and child-level characteristics not accounted for in this study but associated with SES might be associated with children's achievement. Another interpretation is related to criticisms of research based on ecological models noted in the literature review.

Even with multiple covariates controlled and sources of large and small variance accounted for in such studies, levels of the ecology interact in complex ways that cannot be reduced to quantities of variance explained. Another caveat is that regression models

are correlational rather than causal. Although a researcher may quantify multiple sources of variance associated with an outcome, causality remains undetermined. Despite these limitations, including a large number of covariates such as child-level and both proximal and distal contextual factors, and constraining the outcomes of interest, is more likely to capture multiple relationships and developmental processes.

SES as a predictive variable is problematic in several other aspects as well. In the first place, it is not at all clear how SES relates to educational outcomes in specific terms. Being affluent and well-educated does not directly cause high achievement in children. Other variables must intervene and these did not seem to be assessed in ECLS-K. Second, SES is not a malleable factor; as a result immediate implications for interventions are not evident. Intervening variables, however, could be likely targets if they could be exported from high SES families to low SES families (e.g., specific parenting behaviors that could be taught, etc.).

As to the more proximal sources of environmental influence, the present study also confirms a body of research finding that children born to adolescent mothers tend to have poorer outcomes. This result was obtained with SES controlled for kindergarten reading and math, and first and third grade reading. Language development appears to be particularly vulnerable to the impact of adolescent parenthood in the present study, consistent with conclusions of other research that maternal responsiveness and amount of cognitive stimulation vary by both mother's age and SES (Keown, Woodward & Field, 2001; Woodward, Fergusson & Horwood, 2001). One interpretation of the present findings is that intergenerational risks and adverse experiences of study mothers other than poverty (e.g., family discord, harsh discipline and maltreatment, etc.) could be

related to giving birth for the first time before age 18 years. In turn, these hypothesized risks would likely be transmitted through child-caregiver interactions. While variability in caregiver-level characteristics (e.g., mental health, substance use problems, etc.) was not included in the present study, child-level propensities to learn were included. The finding of lower achievement for the children of adolescent mothers was obtained controlling for prior achievement and approaches to learning in addition to poverty and parenting behaviors.

It is well established in the research literature that parenting behaviors may serve to either blunt the impact of environmental risks, or serve as a route of risk transmission (Leventhal & Brooks-Gunn, 2000; Querido, Warner & Eyberg, 2002; Sameroff & Fiese, 2000). While the O-P model considers the impact of parenting behaviors and expectations on children's school outcomes, characterization of the parent-child relationship as a route through which environmental risks are transmitted or moderated is not articulated as it is in the ecological/transactional model (Cicchetti & Lynch, 1993; Sameroff & Chandler, 1975). This may suggest a need to integrate some features of the ecological/transactional model with the O-P model. For example, the most distal family variables, such as SES, ethnicity and home language may be traced through a path diagram to community characteristics such as neighborhood safety and numbers of abandoned properties. The model may be further developed by drawing paths from community characteristics to parent-level characteristics, such as substance abuse, depression and employment, and by relating parent-level characteristics to parenting behaviors like those examined in the present study. Such a model would permit examination of a broader range of direct and indirect relationships with children's school

readiness and achievement. The ECLS-K database includes a rich array of family and community-level variables that could be included in such a follow-up study to test an integrated O-P and ecological /transactional model.

In addition to the findings for children of adolescent mothers, a related finding in the present study is that single parent family status, after controlling for SES and mother's age at first birth, significantly predicted lower reading and math achievement by fall kindergarten, and lower reading achievement in first and third grades.   Once again, literacy development appears to be more vulnerable relative to math to exposure to single parent family structure. Some of the published research suggests that single parenthood has minimal direct effects; rather, risk to children's wellbeing derives from other adverse experiences such as inadequate material resources and family discord (Fergusson, Boden, & Horwood, 2007; Lipman, Boyle, Dooley, & Offord, 2002). In contrast, other research has found direct effects including poorer health even after controlling for income and other family-level factors (e.g., number of children in family, race/ethnicity, etc.) (Bramlett & Blumberg, 2007). Elsewhere, studies have confirmed that single parents tend to have lower educational achievement with fewer supportive relationships and less frequent contact with friends and family members (Amato, 2000; Thomas & Sawhill, 2005), lower levels of involvement with children's schools and children's poorer language development (Arnold, Zeljo, Doctoroff, & Ortiz, 2008). In the present study, the relationship of single parent family status was obtained with other factors controlled, suggesting that auxiliary variables not included in the present study, such as social support, experiences of maltreatment as a child or the presence of psychopathology or other factors may be related to children's outcomes in single parent families.

Language development has a strong relationship with reading achievement, and it is in this area that single parent family status appears to be associated with the most risk in the present study, while first and third grade math did not have these associations. One important factor related to language development is the quality and quantity of linguistic input provided in the environment (Eigsti & Cicchetti, 2004). A number of studies (see Eigsti and Cicchetti, 2004, for a comprehensive review) have found relationships between children's language acquisition and maternal talkativeness (controlling for maternal depression), size of maternal vocabulary, maternal syntactic complexity and maternal responsiveness. Children whose caregivers tend to make only instrumental use of language with direct references to the immediate context only have more difficulty with decontextualized communication (Juel, 1988). The findings of the present study suggest that single parent families may also provide a less than optimal language development environment hypothetically through the parents' lack of educational achievement and smaller vocabularies, less scaffolding, recasting and other language supportive activities.

Specialized language and literacy interventions may hold promise for improving children's early language development. Research has confirmed that early care and education classrooms, especially those serving low-income students, may offer relatively little exposure to book reading, sustained verbal exchanges and other language supportive activities despite evidence linking these activities to enhanced language development (Dickinson & Tabors, 2001; NICHD Early Childcare Research Network, 2000). For children who have few opportunities at home to develop oral language and literacy skills, the absence of adequate opportunities to do so in center care is especially concerning.

An emerging evidence-base supports the utility of language and literacy interventions in center care. One promising practice, *dialogic reading* (Whitehurst et al., 1988), involves a combination of book reading, vocabulary development and structured discourse. The intervention was particularly affective in vocabulary development when used at home by middle income parents, and by low income parents in addition to their children's participation in early care and education (Whitehurst, Arnold, et al., 1994: Whitehurst, Epstein, et al., 1994). When the intervention was used in Head Start centers, however, the intervention group performed better on measures of print concepts and writing only, not on the linguistic awareness and vocabulary measures.

In an effort to counter the impact of poor children's initial low levels of vocabulary, Wasik and Bond (2001) expanded the intervention to include multiple encounters with story book vocabulary beyond the story reading and discussion periods including projects based on the story and vocabulary, teachers' use of new vocabulary throughout the school day and props displaying vocabulary words from the stories being read and discussed. The expanded intervention was tested in two Title I classrooms. Intervention group participants scored significantly better on vocabulary, receptive and expressive language compared to controls. Wasik, Bond and Hindman (2006) tested the expanded intervention adapted for use in 10 Head Start classrooms. Children in the intervention groups achieved significantly higher receptive and expressive language and vocabulary scores. Importantly, these results confirm that even children who are most at-risk with the lowest levels of pre-intervention language development can make significant gains if provided with genuine opportunities.

Exposure to Family Violence. In the present study, children who were spanked relatively more frequently had lower fall kindergarten reading and math achievement (in the first kindergarten models), confirming the body of research linking physical discipline to poorer cognitive outcomes. Most studies on the impact of physical punishment focus primarily on children's behavior (e.g., relative effectiveness vs. ineffectiveness of physical punishments to manage behavior, negative unintended consequences, etc.) and this literature confirms primarily higher rates of child externalizing problems related to physical discipline (Criss et al., 2002; Gershoff & Bitenshy, 2008; Kim & Cicchetti, 2003; Mulvaney & Mebert, 2007). A smaller literature focuses on the relationship of physical punishment and children's cognitive outcomes. Straus and Paschall (2009) found that the more frequently children were spanked by their mothers, the more likely they were to lag behind their peers academically. Smith and Brooks-Gunn (1997) found that low birth weight children who experienced harsh discipline had lower IQ scores even after controlling for birth weight, family structure, SES and other family factors.

One interpretation of the kindergarten finding is that caregivers who use physical discipline rather than cognitive methods of behavior management may tend to have less verbal interaction overall with their children than caregivers who use cognitive methods. This would likely provide physically disciplined children with a less growth promoting environment, as well as introduce a level of stress that is not optimal for learning. In addition to externalizing behavioral problems and poorer cognitive outcomes, physical discipline has also been associated with internalizing problems, parent-child discord and child maltreatment (Gershoff, 2002). A limitation to the present research is an absence of measures of children's effortful control and fearfulness as possible mediating factors.

Children who are relatively less fearful, or who have difficulties executing and sustaining non-dominant responses, might elicit more harsh punishment from some caregivers. That is, child-level individual differences may contribute to differences in parental discipline practices.

In the present study, domestic violence predicted lower reading achievement by spring third grade. Research finds that mothers who experience domestic violence endorse higher rates of physical punishment and other maltreatment proxy behaviors including psychological aggression (Coohey, 2004; Taylor, Guterman, Lee, & Rathouz, 2009). Others pathways of risk transmission include depression and anxiety among mothers who are abused that may exacerbate children's problems (Levendosky & Graham-Berman, 1998). In an effort to examine whether the impact of corporal punishment and domestic violence would be moderated by the presence of parental warmth in the present study, the degree of difficulty parents' reported expressing warmth and closeness to their children was assessed on a scale of *1* (parent reports having difficulty expressing warmth and closeness to the child), through *4* (parent has no difficulty expressing closeness and warmth to the child). Parental warmth was included in all but the first two regression models. However, parental warmth was not a significant predictor and did not moderate the impact of exposure to violence.

The group of findings referenced above combined with those of the present study strongly suggest that exposure to family violence in the forms of physical discipline and domestic violence may have their affects primarily on the emergence of child-level propensities. Pathways from family violence exposure to children's propensities to learn may include difficulties regulating emotions, cognition and behavior. As noted in the

literature review, child maltreatment and maltreatment proxy behaviors have a strong

relationship with domestic violence (Herrenkolh, Sousa, Tajima, Herrenkohl, & Moylan,

2008). The relationship of physical discipline and domestic violence exposure to

internalizing and externalizing problems across studies is strong enough to support the

conclusion that family violence is high-risk and child-endangering. These exposures in

other research are related to deficits in academic engagement, social competence, ego

resiliency and ego control (effects on academic and behavioral adjustment through

significantly lower levels of academic engagement (e.g., extrinsically motivated,

avoiding challenges, lacking persistence, etc.), social competence (conflict resolution

skills, peer group entry skills, etc.) and ego resiliency (less flexibility in meeting complex

demands (Gershoff, 2002; Maugham & Cicchetti, 2002; Rogosch, Cicchetti, & Aber,

1995; Shonk and Cicchetti, 2001). These relationships may suggest that domestic

violence treatment and child welfare interventions may, by targeting high risk caregiver

behaviors, have a role not only in child safety and wellbeing but in children's academic

success.

One caveat is that domestic violence researchers caution against looking for direct

effects of exposure on children due to the high overlap of domestic violence, child

maltreatment, substance abuse, homelessness and social isolation (Golding, 1999; Taylor,

Guterman, Lee, & Rathouz, 2009). An important strength of the ECLS study design is

how information about domestic violence was elicited. Rather than use terms such as

domestic violence and intimate partner abuse, participants were asked whether or not

partners hit each other. Asking in this manner may help to bypass selective responding

by avoiding labels possibly viewed as pejorative. The parent interview data were

obtained by phone rather than face-to-face, further strengthening the validity by reducing

bias introduced through socially desirable responding. A limitation is use of the term

spanking rather than corporal punishment or physical discipline. The latter terms may

apply to a broader range of physically forceful punitive behavior executed by caregivers.

The impact of additional parenting behaviors will be considered below. When collecting

information about family violence toward children and adults, socially desirable

responding may have been further avoided by eliciting this sensitive information other

than through interview. The research has found that participants are more likely to

disclose sensitive information when responding to questionnaires rather than interviewers

(Chang & Krosnick, 2010). Researchers may also include among assessment instruments

one measuring socially desirable responding.

One caveat needs to be noted. The sample size is large enough that significance

may be reached without the finding being meaningful. For example, domestic violence

exposure appears to predict higher 3d grade math achievement, and physical discipline

higher reading achievement in 3d grade. These findings are both contrary to what one

would expect based on the research literature. For this reason, caution needs to be used

when interpreting the association of family violence with achievement. Further,

assessments of family violence were based on parents' reports. Despite responses having

been elicited through phone interviews, any interview format is likely to introduce bias

through parents' socially desirable responding. This source of bias may be reduced by

including observation in addition to parent interviews. Observational assessments such as the Home Observation and Measurement of the Environment (HOME, Caldwell & Bradley, 1984) would facilitate more valid findings as to the relationships of family violence and children's early school achievement.

Parental Expectations and Book Reading. Parental expectations predicted achievement across all models excluding first grade math. This is consistent with earlier research confirming parents' expectations of their children's academic achievement as a significant predictor of children's educational outcomes (Byrnes & Wasik, 2009; Fan & Chen, 2001; Jacobs & Harvey, 2005; Zhan, 2006). Parents' expectations of their children's achievement are likely to be a proxy for a broad range of caregiver behaviors related to children's cognitive and social-emotional growth. Parents with high expectations may be more likely to become involved in their children's schools (e.g., attend parent-teacher conferences, volunteer, attend school activities, etc.), and help with homework and otherwise structure home life around learning supportive activities. Parents with high educational aspirations for their children may also be more likely to encourage adaptive, prosocial behavioral. The manner in which parents' educational expectations may influence children's development include higher levels of cognitive stimulation provided to children such as visits to museums, cultural events and book reading. More frequent book reading predicted higher reading achievement in kindergarten and first grade, and higher math achievement in kindergarten only. One interpretation of this finding is that book reading might serve as a proxy for cognitive stimulation in the home during the preschool period, while book reading is more directly related to children's literacy outcomes once children are acquiring more advanced

language skills with exposure to language arts instruction in the elementary grades. Unfortunately, the ECLS-K did not begin to examine home numeracy activities until the end of grade one. The present study limited its focus to parenting behaviors reported during the kindergarten year only. It is important to note that in the present study, these findings were obtained with SES controlled. That is, while parental expectations and book reading might be pathways through which SES may influence children's outcomes, parental expectations and book reading individually made unique contributions to variance in children's achievement. However, these environmental influences should be considered in light of child-level individual differences such as health including birth status. The impact of prematurity on children's development will be considered in the next section.

Prematurity. The negative association of being born before 37 weeks gestation and reading achievement dissipated by spring third grade and on math achievement by spring first grade. This finding was obtained without controlling for disability status as most of the disabilities diagnostic and treatment information was not included in the public access database. Diagnostic and treatment information that was available had relatively few cases to which the disabilities questions applied with much planned missingness (i.e., questions were not applicable). In general, however, children who were born before 37 weeks gestation and who may have lagged behind peers seemed to catch up. This is in contrast to published literature that finds long term effects on children's cognitive outcomes and other areas of development with those difficulties continuing into adolescence and young adulthood. One possible reason for the apparent differences in findings could be related to sampling methods used. The ECLS-K sample was obtained

using methods that would produce a representative sample though with some planned

overrepresentation of targeted groups. Studies referenced in the literature review section

of this study used convenience samples, very small samples or were meta-analyses that

did not describe how samples in the original studies were obtained. The present study

also did not define the degree of prematurity. Children who were most premature in the

present study were likely to have had greater relative risk of poor outcomes.

  Gender, Ethnicity, Home Language. The fifth and final set of antecedent factors

to be discussed pertain to socio-cultural variables. Gender differences are apparent in the

outcomes of the present study. Males had higher math achievement relative to females in

kindergarten, first and third grade, and lower reading achievement by third grade. This is

consistent with studies of gender and achievement, in which boys evidence higher

achievement in math and girls in reading (Gallagher & Kaufman, 2005; Marks, 2007).

Further, this result was obtained with many background factors controlled, and, with

respect to first and third grade, prior achievement and approaches to learning. Even after

controlling for SES, family structure, maternal age and several other background factors,

evidence of the achievement gap for Black and Hispanic children relative to White

children appeared early and persisted in the present study. Black children had lower

reading achievement relative to White children at spring first and third grades, and lower

math achievement at the beginning of kindergarten and end of first and third grades.

Controlling for use of English at home and the other background factors, Hispanics

children had lower reading and math achievement in fall kindergarten, and lower math

achievement in spring first and third grade relative to White children. This finding

contradicts those of Lareau (2003), Byrnes (2003), and Byrnes and Miller (2007), who

noted that once social class and other factors are controlled, there are no significant

differences between children from differing gender, ethnic, or language groups.

Lareau argued that middle class parents' child rearing practices are characterized

by *concerted cultivation* in which children's leisure time is structured around

involvement in growth promoting activities. While the sample on which Lareau's

observations were based was small and not representative, the findings of Byrnes and

colleagues are from large national studies (NAEP and NELS). The findings of the

present study find support in Fryer and Levitt's (2005) analyses of ECLS-K data. Fryer

and Levitt also found that the disparity between Black and White children's test scores

grows and cannot be explained by inclusion of background variables as controls, such as

SES. Further, Fryer and Levitt obtained their finding using the restricted version of the

ECLS-K, which permitted a far more nuanced examination of background, classroom and

community factors than the present study. These findings suggest dynamics between

formal classroom characteristics, communities and individuals that are difficult to

quantify in a measurement model, but a number of possible explanations have been

described in the literature

Okagaki (2001) offers a number of possible interpretations of ethnicity-based

achievement differences, including that of a cultural mismatch between the structure of

classroom instruction and other school characteristics, and children's home and

community experiences. Many groups have experienced historical social exclusion,

segregation, discrimination and devaluation of *cultural capital* (Bourdieu, cited in

Lareau, 2001). Cultural capital refers to the preferred linguistic patterns, normative social behaviors and values inherited by children from their parents that may confer relative advantage or disadvantage and perpetuate social class distinctions (Lareau, 2001). These differences are highly likely to contribute to experiences of discontinuity between children's home and school environments. Community and within-school segregation may spatially and socially isolate children in stigmatized minority groups from better schools, exposure to a more diverse range of role models, to peers who use middle class speech patterns and other academic and social resources (Echenique & Fryer, 2006).

Family health, another factor not examined in this study, might also be related to Black and Hispanic achievement differences. Andrews and Logan (2010) found that controlling for the impact of parental health significantly reduced the magnitude of Black-White and Hispanic-White reading and math test score gaps in first, third and fifth grade, but effects sizes were not reported. Further, characteristics of different ethnic groups may interact differentially with those of the instructional setting. Groups may also differ in their understanding of the relationship between school success and desirable employment (Okagaki, 2001).

Use of English at home predicted higher reading achievement in kindergarten through third grade, and higher math achievement in fall kindergarten only. This suggests that as children progressed to first grade and beyond, math development was unrelated to home language, while use of English at home was related to children's English language reading acquisition. Research into bilingual children's achievement sheds light on these findings. Some variance in bilingual children's second language

learning is introduced by the structure of the second language itself. For example, languages with a more regular grammatical structure and greater sound-symbol regularity are obtained more quickly by children learning their first languages (Bentin, Hammer & Cahan, 1991; Frith, Wimmer & Landerl, 1998).

Individual differences among children, language minority groups and their communities are also likely to be related to children's English literacy development. Bilingual children with higher levels of English oral language skills such as vocabulary knowledge and narrative ability evidence higher English in-text skills (i.e., reading comprehension and writing). (August & Shanahan, 2006). However, research has also identified low SES and parental education as factors related to struggling bilingual students' achievement (Snow, Burns & Griffin, 1998). The literature review in chapter two extensively discussed research findings linking poverty and poor early literacy development. Páez, Tabors and López (2007) found that low income bilingual (Spanish-English) children had poorer oral language skills in both Spanish and English at the start of prekindergarten and continued to lag behind peers. In the present study, an examination of the phi correlation coefficient between use of English at home and poverty, phi = .240, $p < .000$, suggested a medium effect size and the possibility that the two variables are confounded. Due to the high number of missing data regarding languages other than English used at home, the numbers of children using Spanish and other languages at home could not be determined.

The research literature presents a strong consensus that home language, SES and other background variables discussed above have strong relationships with children's school achievement. There is less agreement in the literature on the role of early care and

education. The debate on issues related to center care, Head Start and achievement was introduced in the literature review. In the section to follow, the findings of the present study regarding early care and education will be discussed.

The Role of Opportunity Factors

In the present study, participation in center care during the year preceding kindergarten was associated with higher emergent reading and math achievement measured at the start of kindergarten, but the relationship of center care and achievement was no longer significant in the spring of first and third grade. This finding contradicts those of the NICHD study of center care, perhaps due to the exclusion from the NICHD study of children in high crime areas, of adolescent mothers and whose home language was not English (Fantuzzo et al., 2005). For this reason, the NICHD findings might not generalize to populations that include individuals exposed to higher risk. The findings of the present study also contradict those of Magnuson, Meyers, Ruhm and Walfogel (2004), who reported in their study of ECLS-K participants that center care continued to predict higher reading and math scores through spring first grade. It is important to note that Magnuson and colleagues excluded cases with missing parent interview and outcomes data. For this reason, bias was highly likely to have been introduced and the results misinterpreted. The findings of the present study concur with the results of other studies concluding that participation in early care and education fades beyond kindergarten (Barnett, 1995; Gilliam & Zigler, 2001). Given that missing data were in the present study addressed using best practice standards, it is likely that these results are less biased and a more accurate estimation of population parameters.

It is important to note that although the opportunity factors including center care and Head Start contributed significant variance, it was far less than that contributed by antecedent factors. Further, the Cohen's f² values indexing the magnitude of the relationship of fall kindergarten reading and the antecedent, opportunity and propensity factors were .26 (medium to high), .003 (extremely low), and .09 (low to medium), respectively. These effects size values confirm that for fall kindergarten reading, antecedent factors had the strongest relationship with emergent reading followed by approaches to learning. Likewise, the Cohen's f² values indexing the magnitude of the relationship of fall kindergarten math and the antecedent, opportunity and propensity factors were .324 (medium to high), .002 (extremely low), and .15 (medium), respectively. These values confirm that as for reading, antecedent factors had the strongest relationship to emergent math, followed by child-level propensities indexed by the approaches to learning scale. While opportunity factors were significantly related, the magnitude of the relationship to outcomes was extremely small.

Despite the low effect sizes for relationships of opportunity factors and emergent academic skills for the sample in the present study, research on the role of early childhood care and education is very likely to have a role in promoting best practices and helping to narrow the achievement gap among children from differing ethnic and language groups. An important question for follow up research concerns the characteristics of center care with the strongest relationships to children's school readiness and higher emergent reading and math achievement. For example, early care and education programs differ in the emphasis given to oral language development, phonics, and parent involvement. The ECLS-K did not, as did the NICHD, examine the

quality of programs attended by participants, though the literature consistently finds that children who attend high quality programs make the most gains (Belsky et al., 2007; NICHD, 2005; Shonkoff & Phillips, 2000). In the NICHD Study of Early Child Care and Youth Development, for example, quality was assessed by placing specially trained research assistants in children's classroom to conduct periodic observational assessments called the Observational Record of Caregiving Environment (ORCE, NICHD,1996). The ORCE assesses cognitive stimulation, positive regard for children, how caregivers respond to children's bids for attention and other observable caregiver characteristics. In contrast, the ECLS-Birth Cohort Study (NCES, 2006) assesses quality through detailed interviews of caregivers. Information is gathered about staff, center services, how caregivers respond to child behaviors, learning environment and curriculum. Although the latter approach may be less valid than observation, these quality measures allow researchers to conduct detailed analyses to identify the center and caregiver characteristics with the strongest relationships to outcomes.

A related question concerns how the relationship of early care and education participation and achievement is maintained or attenuated as children move into first grade and beyond. Magnuson, Ruhm and Waldfogel (2007) followed their ECLS-K sample through grade three and found that characteristics of children's classrooms and instruction were related to the persistence of center care in predicting achievement. Magnuson and colleagues found that participation in early care and education continued to predict higher reading and math achievement in first and third grade, but only for children who subsequently experienced relatively larger class sizes and who had lower amounts of language arts instruction (i.e., was protective in less advantageous elementary

school contexts). However, participants with missing parent survey data and reading and math scores were excluded from these analyses. For reasons detailed elsewhere in this discussion, the results are likely to be biased.

The effect sizes indexing the strength of the relationship of opportunity factors and fall kindergarten reading and math were extremely small (.003 and .002, respectively). Extremely low effect sizes were found for opportunity factors and first and third grade reading (.004 and.005, respectively), and first and third grade math (.001 and .007, respectively). Despite the low effect sizes, Head Start was associated with significantly lower reading in kindergarten, first and third grade, and lower math achievement in kindergarten and third grade.

It should also be noted that in the regression models examining early care and education opportunity factors, participants who attended Head Start at any time during the preschool period were included in the analyses. Due to the high proportion of missing data for the Head Start questions, planned and otherwise, it was not possible to impute values for data missing in response to questions asking for more specific information (e.g., whether the child attended the year before kindergarten, number of hours attended per week, etc.). As noted in the previous chapter where the possibility that Head Start attendance and poverty were confounded was explored, Head Start is attended primarily by children living in poverty, and who may also be exposed to a number of other risks associated with poverty. Magnuson, Ruhm and Waldfogel (2007) noted that Head Start attendees in their ECLS-K study began school with relatively lower levels of academic skill, and also noted that family disadvantage was related to these

differences. The Head Start Impact Study (described below) found a negative association of Head Start participation on math ability by kindergarten for the three year old cohort (DHHS, 2010).

Enduring concerns about the long term impact of Head Start on children's school success lead to a congressional mandate in 1998 to study the relationship of Head Start participation and children's school success (DHHS, 2010). The Head Start Impact Study included a nationally representative sample of approximately 5000 three and four year old children who were randomly assigned to either Head Start or another early care and education program selected by their parents. Children in both cohorts were followed through the spring of first grade with the four year old cohort participating in one year of Head Start, and the three year old cohort participating in two years. The study concluded that children's cognitive gains assessed during Head Start participation were for the most part not maintained. By the end of grade one, children in both cohorts had maintained statistically significant gains (compared to control group) in a single language measure each out of several cognitive measures of language and math skills. These outcomes were disappointing, and may suggest that the programs to which most children have access are unlikely to moderate the complex of risk exposures associated with poverty. However, it is important to note that it is only recently that Head Start programs introduced an enhanced cognitive orientation. Few have stressed important perquisite skills to reading such as language, phonological processing, and letter knowledge. Instead the focus had been on socio-emotional development.

The antecedent factors examined in the present study, including SES, family structure birth status and others, and their relationships with children's outcomes, are well supported in the research literature. As noted above, there is less agreement on the enduring effects of early childhood education programs (with the exception of Head Start), but the research does confirm positive relationships with children's emergent academic skills. In the section to follow, the relationships of child-level individual differences – the propensity factors in the O-P model – and children's reading and math outcomes will be discussed.

Propensity Factors: Approaches to Learning and Prior Achievement

Across all models that included propensity factors, both approaches to learning and prior achievement had positive relationships with first and third grade reading and math. As noted, the approaches to learning scale consists of six items used by teachers to rate children's attention, organization, eagerness to learn, adaptability, persistence and ability to work independently (NCES, 2001). The scale measures children's self-regulatory and motivational capacities, some of which are internal, such as attention, and others external, such as organizational skills. Across all models that included propensity factors in the present study, children's approaches to learning scores predicted both reading and math achievement. These results support Byrnes and Wasik's (2009) previous research on the O-P model and ECLS-K, and confirm a strong association between children's capacity for self-regulated behavior and achievement. Compared to antecedent and opportunity factors, these two propensity factors accounted for substantially more variance in every model.

There is an extensive literature confirming the relationships of achievement and children's socioemotional characteristics. Some researchers have argued that children's characteristics such as self-regulation and social competence predict achievement (O'Neil, Welsh, Parke, Wang & Strand, 1997; Wasik, Wasik & Frank, 1993), while others have argued that children's socioemotional characteristics and academic skills may exert mutual influences and are correlated through the course of children's development (Chen, Rubin & Li, 1997; Smith, Borkowski & Whitman, 2008). Byrnes and Wasik (2009) noted significant path coefficients linking antecedent factors and children's propensity factors (approaches to learning and prior achievement in the models), particularly SES and parent expectations. The present study did not include path models, but regression models using all antecedent factors to predict kindergarten approaches to learning were significant with a Cohen's f^2 of .11, an effect size approaching the medium range. These relationships support the view of the O-P and other ecological/transactional models that parental characteristics and behaviors transmit either relative advantage or risk, may be protective and moderate the impact of environmental risks, and along with child -level characteristics are linked to children's outcomes.

In addition to the relationship of self-regulation and other characteristics indexed by the approaches to learning scale, and children's reading and math achievement in first and third grade, prior achievement also had positive relationships with children's first and third grade reading and math. These findings were obtained after controlling for SES and other antecedent factors, exposure to opportunities during the preschool period and approaches to learning. An extensive literature on school readiness reviewed in chapter two confirms the relationship of emergent academic skills and later achievement (La Paro

& Pianta, 2000; McWayne, Fantuzzo & Mc Dermott, 2004; Rimm-Kaufman & Pianta,

2000). In the present study, the positive relationship of earlier and later achievement

persists through grade three. According to the O-P model, prior achievement represents

the academic skills that children bring to learning opportunities. Byrnes and Wasik

(2009) confirmed that children cannot take full advantage of learning opportunities if

they lack requisite skills, motivation and knowledge, and the findings of the present study

concur.

Implications for Research & Intervention

The present study contributes to research on the O-P model by including a broad

range of predictors from the preschool period including the opportunity factors and

family violence, and these factors were related to children's achievement. The study also

broadened the outcomes examined to include reading, and confirmed the importance of

child-level characteristics to reading and math achievement The major question that the

present study leaves unanswered is why the positive gains that children make in center

care (excluding Head Start) do not persist. Studies have examined characteristics of

classrooms, teachers and instruction to further explain achievement trajectories. For

example, ECLS-K research that examined classroom characteristics suggests that center

care is likely to moderate the impact of larger class size but was unrelated to achievement

when children went on to relatively smaller classrooms (Magnuson, Ruhm & Waldfogel,

2007). Elsewhere, the effect associated with reduction of classroom size on children's

achievement has been small (Funkhouser, 2009). Other research examining class size

finds that the pathway of smaller class size to higher achievement is through a reduction

of disruptive student behaviors in small classes and more time spent on instruction

(Lazear, 2001). Still other research has examined the impact of teachers' characteristics and found that any advantage conferred also fades (Kane & Staiger, 2008). Byrnes and Wasik (2009) found that children had higher math achievement when their teachers used traditional methods of math instruction, or balanced traditional methods with reform approaches, but they did not include center care in their models. A follow-up study is recommended to examine the relationships of classroom characteristics, such as class size, instructional approaches and other classroom-level factors in path models that include center care.

It would be especially important to obtain the restricted-use ECLS-K Head Start file as this file contains data representing confirmed Head Start attendance, including duration and number of hours per week. In addition to confirmed Head Start attendance, administrative data included in the restricted ECLS-K data file would permit confirmation of other school system operated early care and education attendance such as prekindergarten. The restricted use ECLS-K file also contains disabilities and other diagnostic information that would permit a more detailed examination of child-level characteristics and the relationship of classroom factors and outcomes.

Most concerning is the association of Head Start attendance and lower reading and math achievement, especially in light of findings of the Head Start Impact Study. Although not all children who attend Head Start are poor, most participants are low income and are likely to be exposed to a broad range of associated risks, such as exposure to higher levels of community violence, housing problems, parental stress and other adversities. This is consistent with research on ecological models in that children who are exposed to a single adverse experience are more likely to experience others. Children with multiple risk

exposures and trauma tend to have greater difficulty with self-regulation and with moderating reactivity, a have a greater likelihood of disruptive behavior problems (Aguilar, Sroufe, Egeland & Carlson, 2000; Kaufman & Henrich, 2000). Further, the relationship of SES and language development is especially strong, as is the reciprocal influence of peers on the language development of the group (Mashburn, Justice, Downer, & Pianta, 2009). These are among the many factors that are likely related to Head Start outcomes. Child care subsidies for low income families offer a degree of choice to parents and may be used to purchase private center care. However, one study of ECLS-K participants found that use of child care subsidies was related to a range of negative child outcomes including lower reading and math scores, lower motivation and more behavioral problems (Herbst & Tekin, 2009). Therefore, any expectation that increasing use of subsidies to improve children's outcomes might not be realized, especially if the children who receive subsidies are exposed to risk conditions associated with inadequate material resources including parental stress related to unsatisfying low wage employment.

These concerns require further study using path models so that mechanisms linking risk conditions and children's outcomes can be identified and targeted with evidence-supported and promising practices (assuming modifiable conditions). Byrnes and Wasik (2009) caution that interventions directed to providing improved learning opportunities might be too limited. Rather, interventions need also to focus on increasing children's propensities to take advantage of learning opportunities. The literature identifies approaches that seem to be promising. Interventions such as cognitive training designed to help improve children's executive functions were related to increases in attention and children's early

academic skills (Diamond, Barnett, Thomas, & Munro, 2007). Such approaches may hold promise. Similarly, recent studies showing how Head Start and other early childhood teachers can be trained to increase language and literacy skills in children (e.g., Wasik, Bond, & Hindman, 2006) also hold promise as well.

The utility of large scale longitudinal studies such as ECLS-K is that analyses can suggest which factors seem associated with achievement. The next important step in designing interventions is to conduct smaller scale experimental studies where the correlated factors can be show to be causal. For example, when parental book reading is showed to be predictive (as in this study), one can conduct follow-up experimental studies in which low-income parents are trained to engage in more frequent and more effective forms of book reading.

In conclusion, the present study expands the O-P model to include additional antecedent factors (e.g., family violence, birth status, etc.), plus hypothetical early care and education opportunities afforded through center care and Head Start participation. The outcomes were also expanded to include reading. The present study confirms the importance of family factors, the contributions of center care to emergent academic skills, and highlights the challenges of meeting the needs of children impacted by poverty and other risk conditions. Further, the present study confirms the importance of child-level characteristics indexed by the approaches to learning scale and prior achievement. As noted earlier, risk and protective factors at multiple levels of the ecology interact in complex ways related to children's development. These complexities highlight the importance of constructing path models that more accurately capture the dynamics of these ecologies, and the interventions developed to transform relationships.

REFERENCES

Aber, L. J., Jones, S. & Cohen, J. (2000). The impact of poverty on the mental health development of very young children. In Zeanah, C. H., Jr. (Ed.). *Handbook of Infant Mental Health* (2nd ed.). (pp. 113-128). New York: Guildford Press.

Acock, A. C. (2005). Working with missing values. *Journal of Marriage and Family, 67*, 1012-1028.

Agostino, R.B. (1998). Propensity score methods for bias reduction in the comparison of a treatment to a non-randomized control group. *Statistics in Medicine, 17,* 2265-2281.

Aguilar, B., Sroufe, A.L., Egeland, B., & Carlson, E. (2000). Distinguishing the early onset/persistent and adolescence-onset antisocial behavior types: From birth to 16 years. *Development and Psychopathology, 12,* 109-132.

Allen, R., & Wasserman, G.A. (1985). Origins of language delay in abused children. *Child Abuse and Neglect, 9,* 335-340.

Amato, P.R. (2000). The consequences of divorce for adults and children. *Journal of Marriage and the Family, 62,* 1269-1287.

Amster, B.J. (1999). Speech and language development of young children in the child welfare system. In Silver, J.A., Amster, B.J. & Haecker, T. (Eds.). *Young Children and Foster Care* (pp. 117-138). Baltimore: Brookes Publishing.

Anderson, L.M., Shinn, C., Fullilove, M., Scrimshaw, S.C., Fielding, J.E., Normand, J., et al.. (2003). The effectiveness of early childhood development programs: A systematic review. *Journal of Preventive Medicine, 24,* 32-46.

Andrews, H., Goldberg, D., Wellen, N., Pittman, B, & Streuning, E. (1995). Prediction of special education placement from birth certificate data. *American Journal of Preventive Medicine, 11,* 55-61.

Andrews, R.J., & Logan, T.D. (2010). Family health, children's own health, and test score gaps. American Economic Review, Papers & Proceedings, May 2010.

Anning, A., & Edwards, A. (1999). *Promoting children's learning from birth to five: Developing the new early years professional.* Buckingham, UK: Open University Press.

Anthony, J.L., Lonigan, C.J., Burgess, S.R., Driscoll, K., Phillips, B.M., & Cantor, B.G. (2002). Structure of preschool phonological sensitivity to rhyme, words, syllables, and phonemes. *Journal of Experimental Child Psychology, 82*, 65-92.

Arnold, D.H., Zeljo, A., Doctoroff, G.L., & Ortiz, C. (2008). Parent involvement in preschool: Predictors and the relation of involvement to preliteracy development. *School Psychology Review, 37*, 74-90.

Arriaga, R.I., Fenson, L., Cronan, T, & Pethick, S.J. (1998). Scores on the MacArthur communicative development inventory of children from low- and middle-income families. *Applied Psycholinguistics, 19*, 209-223.

Ateah, C. A., & Parker, C. M. (2002). Childhood experiences with, and current attitudes toward, corporal punishment. *Canadian Journal of Community Mental Health, 21*, 35−46.

August, D., & Shanahan , T. (Eds.). (2006). *Developing literacy in second-language learners: Report of the National Literacy Panel on Language-Minority Children and Youth.* Mahwah, NJ: Lawrence Erlbaum.

Bacharach, V.R., & Baumeister, A.A. (1998). Effects of maternal intelligence, marital status, income, and home environment on cognitive development of low birthweight infants. *Journal of Pediatric Psychology, 23,* 197-205

Baharudin, R., & Luster, T. (1998). Factors related to the quality of the home environment and children's achievement. *Journal of Family Issues, 19*, 375-403.

Barnett, D. (1997). The effects of early intervention on maltreating parents and their children. In M.J. Guralnick (Ed.) *The Effectiveness of Early Intervention* (pp. 147-170). Baltimore: Paul H. Brookes Publishing Co.

Barnett, S. (1995). Long-term effects of early childhood programs on cognitive and school outcomes. *The Future of Children, 5*, 25-50.

Barnett, W.S. (1992). The effects of compensatory education. Journal of Human Resources, 27, 272-312.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology,51,* 1173–1182.

Barth, R.R., Guo, S., & McCrae, J.S. (2008). Propensity score matching strategies for evaluating the success of child and family service programs. *Research on Social Work Practice, 18,* 212-222.

Barton, P. (2003). *Parsing the achievement gap: Baselines for tracking progress.* Princeton, NJ: Educational Testing Service, Policy Information Center.

Barton, P. E, & Coley, R.J. (2009). *Parsing the achievement gap: Part II.* Princeton, NJ: Educational Testing Service.

Beckwith, L. (2000). Prevention science and prevention programs. In Zeanah, C. H., Jr. (Ed.). *Handbook of Infant Mental Health* (2nd ed.). (pp. 439 -456). New York: Guildford Press.

Beech, J.R. (2005). Ehri's model of phases of learning to read. *Journal of Research in Reading, 28,* 50-58.

Beitchman, J.H., & Young, A.R. (1997. Learning disorders with a special emphasis on reading disorders: A review of the past 10 years. *Journal of the American Academy of Child & Adolescent Psychiatry, 36,* 1020-1032.

Belsky, J., Vandell, D., Burchinal, M., Clarke-Stewart, K.A., McCartney, K., Owen, M., et al. (2007). Are there long-term effects of early child care? *Child Development, 78,* 681-701.

Bentin, S., Hammer, R., & Cahan, S. (1991). The effects of aging and first grade schooling on the development of phonological awareness. *Psychological Science, 2,* 271-274.

Berch, D.B.(2005). Making sense of number sense: Implication for children with disabilities. *Journal of Learning Disabilities, 38,* 333-339.

Bhutta, A., Cleves, M., Casey, P., Cradock, M., & Anand , K. (2002). Cognitive and behavioral outcomes of school-aged children who were born preterm. *Journal of the American Medical Association, 288,* 728-737.

Bierman, K.L., Nix, R.L., Greenberg, M.T., Clancy, B., & Domitrovich, C.E. (2008). Executive functions and school readiness intervention: Impact, moderation, and mediation in the Head Start REDI program. *Development and Psychopathology, 20*, 821-843.

Bowlby, J. (1969). *Attachment and loss: Vol 1. Attachment. New York: Basic Books.*

Bolger, K.E. & Patterson, C.J. (2001). Developmental pathways from child maltreatment to peer rejection. *Child Development, 72,* 549-568.

Bolger, K.E., Patterson, C.J. & Kupersmidt, J.B. (1998). Peer relationships and self-esteem among children who have been maltreated. *Child Development, 69,* 1171-1197.

Bradley, R.H., & Corwyn,R.F. (002). Socioeconomic status and child development. *Annual Review of Psychology, 53,* 371-399.

Bramlett, M.D., & Blumberg, S.J. (2007). Family structure and children's physical and mental health. *Health Affairs, 26,* 549-558.

Brannon, E.M. (2002). The development of ordinal numerical knowledge in infancy. *Cognition*, *83,* 223–240.

Braungart-Rieker, J.M., & and Stifter, C.A. (1996). Infants' responses to frustrating situations: Continuity and change in reactivity and regulation. Child Development, 67, 1767-1776.

Breslau, N., Brown, G., DelDotto, J., Kumar, S., Ezhuthachan, S., Andreski, P, et al.. (1996). Psychiatric sequelae of low birth weight at 6 years of age. *Journal of Abnormal Child Psychiatry, 24,* 385-400.

Bricker, D.D., & Squires, J. (1999). *Ages and Stages Questionnaire: A parent-completed, child-monitoring system* (2nd ed.). Baltimore: Paul H. Brookes Publishing Company.

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design.* Cambridge, MA: Harvard University Press.

Brooks-Gunn, J., & Duncan, G.J. (1997). The effects of poverty on children. *The Future of Children, 7,* 55-71.

Brooks-Gunn, J., & Markman, L.B. (2005). The contributions of parenting to ethnic and racial gaps in school readiness. *The Future of Children, 15,* 139-168.

Bruer, J. T. (1999). *The myth of the first three years*. New York: Free Press.

Bryant, P. (2002). It doesn't matter whether onset and rime predicts reading better than phoneme awareness does or vice versa. *Journal of Experimental Child Psychology, 82*, 41-46.

Bull, R., Espy, K., & Wiebe, S.A. (2008). Short-term memory, working memory, and executive functioning in preschoolers: Longitudinal predictors of mathematical achievement at age 7 years. *Developmental Neuropsychology, 33*, 205-228.

Bunge, S.A., Dudukovic, N.M., Thomason, M.E., Vaidya, C.J., & Gabrieli1, J.D. (2002). Immature Frontal Lobe Contributions to Cognitive Control in Children: Evidence from fMRI. *Neuron, 33,* 301–311.

Burton, A., & Altman, D.G. (2004). Missing covariate data within cancer prognostic studies: A review of current reporting and proposed guidelines. *British Journal of Cancer, 91*, 4-8.

Byrnes, J. P. (2001). *Cognitive development and learning in instructional contexts* (2nd. Ed.). Boston: Allyn & Bacon.

Byrnes, J.P. (2003). Factors predictive of mathematics achievement in White, Black and Hispanic 12th graders. *Journal of Educational Psychology, 95,* 316-326.

Byrnes, J.P., & Miller, D.C. (2007). The relative importance of predictors of math and science achievement: An opportunity-propensity analysis. *Contemporary Educational Psychology, 32,* 599-629.

Byrnes, J.P., & Wasik, B.A. (2009). Language and Literary Development: What Educators Need to Know. New York: Guilford.

Caldwell, B. & Bradley, R. (1984). *Home Observation for Measurement of the Environment (HOME) - Revised Edition*. University of Arkansas, Little Rock.

Calkins, S.D., Dedmon, S.E., Gill, K.L., Lomax, L.E., & Johnson, L.M. (2002). Frustration in infancy: Implications for emotional regulation, physiological processes, and temperament. Infancy, 3, 175-197.

Campbell, F.A., & Ramey, C.T. (1995). Cognitive and school outcomes for high-risk African-American students at middle adolescence: Positive effects of early intervention. *American Educational Research Journal. 32,* 743-772.

Campbell, F. A., Ramey, C. T., Pungello, E. P., Sparling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian Project. *Applied Developmental Science, 6,* 42–57.

Carmody, D.P., Bendersky, M., DeMarco, K.J., Hiatt, M., Dunn, S.M., Hegyi, T., & Lewis, M. (2006). Early risk, attention, and brain activation in adolescents born preterm. *Child Development, 77,* 384-394.

Caspi, A. (1998). Personality development across the life course. In W. Damon (Ed.), *Handbook of child psychology: Social, emotional, and personality development*. New York: Wiley.

Catts, H.W., Fey, M.E., Zhang, X., & Tomblin, J.B. (1999). Language basis of reading and reading disabilities: Evidence from a longitudinal investigation. *Scientific Studies of Reading, 3,* 331-361.

Chang, L., & Krosnick, J.A. (2010). Comparing oral interviewing with self-administered computerized questionnaires: An experiment. Public Opinion Quarterly, 74, 10-20.

Chapman, D.A., Scott, K.G., & Stanton-Chapman, T.L.(2008). Public health approach to the study of mental retardation. *American Journal of Mental Deficiency, 113*, 102-116.

Chard, D.J., Baker, S.K., Clarke, B., Jungjohann, K., Davis, K., & Smolkowski, K. (2008). Preventing early mathematics difficulties: The feasibility of a rigorous kindergarten mathematics curriculum. *Learning Disability Quarterly, 31,* 11-20.

Chard, D., & Dickson, S.V. (1999). Phonological awareness: Instructional and assessment guidelines. *Intervention in School and Clinic, 34*, 261-270.

Charlesworth, R. (2005). Prekindergarten mathematics: Connecting with national standards. *Early Childhood education Journal, 32,* 229-236.

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,* 489-507.

Chen, X., Rubin, K.H., & Li, D. (1997). Relations between academic achievement and social adjustment: Evidence from Chinese children. *Developmental Psychology, 33,* 518-55.

Cicchetti, D., & Lynch, M. (1993). Toward an ecological/transactional model of community violence and child maltreatment: Consequences for children's development. *Psychiatry, 56,* 96-118.

Cicchetti D., Rogosch F.A. The role of self-organization in the promotion of resilience in maltreated children. Development and Psychopathology. 1997;9:799–817.

Cicchetti, D., & Toth, S.L. (1995). A developmental psychopathology perspective on child abuse and neglect. *Journal of the American Academy of Child and Adolescent Psychiatry, 34,* 541-565.

Clarke, B., Baker, S., Smolkowski, K., & Chard, D.J. (2008). An analysis of early numeracy curriculum-based measurement. Remedial and Special Education, 29, 46-57.

Charlesworth, R. (2005). Prekindergarten mathematics: Connecting with national standards. *Early Childhood Education Journal, 32,* 229-236.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155-159.

Connolly, C.D., Hazen, A.H., Coben, J.H., Kelleher, K.J., Barth, R.P., & Landsverk, J.A. (2006). Persistence of intimate partner violence among families referred to child welfare. *Journal of Interpersonal Violence, 21,* 774-797.

Committee for Economic Development (2006) *The Economic Promise of Investing in High-Quality Preschool*: *Using Early Education to Improve Economic Growth and the Fiscal Sustainability of States and the Nation.* Washington, DC: Author.

Coohey, C. (2004). Battered mothers who physically abuse their children. *Journal of Interpersonal Violence, 9*, 943-952.

Cunningham, A., & Baler, L. (2004). *What about me? Seeking to understand a child's view of violence in the family.* London, ON: Centre for Children and Families in the Justice System.

Curtis, W. J. & Cicchetti, D. (2003). Moving research on resilience into the 21st century: Theoretical and methodological considerations in examining the biological contributors to resilience *Development and Psychopathology 15 ,* 773–810.

Criss, M.M., Pettit, G.S., Bates, J.E., Dodge, K.A., Lapp, A.L. (2002). Family adversity, positive peer relationships, and children's externalizing behavior: A longitudinal perspective on risk and resilience. *Child Development., 74,* 1220–1237.

Cummings, E.M., Davies, P.T., & Campbell, S.B. (2000). *Developmental psychopathology and family process: Theory, research and clinical implications.* New York: Guilford Press.

Currie, J., & Thomas, D. (1995). Does Head Start make a difference? *The American Economic Review, 85,* 341-364.

Davies, P.T., & Cummings, E.M. (1994). Marital conflict and child adjustment: An emotional security hypothesis. *Psychological Bulletin, 116,* 387-411.

Dempster, A. P., Laird, N. M., & Rubin, D.B. (1977). Maximum likelihood from incomplete data via the EM algorithm. *Journal of the Royal Statistical Society, 39*, 1-38.

Diamond, A., Barnett, W.S., Thomas, J., Munro, S. (2007). Preschool program improves cognitive control. *Science, 318*, 1387-1388.

Dickinson, D., & Tabors, P. (2001). *Beginning literacy with language: Young children learning at home and school.* Brookes Publishing: Baltimore, MD.

Dong, M., Anda, R.E., Feletti, V.J., Dube, S.R., Williamson, D.F., Thompson, T.J., et al. (2004). The interrelatedness of multiple forms of childhood abuse, neglect and household dysfunction. *Child Abuse & Neglect, 28,* 771-784.

Dow, M. M., & Eff, E. A. (2009). Multiple imputation of missing data in cross-cultural samples. *Cross-Cultural Research, 43*, 206-229.

Dubrow, E.F., & Ippolito, M.F. (1994). Effects of poverty and quality of home environment on changes in the academic and behavioral adjustment of elementary school-age children. *Journal of Clinical Child Psychology, 23,* 401-412.

Dubow, E., & Luster, T. (1990). Adjustment of children born to teenage mothers: The contribution of risk and protective factors. *Journal of Marriage and the Family, 52*, 393-404.

Duncan, G.J., & Brooks-Gunn, J. (2000). Family poverty, welfare reform, and child development. *Child Development, 71*, 188-196.

Duncan, G.J., Brooks-Gunn, J., & Klebanov, P.K. (1994). Economic deprivation and early childhood development. *Child Development, 65,* 296-318.

Duncan, G.J., Yeung, W.J., Brooks-Gunn, J., & Smith, J.R. (1998). How much does childhood poverty affect the life chances of children? *American Sociological Review,* 406-423.

Duncan, G.J., Claessens, A., Huston, A.C., Pagani, L.S., Engel, M., Sexton, H. et al. (2007). School readiness and later achievement. *Developmental Psychology, 43,* 1428-1446.

Echenique, F., & Fryer, R.G. (2006). *On the measurement of segregation.* National Bureau of Economic Research. NBER Working Papers: No. 11258.

Eigsti, M.I., & Cicchetti, D. (2004). The impact of child maltreatment on expressive syntax at 60 months. *Developmental Science, 7,* 88-102.

Ehri, L.C. (1995). Phases of development in learning to read by sight. *Journal of Research in Writing, 18,* 116-125.

Erickson, M.F., Egeland, B., & Pianta, R. (1989). The effects of maltreatment on the development of young children. In . Cicchetti & V. Carlson (Eds.), Child maltreatment: Theory and research on the causes and consequences of child abuse and neglect (pp. 647-684). Cambridge: Cambridge University Press.

Fan, X., & Chen, M. (2001). Parental involvement and students' academic achievement: A meta-analysis. *Educational Psychology Review, 1,* 1-22.

Fantuzzo, J., & Perlman, S. (2007). The unique impact of out-of-home placement and the mediating effects of child maltreatment and homelessness on early school success. *Youth Services Review, 29*, 941-960.

Fantuzzo, J., Perry, M.A., & McDermott, P. (2004). Preschool approaches to learning and their relationship to other relevant classroom competencies for low-income children. *School Psychology Quarterly, 19,* 212-230.

Fantuzzo, J.W., Rouse, H.L., McDermott, P.A., Sekino, Y., Childs, S., & Weiss, A. (2005). Early childhood experiences and kindergarten success: A population-based study of a large urban setting. *School Psychology Review, 34*, 571-598.

Farren, D.C. (2000). Another decade of intervention. In J.P. Shonkoff and S.J. Meisels (Eds.). *Handbook of early childhood intervention* (2nd ed.) (pp. 522-548). New York: Cambridge University Press.

Feigenson, L., Carey, S., & Hauser, M. (2002). The representations underlying infants' choice of more: object filesversus analog magnitudes. *Psychological Science*, *13*, 150–156.

Feigenson, L., Carey, S., & Spelke, E.S. (2002). Infants' discrimination of number vs. continuous extent. *Cognitive Psychology*, *44,* 33–66.

Fergusson, D. M., Boden, J.M., & Horwood, L.J. (2007). Exposure to single parenthood in childhood and later mental health, educational, economic, and criminal behavior outcomes. *Archives of General Psychiatry, 64*, 89-95.

Fewell, R.R., & Deutscher, B. (2004). Contributions of early language and maternal facilitation variables to later language and reading abilities. *Journal of Early Intervention, 26,* 132-145.

Floyd, R. G., Hojnoski, R. L**.**, & Key, J. M. (2006). Preliminary evidence of technical adequacy of the Preschool: Numeracy Indicators. *School Psychology Review, 35*, 627-644.

Finley, L.L. (2010). Examining domestic violence as a state crime: Nonkilling implications. *Global Nonkilling Working Papers*. ISSN 2077-141X.

Frith, U., Wimmer, H., & Landerl, K. (1998). Differences in phonological recoding in German- and English-speaking children. *Scientific Studies of Reading, 2*, 31-54.

Fryer, R.G., & Levitt, S.D. ((2005). *The black-white test score gap through third grade.* National Bureau of Economic Research. Working Paper, January.

Funkhouser, E. (2009). The effect of kindergarten classroom size reduction on second grade student achievement: Evidence from California. Economics of Education review, 28, 403-414.

Gallagher, A.M., & Kaufman, J.C. (2005). *Gender differences in mathematics: An integrative psychological approach.* Cambridge, UK: Cambridge University Press.

Garces, E., Thomas, D., & Currie, J. (2002). Longer term effects of Head Start. *The American Economic Review, 92,* 999-1012.

Garmezy, N. 1971. Vulnerability research and the issue of primary prevention. *American Journal of Orthopsychiatry. 41,* 101-116.

Gerhardstein, P., Liu, J., & Rovee-Collier, C. (1998). Perceptual constraints on infant memory retrieval. *Journal of Experimental Child Psychology, 69,* 109-131.

Gershoff, E.T. (2002). Corporal punishment by parents and associated child behaviors and experiences: A meta-analytic and theoretical view. Psychological Bulletin, 128, 539-579.

Gershoff, E. (2003). Low income and the development of America's kindergartners: Living at the edge research brief. New York: National Center for Children in Poverty, Columbia University Mailman School of Public Health.

Gershoff, E.T., & Bitenshy, S.H. (2008). The case against corporal punishment of children: Converging evidence from social science research and international human rights law and implications for U.S. policy. *Psychology, Public Policy, and Law, 13*, 231-272.

Giancola, P.R., & Mezzich, A.C. (2000). Executive cognitive functioning mediates the relation between language competence and antisocial behavior in conduct disordered adolescent females. *Aggressive Behavior, 26,* 359-375.

Goals 2000: Educate America Act of 1994, Pub. L. No. 103-227, §102.

Golding, J.M. (1999). Intimate partner violence as a risk factor for mental disorders: A meta-analysis. *Journal of Family Violence, 14*, 99-132.

Good, R.H., Simmons, D.C., & Kame'enui, E.J. (2002). The importance and decision-making utility of a foundational reading skill for third-grade high-stakes outcomes. *Scientific Studies of Reading, 5,* 257-288.

Gough, P.B. (1996). How children learn to read and why they fail. *Annals of Dyslexia, 46,* 3-20.

Graham, J.W., & Donaldson, S.I. (1993). Evaluating interventions with differential attrition: The importance of nonresponse mechanisms and use of follow-up data. *Journal of Applied Psychology, 78,* 119-128.

Gregory, A., Ramsay, J., Agnew-Davies, R., Baird, K., Devine, A., Dunne, D., Eldridge, S., Howell, A., Johnson, M., Rutterford, C., Sharp, D., & Feder, G. (2010). Primary care identification and referral to improve safety of women experiencing domestic violence (IRIS): Protocol for a pragmatic cluster randomized control trial. *BMC Public Health, 10*, 1-7.

Gresham, F.M., & Elliott, S.N. (1990). *Social skills rating system (Elementary Scale A).* Circle Pine, MN: American Guidance Services, Inc.

Guille, L. (2004). Men who batter and their children: An integrative review. *Aggression & Violence Behaviour, 9,* 129-163.

Gunn, B.K., Simmons, D.C., & Kameenui, E.J. (1995). Emergent literacy: A synthesis of the research. Eugene, OR: The National Center to Improve the Tools of Educators. Retrieved on February 2, 2006 from http://idea.uoregon.edu/~ncite/documents/techrep/tech19.html

Guo, S., Barth. S., & Gibbons, C. (2006). Propensity score matching strategies for evaluating substance abuse services for child welfare clients. *Children and Youth Services Review 28*, 357-383.

Guo, G., & Harris, K.M**.** (2000). The mechanisms mediating the effects of poverty on children's intellectual development. *Demography. 2000, 37*, 431-47.

Gutterman, N.B. (2004). Advancing prevention research on child abuse, youth violence, and domestic violence: Emerging strategies and issues. *Journal of Interpersonal Violence, 19*, 299-321.

Hack, M., Klein, N.K., & Taylor, H.G. (1995). Long-term developmental outcomes of low birth weight infants. The Future of *Children, 5,* 176-196.

Hack, M., Flannery, D.J., Schluchter, M., Cartar, L., Borawski, E., & Klein, N. (2002). Outcomes in young adulthood for very-low-birthweight infants. *The New England Journal of Medicine, 346*, 149-157.

Hallman, S., & Ireson, J. (2003). Secondary school teachers' attitudes towards and beliefs about ability grouping. *British Journal of Educational Psychology, 73,* 343-356.

Hart, B., & Risley, T.R. (1995). *Meaningful differences in the everyday experience of young American Children*. Baltimore: Brookes Publishing.

Jacobs, N., & Harvey, D. (2005). Do parents make a difference to cildren's academi achievement? Differences between parents of higher and lower achieving students. *Educational Studies, 31*, 431-448.

Haskins, R. (2004).. Competing visions. *Education Next 4*, 26–33.

Herbst, C.M., & Tekin, E. (2009). Child care subsidies and child development. *Economics of Education Review, 29*, 618-638.

Herrenkohl, T.A., Sousa, C., Tajima, E.A., errenkohl, R.C., & Moylan, C. (2008). Intersection of child abuse and cildren's exposure to domestic violence. *Trauma, Violence, & Abuse, 9*, 84-99.

Hill, M.S., Yeung, W.W.J., & Duncan, G.J. (2001). Childhood family structure and young adult behaviors. Journal of Population Economics, 14, 271-299.

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development, 74,* 1368-1378.

Hoff-Ginsberg, E. (1998). The relation of birth order and socioeconomic status to children's experience and language development. *Applied Psycholingustics, 19,* 603-629.

Holden, G.W., Stein, J.D., Ritchie, K.L., Harris, S.D., & Jouriles, E.N. (1998). Parenting behaviors and beliefs of battered women. In G.W. Holden, R. Geffner, & E. N. Jouriles (Eds.), *Children exposed to martial violence: Theory, research and applied issues* (pp. 289-334). Washington, DC: American Psychological Association.

Hulme, C., Hatcher, P.J., Nation, K., Brown, A., Adams, J., & Stuart, G. (2002). Phoneme awareness is a better predictor of early reading skill than onset-rime awareness. *Journal of Experimental Child Psychology, 82*, 2-28.

Jaudes, K.P., & Shapiro, L.D. (1999). Child abuse and developmental disabilities. In Silver, J.A., Amster, B.J. & Haecker, T. (Eds.). *Young children and foster care* (pp. 213-234). Baltimore: Brookes Publishing.

Jelicic, H., Phelps, E., & Lerner, R. M. (2009). Use of missing data methods in longitudinal studies: The persistence of bad practices in developmental psychology. *Developmental Psychology, 45*, 1195-1199.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology, 80*, 437-447.

Kagan, S.L., & Neuman, M.J. (2000). Early care and education: Current issues and future strategies. In J.P. Shonkoff & S.J. Meisels (Eds.) *Handbook of early childhood intervention* (2nd ed.) (pp 330-360). New York: Cambridge University Press.

Kalil, A., Rosenblum, K., Eccles, J., & Sameroff, J. (1998, February). *Family structure or family resources?: Linking marital status to children's adjustment in economically diverse black and white families.* Paper presented at the biennial meetings of the Society for Research on Adolescence, San Diego, CA.

Kaminski, R. A., & Good, R. H. (1998). Assessing early literacy skills in a problem-solving model: Dynamic Indicators of Basic Early Literacy Skills. In M. R. Shinn (Ed.), *Advanced applications of Curriculum-Based Measurement* (pp. 113–142). New York: Guilford.

Kane, T.J., & Staiger, D.O. (2008). Estimating teacher impacts on student achievement:An experimental evaluation. NBER Working Paper No. 14607.

Kaufman, J., & Henrich, C. (2000). Exposure to violence and early childhood trauma. In Zeanah, C. H., Jr. (Ed.). *Handbook of Infant Mental Health* (2nd ed.). (pp. 195-210). New York: Guildford Press.

Kelley, J.F., Morriset, C.E., Barnard, K.E., Hammond, M.A., & Booth, C.L. (1996). The influence of early mother-child interaction on preschool cognitive/linguistic outcomes in a high-social-risk group. *Infant Mental Health Journal, 17,* 310-321.

Kellam, S., Ensminger, M., & Turner, R. (1977). Family structure and the mental health of children." *Archives of General Psychiatry* 34, 1012-1022.

Keown, L.J., Woodward, L. J., & Field, J. (2001). Language development of pre-school children born to teenage mothers. *Infant and Child Development*, 10, 129-145.

Kim, J. & Cicchetti, D. (2003). Social self-efficacy and behavior problems in maltreated and nonmaltreated children. *Journal of Clinical Child and Adolescent Psychology, 32,* 106-117.

Kirkbride, H., Castor, C., Hoffman, E., & Fuger, K. (2000). Thirty-six month outcome of prenatal cocaine exposure for term or near-term infants: Impact of early case management. *Journal of Developmental Pediatrics, 21,* 19-26.

Klebanov, P.K., Brooks-Gunn, J., McCanton, C., & McCormick, M.C. (1998). The contribution of neighborhood and family income to developmental test scores over the first three years of life. *Child Development, 69*, 1420-1436.

Kochanska, G. (1997). Mutually responsive orientation between mothers and their children: Implications for early socialization. *Child Development, 68,* 94-112.

Kochanska, G., Coy, C.C. & Murray, K. T. (2001). The development of self-regulation in the first four years of life. *Child Development, 72*, 1091-1111.

Kolker, J., Osborne, D., & Schnurer, E. (2004). Early child care and education: The need for a national policy. Washington, DC: Center for National Policy.

Konold, T.R., Juel, C., McKinnon, M., & Deffes, R. (2003). A multivariate model of early reading acquisition. *Applied Psycholinguistics, 24*, 89-112.

Kopp, C. B., & Neufeld, S. J. (2003). Emotional development during infancy. In R. J. Davidson, K. R. Scherer & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 347-374). New York: Oxford University Press.

Kowaleski-Jones, L., Dunifon, R., & Ream, G. (2006). Community contributions to scholastic success. *Journal of Community Psychology, 34*, 343-362.

Kozol, J. (2005). The shame of the nation: Restoration of apartheid schooling in America. New York, NY: Three Rivers Press.

Kraemer, H.C., Stice, E., Kazdin, A., & Kupfer, D. (2001). How do risk factors work together? Mediators, moderators, and independent, overlapping, and proxy risk factors. *The American Journal of Psychiatry, 158*, 848-856.

Kraemer, H.C., Wilson, G.T., Fairburn, C.G., & Agras, W.S. (2002). Archives of General psychiatry, 59, 877-883.

Ladd, G. W., & Burgess, K. B. (2001). Do relational risks and protective factors moderate the linkages between childhood aggression and early psychological and school adjustment? *Child Development, 72,* 1579-1601.

Laible, D. (2004). Mother-child discourse about a child's past behavior at 30 months and early socioemotional development at age 3. *Merrill-Palmer Quarterly, 50,* 159-180.

Laible, D. (2004). Mother-child discourse in two contexts: Links with child temperament, attachment security and socioemotional competence. *Developmental Psychology, 40,* 979-992.

Lanphear, B.P., Dietrich, K., Auinger, P., & Cox, C. (2000). Cognitive deficits associated with blood lead concentrations <10 microg/dL in US children and adolescents. *Public Health Reports, 115*, 521-529.

La Paro, K.M., & Pianta, R.C. (2000). Predicting children's competence in the early school years: A meta-analytic review. *Review of Educational Research, 70*, 443-484.

Larzelere, R.E. (2000). Child outcomes of nonabusive and customary physical punishment by parents: An updated literature review. *Clinical Child and Family Psychology Review, 3*, 199-221.

Lareau, A. (2001). Linking Bourdieu's concept of cultural capital to the broader field: The case of family-school relationships. In B.J. Biddle (Ed.). *Social class, poverty and education: Policy and practice* (pp. 77-100). New York: Routlege/Falmer.

Lareau, A. (2003). *Unequal childhoods: Class, race and family life.* Berkley, CA: University of California Press.

Lazear, E. 92001). Educational production. *Quarterly Journal of Economics, 116,* 777-803.

Leland Benham, A. (2000). The observation and assessment of young children including use of the infant-toddler mental status exam. In C.H. Zeanah, Jr. (Ed.), *Handbook of infant mental health,* (2nd. ed., pp. 249-265). New York: Guilford Press.

Levendowsky, A.A., & Graham-Berman, S.A. (1998). The moderative effects of parenting stress on children's adjustment in women –abusing families. Journal of Family Violence, 13, 383-397.

Leventhal, T., & Brooks-Gunn, J. (2000). The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. *Psychological Bulletin, 126,* 309-337.

Lipman, E.L., Boyle, M.H., Dooley, M.D., & Offord, D.R. (2002). Child well-being in single-mother families. *Child and Adolescent Psychiatry, 41*, 75-82.

Little, R. J. A., & Rubin, D. B. (1989). The analysis of social science data with missing values. *Sociological Methods & Research, 18*, 292-326.

Lonigan, C.J., Bloomfield, B.G., Anthony, J.L., Bacon, K.D., Phillips, B.M., & Samwel, C.S. (1999). Relations among emergent literacy skills, behavior problems, and social competence in preschool children from low- and middle-income backgrounds. *Topics in Early Childhood Special Education, 19,* 40-53.

Lonigan, C.J., Bloomfield, B.G., Anthony, J.L., Bacon, K.D., Phillips, B.M., & Samwel, C.S. (1999). Relations among emergent literacy skills, behavior problems, and social competence in preschool children from low- and middle-income backgrounds. *Topics in Early Childhood Special Education, 19,* 40-53.

Lonigan, C.J., Burgess, S.R., & Anthony, J.L. (2000). Development of emergent literacy and early reading skills in preschool children: Evidence from a latent variable longitudinal study. *Developmental Psychology, 36*, 596-613.

Ludwig, J., & Miller, D.L. (2005). Does Head Start improve children's life changes? Evidence from a regression discontinuity design. Institute for Research on Poverty. Discussion paper No. 1311-05.

Ludwig, J., & Phillips, D. (2007). The benefits and costs of Head Start. *Social Policy Report, 21*, 3-18.

Luthar, S.S., Doernberger, c.H., & Zigler E. (1993). Resilience is not a unidimensional construct: Insights from a prospective study of inner-city adolescents. *Development and Psychopathology, 3*, 703-717.

Luster T, Vandenbelt M. Caregiving by low-income adolescent mothers and the language abilities of their 30-month-old children. *Infant Mental Health Journal, 20,* 148–165.

Luster, T., & Lekskul, K., & Oh, S.M. (2004). Predictors of academic motivation in first grade among children born to low income adolescent mothers. *Early Childhood Research Quarterly, 19,* 337-353.

Luthar, S.S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development, 71*, 543-562.

MacDorman, M. F., Minino, A. M., Strobino, D. M., & Guyer, B. (2002). Annual summary of vital statistics: 2001. *Pediatrics, 110,* 1037-1052.

Magnuson, K., Meyers, M., Ruhm, C., & Waldfogel, J. (2004). Inequality in preschool education and school readiness. *American Educational Research Journal, 41*, 115-157.

Magnuson, K.A. & McGroder, S.M. (2002). The effect of increasing welfare mothers' education on their young children's academic and school readiness. Joint Center for Poverty Research. JCPR Working Paper 280.

Magnuson, K.A., Ruhm, C., & Waldfogel, J. (2007). The persistence of preschool effects: Do subsequent classroom experiences matter? *Early Childhood Research Quarterly, 22,* 18-38.

Magnuson, K.A., & Walfogel, J. (2005). Early childhood care and education: Effects on ethnic and racial gaps in school readiness. *The Future of Children, 15,* 169-196. Retrieved January 20, 2008 from the PsycARTICLES database.

Marks, G.N. (2007). Accounting for the gender gap in reading and mathematics: Evidence from 31 countries. *Oxford Review of Education, 34,* 1-21.

Mashburn, A.J., Justice, L.M., Downer, J.T., & Pianta, R.C. (2009). Peer effects on children's language development during pre-kindergarten. *Child Development, 80*, 686-702.

Masten, A.S., & Coatsworth, J.D. (1998). The development of competence in favorable and unfavorable environments. *American Psychologist, 53,* 205-220.

Maughm, A., & Cicchetti, D. (2002). Impact of child maltreatment ans interadult violence on children's emotion regulation abilities and socioemotional adjustment. *Child Development, 73*, 1525-1542.

McKee, L., Roland, E., Coffelt, N., Olson, A.L., Forehand, R., Massari, C., Jones, D., Gaffney, C.A., & Zens, M.S. (2007). Harsh discipline and child behavior problems: The roles of positive parenting and gender. *Journal of Family Violence, 22*, 187-196.

McKey, R. H. (1985) The impact of Head Start on children, families and communities: Final report of the Head Start Evaluation, Synthesis and Utilization Project (Report No. DHHS-OHDS-85-31193). Washington, DC: Administration for Children, Youth and families. (ERIC Document reproduction Service No. ED 263984).

McWayne, C.M., Fantuzzo, J.W., & McDermott, P. (2004). Preschool competence in context: An investigation of the unique contribution of child competencies to early academic success. *Developmental Psychology, 40*, 633-645.

Meisels, S.J. (1998). *Assessing readiness* (Report No. CIERA-R-3-002). Ann Arbor, MI: Center for the Improvement of Early Reading Achievement. (ERIC Document Reproduction Service No. ED 429272).

Meyers, R., Alexander, J., Silver, J. A., & Vogel, C.A. (1999). Children with complex health care needs and the public sector child welfare agency. In Silver, J.A., Amster, B.J. & Haecker, T. (Eds.). *Young Children and Foster Care* (pp. 235-257)*.* Baltimore: Brookes Publishing.

Minde, K. (2000). Prematurity and serious medical conditions in infancy: Implications for development, behavior and intervention. In Zeanah, C. H., Jr. (Ed.). *Handbook of Infant Mental Health* (2nd ed.). (pp. 176-194). New York: Guildford Press.

Moore, D., Benenson, J., Reznick, J.S., Peterson, M., & Kagan, J. (1987). Effect of auditory numerical information on infants looking behavior: Contradictory evidence. *Developmental Psychology, 23*, 665-670.

Mulvaney, M.K., & Mebert, C.J. (2007). Parental corporal punishment predicts behavior problems in early childhood. *Journal of Family Psychology, 21*, 389-397.

Murray, A.D., Fees, B.S., Crowe, L.K., Murphy, M.E., & Henriksen, A.L. (2006). The language environment of toddlers in center-based care versus home settings. *Early Childhood Education Journal, 34,* 233-239.

Murray, K.T. & Kochanska, G. (2002). Effortful control: Factor structure and relation to externalizing and internalizing behaviors. *Journal of Abnormal Child Psychology, 30,* 503-514.

Musick, J., & Stott, F. (2000). Paraprofessionals revisited and reconsidered. In J.P. Shonkoff and S.J. Meisels (Eds.). *Handbook of early childhood intervention* (2nd ed.) (pp. 439-453). New York: Cambridge University Press.

Myung, I. J. (2003). Tutorial on maximum likelihood estimation. *Journal of Mathematical Psychology, 47,* 90-100.

National Bureau of Economic Research (2007). The benefits and costs of Head Start. (Working Paper No.12973). Cambridge, MA: Author.

The National Center on Addiction and Substance Abuse at Columbia University (2001, January). *Shoveling up the impact of substance abuse on state budgets*. Retrieved November 14, 2003, from www.casacolumbia.org/pdshopprov/shop/item.asp?itemid=26 - 31k

National Center for Children in Poverty (2002). *Early childhood poverty: A statistical profile.* New York: National Center for Children in Poverty, Columbia University Mailman School of Public Health. Retrieved on February 17, 2006 from http://www.nccp.org/media/ecp02-text.pdf.

National Center for Children in Poverty (2008). *Who are America's Poor Children? The Official Story.* New York, NY: Columbia University Mailman School of Public Health.

National Educational Goals Panel. (1998). Recommendations regarding the implementation of standards. Retrieved on February 17, 2006 from http://govinfo.library.unt.edu/negp/page1-13-9.htm.

National Education Goals Report (1999). Retrieved on February 17, 2006 from http://govinfo.library.unt.edu/negp/reports/99rpt.pdf

National Institute of Child Health and Human Development (NICHD). (1997). Mother-child interaction and cognitive outcomes associated with early child care: Results of the NICHD Study. Poster symposium presented at the biennial meeting of the Society for Research in Child Development, Washington, DC.

National Institute of Child Health and Human Development Early Child Care Research Network (2000). The relation of child care to cognitive and language development. *Child Development, 71,* 960-980.

National Institute of Child Health and Human Development Early Child Care Research Network. (2003). Social functioning in first grade: Associations with earlier home and child care predictors and with current classroom experiences. *Child Development, 74*, 1639-1662.

National Institute of Child Health and Human Development Early Child Care Research Network (2004). Trajectories of physical aggression from toddlerhood to middle childhood. *Monographs of the Society for Research in Child Development, 69*, Serial No. 278.

National Institute of Child Health and Human Development Early Child Care Research Network (2005). Early child care and children's development in the primary grades. Results from the NICHD Study of Early Child Care. American Educational Research Journal, 42, 537-570.

National Research Council. (2001). *Eager to learn: Educating our preschoolers.* Washington, DC: National Academy Press.

No Child Left Behind Act of 2001, Pub. L. No.107–110 (H.R.1).

Nordin, J.D., Rolnick, S.J., & McGriffin, J. (1994). Presence of excess lead absorption and associated risk factors in children enrolled in midwestern health maintenance organizations. *Pediatrics, 93*, 172-176.

Okagaki, L. (2001). Triarchic model of minority children's school achievement. *Educational Psychologist, 36*, 9-20.

O'Neil, R., Welsh, M., Parke, R.D., Wand, S., & Strand, C. (1997). A longitudinal assessment of the academic correlates of early peer acceptance and rejection. *Journal of Clinical Child Psychology, 26,* 290-303.

Orlin, M.N. (1999). Motor development and disorders in young children. In Silver, J.A., Ramey, C.T., Campbell, F.A., & Ramey, S.L. (1999). Early intervention: Successful pathways to improving intellectual development. *Developmental Neuropsychology*, *16*, 385-392.

Querido, J.G., Warner, T.D., & Eyberg, S.M. (2002). Parenting styles and school behavior in African American families of preschool children. *Journal of Clinical Child Psychology, 31*, 272-277.

Oxford, M., & Spieker, S. (2006). Preschool language development among children of adolescent mothers. *Journal of Applied Developmental Psychology, 27*, 165-182.

Páez, M., Tabors, P., & López, L. (2007). Language and literacy development of Spanish-speaking preschool children. *Journal of Applied Developmental Psychology, 28*, 85-102.

Peterson, B.S., Anderson, A.W., Ehrenkranz, R., Staib, L.H., Tageldin, M., Colson, E., Gore, J.C., Duncan, C.C.,Makuch, R., & Ment, L.R. (2003). Regional brain volumes and their later neurodevelopmental correlates in term and preterm infants. *Pediatrics, 111*, 939-984.

Pigott, T.D. (2001). A review of methods for missing data. *Educational Research and Evaluation, 7*, 353-383.

Prizant, B.M., Wetherby, A.M., & Roberts, J.E. (2000). Communication disorders in infants and toddlers. In C. Zeanah (Ed.), *Handbook of infant mental health* (2nd. Ed.). New York: Guilford.

Ramey, C.T., Bryant, D.M., Wasik, B.H., Sparling, J.J., Fendt, K.H., & LaVange, L.M. (1992). Infant Health and Development Program for low birth weight, premature infants: Program elements, family participation, and child intelligence. *Pediatrics. 89*, 454-465.

Ramey, C.T., Campbell, F.A., & Ramey, S.L. (1999). Early intervention: Successfuk pathways to improving intellectual development. *Developmental Neuropsychology, 16*, 385-392.

Ramey, C.T., & Ramey, S.L. (2004). Early learning and school readiness: Can early intervention make a difference? *Merrill-Palmer Quarterly, 50*, 471-491.

Rimm-Kaufman, S.E., Pianta, R.C. (2000). Teachers' judgements of problems in the transition to Kindergarten. Early Childhood Research Quarterly, 15, 147-166.

Rimm-Kaufman, S.E., Pianta, R.C., & Cox, M.J. (2000). Teachers' judgments of problems in the transition to kindergarten. *Early Childhood research Quarterly, 15, 147-166.*

Rogosch, F.A., Cicchetti, D, & Aber, J.L. (1995). The role of child maltreatment in early deviations in cognitive and affective processing abilities and later peer relationship problems. *Development and Psychopathology, 7,* 591-609.

Rose, S.A., Futterweit, L.R., & Jankowski, J.J. (1999). The relation of affect to attention and learning in infancy. *Child Development, 70*, 549-560.

Rosenbaum, P.R., & Rubin, D.B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrica, 70,* 41-55.

Rothbart, M.K., & Bates, J. E. (1998). Temperament. In W. Damon (Ed.), *Handbook of child psychology: Vol. 3. Social, emotional and personality development* (pp. 105-176). New York: Wiley.

Rothbart, M., & Derryberry, D. (1981). Development of individual differences in temperament. In M. Lamb & A. Brown (Eds.). *Advances in developmental psychology* (pp. 37-86). Hillsdale, NJ: Erlbaum.

Rouse, C., Brooks-Gunn, J., & McLanahan, S. (2005). Introducing the issue. *The Future of Children, 15,* 5-14.

Rubin, D. B. (1987). Multiple imputation for nonresponse in surveys. New York: Wiley.

Rutter, M., Pickles, A., Murray, R., & Eaves, L. (2001). Testing hypotheses on specific environmental causal effects on behavior. *Psychological Bulletin, 127*, 291-324.

Rutter, M., & Sroufe, L.A. (2000). Developmental psychopathology: Concepts and challenges. *Development and Psychopathology, 12*, 265-296.

Sameroff, A.J. (2000). Developmental systems and psychopathology. *Development and Psychopathology, 12*, 297-312.

Sameroff, A.J., & Chandler, M.J. (1975). Reproductive risk and the continuum of caretaking casualty. In F.D. Horowitz, M. Hetherington, S., Scarr-Salapatek, & G. Siegel (Eds.), *Review of child development research* (Vol. 4, pp. 187-244). Chicago: University of Chicago Press.

Sameroff, A.J., & Fiese, B.H. (2000). Models of development and developmental risk. In Zeanah, C. H., Jr. (Ed.). *Handbook of Infant Mental Health* (2nd ed.). (pp. 3-19). New York: Guildford Press.

Sameroff, A.J., & MacKenzie, M.J. (2003). Research strategies for capturing transactional model of development: The limits of the possible. *Development & Psychopathology, 15,* 613-640.

Schafer, J.L., & Graham, J.W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147-177.

Schlomer, G.L., Bauman, S., & Card, N.A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology, 57*, 1-10.

Schore, A.N. (2001). The effects of secure attachment on right brain development, affect regulation and infant mental health. *Infant Mental Health Journal*, *22*, 7-66.

Schweinhart, L. J. (2000). The High/Scope Perry Preschool Study: A case study in random assignment. Evaluation and Research in Education, 14, 136–147.

Schweinhart, L. J., Barnes, H. V., & Weikart, D. P. (1993). *Significant benefits: The High/Scope Perry Preschool Study through age 27. Monographs of the High/Scope Educational Research Foundation, 10*. Ypsilanti, MI: High/Scope Press.

Seidenberg, M.S., & McClelland, J.L. (1989). A distributed, developmental model of word recognition and naming. *Psychological Review, 96*, 523-568.

Shonk, S.M., & Cicchetti, D. (2001). Maltreatment, competency deficits, and risk for academic and behavioral maladjustment. Developmental Psychology, 37, 3-17.

Shonkoff, J.P., & Meisels, S.J. (Eds.). (2000). *Handbook of early childhood intervention* (2nd ed.). New York: Cambridge University Press.

Shonkoff, J.P., & Phillips, D.A. (Eds.). (2000). *From neurons to neighborhoods: The science of early childhood development.* Washington, DC: National Academy Press.

Silver, J.A. (1999). Starting young. In Silver, J.A., Amster, B.J., & Haecker, T. (Eds.). *Young children and foster care.* Baltimore: Brookes Publishing.

Silver, J. A., Amster, B.J. & Haecker, J. (Eds.). (1999). *Young children and foster care: A guide for professionals.* Baltimore: Brooks Publishing.

Smith, J.R., & Brooks-Gunn, J. (1997). Correlates and consequences of harsh discipline for young children. *Archives of Pediatrics and Adolescent Medicine, 151*, 777-786.

Smith, L.E., Borkowski, J.G., & Whitman, T.L. (2008). From reading readiness to reading competence: The role of self-regulation in at-risk children. *Scientific Studies of Reading, 12*, 131-152.

Snow, C.E., Burns, M.S., & Griffin, P. (1998). *Preventing reading difficulties in young children.* Washington, DC: National Academy Press.

Spelke, E., & Kinzler, K. Core knowledge. *Developmental Science, 10,* 89-96.

Spencer, N. (2005). Does material disadvantage explain the increased risk of adverse health, educational, and behavioural outcomes among children in lone parent households in Britain? A cross sectional study. *Journal of Epidemiology and Community Health, 59, 152-157.*

Starkey, P., & Cooper, R. (1980). Perception of numbers by human infants. *Science, 210*, 1033-1034.

Steele, C.M., & Aronson, J. (1995). Stereotype treat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*, 797-811.

Sternberg, R.J., Grigorenko, E.L., & Bundy, D.A. (2001). The predictive value of IQ. *Merrill-Palmer Quarterly , 47*:1–41.

Stifter, C.A., & Braungart, J.M. (1995). The regulation of negative reactivity in infancy: Function and development. *Developmental Psychology, 31,* 448-455.

Stifter, C.A., Spinrad, T.L. & Braungart-Rieker, J.M. (1999). Toward a developmental model of child compliance: The role of emotional regulation in infancy. *Child Development, 70,* 21-32.

Straus, M.A., & Field, C. (2003). Psychological aggression by American parents: National data on prevalence, chronicity, and severity. *Journal of Marriage and the Family, 65*, 795–808.

Straus, M. A., & Kaufman Kantor, G. K. (1994). Corporal punishment by parents: A risk factor in the epidemiology of depression, suicide, alcohol abuse, child abuse and wife beating. Adolescence, 29, 543-561.

Straus, M.A., & Paschall, M.J. (2009). Corporal punishment by mothers and development of children's cognitive ability; A longitudinal study of two nationally representative. *Journal of Aggression, Maltreatment & Trauma, 18*, 459-483.

Straus, M.A., & Stewart, J.H. (1999). Corporal punishment by American parents: National data on prevalence, chronicity, severity, and duration, in relation to child and family characteristics. *Clinical Child and family Psychology Review*, *2-8.*

Stuart, M., Masterson, J., & Dixon, M. (2000). Spongelike acquisition of sight vocabulary in beginning readers? *Journal of Research in Reading, 23,* 12-27.

Taub, G.E., Floyd, R.G., Keith, T.Z., & McGrew, K.S. (2008). Effects of general and broad cognitive abilities on mathematics achievement. *School Psychology Quarterly, 23,* 187-198.

Taylor, C.A., Guterman, N.B., Lee, S.J., & Rathouz, P.J. (2009). Intimate partner violence, maternal stress, nativity, and risk for maternal maltreatment of children. *American Journal of Public Health, 99*, 175-183.

Theodore, A.D., Chang, J.J., Runyan, D.K., Hunter, W.M., Bangdiwala, S.I., & Agans, R.(2005). Epidemiologic features of the physical and sexual maltreatment of children in the Carolinas. *Pediatrics, 115,* 331-337.

Thomas, A.,& Sawhill, I. (2005). For love and money? The impact of family structure on income. The Future of Children, 15, 57-74.

Tomblin, J.B. (2006). A normativist account of language-based learning disability. *Learning Disabilities Research and Practice, 21*, 8-18.

Torgesen, J.K. (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities Research & Practice, 15,* 55-64.

Uller, c., Huntley-Fenner, G., Carey, S., & Klatt, L. 1999). What representations might underlie infant numerical knowledge? *Cognitive Development, 12,* 349-372.

U.S. Department of Education (2003). *Paige announces $72 million in Early Reading First Grants: Grants going to groups in 22 states are authorized under the No Child Left Behind Act.* Retrieved August 24, 2006 from http://www.ed.gov/news/pressreleases/2003/01/01232003.html

U.S. Department of Education, National Center for Educational Statistics (2000). *America's Kindergarteners.* Washington, DC: Author NCES 2000 07.

U.S. Department of Education, National Center for Educational Statistics (2001). *User's manual for the ECLS-K base year public use data files and electronic codebook.* Washington, DC:U.S. D.O.E.

U.S. Department of Education, National Center for Educational Statistics (2006). Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), *Combined Users Manual for the ECLS-K Fifth Grade Data Files and Electronic Codebooks.* Washington, DC: Author NCES 2006-032.

U.S. Department of Education, National Center for Education Statistics. (2007). Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), Longitudinal 9-month/Preschool Restricted-Use Data File (NCES 2008-024).

U.S. Department of Education, National Center for Educational Statistics (2006). *The Condition of Education 2006.* Washington, DC: Author NCES 2006-071.

U.S. Department of Education, National Center for Educational Statistics (2007). *The Condition of Education 2007.* Washington, DC: Author NCES 2007-064.

U.S Department of Education. National Center for Educational Statistics. (2004). *International Outcomes of Learning in Mathematics Literacy and Problem Solving: PISA 203Results from the U.S. Perspective,* NCES 2005-003. Washington, DC: NCES.

U.S. Department of Health & Human Services (1999). Letter to State Medicaid Directors. Retrieved on February 2, 2006 from http://72.14.209.104/search?q=cache:sgb8WUWLUaQJ:www.afhh.org/res/res_pubs/Directorletter.doc+federal+medicaid+mandatory+lead+testing&hl=en&gl=us&ct=clnk&cd=2

U.S. Department of Health and Human Services (2002). *Making a difference in the lives of infants and toddlers and their families: The impacts of Early Head Start. Executive summary.* Retrieved on December 12, 2006 from http://www.mathematica-mpr.com/publications/pdfs/ehsfinalsumm.pdf

U.S Department of Health and Human Services (2004). *Making a difference in the lives of infants and toddlers and their families: The Impacts of early Head Start.* Washington. DC: Author.

U.S. Department of Health & Human Services, Administration for Children and families (2005). *Head Start Impact Study: First year Findings.* Washington, DC.

U.S. Department of Health and Human Services (2010). Head Start Impact Study: Final Report. Washington, DC: Author.

U.S. General Accounting Office (2006). *Federal Register, 71,* 3848-3849 Retrieved on August 24, 2006 from http://frwebgate5.access.gpo.gov/cgi-bin/waisgate.cgi?WAISdocID=874409356800+1+0+0&WAISaction=retrieve

Vgotsky, L. (1978). Mind in society. Cambridge, MA: Harvard University Press.

Votruba-Drzal, E. (2003). Income changes and cognitive stimulation in young children's home learning environments. *Journal of Marriage and Family, 65*, 341-335.

Wadsworth, J., Taylor, B,, Osborn, A., & Butler, N. (1984). Teenage mothering: Child development at five years. *Journal of Child Psychology and Psychiatry 25,* 305–313

Wakeley, A., Rivera, S., & Langer, J. (2000). Can young infants add and subtract? *Child Development*, *71*, 1525–1534.

Walberg, H.J., & Tsai, S.L. (1983). Matthew effects in education. *American Educational Research Journal, 20*, 359-373.

Wasik, B.A., & Bond, M.A. (2001). Beyond the pages of a book: Interactive book reading and language development in preschool classrooms. *Journal of Educational Psychology, 93*, 243-250.

Wasik, B., Bond, M.A., & Hindman, A. (2006). The effects of a language and literacy intervention on Head Start children and teachers. *Journal of Educational Psychology, 98*, 63-74.

Wasik, B.H., Wasik, J.L., & Frank, R. (1993). Sociometric characteristics of kindergarten children at risk for school failure. *Journal of School Psychology, 31,* 241-257.

Whitehurst, G.J., Arnold, D., Epstein, J., Angell, A., Smith, M. & Fischel, J. (1994). A picture book reading intervention in day care and home for children from low-income families. *Developmental Psychology, 30,* 679-689.

Whitehurst, G.J., Epstein, J., Angell, A., Payne, A., Crone, D., & Fischel, J. (1994). Outcomes of an emergent literacy intervention in Head Start. *Journal of Educational Psychology, 86*, 542-555.

Whitehurst, G., Falco, F., Lonigan, C., Fischel, J., DeBaryshe, B., Valdez-Menchaca, M., et al. (1988). Accelerating language developemtn through picture book reading. *Developmental Psychology, 24,* 552-559.

Whitehurst, G.J., & Lonigan, C.J. (1998). Child development and emergent literacy. *Child Development, 69,* 848-872.

Widaman, K. F. (2006). Missing data: What to do with or without them. *Monographs of the Society for Research in Child Development, 71*, 42-64.

Williams, W., & Evans, J.W. (1969). The politics of evaluation: The case of Head Start. *The Annals of the American Academy of Political and Social Science, 385,* 118-132.

Willians, W., & Evans, J.W. (1969). The politics of evaluation: The case of Head Start. *The Annals of the American Academy of Political and Social Science, 385,* 118-132.

Wood, J.N., & Spelke, E.S. (2005). Infants' enumeration of actions: numerical discrimination and its signature limits. *Developmental Science 8,* 173–181.

Woodward, L.J., Fergusson, D.M., & Horwood, L.J. (2001). Risk factors and life processes associated with teenage pregnancy: Results of a prospective study from birth to 20 years. *Journal of Marriage and the Family, 63,* 1170-1184.

Wynn, K. (1992). Psychological foundations of number: Numerical competence in human infants. *Trends in Cognitive Sciences, 2*, 296-303.

Xu, F., & Spelke, E.S. (2000). Large number discrimination in 6-month-old infants. *Cognition, 74,* 1-11.

Xu, F., & Spelke, E.S., & Goddard, S. (2005). Number sense in human infants. *Developmental Science, 8,* 88–101.

Yoshikawa, H. (2005). Placing the first-year findings of the national Head Start Impact Study in context. Washington, DC: Society for Research in Child Development.

Yuan, K. H. (2009). Identifying variables responsible for data not missing at random. Psychometrika, 74, 233-256.

Zeanah, C., Boris, N.W., & Larrieu, J.A. (1997). Infant development and developmental risk: A review of the past 10 years. *Journal of the American Academy of Child and Adolescent Psychiatry, 36,* 165-178.

Zhan, M. Assets, parental expectations and involvement, and children's educational performance. *Children & Youth Services Review, 28*, 961-975.