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Native American children and school readiness: A nationally representative study of individual and cumulative risks

by

Quentin H. Riser

A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Human Development and Family Studies

Program of Study Committee:
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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University

Ames, Iowa

2018

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ACKNOWLEDGEMENTS

This research was supported by grants from the National Science Foundation (predoctoral Research Fellowship), the Spencer Foundation (#20180006), and Iowa State University College of Human Sciences and the Department of Human Development and Family Studies. The content is solely the responsibility of the author and does not necessarily represent the official views of the funding agencies.

ABSTRACT

Using a nationally representative dataset (Early Childhood Longitudinal Study-Birth Cohort) and bioecological-cumulative disadvantage framework, the present study examined school readiness among American Indian and Alaska Native (AIAN) children. It investigated the relations between salient child and family risk experiences (i.e., poverty, preterm/low birth weight, low maternal education, single motherhood, inadequate prenatal care, teen motherhood, and severe maternal depression), and kindergarten academic (i.e., reading and math) and behavioral outcomes (i.e., social competence, approaches to learning, and externalizing behaviors). Descriptive statistics (representative of children born in 2001) revealed 58.5% of AIAN children experienced poverty at least once prior to kindergarten entry and 45% experienced two or more risks. Hierarchical linear regression examining cumulative risk counts explained less variance in all outcomes than individual risk models and were not significant for behavior outcomes. Regression models with all seven individual risks revealed that poverty exposure at any point prior to kindergarten meaningfully impacted academic skills; however, individual risks were not uniquely related to parent-reported behavioral skills. Individual risk models accounted for 12% and 13% of unique variance in reading and math, respectively. Significant moderation effects were found for behavior outcomes indicating maternal characteristics such as single motherhood, teen motherhood, and low maternal education were related to behavior only in the context of poverty. Findings suggested children who experienced poverty and had mothers without a high school diploma or who gave birth as teenagers demonstrated lower social competence and approaches to learning and higher externalizing behaviors. Interestingly, findings also revealed children of single mothers who experience poverty scored *higher* on approaches to learning and *lower* on externalizing behaviors than

children with married/cohabitating parents experiencing poverty. Given the salience of specific combinations of poverty and maternal characteristics for AIAN children, implications for two-generation programming is discussed along with the potential value of extended family networks. In light of the findings regarding single mothers, more research is needed to explore the unique experiences of AIAN families in the context of their cultural networks to better understand the strengths and protective factors supporting these families en route to resilient outcomes.

CHAPTER 1. INTRODUCTION

American Indian and Alaska Native (AIAN) children experience some of the worst educational and wellbeing outcomes of any group of school children in the United States. Research suggests AIAN children struggle to meet reading and math proficiency standards during formal schooling (Moran et al., 2008; National Center for Education Statistics, 2016; Perie, Grigg, & Donahue, 2005), and report higher rates of school absences, dropping out, and identification in special education than other students (DeVoe, Darling-Churchill & Snyder, 2008; Hibel et al., 2008; National Center for Education Statistics, 2016). These educational and wellbeing disparities are manifested as early as kindergarten entry (Frankel et al., 2014; Marks & Garcia Coll, 2007; Mitchell et al., 2011; Sarche et al., 2009) and often persist into adulthood. For instance, AIAN adults are more likely to exhibit problem drinking behaviors, commit suicide, become teen parents and experience negative labor market outcomes such as unemployment and reduced labor force participation rates (Espey et al., 2014; National vital statistics, 2003; Ogunwole, 2006; Olson & Wahab, 2006).

While the impetus for these disparities is not fully understood, research underscores the significance of historical policies that have contributed to persistent isolation as well as social and economic disadvantage experienced by AIAN families. In particular, colonialist expansionary policies dictated locations in which AIAN families would settle (Heart & DeBruyn, 1998) resulting in AIAN families inhabiting their own isolated, sovereign nations. For most AIAN families, these policies translated into restricted access to resources and opportunities (e.g., health care and education) as well as perpetual poverty exposure (Campbell & Evans-Campbell, 2011). As a result, AIAN families today may experience physical and social risks (e.g., poverty, low maternal education, maternal depression, birth-related risks) that are

associated with geographic isolation, social disadvantage and economic disadvantage (Baldwin et al., 2002; DeNavas-Walt et al., 2012; Martins & Gaffan, 2000; Ogunwole, 2006; Ventura, Mathews, & Hamilton, 2001; Schell, 1997; Vital Statistics of the United States, 2016). Research suggests these risks influence school readiness and may help explain why AIAN children underperform relative to their peers at the start of school and develop at a slower rate academically throughout school (Golding & Fitzgerald, 2017; Lickers, 2007; Marks & Garcia Coll, 2007; Sarche, Tafoya, Croy, & Hill, 2017). However, to better understand the influence of these risk factors scholarship would benefit from a more nuanced view that considers the unique effects of risks such as teen motherhood, single motherhood, and low maternal education and poverty on child outcomes for American Indians and Alaska Natives.

The current corpus of research is insufficient to inform a national approach to address the persistent gaps in school readiness among AIAN children because it does not establish representative estimates of exposure to policy-relevant types of risks of AIAN children and their families. In addition, it does not examine these types of risks concurrently to observe which risks emerge as the strongest influencers of school readiness thus allowing for targeted interventions, nor does it examine how school readiness is impacted as exposure to risk factors accumulate over time. One challenge is that much of the body of research on AIAN children has long been constrained to studies employing cross-sectional designs (Beals et al., 2005; Sarche et al., 2009) or ones that do not contain comprehensive sets of risk factors (Marks & Garcia Coll, 2007). Cross-sectional designs are limited by the fact that they are carried out at one time point (Levin, 2006) and provide snapshots which cannot capture entire histories of experiences (i.e., the breadth of risk experiences between ages 0-5), or the density of risk experiences over time (i.e., the depth of risk experiences between ages 0-5). Further, when cross-sectional designs are

employed, it is impossible to determine whether risk exposure occurs before or during the period being examined, and if risk exposure will occur in subsequent periods.

In addition, research with AIAN children has most often employed designs (e.g., descriptive designs, ethnographic designs, case studies) and small sample sizes that preclude generalizable findings (see Demmert, 2001; Marks, Moyer, Roche, & Graham, 2003). Further, studies with small samples may be underpowered (Cohen, 1992); and, therefore, researchers may be unable to detect statistical differences among low prevalence events (e.g., maternal depression, or low birth weight) as they may not include sufficient numbers of children who experience the events. As such, risk research on AIAN families would be improved by using representative data with sample sizes that enable researchers to detect statistically significant differences and reach population-level conclusions.

Finally, the limited research on development among AIAN children has focused on school-aged children. The disparities AIAN families may experience in educational and wellbeing outcomes are evident as early as kindergarten entry (Marks & Garcia Coll, 2007; Mitchell et al., 2011; Sarche et al., 2009), and some visible gaps are evident as early as the first year of life (Mitchell et al., 2011). Unfortunately, there is not sufficient information about what factors relate to these gaps, and research is needed to better understand these early origins of developmental disparities (Canivez & Bohan, 2006; Pewewardy, 2002). Focusing on early childhood presents a unique opportunity to uncover and address the origins of educational and wellbeing disparities within AIAN families, which can frame how evidence-based interventions can be utilized more effectively. This early period provides an opportunity for interventionists to uncover and address the causes of disparities and act before gaps in achievement and wellbeing can mature. Furthermore, early development is of importance as research suggests a critical

period during early childhood in which children experience heightened levels of brain plasticity (i.e., the brains ability to change; Hensch, 2004). During early childhood, neuronal circuits are shaped by interactions with the external environment, and the critical period presents an optimal time to nurture the brain of the developing child. This period in early childhood facilitates the child's development of skills that prepares the child for success in school. For example, pre-academic and behavioral skills cultivated during early childhood are important in setting the foundation for later school success (Ackerman et al., 2007; Duncan et al., 2007; Hair et al., 2006; Hohm, Jennen-Steinmetz, Schmidt, & Laucht, 2007; Morgan et al., 2008; Wise et al., 2007). Thus, researchers and interventionists examining development during early childhood may reap the greatest returns.

AIAN children remain among the most understudied and under-served children in the United States despite persistent achievement gaps and a historical context of forced isolation (Mueller et al.,1999). As a result, more research is needed on AIAN children that can inform critical issues of policy and practice, better reflect the nature and extent of current risks, and uncover opportunities for early identification and strategic intervention in support of closing persistent achievement gaps. This research requires a theoretical framework capable of understanding the complexities of context and development over time. An ecological-cumulative disadvantage framework is a well-suited framework for such a study because the framework accounts for complex transactions of person and context resulting in the acquisition of developmentally appropriate competencies (Bronfenbrenner, 1986). In addition, the framework can be used to explain how risks may accumulate in meaningful ways to produce persistent achievement gaps among AIAN children (DiPrete & Eirich, 2006). Examining school readiness through this framework, it is important to study the impact of both individual and cumulative

risks. In order to capture multiple risks, low prevalence events, and cumulative exposure over time, comprehensive datasets with longitudinal information on children and families is needed. The Early Childhood Longitudinal Study-Birth Cohort (ECLS-B; Denton Flanagan & McPhee, 2009) is well-positioned to empirically document the individual and cumulative impact of risk factors on negative outcomes among AIAN families. The ECLS-B is nationally representative and purposely oversampled AIAN families. Furthermore, the ECLS-B includes a large set of child and family experiences with over 15,000 variables collected from families, caregivers, teachers, as well as through direct child assessments. Though the ECLS-B data were collected in partnership with the Office of Indian Education (OIE) and contain rich, longitudinal information on AIAN children and families, no peer-refereed studies have employed this data to study AIAN children and families. The purpose of the present study is to address limitations in the current literature base on AIAN children by employing an ecological-cumulative disadvantage framework and using an under-utilized, nationally representative data of AIAN youth. The study seeks to estimate national prevalence and co-occurrence of early childhood risk factors, examine the linkages between individual risk factors and school readiness outcomes, and investigate the associations between cumulative risk exposure and school readiness among AIAN children.

CHAPTER 2. LITERATURE REVIEW

Children that have not mastered critical academic and behavioral competencies prior to kindergarten entry are more likely to have educational, societal, and economical challenges across the life span (Duncan et al., 2007). This suboptimal start not only affects school performance but remains consequential throughout development as these children are more likely to abuse substances, exhibit delinquent and/or violent behavior, dropout, become teen parents, engage in criminal activities, suffer from unemployment, and become clinically depressed as adults (Haskins & Rouse, 2005; Fergusson et al., 2005; Fitzpatrick et al., 2015; Webster-Stratton & Taylor, 2001). Because of this compelling evidence, early childhood researchers agree on the important role of school readiness skills (i.e., pre-academic and behavioral competencies) in improving later outcomes.

School readiness is composed of a set of interdependent developmental dimensions that encompass a collection of behaviors and skills that can increase the likelihood of proficiency when children enter school. This literature review provides an overview of the major constructs that comprise the school readiness literature to date. Most often, researchers examine the interrelated school readiness dimensions in two distinct categories: pre-academic skills (e.g., cognition and reasoning, early literacy, pre-reading cognition and language/literacy) and behavioral skills (e.g., social, emotional, and approaches to learning).

Pre-Academic Skills

Researchers consistently point to the important role of pre-academic skills in setting the foundation for later school success (Duncan et al., 2007; Hohm, Jennen-Steinmetz, Schmidt, & Laucht, 2007; Wise et al., 2007). This category includes multiple dimensions of pre-academic

skills such as language and literacy skills which underpin early reading skills, and cognition and reasoning which set the foundation for early math skills.

Early Reading Skills

Language development is the process by which children learn, understand and communicate during early childhood (The Head Start Early Learning Outcomes Framework, 2015). In the study of contemporary literature on language, two dimensions are primarily studied: receptive language and expressive language (Hess et al., 2014; Laake, & Bridgett, 2014; Yoder, Watson, & Lambert, 2015). Receptive language refers to the emerging ability to listen and understand the concepts that are communicated by others; expressive language is defined as the communication of concepts through language (The Head Start Early Learning Outcomes Framework, 2015). Early childhood education researchers suggest receptive language (Ryan, Fauth, & Brooks-Gunn, 2013) and expressive language (Duncan et al., 2007; Hohm, Jennen-Steinmetz, Schmidt, & Laucht, 2007; Wise et al., 2007) are both meaningful proxies of school readiness.

An associated yet distinct construct is emerging literacy which refers to the knowledge and skills that lay the foundation for reading and writing (The Head Start Early Learning Outcomes Framework, 2015). Emerging literacy includes phonological awareness, print awareness, and comprehension (The Head Start Early Learning Outcomes Framework, 2015). Phonological awareness is the aptitude to perceive and manipulate the sounds of spoken words (Melby-Lervåg, Lyster, & Hulme, 2012), such as producing the sound that the first letter of a word makes (The Head Start Early Learning Outcomes Framework, 2015). Print awareness is loosely defined as knowledge of the forms and functions of written language (e.g., knowing the left page of a book is read first; Pullen & Justice, 2003). The last component of emerging literacy

is comprehension, which is defined as the ability to understand sentences or passages (see Woodcock, 1997). An example of comprehension is a child recounting the sequence of events from a story that was read to them (The Head Start Early Learning Outcomes Framework, 2015). These foundational pre-literacy skills are each uniquely related to later reading success (Badian, 2001; Catts, Fey, Zhang, & Tomblin, 1999; Kjeldsen et al., 2014; Melby-Lervåg, Lyster, & Hulme, 2012; Raikes et al., 2006; Sparks, Patton, & Murdoch, 2014).

Early Math Skills

Cognitive skills are the result of exposure to rich learning opportunities which allow individuals to accumulate and organize information (Emig, 2000; National Education Goals Panel, 1999; The Head Start Early Learning Outcomes Framework, 2015). Cognitive development includes working memory, reasoning/problem-solving, and mathematical thinking (The Head Start Early Learning Outcomes Framework, 2015).

Working memory, which is defined as one's ability to conserve and manipulate information over a short period, is a vital element of cognition that uniquely impacts school success in academic and behavioral domains (Constantinidis & Klingberg, 2016; Ziermans et al., 2012; Fitzpatrick & Pagani, 2012; Gathercole et al., 2004). In addition to being one of the strongest predictors of later school achievement (Ziermans et al., 2012; Gathercole et al., 2004), working memory is predictive of positive behavioral skills (e.g., engagement; Fitzpatrick & Pagani, 2012) that are tied to school readiness. The benefits of early working memory skills persist over developmental periods, for example, working memory skills have been shown to reduce the likelihood of school dropout (Fitzpatrick et al., 2015).

Early problem-solving skills and reasoning skills are foundational cognitive skills that are associated with school achievement (Clements & Sarama, 2011; The National Council of Teachers of Mathematics, 2000), and complex human reasoning later in development (Phillips &

Shonkoff, 2000). Reasoning and problem-solving skills are defined as the act of thinking about complex problems in a logical way to derive a sensible solution (Greeno, 1978). An example of reasoning and problem solving is a child employing a variety of strategies to sort objects by size and color (The Head Start Early Learning Outcomes Framework, 2015).

Another related construct associated with school readiness is mathematical thinking, which is the process of constructing methods of communicating with peers about mathematical content (Van Oers, 2010). Examples of mathematical thinking include counting numbers of objects or identifying groups with greater or fewer units without counting (The Head Start Early Learning Outcomes Framework, 2015).

Behavioral Skills

Early behavioral skills provide a critical foundation for learning and development throughout the lifespan. In fact, these early behavioral skills are predictive of positive outcomes (Ackerman et al., 2007; Hair et al., 2006; Morgan et al., 2008). This category includes multiple dimensions of behavior such as social competence, approaches to learning and externalizing behaviors.

Social Competence

Social competence may be the most broadly defined school readiness dimension. Some expressions of this construct include inviting other children to play, volunteering to help others, and using words to describe feelings (e.g., Mashburn et al., 2008 Rispoli et al., 2013). Social competence helps facilitate interactions and communication between individuals (Riggio, 1986). In practice, socially competent children contribute to a supportive learning environment. For example, children may elect to help their peers that are struggling to master course content, and this pattern of helping may improve learning outcomes for a number of children. The importance of social competence is well documented as well. In kindergarten, social competence enhances a

child's academic development by setting a foundation that allows for future educational attainment (LoCasale-Crouch et al., 2008).

Approaches to Learning

Another foundational skill connecting children to the academic learning context is a child's approaches to learning behaviors. Approaches to learning help children acquire knowledge, learn new skills, and set and achieve goals (The Head Start Early Learning Outcomes Framework, 2015), and include dimensions such as attentiveness, independent learning, task completion, concentration, and imagination. Approaches to learning have been shown to profoundly impact academic achievement and school readiness (Meng, 2015; Razza, Martin, & Brooks-Gunn, 2015; Fantuzzo, McWayne, Perry, & Childs, 2004). For example, children with positive approaches to learning are more likely to engage in constructive, in-class activities such as book reading experimentation, drawing, playing number games, and building (Chen & McNamee, 2011).

Approaches to learning are comprised of multiple constructs including emotional self-regulation and cognitive self-regulation. Emotional self-regulation is defined as a child's development of coping strategies that allow for the effective management of feelings and actions (Batum & Yagmurlu, 2007). Cognitive self-regulation is defined as the control processes responsible for planning and monitoring other cognitive operations (see Salthouse, Atkinson, & Berish, 2003). Cognitive self-regulation includes sustained attention, impulse control and cognitive flexibility. Attention and impulse control are dimensions of cognitive self-regulation generally related to focusing, inhibiting dominant responses in favor of a subdominant response, and in service of future goals rather than instant gratification (see Duncan & Magnuson, 2011). Early attention-related competencies have been found associated with both short-term academic achievement (Duncan et al., 2007) and long-term outcomes including higher SAT scores,

graduation from prestigious postsecondary institutions, and better adult outcomes (Mischel, Shoda, and Rodriguez, 1989). Furthermore, research highlights an association between cognitive flexibility, which is defined as the ability to quickly switch between several tasks (Monsell, 2003), and school success. Evidence from meta-analysis of 20 studies documents substantial relationships exist between cognitive flexibility and school readiness (Yeniad et al., 2014).

Externalizing Behaviors

Externalizing behavior is a problem behavior that is manifested in children's observable actions and interactions with peers and teachers (Campbell, Shaw, & Gilliom, 2000; Eisenberg et al., 2001). In the literature, researchers may use overactivity and externalizing behaviors interchangeably (e.g., Bulotsky-Shearer et al., 2010). A few examples of externalizing behaviors include aggression, hyperactivity, and disruptiveness (see Hinshaw, 1987). Children with consistently high levels of aggression (i.e., hostile or violent behavior or attitudes toward individuals or property) are found at increased risk of experiencing achievement problems in grade school (NICHD Early Child Care Research Network, 2004). In a meta-analysis, Duncan and colleagues (2007) found modest relationships between externalizing behaviors at school entry and teacher-reported mathematics and reading achievement in 5th grade.

Multidimensional School Readiness

While research documents the importance of both pre-academic and behavioral skills, it is also relevant to understand how these dimensions interact and are uniquely related when considered together. A few researchers have accomplished this concurrent examination by employing a multidimensional perspective using math, reading, and behavioral skills, with an objective of investigating the unique contributions of each domain on school readiness. In a longitudinal analysis of six datasets, Grissmer and Colleagues (2010) sought to do exactly this and demonstrated that pre-academic skills and behavioral skills each explained unique variance

in later math, reading, and science achievement. Similarly, in a comprehensive study of school readiness, Hair et al. (2006) found children with a comprehensive positive development profile (i.e., a profile in which children exhibited high pre-academic and behavioral ability) performed well on tests of school readiness. The work demonstrates how pre-academic and behavioral skills both uniquely contribute to later school success. In contrast, the researchers concluded children with high risk profiles (i.e., low pre-academic and behavioral ability) performed the worst on measures of school readiness. The work further supports the notion that pre-academic and behavioral skills are both requisite for school success. Taken together, these studies suggest the unique and overlapping contributions of pre-academic and behavioral skills on school readiness outcomes. As such, this study considers the development of both pre-academic and behavioral skills.

Theoretical Framework

Ecological-Cumulative Disadvantage Framework

The complexity of the multidimensional context in which children develop and the display of persistent achievement gaps for AIAN children requires an equally comprehensive theoretical approach. An earlier iteration of the ecological framework is a well-suited framework through which one can examine school readiness in context. In this conceptual framework, complex transactions of person and context result in the acquisition of developmentally appropriate competencies (Bronfenbrenner, 1986). The ecological framework suggests that children exist within nested contexts in their environment and suggests that the most proximal contexts have stronger impacts on the developing child by either creating rich opportunities for early skill development or threatening early skill development.

For young children, the most influential context is the home (Huston & Bentley, 2010). As children repeatedly interact with primary caregivers in the home, they either attain

developmentally appropriate skills, which can be bolstered by a supportive environment, or they fail to acquire the skills necessary to be proficient because these environments act as mediums through which children are exposed to risks (Bronfenbrenner, 1986). For example, studies assessing parent participation in early home literacy activities reveal a particularly strong link between parent involvement and early student success (Englund, Luckner, Whaley & Egeland, 2004; Sénéchal & LeFevre, 2002). This line of research suggests maternal participation in home literacy activities improves reading outcomes, mathematics outcomes, and both socioemotional and language development (Baker, 2013; Englund, Luckner, Whaley & Egeland, 2004). However, in homes where mothers experience depression, parent-child literacy activities are less likely to occur (Paulson, Keefe, & Leiferman, 2009). Because primary caregivers in the United States are most often mothers, this study focuses on maternal characteristics.

Within the ecological framework, there is recognition that the people, objects, and contexts surrounding a developing child may also introduce risks; and these proximal transmitters of risks may disrupt growth by reducing the stability of transactions that are necessary for the child to cultivate certain skills (Swick & Williams, 2006). When children are exposed to multiple risk factors their impact may be more devastating on long-term development (Evans, Li, & Whipple, 2013; Kraemer, Lowe, & Kupfer, 2005). Accordingly, it is important to examine both the individual and cumulative risks to which the developing child is exposed. To supplement the ecological perspective, a cumulative disadvantage framework is employed; cumulative disadvantage is often used to explain inequality in time-based processes (DiPrete & Eirich, 2006). While the ecological framework provides the rationale for examining certain proximal risk factors that can disrupt development, cumulative disadvantage provides the

necessary logic to address how multiple proximal risks accumulate over time to produce a unique and combined effect on development.

This framework has utility in describing how school readiness outcomes diverge as risk factors accumulate. Cumulative disadvantage suggests that children exposed to zero risks are at the greatest advantage (i.e., will have the most optimal school readiness outcomes). Children experiencing one risk are less advantaged than children experiencing zero risks, and children experiencing two risks are less advantaged than children experiencing one risk. This trend continues for each additional risk to which a child is exposed. The effect of cumulative exposure to risks over time results in compounding disadvantage and this disadvantage can be evident across school readiness domains. As children develop, multiple risk exposure can explain increased heterogeneity and inequality in school readiness outcomes. Because progression in education requires satisfactory performance in prior steps, children who experience early and cumulative disadvantage in school readiness can threaten later educational outcomes (Bast & Reitsma 1998; Daneman, 1991; DiPrete & Eirich, 2006). Over time, this disadvantage compounds with additional risk exposure and intensifies inequality in later outcomes.

Early Risks and School Readiness

From an ecological-cumulative disadvantage perspective, there are sets of risks situated in proximal contexts, such as biological birth risk, inadequate prenatal care, and maternal depression that may accumulate over time producing both an individual and cumulative impact on school readiness--putting a child at risk of being unprepared for school.

Child-Level Risk Factors

Proximal contexts have an important role in encouraging child development. Early developmental context is of particular import as research suggests at near-term a child's brain undergoes a period of rapid development (Nossin-Manor et al., 2013; Oishi et al., 2011).

Changes in the early environment in which this rapid development occurs may alter developmental processes. Research sampling pre-term children (i.e., children with less than 37 weeks completed gestation), for example, suggests irregularities may emerge during this early period, and they are proposed as potential predictors of later neurodevelopment (Aeby et al., 2013; Thompson et al., 2012; Woodward et al., 2012). Because of the significant influence of this early developmental context, it is important to examine risk factors that emerge during this critical period. Two such early risk factors are pre-term and very pre-term birth. Pre-term and very pre-term birth are defined as births of less than 37 weeks completed gestation or births of less than 32 weeks completed gestation, respectively (Vital Statistics of the United States, 2016). Employing these definitions, national estimates suggest prevalence rates of 9.6% for pre-term births and 1.6% for very pre-term births (Vital Statistics of the United States, 2016). Research suggests children born pre-term are more likely to experience unsatisfactory academic and behavioral outcomes (Bhutta et al., 2002; De Schuymer et al., 2011). Likewise, very pre-term children experience similar academic and behavioral outcomes (Cheng et al., 2016; Foster-Cohen et al., 2007; Jansson-Verkasalo et al., 2004).

Another child-level risk factor closely related to pre-term birth is low birth weight (LBW) and very low birth weight (VLBW) which are defined as a child weighing less than 2,500 (5 lb. 8 oz.) and a child weighing less than 1500 grams (3 lb. 4 oz.), respectively (Vital Statistics of the United States, 2016). By these definitions, national estimates suggest prevalence rates of 8.0% for LBW and 1.4% for VLBW (Vital Statistics of the United States, 2016).

Consistent research with diverse samples has documented relationships between LBW and VLBW experiences and suboptimal cognitive and language development (Aarnoudse-Moens et al. 2009; Boardman et al., 2002; Hack et al. 2002; Jansson-Verkasalo et al., 2004; Taylor,

Klein, & Hack, 2000). In addition to the academic outcomes, researchers find negative relationships between LBW and VLBW and behavioral outcomes including externalizing behaviors and problem behaviors (Hayes & Sharif, 2009; Hack et al., 2004; McCormick, Workman-Daniels, & Brooks-Gunn, 1996). Taken together, the studies demonstrate the salient role of LBW and VLBW in contributing to the likelihood of suboptimal pre-academic and behavioral development. Though research suggests child-level characteristics (e.g., pre-term/low birth weight) are associated with multiple school readiness outcomes, given their low rate of prevalence in the population, it is important to consider other predictors of school readiness outcomes (see Vital Statistics of the United States, 2016). Accordingly, researchers should examine other contextual factors to get a comprehensive picture of factors promoting or constraining school readiness.

Inadequate prenatal care is another meaningful risk factor that may impact school readiness. The American Academy of Pediatrics and American College of Obstetricians and Gynecologists (2002) recommends that woman with uncomplicated pregnancies be examined every 4 weeks for the first 28 weeks of pregnancy; every 2 to 3 weeks until 36 weeks' gestation; and weekly following 36 weeks. Women who do not follow these guidelines may not experience sufficient care to detect in-utero developmental anomalies or receive nutrition and health counseling needed to adequately support fetal growth. Using the Adequacy of Prenatal Care Utilization Index, inadequate prenatal care is defined as mothers receiving no care during the first trimester of pregnancy or mothers with less than 5 prenatal care visits (see Kotelchuck, 1994; Hamilton., Osterman, Driscoll, & Rossen, 2018). National estimates of the prevalence of inadequate prenatal care yield rates between 7.1 and 11.2% (National Vital Statistics, 2010; Partridge et al., 2012). The prevalence of inadequate prenatal care is of note as it verifiably

impacts a myriad of health outcomes—some of which are strongly associated with school readiness. For example, inadequate prenatal care is associated with increased risk of preterm birth, low birth weight and infant mortality regardless population sample (Cox et al., 2011; Partridge et al., 2012). And, preterm birth and low birth weight are associated with suboptimal cognitive and behavioral development (Aarnoudse-Moens et al., 2009; Cheng et al., 2016; De Schuymer et al., 2011; Hayes & Sharif, 2009).

Family-Level Risk Factors

For young children, one of the most influential contexts is the home context (Huston & Bentley, 2010). As children repeatedly interact with primary caregivers in their home, transactions can either help or hinder the acquisition of developmentally appropriate skills (Bronfenbrenner, 1986). Because of the influence of this early home environment, it is important to consider the impact of family-level risk factors on child development outcomes. Research consistently highlights the negative associations between family-level risk factors associated with poverty and developmental outcomes (Duncan, Magnuson, & Votruba-Drzal, 2015; Duncan, Morris, & Rodrigues, 2011; Harding, Morris, & Hughes, 2015).

Poverty is a critical family-level risk factor that has been found to be strongly associated with school readiness outcomes. While the definition of poverty varies across studies, the U.S. Census Bureau determines poverty status by comparing pre-tax income to a threshold that is set at three times the cost of a minimum food diet in 1963 (see Duncan, Magnuson, & Votruba-Drzal, 2015); the metric is adjusted yearly for inflation and accounts for household size and composition. Employing this definition of poverty, national reports suggest 23.0% of United States children under the age of six live in poverty (Jiang, Granja, & Koball, 2017). Contemporary studies on the effects of poverty on brain structure reveal poverty alters several areas of the brain associated with school readiness competencies that may negatively impact

school success (Hair et al., 2015; Luby et al., 2013). In addition to modification of brain architecture, researchers point to other factors associated with poverty as the determinants of school readiness outcomes—not simply poverty exposure (i.e., being poor). For example, children living in poverty have higher rates of low birth weight, preterm birth, low maternal education, and mothers experiencing depression (National Research Council and Institute of Medicine, 2009; Haworth et al., 2010). As stated earlier, low birth weight, preterm birth, low maternal education, and maternal depression are negatively associated with school readiness outcomes (Foster-Cohen et al., 2007, Datar & Jacknowitz, 2009; Hayes & Sharif, 2009; Bennett, Bendersky, & Lewis, 2002).

Furthermore, children's early interactions with their most proximal caregivers, often studied as mothers, are among the most formative developmental experiences. Therefore, it is necessary to examine maternal characteristics and experiences such as single motherhood and adolescent motherhood and their impact on developmental outcomes. Current estimates suggest approximately 39.8% of all births are to unmarried women (Vital Statistics of the United States, 2018). Further, 5.3% of all children are born to teenage mothers (Vital Statistics of the United States, 2018). These maternal characteristics, which occur at the time of a child's birth, are consistently associated with negative cognitive and socioemotional outcomes (McLanahan, Tach, & Schneider, 2013; Mollborn & Dennis, 2012; Mollborn et al., 2014). Following an ecological framework, past research suggests disproportionate exposure of single and adolescent mothers to poverty and its correlates (e.g., low birth weight, low maternal education, and maternal depression) may act as mechanisms through which the maternal risk factors affect developmental outcomes (DeNavas-Walt et al., 2012).

In addition, the influence of maternal educational attainment is important to consider when examining child development. Specifically, the negative relationship between maternal educational attainment and the education of the child is worthy of examination as maternal educational attainment is one of the strongest predictors of child educational attainment (Reardon, 2011; Sirin, 2005). In fact, children ages birth to five of mothers with less than a high school education, which is approximately 12.3% of children (Child Trends Databank, 2015), evidence cognitive delays in early childhood and throughout primary school (Harding, Morris, & Hughes, 2015; Perry & Fantuzzo, 2010). Some research suggests the link exists because maternal education shapes parenting behaviors and increases opportunities for stimulating activities (Kalil, Ryan, & Corey, 2012). The absence of positive parenting behaviors and stimulating activities, resulting from low maternal education, may result in suboptimal child outcomes.

In the first few years of life, maternal depression is also strongly related to child development (see Martins & Gaffan, 2000). Researchers measure depression using dimensional scales such as the Centers for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977). Typically, higher scores on scales such as the CES-D indicate a general distress that serves as a proxy for depression. The rate of maternal depression varies across age, the socioeconomic distribution, educational levels, and family structures, but recent estimates suggest maternal depression has a lifetime prevalence rate between 7.0 and 13.0% (Andrade et al., 2008; Cooper et al., 2007).

Despite the difficulties estimating the prevalence of maternal depression, its effects on behavioral and cognitive development are pronounced in the literature (Connell and Goodman 2002; Goodman, 2006; National Research Council and Institute of Medicine, 2009). One mechanism through which maternal depression may affect behavioral and cognitive development

is parent-child reading. Researchers assert depressed mothers are less likely to engage in parent-child reading activities (Paulson, Keefe, & Leiferman, 2009). Some additional mechanisms through which depressed mothers may negatively impact child development are harsh disciplining methods, lack of affection, lack of provision of safety and care, and lack of regulatory control over the child's sleeping patterns (Lovejoy, Graczyk, O'Hare, & Neuman, 2000; McLearn, Minkovitz, Strobino, Marks, & Hou, 2006; Minkovitz et al., 2005; Sills, Shetterly, Xu, Magid, & Kempe, 2007).

Cumulative Risk

Some existing studies in the educational literature examine the associations between indexed risks, which are computed by summing the number of risk conditions present, and school readiness (Burchinal et al. 2000, 2006). This indexing approach to cumulative risks treats combined risk factors as one continuous, linear variable rather than a set of dummy coded variables. This treatment of cumulative risks suggests the direction of the relationship between the amalgamated risk factors and school readiness, but this approach falls short of capturing how each additional risk exposure acts to significantly disadvantage the child and leave the child ill prepared to begin school.

Other studies dichotomize individual risk factors and score each risk factor if the risk is present and examine associations between increased exposure to risks and outcomes (see Evans & Kim, 2007, for example). Employing this cumulative risk perspective, findings suggest that while some individual risk factors may not significantly relate to negative outcomes, children exposed to a certain number of risks are more likely to evidence psychological distress (Evans, 2003; Sameroff, Seifer, Zax, & Barocas, 1987) and perform worse on achievement tests (Luster & McAdoo, 1994; Pratt, McClelland, Swanson, & Lipscomb, 2016). Further, this literature

suggests accumulating risks are associated with negative school readiness outcomes (Evans, Li, & Whipple, 2013; Mistry, Benner, Biesanz, Clark, & Howes, 2010).

Across cumulative risk studies, researchers assess anywhere from two to 43 risk factors (Evans, Li, & Whipple, 2013). Sociodemographic variables such as income, parental education, single parenthood, and teenage parenthood are among the most commonly assessed risk factors across cumulative risk studies. Research finds maternal depression is highly correlated with these sociodemographic factors and is also strongly related to child development (see DeNavas-Walt et al., 2012; Martins & Gaffan, 2000). These physical and social risk factors are often concentrated among the poor and ethnic minority populations (Schell, 1997). In addition to these risks, the geographic isolation experienced by AIAN mothers introduce birth-related risks (e.g., preterm/low birthweight, inadequate prenatal care) to the ecologies of young AIAN children. As such, to tailor models to the ecologies of young AIAN children, these risk factors were included in cumulative risk models.

American Indians and Alaska Native Children and Families

Because of historical policies that restricted access to resources and opportunities, AIAN families may experience an increased likelihood of exposure to child-level risk factors such as low birth weight and preterm birth. Further, AIAN children and families may have access to fewer resources and opportunities resulting in disproportionate exposure to family-level risk factors such as teen motherhood, single motherhood, and low maternal education (Baldwin et al., 2002). But research should disentangle the impact of having fewer resources (i.e., measure by poverty exposure) from the unique impact of factors such as teen motherhood, single motherhood, and low maternal education on school readiness outcomes. Employing an ecological framework, it is vital to examine such risk factors independently as the framework suggests each respective risk may uniquely impact school readiness outcomes. In concert, it is

important to use a cumulative disadvantage framework to investigate aggregated risks, irrespective of type, as cumulative disadvantage suggests the collection of risks may produce a unique, combined effect on school readiness outcomes.

A significant literature documents that AIAN families are disproportionately exposed to several of the risk factors discussed above, each of which may impact school readiness. Data from the National Center for Health Statistics, for example, documents rates of inadequate prenatal care among AIAN infants that are two to three times those of white infants (Baldwin et al., 2002). This trend of disproportioned exposure to risk factors holds at the family-level. For instance, 37.0% of AIAN children under the age of six are living in poverty which is 14.0% greater than the general population rate (Jiang, Granja, & Koball, 2017); in addition, 65.0% of AIAN children under six live in families that are near poverty compared to 45.0% of their peers in the general population. And fewer AIAN adults possess high school diplomas or GEDs (71.0% versus 80.0%) or bachelor's degrees (11.5% versus 24.4%) than their white peers (Ogunwole, 2006).

Furthermore, AIAN children's disproportionate exposure to maternal experiences such as single motherhood and adolescent motherhood. Current estimates, for example, suggest approximately 65.7% (compared to 39.8% of the general population) of all AIAN births are to unmarried women (Vital Statistics of the United States, 2018). Further, 9.9% of all AIAN children were born to teenage mothers (compared to 5.3% % of the general population; Vital Statistics of the United States, 2018).

Though AIAN families may experience disproportionate exposure to some salient risk factors, evidence suggests AIAN family's rates of low birth weight, pre-term birth and maternal depression match those of the general population. For instance, estimates suggest LBW

prevalence rates of 7.5% for AIAN families and 1.3% for VLBW compared to national rates of 8.0% for LBW and 1.4% for VLBW (Vital Statistics of the United States, 2003; 2016). For pre-term births, estimates suggest prevalence rates of 13.7% among AIAN families compared to a national rate of 9.6% (Vital Statistics of the United States, 2003; 2016). At the family level, the trend continues as the lifetime rates of maternal depression among AIAN mothers does not significantly differ from national lifetime rates (8.2-11.4% compared to 7.0-14.0%; Andrade et al., 2008; Beals et al., 2005; Cooper et al., 2007). While these estimates suggest disproportionate exposure to risk factors, they are insufficient to inform a school readiness approach designed to mitigate gaps for AIAN children, largely because the studies from which they are derived do not make use of nationally-representative, longitudinal data with the goal of studying the co-occurrence of risk factors or the unique impact of individual and cumulative risks on school readiness.

The Present Investigation

To best explore how the ongoing exposure to individual and cumulative risk factors may impede AIAN children's success in school, research is needed which considers the following: First, the research should be conducted using population-based, representative data that allows researchers to study low prevalence events and derive generalizable information on AIAN children and families. In the past, national early childhood studies, such as studies funded by the Administration on Children and Families, have excluded AIAN communities (Willis & Spicer, 2013), and quality data on AIAN children and families are often difficult to obtain given the isolated, diverse, and distinct nature of tribal communities (Beals, Manson, Mitchell, Spicer, & The AI-SUPERPFP Team, 2003; Grossman, 2003)**.** Thus, extant research on AIAN children has most often used descriptive designs, ethnographic designs, case studies, and capitalized on small sample sizes (Demmert, 2001; Marks, Moyer, Roche, & Graham, 2003). And, the studies have

often relied on samples of convenience (Beals et al., 2003; 2005; Mitchell et al., 2011; Sarche et al., 2009; Whitesell, Mitchell, & Spicer, 2009). Though descriptive, ethnographic, and case study designs drawn from samples of convenience are helpful in that they provide preliminary data in unchartered topic areas, they are limited because they preclude generalizable findings. An additional limitation of these studies is they may be underpowered (Cohen, 1992); therefore, researchers may be unable to detect differences in low prevalence events (e.g., low birth weight) as their data may not include sufficient numbers of children who experience the events. As such, risk research should be conducted using representative data with samples that enable researchers to detect differences and reach population-level conclusions about AIAN children and families. The few studies on AIAN children taking advantage of representative samples (e.g., Hibel, Faircloth, & Farkas, 2008; Marks & Garcia Coll, 2007) focus on school aged children and miss the critical period from birth to kindergarten.

Second, this research should be conducted using longitudinal data. Much of research on AIAN children is not conducted using longitudinal data or comprehensive sets of risk factors that allow researchers to thoroughly investigate contextual factors influencing development (see Marks et al., 2003). Some studies have emerged to fill the gaps, but the studies focus primarily on African American and Hispanic children. As such, research on AIAN children is limited to studies using cross-sectional designs (Beals et al., 2005; Sarche et al., 2009). Cross-sectional designs are only carried out at one time point (Levin, 2006). Therefore, cross-sectional designs cannot account for the breadth of risk exposure (e.g., any risk experience between ages 0-5), or the depth of risk experiences (e.g., children experiencing risks once or multiple times over time). In addition, when cross-sectional designs are employed, it is difficult to determine whether risk exposure occurs before or during the period being examined, and if risk exposure will occur in

subsequent periods. To address this gap, Marks & Garcia Coll (2007) conducted a longitudinal study of child development using the Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K). The authors found the baseline scores of students were strongly correlated with growth over subsequent years of schooling. Though this work addressed the need for longitudinal design to assess child development, the study focused on a school-aged sample and missed meaningful early years of risk exposure.

Finally, research should examine the *early childhood* experiences of AIAN children from birth to kindergarten in the context of children's individual and family-level risk experiences to investigate the origins of the child's achievement disparities. The limited research on development among AIAN children has focused on school-aged children. The literature on school–aged children suggests only one of every six AIAN students are proficient in reading and one in every four AIAN students are proficient in mathematics (Moran et al., 2008; Perie, Grigg, & Donahue, 2005). Further, the literature posits AIAN students rank below their White, Black, Hispanic, and Asian/Pacific Islanders peers in math and reading (Nelson, Greenough, & Sage, 2009). These differences in achievement are often disseminated in products such as national reports, but there is little research investigating when and why these achievement disparities emerge for AIAN children. Therefore, research is needed to address the gap in examining the development of AIAN children younger than 5 years old to uncover the early origins of developmental disparities (Canivez & Bohan, 2006; Pewewardy, 2002). While evidence suggests disparities among AIAN children in educational and wellbeing outcomes are evident as early as kindergarten entry (Marks & Garcia Coll, 2007; Mitchell et al., 2011; Sarche et al., 2009), the research is not conducted using nationally representative data. This early childhood period presents a unique opportunity to uncover and address the individual origins of educational and

wellbeing disparities, so early childhood researchers and practitioners can design and implement evidence-based interventions to improve child outcomes.

Employing an ecological-cumulative disadvantage framework, the purpose of the present study is to estimate prevalence and co-occurrence rates of risk factors among AIAN children and families, examine the linkages between individual risk factors and school readiness outcomes, and investigate the associations between cumulative risk exposure and school readiness. Three specific aims guide this research:

1. Document the prevalence and co-occurrence of relevant child and family risk experiences among AIAN children.
2. Investigate relationships between individual risks (i.e., preterm/low birth weight, inadequate prenatal care, poverty, low maternal education, birth to a single mother, birth to a teen mother, and maternal depression) and pre-academic and behavioral competencies at kindergarten entry among AIAN children, controlling for child demographics. These relationships are inspected to determine whether they vary as a function of poverty exposure.
3. Investigate relationships between cumulative risks and pre-academic and behavioral competencies at kindergarten entry among AIAN children, controlling for child demographics.

CHAPTER 3. METHODOLOGY

The Early Childhood Longitudinal Study-Birth cohort (ECLS-B) is a longitudinal study conducted by the National Center for Education Statistics at the Institute of Education Sciences, U.S. Department of Education. The ECLS-B was the product of a joint collaboration between agencies such as the Centers for Disease Control and Prevention, Office of Minority Health, and Administration for Children and Families. The ECLS-B purpose was to inform research with longitudinal designs focusing on factors potentially impacting child development (e.g., cognitive and social and emotional development).

The ECLS-B includes a nationally-representative sample of approximately 10,400 children born in 2001. With funding from the Office of Indian Education (OIE), the ECLS-B purposively oversampled AIAN children and families. This was done so investigators could conduct research that would be generalizable (i.e., to the 85,000 AIAN children born in 2001) and address the dearth of research with young AIAN children and families. ECLS-B data were collected when the children were approximately 9 months, 2 years, 4.5 years (preschool year), and 5.5 years old (kindergarten year). Data collectors used multiple approaches including parent (i.e., mothers, resident fathers, and non-resident fathers) interviews and questionnaires, birth certificate records, home visits, teacher interviews and questionnaires, classroom observations, and direct child assessments. The ECLS-B provides extensive information on child and family characteristics, early care experiences, and child outcomes relating to their health, development and education (see Snow et al., 2009).

Dataset Design

The ECLS-B sample was selected by using a clustered, list frame sampling design, based on registered births records in the National Center for Health Statistics (NCHS) vital statistics

system (Najarian et al., 2010). Births were sampled within a set of 96 primary sampling units (PSUs) to control data collection costs. Collectively, the 96 PSUs represent all children born in the U.S. in 2001 (Nord et al., 2004). PSU membership was either based on the location of birth or the residence of the child's mother reported on the birth certificate. The ECLS-B's target population comprised all children born in 2001 excluding children born to mothers younger than 15 years old and children who died or were adopted before the 9-month wave of data collection.

The three general specifications for the AIAN supplemental sample include: (1) there had to be an initial sample of approximately 1,250 total AIAN births, (2) the within-PSU selected sample had to contain at least 50 AIAN births, and (3) they could include no more than 20 PSUs (Bethel et al. 2005). The ECLS-B core (i.e., including AIAN births) and AIAN supplemental PSU samples included AIAN births occurring in counties within 46 states and in Washington, DC. Of these states, 10 state institutional review boards or registrar offices had requirements which put restrictions on standard ECLS-B contact and consent protocol. Further, The Navajo Nation reservations did not permit participation in the study, so the cases drawn from individuals residing on a Navajo Nation reservation were treated as non-response. Ultimately, the full AIAN sample consists of AIAN cases selected within 18 PSUs selected from the AIAN PSU frame and 92 PSUs selected for the core ECLS-B PSU sample (Snow et al., 2009). This combination provides full coverage of the AIAN population (Bethel et al. 2005). More detailed information on AIAN supplemental PSU sampling procedures in the ECLS-B dataset is available in the ECLS-B 9-Month Methodology Report: Sampling (see Bethel et al. 2005).

Participants

The present study includes pooled data from 850[1] AIAN children and their parents who participated in ECLS-B data collection at 9 months, 2 years and 4.5 years (preschool year), and 5.5 years old (kindergarten year). In the ECLS-B dataset, the kindergarten year is comprised of two waves consisting of children entering kindergarten for the first time in 2006 and children entering kindergarten for the first time or repeating kindergarten in 2007. Therefore, there are variables for the math, reading, and behavioral scale scores from both kindergarten waves, though most children only have scores for one wave or the other. Scores were selected based upon the wave of data collection in which the child first entered kindergarten (see measures for further explication).

Analytic Sample

The analytic sample started with all children who were identified as AIAN on their birth certificate or in a series of variables from the 9-month parent interview (multiple races could be indicated along with AIAN; n=850). The sample was restricted to children who had complete data for sample weight WK1RO used in all descriptive and multivariate analyses (n=650). This was a kindergarten weight, so excluded children without information for the final wave of data collection. Next, the sample was limited to those with complete information on the five kindergarten outcomes (i.e., reading; math; parent-reported social competence; externalizing behaviors; approaches to learning; n=600). Finally, after conducting a battery of diagnostic tests on key study variables, less than one percent of remaining observations were excluded with unusual and influential data (e.g., extreme outliers) exerting undue effects on regression

[1] as per the NCES license requirements, all sample sizes were rounded to the nearest 50

coefficients. To do so, DFBETA estimates derived from residual analyses of regression models were used (Fox, 1991). The final analytic sample consists of 600 AIAN children.

Missing Data

The majority of key study variables had individual missingness levels of less than 3.5%, with the exception of inadequate prenatal care (15.0% missingness), pre/term low birth weight (11.0% missingness), and low maternal education (11.0% missingness). The overall missingness rate was 19.0%. Following best practices for dealing with missing data (Royston & White, 2011), missingness was addressed among independent variables using chained equations multiple imputation procedures in Stata 15, generating 20 imputed data sets (M=20) that were used to fit all analytic models.

Measures

Pre-Academic Skills

Pre-academic skills were measured with direct assessments of math and reading taken in the fall of the child's first kindergarten year. The test framework was developed by content experts in children's early math and reading skills and field tests by ECLS-B to determine the psychometric properties of the items; the field test permitted the creation of the ECLS-B mathematics and reading tests for the kindergarten wave of data collection. The test was scored by the National Center for Education Statistics (NCES) using Item Response Theory (IRT) procedures. IRT estimates the probability of correct response as a function of an individual's ability level for a measured construct as well as the item on which the individual is being tested (Snow et al., 2009). To reduce burden, children were not administered the full assessments. Rather, they were given a written adaptive measure on which they first answered a series of routine items. Based on performance on these initial items, children were assigned either the low

difficulty, medium difficulty, or high difficulty set of assessment items. The IRT scale scores approximate the number of items a child would likely have answered correctly if the child was assessed on all the scored questions in a given domain. In other words, IRT scale scores are on a metric that translates to the summed number of correct items. The scores for different content areas are not comparable because they are based on different numbers of questions.

In the present study, the pre-academic outcomes were taken from the appropriate wave for each child, which was either wave 4 (2006) or wave 5 (2007), depending on the wave of kindergarten entry.

Early Reading skills. Children's kindergarten reading skills were measured as a part of an ECLS-B reading test. The measure was designed to assess constructs related to receptive language, expressive language, and emerging literacy such as English language skills/oral language, letter and letter-sound knowledge, phonological awareness, word recognition, vocabulary, and print conventions (Najarian et al., 2010). The 85 items were taken from the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) as well as validated, standardized instruments such as the Peabody Picture Vocabulary Test-Third Edition (PPVT-III; Dunn & Dunn 1997). Cronbach's reliability coefficient of IRT-based reading skills score for kindergarten 2006 (X4RSCR2; n = 6,800) and 2007 (X5RSCR2; n = 1,850) were .92 and .93, respectively (Najarian et al., 2010).

Early Math Skills. Children's kindergarten math skills were measured as a part of an ECLS-B mathematics test that was designed to assess constructs related to working memory, reasoning/problem-solving, and mathematical thinking such as number sense, patterns, properties, and operations skills (Najarian et al., 2010). The 71 items were taken from the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) as well as validated, standardized

instruments such as the Test of Early Mathematics Ability-3 (TEMA-3; Ginsburg & Baroody, 2003). Cronbach's reliability coefficient of the IRT-based math skills scale score for kindergarten 2006 (X4MSCR2; *n* = 6,850) and 2007 (X5MSCR2; *n* = 1,850) were both .92, respectively (Najarian et al., 2010).

Parent-Reported Behavioral Skills

Children's social competence, approaches to learning, and externalizing behavior were evaluated by parents as a part of an ECLS-B social development assessment. The ECLS-B collected a total of 25 parent-reported items designed to appraise behavioral skills such as showing eagerness to learn new things, working or playing independently (without the need for adult direction), inviting others to play, and continuing working until finished with a task. For each of the behaviors, parents were asked to indicate how often they witnessed the child behaving in a certain way over the last three months (responses rated on 5-point Likert scale and include never, rarely, sometimes, often, and very often). These items were adapted from several previously established scales such as the Social Skills Rating System (SSRS; Gresham & Elliott, 1990), the Preschool and Kindergarten Behavior Scales, Second Edition (PKBS-2; Merrell, 1994), and the Early Childhood Longitudinal Study – Kindergarten Class (ECLS-K; U.S. Department of Education, n.d.) Social Rating Scale.

Following the same method as previously published work that explored and used this measure to study children's behavioral outcomes in kindergarten (Rispoli et al., 2013), the present study used confirmatory factor analysis (CFA) to examine construct validity and derive empirically supported measures based on the parent ratings. The CFA model included the three factors assessed by Rispoli and colleagues (2013): Social competence, externalizing behaviors, and approaches to learning. Two items (i.e., "worries" and "unhappy") were excluded as they

focused on internalizing behaviors and researchers have expressed concerns over the interrater agreement of these items (see Roisman & Fraley, 2012). The a priori factor structure proposed by the researchers was based on knowledge regarding previous classifications of the items on the respective measures from which they were derived as well as previous psychometric use of the items (see Rispoli et al., 2013).

Employing Hu and Bentler's empirically derived joint criteria, RMSEA values between .05 and .08 and SRMR values less than .08 suggest an acceptable fit (Browne & Cudeck, 1993; Hu & Bentler, 1999). Fit indices for the three-factor CFA model (allowing factors to correlate) suggested an acceptable fit, RMSEA = .047 (90% CI = .042–.052) and SRMR = .078. Two pairs of items were allowed to covary based on conceptual commonalities and moderate correlations (i.e., r = .49 and .58, respectively). Pairs included (1) child is invited to play and child invites others to play and (2) child gets angry and child throws a temper tantrum. The appendix lists parent-rated social development items included in the ECLS-B and their loadings on 8 social competence items, 8 approaches to learning items, and 7 externalizing behaviors items. Cronbach's alphas for social competence, approaches to learning, and externalizing behavior were .80, .78, and .79, respectively.

Individual risks

Multiple child and family risk indicators were created from information collected across all waves of data and from multiple informants. Each variable was recoded as a dichotomous indicator of either "1" (presence of risk) or "0" (no risk factor present).

Preterm or low birth weight. Data on children's preterm birth status or low birth weight (LBW) status were obtained using information from child birth certificate records. Children were

identified as preterm/LBW if they were born prior to 37 weeks gestation or they weighed less than 2,500 grams at birth (Vital Statistics of the United States, 2016).

Inadequate prenatal care. Data on inadequate prenatal care was obtained from child birth certificate records. Mothers who either did not receive prenatal care during their first trimester or had fewer than four prenatal visits throughout the pregnancy were identified to have received inadequate prenatal care (Hamilton, Osterman, Driscoll, & Rossen, 2018).

Poverty. Household poverty status was identified based on parent report of household income at each wave of data collection. Poverty was indicated for children in a household with an income below 100% of the federal poverty threshold at any wave of data collection prior to kindergarten (i.e., poverty indicated at 9 months, 2 years, or preschool waves).

Single mother. Data on mother's marital status were obtained from child birth records and resident father questionnaires. First, mothers who were unmarried on the birth records were identified. Next, the resident father interview questionnaire was used to determine cases in which mothers were unmarried and lived with or without a birth father, stepfather, foster father or male guardian. Unmarried mothers living without birth fathers, stepfathers, foster fathers or other male guardians in the home were categorized as single mothers.

Teen mother. Data on teen mother status were obtained from child birth records. Mothers who were between 15 and 19 years old at time of the child's birth were identified as teen mothers (Martin, Hamilton, & Osterman, 2017).

Low maternal education. Data on mothers' years of education at child birth were obtained from child birth records. Mothers were identified to have low education if they were 20 years old or older (range: 20 to 45) at the time of the target child's birth and had completed less than a high school education. The consideration of mothers' age was to accommodate mothers

who may have been retained in school but still graduated at a later age, who were enrolled in special education and graduated later, and to differentiate mothers' education with another risk examining "teen mother" status (above). This approach has been used in prior literature (e.g., Brumley, Fantuzzo, Perlman, & Zager, 2015).

*Severe maternal depression***.** Maternal depression was assessed via parent questionnaire when children were approximately 9 months and in preschool using an abbreviated version of the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). This short form was initially developed and tested for use in the Head Start Family and Child Experiences Survey (Child Care and Early Education Research Connections, n.d.) prior to use by NCES in the ECLS-B. The CES-D short form contains 12 items measuring depression symptoms such as depressed affect, positive affect, somatic symptoms, psychomotor retardation, and interpersonal activity. Items were rated using a 4-point Likert-type scale indicating the frequency of depressive symptoms ranging from 0 "rarely or never" to 3 "most or all." Total scores at each wave range from 0 to 36 with higher scores indicating more severe depression. Based on prior studies (e.g., Choi, Bishai, & Minkovitz, 2009), mothers rated 15 points or higher on the CES-D were identified as at risk for suspected severe depression (Paulson, Dauber, & Leiferman, 2006). Suspected severe maternal depression was indicated for mothers above the 15-point cutoff on the CES-D at either the 9 month or preschool wave.

Cumulative risk

All 7 individual risks were summed to create a cumulative risk variable indicating the total number of risk experiences ranging from 0 to 7. Based on the limited cases with greater than 3 risks (less than 5.0%), this category was collapsed into 3 or more risks. Each respective category was dummy coded; the "0 risks" group was used as the reference group.

Covariates

Several influential child characteristics were controlled in analyses, including: parent reported sex (1 = male; 0 = female), age in months at the time of assessment in kindergarten (range: 57 to 82 months), and cognitive skills at 9 months measured by the Bayley Short Form-Research Edition mental scale score (range: 48 to 125; BSF-R). The BSF-R is a shortened version of the Bayley Scales of Infant Development, 2nd Edition (BSID- II; Bayley, 1993) that was developed and validated specifically for the ECLS-B by NCES (Najarjan et al., 2010). The BSF-R mental score was based on 31 items that assessed cognitive skills relating to problem solving, memory, and language skills. NCES-derived scaled scores for the BSF-R mental score were used in analyses (α = .98; Najarjan et al., 2010). The continuous covariates included in analytic models, child cognition and age, were mean-centered to ensure the intercept was meaningful.

Analytic Method

Stata version 15.0 (2017) was used to compute weighted descriptive statistics (see Table 1). To fit more complex statistical models, multiple imputation was used to address missingness and because of the complex, multistage cluster survey design (see Snow et al., 2007), the selection of one participant is related to the selection of another participant; thus, the sample selection is non-random and the oversampling of certain subgroups of the population may result in underestimated standard errors. Therefore, following the guidelines outlined by National Center for Education Statistics (NCES) and the ECLS-B Data File User's Manual (Snow et al., 2009), standard errors were adjusted with jackknifing procedures and the WK1R0 sampling weight was employed, so that findings can be generalized to the U.S. population of AIAN children born in 2001.

The first aim was to document the prevalence and co-occurrence of relevant child and family risk experiences among AIAN children. To address this first aim, the percentage of cases in which exposure to specific individual risks and cumulative risks occurred were examined. Then, the percentage of cases in which exposure to two risks occurred concurrently were examined. To do this, a series of weighted proportions were computed, and a series of cross-tabulations were run to determine the extent to which individual risks co-occurred (i.e., percentage of cases with overlapping risk exposure). Each set of risks (i.e., two risks in each cross-tabulation) were examined independently until all permutations were exhausted. The prevalence and co-occurrence of individual risk factors are presented in Table 2.

The second aim was to investigate relationships between individual risks and pre-academic and behavioral competencies at kindergarten entry among AIAN children. For behavioral outcomes, individual relationships were explored, and where indicated, significant interactions were tested. To address this aim, the relationships between individual risk experiences and kindergarten reading, math, social competence, approaches to learning skills, and externalizing behaviors were examined. For the first step of the hierarchical linear regression model, kindergarten math, reading, social competence, externalizing behaviors, and approaches to learning skills were regressed onto control variables. Next, each of the individual risks were added to the models. In the second step, poverty was not meaningfully related to behavioral outcomes as theorized, so these relationships were further explored by testing for interaction effects. For cumulative models, interactions were not appropriate as poverty was a component of the cumulative risk index. The final math and reading models include all risks, and the final social competence, externalizing behavior, and approaches to learning models include all risks and interaction terms.

For Aim 3, the relationship between cumulative risk experiences and kindergarten reading, math, social competence, approaches to learning skills, and externalizing behaviors was examined. As in previous analyses, using hierarchical linear regression, kindergarten math, reading, social competence, externalizing behaviors, and approaches to learning were regressed onto covariates. Then, the cumulative risk dummy variables were added to the model. the "0 risks" group was used as a reference group, and post-hoc analyses were conducted varying the reference groups so that all groups were compared. Final equations for AIMS 2 and 3 are as follows:

AIM 2:

$$Y_{sr} = \alpha + \beta_1 (male) + \beta_2 (mean\text{-}centered\ child\ age) + \beta_3 (mean\text{-}centered\ baseline\ cognition) + \beta_4 (preterm/lbw) + \beta_5 (inadequate\ prenatal) + \beta_6 (poverty) + \beta_7 (single\ mother) + \beta_8 (teen\ mother) + \beta_9 (low\ maternal\ education) + \beta_{10} (maternal\ depression) + \beta_{11} (single\ mother*poverty) + \beta_{12} (teen\ mother*poverty) + \beta_{13} (low\ maternal\ education*poverty) + \varepsilon$$

AIM 3:

$$Y_{sr} = \alpha + \beta_1 (male) + \beta_2 (\text{mean-centered child } age) + \beta_3 (\text{mean-centered } baseline\ cognition) + \beta_4 (1\ risk) + \beta_5 (2\ risks) + \beta_6 (3\ or\ more\ risks) + \varepsilon$$

In regression equations, Y_{sr} denotes all five school readiness outcomes which each will be analyzed independently. In addition, β_1, β_2, $\beta_{3, \ldots}\beta_n$ denote the regression coefficients associated with each predictor and ε denotes the error term for the regression equation. For both aims, the reference group (base cell, omitted group) represents the most advantaged children in the sample (e.g., females that are of average age and cognitive ability that have not experienced exposure to individual risks) and each coefficient reflects the impact of that particular variable on the child's

educational success. For example, if the regression intercept for the reading model were 15, and the coefficient for male (male =1; female = 0) was β = -.50, results may be interpreted as follows: females that are of average age and cognitive ability that have not experienced exposure to individual risks have an average reading score of 15, and males that are of average age and cognitive ability that have not experienced exposure to individual risks have an average reading score of 14.5. When interpreting a particular coefficient, all other predictors in the model are held constant.

The robustness of the core findings from regression models were judiciously inspected; however, this study has several methodological limitations. First, a secondary dataset was used to investigate primary research questions. As such, results are correlational, and therefore all threats to conclusions cannot be ruled out. In addition, this study has limitations with respect to the measurement of key study variables. Behavioral measures in this study were derived solely from parent-reports, and thus these measures may suggest differences founded on parents' unique outlooks concerning the behavioral competencies of their children. Therefore, findings derived from other sources, such as teachers or non-parental care providers, may differ in meaningful ways when compared to findings from the present study. Further, restricted range (preference for positive ratings) was evident for these parent-reported behavioral outcomes and these measures were less reliable than pre-academic measures. Finally, key predictors were derived from parent reports and this introduced common-method error variance into regression models focused on behavioral outcomes. Taken together, these limitations may help explain some of the unique relationships found between risk factors and behavioral outcomes.

Finally, five outcomes were examined and, in an effort to keep predictors consistent across models, parsimony was a key concern. Also, data/sample constraints emerge during the

investigative process. A set of variables were theorized to be meaningful predictors of the observed outcomes; however, because of high levels of missingness/non-response, the variables were not viable. These limitations may have led to underfit models. For example, diagnostic tests revealed mixed support for model specification error in the reading model--though no misspecification errors were found across the other 4 outcomes. As a consequence of misspecification, some findings may be the spurious result of unmeasured differences that are correlated with both the predictors and outcomes in analytic models.

Power Analysis

Aim 2

The model includes 3 covariates, which are estimated to yield a conservative R-squared of .00. The model will include 7 variables in the set of interest. In this power analysis, only one variable is assumed to yield a conservative R-squared increment of .02 (i.e., variance explained between small and moderate effect) and all others .00. The power analysis focuses on the increment for the set of interest over and above any prior variables (i.e. 1 variable yielding an increment of .02). With the given sample size of 600 and alpha set at .05, the study will have power of .93. This R-squared increment (i.e., .02) was selected as the smallest R-Squared increment that would be important to detect, in the sense that any smaller R-Squared increment would not be of substantive significance. In addition, sensitivity analyses were conducted employing near small (i.e., .02), moderate and large R-Squared increments as defined by Cohen (1992), and at all levels, there is ample power to detect meaningful R-Squared increments.

Aim 3

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between small and moderate effect) and all others .00. The power analysis focuses on the increment for the set of interest over and above any prior variables (i.e., 1 variable yielding an increment of .02). With the given sample size of 600 and alpha set at .05, the study will have power of .94. This R-squared increment (i.e., .02) was selected as the smallest R-Squared increment that would be important to detect, in the sense that any smaller R-Squared increment would not be of substantive significance. In addition, sensitivity analyses were conducted employing near small (i.e., .02), moderate and large R-Squared increments as defined by Cohen (1992), and at all levels, there is ample power to detect meaningful R-Squared increments.

CHAPTER 4. RESULTS

Descriptive statistics (representative of children born in 2001) revealed salient patterns in risk prevalence. As shown in Table 1, 59.0% of AIAN children experienced poverty at least once prior to kindergarten entry. The next most prevalent risk was birth to a single mother (23.0%), and this was followed by low maternal education at birth (23.0%), severe maternal depression (16.0%), preterm/low birthweight (11.0%), inadequate prenatal care (10.0%), and teen mother (8.0%). When the cumulative number of risks among the seven indicators were examined, 25.0% of AIAN children were found to experience zero risks, 30.0% experienced one risk, 24.0% experienced two risks, and 21.0% of AIAN children experienced three or more risks.

Findings from a series of chi-square tests revealed patterns among risk experiences that co-occur (see Table 2). Among the 23.0% of AIAN children born to mothers without high school educations, 92.0% of the children experienced poverty at least once prior to kindergarten compared to 59.0% in the overall AIAN sample. AIAN children with teen or single mothers were more likely to experience poverty as well; Four out of five children born to a single mother (81.0%) experienced poverty, and three out of four children born to teen mothers experienced poverty (76.0%). Using subsamples constrained to include only children exposed to poverty, the percentage of children born to mothers with low levels of education, single mothers, and teen mothers were estimated. Poverty exposed children were more likely to have mothers with low levels of education (36.0% compared to 23.0% in the general AIAN population), single mothers (31.0% compared to 23.0% in the general AIAN population), and teen mothers (11.0% compared to 8.0% in the general AIAN population).

Child characteristics and outcomes

Findings from the individual and cumulative risk models are presented in Tables 3, 4, and 5. The associations between control variables and outcomes were quite similar across models (see Appendix). Results showed that boys were more likely to exhibit externalizing behaviors (B = .27, t = 2.50, p < .05) than their female counterparts. Older children had more advanced reading (B = 1.15, t = 4.61, p < .05) and math (B = .61, t = 3.04, p < .05) skills in kindergarten than younger children, and children with higher baseline cognitive abilities displayed superior reading (B = .20, t = 2.02, p < .05), math (B = .18, t = 2.18, p < .05), and approaches to learning (B = .01, t = 2.35, p < .05) skills in kindergarten than their counterparts.

Individual risk experiences and kindergarten academic and behavioral outcomes

Generally, the individual risk models were useful in predicting academic outcomes; however, the models did not clearly predict behavioral outcomes (see Table 3). Results indicated poverty uniquely predicted kindergarten academic competencies net of child characteristics (i.e., child sex, age, and baseline cognition at 9 months) and other risk factors, but poverty was not predictive of any of the behavioral outcomes that were examined. In the academic models, poverty exposure was associated with lower skills in reading (B = -8.77, t = -3.42, p < .05) among AIAN children. The negative association indicated children exposed to poverty received about 9 fewer points on tests of reading skills when compared to the most advantaged children in the sample (i.e., the reference string of average-aged children with average cognitive ability not exposed to risk factors). Similarly, poverty exposure was correlated with lower skills in math (B = -6.76, t = -3.40, p < .05) among AIAN children. The negative association suggests children exposed to poverty received circa 7 fewer points on test of mathematics skills when compared to the most advantaged children in the sample. Focusing on the behavioral models, children receiving inadequate care while in utero were more likely to display externalizing behaviors *(B*

= .39, $t = 2.18$, $p < .05$); specifically, results indicate children receiving inadequate prenatal care exhibited externalizing behaviors "sometimes" whereas the most advantaged children in the sample "rarely" exhibited externalizing behaviors.

Overall, the models with child-level covariates and individual risks accounted for 25.0% of the variance in reading and 22.0% of the variance in math. When the behavioral outcomes were analyzed, the full models accounted for less than 10.0% of the variance in any given outcome (Range: 5.0%-10.0%). As stated earlier, the models were more useful in predicting academic outcomes than behavioral outcomes. Results showed about 12.0% of the variance in kindergarten reading and 13.0% of the variance in kindergarten mathematics was explained by the individual risk models. However, the individual risk models explained a meager 4.0% of the variance in kindergarten social competence, 3.0% of the variance in kindergarten approaches to learning, and 5.0% of the variance in kindergarten externalizing behavior.

Poverty as a moderator and kindergarten behavioral outcomes

Given prior research and theory, poverty was suspected to be significantly associated with all school readiness outcomes. When poverty emerged as a non-significant predictor of behavioral dimensions, these findings were further explored. In light of the results from descriptive analyses (see Table 2; i.e., the co-occurrence of maternal risk factors with poverty), the relationships between three maternal risk factors (i.e., low maternal education, single motherhood, and teen motherhood) and poverty were investigated. Specifically, the nature of the associations between maternal risk factors and behavioral outcomes were theorized to be different for poor and non-poor children and families. To test for moderation, hierarchical regression models were re-estimated adding three interaction terms to each model (using risk factors that were found to co-occur with poverty while addressing research question 1), which were calculated as the product of low maternal education, single motherhood, or teen

motherhood and poverty status (poor = 1; non-poor = 0). In this analysis, 8 of the 9 interactions were statistically significant (see Table 4).

When the risk model with interaction terms was regressed on social competence, low maternal education ($p < .05$) and teen motherhood ($p < .05$) significantly interacted with poverty to produce unique effects on the outcome. Analyses of approaches to learning and externalizing behaviors outcomes revealed meaningful interaction terms as well. Precisely, low maternal education ($p < .05$), single motherhood ($p < .05$), and teen motherhood ($p < .05$) each significantly interacted with poverty to influence approaches to learning. Similarly, the three maternal risk factors interacted with poverty to significantly impact externalizing behaviors (each at $p < .05$).

The interactions were further explored by testing conditional effects of low maternal education, single motherhood, and teen motherhood on behavioral outcomes for children considered poor and non-poor. Findings are illustrated in Figures 1-8, which show the predicted outcome scores for children exposed to maternal risk factors versus children not exposed to maternal risk factors, who were classified as either poor or non-poor on the poverty measure.

Among children that also experienced poverty, results showed low maternal education was associated with .73-point lower scores on social competence (see Figure 1, C to D slope; $t = -4.46$, $p = .05$). Teen motherhood was correlated with .61-point lower scores on social competence (See Figure 2, C to D slope; $t = -3.66$, $p = .05$). In addition, low maternal education was associated with .67-point lower approaches to learning (See Figure 3, C to D slope; $t = -3.59$, $p = .05$), single motherhood predicted .39-point higher approaches to learning (See Figure 4, C to D slope; $t = 2.65$, $p = .05$), and teen motherhood was related to .46-point lower approaches to learning for children exposed to poverty (See Figure 5, C to D slope; $t = -4.08$, p

= .05). Further, low maternal education predicted .61-point higher externalizing behaviors (See Figure 6, C to D slope; $t = 3.85$, $p = .05$), single motherhood was associated .64-point lower externalizing behaviors (See Figure 7, C to D slope; $t = -4.50$, $p = .05$), and teen motherhood was related to .68-point higher externalizing behaviors amid children exposed to poverty (See Figure 8,C to D slope; $t = 3.98$, p = .05).

When interaction terms were added to the models, an additional 5.0% of the variance in social competence, approaches to learning, and externalizing behaviors was explained. The model with child-level covariates, individual risks, and interaction terms explained 10.0% of the variance in social competence, 10.0% of the variance in approaches to learning, and 15.0% of the variance in externalizing behaviors.

Cumulative risk experiences and kindergarten academic and behavioral outcomes

Kindergarten reading, mathematics, social competence, approaches to learning, and externalizing behaviors were compared among children exposed to different quantities of risks (i.e., 0, 1 risk, 2 risks, and 3 or more risks). As before, the cumulative risk models were useful in predicting academic outcomes, but the models were of limited benefit in estimating behavioral outcomes (see Table 5). Focusing on academic outcomes, results demonstrated when compared to children exposed to 0 risks (reference group), children experiencing 2 risks demonstrated significantly lower skills in reading ($B = -9.90$, $t = -2.88$, $p < .05$) and math ($B = -7.64$, $t = -3.04$, $p < .05$). Further, children experiencing 3 risks demonstrated significantly lower skills in reading ($B = -8.11$, $t = -2.38$, $p < .05$) and math ($B = -6.86$, $t = -2.70$, $p < .05$) than children exposed to 0 risks. In contrast, there were no statistically significant relationships between the number of risks to which a child was exposed and their social competence, approaches to learning, or externalizing behaviors.

For the academic outcomes that yielded significant associations, a series of post-hoc analyses were conducted varying reference groups to examine differences among children with 1, 2, and 3 or more risk experiences. Results demonstrated no statistically significant incremental effects. That is to say: reading and math outcomes for children exposed to two risks were not meaningfully different than outcomes of children exposed to 1 risk. Likewise, reading and math outcomes for children exposed to 3 or more risks were not meaningfully different than the outcomes of children exposed to 2 risks. Significant differences were found between children with zero risks and those experiencing 2 or more; but, no differences were found between the other levels of risk.

Overall, when compared to cumulative risk models, the individual risk models better explained school readiness outcomes. Though generally the cumulative models did not fit the data as well as individual risk models, when regressed on academic outcomes, the cumulative models explained a substantive proportion of variance (8.0% in reading and 9.0% in math). On the other hand, the cumulative risk models explained less than 3.0% of variance in social competence, approaches to learning, and externalizing behaviors, respectively (Range: 1.0-3.0%).

CHAPTER 5. DISCUSSION

The present investigation applied an ecological-cumulative disadvantage framework to examine how individual and cumulative risks affect school readiness among young AIAN children. A nationally representative sample was used to ensure results were generalizable, and several important background characteristics were held constant, so findings would be robust. Further, the present study highlights the importance of longitudinal data that allow better measurement of key study variables over time.

Poverty and Kindergarten Academic Outcomes

One noteworthy finding in this study is that exposure to poverty at any point prior to kindergarten entry uniquely and materially impacts AIAN children's academic outcomes. Though research consistently finds point-in-time assessments of poverty are associated with early academic skill gaps (e.g., Dahl & Lochner, 2012; Magnuson, Waldfogel, & Washbrook, 2012; Milligan & Stabile, 2011), these results are extended to a national sample of AIAN children, exposure to poverty at any point prior to kindergarten entry is captured, and the comorbidity of poverty and other risk factors (e.g., low maternal education, teen motherhood) that purportedly influence academic outcomes is examined.

Findings underscore the importance of capturing children's complete histories of poverty exposure prior to kindergarten entry (and therefore longitudinal data) when estimating the effect of economic disadvantage on reading and math outcomes. 59.0% of AIAN children were found to be exposed to poverty at some point prior to kindergarten entry. This rate is 22.0% higher than prior national prevalence rates derived from cross-sectional data that document 37.0% of AIAN children under the age of six are living in poverty at any given time (see Jiang, Granja, & Koball, 2017). This between-study gap in poverty rates arises because the measure used in the present

study broadens the definition of poverty to include any child whose family income fell below 100% of the federal poverty line at any time prior to kindergarten. This approach to measuring poverty was informed by literature that suggests family income levels fluctuate across early childhood (see Duncan, Yeung, Brooks-Gunn, & Smith, 1998; Wagmiller, Lennon, Kuang, Alberti, & Aber, 2006, for example). In fact, longitudinal data have shown household income volatility is common among Americans with incomes near the poverty line (Morduch, & Siwicki, 2017). These individuals may experience episodic poverty spells lasting anywhere from a month to multiple years (Bane & Ellwood, 1986; Morduch, & Siwicki, 2017; Stevens, 1999). When studies measure family income level using aggregate or average income, they risk concealing this meaningful variation in income which can lead scholars to underestimate the proportion of children exposed to poverty (Hill et al., 2013).

Given the well-established effect of poverty exposure on academic outcomes (e.g., Duncan, Morris, & Rodrigues, 2011; Maynard & Munane, 1979; Morris, Duncan, & Clark-Kauffman, 2005), underestimating the rate of poverty may mislead programs and policies designed to serve children at risk for early academic disparities. Because of an inability to detect true poverty exposure rates, programs and policies serving the poor may exclude children recently classified as poor or children that may be classified as poor in the near future—serving only children classified as poor at the time of measurement. In such cases, changes in family income can affect eligibility for social programs and exacerbate academic disparities.

Another key contribution of this study is the examination of the comorbidity of poverty and other risk factors to parse out their effects on academic outcomes. Prior research suggests poverty tends to cluster together with other risk factors (Baldwin et al., 2002; Jiang, Granja, & Koball, 2017; Ogunwole, 2006; Ventura, Mathews, & Hamilton, 2001; Vital Statistics of the

United States, 2016), which makes it difficult to isolate the unique effect of poverty on academic outcomes. And, to accurately attribute a significant effect to poverty, one should rule out other explanations for the relationships between poverty and child outcomes. In the literature, researchers argue that poverty effects are simply the spurious result of unmeasured difference correlated with both poverty and child outcomes (Mayer, 1997). Other researchers claim any attempts to measure the effects of poverty can be distorted because risk factors correlated with poverty may themselves be predicted by poverty (Gershoff, Aber, & Raver, 2003). There is evidence supporting this hypothesis as children from low income households are more likely to experience a number of major psychosocial risk factors (Evans, & Kantrowitz, 2002; McLoyd, 1998). In fact, assessing cumulative physical and psychosocial environmental risks, Evans (2004) found approximately 20.0% of poor families experience three or more risk factors.

While the present study finds evidence that co-morbid risks with poverty occur, the negative relationship between early poverty exposure and reading and mathematics outcomes still remains after controlling for the effects of child characteristics and co-morbid risk factors. In fact, early poverty exposure emerges as the only unique predictor of kindergarten reading and math skills with this nationally representative AIAN population, and the magnitude of the effect is between small and medium (see Cohen, 1992). This suggests above and beyond all co-morbid risks included in the analytic model, poverty has a unique, direct effect on academic outcomes.

The co-morbid risks included in the analytic models (e.g., maternal depression, low maternal education, single motherhood, and preterm/low birthweight) are physical and social risk factors that are often concentrated among the poor and ethnic minority populations (Schell, 1997). Research has consistently linked these risk factors to academic school readiness outcomes (Aarnoudse-Moens et al. 2009; Aeby et al., 2013; Hair et al., 2015; Harding, Morris, & Hughes,

2015; Martins & Gaffan, 2000; McLanahan, Tach, & Schneider, 2013) and has found they are prevalent among AIAN children and families (Baldwin et al., 2002; Jiang, Granja, & Koball, 2017; Ogunwole, 2006 DeNavas-Walt et al., 2012; Martins & Gaffan, 2000). As such, these risks that were tailored to the developmental ecologies of young AIAN children were studied and postulated to impact AIAN children's outcomes. Because most risks were not statistically significant, results suggest a need to take a closer look at how poverty affects resource allocation within families to uncover the mechanism through which income affects academic outcomes among AIAN children.

Amount of Risks and Kindergarten Academic Outcomes

Findings on the relationship between cumulative risk and academic outcomes are consistent with the cumulative disadvantage framework and prior literature. This prior work suggests the amount of risks, regardless of type, significantly relates to children's performance across school readiness outcomes (e.g., Evans, Li, & Whipple, 2013; Luster & McAdoo, 1994; Mistry et al., 2010; Pratt, McClelland, Swanson, & Lipscomb, 2016; Rouse et al., 2018). Despite the explanatory power of cumulative risk across multiple school readiness domains, academic/cognitive domains are of particular import. Developmental neuroscience demonstrates compounding risk exposure within children's early ecologies alters timing and arrangement of genetic manifestation, which results in changes in brain architecture and function (Vegas, & Santibáñez, 2009). Cumulative risk associated with poverty, such as stress-inducing risks or risks thwarting stimulation, affect brain regions associated with cognitive efficiency and processing (Nores, & Barnett, 2010). These early disruptions to brain architecture and function take place during a period when children experience heightened levels of brain plasticity (Hensch, 2004). As their neuronal circuits are fashioned by proximal interactions, cumulative risk exposure may cause irreversible harm to a child's developing brain. The harm brought about by cumulative risk

exposure may constrain the potential of the young child and threaten outcomes extending far beyond their school years. As such, to ensure AIAN children reach their full potential, monitoring how cumulative risks effect AIAN children's academic/cognitive development is a critical contribution of the present study.

The types of risks included in this cumulative approach is another important contribution of the present study. While research estimates that between 20.0-30.0% of children experience 3 or more risks (National Center for Children in Poverty, 2010), studies differ on the types of risks they include in cumulative models. One seminal set of risks assessed in the cumulative risk literature is Adverse Childhood Experiences (ACES; Felitti et al., 1998). ACES researchers often emphasize the importance of including risk factors such as physical abuse, emotional abuse, physical neglect, emotional neglect, and sexual abuse in cumulative models (see Finkelhor et al., 2015; Reuben et al., 2016; Solís et al., 2015, for example). However, recent ACES research emphasizes the need to expand this paradigm of adversity to better understand challenges faced by socioeconomically and racially diverse subgroups (Cronholm et al., 2015). Recognizing the need for a tailored approach for newly explored subgroups, the literature was surveyed and risks unique to the ecologies of young AIAN children were identified.

While researchers assess several risks (Evans, Li, & Whipple, 2013), poverty, parental education, single parenthood, and teenage parenthood are among the most commonly assessed risk factors across cumulative risk studies, and these physical and social risk factors are often concentrated among the poor and ethnic minority populations (Schell, 1997). Given the prevalence of poverty, low maternal education, single motherhood, and teenage motherhood among AIAN families (Baldwin et al., 2002; Jiang, Granja, & Koball, 2017; Ogunwole, 2006), cumulative risk models including these factors were postulated to partially explain achievement

disparities faced by AIAN children. Since maternal depression is highly correlated with these sociodemographic factors and is also strongly related to child development (see DeNavas-Walt et al., 2012; Martins & Gaffan, 2000), there was sufficient evidence to warrant its inclusion with the other risks in the cumulative model. Because AIAN communities experience geographic isolation, restricted access to resources (e.g., health care) were posited to introduce birth-related risks (e.g., preterm/low birthweight, inadequate prenatal care) to the ecologies of young AIAN children.

As such, the effect of cumulative risk exposure on AIAN children's academic outcomes was theorized to be pronounced after accounting for exposure to these risk factors. As cumulative disadvantage theory suggests, multiple proximal risks exposure produces a unique and combined effect on both reading and math outcomes. In this sample, tailored sets of risks were used and findings revealed children experiencing two or more risks are less academically competent than children experiencing zero risks. This finding suggests cumulative risk exposure results in compounding disadvantage across academic domains for AIAN children. Further, this result underscores the value of identifying risk factors unique to the ecologies of understudied subpopulations of young children. Because academic outcomes appear to diverge as these particular risks accumulate, the amount of risk (not simply the types) to which an AIAN child is exposed warrants significant attention.

Risk Patterns and Kindergarten Behavioral Outcomes

Another salient finding in this study was that the relationships between risks and behavioral outcomes followed a different pattern than academic outcomes. Whereas individual risks were uniquely related to academic outcomes, with behavior the significant results were about combinations of specific risks that, in isolation, did not demonstrate unique relationships. Children experiencing poverty in isolation did not evidence lower levels of behavioral

competence. Rather, this study suggests behavioral outcomes are influenced by concurrent exposure to maternal risk factors (e.g., teen motherhood, low maternal education) and poverty, as discussed more below.

In contrast to prior literature that demonstrates direct relationships between poverty and associated risks with children's behavioral outcomes (Duncan, Brooks-Gunn, & Klebanov, 1994; Knapp et al., 2007), results from the present study suggest that it is the interaction between maternal risk characteristics and poverty that influences child behavior. Children of mothers with less than a high school education or children of teen mothers demonstrate lower behavioral competencies when exposed to episodic poverty spells during the first five years of their lives. However, in the absence of poverty, children of mothers with less than a high school education or children of teen mothers do not uniquely display lower behavioral competencies. Prior studies provide support for the proposition that these combinations of maternal risks and poverty are important (DeNavas-Walt et al., 2012; Mollborn & Dennis, 2012; Mollborn et al., 2014). In this sample of AIAN children, empirical support was found that poverty and maternal risk factors may each be necessary, but not sufficient, conditions that interact to influence children's behavioral competencies. The interactive effects produce modest, but consistent, associations with behavioral outcomes.

Interestingly, the importance of this nuanced relationship between maternal risks and poverty was highlighted in the one explanatory variable that emerged as a significant predictor in the behavioral models. Inadequate prenatal care was a meaningful influencer of AIAN children's externalizing behavior. This predictor captures maternal characteristics and economic disadvantage as women receiving inadequate prenatal care are more likely to be less educated, uninsured, impoverished, and single (Braveman et al., 2000; Gonthier et al., 2017; Maupin et al.,

2004; Mazul, Ward, & Ngui, 2017). As such, Inadequate Parental Care may serve as a fairly comprehensive proxy risk factor that captures economic and social disadvantage among AIAN mothers.

One interesting finding that might appear contrary to hypothesized relationships was that children of single mothers exposed to poverty score *higher* on approaches to learning and *lower* on externalizing behaviors than children with married/cohabiting parents exposed to poverty. These findings challenge the notion that children of single mothers do not do as well across developmental outcomes as their counterparts with married/cohabiting parents (see DeNavas-Walt et al., 2012; McLanahan, Tach, & Schneider, 2013; Mollborn & Dennis, 2012; Mollborn et al., 2014). Given certain conditions, children of single mothers may thrive developmentally.

Particularly, when children and their mothers receive support from other sources, children may display positive behavioral development regardless of their nuclear family structure. One unique characteristic of AIAN familial context that may explain this finding is the strength and importance of extended familial networks, though the present study did not examine this directly; such networks may offer support to single moms that optimizes AIAN children's outcomes in this context (LaFromboise, Hoyt, Oliver, & Whitbeck, 2006; LaFromboise & Medoff, 2004; Light & Martin, 1986). Research identifies such extended familial networks that provide AIAN children rich and diverse opportunities for skill development that promote positive outcomes in the face of hardship and/or the absence of one parent (LaFromboise, Hoyt, Oliver, & Whitbeck, 2006; Moore et al. 2002).

A further plausible explanation is that AIAN children that are economically disadvantaged and grow up with single parents may experience greater emotional stability than their disadvantaged counterparts with married/cohabiting parents. Past research suggests married

couples that are economically disadvantaged experience increased marital discord and disruption as well as stress (Fein, & Fein, 2004). Marriages characterized by this sort of family stress may be worse for children than living in a single parent household from birth as this marital stress may lead to inconsistent and/or harsh parenting, the eventual dissolution of marriage as well as other suboptimal outcomes (Amato, & Booth, 2001; Amato, & Cheadle, 2008; Conger, Conger, & Martin, 2010; Troxel, & Matthews, 2004). As children experience household stress associated with marital/cohabitation discord, disruption, and stress, their developmental outcomes may be adversely impacted (see Conger, Conger, & Martin, 2010; Heckman, 2011; Fomby, & Cherlin, 2007).

For AIAN children living in single mother headed households, the absence of marital/cohabitation discord, disruption, and stress may allow for enhanced behavioral development. As such, children growing up in stable households with extended familial support, notwithstanding specific family structure, may experience improved outcomes (Battle, 1998; Kamp Dush, 2009; LaFromboise, Hoyt, Oliver, & Whitbeck, 2006; LaFromboise & Medoff, 2004; Light & Martin, 1986).

Future Research

Findings point to meaningful avenues for future research beyond the scope of this initial investigation, including the need to consider culturally-informed protective factors, develop and evaluate behavioral measures, and target the most vulnerable AIAN children and families.

Need for Culturally-informed protective factors

Future studies should include culturally-informed protective factors that may improve academic and behavioral outcomes. In research with AIAN children, there is a need to shift from a deficit-oriented paradigm (i.e., what does not work?) to a protective paradigm (i.e., what works and under what conditions?). In the last 50 years, the research community has placed a greater

emphasis on a need to uncover properties of resilience evidenced by some of the youngest and most vulnerable children and families (Luthar, & Cicchetti, 2000; Luthar, 2015; Masten, & Reed, 2002). This resilience work targets populations with a greater probability of experiencing unfavorable outcomes and identifies factors that enable children to thrive despite adverse conditions (Benard, 1991; Garmezy, 1993; Resnick, 2000).

What is currently established in the literature is that AIAN children experience an array of poor educational and well-being outcomes (DeVoe, Darling-Churchill & Snyder, 2008; Hibel et al., 2008; Moran et al., 2008; National Center for Education Statistics, 2016; Perie, Grigg, & Donahue, 2005). However, more work is needed that investigates protective factors that enable children to thrive across both academic and behavioral domains despite adverse conditions. Protective factors such as family, community, culture, enculturation and maternal support and warmth are among those purported as meaningful in the literature (LaFromboise, Hoyt, Oliver, & Whitbeck, 2006; Sarche et al., 2009).

Findings from the current study suggest there may be protective factors in extended familial networks that need to be articulated and studied in early childhood school readiness research; particularly, for children in families experiencing poverty and children in single parent households, extended family networks may support AIAN children's behavioral development (see LaFromboise, Hoyt, Oliver, & Whitbeck, 2006; LaFromboise & Medoff, 2004; Light & Martin, 1986). These extended familial networks may provide AIAN children with rich and diverse opportunities for behavioral skill development that allow for positive outcomes in the face of economic hardship and/or parental absence.

Further, factors such as oral traditions and storytelling are rich cultural assets of AIAN communities that may serve as promotive factors capable of improving academic outcomes

(Becker, 2002; Claudia & Curry, 1998; Hodge, Pasqua, Marquez, & Geishirt-Cantrell, 2002; Moses, 2004; Verbos & Humphries, 2014; Warner & Grint, 2006). Both oral traditions and storytelling allow orators to transmit complex ideas simply, so young children can understand. Using these tools, parents can express complex ideas that are educational as well as culturally-informed and thus better help children develop academic competencies.

Need for developing and evaluating behavioral competence measures of AIAN children

Among AIAN children, it is possible that the parent-reported behavioral dimensions do not precisely assess culturally-salient competencies. Within the field, researchers still fail to reach consensus on what domains comprise behavioral development and struggle to develop psychometrically reliable and valid measures of these behavioral constructs with young children (Hirsh-Pasek et al., 2005, Raver, 2002). And, this measurement problem is exacerbated when capturing the unique behavioral competencies of diverse populations (Jones, Zaslow, Darling-Churchill, & Halle, 2016).

In fact, research demonstrates AIAN children's behavioral constructs may be fundamentally different than their peers from other cultural groups (Worthly, 1987). Differences on these constructs may arise as a result of collectivist cultural preferences and a myriad of tribal differences. Research failing to account for these preferences and neglecting to use measures designed with AIAN children and families may yield inaccurate results.

Surveying the AIAN behavioral literature, several examples are found of how behavioral development may be different for AIAN children resulting from AIAN collectivism (Weenie, 2000). As a logical outcome of their emersion in a collectivist culture, AIAN children may prefer collaborative learning environments, and the literature suggests AIAN students thrive in such environments (Cajete, 1999; Ward, 1993). This strong cultural preference for collaborative learning may result in a predisposition toward individual competition aversion--particularly if

onlookers are present. AIAN children's competition aversion may be more evident if the ultimate result (i.e., winning or losing) places one student ahead of another (Swisher and Deyhle, 1989). In such cases, cultural preferences (and incongruences) may result in a cross-cultural distortion of what it means for AIAN parents to endorse behavior indicators from global measures such as those used in the ECLS-B. As a result, AIAN cultural preferences may muddle cross-cultural assessments of AIAN parent's ratings of social competence that were derived from traditional definitions of "optimal behavior" based on white, middle class values.

Children raised in a collectivist culture also tend to be holistic or global learners (Nuby, Ehle, & Thrower, 2001). Typically, global learners are highly visual, contextual, relational, and intuitive. The learner's thinking is not necessarily constrained to linearity or hierarchy, and the learner often looks to authority figures for guidance. As a result of cultural preferences, AIAN children may not be seen as independent learners as traditionally defined by existing behavioral measures. Thus, absent an evaluator interpreting parental responses to items with a culturally competent lens, this preference may be viewed as a deficit.

These examples are in line with prior work with AIAN children that speculates about the disutility of using universal measures to tap behavioral competencies with this unique population. Sarche et al. (2009) claimed measures of behavioral skills may miss cultural competencies such as paying attention to elders (in contrast to reading), and inaccurately assess cultural competencies such as autonomous exploration as externalizing behavior problems. The inadvertent exclusion of cultural competencies and the misinterpretation of cultural preferences may lead to erroneous conclusions about a child's competence on the actual underlying construct.

Therefore, researchers seeking to accurately measure competencies among AIAN children should work closely with AIAN communities to determine what comprises these constructs. Using qualitative methods such as cultural domain analysis, researchers can investigate definitions and boundaries of behavioral competence among AIAN children and families (Bernard, 2017). Allowing AIAN informants to define behavioral domains is one way to ensure the construct accurately reflects AIAN interpretations (see Bernard, 2017; Borgatti,1994). Further, ethnographic techniques (i.e., scientific description of cultural customs) can provide meaningful information that informs the survey questions researchers ask once the content domain is specified. These procedures can lead to a culturally-valid behavioral competence questionnaire that is sensitive and capable of capturing within-group variability.

Need for targeting the most vulnerable AIAN children and families

While results in the present study are derived from nationally representative data, results may not reflect important diversity among AIAN children and families. While commonalities do exist between children classified as American Indian and Alaska Natives, meaningful variation remains between AIAN communities (see Sarche et al., 2009). In an effort to uncover if results from the present study accurately represent how diverse, vulnerable AIAN children living in the most isolated communities are developing, future research should comprehensively examine such samples of AIAN children and families; this research can triangulate results from the present study within specific communities to ensure these findings are sensitive across specific cultural contexts (Hitchcock et al., 2005; Nastasi et al., 2007).

Prior research alludes to potential differences that may exist as a result of geographic setting as well as a myriad of tribal differences. AIAN children represent over one half million students enrolled in U.S. public schools each year (DeVoe, J. F. & Darling-Churchill, 2008). As stated, 22 percent of the AIAN population still live on reservations or in Alaska Native villages

(U.S. Census Bureau 2012). Because of this geographic reality, AIAN children and families may seem to be a hidden population in American society (Wilson, 1998). This relative geographic isolation exposes reservation communities to poverty, limited educational attainment and underfunded health services (Dixon & Roubideaux, 2001; Spicer & Sarche, 2012; Willis & Bigfoot, 2003; Zuckerman, Haley, Roubideaux, & Lillie-Blanton, 2004). As such, AIAN children living on reservations may experience greater levels of risk exposure than the nationally representative sample investigated in the present study. Future research should investigate this possibility.

Furthermore, a myriad of tribal differences may result in a need for nuanced understanding of each child's early ecology. The AIAN population as a whole is comprised of more than 550 federally recognized tribes in the U.S. representing different cultures, languages and places of origin (see Elementary and Secondary Education Act of 2016). Each of these subgroups has their own rich cultural, lingual, and tribal assets. Amid this diversity, future protective research should thoroughly explore what improves outcomes and for whom. In doing so, precise, honest research will ensure interventions evidenced to work for nationally representative samples of AIAN communities are not uncritically applied across diverse AIAN communities. Results from national studies and findings derived from local communities should work in harmony to inform evidence-based interventions.

Implications for Policy and Practice

Advancing cognitive development

Academic attainment is the bedrock on which American social and economic prosperity are built. Unfortunately, for AIAN children, poverty exposure reduces the likelihood of academic success. In an effort to combat poverty exposure, preschool programs meeting the highest standards of structural and process quality should be made available in the most vulnerable

communities. Research consistently highlights the positive effect of high-quality preschool programs on academic outcomes (Bania, 2014; Camilli et al., 2010; Leak et al., 2012; Yoshikawa et al., 2013). And, the effect of high-quality preschool on academic outcomes is stronger for children that are economically disadvantaged (Gormley Jr, Gayer, Phillips, & Dawson, 2005; Weiland, & Yoshikawa, 2013).

Furthermore, the general public as well as political pundits recognize the value of high-quality preschool programing. At the present moment, about 70.0% of the general public support legislation augmenting high-quality preschool programs, and in Washington D.C., high-quality preschool expansion receives bipartisan political support (Jones, 2014). However, despite evidence of positive effects as well as public and political support, still very few public dollars are allocated to ensuring economically disadvantaged children, and AIAN children in particular, gain access to high quality preschool (Barnett et al., 2015; Chaudry, Morrissey, Weiland, & Yoshikawa, 2017; Mashburn et al., 2008). As a result, AIAN children do not have the same access to high-quality preschool programs and services as more affluent families (Chaudry, Morrissey, Weiland, & Yoshikawa, 2017). Thus, rather than closing income-based achievement gaps, preschool programs tend to widen gaps.

The United States is at a favorable moment, both publicly and politically, to reverse this trend of preschool programs widening academic achievement gaps rather than closing them. In the long run, solutions aiming to provide universal access to preschool such as those recommended by Chaudry and Colleagues (2017) should be considered. In an effort to ensure universal access to high-quality preschool, the researchers recommended that states fund, develop, and implement universal preschool programs. In the authors' proposal, the federal government acts in a supplementary role: providing ramp-up matching funds to states, ensuring

economically and socially disadvantaged children gain access to preschool programs, and sharing evidence on what works best. While this proposal is promising, it is unclear when, or if, such a proposal will be adopted.

As such, policymakers, practitioners, and AIAN child advocates laboring to improve child development now, should work with preschool programs as presently constructed. In the 42 states (and District of Columbia) with universal preschool programs (Barnett et al., 2015), policymakers can work to hold preschool programs accountable to high standards of quality and pledge that a proportion of preschool slots be reserved for AIAN children as well as children that are economically disadvantaged. Access to such programs will provide AIAN children and families with resources and expertise that will help them overcome the negative effects of poverty and multiple risk exposure. In the remaining eight states without universal preschool programs, policymakers, practitioners, and AIAN child advocates should labor until high-quality preschool programs and services are made available.

Strengthening behavioral competence

Targeted, high-quality early child care programs can be useful in improving behavioral competencies among AIAN children. However, because precise combinations of risks (i.e., maternal risk factors and poverty) matter for behavioral outcomes, in addition to increasing access to high-quality child care, programs should also focus on developing parental capacities. To this end, targeted high-quality child care programs together with a multi-generational approach that supports both children and their parents will yield the greatest advances in children's behavioral competencies.

The federally funded Head Start program is a good example of a model program that could be expanded to prioritize AIAN families, as it includes comprehensive supports for education, health, nutrition, social development, and other services for both parents and children

enrolled (Malone, Bernstein, Atkins-Burnett, & Xue, 2018). Since the launch of Head Start, the program has aimed to serve AIAN children. During the first summer of Head Start's implementation, 34 tribal Head Start programs were opened, and today there are about 150 tribally run Head Start programs that serve nearly 20,000 AIAN children (Malone, Bernstein, Atkins-Burnett, & Xue, 2018). Several studies suggest these children enrolled in Head Start programs display considerable gains in developmental competencies while in the program (Bitler, Domina, Penner, & Hoynes, 2016; Miller, Farkas, Vandell, & Duncan, 2014; Miller, Farkas, & Duncan, 2016); however, pundits debate whether there are positive, long-term effects of Head Start matriculation (Jenkins et al., 2018; Puma et al., 2010).

The current body of evidence on the effectiveness of Head Start is, at best, mixed. The program seems to have positive effects, but this evidence is inconclusive. As such, in a more comprehensive and coordinated model, targeted high-quality early childcare programs should be combined with services that improve young AIAN children's home environments (e.g., providing parent workforce training, education advancement; Chaudry, Morrissey, Weiland, & Yoshikawa, 2017; Haskins, Garfinkel, & McLanahan, 2014). This approach to serving families assumes that serving children and families concurrently with high-quality programs is better than serving them respectively. The term used to describe this approach is multi-generational or two-generational approach.

The Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program is a good example of a federal home visiting program that uses this two-generational approach. MIECHV serves at-risk mothers that are pregnant or who have at least one child under the age of 6. MIECHV builds upon years of scientific evidence that demonstrates professionals working in-home with families improve critical outcomes for children and families (Bilukha et al., 2005;

Kendrick et al., 2000; Sweet, & Appelbaum, 2004). The program accomplishes this by supporting positive parenting and promoting optimal development as well as school readiness competencies.

Currently, MIECHV allocates 3 percent of its budget to the Tribal MIECHV Program which exists to serve AIAN children and families (Adirim, & Supplee, 2013). Though Tribal MIECHV Programs serve a number of AIAN parents and their children each year, currently, very few home visiting practices within tribal communities are evidence-based (Administration for Children and Families, 2016). The development of evidence-based best practices may expand MIECHV's capacity to serve AIAN children and families. And, with this expanded capacity, the tribal MIECHV program may meaningfully improve the home environment of young AIAN children. If programs such as Tribal Head Start and the Tribal MIECHV are implemented jointly using a two-generational framework, the programs have the potential to buffer the negative effect of precise combinations of risks (i.e., maternal risk factors and poverty) and help improve behavioral competencies.

Recently, the Administration for Children and Families, Tribal Head Start, Child Care Development Fund, and Tribal Maternal, Infant, and Early Childhood home visiting programs partnered with four AIAN tribes in an effort called The Tribal Early Learning Initiative (TELI; Administration for Children and Families, 2015). The primary goals of this consortium were to support tribes and coordinate early learning programs, support high-quality childcare programming, provide families with high-quality services from birth to kindergarten, and increase inter-system collaboration. To this end, the collaborators identified early childhood programmatic strengths, weakness, gaps in services, and existing areas where collaboration and integration of information were feasible. One consistent finding across all four sites was that

cross-system collaboration could be improved. The TELI was successful in breaking down cross-system silos in these four tribal communities, and in response to this success, the consortium is expanding to additional sites. This approach is in line with what this study outlined above, and this collaboration is promising for young AIAN children's development.

Conclusion

Results support three principal conclusions for developmental research with American Indian and Alaska Native children. First, poverty exposure at any point prior to kindergarten entry is associated with lower levels of kindergarten reading and math skills. The relationship between poverty exposure and academic outcomes was the most powerful of any of the predictors on any of the outcomes examined in the present study. In the face of poverty, high quality preschool may provide AIAN children exposed to poverty with the rich developmental opportunities necessary to improve academic outcomes.

Second, the amount of risks to which a child is exposed, regardless of type, significantly relates to children's performance across academic outcomes. Monitoring cumulative risks exposure may be useful to uncover AIAN children at risk for suboptimal academic/cognitive development.

Finally, precise combinations of risks (i.e., maternal risk factors and poverty) are important for behavioral outcomes among AIAN children. Inadequate prenatal care may serve as a proxy for the interaction between maternal risk factors and poverty indicating social and economic disadvantage among AIAN mothers. To improve behavioral outcomes among AIAN children, targeted high-quality child care programs together with a multi-generational approach that supports both mothers and their children should be considered.

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Table 1

Weighted means and proportions for child characteristics, risk experiences, and outcomes. Standard deviations in parentheses. (*N* = 600)

Variables	AIAN Sample Proportion/ *M* (*SD*)	Reading Skills *M* (*SD*)	Math Skills *M* (*SD*)	Social Competence *M* (*SD*)	Approaches to Learning *M* (*SD*)	Externalizing Behaviors *M* (*SD*)
Kindergarten Outcomes		38.39 (14.85)	39.91 (10.69)	3.90 (.57)	3.95 (.53)	2.46 (.65)
Child Covariates						
Male	0.49 (.50)	36.94 (15.90)	39.45 (11.29)	3.88 (.55)	3.93 (.57)	2.59 (.67)
Female	0.51 (.50)	39.79 (13.63)	40.35 (10.08)	3.93 (.59)	3.97 (.48)	2.33 (.62)
Child age in months	67.68 (4.39)					
Baseline cognition	77.63 (9.74)					
Individual Risks						
Poverty (at any wave)	0.59 (.49)	**34.27 (13.28)**	**36.91 (10.18)**	3.88 (.60)	3.94 (.60)	2.47 (.70)
Non-poor	0.41 (.49)	**44.09 (15.20)**	**43.97 (10.09)**	3.92 (.53)	3.97 (.41)	2.44 (.59)
Preterm/low birth weight	0.11 (.32)	37.30 (12.00)	38.99 (8.49)	3.88 (.58)	3.89 (.43)	2.34 (.54)
Term/Normal birthweight	0.89 (.32)	38.41 (15.35)	39.97 (11.08)	3.90 (.57)	3.96 (.54)	2.49 (.67)
Low maternal education	0.23 (.42)	34.76 (13.62)	37.61 (8.53)	3.81 (.70)	3.92 (.70)	2.52 (.62)
Maternal Education > 12 years	0.77 (.42)	39.71 (15.02)	41.06 (10.62)	3.94 (.53)	3.97 (.46)	2.43 (.67)
Single mother at birth	0.23 (.42)	37.84 (12.54)	40.23 (8.72)	4.06 (.60)	4.08 (.51)	2.46 (.68)
Cohabiting or married mother	0.77 (.42)	38.55 (15.48)	39.81 (11.22)	3.86 (.56)	3.91 (.53)	2.46 (.65)
Inadequate prenatal care	0.10 (.31)	36.64 (18.28)	36.88 (11.29)	3.82 (.56)	3.93 (.42)	2.90 (.79)
Adequate Prenatal Care	0.90 (.31)	38.79 (14.62)	40.72 (10.21)	3.93 (.57)	3.97 (.53)	2.41 (.63)
Teen mother	0.08 (.28)	34.48 (12.85)	35.60 (11.30)	3.95 (.65)	3.88 (.51)	2.62 (.68)
Mother older than 19 years	0.92 (.28)	38.65 (15.14)	40.25 (10.69)	3.90 (.57)	3.96 (.53)	2.46 (.65)
Severe maternal depression (at any wave)	0.16 (.37)	42.15 (15.23)	42.00 (10.54)	3.89 (.54)	3.96 (.49)	2.50 (.62)

Table 1 (continued)

Variables	AIAN Sample Proportion/ *M* (*SD*)	Reading Skills *M* (*SD*)	Math Skills *M* (*SD*)	Social Competence *M* (*SD*)	Approaches to Learning *M* (*SD*)	Externalizing Behaviors *M* (*SD*)
Lower depressive symptoms	0.84 (.37)	37.67 (14.68)	39.51 (10.68)	3.91 (.58)	3.95 (.53)	2.45 (.66)
Cumulative Risks						
0 risks	0.25 (.44)	43.29 (15.27)	43.48 (10.73)	3.86 (.53)	3.96 (.41)	2.45 (.54)
1 risk	0.30 (.46)	41.05 (16.13)	42.35 (10.50)	4.01 (.47)	4.01 (.47)	2.29 (.66)
2 risks	0.24 (.43)	32.20 (12.86)	36.01 (8.78)	3.80 (.65)	3.83 (.63)	2.68 (.74)
3 risks or more	0.21 (.40)	36.44 (12.97)	38.19 (9.66)	3.94 (.64)	4.07 (.55)	2.45 (.64)

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50. Bold numbers indicate significant mean difference after Bonferroni correction.

Table 2

Prevalence and Co-Occurrence of Individual Risk Factors

	1	2	3	4	5	6	7
	(58.5)	(11.2)	(22.7)	(23.0)	(10.4)	(8.3)	(16.2)
1. Poverty (58.5)	-	10.0	35.9*	31.3*	12.7	11.1*	18.8
2. Preterm/low birth weight (11.2)	51.0	-	21.7	33.0	17.8	12.7	10.2
3. Low maternal education (22.7)	92.0*	10.7	-	27.4	15.0	-	20.0
4. Single mother (23.0)	80.5*	17.1	26.8	-	14.6	17.1*	20.7
5. Inadequate prenatal care (10.4)	68.9	18.3	33.6	29.4	-	10.9	14.9
6. Teen mother (8.3)	75.9*	16.7	-	44.2*	13.7	-	18.3
7. Severe Maternal Depression (16.2)	67.8	7.3	27.6	29.3	9.8	9.6	-

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Numbers in parentheses represent the population percentage. Numbers represent percentages of children within a risk group (row) who also experienced each of the other risks (column).

† $p < .10$.

* $p < .05$.

Table 3

Final Regression Models Predicting Kindergarten Academic Outcomes with Individual Risks (N =600; M = 20)

	Individual Models									
	Reading Skills		Mathematics Skills		Social Competence		Approaches to Learning		Externalizing Behaviors	
	B *p*	*β*	*B* *p*	*β*	*B* *p*	*β*	*B* *p*	*β*	*B* *p*	*β*
Child Covariates										
Male	-2.35	-.08	-.04	.00	-.03	-.03	-.02	-.02	.24	.18*
Age	1.11	.33*	.56	.23*	.00	.02	.00	-.02	-.01	-.04
Baseline cognition	.25	.16*	.21	.19*	.01	.09	.01	.15*	-.01	-.10
Individual Risks										
Poverty	-8.77	-.29*	-6.76	-.31*	-.06	-.05	-.05	-.05	-.08	-.06
Preterm/low birth weight	-.25	-.01	-.20	-.01	-.04	-.02	-.06	-.04	-.18	-.08†
Low maternal education	-3.24	-.09	-2.33	-.09	-.13	-.09	-.08	-.06	.09	.06
Single mother	.33	.01	1.97	.08	.24	.17†	.20	.16†	-.02	-.01
Inadequate prenatal care	.05	.00	-2.34	-.07	-.08	-.04	-.02	-.02	.39	.19*
Teen mother	-2.62	-.05	-3.90	-.11†	-.03	-.01	-.13	-.07	.17	.08
Severe maternal depression	3.57	.09	1.87	.06	-.04	-.03	-.01	-.01	.07	.04
Intercept	44.97*		44.28*		3.95*		3.99*		2.32*	
R^2	.25		.22		.05		.06		.10	
F	5.85*		4.16*		.97		1.44		1.87*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

† $p < .10$.

* $p < .05$.

Table 4

Final Regression Models Predicting Kindergarten Behavioral Outcomes with Individual Risks (N =600; M = 20)

	Individual Models					
	Social Competence		Approaches to Learning		Externalizing Behaviors	
	B p	*β*	*B p*	*β*	*B p*	*β*
Child Covariates						
Male	-.02	-.02	-.01	-.01	.23	.17*
Age	.00	-.01	-.01	-.06	.00	.00
Baseline cognition	.01	.10	.01	.16*	-.01	-.11
Individual Risks						
Poverty	-.01	-.01	-.03	-.03	-.11	-.09
Preterm/low birth weight	-.03	-.02	-.06	-.03	-.17	-.08†
Low maternal education	.49	.36*	.48	.38*	-.53	-.34*
Single mother	-.07	-.05	-.11	-.09	.38	.24*
Inadequate prenatal care	-.14	-.08	-.08	-.05	.45	.22*
Teen mother	.40	.21*	.17	.09	-.40	-.18*
Severe maternal depression	-.03	-.02	.00	.00	.05	.03
Interaction terms						
Low maternal education*Poverty	-.72	-.51*	-.64	-.49*	.72	.45*
Single mother*Poverty	.40	.27	.42	.31*	-.53	-.31*
Teen mother*Poverty	-.60	-.28*	-.43	-.21*	.79	.31*
Intercept	3.93*		3.98*		2.33*	
R^2	.10		.10		.15	
F	2.73*		2.36*		2.84*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

† $p < .10$.

* $p < .05$.

Table 5

Final Regression Models Predicting Kindergarten Outcomes with Cumulative Risks (N =600; M = 20)

	Cumulative Models									
	Reading Skills		Mathematics Skills		Social Competence		Approaches to Learning		Externalizing Behaviors	
	B p	*β*	*B p*	*β*	*B p*	*β*	*B p*	*β*	*B p*	*β*
Child Covariates										
Male	-3.10	-.10	-.72	-.03	-.07	-.06	-.03	-.03	.26	.20*
Age	1.24	.37*	.68	.28*	.01	.04	.00	-.01	-.01	-.04
Baseline cognition	.22	.14*	.20	.18*	.01	.09	.01	.15*	-.01	-.10
Cumulative Risks										
0 risks[a]										
1 risks	-1.07	-.03	-1.16	-.05	.15	.12	.04	.04	-.18	-.12
2 risks	-9.90	-.29*	-7.64	-.31*	-.02	-.02	-.11	-.09	.15	.10
3 or more risks	-8.11	-.23*	-6.86	-.27*	.04	.03	.05	.04	.01	.00
Intercept	44.45*		44.00*		3.89*		3.97*		2.34*	
R^2	.21		.18		.03		.04		.08	
F	7.21*		4.78*		1.11		1.34		2.10	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

[a] Reference

$^{\dagger} p < .10$.

$^{*} p < .05$.

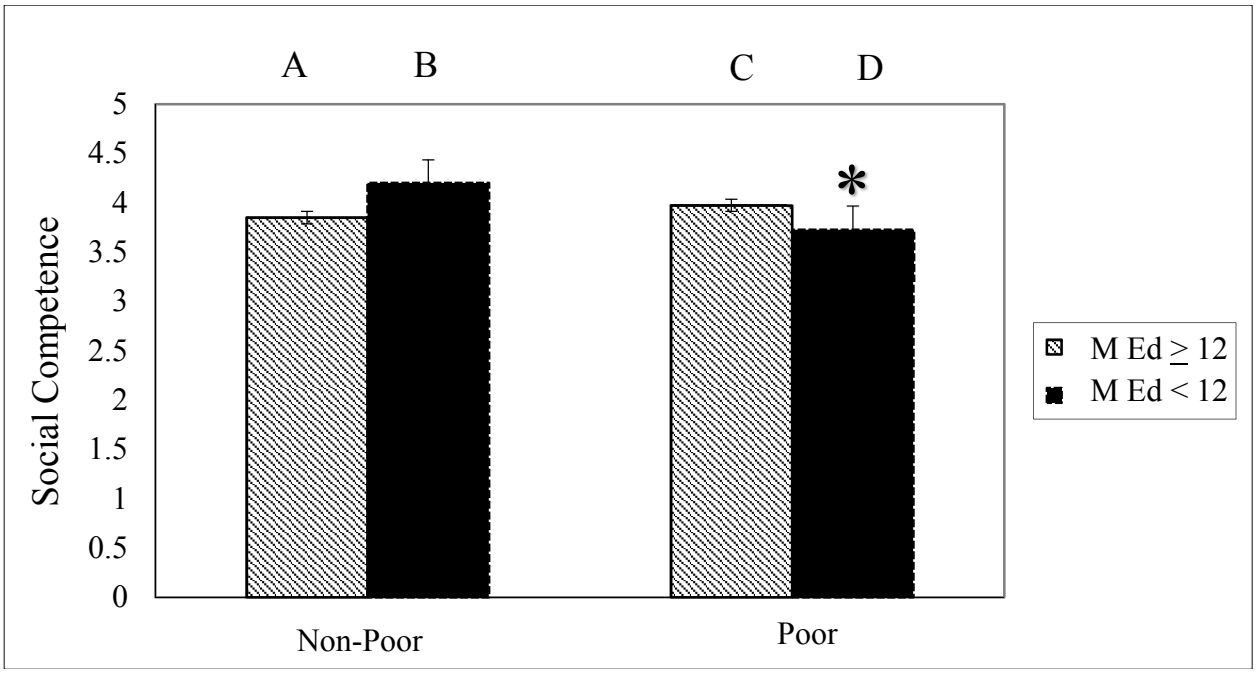

Figure 1. Low maternal education and social competence

Interaction between low maternal education and poverty exposure prior to kindergarten entry predicting social competence. The AB slope compares non-poor children living with mothers with greater than or equal to 12 years of education at birth versus non-poor children living with mothers with less than 12 years of formal education at birth. The CD slope compares poor children living with mothers with greater than or equal to 12 years of education at birth versus poor children living with mothers with less than 12 years of formal education at birth. Error bars represent standard errors. M = Mom; Ed = Education. Asterisk indicates significant mean difference.

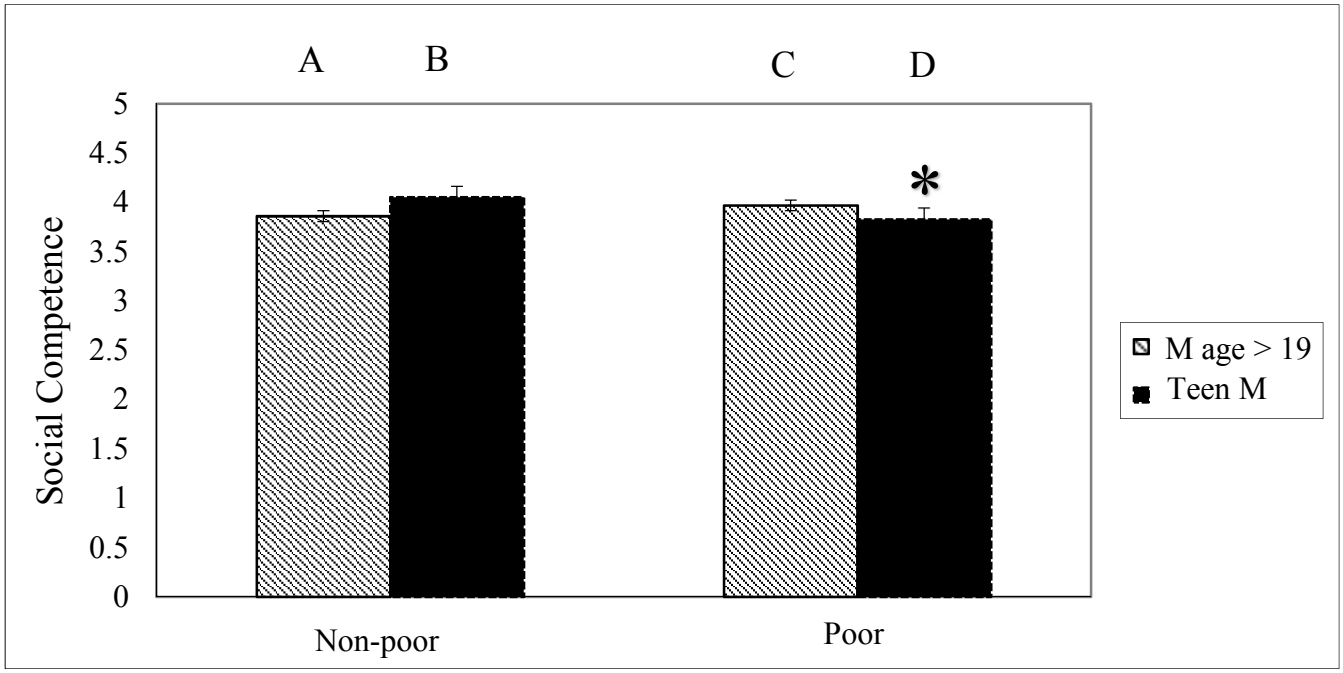

Figure 2. Teen motherhood and social competence

Interaction between teen motherhood and poverty exposure prior to kindergarten entry predicting social competence. The AB slope compares non-poor children living with mothers older than 19 years of age at birth versus non-poor children living with mothers 19 years old or younger at birth. The CD slope compares poor children living with mothers older than 19 years of age at birth versus poor children living with mothers 19 years old or younger at birth. Error bars represent standard errors. M = Mom. Asterisk indicates significant mean difference.

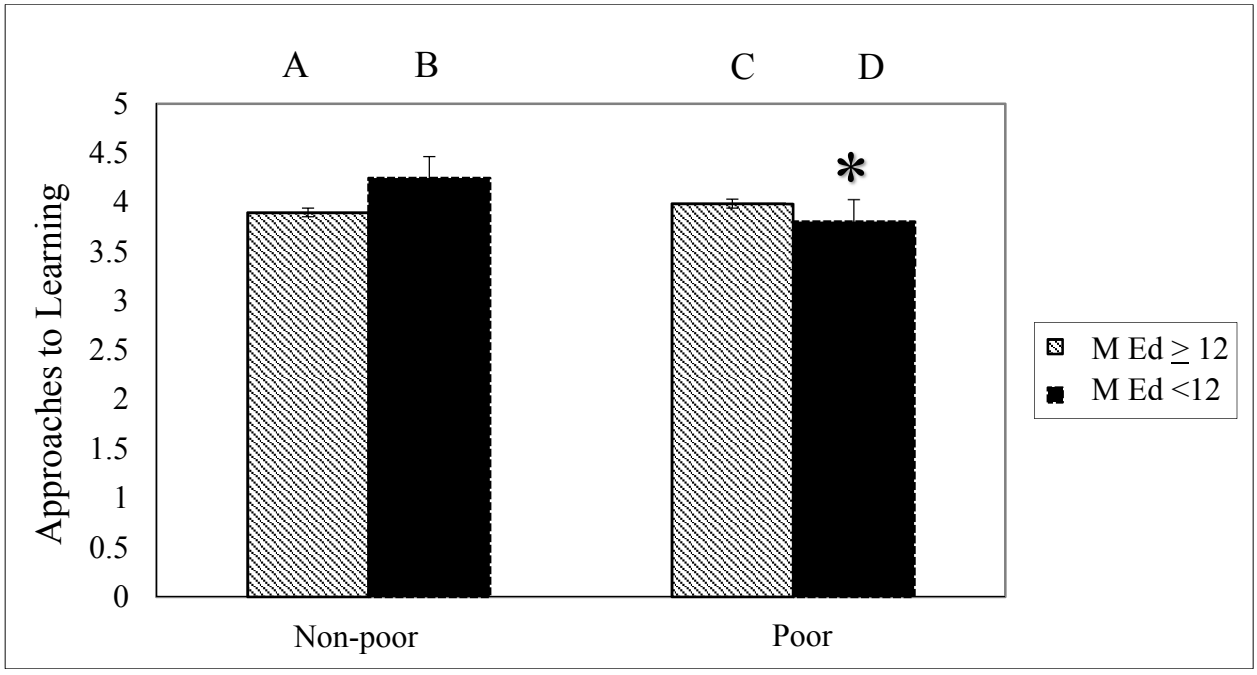

Figure 3. Low maternal education and approaches to learning
Interaction between low maternal education and poverty exposure prior to kindergarten entry predicting approaches to learning. The AB slope compares non-poor children living with mothers with greater than or equal to 12 years of education at birth versus non-poor children living with mothers with less than 12 years of formal education at birth. The CD slope compares poor children living with mothers with greater than or equal to 12 years of education at birth versus poor children living with mothers with less than 12 years of formal education at birth. Error bars represent standard errors. M = Mom; Ed = Education. Asterisk indicates significant mean difference.

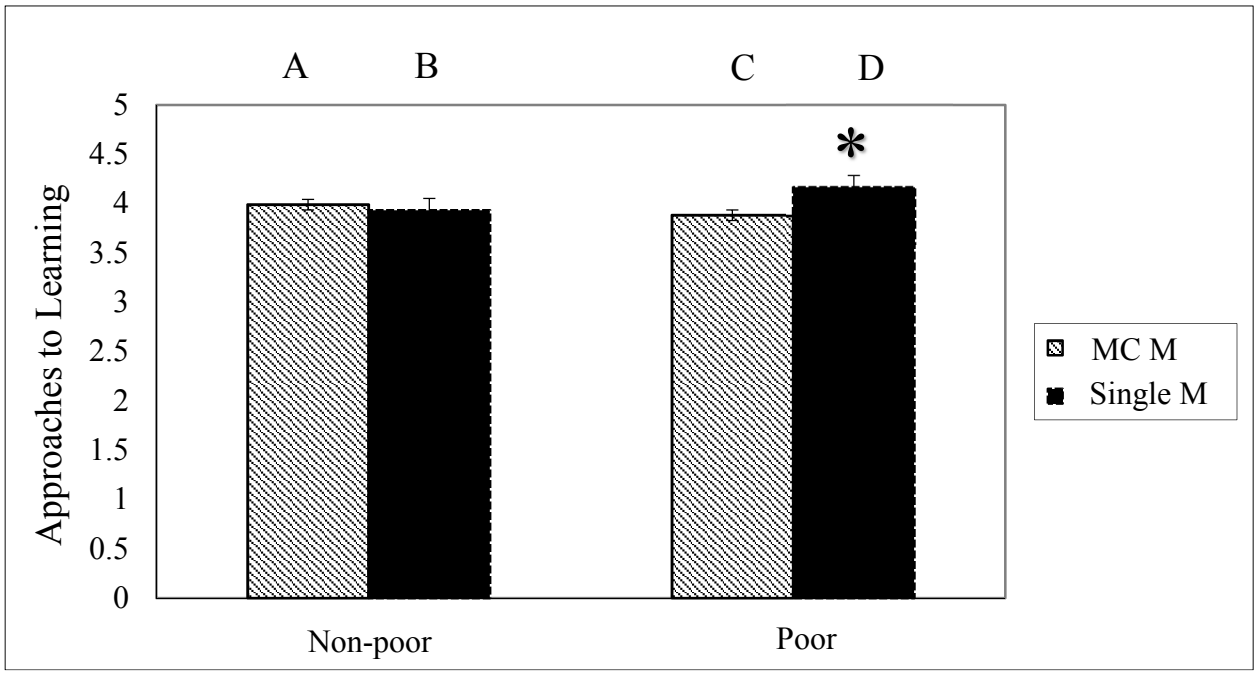

Figure 4. Single motherhood and approaches to learning

Interaction between single motherhood and poverty exposure prior to kindergarten entry predicting approaches to learning. The AB slope compares non-poor children living in homes in which parents were married/cohabiting at birth versus non-poor children living in single parent homes at birth. The CD slope compares poor children living in homes in which parents were married/cohabiting at birth versus poor children living in single parent homes at birth. Error bars represent standard errors. MC = Married/Cohabiting; M = Mom. Asterisk indicates significant mean difference.

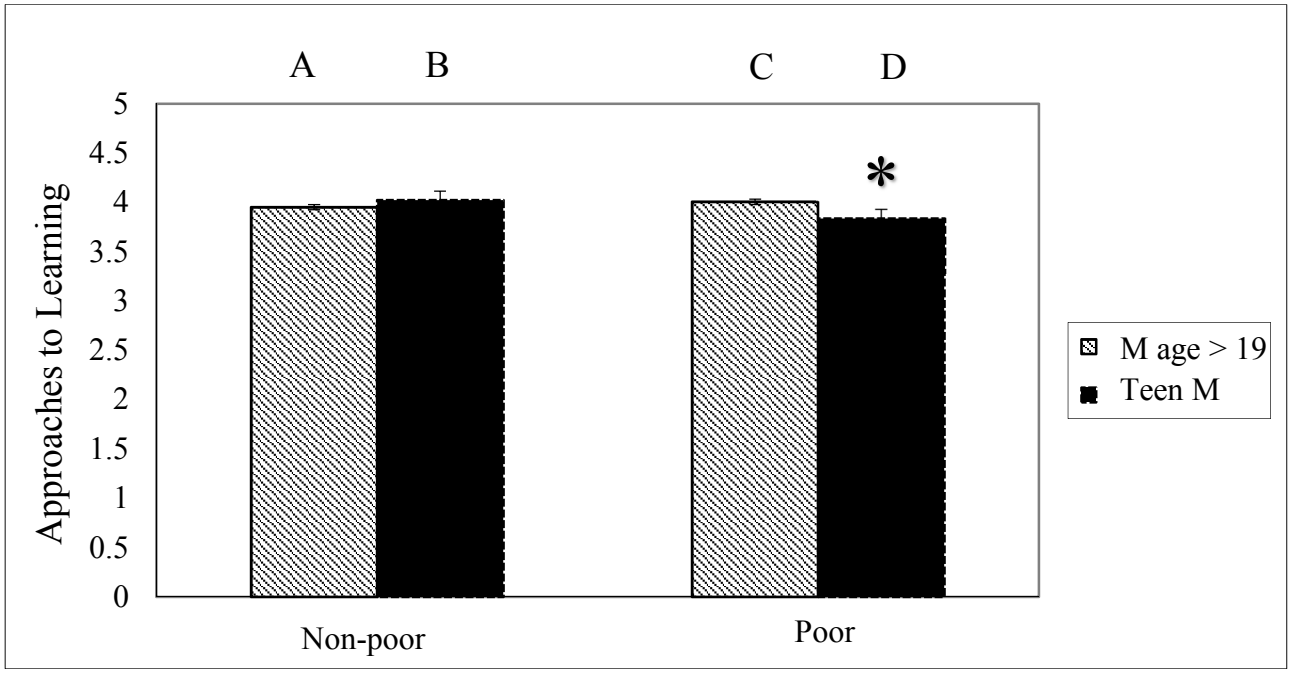

Figure 5. Teen motherhood and approaches to learning

Interaction between teen motherhood and poverty exposure prior to kindergarten entry predicting approaches to learning. The AB slope compares non-poor children living with mothers older than 19 years of age at birth versus non-poor children living with mothers 19 years old or younger at birth. The CD slope compares poor children living with mothers older than 19 years of age at birth versus poor children living with mothers 19 years old or younger at birth. Error bars represent standard errors. M = Mom. Asterisk indicates significant mean difference.

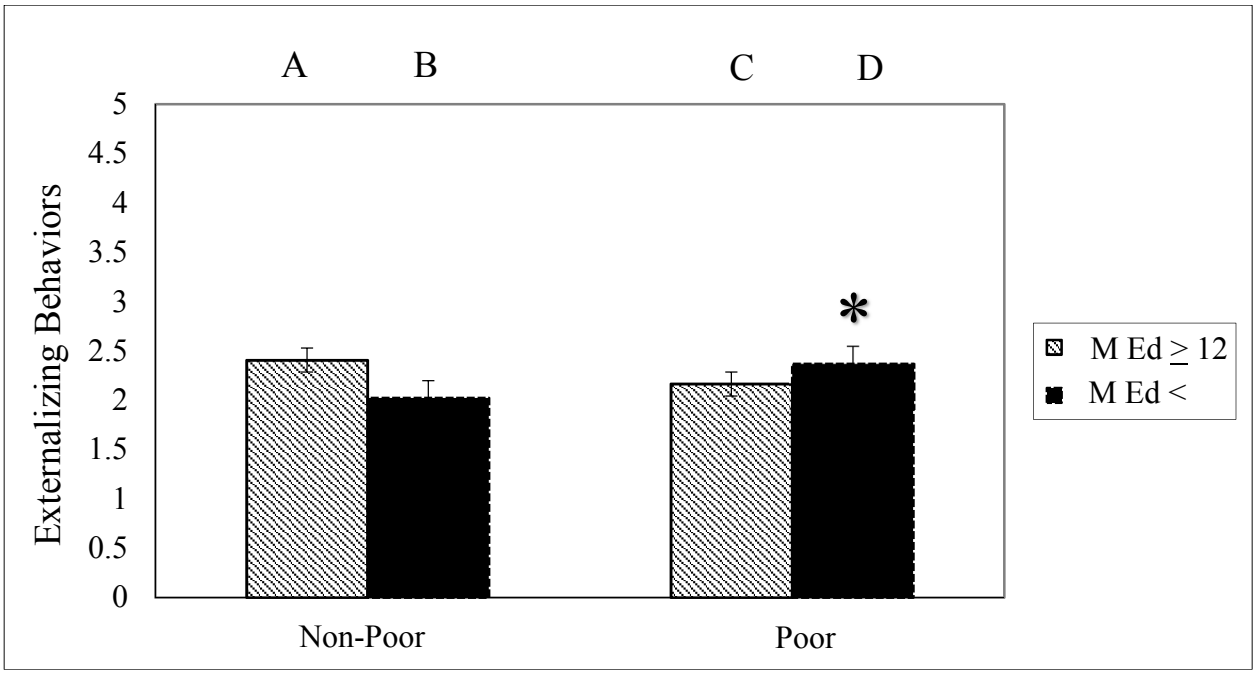

Figure 6. Low maternal education and externalizing behaviors
Interaction between low maternal education and poverty exposure prior to kindergarten entry predicting externalizing behaviors. The AB slope compares non-poor children living with mothers with greater than or equal to 12 years of education at birth versus non-poor children living with mothers with less than 12 years of formal education at birth. The CD slope compares poor children living with mothers with greater than or equal to 12 years of education at birth versus poor children living with mothers with less than 12 years of formal education at birth. Error bars represent standard errors. M = Mom; Ed = Education. Asterisk indicates significant mean difference.

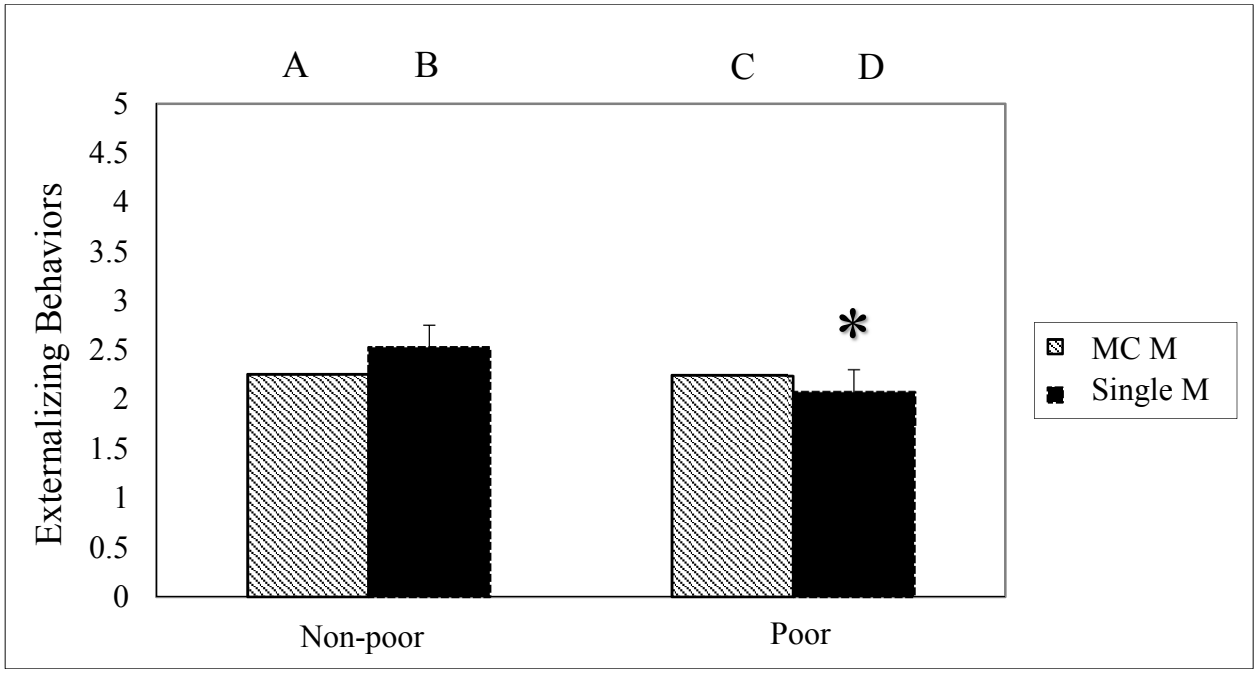

Figure 7. Single motherhood and externalizing behaviors
Interaction between single motherhood and poverty exposure prior to kindergarten entry predicting externalizing behaviors. The AB slope compares non-poor children living in homes in which parents were married/cohabiting at birth versus non-poor children living in single parent homes at birth. The CD slope compares poor children living in homes in which parents were married/cohabiting at birth versus poor children living in single parent homes at birth. Error bars represent standard errors. MC = Married/Cohabiting; M = Mom. Asterisk indicates significant mean difference.

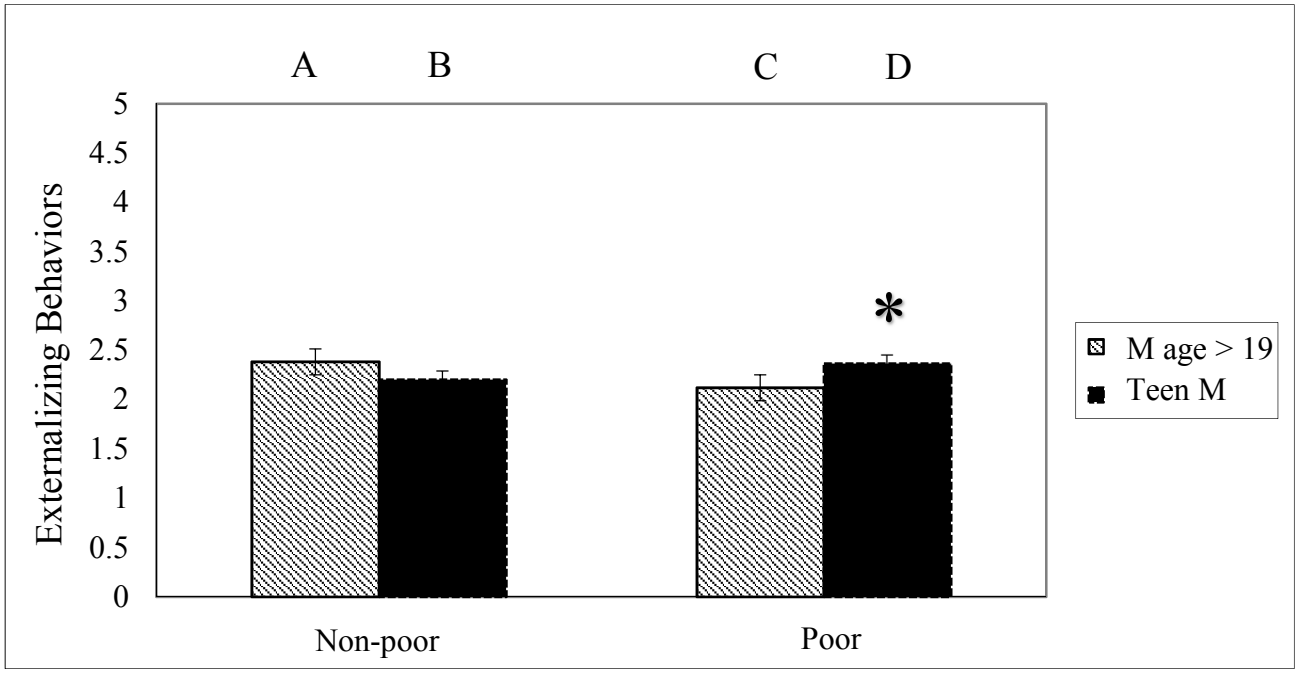

Figure 8. Teen motherhood and externalizing behaviors

Interaction between teen motherhood and poverty exposure prior to kindergarten entry predicting externalizing behaviors. The AB slope compares non-poor children living with mothers older than 19 years of age at birth versus non-poor children living with mothers 19 years old or younger at birth. The CD slope compares poor children living with mothers older than 19 years of age at birth versus poor children living with mothers 19 years old or younger at birth. Error bars represent standard errors. M = Mom. Asterisk indicates significant mean difference.

APPENDIX. SUPPLEMENTAL DATA

Table A1. CFA factor loading parameter estimates based on parent-reported behavioral skills

Factor	*B*	*β*
Social Competence		
Invited to play by other children	.73	.34*
Volunteers to help others	1.62	.59*
Is liked by others	1.00	.62*
Comforts other children	1.62	.70*
Uses words to describe feelings	1.31	.64*
Invites other children to play	.65	.36*
Stands up for others' rights	1.08	.51*
Tries to understand others	.92	.48*
Externalizing behaviors		
Is physically aggressive	1.00	.64*
Angry	1.08	.62*
Act impulsively	1.10	.58*
Is overly Active	.99	.44*
Has temper tantrums	.95	.54*
Annoys other children	1.28	.75*
Destroys others' things	.85	.58*
Approaches to learning		
Shows eagerness to learn	1.00	.66*
Pays attention well	1.31	.74*
Accepts ideas	.91	.53*
Works/plays independently	.83	.48*
Keeps working until finished	1.29	.69*
Adjusts to new situations	.75	.45*
Tries new things	1.07	.63*
Shows imagination	.68	.48*

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

* $p < .05$.

Table A2. Regression Models Predicting Reading with Individual Risks (N = 600; M = 20)

	Model 1		Model 2	
	B *p*	*β*	*B* *p*	*β*
Child Covariates				
Male	-4.47	-.15†	-2.35	-.08
Age	1.15	.34*	1.11	.33*
Baseline cognition	.20	.13*	.25	.16*
Individual Risks				
Poverty			-8.77	-.29*
Preterm/low birth weight			-.25	-.01
Low maternal education			-3.24	-.09
Single mother			.33	.01
Inadequate prenatal care			.05	.00
Teen mother			-2.62	-.05
Severe maternal depression			3.57	.09
Intercept	40.59*		44.97*	
R^2	.13		.25	
F	11.24*		5.85*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

† $p < .10$.

* $p < .05$.

Table A3. Regression Models Predicting Math with Individual Risks (N = 600; M = 20)

	Model 1		Model 2	
	B p	*β*	*B p*	*β*
Child Covariates				
Male	-1.81	-.08	-.04	.00
Age	.61	.25*	.56	.23*
Baseline cognition	.18	.16*	.21	.19*
Individual Risks				
Poverty			-6.76	-.31*
Preterm/low birth weight			-.20	-.01
Low maternal education			-2.33	-.09
Single mother			1.97	.08
Inadequate prenatal care			-2.34	-.07
Teen mother			-3.90	-.11†
Severe maternal depression			1.87	.06
Intercept	40.80*		44.28*	
R^2	.09		.22	
F	6.86*		4.16*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

$^{\dagger}p < .10$.

$^{*}p < .05$.

Table A4. Regression Models Predicting Social Competence with Individual Risks (N = 600; M = 20)

	Model 1		Model 2		Model 3	
	B p	*β*	*B p*	*β*	*B p*	*β*
Child Covariates						
Male	-.06	-.06	-.03	-.03	-.02	-.02
Age	.00	.03	.00	.02	.00	-.01
Baseline cognition	.01	.09	.01	.09	.01	.10
Individual Risks						
Poverty			-.06	-.05	-.01	-.01
Preterm/low birth weight			-.04	-.02	-.03	-.02
Low maternal education			-.13	-.09	.49	.36*
Single mother			.24	.17†	-.07	-.05
Inadequate prenatal care			-.08	-.04	-.14	-.08
Teen mother			-.03	-.01	.40	.21*
Severe maternal depression			-.04	-.03	-.03	-.02
Interaction terms						
Low maternal education*Poverty					-.72	-.51*
Single mother*Poverty					.40	.27
Teen mother*Poverty					-.60	-.28*
Intercept	3.93*		3.95*		3.93*	
R^2	.01		.05		.10	
F	1.07		.97		2.73*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

† $p < .10$.

* $p < .05$.

Table A5. Regression Models Predicting Approaches to Learning with Individual Risks (N = 600; M = 20)

	Model 1		Model 2		Model 3	
	B p	*β*	*B p*	*β*	*B p*	*β*
Child Covariates						
Male	-.04	-.04	-.02	-.02	-.01	-.01
Age	.00	-.01	.00	-.02	-.01	-.06
Baseline cognition	.01	.15*	.01	.15*	.01	.16*
Individual Risks						
Poverty			-.05	-.05	-.03	-.03
Preterm/low birth weight			-.06	-.04	-.06	-.03
Low maternal education			-.08	-.06	.48	.38*
Single mother			.20	.16†	-.11	-.09
Inadequate prenatal care			-.02	-.02	-.08	-.05
Teen mother			-.13	-.07	.17	.09
Severe maternal depression			-.01	-.01	.00	.00
Interaction terms						
Low maternal education*Poverty					-.64	-.49*
Single mother*Poverty					.42	.31*
Teen mother*Poverty					-.43	-.21*
Intercept	3.97*		3.99*		3.98*	
R^2	.03		.06		.10	
F	2.17		1.44		2.36*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

† $p < .10$.

* $p < .05$.

Table A6. Regression Models Predicting Externalizing Behaviors with Individual Risks (N = 600; M = 20)

	Model 1		Model 2		Model 3	
	B p	*β*	*B p*	*β*	*B p*	*β*
Child Covariates						
Male	.27	.21*	.24	.18*	.23	.17*
Age	.00	-.02	-.01	-.04	.00	.00
Baseline cognition	-.01	-.10	-.01	-.10	-.01	-.11
Individual Risks						
Poverty			-.08	-.06	-.11	-.09
Preterm/low birth weight			-.18	-.08†	-.17	-.08†
Low maternal education			.09	.06	-.53	-.34*
Single mother			-.02	-.01	.38	.24*
Inadequate prenatal care			.39	.19*	.45	.22*
Teen mother			.17	.08	-.40	-.18*
Severe maternal depression			.07	.04	.05	.03
Interaction terms						
Low maternal education*Poverty					.72	.45*
Single mother*Poverty					-.53	-.31*
Teen mother*Poverty					.79	.31*
Intercept	2.32*		2.32*		2.33*	
R^2	.05		.10		.15	
F	2.61		1.87*		2.84*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

† $p < .10$.

* $p < .05$.

Table A7. Regression Models Predicting Reading with Cumulative Risks (N = 600; M = 20)

	Model 1		Model 2	
	B p	*β*	*B p*	*β*
Child Covariates				
Male	-4.47	-.15†	-3.10	-.10
Age	1.15	.34*	1.24	.37*
Baseline cognition	.20	.13*	.22	.14*
Cumulative Risks				
0 risks[a]				
1 risks			-1.07	-.03
2 risks			-9.90	-.29*
3 or more risks			-8.11	-.23*
Intercept	40.59*		44.45*	
R^2	.13		.21	
F	11.24*		7.21*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

† $p < .10$.

* $p < .05$.

Table A8. Regression Models Predicting Math with Cumulative Risks (N = 600; M = 20)

	Model 1		Model 2	
	B p	*β*	*B p*	*β*
Child Covariates				
Male	-1.81	-.08	-.72	-.03
Age	.61	.25*	.68	.28*
Baseline cognition	.18	.16*	.20	.18*
Cumulative Risks				
0 risks[a]				
1 risks			-1.16	-.05
2 risks			-7.64	-.31*
3 or more risks			-6.86	-.27*
Intercept	40.80*		44.00*	
R^2	.09		.18	
F	6.86*		4.78*	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

$^{\dagger}p < .10$.

$^{*}p < .05$.

Table A9. Regression Models Predicting Social Competence with Cumulative Risks (N = 600; M = 20)

	Model 1		Model 2	
	B p	*β*	*B p*	*β*
Child Covariates				
Male	-.06	-.06	-.07	-.06
Age	.00	.03	.01	.04
Baseline cognition	.01	.09	.01	.09
Cumulative Risks				
0 risks[a]				
1 risks			.15	.12
2 risks			-.02	-.02
3 or more risks			.04	.03
Intercept	3.93*		3.89*	
R^2	.01		.03	
F	1.07		1.11	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

$^{\dagger}p < .10$.

$^{*}p < .05$.

Table A10. Regression Models Predicting Approaches to Learning with Cumulative Risks (N = 600; M = 20)

	Model 1		Model 2	
	B p	*β*	*B p*	*β*
Child Covariates				
Male	-.04	-.04	-.03	-.03
Age	.00	-.01	.00	-.01
Baseline cognition	.01	.15*	.01	.15*
Cumulative Risks				
0 risks[a]				
1 risks			.04	.04
2 risks			-.11	-.09
3 or more risks			.05	.04
Intercept	3.97*		3.97*	
R^2	.03		.04	
F	2.17		1.34	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

$^{\dagger}p < .10$.

$^{*}p < .05$.

Table A11. Regression Models Predicting Externalizing Behaviors with Cumulative Risks (N = 600; M = 20)

	Model 1		Model 2	
	B p	*β*	*B p*	*β*
Child Covariates				
Male	.27	.21*	.26	.20*
Age	.00	-.02	-.01	-.04
Baseline cognition	-.01	-.10	-.01	-.10
Cumulative Risks				
0 risks[a]				
1 risks			-.18	-.12
2 risks			.15	.10
3 or more risks			.01	.00
Intercept	2.32*		2.34*	
R^2	.05		.08	
F	2.61		2.10	

Note. All analyses were conducted using ECLS-B sampling weight WK1R0. Per requirements of the NCES data license, all N sizes are rounded to the nearest 50.

$^{\dagger}p < .10$.

$^{*}p < .05$.