

# **Relationships between Family Risks and Children's Reading and Mathematics Growth from Kindergarten through Third Grade**

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### **Perspective**

Risk factors identified in previous education research include coming from a low-income family or single-parent household, having parents who did not complete high school, and having parents who speak a language other than English in the home (Croninger and Lee 2001; Pallas, Natriello, McDill 1989; Rathbun and West 2004; Zill and West 2001). Previous studies have found associations among these family background characteristics and poor educational outcomes, including low achievement scores, grade repetition, and dropping out of high school. Many children with one risk factor have other family risks present. For instance, children in single-parent households are likely to also live in poverty (Pallas, Natriello, and McDill 1989; Rathbun and West 2004). Given that family risks may occur alone or in combination, it is important to examine relationships between particular sets of risks and children's early school achievement to explore whether children with certain types of risk factors begin school demonstrating fewer reading and mathematics skills than other kindergartners, and whether they fall further behind other children in reading and mathematics over the first four years of school.

Previous research has found that the association between family risks and children's reading and mathematics achievement is apparent in kindergarten and may not diminish in the early grades (Fryer and Levitt 2004; Lee and Burkam 2002; West, Denton, and Germino Hausken 2000; West, Denton, and Reaney 2001; Zill and West 2001). At school entry, children with one or more family risk factors, such as having a primary home language that is non-English or living in a single-parent household, have lower achievement scores in reading and mathematics when they start kindergarten than children with no factors. Furthermore, initial socioeconomic achievement gaps widen over the first few years of school (Downey, von Hippel, and Broh 2004; Rathbun and West 2004). As the number of family risk factors increase, children tend to gain less in reading and mathematics, after controlling for children's sex, number of family risk factors, kindergarten program type (half or full day), and school type (public or private) (Rathbun and West 2004).

Researchers have compared different analytic approaches to examine the relationship between family risk factors and children's social and academic development (Ackerman et al. 1999;

Burchinal et al. 2000; Gutman, Sameroff, and Cole 2003; Sameroff et al. 1993). In one approach, sometimes called the additive factors or multiple predictor approach, individual risk factors are used as predictors of children's development in a multivariate analysis to explore the unique effects of each risk factor. The benefits of this approach are that it retains the full predictive power of each risk in the original variable set and it allows for the evaluation of the relative importance of each risk factor. The drawback to this approach is the loss of statistical power to detect significant relationships, especially when sample sizes are small and the number of individual risk factors under consideration is large. An additional disadvantage of this approach is the potential for overlap or correlation among predictors, which can obscure meaningful relationships of individual risk factors with outcomes due to deflated parameter estimates. A second approach, sometimes called the composite or cumulative risk index approach, involves the creation of a single, multiple risk index based on a series of dichotomous risk ratings, which is then used as a predictor of children's social or academic development. The benefits of this approach are that it enables researchers to simultaneously consider multiple risks with a single predictor. This feature is especially attractive when analyzing data sets with relatively small samples. The drawback to this approach is that it does not allow for identification of specific relations between risk factors, alone or in combination, and child outcomes.

Many of the studies that compare approaches to examining the relationship between risk factors and child outcomes have been based on relatively small sample sizes and have included large numbers of contextual risk factors as predictor variables. Furthermore, in many instances the samples were not representative of the U.S. population of children; rather, they tended to focus on minority children or those who had certain risk factors present (e.g., large proportion of families in poverty, overrepresentation of parental psychopathology). With such samples, researchers noted that the composite or cumulative risk index approach tended to provide the greater statistical power for examining the relationships between risk factors and child outcomes than the multiple predictor approach (Burchinal et al. 2000; Gutman, Sameroff, and Cole 2003). However, exploring the unique effects of risk factors allows for the isolation of qualitatively distinct sources of contextual risk (Ackerman et al. 1999).

Using data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), this paper extends the findings from prior research. First, it explores whether kindergartners' reading and mathematics gains over the first 4 years of school are more strongly associated with particular risk factors alone or in combination, as opposed to the cumulative number of family

risk factors a child experiences. Second, the analysis makes use of the reading and mathematics data collected at 4 time points (i.e., fall kindergarten, spring kindergarten, spring first grade, and spring third grade) to describe achievement growth over time, rather than using scores from two time points (fall kindergarten and spring third grade) as a measure of academic gain.

## **Data Source**

The ECLS-K, sponsored by the National Center for Education Statistics (NCES), within the U.S. Department of Education's Institute of Education Sciences, has followed a nationally representative sample of kindergartners from the fall of 1998 through the spring of 2004, when most of the children were enrolled in fifth grade.<sup>1</sup> The study collects information directly from the children and their families, teachers, and schools. The full ECLS-K base-year sample is composed of 22,782 children who attended 1,277 schools with kindergarten programs during the 1998–99 school year.

The findings in this paper are based on the 10,345 children in the ECLS-K sample who entered kindergarten for the first time in 1998, were administered the English version of the ECLS-K cognitive assessments in fall 1998, spring 1999, spring 2000, and spring 2002, and have complete data on their sex, race/ethnicity, and each of the four family risk factors included in the paper.<sup>2</sup> Prior to administering the assessments in kindergarten and first grade, children's English proficiency was evaluated. Children whose home language was other than English (as determined by school records) were administered the Oral Language Development Scale (OLDS). Those children who reached the specified criterion on the OLDS were then assessed with the English version of the ECLS-K assessments.<sup>3</sup> Approximately 68 percent of Hispanic children and 78 percent of Asian/Pacific Islander children were assessed in English in the fall and spring of kindergarten and in the spring of first grade (Denton and West 2002). In the third-grade year, the

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<sup>1</sup>The ECLS-K website (<http://nces.ed.gov/ecls/>) provides information on the study and details on how to order publications and data files.

<sup>2</sup>Estimates in this report are weighted by the ECLS-K longitudinal full-sample child weight, C1\_5FC0.

<sup>3</sup>If children did not pass the OLDS in a given round, they were retested again in later rounds of kindergarten and first grade with the OLDS until their English proficiency permitted them to take the ECLS-K assessments.

OLDS was not administered and all children were assessed in English. Since children who did not pass the OLDS in fall of kindergarten do not have reading and mathematics scores for all rounds, they were excluded from the analyses in this report.<sup>4</sup>

The weighted school response rate for the kindergarten year was 74 percent. The child and parent completion rates in the kindergarten year were 92 percent and 89 percent, respectively. In the spring of 2002, 80 percent of the children and 77 percent of the parents who were eligible for the third-grade data collection participated in the study (Rathbun and West 2004).

Comparisons in the text are tested for statistical significance to ensure that the differences are larger than might be expected due to sampling variation. All differences described are significant at the .05 alpha level. Due to the large sample size, many differences (no matter how substantively minor) are statistically significant. Effect sizes are also included in the paper to provide a measure of the magnitude of differences between estimates. Cohen's (1988) convention for interpreting effect sizes considers effect sizes of .20 as small, .50 as medium, and .80 as large.

## Measures

Information in this paper was collected through parent interviews conducted in the kindergarten year and repeated, one-on-one child assessments in the fall and spring of kindergarten, spring of first grade, and spring of third grade. Below is a brief description of the key measures and characteristics used from these information sources. The variables created for the analyses come from the ECLS-K Longitudinal Kindergarten–Third Grade public-use data file (NCES 2004–089). Variable names from the ECLS-K database are included in the descriptions using the kindergarten names and are indicated in all capital letters.

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<sup>4</sup>Initially the analyses included the sample of students who were not able to be assessed in English in the early rounds of the study due to limited English proficiency since many of these children had valid assessment scores in later rounds. However, because the missing assessment data for these children were not randomly distributed, the level-1 data violated assumptions of HLM and led to incorrect level-2 coefficients of children's achievement. In an earlier report (Denton and West 2002), analyses were conducted to explore how including children who initially could not take the battery in English but were tested by spring of first grade would impact achievement estimates. Significant reading *t*-score differences overall and by specific racial/ethnic group were not detected between the sample assessed in English at all time points and the total sample, including those who were able to be tested with the English assessment at a later time. In third grade, the reading *t*-scores for children whose home language was non-English did not differ based on whether they had sufficient English skills to take the ECLS-K battery at kindergarten entry or at later rounds (*t*-scores of 49.2 and 48.2, respectively, *t*-test value = 0.465).

*Presence of family risk factors in the kindergarten year (4 variables).* This paper uses four family characteristics identified in previous research as potential risk factors for children's school achievement. Risk factors used in the analyses come from parent reports in the kindergarten year. The four risk factors examined included:

- 1) Living in a single-parent household (i.e., mother-only or father-only household) (P2HFAMIL, collapsed)
- 2) Living below the federal poverty threshold (WKPOV\_R)<sup>5</sup>
- 3) Having a primary home language that is not English (WKLANGST)
- 4) Having a mother who did not complete high school (i.e., did not receive a high school diploma or GED) (WKMOMED, collapsed).

*Children's cognitive knowledge and skills.* The ECLS-K reading and mathematics assessments measure children's status in each subject in kindergarten, first, and third grade and provide a means of measuring academic growth since kindergarten entry. The reading assessment includes children's basic literacy skills, vocabulary, and comprehension items. The mathematics assessment measured children's conceptual understanding of numbers, shapes, patterns, mathematical operations, and processes for problemsolving (for more details on the psychometric properties of the ECLS-K assessments, please see Pollack et al. forthcoming; Rock and Pollack 2002). The analyses in this paper use the overall achievement score for each subject area, which is an Item Response Theory (IRT) scale score. Assessment data from the fall and spring of kindergarten (fall 1998 and spring 1999), the spring of first grade (spring 2000), and the spring of third grade (spring 2002) are analyzed.<sup>6</sup> (Reading variables: C1R2RSCL, C2R2RSCL, C4R2RSCL, C5R2RSCL; Mathematics variables: C1R2MSCL, C2R2MSCL, C4R2MSCL, C5R2MSCL).

*Elapsed time between assessments.* The date of assessment was recorded at each data collection period (e.g., in the kindergarten year, C1ASMTMM (month), C1ASMTDD (day), C1ASMTYY(year)). The elapsed time, in months, was calculated between the initial assessment (in fall kindergarten) and each later assessment (i.e., spring kindergarten, spring first grade, spring

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<sup>5</sup>The federal poverty level status composite variable is derived from household income and the total number of household members. Federal poverty thresholds are used to define households below the poverty level. For instance, in 1998 if a household contained 4 members, and the household income was lower than \$16,655, then the household was considered to be in poverty.

<sup>6</sup>This paper refers to data collected in the spring of 2002 as third-grade data and the sampled children as third-graders, although not all children in the sample used for this paper were enrolled in third grade. In the spring of 2002, about 89 percent of the sample children were in third grade, 10 percent were in second grade, and about 1 percent were enrolled in other grades (e.g., first or fourth grade).

third grade). The elapsed time variable is used in the analyses to describe the amount of reading and mathematics gains children demonstrated each month since the fall kindergarten assessment.

*Control variables.* Children's sex and race/ethnicity are included as control variables in the analyses given that previous research has found relationships between these characteristics and children's achievement in reading and mathematics (Downey, von Hippel, and Broh 2004; Rathbun and West 2004; West, Denton, and Germino Hausken 2000; Zill and West 2001). Furthermore, although race/ethnicity is related to the number of family risk factors a child may experience (Zill and West 2001), each of the two characteristics is also independently related to children's achievement gains over the first 4 years of school (Rathbun and West 2004).

- *Child's sex:* Male or female (GENDER).
- *Child's race/ethnicity:* White, non-Hispanic; Black, non-Hispanic; Hispanic, Asian/Pacific Islander; and Other, non-Hispanic (which includes American Indians, Alaska Natives, and non-Hispanic multiracial children). (RACE, collapsed).

## **Findings**

Zill and West (2001) found that 46 percent of all first-time kindergartners had at least one risk factor present. Twenty-three percent came from single-parent households, 14 percent of children's mothers had not completed high school, 18 percent of children's families were on welfare or received food stamps, and 9 percent of children lived in a household where English was not the primary language. Of those first-time kindergartners who were administered the ECLS-K assessments beginning in the fall of kindergarten (i.e., the sample used for this paper), 39 percent had at least one family risk factor in their first year of school. Twenty-five percent came from single-parent households, 11 percent of children's mothers had not completed high school, 18 percent lived below the federal poverty threshold, and 5 percent of children lived in a household where English was not the primary language. Twenty-three percent of kindergartners had exactly one of the four risk factors, 12 percent had two risk factors, 4 percent had three risk factors, and less than 1 percent had all four risk factors in kindergarten. The percentages of children with different numbers and types of risk factors in this paper are in some cases lower than the percents reported by Zill and West (2001) because the analytic sample for their report did not exclude kindergartners who were unable to take the assessments due to limited English proficiency. For example, the percent of children from homes with non-English primary language who also lived in poverty was larger for the population of first-time kindergartners than it was for

the sample of children who were fluent enough in English to take the assessments when they began kindergarten (44 percent vs. 31 percent, respectively) (data not in table).<sup>7</sup>

Certain patterns of family risks were more prevalent than others (table 2). For instance, while 24 percent of kindergartners living in poverty had no other risk factors, 60 percent of poor kindergartners also lived in a single-parent household. Also, children whose primary home language was not English were more likely than those whose mothers did not complete high school to have only one risk factor (45 percent vs. 32 percent, respectively). Thus, it is important to look specifically at the associations of particular combinations of risk factors that children experience with their achievement growth to explore whether certain types of risk factors are more strongly associated than others with children's initial achievement and their growth in reading and mathematics in the first four years of school.

#### *HLM Analyses*

Two-level hierarchical linear modeling (HLM) was used to describe the achievement growth of children with different types and numbers of family risk factors. Analyses were conducted separately for reading and mathematics. At level 1, children's individual growth trajectories were modeled based on their assessment scores from multiple occasions (fall K, spring K, spring 1<sup>st</sup> and spring 3<sup>rd</sup>). Thus, the level 1 model is:

$$Y_{ij} = \pi_{0i} + \pi_{1i}a_{ti} + e_{ti}$$

Where  $Y_{ij}$  is the child's subject-area score at a given time point,  $a_{ti}$  is the elapsed time (i.e., number of months) since the initial (fall K) assessment,  $\pi_{0i}$  is the child's initial (fall K) achievement score (i.e., at 0 months), and  $\pi_{1i}$  is the growth rate over the first 4 years of school, which represents the child's expected change in achievement each month. This model assumes that errors ( $e_{ti}$ ) are independent and normally distributed, with a common variance (Bryk and Raudenbush 1992).

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<sup>7</sup>Standard error for full sample estimate = 1.9; standard error for analysis sample = 2.3.



The level 2 model incorporated child-level characteristics (i.e., child's sex, race/ethnicity, and the 4 family risk factors).<sup>8</sup> These variables are included as predictors in the second-level equations of both the intercept and growth-rate parameters. The level 2 models are:

$$\pi_{0i} = \beta_{00} + \beta_{01}(\text{MALE}) + \beta_{02}(\text{BLACK}) + \beta_{03}(\text{HISPANIC}) + \beta_{04}(\text{ASIAN/PI}) + \beta_{05}(\text{OTHER}) + \beta_{06}(\text{FIRST RISK}) + \beta_{07}(\text{SECOND RISK}) + \dots + \beta_{0j}(\text{LAST RISK}) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + \beta_{11}(\text{MALE}) + \beta_{12}(\text{BLACK}) + \beta_{13}(\text{HISPANIC}) + \beta_{14}(\text{ASIAN/PI}) + \beta_{15}(\text{OTHER}) + \beta_{16}(\text{FIRST RISK}) + \beta_{17}(\text{SECOND RISK}) + \dots + \beta_{1j}(\text{LAST RISK}) + r_{1i}$$

The estimates of the  $\beta_{0j}$  and  $\beta_{1j}$  coefficients describe the amount of initial differences (i.e., in fall kindergarten) and differences in growth over time, respectively, that can be associated with each of the child-level predictors.

A series of HLM analyses were conducted to compare findings for the relationship between children's achievement and 1) a cumulative risk factor index; 2) the four individual risk factor variables; and 3) unique combinations of the four risk factors, as represented by a series of dummy-coded variables.<sup>9</sup> The first analysis included a single level-2 risk predictor (i.e., cumulative number of risk factors for a child) and the second analysis included four level-2 risk predictors (i.e., dummy codes for whether the child lived below the poverty threshold, lived in a single-parent household, had a mother who did not complete high school, and had a primary home language that was not English). For the third analysis, 11 dummy-coded combinations of risk factors were created:

Children with only 1 risk factor:

1. Living below the poverty threshold
2. Living in a single-parent household
3. Having a mother who did not complete high school
4. Having a primary home language that is not English

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<sup>8</sup>For the purposes of the current presentation, we did not include school as a third level in the HLM models because of complexities introduced by student mobility over the 4 years of the data collection.

<sup>9</sup>Using a complete set of dummy-coded variables in the HLM analyses yields the same results as a model that includes all main effects and 2- and 3-way interactions between the 4 risk factor variables. The advantage of using the dummy-coded combinations is that the coefficients and standard error terms for each unique combination of risk factors is already calculated in the analysis output, allowing for easier interpretation and comparison for children with different combinations of risk factors.

Children with two risk factors:

5. Living below the poverty threshold and in a single-parent household
6. Living below the poverty threshold and having a mother who did not complete high school
7. Living below the poverty threshold and having a primary home language that is not English
8. Living in a single-parent household and having a mother who did not complete high school
9. Living in a single-parent household and having a primary home language that is not English
10. Having a mother who did not complete high school and having a primary home language that is not English

Children with three or four risk factors:

11. Three or four of the four risk factors present

Although children with three or four risk factors could also be separated into unique combinations of multiple risk factors (e.g., living below the poverty threshold, living in a single-parent household, and having a mother who did not complete high school; having all four risk factors present), most of the combinations yielded small sample sizes, as noted in table 1. Since the small sample size precluded reporting estimates for some of these multiple risk categories, children with three or four risk factors were grouped together into a single dummy-coded variable of three or four risk factors.

The risk factor variables for each of the three analyses were entered as level-2 predictors of children's initial (fall kindergarten) achievement and as predictors of children's achievement growth from fall kindergarten to spring of third grade. In addition, children's sex and race/ethnicity were included as control variables.

The regression coefficients reported in the text and tables of this paper are unstandardized coefficients, representing the change in mean score points for a child with a given risk factor. For example, if the reported regression coefficient for being in poverty was -1.2, this would indicate that a child living below the poverty threshold would score, on average, 1.2 points lower than a child living at or above the poverty threshold. The coefficients for each of the predictor variables were checked for significance, indicating that a child with a particular risk or combination of risk factors had different achievement status or growth than a child with no risk factors. Post-hoc *t*-test comparisons with Bonferroni adjustment<sup>10</sup> were also conducted in the third set of analyses to compare the coefficients for children with various combinations of risk factors to determine

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<sup>10</sup>The Bonferroni adjusted critical *t*-value for the second set of analyses is set at 2.87 for 12 comparisons and is set for the third analysis at 3.50 for 110 comparisons (2-tailed tests).

whether certain combinations of risk factors were associated with differential achievement status and/or growth.

It is important to note that these analyses do not imply a causal relationship between family risk factors and children's achievement. Other potentially important variables (e.g., preschool experiences, home environment, and school resources) may be related to children's achievement but are not represented in the analysis. The analyses in this paper are intended to provide a description of the differences associated with the presence of particular family risk factors and children's achievement and to stimulate others to further explore the differences found here.

As a preliminary step in the 2-level HLM analysis, unconditional models were run for both subject areas, in which no level 2 (child-level) predictors were included. The mean intercept and growth rate coefficients from the unconditional models were all significant, indicating that both parameters were appropriate to include when describing children's mean growth trajectory in reading and mathematics (Bryk and Raudenbush 1992).

Results from the reading and mathematics analyses indicated that the presence of family risk factors was associated with children's achievement status at kindergarten entry as well as their growth in each subject area over the first 4 years of school (tables 3 through 5). Below is a discussion of findings for each of the three sets of HLM analyses that examined: 1) cumulative risk factor index (1 predictor variable); 2) individual risk factors (4 predictor variables); and 3) unique combinations of risk factors (11 predictor variables).

### Cumulative Risk Index Analysis

The first set of HLM analyses described the relationships between children's initial status and growth in reading and mathematics over the first 4 years of school and the total number of risk factors they experienced in the kindergarten year (table 3). In both reading and mathematics, children's initial achievement and growth were negatively related to the number of risk factors present. In the fall of kindergarten, a White female with no risk factors scored, on average, 32 points in reading and 27 points in mathematics.<sup>11</sup> For each risk factor present, a child's initial reading score decreased by 3.2 points and his/her mathematics score decreased by 2.7 points

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<sup>11</sup>The standard deviations for initial achievement were 9.6 points for reading and 8.7 points for mathematics. The standard deviations for achievement growth were 0.39 points/month in reading and 0.32 points/month in mathematics.

(effect sizes (ES) =0.33 standard deviation (SD) and 0.31 SD, respectively). In the fall of kindergarten, a White female with no risk factors gained, on average, 2.1 points each month in reading and 1.5 points in mathematics. Also, children's achievement growth was smaller by .09 points per month in reading and .05 points per month in mathematics for each risk factor present (ES = 0.23 SD and 0.16 SD, respectively). Not only did children with one or more risk factors start kindergarten demonstrating fewer achievement skills and knowledge, the achievement gap between themselves and their peers with no risk factors widened by about 4 points in reading and about 2 points in mathematics over the first 4 years of school for each risk factor present (based on an average of 42.5 months between the fall kindergarten and spring third-grade assessments).

In addition, boys' initial reading scores were 1.8 points lower than girls' (ES = 0.19 SD), and Black, Hispanic, and other, non-Hispanic kindergartners had lower initial reading scores than White kindergartners after taking into account other factors (1.8, 1.8, and 1.7 points lower, respectively (ES = 0.19 SD, 0.19 SD, and 0.18 SD)). In contrast, Asian/Pacific Islanders' initial reading scores were 4.8 points higher than White children's scores, after taking into account the other factors in the analysis (ES = 0.50 SD). In terms of reading growth, boys gained about 0.06 points less each month in reading than girls (ES = 0.15 SD), and Black and other, non-Hispanic children made slower growth in reading than White children (0.24 and 0.18 points less per month, respectively (ES = 0.62 SD and 0.46 SD)). Hispanic children gained 0.03 points less per month in reading than White children, representing a negligible effect size of 0.08 SD. Asian/Pacific Islander children also had slower reading growth rates than White children (0.06 points per month, ES = 0.15 SD), indicating that while their initial status in reading was higher, they did not progress as quickly in reading knowledge and skills as did White children.

In mathematics, Black, Hispanic, and other, non-Hispanic children had lower initial scores than White children (4.2, 3.3, and 3.2 points lower, respectively (ES = 0.48, 0.38 SD, 0.37 SD). Asian/Pacific Islander children's initial scores did not differ from White children's. Black and other, non-Hispanic children made slower growth each month in mathematics than White children (0.20 and 0.08 points less per month, respectively (ES = 0.63 SD and 0.25 SD). Hispanic and Asian/Pacific Islander children's growth rate did not differ from White children's growth. Also, boys gained about 0.07 points more each month in mathematics than girls (ES = 0.022 SD), indicating that while children's mathematics achievement did not differ by sex at the start of kindergarten, boys' mathematics skills and knowledge grew more rapidly than girls' in the first 4 years of school. For the most part, patterns of differences in children's initial achievement and

growth in reading and mathematics observed in the cumulative risk index analysis were consistent with the results from the analyses discussed later in the paper.<sup>12</sup> Since the focus of this paper is on the four family risk factors, findings for sex and racial/ethnic categories are not discussed in further detail.

As noted in earlier research, using the cumulative risk index in place of individual risk variables as predictors reduces the information provided about the unique relationship of each risk factor to achievement. The cumulative risk index treats the individual risk variables as if they all have the same association with achievement outcomes. The next two analyses improve upon the information provided by cumulative risk index analysis, in that they describe the relationships of each individual risk variable to achievement.

### Individual Risk Factor Analysis

For the second set of analyses, each individual risk factor variable was included as a predictor of children's initial achievement and growth (table 4). In both reading and mathematics, all of the risk factors explored in this paper were associated with children's initial achievement and their growth over the first 4 years of school. For instance, children whose mothers did not complete high school scored 4.7 points lower in reading and 4.1 points lower in mathematics at the start of school than children whose mothers held at least a high school diploma (ES = 0.49 SD and 0.47 SD, respectively). Kindergartners in poverty scored 3.8 points lower in reading and 3.0 points lower in mathematics than those at or above the poverty threshold (ES = 0.40 SD and 0.34 SD, respectively). Children in single-parent households had scores that were 2.3 points lower in reading and 1.9 points lower in mathematics than those in two-parent homes (ES = 0.24 SD and 0.22 SD, respectively). Also, children whose primary home language was non-English scored 1.2 points lower in reading and 1.1 points lower in mathematics in fall of kindergarten than those whose primary home language was English (ES = 0.13 SD for both subjects).

The four family risk factors were also associated with children's reading and mathematics growth rates over the first 4 years of school. Children whose mothers did not complete high school

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<sup>12</sup>The only difference in findings for the control variables (i.e., sex and race/ethnicity) was that the individual risk factor analysis detected that Hispanic children had smaller mathematics growth than White children in mathematics each month, which was not present in the cumulative risk index analysis or the analysis with 11 dummy-coded risk categories.

gained 0.17 points less each month in reading and 0.12 points less in mathematics than those whose mothers had completed high school (ES = 0.44 SD and , 0.0.38 SD, respectively). Kindergartners in poverty gained about 0.14 points less each month in reading and 0.09 points less in mathematics than children not in poverty (ES = 0.36 SD and 0.28 SD, respectively). Children in single-parent households gained about 0.04 points less per month in reading and 0.02 points less in mathematics than those in other households (ES = 0.10 SD and 0.06 SD, respectively).

On the other hand, children who lived in households where the primary home language was not English made greater growth in both subject areas than children whose primary home language was English (0.06 more points/month in reading and 0.07 more points/month in mathematics) (ES = 0.15 SD and 0.22 SD, respectively). However, it is important to recall that while these children lived in households where English was not the primary home language, their own English skills were sufficient in the fall of kindergarten to enable them to participate in the ECLS-K assessments.

In addition to most of the individual risk factors being negatively related with children's initial achievement and growth in reading and mathematics, t-test comparisons of the regression coefficients for the individual risk factors indicated that individual risks were differentially related to achievement status and growth. For instance, the relative contributions of living in poverty and coming from a single-parent household on children's initial reading achievement were compared by using the regression coefficients for each risk factor and their respective standard errors from the full regression model (table 4) to calculate the t-value of the difference between the two estimates.<sup>13</sup>

Living in poverty or having a mother who did not complete high school were related to larger mean differences in children's initial achievement and their growth in reading and mathematics than living in a household with only one parent or having a primary home language that was non-English. For instance, having a mother who did not complete high school reduced a child's initial reading score by about 4.7 points, while living in a single-parent household reduced a child's initial reading score by 2.3 points. Thus, findings from this second set of analyses indicate that

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<sup>13</sup>For this example, the resulting t-test calculation is equal to  $[(-3.75) - (-2.32)] / (\text{Square root of } (0.300^2 + 0.309^2)) = 3.320$ .

individual risk factors did vary in terms of the magnitude of their relationship with achievement outcomes.

While the second set of analyses indicated that individual family risk factors were differentially related to achievement status and growth, they did not examine whether the presence of two or more risk factors was associated with greater differences in initial achievement and smaller growth than having only a single risk factor. The third set of analyses, which included dummy-coded variables for each unique combination of the four family risk factors, allowed for the comparison of the relationship of different combinations of risks on children's achievement.

#### Analysis of Combinations of Risk Factors

For the third set of analyses, 11 combinations of risk factors were included as predictors of children's initial achievement and growth (table 5). The resulting regression coefficients were examined to determine: 1) whether particular combinations of family risk factors were differentially associated with achievement compared to having no risks; 2) whether an increase in the number of family risk factors was associated with differential achievement outcomes compared to having fewer risks; and 3) whether combinations of risk factors were differentially associated with achievement for children with the same cumulative number of risk factors.

#### *Comparison of combinations of risk factors to having no risk factors*

Examination of the regression coefficients indicated that all of the unique combinations of risk factors were negatively related to children's initial achievement status in reading and mathematics in the fall of kindergarten. This finding indicated that children with one or more risk factors entered school with lower reading and mathematics achievement than children with none of the four risk factors. Most of the combinations of risk factors were also associated with children's growth in both subjects over the first 4 years of school. With the exception of positive mathematics growth ( $b = 0.07$  points/month,  $ES = 0.22$  SD) for children who lived in homes where English was not the primary language, in most cases the combinations of risk factors were negatively associated with children's growth. For example, a child in a single-parent household whose mother did not complete high school gained about one-fifth of a point less per month

( $b=0.20$  points/month,  $ES = 0.51$  SD) in reading achievement from fall kindergarten to spring of third grade than a child with no risk factors.<sup>14</sup>

#### *Relationship of additional risk factors to differential achievement*

Each of the risk factors was next examined to determine whether the presence of additional risk factors increased the degree to which the first risk was associated with children's achievement status and growth. The relative contributions of having a single risk factor versus having the particular risk and additional risk(s) on children's achievement were compared by using the regression coefficients for each unique combination of risk factors and their respective standard errors from the full regression model (table 5) to calculate the t-value of the difference between the two estimates.<sup>15</sup> Each of the four risk factors is highlighted below:

Mother's education less than high school diploma. For children whose mothers did not complete high school, initial achievement status and growth in reading and mathematics over the first 4 years of school did not differ depending on whether additional risk factors were present. Within this group, there were no differences in achievement between children who had two, three, or four risk factors present.

Living below the poverty threshold. For the most part, poor children with additional risk factors did not have lower initial scores or slower growth in reading or mathematics than poor children with no other risk factors. Initial reading achievement and growth were both lower among poor children whose mothers did not complete high school than among children for whom poverty was the only risk factor identified in this study. A poor child whose mother did not complete high school scored about 3.3 points lower<sup>16</sup> ( $ES = 0.34$  SD) in reading at the start of kindergarten and gained about 0.18 points less per month ( $ES = 0.46$  SD) over the first 4 years of school than a poor child with no other risk factors present.

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<sup>14</sup>The coefficients for the few combinations of risk factors that were not associated with achievement growth (i.e., poverty and non-English household, single-parent and non-English household) may not be significant due to small sample sizes or due to the fact that non-English language was positively associated with achievement growth, while other risk factors were all negatively associated with achievement growth.

<sup>15</sup>For example, to examine whether children whose only risk factor was living in a single-parent household had differential growth in reading than children from single-parent households who also were in poverty, the t-test comparison would be  $t = [(-0.06) - (-0.17)] / (\text{Square root of } (0.014^2 + 0.020^2)) = 4.60$ .

<sup>16</sup>Differences in initial achievement scores and gains reported in this section were calculated by subtracting the individual risk factor coefficient from the multiple risk factors coefficient. For example,  $-8.98$  (coefficient for living in poverty and having a mother who did not complete high school)  $- -5.67$  (coefficient for living in poverty as only risk factor)  $= -3.31$ .



Living in a single-parent household. Children from single-parent households had lower initial reading and mathematics achievement scores if they also lived in poverty or if they had three or four risk factors present, compared to having the single risk factor. For instance, children from single-parent households who also lived in poverty scored about 3.3 points lower in mathematics in the fall of kindergarten than children whose only risk factor was living in poverty (ES = 0.29 SD). Those in single-parent households had lower initial reading scores if their mother did not complete high school than if they had no other risk factors present. Children in single-parent households had slower reading growth if they lived in poverty or had three or four risk factors compared to having the single risk factor.

Non-English primary home language. Compared to children whose only risk factor was living in a home where English was not the primary language, those who also had mothers who did not complete high school, lived in poverty, or had 3 or more risk factors scored lower in initial reading achievement. For instance, children from non-English homes who also lived in poverty scored about 5.0 points lower in reading in fall of kindergarten than children whose only risk factor was living in a non-English home (ES = 0.52 SD). Children whose primary home language was non-English had lower initial mathematics scores and made slower growth in reading and mathematics if they had a total of three or four risk factors than if they had no other risk factors. In addition, if children whose primary home language was non-English had a mother who did not complete high school, their mathematics growth was negative ( $b = -0.11$  points/month), whereas their growth was positive if their mother had completed high school ( $b = 0.07$  points/month) (ES = 0.56 SD).

#### Summary of findings on additional risk factors

These results indicate first that different risk factors have differential associations with children's achievement. They also suggest that whether children with multiple risk factors demonstrate significantly lower achievement gains over time than do children with a single risk factor depends upon the specific risk factors identified. In addition to examining the differences in achievement with the addition of risk factors, comparisons were also conducted to see whether having three or four risk factors was different from having any particular combination of two risk factors. Findings indicated that children's initial status and growth in reading and mathematics did not differ as the number of cumulative risks increased from two to three or four risk factors.

### *Comparison of combinations of risk factors for children with the same number of risks*

For children with only one risk, living in poverty or having a mother who did not complete high school was related to lower initial reading achievement and slower reading growth than living in a household where English was not the primary language or where there was only one parent. Compared to a child with no risk factors, on average, a child in poverty would have an initial score about 5.7 points lower in reading and a child whose mother did not complete high school would have an initial score about 7.6 points lower, compared to a lower initial reading score of about 1.8 points for children whose primary home language was English and 3.1 points for children in single-parent households (ES = 0.59 SD, 0.79 SD, 0.19 SD, and .032 SD, respectively). In mathematics, children whose mothers did not complete high school had lower initial achievement and slower growth than those living in a household where English was not the primary language or where there was only one parent. Also, children in poverty made slower mathematics growth than those in single-parent or non-English households. Furthermore, children coming from a household where English was not the primary language made greater growth in mathematics than children in single-parent households.

For children with two risk factors, initial reading achievement was lower for poor children whose mothers did not complete high school compared to poor children in single-parent households (9.0 points vs. 6.4 points, ES = 0.27 SD). No differences across 2-risk factor combinations were detected for initial mathematics achievement. In terms of reading growth, poor children whose mothers did not complete high school made smaller growth (-0.36 points/month) over the first 4 years than 1) poor children whose primary home language was non-English (-0.10 points/month); 2) poor children in single-parent households (-0.17 points/month); 3) non-poor children whose primary home language was non-English and whose mothers did not complete high school (-0.10 points/month); and 4) non-poor children whose primary home language was non-English and who lived in single-parent households (-0.07 points/month). Poor children whose mothers did not complete high school also had slower math growth than poor children whose primary home language was not English (-0.24 points/month vs. -0.01 points/month, ES = 0.72 SD).

### **Conclusion**

The purposes of this paper were to examine whether certain patterns of family risk factors were more prevalent than others, and if so, whether the number and unique combinations of family risk

factors were differentially related to children's initial status and growth in reading and mathematics from the fall of kindergarten to the spring of third grade. Over 39 percent of first-time kindergartners had one or more family risk factors, and 16 percent had multiple family risks when they began school. Certain patterns of risk factors were more prevalent than others. Since this was the case, the associations between particular combinations of risk factors that children experience and their achievement growth were examined to explore whether certain types of risk factors leave children more vulnerable to beginning school with lower reading and mathematics achievement and falling further behind their classmates over the first 4 years of school.

Earlier research examining the relationships between family risks and early development indicated that using individual risk factors as predictors of achievement would provide more information on the relative importance of individual risks than a cumulative risk index (Ackerman et al. 1999; Burchinal et al. 2000; Gutman, Sameroff, and Cole 2003; Sameroff et al. 1993). However, the cumulative risk index approach was often used in these studies and was more powerful for detecting significant relationships given their small sample sizes, focus on high risk children, and the relatively large number of risk factors being considered. The large, nationally representative sample in the ECLS-K presents an opportunity to compare the alternative methods discussed in prior studies for examining the relationships between family risks and achievement.

In this paper, three approaches to examining the relationship between family risks and achievement growth were used. First, children's reading and mathematics initial achievement status and growth were regressed on the cumulative number of risk factors present when they were in kindergarten. This approach, commonly used in other research, indicated that children with more risk factors had lower initial status and growth in both subjects than did children with fewer risk factors. The second approach included each of the four family risk variables as predictors of achievement. Findings from this set of analyses showed that the individual risks varied in terms of their association with children's initial achievement status and growth.

The final set of analyses, which included dummy-coded variables for 11 combinations of family risk factors, yielded more specific information on the relationship between particular combinations of risk factors and achievement. Compared to children with no family risks, children in single-parent households and those from homes where English was not the primary language demonstrated lower achievement, but if they had no other family risks they tended to

have higher initial scores and made greater growth over the first 4 years of school than children in poverty or those whose mothers did not complete high school. Results from the third set also indicate that increases in the number of family risk factors are not always associated with greater differences in achievement. For example, children with any combination of two family risks did not differ in their achievement from children with three or four risks. Furthermore, in some cases, having three or four risk factors was not more detrimental than having the single risk of living below the poverty threshold or having a mother who did not complete high school.

Findings from the third analyses also indicated that children whose only risk was living in a home where English was not the primary language tended to begin school with lower mathematics achievement, but over the course of the first 4 years they made greater growth, on average, than other children, in essence narrowing the mathematics achievement gap. This advantage only occurred, however, if the child had no other family risks. Also, this finding is limited to children who were fluent enough in English to take the reading and mathematics assessments when they began kindergarten.

In summary, the findings from this analysis support earlier research indicating that children's reading and mathematics achievement in the fall of kindergarten and their growth in both subjects over the first few years of school vary in relation to the number of family risk factors present at school entry (Downey, von Hippel, and Broh 2004; Rathbun and West 2004; West, Denton and Reaney 2001). Results from this study build on earlier findings by demonstrating that particular combinations of risk factors are differentially associated with children's initial achievement and their growth from the start of kindergarten to the end of third grade.

The ECLS-K is designed to provide information on children's development from kindergarten through fifth grade across multiple contexts, including the home, classroom, school, and community. Future research using the ECLS-K could incorporate findings from this paper and other recent studies to further explore the achievement gaps observed between disadvantaged and more advantaged children. For instance, Fryer and Levitt (2004) were able to substantially reduce the Black-White achievement gap observed in the beginning of kindergarten by controlling for other child and family risk factors, including birth weight, mother's age at child's birth, and the number of children's books in the home. Downey, von Hippel, and Broh (2004) incorporated measures of in-school/out-of-school time into their research to describe patterns of growth over different time periods. While this paper used a static measure of family risks from the

kindergarten year, future research could also take into account changes in children's family risk status by incorporating data on family structure, income, and mother's education across time. Other variables in the ECLS-K, such as home experiences, teacher characteristics and instructional practices, and school quality could also be used to explore achievement gaps.

Table 1. Percentage distribution of fall 1998 first-time kindergartners, by number and type of family risk factors present<sup>1</sup>: School year 1998–99

Combination of risk factors present	Sample size	Weighted percent (standard error)
Total	10,345	100
No risk factors	6,765	61 (1.0)
One risk factor present	2,188	23 (0.6)
Below federal poverty threshold <sup>2</sup>	410	4 (0.3)
Primary home language non-English	386	2 (0.2)
Mother's education less than high school	262	4 (0.4)
Single-parent household	1,130	13 (0.5)
Two risk factors	1,053	12 (0.7)
Poverty and non-English	69	1 (0.1)
Poverty and mother's education less than high school	166	2 (0.2)
Poverty and single-parent household	596	7 (0.5)
Non-English and mother's education less than high school	98	1 (0.1)
Non-English and single-parent household	39	#
Mother's education less than high school and single-parent household	85	1 (0.2)
Three risk factors	311	4 (0.3)
Poverty, non-English, and mother's education less than high school	57	1 (0.1)
Poverty, non-English, and single-parent household	30	#
Non-English, mother's education less than high school, and single-parent household	‡	‡
Poverty, mother's education less than high school, single-parent household	208	3 (0.3)
All four risk factors present	‡	‡

# Estimate rounds to zero.

‡ Reporting standards not met due to small sample size.

<sup>1</sup>Family risk factors included living below the federal poverty level, primary home language was non-English, mother's highest education was less than a high school diploma/GED, and living in a single-parent household. Poverty is a function of household size and household income.

<sup>2</sup>Poverty is a function of household size and household income. Based on 1998 Census information, a household of four with a total income below \$16,655 was considered to be below the federal poverty level.

NOTE: Estimates reflect the sample of children assessed in English in all assessment years.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Longitudinal Kindergarten – Third Grade Public-Use data file, fall 1998, spring 1999, spring 2000, and spring 2002.

Table 2. Percentage of fall 1998 first-time kindergartners with at least one family risk factor<sup>1</sup> present, by the presence of a second risk factor: School year 1998-99

Family risk factor present	Percent with second risk factor present (standard error)				
	No second risk factor	Single-parent household	Living below poverty threshold	Mother's education less than high school	Primary home language non-English
Single-parent household	50 (1.7)	—	43 (1.9)	17 (1.2)	4 (0.6)
Living below poverty threshold	24 (1.6)	59 (1.8)	—	30 (1.8)	9 (0.9)
Mother's education less than high school	32 (2.5)	38 (2.2)	49 (2.6)	—	16 (1.6)
Primary home language non-English	45 (2.5)	20 (2.4)	31 (2.3)	32 (2.8)	—

— Not applicable.

<sup>1</sup>Family risk factors included living below the federal poverty level, primary home language was non-English, mother's highest education was less than a high school diploma/GED, and living in a single-parent household. Poverty is a function of household size and household income.

NOTE: Children with a second risk factor may also have additional risk factors present. Thus, the categories for children with a second risk factor present are not mutually exclusive and the row totals do not equal 100 percent. Estimates reflect the sample of children assessed in English in all assessment years.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Longitudinal Kindergarten – Third Grade Public-Use data file, fall 1998, spring 1999, spring 2000, and spring 2002.

Table 3. Linear model of growth in first-time kindergartners' reading and mathematics knowledge and skills (Relationships of sex, race/ethnicity, and cumulative number of family risk factors): Fall 1998–spring 2002

Fixed Effect	Reading		Mathematics	
	Regression coefficient	Standard error	Regression coefficient	Standard error
<b>Initial status (fall kindergarten)</b>				
Intercept	32.20	0.189	26.69	0.160
Male	-1.83*	0.230	0.26	0.206
Black	-1.76*	0.339	-4.42*	0.283
Hispanic	-1.83*	0.345	-3.25*	0.306
Asian/ Pacific Islander	4.81*	0.654	0.81	0.517
Other, non-Hispanic	-1.69*	0.580	-3.21*	0.466
Cumulative number of risk factors <sup>1</sup>	-3.19*	0.140	-2.67*	0.128
<b>Growth rate (fall kindergarten – spring third grade)</b>				
Intercept	2.05	0.006	1.52	0.006
Male	-0.06*	0.008	0.07*	0.008
Black	-0.24*	0.015	-0.20*	0.013
Hispanic	-0.03*	0.013	-0.01	0.013
Asian/ Pacific Islander	-0.06*	0.018	0.02	0.017
Other, non-Hispanic	-0.18*	0.023	-0.08*	0.019
Cumulative number of risk factors	-0.09*	0.006	-0.05*	0.005

\* p<.05

<sup>1</sup>Family risk factors included living below the federal poverty level, primary home language was non-English, mother's highest education was less than a high school diploma/GED, and living in a single-parent household. Poverty is a function of household size and household income. Based on 1998 Census information, a household of four with a total income below \$16,655 was considered to be below the federal poverty level.

NOTE: Estimates reflect the sample of children assessed in English in all assessment years.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Longitudinal Kindergarten – Third Grade Public-Use data file, fall 1998, spring 1999, spring 2000, and spring 2002.



Table 4. Linear model of growth in first-time kindergartners' reading and mathematics knowledge and skills (Relationships of sex, race/ethnicity, and individual family risk factors): Fall 1998–spring 2002

Fixed Effect	Reading		Mathematics	
	Regression coefficient	Standard error	Regression coefficient	Standard error
<b>Initial status (fall kindergarten)</b>				
Intercept	32.17	0.191	26.73	0.148
Male	-1.82*	0.230	0.17	0.186
Black	-1.73*	0.347	-4.50*	0.261
Hispanic	-2.15*	0.373	-3.48*	0.288
Asian/ Pacific Islander	4.14*	0.675	0.16	0.489
Other, non-Hispanic	-1.64*	0.581	-3.00*	0.431
Primary home language non-English	-1.19*	0.527	-1.07*	0.404
Mother's education less than high school	-4.72*	0.309	-4.06*	0.295
Below federal poverty threshold <sup>1</sup>	-3.75*	0.300	-2.99*	0.263
Single-parent household	-2.32*	0.309	-1.85*	0.232
<b>Growth rate (fall kindergarten through spring third grade)</b>				
Intercept	2.05	0.006	1.52	0.005
Male	-0.06*	0.008	0.07*	0.006
Black	-0.23*	0.015	-0.19*	0.011
Hispanic	-0.06*	0.014	-0.03*	0.011
Asian/ Pacific Islander	-0.11*	0.019	-0.02	0.015
Other, non-Hispanic	-0.17*	0.023	-0.09*	0.016
Primary home language non-English	0.06*	0.018	0.07*	0.015
Mother's education less than high school	-0.17*	0.018	-0.12*	0.013
Below federal poverty threshold <sup>1</sup>	-0.14*	0.015	-0.09*	0.011
Single-parent household	-0.04*	0.012	-0.02*	0.009

\* p<.05

<sup>1</sup>Poverty is a function of household size and household income. Based on 1998 Census information, a household of four with a total income below \$16,655 was considered to be below the federal poverty level.

NOTE: Estimates reflect the sample of children assessed in English in all assessment years.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Longitudinal Kindergarten – Third Grade Public-Use data file, fall 1998, spring 1999, spring 2000, and spring 2002.

Table 5. Linear model of growth in first-time kindergartners' reading and mathematics knowledge and skills (Relationships of sex, race/ethnicity, and unique combinations of family risk factors): Fall 1998–spring 2002

Fixed Effect	Reading		Mathematics	
	Regression coefficient	Standard error	Regression coefficient	Standard error
<b>Initial status (fall kindergarten)</b>				
Intercept	32.40	0.195	26.85	0.166
Male	-1.83*	0.229	0.27	0.206
Black	-1.73*	0.346	-4.40*	0.286
Hispanic	-2.12*	0.364	-3.45*	0.329
Asian/ Pacific Islander	4.34*	0.675	0.57	0.538
Other, non-Hispanic	-1.51*	0.580	-3.07*	0.464
<b>One risk factor present</b>				
Below federal poverty threshold <sup>1</sup>	-5.67*	0.518	-4.70*	0.510
Primary home language non-English	-1.82*	0.729	-2.40*	0.562
Mother's education less than high school	-7.56*	0.482	-6.41*	0.541
Single-parent household	-3.10*	0.351	-2.68*	0.308
<b>Two risk factors</b>				
Poverty and non-English	-6.78*	1.110	-4.76*	1.112
Poverty and mother's education less than high school	-8.98*	0.605	-7.68*	0.685
Poverty and single-parent household	-6.42*	0.411	-5.17*	0.425
Non-English and mother's education less than high school	-6.63*	0.869	-4.77*	0.927
Non-English and single-parent household	-5.33*	2.301	-4.29*	1.722
Mother's education less than high school and single-parent household	-7.96*	0.654	-5.49*	0.758
<b>Three or four risk factors</b>				
	-7.75*	0.558	-7.08*	0.546

See notes at end of table

Table 5. Linear model of growth in first-time kindergartners' reading and mathematics knowledge and skills (Relationships of sex, race/ethnicity, and unique combinations of family risk factors): Fall 1998–spring 2002—Continued

Fixed Effect	Reading		Mathematics	
	Regression coefficient	Standard error	Regression coefficient	Standard error
<b>Growth rate (fall kindergarten through spring third grade)</b>				
Intercept	2.06	0.006	1.53	0.006
Male	-0.06*	0.008	0.07*	0.008
Black	-0.24*	0.015	-0.20*	0.013
Hispanic	-0.05*	0.013	-0.02	0.014
Asian/ Pacific Islander	-0.09*	0.019	-0.02	0.018
Other, non-Hispanic	-0.17*	0.023	-0.08*	0.019
One risk factor present				
Below federal poverty threshold <sup>1</sup>	-0.18*	0.027	-0.12*	0.020
Primary home language non-English	0.02	0.021	0.07*	0.022
Mother's education less than high school	-0.21*	0.031	-0.18*	0.024
Single-parent household	-0.06*	0.014	-0.03*	0.013
Two risk factors				
Poverty and non-English	-0.08	0.054	-0.01	0.044
Poverty and mother's education less than high school	-0.36*	0.043	-0.24*	0.034
Poverty and single-parent household	-0.17*	0.020	-0.10*	0.020
Non-English and mother's education less than high school	-0.10*	0.041	-0.11*	0.036
Non-English and single-parent household	-0.07	0.066	-0.03	0.049
Mother's education less than high school and single-parent household	-0.20*	0.051	-0.13*	0.037
Three or four risk factors	-0.25*	0.026	-0.12*	0.025

\* p<.05

<sup>1</sup>Poverty is a function of household size and household income. Based on 1998 Census information, a household of four with a total income below \$16,655 was considered to be below the federal poverty level.

NOTE: Estimates reflect the sample of children assessed in English in all assessment years.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Longitudinal Kindergarten – Third Grade Public-Use data file, fall 1998, spring 1999, spring 2000, and spring 2002.

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