

Defining Risk for Preschoolers With Disabilities and Predicting Educational Performance

Abstract

This paper evaluates risks for poor educational outcomes among preschoolers with disabilities using a nationally representative sample of 3,000 children who were included in the Pre-Elementary Education Longitudinal Study (PEELS). The authors addressed three questions: 1) Can individual, familial, and temperament attributes be used to define one or more latent risk factors; 2) How do these risk factors relate to specific academic outcomes; and, 3) How do these relationships vary by race/ethnicity and metropolitan status? To answer these questions, they created factor scales for child, familial, and temperament risk factors, and used them as predictors of academic outcomes. Results indicate that the factor scales were successful predictors of risk.

The concept of risk for educational failure has changed profoundly over time. As Land and Legters (2002) explain, risk was initially viewed narrowly as “caused largely by poverty, minority status, and other individual or family characteristics” (p. 2). Starting in 1983 with the publication of *A Nation at Risk*, researchers, educators, and policymakers started taking a more comprehensive approach, looking at everything from child, family, community, and school factors; district and state policy; and the political economy of education. Much of the recent risk research takes the child’s context into consideration, noting that risk factors do not stand alone or affect a child in a vacuum, but interact and evolve with time.

Unlike previous studies that focused on risk in the general population, this study evaluates risk for a sample of children who were 3 through 5 years old and receiving special education services, thus applying previous research in a new context. In particular, the study aims to answer three research questions: 1) Can individual, familial, and temperament attributes of children who received preschool special education services be used to define one or more latent risk factors; 2) How do these risk factors relate to early language, literacy, and math performance; and 3) How do the relationships between risk factors and early academic outcomes vary by race/ethnicity and metropolitan status?

Keogh and Weisner (1993) define risk as “negative or potentially negative conditions that impede or threaten normal development” (p. 4). In an educational context, Land and Legters (2002) explain that risk is generally defined as those conditions that lead to academic failure and

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dropout. As Keogh (2000) explains, above all else, “risk is a probability statement...meaning early individual and environmental conditions are used to predict future outcomes,” and that risk conditions are likely confounded. Thus, it is important to evaluate several types of risk factors and determine how they work together to influence educational outcomes.

Individual Child Factors

Many factors have been identified in an attempt to predict which children are at the highest risk for poor educational outcomes. Health-related, or individual child risk factors, such as birth weight, prematurity, and medical conditions present at birth, are clearly associated with special education referral rates and educational outcomes (Avchen, Scott, & Mason, 2001; Cockburn & Cooke, 1993; Delgado & Scott, 2006; Holloman, Dobbins, & Scott, 1998; Keogh, 2000; Parry, Tucker, & Tarnow-Mordi, 2003; Rautonen & Makela, 1994; Tarnow-Mordi et al., 1995). Cockburn and Cooke (1993), Parry et al. (2003), Rautonen and Makela (1994), and the Scottish Neonatal Consultants’ Collaborative Study Group (1995) all evaluated different variations of the CRIB index—the Critical Risk Index for Babies. Although this index was initially developed to evaluate risk for neonatal mortality, it has evolved over time to evaluate risk for impairments that could result in poor educational outcomes as well. Consistently, researchers have found that birth weight alone is not a significant predictor of risk. However, combined in a larger model, birth weight and gestational age are important predictors of risk, regardless of how these variables are defined.

In addition to birth weight and prematurity, the number of nights a child stays in the hospital after birth has also been associated with risk for poor educational outcomes. Rautonen and Makela (1994) found that the higher a surviving child’s CRIB score, the higher the child’s risk, and the longer the newborn stayed in the hospital.

Familial Risk Factors

While these health-related, or individual child risk factors, have a significant effect on developmental outcomes during the first few years of life, this relationship fades as children get older. Between the ages of 3 and 7, socioeconomic risk factors become more influential indicators of child outcomes (Chamberlin, 1987; Werner & Smith, 1982). Examples of these socioeconomic or familial factors include household income, mother’s age at child’s birth, parents’ educational status, marital status, as well as other characteristics of the home environment (Delgado & Scott, 2006; Grizenko & Pawliuk, 1994; Harry & Klingner, 2006; Keogh, 2000; Land & Legters, 2002; Nichols & Chen, 1981; Ramey & Campbell, 1991).

Often, studies evaluating risk have found a correlation between familial poverty and risk for school failure. In fact, Land and Legters (2002) find that poverty is the “most consistently associated indicator of poor academic achievement and school failure” (pp. 4–5) and note that this is the case despite the many ways “poverty” is defined and operationalized in the research.

Previous research has also identified low parental education as a risk factor for school failure. In general, mother’s level of education has been significantly associated with risk, but more recent studies have found that father’s education level is a factor, as well (Land & Legters, 2002, p. 9). Delgado and Scott (2006) found that low maternal education was a significant indicator of risk and specifically found that low maternal education was a much better predictor than maternal age at child’s birth, maternal marital status, and both prematurity and low birth weight. They noted that maternal education serves as an indicator of family income and overall socioeconomic status as well as “...cognitive stimulation, parental knowledge of child development, parenting practices, nutrition, health care, and quality of the language environment” (p. 32).

Many studies have focused on single mothers raising children on their own and the relationship between single-parent status and risk for poor educational outcomes. As Land

and Legters (2002) explain, the traditional focus on single mothers is giving way to a focus on not only single mothers but on single fathers as well as on nontraditional families.

Land and Legters (2002) also review previous research on school factors, in particular, urbanicity. Specifically, they describe achievement rates of students in urban, suburban, and rural schools. Consistently, the research shows that children from urban schools are at the greatest risk for school failure. Even after taking school poverty levels into account, students from urban schools are more likely to experience school failure, which leads to poverty and unemployment later in life (p. 15). However, Land and Legters (2002) point out that it is difficult to untangle the many interrelated issues facing students at urban schools. Compared with suburban and rural schools, urban ones tend to be large and poorly funded, employ less qualified teachers, and have higher populations of Black, Hispanic, and non-English-proficient students, as well as more students with low socioeconomic status. Urban schools are also likely to have environmental stresses that suburban and rural schools do not, such as health and safety risks that can further distract students and teachers from learning and add to rates of school failure.

Temperament

In addition to the relevant influence of individual and familial risk factors, researchers have demonstrated that temperament also has a significant effect on academic outcomes and risk of academic failure. Thomas and Chess (1977), pioneers of temperament research, define temperament as a “behavioural style” that reflects how a person behaves rather than what he or she does or why he or she does it. Originally, Thomas and Chess identified nine dimensions of temperament as part of the New York Longitudinal Study (NYLS): activity level, intensity of emotion, sensitivity to environment, mood, approach/withdrawal to novelty, rhythmicity, adaptability to new situations, persistence, and distractibility. Researchers working with the NYLS found that nonadaptability and withdrawal were predictive of low academic achievement scores for children at age 5 (Thomas & Chess, 1977). Martin, Drew, Gaddis, and Moseley (1988)

determined that three of these dimensions—distractibility, activity, and task persistence—were most important when predicting academic performance. Their research demonstrated that measurements of distractibility, activity, and task persistence in first grade were predictive of end-of-semester grades in both first and fifth grades. These three dimensions together are referred to as “task orientation” and have been consistently associated with academic achievement (Keogh, 2003; Martin, 1989; Martin et al., 1988).

In a study of children’s temperament and teachers’ decision strategies, Pullis and Cadwell (1982) concluded that teachers relied on information regarding their students’ temperament when making classroom management decisions more than any other information examined in the study, including ability, motivation, social skills, academic performance, or potential. In addition to the direct effects of activity, distractibility, persistence, and other temperament characteristics on a child’s ability to learn, the reactions and feedback that a child’s temperament incites from the individuals in their environment also has a significant effect on their classroom experiences, behaviour, and academic outcomes.

Keogh (1994) found strong associations between temperament and teachers’ perceptions of three dimensions of “teachability,” including cognitive/motivational characteristics, school-appropriate behaviours, and personal/social skills, with the strongest association being between task orientation and school-appropriate behaviours. Teachers rated students as less teachable when they were rated low on task orientation and personal/social flexibility and high in reactivity, despite having similar ability and cognitive characteristics as other students who were considered more teachable (Keogh, 1994; see also Kornblau, 1982).

Martin and Holbrook (1985) found a significant positive association between measures of adaptability and persistence and both teachers’ assigned grades in reading and math and standardized achievement tests. Behaviours that teachers deem inappropriate for the classroom negatively influence teachers’ perceptions of the academic abilities of difficult students (see also Thomas & Chess, 1977). In fact, some

research indicates that a child's ability to fit into the scholastic setting may be more important than his or her intellectual abilities. Martin, Olejnik, and Gaddis (1994) found that teacher ratings of a child's activity level, distractibility, and persistence had three times as much influence on math achievement as scholastic ability and more than five times as much impact on reading achievement. Ultimately, the ways in which teachers react to and treat students influences the students' academic self-concept, leading to variations in academic outcomes that are rooted in temperament (Keogh 2003; Martin et al., 1994; Werner & Smith, 1998).

Risk Among Children in Special Education

Most of the existing research regarding risk for educational failure involved children in regular education. This study evaluates risk for young children who receive or have received special education services and will reflect on whether risk factors similarly affect children with and without disabilities. Keogh (1982) proposed that temperament is especially important for children with disabilities because of their cognitive, social, or motor limitations. However, Keogh's study of elementary students with learning disabilities produced results similar to those of Martin and colleagues, who studied children in regular education. Keogh (1986) found that task orientation and reactivity accounted for 39 percent of the variance in achievement ratings, while IQ accounted for only 7 percent.

Not all research indicates that risk factors have the same effect on children with and without disabilities. In a comparison of interactions between teachers and students with and without disabilities, Keogh and Burstein (1988) found that teachers interacted more with students without disabilities with positive temperaments than with students without disabilities with negative temperaments, but interacted more with students with disabilities who had negative temperaments than those with positive temperaments. These findings suggest that some risk factors, such as temperament, affect children in regular education and those in special education differently.

Analyzing Risk

Researchers with the Kauai longitudinal study have proposed that the relationship between outcomes and risk factors can best be examined with a "transactional" model, in which parents and children are continually influencing each other over time, rather than a linear model, in which a single risk condition predicts a later outcome (Werner & Smith, 1998). Keogh (2000) notes, "The path between early conditions and outcomes is not a single one, nor is it linear, and prediction from early conditions to specific outcomes is limited." Single risk factors have limited predictive power; multi-risk or additive models provide better predictions. Additionally, if we look at risk factors individually or as isolated indicators, they significantly over predict educational failure (Natriello, McDill, & Pallas, 1990). Because individual, familial, and temperament risk factors are so intrinsically intertwined, it is best to assess risk when these factors are evaluated together. A good illustration of this is evaluating risk in conjunction with race. Nichols and Chen (1981) and Kraemer and colleagues (1997) found that race was not a significant risk factor when they controlled for socioeconomic status and demographic variables. But, because more minorities live in poverty in the United States, we tend to see more minorities at risk.

Method

Approach

This paper evaluates risk for preschoolers with disabilities who are participating in the Pre-Elementary Education Longitudinal Study (PEELS). PEELS is a 6-year longitudinal study of preschoolers with disabilities, which is currently in its final year. This national sample includes over 3,100 children from 258 school districts who were ages 3 through 5 and were receiving special education services in 2003-04, when the study began. The project was approved by Westat's Institutional Review Board. The study will examine children's preschool experiences and outcomes, their transition to kindergarten, and their early elementary school experiences and outcomes. PEELS looks to better understand

the characteristics of the children receiving special education, the types of services they receive, their transitional experiences, how they perform in different educational settings, and what child characteristics, services, and programs are associated with performance. Although the focus of PEELS is not specific to risk for educational failure, the PEELS data provide many of the key variables studied in previous risk research and thus present an opportunity to look at risk in a population of preschoolers with disabilities.

PEELS data collection comprises a 45-minute one-on-one assessment that evaluates children's school readiness and achievement in mathematics and literacy; an annual parent telephone interview, which addresses child and family characteristics, functional skills, out-of-school activities, and satisfaction; and mail questionnaires sent to children's teachers and schools, districts, and state-level administrators. Copies of the instruments developed for PEELS, including the parent interview protocol and mail questionnaires, are available on the PEELS website (www.peels.org). The standardized assessments used in the study are copyright protected and may only be obtained from the publishers. The PEELS restricted-use data set is available through the U.S. Department of Education. Interested parties may contact Celia Rosenquist at celia.rosenquist@ed.gov. More limited PEELS data are available for analysis through a web-based analysis system at <http://nces.ed.gov/das/>.

Eligibility and Sampling

Three criteria were used to determine children's eligibility for the PEELS study. There had to be an English- or Spanish-speaking adult or an adult who used signed communication in the household who could respond to a

telephone interview or, alternatively, respond using a telephone relay service or interpreter for the hearing impaired. Only the first child sampled per household could participate, and the sampled child must have resided within the participating school district at the time of enrollment.

Eighty-eight percent of families sampled were found to be eligible for the study and 80% of those eligible agreed to participate. The analysis presented in this paper is based on multiple data collection instruments from multiple data collection years. Only participants who responded to all variables used in this analysis were included. (For a more detailed description of family recruitment and sampling, see Markowitz et al., 2006, at www.peels.org.)

Major Analytic Subgroups

In order to address our third research question relating to previous research that indicates socioeconomic status is a better predictor of risk than race/ethnicity or metropolitan status, this study will evaluate risk factors based on these two variables. Race/ethnicity was derived from a series of parent interview questions and recoded into three categories: Hispanic and of any race, Black or African American (not Hispanic), and White (not Hispanic). Children from other racial groups were excluded from analyses by race because samples were too small to produce reliable results. Table 1 indicates the number of children in the sample by race/ethnicity.

When we looked at our sample by race/ethnicity and household income, a key component of the familial risk factor, we found that 47% of Black children lived in households that earned less than \$20,000 per year, and only 18% lived in households that earned more than \$40,000

Table 1. Number and percentage of children in sample, by race: School year 2003-04

	<i>Black</i>	<i>Hispanic</i>	<i>White</i>
N of Children	182	396	1416
% of Sample	9%	20%	71%

SOURCE: U.S. Department of Education, National Center for Special Education Research, Pre-Elementary Education Longitudinal Study (PEELS), "Parent interview" previously unpublished tabulation (March 2008).

Table 2. Number and percentage of children in sample, by metropolitan area: School year 2003-04

	<i>Urban</i>	<i>Suburban</i>	<i>Rural</i>
N of Children	542	1040	412
% of Sample	27%	52%	21%

SOURCE: QED National Education Database™, “Early childhood and elementary and secondary school files” (2007).

per year, whereas 56% of White children and 33% of Hispanic children lived in homes that earned more than \$40,000 per year, and only 17% of White children and 37% of Hispanic children lived in households that earned less than \$20,000 per year.

Information about the districts from which children were sampled was taken from the Quality Education Data (QED) district file, which was used as the PEELS district sampling frame. Metropolitan status was defined by the designations of the U.S. Department of Education’s National Center for Education Statistics (NCES), as applied by Quality Education Data (QED), and was classified as urban, suburban, and rural. Table 2 indicates the number of children in the sample by type of metropolitan status.

When we examined our sample by metropolitan status and income, we found that the relative distribution of children who live in urban and rural areas represents a higher percentage of households earning less than \$20,000 a year and a smaller percentage of households earning more than \$40,000 a year than the distribution of children who live and go to school in suburban areas.

Outcome Measures

Outcome measures for this study were based on one-on-one direct assessments with participating children. The complete PEELS direct assessment consisted of 13 subtests administered by over 400 assessors from participating districts. Assessors included school psychologists, teachers, administrators, and other individuals with experience in administering standardized assessments to young children. This study reports data from three of these subtests: the Peabody Picture Vocabulary Test III (PPVT-III; Dunn & Dunn,

1977), the Woodcock-Johnson III Letter-Word Identification subtest, and the Woodcock-Johnson III Applied Problems subtest (Woodcock, McGrew, & Mather, 2001).

The PPVT is a measure of receptive language in which the assessors show a child four pictures on a single page and say a word aloud. Children are asked to point to the picture that matches the word the assessor said. PEELS used a revised version of the PPVT that was shortened using Item Response Theory (IRT). Using IRT scaling, we estimated two aspects of the PPVT. First, we estimated the proficiency scores of each student. Second, we estimated how well a student would do on each item if the student was at a certain level of proficiency. The latter estimate is the item response of IRT. If we know the item response functions of all items, we can predict what total score a student will get if he/she is at a given level of proficiency. These item responses are assumed to be constant from one sample to another in IRT. Because of this invariance of item responses across samples, if two groups are given the same set of items, then the proficiency scales can be linked. Following a method detailed in Stocking and Lord (1983), we linked the proficiency scales between two samples by finding a linear transformation of the proficiency scales that preserves the item responses of the items. The product of this IRT scaling, a shortened version of the PPVT, consisted of 14 items that were administered to all children. Children who performed poorly on this core set of items received an easier basal set of items, while children who performed very well on the core set of items continued with a more difficult ceiling set of items.

The Woodcock-Johnson III Letter-Word Identification subtest is a measure of a child’s word identification skills. Initial items require children to identify letters that appear in large

type, and more difficult items require children to read words correctly. Test items progress in difficulty from common to uncommon words in written English. Part of the same battery, the Applied Problems subtest is a measure of children's ability to analyze and solve practical math problems using simple counting, addition, or subtraction operations.

Children's scores on all three of these measures were converted to a norm-referenced scale with a mean of 100 and a standard deviation of 15. These three subtests were selected because they were administered to the largest number of children in the sample (some measures were administered only to older or younger children). In total, 88% of the sample received these direct assessment measures in 2003-04.

If a child was unable to follow simple directions, had a visual impairment that would interfere with test administration, or was unable to meaningfully participate due to his or her disability, the child received the Adaptive Behavior Assessment System II (ABAS; Harrison & Oakland, 2003) as an alternate assessment. This applied to 5% of the children participating in PEELS.

Analysis

The first research question, *Can individual, familial, and temperament attributes of children who received preschool special education services be used to define one or more latent risk factors*, was answered by creating factor scales for each of three constructs—individual child risk, familial risk, and temperament—based on variables from the PEELS parent interview that have been previously used in related studies and grouped based on theoretical considerations. All variables used in factor scales either come from the first year of PEELS data collection (Wave 1), when children were 3 through 5 years old, or are retrospective in that they were collected in the first completed parent telephone interview, regardless of data collection year. All retrospective variables deal with aspects of the child's health at birth, so they are unaffected by data collection year. An individual child factor scale was created based on health-related risk factors present at birth. A familial factor scale was created based on socioeconomic variables, and a

temperament factor scale was created based on variables indicative of a child's temperament. A confirmatory factor analysis was used to assess how well individual variables reliably measure these three constructs.

The second question, *How do these risk factors relate to early language, literacy, and math performance*, was answered by using the individual child, familial, and temperament factor scales as predictors of academic outcomes in a multiple regression analysis. The outcome measures used include the PPVT and two subtests from the Woodcock-Johnson: Letter-Word Identification and Applied Problems, which were administered in the third year of PEELS data collection (Wave 3) when children were 5 through 7 years old. Additionally, a fourth outcome measure was created that combines these three outcomes into a single factor, an early academic factor. The multiple regression analysis confirms the validity of the factors for predicting early academic outcomes.

Results

Confirmatory Factor Analysis

In this part of the analysis, we define the three risk-related factors: individual child, familial, and temperament. We determined the feasibility of the measurement model by running a confirmatory factor analysis using the Mplus software (Muthén & Muthén, 2006), which accommodates categorical and continuous measures. We assumed a simple structure, i.e., each item measures just one of the three hypothesized factors. After initial exploratory runs, some items were dropped due to poor loadings on the underlying factor. The final configuration is a model in which 3 items measure the individual child factor, 10 items measure the familial factor, and 15 items measure the temperament factor. Table 3 gives the standardized loadings (i.e., item/factor correlations) for the items on the factors, where 1 is the highest loading. Most of the items have strong loadings. The reliabilities of the three scales are .83, .78, and .85, respectively, which are in a moderately high range.

The estimated factor-to-factor correlations were small, indicating that the three factors

Table 3. Factor loadings of the confirmatory factor analysis

<i>Factor</i>	<i>Loading (standardized)</i>
Individual child	
Birth weight	0.98
Prematurity	0.92
Nights spent in hospital at birth	0.83
Familial	
Household income	0.87
Household received food stamps	0.87
Household received welfare	0.75
Mother's education	0.74
Father's education	0.74
Household received WIC food vouchers	0.67
Household parent composition	0.64
Household received SSI	0.55
Mother's age at birth of child	0.47
Neighborhood safety	0.32
Temperament	
Does not behave appropriately	0.81
Is not easy to manage	0.79
Is restless	0.72
Has temper tantrums	0.67
Does not takes turns	0.66
Does not stay focused	0.61
Has trouble playing with others	0.61
Is easily distracted	0.60
Is anxious/depressed	0.60
Does not get involved easily	0.58
Is aggressive	0.56
Has difficulty with change	0.54
Is jumpy	0.47
Does not finish things	0.43
Does not do things on own	0.30

SOURCE: U.S. Department of Education, National Center for Special Education Research, Pre-Elementary Education Longitudinal Study (PEELS), "Parent interview," previously unpublished tabulation (March 2008).

Table 4. Correlation of latent variables

	<i>Child</i>	<i>Familial</i>	<i>Temperament</i>
Individual child	1.00		
Familial	0.16	1.00	
Temperament	0.14	0.34	1.00

SOURCE: U.S. Department of Education, National Center for Special Education Research, Pre-Elementary Education Longitudinal Study (PEELS), "Parent interview," previously unpublished tabulation (March 2008).

contain nonoverlapping information about the children in our sample (see Table 4). The statistical fit indices from the confirmatory factor analysis are in an acceptable range, indicating the measurement model adequately represents the data.

Regression Analysis Predicting Cognitive Achievement From Child, Familial, and Temperament Factors: Whole Group

Table 5 presents the results of the regression analyses. In the first three analyses, the early academic outcomes—the PPVT, Letter-Word Identification, and Applied Problems—are separately predicted by the risk factors. This resulted in moderately small percentages of the variance being accounted for by the prediction: 18%, 12%, and 17%, respectively. In the fourth model, the three academic outcomes are combined into a single factor. This last regression accounted for 25% of the variability in the outcome, a moderate amount. While the degree of prediction is not large, the regressions demonstrate the validity of the risk constructs defined in this study. The regression weights, which are standardized, give some evidence of the relative importance of the predictors. For PPVT and Letter-Word Identification, the familial factor appears to be the most important for predicting early academic outcomes, followed by the temperament factor. This same pattern is found when the outcome is evaluated as a combined early academic factor. For the Applied Problems early math outcome, the temperament factor appears most important, followed by the familial and individual child factors.

Regression Analysis Predicting Cognitive Achievement From Child, Familial, and Temperament Factors: Racial/Ethnic Groups

In order to gauge how the prediction of cognitive outcomes is affected by membership in different racial/ethnic groups, a separate regression was run for Black, Hispanic, and White children. Less than 10% of the sample was Black; twice as many were Hispanic, with the rest identified as White (see Table 1 above). Table 6 presents the regression results separately for children in the three racial/ethnic groups. While the regression coefficients were different by subgroup, the measurement model was similar for each group. As a result, they will not be presented separately here.

There were several differences worth noting in the way factors predicted outcomes. First, the percentage of variation in the outcomes accounted for by the regression was consistently less for Black children than for other groups. Also, for Black children, the child factor was not a significant predictor for any outcome. Familial factors were the most important predictor of outcomes, while the temperament factor was a significant predictor only for Applied Problems and the Early Academic Factor.

Hispanic and White children had similar percentages of outcome variation explained by the regression (close to that obtained in the whole group analysis). However, the child factor was a more important predictor of cognitive outcomes for Hispanic children than for White children. For Letter-Word Identification, the child factor was not a significant predictor for White children. For Hispanic children, the familial factor was a stronger predictor of PPVT

Table 5. Regression analyses of academic outcomes for school year 2005-06 using child, familial, and temperament predictors

Wave 3 outcome	Predictor	Regression weights
PPVT	Child	1.44
	Familial	4.04
	Temperament	2.64
	% of outcome accounted for	18%
Letter-Word Identification	Child	1.72
	Familial	4.05
	Temperament	2.15
	% of outcome accounted for	12%
Applied Problems	Child	3.06
	Familial	3.66
	Temperament	4.78
	% of outcome accounted for	17%
Early Academic Factor	Child	0.16
	Familial	0.30
	Temperament	0.25
	% of outcome accounted for	25%

NOTE: All regression weights are significant.

Predictors are latent factors. Coefficients are corrected for attenuation due to unreliability.

SOURCE: U.S. Department of Education, National Center for Special Education Research, Pre-Elementary Education Longitudinal Study (PEELS), "Parent interview," previously unpublished tabulation (March 2008).

scores than for White children and about the same as for Black children. However, for Letter-Word Identification, the familial factor was a less important predictor for Black children than for other children. For Hispanic and White children, temperament was a significant predictor of all four outcomes. However for PPVT and the Early Academic Factor, temperament was somewhat less important as a predictor for Black children than for White children.

Regression Analysis Predicting Cognitive Achievement From Child, Familial, and Temperament Factors: Metropolitan Classification Groups

As with race/ethnicity, it was thought that important differences in how factors predict outcomes might be due to the type of com-

munity in which children lived. To explore this issue, we ran the regression analysis separately for children from the three types of metropolitan areas: urban, suburban, and rural. As with the regression analysis by race/ethnicity, the measurement model was similar for each metropolitan group; therefore, separate measurement model results will not be presented here.

Referring to Table 2 above, we see that most of the children in the sample were suburban, with about half as many in urban and rural settings. Table 7 shows the regression analysis performed separately by metropolitan group. Generally, we see that the percentage of variation in outcomes accounted for is similar for urban and suburban groups as for the whole sample, although the analysis accounted for a somewhat smaller percentage of the variance for rural

Table 6. Regression analyses of academic outcomes for school year 2005-06 using child, familial, and temperament predictors, by race/ethnicity

Wave 3 outcome	Predictor	Regression weights		
		Black	Hispanic	White
PPVT	Child	-0.03	0.17	0.10
	Familial	0.26	0.26	0.22
	Temperament	0.09	0.16	0.23
	% of outcome accounted for	9%	16%	16%
Letter-Word Identification	Child	0.11	0.21	0.06
	Familial	0.25	0.19	0.24
	Temperament	0.08	0.15	0.13
	% of outcome accounted for	10%	13%	11%
Applied Problems	Child	0.07	0.21	0.15
	Familial	0.17	0.13	0.15
	Temperament	0.19	0.25	0.26
	% of outcome accounted for	10%	16%	16%
Early Academic Factor	Child	0.08	0.25	0.14
	Familial	0.29	0.25	0.25
	Temperament	0.17	0.24	0.27
	% of outcome accounted for	16%	25%	22%

NOTE: Significant regression coefficients are in bold.

SOURCE: U.S. Department of Education, National Center for Special Education Research, Pre-Elementary Education Longitudinal Study (PEELS), "Parent interview," previously unpublished tabulation (March 2008).

children. However, there were noteworthy differences across subgroups in the significance of predictors. For example, for urban children, the child factor was less important than it was for suburban and rural children and was only significant for the Applied Problems scores. The familial factor was generally more important for urban children than for suburban and rural ones. The child and familial factors showed no consistent pattern among suburban and rural children; the familial factor was a stronger predictor for suburban children for the

Letter-Word Identification outcome, while the child factor was a stronger predictor for rural children for the Applied Problems outcome.

Discussion

The analysis explored the validity of the measures by determining how strongly they related to early academic outcomes. The factor scales in this research study demonstrated moderate predictive power, which bodes well for the prospect of defining risk for this popula-

tion. Further, the three risk factors showed fairly consistent predictive power for each academic outcome measure where the individual risk factor was least important; temperament was a stronger predictor; and the familial factor was the strongest predictor of academic outcomes.

The familial factor was consistently more important in predicting early academic outcomes than was the individual child factor. These findings support previous research that suggest health-related and temperament variables are the most important predictors of risk during infancy and early childhood but that in childhood, familial factors become more influential (Werner & Smith, 1998). Since the models used predictors for children when they were ages 3 through 5 and outcomes when they were ages 5 through 7, it seems reasonable that familial-related risk factors outweighed individual child and temperament-related risk factors.

The temperament factor was also a consistently strong predictor of academic outcomes, more so than the health-related, or child, factor. While temperament was less predictive than the familial factor for the two reading outcomes, PPVT and the Woodcock-Johnson: Letter-Word Identification subtest, it was more predictive of outcomes on the Woodcock-Johnson: Applied Problems subtest, a test of math and logic skills. A distinction such as this has not been reported in previous research. It is feasible that reading and math skills are influenced differently by different risk factors. For instance, reading at home with children has been shown to positively influence children's academic performance in reading (Barton & Coley, 2007). Familial risk factors such as household income, parental education, and parent composition may be particularly influential in parents' ability to provide an environment that is supportive of reading skills. Math skills may be more reliant on temperament characteristics such as task orientation. Overall, temperament is clearly a relevant risk factor for all outcome measures.

When we evaluated risk for poor educational outcomes by race/ethnicity, we found that for Black children, the familial risk factor was most important in predicting poor educational outcomes, while the individual child factor

was not significant for any outcomes, and the temperament factor was only significant for Applied Problems and the early academic factor. As previously mentioned, when we evaluated our sample by race/ethnicity and household income, we found that more Black children were likely to live in households earning less than \$20,000 per year, whereas White children were likely to live in households earning more than \$40,000 per year. Previous research notes that familial factors, such as income and/or socioeconomic status, are more informative predictors of risk than race or ethnicity, especially noting how often the two are conflated.

Previous research notes that children living in urban and rural areas are at greater risk for poor educational outcomes. When we look at the early academic factor, we see that the familial factor is again more important for determining this outcome for children from both urban and rural areas. When we evaluated risk by metropolitan status and income, we found that children in urban and rural schools are more likely to live in households that earn less than \$20,000 per year. This provides strong evidence that some of what we are seeing here is due to income and less to metropolitan status and/or race/ethnicity specifically.

This study was limited by our ability to use only predictors available in the various PEELS data collection instruments. Because the primary interest of the PEELS study is not to evaluate risk for poor educational outcomes, we did not have access to all of the variables previously evaluated, particularly predictors of school-level risk factors. Also, some of the predictors that were used here are not operationalized exactly as they were in previous studies. However, regardless of how the specific predictors were operationalized, our results using a population of preschoolers with disabilities were generally in agreement with results from previous research, most of which involves children in regular education. This study demonstrates that the risk factors that influence children in regular education have similar effects on children in special education.

In terms of future research, it would be beneficial to study children with and without disabilities using the same predictors and outcome measures to further explore the similarities

Table 7. Regression analyses of academic outcomes for school year 2005-06 using child, familial, and temperament predictors, by metropolitan status

Wave 3 outcome	Predictor	Regression weights		
		Urban	Suburban	Rural
PPVT	Child	0.02	0.14	0.12
	Familial	0.35	0.26	0.33
	Temperament	0.19	0.20	0.09
	% of outcome accounted for	20%	19%	18%
Letter-Word Identification	Child	0.08	0.11	0.10
	Familial	0.27	0.25	0.13
	Temperament	0.09	0.16	0.15
	% of outcome accounted for	11%	14%	8%
Applied Problems	Child	0.12	0.15	0.21
	Familial	0.26	0.16	0.17
	Temperament	0.21	0.27	0.19
	% of outcome accounted for	18%	18%	16%
Early Academic Factor	Child	0.09	0.17	0.20
	Familial	0.36	0.28	0.28
	Temperament	0.21	0.28	0.19
	% of outcome accounted for	25%	27%	23%

NOTE: Significant regression coefficients are in bold.

SOURCE: U.S. Department of Education, National Center for Special Education Research, Pre-Elementary Education Longitudinal Study (PEELS), "Parent interview," previously unpublished tabulation (March 2008).

and potential differences in these populations. Future research, for both populations with and without disabilities, should also include resilience as a factor in achievement for children at-risk. When discussing risk, it is important to recognize that some individuals succeed academically despite having multiple risk factors. Among children with similar deficits, there are factors that allow some children to succeed in school, while others fall behind. Researchers have referred to this as resilience. Masten, Best, and Garmezy (1990) define resilience as "the process of, capacity for, or outcome of successful adaptation despite challenging or threatening

circumstances" (p. 426). Resilient children develop well even when faced with potentially negative circumstances. For example, Hollomon, Dobbins, and Scott (1998) showed that while children with very low birth weight (VLBW) were at high risk for special education placement, having a mother with more than a high school education offered a significant buffer from this biological risk. Future research should address both children's risk and resilience as they both contribute to academic achievement.

Additionally, risk for children with disabilities needs to be measured more comprehensively,

including child and school-level factors that were not available in the present study. Also, it will be important to evaluate risk at different ages, as the literature focusing on children without disabilities suggests that predictors shift in importance based on the age of the child. Finally, future research should look to better understand the complicated relationship between race/ethnicity, metropolitan status, income, and risk. Further evaluation of risk for children with disabilities and the ability to effectively predict potential academic failure for this population will help educators cater to the needs of their students in an effort to improve their academic experiences.

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