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## Effects of Family Structure Type and Stability on Children's Academic Performance Trajectories

*Using five waves of panel data from 8,008 children in the ECLS-K, the current study compared children's academic performance growth curves from kindergarten through fifth grade among three types of nondisrupted and three types of disrupted families. The analyses found that children in nondisrupted two-biological-parent and nondisrupted stepparent households consistently made greater progress in their math and reading performances over time than their peers in nondisrupted single-parent, disrupted two-biological-parent, and disrupted alternative families with multiple transitions. These trajectory differences were either partially or completely accounted for by family resources in the kindergarten year (Time 1). Overall, our findings provided strong support for the resource-deprivation perspective and partial support for the instability-stress perspective.*

Decades of changing rates in marriage, divorce, remarriage, and cohabitation in the United States have led to two general trends in the living arrangements of American children. On one hand, American children are living in

increasingly diversified family contexts (Brown, 2006) characterized by a declining percentage of children living with both biological parents and a growing proportion of their peers living in a wide variety of non-two-biological-parent (hereafter referred to as alternative) family structures (Brown; U.S. Census Bureau, 2001). On the other hand, American children are more likely than ever to experience family structural transitions during their childhoods (Bumpass & Lu, 2000; Raley & Wildsmith, 2004).

To assess the educational consequences of these two trends for children, a large body of previous research has separately compared children's educational outcomes (typically measured at one time point) between two-biological-parent and alternative families (e.g., Astone & McLanahan, 1991; Downey, 1995) and between disrupted and nondisrupted households (e.g., Cavanagh, Schiller, & Riegle-Crumb, 2006; Fomby & Cherlin, 2007). Much less, however, has been done to combine these two measures of family structure type and transition status to examine their joined impact on the trajectories of children's educational outcomes over time (a recent exception was Magnuson & Berger, 2009). Further, although some studies have suggested that low and fluctuating levels of financial and parenting resources associated with family transitions are major reasons for poor child outcomes in unstable families, empirical tests of such mediating effects have been restricted to statically measured child outcomes (e.g., Pong & Ju, 2000; Wu, 1996). To understand fully how

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*Key Words:* academic performance, child development, family instability, family structure, growth-curve models, hierarchical linear models.

changes in family structures, family resources, and child outcomes are interrelated over time, it is crucial to measure all three factors at multiple time points during childhood.

Using five waves of panel data from 8,008 young children in the Early Childhood Longitudinal Study—Kindergarten Cohort (ECLS—K), the current study combined the measures of family structure type and family transition status to compare children's performance trajectories during the period of kindergarten (T1) through fifth grade (T5) among three types of families whose family structures have remained unchanged between T1 and T5 and three types of families that have gone through one or more structural transitions during the same period. Although two of the three types of nondisrupted families in our classification (i.e., nondisrupted single-parent and nondisrupted stepparent families) might have experienced one or more transitions before the kindergarten year, they had remained structurally stable during the K—5 period. By comparing children's performance trajectories in these nondisrupted alternative families and the trajectories in other alternative families that experienced additional structural changes between T1 and T5, we were able to investigate whether a stabilized family structure after some initial changes may benefit children's academic progress over time. In addition to comparisons of performance growth rates, the current study also examined whether financial and parenting resources measured in the kindergarten year and changes in such resources between kindergarten and fifth grade mediated the differences in performance growth rates among the six types of families.

#### FAMILY STRUCTURE TYPE AND CHILDREN'S EDUCATIONAL OUTCOMES

Most previous studies have concurred that growing up in various alternative family structures has negative educational consequences. Compared with their peers raised in two-biological-parent families, children growing up in single-parent families typically showed lower levels of academic achievement (e.g., Finn & Owings, 1994; Hofferth, 2006; Schiller, Khmelkov, & Wang, 2002), exhibited lower educational expectations (e.g., Sun, 2003), and had lower chances of graduating from high school and attending college (e.g., Astone & McLanahan, 1991; Ermisch & Francesconi, 2001). Meanwhile, children in

stepfamilies were also found to do less well than their peers in two-biological-parent households on GPAs, standardized tests, high school graduation rates, and college attendance (e.g., Astone & McLanahan; Deleire & Kalil, 2002; Downey, 1995). Studies comparing single-parent and stepfamilies, however, often reported similar child outcome levels, with neither group having a clear educational advantage over the other (Coleman, Ganong, & Fine, 2000; Manning & Lamb, 2003).

The most common explanation for educational disadvantages in alternative families has been resource deprivation, an argument built on conceptual models of parental investment. As Coleman has previously pointed out (1988), parents could accumulate and invest financial, human, cultural, and social resources, and these valuable parental resources, together with other factors, were crucial for children's educational success. In single-parent households, however, the levels of parental resources were likely to be lower, and this shortage of resources was at least partially responsible for poor educational outcomes in such families (Coleman; McLanahan, 1985). Although a stepparent could substitute for the nonresidential biological parent to some degree by providing additional resources, the extent of such substitution was often limited (Downey, 1995). In addition, compared with two-biological-parent families, single-parent and stepfamilies were less likely to invest in their social relationships with other parents and school personnel (Coleman) and, consequently, were less likely to allocate external educational resources. Empirically, most tests of the resource-deprivation model provided consistent support. The levels of economic, human, and parenting resources were found to be significantly lower in single-parent and stepfamilies than in two-biological-parent families (e.g., Downey; Sun, 2003). When these family resources were held constant, the negative effects of alternative family structures were either reduced or totally eliminated (Downey; McLanahan & Sandefur, 1994; Thomson, Hanson, & McLanahan, 1994).

One major limitation of most studies in this area has been their reliance on a static, snapshot measure of family structure, which classified children into either two-biological-parent or various types of alternative families on the basis of their family structure type at one time point during childhood (Cavanagh et al., 2006; Wu

& Martinson, 1993). Such a crude measure was insensitive to the frequency and duration of family structure transitions that result from parents' cohabitations with new partners, remarriages, and terminations of new unions. In addition to a statically measured family structure, children's educational outcomes have also been measured at only one time point in most previous studies. Although several divorce studies have employed growth-curve and pooled-time series models to study the trajectory differences between divorced and married families in children's mental health (Cherlin, Chase-Lansdale, & McRae, 1998) or in adolescents' academic performance over time (Sun & Li, 2002, 2009), few studies have used such models to map American children's early educational trajectories among various alternative families. Consequently, relatively little has been learned about whether the educational gaps reported by previous studies between preschool-aged children in two-biological-parent and other types of alternative families will continue to grow during their remaining childhoods and, if so, at what rates.

#### FAMILY STRUCTURE DISRUPTIONS AND CHILDREN'S EDUCATIONAL PROGRESS

To move beyond a static approach to study family structure, a growing body of recent studies has used an instability-stress perspective to guide their research (e.g., Capaldi & Patterson, 1991; Cavanagh et al., 2006; Wu & Martinson, 1993). This approach has been inspired by the idea that a family offers children a basic sense of security, accountability, and stability (Bretherton, Walsh, Lependorf, & Georgeson, 1997; Cummings, Davies, & Campbell, 2000). Family structural instability (defined as one or more changes in family structure) compromises children's trust in such security and imposes emotional stress on children (Amato, 2000; Demo & Fine, 2010), both of which are likely to relate negatively to child outcomes. Further, establishment of new unions and termination of existing ones also introduce changes in family resources, rules, and parenting practices (Beck, Cooper, & McLanahan, 2010; Demo & Fine), and may adversely affect children by further increasing their stress level related to adjustments to new family environments (Demo & Fine). Because multiple transitions cumulate and extend children's anxieties, they have the

potential to escalate and compound their effect on children over time.

Most existing studies have measured family instability by the number of changes in the residential parent's union statuses (e.g., Cavanagh et al., 2006; Fomby & Cherlin, 2007; Osborne & McLanahan, 2007). Compared with their peers in nondisrupted two-biological-parent families, children who had experienced one or more family transitions were found to have lower GPAs and test scores (Capaldi & Patterson, 1991; Fomby & Cherlin; Heard, 2007; Kurdek, Fine, & Sinclair, 1995), math placement at the end of high school (Cavanagh et al.), high school graduation rates (Pong & Ju, 2000), and educational attainment in young adulthood (Sun & Li, 2008).

Although the instability-stress perspective was originally developed to explain the negative impact of family instability, the same argument can be extended to imply that stability (i.e., an absence of transitions) in any family structure should benefit children because of a lack of emotional stress associated with change, a potentially low level of interpersonal conflicts between parents (or parent and partner), and a low chance for dramatic changes in parenting practices. When studying such nondisrupted alternative families, several studies found that children living in single-parent families either all the time or for a long period fared less well in academic outcomes than their peers in nondisrupted two-biological-parent families (Carlson & Corcoran, 2001; Fomby & Cherlin, 2007; Magnuson & Berger, 2009). By contrast, Demo and Acock (1996) reported that growing up in nondisrupted single-parent families had no negative effect on adolescents' academic performance.

Previous studies of family transitions can be enhanced in at least four aspects. First, although recent studies have begun to include children from nondisrupted single-parent and stepfamilies in their investigations, the focus has remained on the comparisons between such alternative families and nondisrupted two-biological-parent families. To better understand the confounding effects of family structure type and transition status, it is necessary to compare child outcomes across all structure types and disruption statuses (e.g., between nondisrupted single-parent and nondisrupted stepfamilies, and between nondisrupted single-parent and disrupted two-biological-parent families).

Second, most previous studies of family transitions have not sufficiently controlled for the

levels of child well-being and family resources prior to family changes. As demonstrated by previous divorce research (e.g., Sun, 2001; Sun & Li, 2002), both child well-being and family environment start to deteriorate long before parental divorce or separation. Following the same logic, family structure transitions resulting from the formation or termination of the residential parent's unions are also likely to be preceded by financial, social, and educational disadvantages in families. When these prechange factors (especially the prechange level of child outcomes) are left out of investigations, the effects of multiple transitions on children are likely to be overestimated.

Third, although the instability-stress perspective has identified fluctuating resources during transitions as one key mechanism through which children were affected, only a few studies have tested this argument. In one study, Wu (1996) found that low, fluctuating, and declining family income levels during family transitions did not mediate the effects of these transitions on premarital birth risks. In another study, Sun and Li (2008) also reported that family resource changes during high school years explained only a relatively small amount of the effects of growing up in unstable postdivorce families on young adults' educational attainment. Obviously, more studies are needed to explore the role of changing family resources in explaining poor educational outcomes in disrupted families.

Finally, almost all existing studies of multiple family transitions have examined how a dynamically measured family structure history has affected a statically measured child outcome (e.g., children's test scores in a given grade). This approach has fallen short of a full test of the instability-stress theory, which argues that continuous family transitions not only sustain, but also escalate their effect on children over time as multiple transitions continue to increase children's stress levels. To our knowledge, only one study (Magnuson & Berger, 2009) has compared children's academic performance trajectories over time between nondisrupted two-biological-parent and various alternative and disrupted families. The study demonstrated that compared with their peers in nondisrupted two-biological-parent households, children in nondisrupted single-parent families made less academic progress in both reading and math over time whereas children in nondisrupted stepfamilies made ever greater progress in math.

Despite these interesting findings, their study can be further enhanced by comparing performance trajectories across all family structure types and transition statuses (particularly between nondisrupted alternative families and other alternative families that have experienced additional changes) and by examining the mediating effects of family resources prior to and during the transition period.

The current study addresses these limitations of previous research by comparing children's performance growth rates among a variety of alternative and disrupted families and by evaluating the roles of family resources in accounting for differences in performance trajectories. Drawing on previous studies of alternative families and the instability-stress perspective, we hypothesized that

Hypothesis 1: Children in nondisrupted two-biological-parent families make greater academic progress between T1 and T5 than their peers in nondisrupted single-parent, nondisrupted stepparent, and three types of disrupted families that had one (or more) family transitions during the same period.

In addition to examining the potential negative effects of family structure changes, we further tested the reverse argument of the instability-stress perspective by examining whether family stability between T1 and T5 in nondisrupted single-parent and stepparent families benefits children's academic progress. Thus, we further hypothesized that

Hypothesis 2: Performance growth curves are more positive in nondisrupted single-parent and stepparent households than in the three types of disrupted families.

Also drawing on the instability-stress argument, we hypothesized that

Hypothesis 3: Performance growth curves are more positive in alternative families that encountered one transition between T1 and T5 than in alternative families that countered multiple transitions during the same period.

Next, we tested the mediating effects of family resources prior to and during the transition period. Because family resources were likely to be lower in nondisrupted single-parent and stepfamilies than in nondisrupted two-biological-parent families at T1 and because levels of

family resources were also likely to decline in predisrupted families at T1, before subsequent disruptions occurred (Sun, 2001), we hypothesized that

Hypothesis 4: Growth-curve differences between nondisrupted two-biological-parent and each of the other five alternative families are likely to be reduced after family resources at T1 are held constant.

Finally, because family resources were more likely to decline or fluctuate in disrupted than in nondisrupted families between T1 and T5, we hypothesized that

Hypothesis 5: The performance growth-curve deficits in the three disrupted groups relative to the three nondisrupted groups are likely to be reduced when changes in resources between T1 and T5 are held constant.

When testing these five hypotheses, we also controlled for a wide range of child and parent characteristics, because these characteristics were found in previous research to be correlated with family structure types or children's academic performance. The individual-level controls included children's gender, race and ethnicity, underweight status at birth (Magnuson & Berger, 2009), disability status (Magnuson & Berger), native language status, number of siblings at home (Downey, 1995), biological mother's age (Carlson & Corcoran, 2001), and biological mother's marital status when the child was born (Osborne & McLanahan, 2007). Given that certain school characteristics have also been found to have contextual effects on children's academic performance within schools (Lee & Bryk, 1989; Pong, 1997), we also controlled for school enrollment, percentage of minorities, percentage of students eligible for free lunch, type of schools, and school location.

## METHOD

### *Data and Sample*

Data used in this study came from the ECLS-K of 1998. The base-year study included a nationally representative sample of more than 22,000 American kindergarteners in fall 1998. The study used a multistage cluster sampling design, which selected, first, geographic regions, then schools within regions, then students within schools.

After 1998, the study collected additional waves of survey data from parents and teachers as well as cognitive test data from children. The current study used data from five waves: (a) fall of kindergarten, (b) spring of kindergarten, (c) spring of first grade, (d) spring of third grade, and (e) spring of fifth grade.

We set up the sampling pool by selecting children who had participated in all five waves. From this pool of 8,370 children, we first excluded 101 cases (or 1.2% of the pool) who had fewer than three waves of test data. We further excluded 93 adopted children (or 1.1% of the pool) in families with two adoptive parents and 10 children (0.1%) in households with one adoptive and one stepparent at T1 because (a) several previous studies reported that adopted children fared less well in various child outcomes than their peers in two-biological-parent families (e.g., Haugaard, 1998) and (b) adding adopted children as a separate family category would significantly increase the number of bigroup comparisons of performance slopes. We also excluded 158 families (or 1.8%) with neither biological parent present at T1 because these families were beyond the scope of this study. The final sample consisted of 8,008 children with a total of 39,175 observations in five waves.

### *Measures*

Table 1 provides descriptive statistics of all the dependent, independent, and intervening (family resource) variables. All statistics in Table 1 were weighted by the panel weights in the ECLS-K to correct factors involving unequal probabilities in the sampling of the ECLS-K panel.

*Dependent variables.* We used the students' item-response-theory scores in the math and reading cognitive tests in each of the five waves as the dependent variables. On the basis of a student's answers to test questions with different levels of difficulty and the number and type of questions omitted, the item-response-theory scores estimated the number of right answers students would have provided if they had answered all questions. These math and reading scores have also been recalibrated by the ECLS-K personnel to allow cross-wave analyses of performance gains and losses.

*Independent variables.* The key independent variable was our categorical classification of

Table 1. *Descriptive Statistics of Dependent, Key Independent, and Intervening Variables<sup>a</sup>*

Variables	Descriptions	<i>M</i>	<i>SD</i>	<i>N</i>
<b>Academic performance</b>				
Math score at T1	IRT <sup>b</sup> scaled math score in fall of kindergarten.	22.73	8.71	7,833
Math score at T2	IRT <sup>b</sup> scaled math score in spring of kindergarten.	33.06	11.35	7,919
Math score at T3	IRT <sup>b</sup> scaled math score in spring of first grade.	57.69	16.30	7,923
Math score at T4	IRT <sup>b</sup> scaled math score in spring of third grade.	92.18	21.01	7,783
Math score at T5	IRT <sup>b</sup> scaled math score in spring of fifth grade.	113.53	20.77	7,717
Reading score at T1	IRT <sup>b</sup> scaled reading score in fall of kindergarten.	29.42	9.98	7,403
Reading score at T2	IRT <sup>b</sup> scaled reading score in spring of kindergarten.	40.85	13.42	7,636
Reading score at T3	IRT <sup>b</sup> scaled reading score in spring of first grade.	71.83	22.12	7,775
Reading score at T4	IRT <sup>b</sup> scaled reading score in spring of third grade.	118.82	24.26	7,620
Reading score at T5	IRT <sup>b</sup> scaled reading score in spring of fifth grade.	139.47	22.04	7,589
<b>Family resources at T1</b>				
Annual family income	Annual family income (×\$1,000).	51.22	53.63	8,008
Parental educational attainment	The higher educational attainment of either parent or the highest attainment level of the residential parent (1 = 8th grade or below; 8 = doctoral degree).	4.06	1.50	8,008
Parent–child ties	The sum of frequency with which parents do nine activities with the child in a typical week (0 = do not do any of the nine activities; 27 = do all activities).	15.95	4.40	8,008
<b>Resource changes</b>				
Change in annual income	Annual change rate in family income (×\$1,000).	2.14	9.15	8,008
Change in school activities <sup>c</sup>	Change in parent's participation in school activities.	0.08	0.58	8,008
Change in volunteering <sup>c</sup>	Change in parent's participation in volunteering.	−0.04	0.56	8,008
Change in fundraising <sup>c</sup>	Change in parent's participation in fundraising.	0.09	0.55	8,008
<b>Family Structures</b>		<b>Frequency</b>		<b>Weight %</b>
Nondisrupted two-biological-parent	Families with two biological parents in all five waves	5,503		56.21
Nondisrupted stepparent	Families with the same biological parent and his or her married or cohabiting partner in all five waves.	318		4.45
Nondisrupted single-parent	Families with the same single parent in all five waves.	735		13.51
Disrupted two-biological-parent	Families with two biological parents at T1, but changed their family structures at least once in later waves.	720		12.62

Table 1. *Continued*

Variables	Descriptions	Frequency	Weight %
Disrupted alternative (one change)	Families with single-parent or stepparent structure at T1 and who changed their structure once in later waves.	497	13.21
Disrupted alternative (multiple changes)	Families with single-parent or stepparent structure at T1 and who changed their structure twice or more in later waves.	235	5.11

<sup>a</sup>All descriptive statistics were weighted by the ECLS-K panel weights.

<sup>b</sup>Test scores were estimated on the basis of Item Response Theory. These scores have been recalibrated to allow analyses of performance gains and losses across waves.

<sup>c</sup>Changes in parents' participation in school activities, volunteering, and fundraising were derived from parents' responses on these three items at T2 and T5 (with the value of  $-1$  on a given activity indicating a decrease in participation from T2 to T5, the value of  $+1$  suggesting an increase in participation, and the value of  $0$  indicating no change in participation).

family structure and change. In each wave of the ECLS-K, parents provided a list of up to 15 people living in the same household with the child as well as their gender, age, and relation to the child. On the basis of such household roster information, the ECLS-K constructed a family structure composite for each wave, classifying children's families into two-biological-parent, single-mother, single-father, biological mother with stepfather or male guardian, or biological father with stepmother or female guardian. Using these composite variables in each wave, we first identified three types of nondisrupted families: (a) *nondisrupted two-biological-parent families* had two biological parents present in the household through all five waves ( $n = 5,503$ ); (b) *nondisrupted single-parent families* had the same single biological parent through five waves ( $n = 735$ ); and (c) *nondisrupted stepfamilies* had the same biological parent and either the married stepparent or cohabiting opposite-sex partner in the household through the five waves ( $n = 318$ ). In this study, we combined nondisrupted cohabiting and nondisrupted married stepfamilies, because there were only 49 nondisrupted cohabiting stepfamilies in the sample and the performance trajectories in these families were not significantly different from those in nondisrupted married stepfamilies.

For families that encountered family transitions between T1 and T5, we first created a category of *disrupted two-biological-parent families* ( $n = 720$ ), which had both biological parents present at T1, but experienced one or more structural changes in the remaining waves. We did not further separate this group by the number of transitions experienced between T1 and T5 because preliminary analyses showed almost identical performance growth curves in such families with one and with two or more

transitions. Finally, we classified the rest into two groups: (a) *disrupted alternative families with one transition*, which had either single-parent or stepparent structure at T1 and encountered only one transition by T5 ( $n = 497$ ), and (b) *disrupted alternative families with multiple transitions*, which had alternative structures at T1 and experienced two or more transitions by T5 ( $n = 235$ ).

Another important independent variable in our growth-curve analyses was the age of the child (or the measure of time) at each wave. Because children from different schools took their cognitive tests in different months and because children from the same school varied by age, we used the test-date data and calculated each child's age on the dates of exams in each wave as our time variable (the average ages on test dates for the five waves were 5.62, 6.13, 7.14, 9.12, and 11.06 years of age).

*Intervening variables.* Annual household income collected in the kindergarten year (in thousands of dollars) was included to measure family financial resources at T1. To gauge the amount of human capital in the household at T1, we used the higher educational attainment of either parent for various two-parent families and the attainment level of the residential parent for single-parent households (1 = *eighth grade or below*, 8 = *Ph.D. or professional degree*). For parenting resource measures, we included a composite measure of parent-child contacts, gauging how often in a typical week a parent (or parent's spouse or partner) did the following with the child: (a) read a book, (b) tell stories, (c) sing songs, (d) art, (e) chores, (f) play games, (g) talk about nature or work on science project, (h) build something or play with construction toys, or

(i) play sports (0 = never done any of the above; 27 = done each of the above every day,  $\alpha = .70$ ).

We also calculated four measures of changes in family resources across waves. Given that hierarchical linear models (HLM) used in this study could only treat time-varying variables as within-individual predictors, but not as between-individual covariates, we used the general linear model with repeated measures in SAS and regressed  $i$ th child's family income in multiple waves on  $i$ th child's age at  $t$ , and then output the age slope (i.e., the time slope) for each child. For instance, a positive time slope of 2.0 on income for a child meant this child's family showed an income increase of \$2,000 ( $2 \times \$1,000$ ) per year. To further measure changes in parents' contacts with school personnel and other parents, we used three dummy variables obtained at T2 and T5 (these three variables were unavailable at T1) to gauge whether the parent (or a spouse/partner) attended a school or class event, worked as a volunteer at school, or participated in fundraising activities (0 = no; 1 = yes). Three separate change measures were created for these three activities, with a value of +1 suggesting that the parent increased the participation level in a given activity from nonparticipation at T2 to participation at T5, and a value of -1 indicating a decreased level of participation from participation at T2 to nonparticipation at T5. A value of zero suggested no changes over time.

In preliminary analyses, we also created a variable to gauge changes in parent-child contacts over time. Inconsistent with the parental-resource argument, this change measure was negatively related to children's performance growth rate and the negative relationship was highly significant. This finding suggested that when some children's performance levels declined in early waves, their parents might have increased their contacts with children to help them tackle the problems. Because this change variable was more likely to be a measure of parents' ad hoc responses to children's earlier academic difficulties than a measure of parents' proactive investment in their social relationships with their children, we did not include this change measure in the present analysis.

*Control variables.* Child and parent characteristics controlled in the later analyses included children's gender, race and ethnicity, underweight status at birth (0 = 5.5 pounds or higher;

1 = under 5.5 pounds), disability status (0 = no physical disability; 1 = physical disability), native language (0 = English; 1 = foreign language), number of siblings (from 0 to 13), biological mother's age, and biological mother's marital status when the child was born (0 = not married; 1 = married). Also included as school-level controls were school enrollment (under 200, 200 to 399, and 400 or more), percentage of minorities (under 10%, 10% to 49%; and 50% or higher), percentage of students eligible for the free lunch program (coded as a continuous variable), type of school (public, Catholic, other religious, other private), and school location (urban, suburban, rural).

#### *Growth-Curve Models and Missing Value Strategy*

In this study, we chose to use a three-level, random effects growth-curve model over a fixed effects model because the former could estimate the main effects of time-invariant covariates and thus allowed an estimate of growth-curve differences among the three types of nondisrupted families whose family structures remained unchanged across waves (for a detailed introduction to hierarchical growth-curve models, see Bryk & Raudenbush, 1992; Cherlin et al., 1998). Three additional advantages of using a three-level HLM were that (a) the model offered an estimate of performance differences among the six family groups at T1 (i.e., at the prechange stage) as well as at any of the other four time points; (b) it mapped out the performance growth curves in these six types of families during the entire transition period (i.e., before, during, and after the transitions); and (c) it adjusted for the design effects associated with the cluster sample of the ECLS-K in estimating standard errors.

For our purposes, the simplest approach was to model children's test scores across the five waves as a linear function of the children's ages at  $t$  in the Level 1 (within-person) equation of HLM:

$$Y_{ti} = \pi_{0i} + \pi_{1i}(a_{ti} - 5.62) + e_{ti} \quad (1.1)$$

where  $Y_{ti}$  was  $i$ th child's test score at time  $t$ ;  $\pi_{0i}$  was the estimate of  $i$ th child's score at the age of 5.62 (i.e., the average age of all children at T1);  $a_{ti}$  was the age of the  $i$ th child on the dates of exams at  $t$ ;  $\pi_{1i}$  was the linear growth rate of

performance for  $i$ th child per year; and  $e_{ti}$  was the error term. Preliminary analyses, however, showed that the growth curves of the children's math and reading performances were nonlinear, with performances improving faster between T1 and T2 than between T3 and T5. To address this, we conducted separate preliminary analyses using (a) a quadratic growth model, (b) a piecewise model, and (c) a model using a logarithm of the children's ages at  $t$ . We finally chose the method of taking the logarithm of the children's ages at five test times, because this method offered the most accurate estimate of nonlinear performance growth and the best goodness of fit. Thus, the Level 1 equation of our HLM model was modified to

$$Y_{ti} = \pi_{0i} + \pi_{1i}(\log(a_{ti}) - \log(5.62)) + e_{ti} \quad (1.2)$$

Whereas  $Y_{ti}$  and  $\pi_{0i}$  in Equation 1.2 remained the same as in 1.1,  $\pi_{1i}$  denoted the performance growth rate per each logged year. Given that it is difficult to interpret a growth rate on the basis of one logged year, we further modified the Level 1 equation to

$$Y_{ti} = \pi_{0i} + \pi_{1i} \left( \frac{\log(a_{ti}) - \log(5.62)}{\log(11.06/5.62)} \right) + e_{ti} \quad (1.3)$$

In this new equation,  $\pi_{1i}$  offered a direct estimate of  $i$ th child's performance growth between fall of kindergarten and spring of fifth grade (i.e., over a period of  $11.06 - 5.62 = 5.44$  years). For instance, if  $\pi_{1i}$  for  $i$ th child was estimated to be +10, it meant that his or her test score improved between T1 and T5 by 10 points. It is important to note that  $\pi_{1i}$  only estimated performance growth between fall of kindergarten and spring of fifth grade; it did not represent the growth rate in the next 5.44 years beyond fifth grade.

Our main research interests were in the Level 2 equations, in which the unit of analysis was each child, and both the  $i$ th child's performance at T1 ( $\pi_{0i}$ ) and his or her performance growth rate ( $\pi_{1i}$ ) over the 5.44 years were treated as functions of the child's characteristics, specified as

$$\pi_{0i} = \beta_{00} + \sum \beta_{0q} X_{0qi} + r_{0i} \quad (2.1)$$

$$\pi_{1i} = \beta_{10} + \sum \beta_{1q} X_{1qi} + r_{1i} \quad (2.2)$$

where  $X_{qi}$  were family types, controls, and family resources of the  $i$ th child, and  $\beta_{0q}$  and  $\beta_{1q}$  were coefficients modeling  $\pi_{0i}$  and  $\pi_{1i}$ . The  $r_{0i}$  and  $r_{1i}$  were the associated random effects.

In Level 3 equations, the Level 2 intercepts ( $\beta_{00}$  and  $\beta_{10}$ ) were further modeled by school characteristics, specified as

$$\beta_{00j} = \gamma_{000} + \sum \gamma_{00q} Z_{00qj} + \mu_{00j} \quad (3.1)$$

$$\beta_{10j} = \gamma_{000} + \sum \gamma_{00q} Z_{00qj} + \mu_{00j} \quad (3.2)$$

Given that we did not intend to study the relationships between school features and the effects of Level 2 covariates other than family type and transition status on performance (e.g., how the effect of gender on performance varied by school), we fixed those effects in Level 3 equations.

Before conducting the analyses, we used Rubin's multiple imputation techniques (Rubin, 1987) to impute missing values on the intervening and control variables, each for five times. Each subsequent analysis was repeated on the basis of these five imputed data sets, and the summary coefficients were reported.

## RESULTS

### *Differences in Performance Trajectories Among Six Types of Families*

We started our analyses by comparing the performance trajectories among six types of families. The HLM program (Version 6.06) was used to specify the Level 1 equation (1.3) for both math and reading scores. For Equations 2.1 and 2.2, the individual-level covariates included the five dummy measures of nondisrupted stepparent, nondisrupted single-parent, disrupted two-biological-parent, disrupted alternative families with one change, and disrupted alternative families with multiple changes (nondisrupted two-biological-parent families were the reference), plus the eight controls of child and mother characteristics. School-level controls were also included in Equations 3.1 and 3.2. Because findings on math and reading were similar, we only present those on math to save space.

Before discussing the findings on the math growth curves ( $\pi_{1i}$ ), we first present the effects of covariates on the intercept ( $\pi_{0i}$ ), because these effects observed at T1 (i.e., when children averaged 5.62 years of age) set a benchmark for evaluating the effects on performance growth in the

following waves. The effects on  $\pi_{0i}$  are summarized in the left column under Model 1 in Table 2.

Kindergarteners in nondisrupted single-parent households scored lower on their math test at T1 than their peers in nondisrupted two-biological-parent families by 2.76 points ( $p < .001$ ) net of the effects of individual-

and school-level controls (see the left column of Model 1). The effect size was estimated to be approximately  $-0.38$  units. Similarly, compared with their peers in nondisrupted two-biological-parent families, children in both types of disrupted alternative families that would subsequently experience one or multiple

Table 2. HLM Coefficients of Family Structures and Resources on Math Performances at T1 and Math Trajectory Between T1 and T5 (N = 8,004)

	Model 1		Model 2	Model 3
	Intercept at ( $\pi_{0i}$ ) <sup>a, b</sup>	Growth curve between T1 & T5 ( $\pi_{1i}$ ) <sup>a, b</sup>	Growth curve between T1 & T5 ( $\pi_{1i}$ ) <sup>a, b</sup>	Growth curve between T1 & T5 ( $\pi_{1i}$ ) <sup>a, b</sup>
Intercept	24.48***	99.21***	99.34***	99.36***
Nondisrupted two-biological-parent	0.00	0.00	0.00	0.00
Nondisrupted stepparent <sup>c</sup>	-0.77 <sup>AB</sup>	1.58 <sup>A</sup>	1.84 <sup>A</sup>	2.03 <sup>A</sup>
Nondisrupted single-parent <sup>c</sup>	-2.76*** <sup>C</sup>	-2.65* <sup>BC</sup>	-1.12 <sup>A</sup>	-0.97 <sup>A</sup>
Disrupted two-biological-parent <sup>c</sup>	-0.88 <sup>A</sup>	-1.80 <sup>†BC</sup>	-1.11 <sup>A</sup>	-0.99 <sup>A</sup>
Disrupted alternative (one change) <sup>c</sup>	-2.38*** <sup>CB</sup>	-0.94 <sup>AC</sup>	-0.06 <sup>A</sup>	0.04 <sup>A</sup>
Disrupted alternative (multiple changes) <sup>c</sup>	-3.10*** <sup>C</sup>	-5.80*** <sup>D</sup>	-4.48** <sup>B</sup>	-4.30* <sup>B</sup>
Female	0.56 <sup>†</sup>	-4.68***	-4.84***	-4.84***
Asian	2.62**	4.37**	3.68*	3.63*
African American	-2.23**	-6.61***	-6.37***	-6.46***
Hispanic	-2.03**	-0.51	0.54	0.60
American Indian	-3.28	2.89	3.10	3.52
Other racial or ethnic groups	-1.10	2.12	1.90	1.93
Underweight at birth	-1.70**	-3.27*	-3.53*	-3.38*
Physical disability	-4.04***	-2.81**	-2.88**	-2.84**
Native language not English	-3.34***	-0.75	0.88	0.53
Number of siblings	-0.90***	-0.70*	-0.51 <sup>†</sup>	-0.49
Mother married when child born	1.11*	2.64**	1.93*	1.94*
Mother's age	0.15***	0.28***	0.18**	0.19**
Annual household income at T1			0.01**	0.02*
Parental educational attainment at T1			2.15***	2.10***
Parent-child ties at T1			0.06	0.06
Changes in annual household income				0.03
Changes in attending school activities				2.55***
Changes in volunteering at school				-0.36
Changes in fundraising at school				0.30

<sup>a</sup>All HLM coefficients were weighted by the ECLS-K panels weights.

<sup>b</sup>School-level variables were also controlled when estimating all coefficients.

<sup>c</sup>Adjusted group mean differences with the same uppercased letters were not statistically significant from one another. Mean differences indicated by different uppercased A, B, C, and D were statistically significant at  $p < .10$  level.

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

transitions already showed performance deficits of 2.38 and 3.10 points, respectively (with the effect sizes respectively approximating  $-0.32$  and  $-0.42$  units,  $p < .001$ ). By contrast, performance differences between nondisrupted two-biological-parent and nondisrupted stepfamilies and between nondisrupted two-biological-parent and two-biological-parent families that would subsequently encounter changes were statistically nonsignificant.

Among the five alternative families, kindergarteners in nondisrupted stepfamilies and in two-biological-parent families that would subsequently dissolve consistently outperformed their peers in nondisrupted single-parent and disrupted alternative households with multiple transitions at T1 ( $p < \text{at least } .10$ ). Yet, performance differences between nondisrupted stepfamilies and disrupted two-biological-parent families and between nondisrupted single-parent and each of the two disrupted alternative groups were statistically nonsignificant. Finally, the performance level in alternative families that would subsequently encounter one change was significantly lower than that in two-biological-parent families that would later experience changes, but more or less the same as that in the other three alternative groups.

In light of such group differences at T1, we then investigated whether these performance gaps at T1 further widened in the following 5.44 years by assessing group differences in growth curves (Hypotheses 1, 2, and 3). Table 2 summarizes these findings in the second column under Model 1.

Consistent with Hypothesis 1, children in nondisrupted single-parent, disrupted two-biological-parent, and disrupted alternative families with multiple transitions consistently made less progress in math performance between T1 and T5 than their peers in nondisrupted two-biological-parent families by 2.65, 1.80, and 5.80 points, respectively. These differences approximated  $-0.22$ ,  $-0.15$ , and  $-0.47$  units in effect size. It is important to note that with such group differences in growth rates over the 5.44 years, the initial performance gap between nondisrupted single-parent and nondisrupted two-biological-parent families at T1 ( $-2.76$  points) was estimated to increase to  $-5.41$  points ( $-2.76 + (-2.65)$  by T5, or a 96% increase). The same performance deficits in disrupted two-biological-parent and disrupted alternative families with multiple transitions at

T1 were estimated to increase to over 200% and 187%, respectively, by T5. Also, although the difference in performance slopes was statistically nonsignificant between disrupted alternative families with one transition and nondisrupted two-biological-parent households, the performance slope in the former was less positive, a pattern that was consistent with Hypothesis 1. Inconsistent with Hypothesis 1, however, children in nondisrupted stepfamilies made at least as much math progress over time as their peers in nondisrupted two-biological-parent families.

Among the five alternative groups, children in nondisrupted stepfamilies consistently made greater progress than their peers in both disrupted two-biological-parent and disrupted alternative families with multiple transitions, a finding that supported Hypothesis 2. Also consistent with Hypothesis 2, the math performance slope was more positive in nondisrupted single-parent families than in disrupted alternative families with multiple transitions. Two other findings on nondisrupted single-parent families were inconsistent with Hypothesis 2: (a) Children in such families made less math progress over time than their peers in nondisrupted stepparent households, although both types of alternative families experienced no structural disruptions during this period, and (b) the math slope in nondisrupted single-parent families was significantly different neither from that in disrupted two-biological-parent families nor from that in disrupted alternative families with one change. Finally, consistent with Hypothesis 3, children in disrupted alternative families with multiple transitions performed less well over time than their peers in alternative families with only one change.

#### *Intervening Effects of Financial and Parenting Resources*

If children in the six types of households differed in their performance trajectories between kindergarten and fifth grade, were these differences attributable to variations in family financial and parenting resources before and during these years? To answer this question, we further included T1 measures of household income, human resources, and parent-child contacts in Model 1. Given our research focus on performance growth curves, we only presented intervening effects on  $\pi_{1i}$ .

As shown in Model 2, annual household income and parental educational attainment at T1 both had significant and positive relationships with the math trajectory, whereas parent-child contact at T1 was unrelated to the math trajectory. More important to this study, these three T1 resource measures reduced the growth-curve difference between nondisrupted two-biological-parent and nondisrupted single-parent families to a statistically nonsignificant level (from  $-2.65$  points in Model 1 to  $-1.12$  in Model 2, or by  $-58\%$ ). In addition, controlling for T1 resources also reduced the growth-curve difference between nondisrupted and disrupted two-biological-parent families to a nonsignificant level (from  $-1.80$  to  $-1.11$ , or  $-38\%$ ) and the growth-curve difference between nondisrupted two-biological-parent and disrupted alternative families with multiple transitions moderately (from  $-5.80$  to  $-4.48$ , or  $-23\%$ ). All these findings were consistent with Hypothesis 4, suggesting that the slower academic progress observed in the alternative and disrupted families was either completely or partially attributable to a shortage of financial, human, and parenting resources in these families at T1.

Among the five types of alternative families, the T1 resource measures also reduced the differences in performance trajectory between nondisrupted stepparent and nondisrupted single-parent families and between nondisrupted stepfamilies and disrupted two-biological-parent families to nonsignificant levels. Disrupted alternative families with multiple transitions, however, continued to show a less positive performance trajectory than each of the other four alternative groups ( $p < \text{at least } .10$ ), although the magnitudes of these trajectory gaps were marginally reduced (from  $-7\%$  to  $-16\%$ ).

Finally, we further included in Model 2 the four measures of resource changes to test Hypothesis 5. As shown in Model 3, an increase in parents' participation in school or class activities was positively related to math progress over time, whereas changes in annual income and parents' participations in volunteering and fundraising were unrelated to the children's math trajectory. More important to this study, the inclusion of the resource changes further reduced the trajectory difference between nondisrupted two-biological-parent and disrupted alternative families with multiple transitions (from  $-4.48$  to  $-4.30$  points, or  $-4\%$ ), a finding that modestly

supported Hypothesis 5. Further, although the growth-curve differences between nondisrupted and disrupted two-biological-parent families and between nondisrupted two-biological-parent and nondisrupted single-parent families were already reduced to nonsignificant levels in Model 2, measures of resource changes further reduced them by  $-11\%$  and  $-13\%$ , respectively, a trend that also supported Hypothesis 5. Finally, inconsistent with Hypothesis 5, disrupted alternative families with multiple disruptions continued to show a less positive math trajectory than each of the other four alternative groups after resource changes were controlled, with trajectory differences barely reduced (reductions were less than  $-4\%$ ).

## DISCUSSION

Most previous studies of family structure have focused on the impact of either alternative family structures or multiple structural transitions on statically measured child outcomes. This study contributed to the existing research in that it combined the measures of structure type and transition status, compared the performance trajectories among various nondisrupted and disrupted families, and elucidated the roles of family resources and resource changes in explaining performance trajectory differences.

Our analyses offered three groups of findings that supported the instability-stress argument: (a) The performance slope was more positive in two of the three nondisrupted families (nondisrupted two-biological-parent and stepfamilies) than in two of the three disrupted families (disrupted two-biological-parent and alternative families with multiple transitions); (b) the performance trajectory was also more positive in nondisrupted single-parent than in disrupted alternative households with multiple transitions; and (c) disrupted alternative families with one change showed a more positive math growth curve than those with multiple transitions. Whereas these findings were highly consistent with some earlier studies that also reported poor educational outcomes in unstable families (e.g., Cavanagh et al., 2006; Fomby & Cherlin, 2007; Heard, 2007; Sun & Li, 2008), the effects presented in this study were on performance growth rates and therefore suggested more profound substantive and conceptual implications. Substantively, although the effect sizes of these growth-rate differences were modest, such rates

could still escalate and accumulate a fair number of disadvantages over time. For instance, with the different growth rates estimated in this study, the academic disadvantage of growing up in disrupted alternative households with multiple transitions relative to the nondisrupted two-biological-parent families more than doubled its size from T1 to T5. Conceptually, these findings were among a very few that support the instability-stress hypothesis by demonstrating that the effects of multiple transitions can not only be sustained, but can escalate over time.

The analyses also identified a few findings that were inconsistent with the instability-stress argument. In fact, these findings demonstrated the limitation of focusing only on family transition status and highlighted the need for coupling family instability (or stability) with family structure types. For instance, whereas structural stability in nondisrupted single-parent families indeed offered academic benefits to children over time when compared with unstable alternative families with multiple disruptions, stability in the same nondisrupted single-parent group did not generate much benefit when compared with nondisrupted stepparent, disrupted two-biological-parent, and disrupted alternative families with one change. Despite their inconsistency with the instability-stress argument, these findings were actually consistent with several previous studies that also reported educational disadvantages in nondisrupted single-parent families (e.g., Carlson & Corcoran; 2001; Fomby & Cherlin, 2007; Magnuson & Berger, 2009). One possible explanation is that the shortage of financial and social resources in such families is likely to stretch over a long section of childhood and may outweigh any benefit of living in a nondisrupted family (Demo & Fine, 2010). Another explanation lies in potential dating transitions of residential parents that are unmeasured in this study. Although single parents may not have partners residing in their households, many keep and change romantic relationships with partners (Osborne & McLanahan, 2007). A recent study (Beck et al., 2010) found that a high frequency of dating transitions has a negative effect on maternal parenting, which in turn is likely to be negatively associated with child outcomes. Thus, the educational disadvantages in a seemingly nondisrupted single-parent household may be partially attributable to instability in the residential parent's dating relationships. Although

this study does not have information on parents' dating behaviors to test this explanation, the idea that some covert instability in parents' romantic relationships with nonresidential partners may outweigh overt stability in family structure is certainly worth pursuing with future research.

Other than nondisrupted single-parent families, the two types of disrupted alternative families also deserve more discussion. Consistent with some previous cross-sectional analyses of alternative family structures, children in both groups showed a moderate but statistically significant performance deficit in the kindergarten year when compared with nondisrupted two-biological-parent families. Nevertheless, compared with nondisrupted two-biological-parent and stepfamilies, the two types of disrupted alternative families showed different rates in academic progress. On one hand, although children in alternative families with one transition continued to make less progress over the next 5.44 years than their peers in nondisrupted two-biological-parent and stepfamilies, the magnitudes of the growth-curve differences were marginal and statistically nonsignificant, probably because much of the educational disadvantage of growing up in such alternative families was already evident by T1, and the one family transition after T1 did not necessarily generate enough additional stress on children to further degrade their performance levels. By contrast, disrupted alternative families with multiple transitions might have already experienced one or more transitions before T1, plus two or more transitions between T1 and T5. Such continuous instability was likely to substantially reduce the children's sense of security and increase their stress levels, resulting in a slower academic growth rate in this than in each of the other five family groups.

The most striking finding from the current study was related to children from continuous stepparent families. Net of other individual- and school-level controls, children in such families consistently made more academic progress than their peers in three of the four other alternative groups. In fact, they even showed as much progress in math over time as their peers in nondisrupted two-biological-parent families. Notably, these findings are not directly comparable with most previous studies of stepfamilies because our findings were based on nondisrupted stepfamilies, and the outcome measures were children's performance slopes.

Nevertheless, the findings are consistent with one study (Magnuson & Berger, 2009), which reported an even more positive math slope in nondisrupted stepfamilies than in nondisrupted two-biological-parent households. The exact reasons for relatively fast academic progress in such families are unknown. One possible explanation lies in their earlier academic deficits associated with the initial family transitions (i.e., the initial parental divorce, the establishment of new unions). It is possible that as the family structure stabilizes and interpersonal conflicts are reduced, the level of stress associated with earlier family transitions also decreases over time for both residential parents and children, which helps children achieve faster academic progress as they recover from their earlier academic losses. Obviously, future studies with more complete information on family structure and children's cognitive development histories may further test this explanation.

Consistent with the resource deprivation perspective, our analyses also suggested that the slower academic progress in both nondisrupted single-parent and disrupted two-biological-parent families relative to both nondisrupted two-biological-parent and nondisrupted stepfamilies were entirely attributable to a shortage of family resources in the two former groups at T1. Separate analyses (not shown) also demonstrated that levels of family income and parental educational attainment were indeed lower in the two former groups than in the two latter ones. Given that children's academic progress is cumulative, with performance level in previous years highly related to that in later years, it is not surprising to find that variations in T1 resources explained not only performance differences at T1, but those in later years (i.e., in growth rates). Overall, these findings were consistent with several earlier studies, which also found that low levels of family resources in alternative and predivorced families partially or completely accounted for educational disadvantages in such households (e.g., Astone & McLanahan, 1991; Downey, 1995; Sun, 2001, 2003).

For disrupted alternative families with multiple transitions, the T1 resource measures also moderately reduced the growth-rate deficits relative to each of the other five family groups, but these deficits remained statistically significant. Although the inclusion of resource change measures further reduced these deficits in such families, the extents of the reduction were small (less

than 4%). These findings were consistent with several previous studies (e.g., Wu, 1996; Sun & Li, 2008), which also reported that changes in family income and other resources over the transition period mediated either none or only a small portion of the negative effect of family instability. Overall, these findings seemed to suggest that factors other than resource declines or fluctuations are responsible for the poor academic progress associated with frequent family transitions. One important factor suggested by the instability-stress hypothesis, but not included in this study, is a potential increase in children's stress and anxiety levels as children encounter continuous family instability over a long period. Given the limitation of the current data set, we did not specifically test this argument. Future studies with children's stress and anxiety levels measured before and during family transitions should further test whether changes in stress levels may mediate the negative effect of multiple family transitions.

Several limitations of this study should be noted. Given the small sizes of some alternative family groups in this data set, the current study did not further test the potential interaction effects between family type and race on performance trajectories, although there are sound conceptual reasons and accumulating evidence for expecting such effects (Fomby & Cherlin, 2007; Wu & Thompson, 2001). Also, because of the relatively small sizes in disrupted groups, we did not further divide each group into subgroups by the time period during which transitions occurred (e.g., between T1 and T2). Thus, the current measure of family type and transition status does not allow a specific assessment of the time effects of a transition (e.g., the performance differences exactly 1.5 years after a transition). This limitation is particularly relevant if a researcher wants to assess a potential delayed effect of a family disruption. Thus, future studies that investigate the timing of such delayed effects may use time-varying measures of family transitions and pooled-time series models to achieve that goal. Finally, as mentioned earlier, further studies should go beyond family structure measures and use measures of residential parents' romantic relationships to examine the consequences of growing up in nondisrupted single-parent families.

In summary, decades of changes in the American family system have significantly

increased the chances of American children living in alternative family structures and encountering multiple family transitions. Our findings indicate that both family structure type and family transition status matter to children's educational progress over time. The negative effects of growing up in most alternative and disrupted families, however, are largely attributable to the shortage of family resources in such families. Finally, our study underlines the importance of incorporating dynamic measures of family structure and child outcomes when investigating the consequences of living in contemporary American families.

#### NOTE

An earlier version of this paper was presented at the 2009 annual meeting of the American Sociological Association in San Francisco, CA. The authors wish to thank Dr. David Johnson for his advice on statistical analyses. Special thanks to Dr. Delwin Lindsey for proofreading.

Disclaimer: The views expressed are those of the authors and should not be construed to represent the positions of the Department of the Army or Department of Defense. The second author does not have any associations, financial or otherwise, that may present a conflict of interest with the Department of the Army or Department of Defense.

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