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Ready or Not: Predicting High and Low Levels of School Readiness among Teenage Parents' Children

Stefanie Mollborn
Jeff A. Dennis

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Stefanie Mollborn

University of Colorado at Boulder

Jeff A. Dennis

University of Texas of the Permian Basin

RUNNING HEAD: School Readiness among Teenage Parents' Children

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Abstract

Past research has documented compromised development for teenage mothers' children compared to others, but less is known about predictors of school readiness *among* these children or about teenage fathers' children. Using parent interviews and direct assessments from the Early Childhood Longitudinal Study-Birth Cohort, we identify factors associated with unusually high and low math, reading, and behavior scores, and unusually good or bad health, shortly before kindergarten. The sizeable sample of children born to a teenage mother and/or father facilitates the inclusion of factors from five structural and interpersonal domains based on the School Transition Model. Multinomial logistic regression models predict the likelihood of scoring in the highest, and lowest, quintile compared to the middle quintile for math, reading, and behavior. Excellent, and poor/fair/good, health are compared to very good health. Many children of teenage parents score highly in one or more domains. The models strongly predict which children have unusually high or low math and reading scores, and to a lesser degree behavior and health. Both relational and structural factors are important for predicting variation in preschool outcomes among teenage parents' children. Important predictors differ depending on the domain being considered. Most significant factors matter either for predicting unusually high or low scores, but not both. Policies that improve families' socioeconomic status and financial stability, as well as those that encourage low-conflict, positive relationships and coresidence with fathers and grandparents, seem promising. Encouraging relationship stability at any cost is not likely to benefit these children.

**Ready or Not:
Predicting High and Low Levels of School Readiness among Teenage Parents' Children**

Teenage childbearing is common in the United States today, with 18% of all girls expected to give birth before age 20 (Perper & Manlove, 2009). After a long decline, the teenage birth rate has stalled (Hamilton, Martin, & Ventura, 2010). Decades of research has addressed this issue, including both its causes and its consequences for young parents and their children. Much of the research on the consequences of teenage parenthood for children has compared the children of teenage mothers to other children (e.g., Geronimus, Korenman, & Hillemeier, 1994; Levine, Pollack, & Comfort, 2001; Mollborn & Dennis, 2009; Moore & Snyder, 1991; Turley, 2003), while a smaller body of work has focused on understanding differences in outcomes *among* children of teenage parents (Dubow & Luster, 1990; Furstenberg, Brooks-Gunn, & Morgan, 1987a; Hubbs-Tait, Osofsky, Hann, & Culp, 1994; Luster, Bates, Fitzgerald, Vandenbelt, & Key, 2000; Luster, Lekskul, & Oh, 2004b). Asking why some preschool-aged children of teenage parents end up well prepared to start school and others do not is an important question with clear policy implications. This study uses data from the Early Childhood Longitudinal Study-Birth Cohort to identify children who are likely to be at risk at the start of the transition to school, as well as those who are likely to be quite successful. By understanding social structural and interpersonal factors associated with belonging in one of these groups, policymakers can better understand which children to target for interventions and which factors have potential for protecting them.

This study focuses on three domains of child development that have been shown to be important for children's successful transitions to school and long-term outcomes (Entwisle, Alexander, & Olson, 2004; Halonen, Aunola, Ahonen, & Nurmi, 2006; Weller, Schnittjer, & Tuten, 1992): academic preparedness, behavior, and health. They are all critical components of success in the transition to school, which determines a large part of children's academic outcomes throughout

compulsory schooling (Baydar, Brooks-Gunn, & Furstenberg, 1993). Health and education in childhood work hand in hand to influence socioeconomic attainment and health in adulthood (Haas, 2007; Hayward & Gorman, 2004; Palloni, 2006; Ross & Wu, 1996). Crosnoe (2006) has identified children's health as a key component of the transition to school.

From past research, we know that on average, children of teenage mothers approach the start of school at a disadvantage on each of these three dimensions (Geronimus et al., 1994; Levine et al., 2001; Mollborn & Dennis, 2009; Moore & Snyder, 1991; Turley, 2003). Some research on the causes of this disadvantage pinpoints preexisting factors, while other work identifies factors directly related to early childbearing. Much less is known about children of teenage fathers, though several of their preschool outcomes are also compromised (Mollborn & Dennis, 2009). But what factors are associated with children doing unusually well or unusually poorly? This question requires a different kind of approach than a typical mean-based regression analysis. Using a relatively large subsample of children of teenage mothers and fathers on the cusp of the school transition (4½ years old), we compare high-scoring and low-scoring children to those near the median on each dimension of development. Previous studies each examine part of the puzzle in understanding variation in the preschool outcomes of teenage mothers' children, but none include children of teenage fathers, and all use older or local data sources. We located one study that has compared unusually high- and low-scoring preschool-aged children of teenage mothers (Luster et al., 2000). Although it explored a variety of potential predictors in a nuanced, multi-method analysis, Luster and colleagues' study was based on a small (N=44) local sample, did not differentiate processes related to scoring particularly low versus particularly high, and did not examine child outcomes beyond vocabulary scores.

THEORETICAL FRAMEWORK

In general, the preschool period is critical for children's futures (Chase-Lansdale, Gordon, Brooks-Gunn, & Klebanov, 1997; Mulligan & Flanagan, 2006). Cognitive, verbal, and behavioral

outcomes from early childhood predict success when children start school (Baydar et al., 1993). In turn, children who start off doing well in elementary school tend to do better on later assessments of achievement, are more likely to complete high school, and attain higher levels of education than those who struggle at first (for a review, see Entwisle et al., 2004). Early language development has important influences on later reading, spelling, and language, and its influence remains stable throughout the first years of elementary school (Walker, Greenwood, Hart, & Carta, 1994) and for years afterwards (Baydar et al., 1993). For all of these reasons, children's readiness for the transition to school is critical, laying the groundwork for long-term socioeconomic and health inequalities (see Entwisle et al., 2004 for a review).

A variety of studies have shown that the children of teenage parents are at risk for compromised development and health (Geronimus et al., 1994; Levine et al., 2001; Moore & Snyder, 1991; Turley, 2003). Teenagers are still developing psychologically and may not have the maturity that older parents have, so there may be disparities between teenagers' and adults' parenting styles and skills, home environments, and emotional resources that have developmental implications for their children (Furstenberg, Brooks-Gunn, & Chase-Lansdale, 1989). Adolescents are more likely than adults to engage in risky behaviors such as smoking, binge drinking, and delinquency that may endanger their children as well as themselves (Jessor, Donovan, & Costa, 1991). Teenage parents are also tackling the difficult task of parenting at the same time that they are working to build human capital by completing schooling or starting a career, which may put them at risk of being less successful in both these domains. They are in a life phase when many adolescents enter into and terminate relationships with various partners as they gain experience with intimacy, potentially resulting in higher levels of partner instability that can negatively affect their children (Fomby & Cherlin, 2007; Osborne & McLanahan, 2007). These explanations deal with *average* differences between teenagers and older parents, but it is easy to imagine that teenage parents differ in the

degree to which these factors are present and negatively impact their children. Indeed, Vandenberg, Luster, and Bates (2001) found that differences among low-income teenage mothers in home environments and parenting at age 4 predicted children's achievement in first grade.

The *School Transition Model* (Alexander, Entwisle, Blyth, & McAdoo, 1988; further articulated by Crosnoe, 2006) provides a useful theoretical framework for organizing a variety of influences on children's school preparedness. In this model, children's *social structural circumstances*, such as socioeconomic resources, influence three sets of more proximate factors: *social psychological factors* (interpersonal relationships), *experiential factors* (experiences outside of family relationships), and *personal factors* (children's attributes such as personality). All of these factors influence children's cognitive achievement in the transition to school. We extend the model to encompass health and behavior. Crosnoe (2006) found that social structural factors influenced children's health, which in turn affected cognitive achievement. The same is true for behavior: Behavior problems indicate compromised social and/or emotional development, and such problems in early childhood are highly correlated with behavior problems and academic problems at school age (Halonen et al., 2006). While the School Transition Model predicts children's outcomes at the start of school, our study assesses them shortly before, at age 4½. Luster, Lekskul, and Oh (2004b) found that children's language scores at this age predicted achievement test scores and teachers' assessments of children's academic motivation in first grade.

One of the benefits of the School Transition Model is that it considers both *structural* and *relational* factors to be important for understanding children's chances of success. Although many studies focus on one of these dimensions at the expense of the other, there is empirical support for taking a broader perspective. For example, Jaffee and colleagues (2001) found in a sample of New Zealanders that family circumstances and maternal characteristics mattered about equally for predicting the long-term outcomes of children of teenage mothers. Oxford and Spieker (2006)

found in a local convenience sample that maternal characteristics interacted with the home environment to influence children's preschool language scores.

HYPOTHESES

Our hypotheses group potential influences on the reading and math scores, behavior, and health of teenage parents' children into categories, linking them with various facets of the School Transition Model. Social structural hypotheses are followed by more proximate influences that the model expects to be shaped by social structure. We cite past research justifying the inclusion of each set of factors.

Hypothesis 1 (current socioeconomic resources): Children of teenage parents whose households have more socioeconomic resources will be more likely to have positive health and developmental outcomes and less likely to have negative outcomes. These are considered social structural factors in the School Transition Model. Cooley and Unger (1991) used the National Longitudinal Survey of Youth, an older survey of children born around 1980 and their mothers, to estimate the effects of "family factors," including several resource measures, on the academic and behavioral outcomes of teenage mothers' children at ages 6 to 7. They found that these resources had important positive associations with development. In particular, family income is related to children's cognitive outcomes and behavior problems at age 3 to 5 (see Yeung, Linver, & Brooks-Gunn, 2002 for a review). Income has been linked to children's intellectual development through cognitive stimulation in the home, parenting styles, the home's physical environment, and children's health status at birth (Guo & Harris, 2000). Maternal education is another socioeconomic resource that influences the development of teenage mothers' children (Cooley & Unger, 1991; Dubow & Luster, 1990; Luster et al., 2000; Luster, Bates, Vandenbelt, & Nievar, 2004a). Extreme deprivation also matters for children's development. For example, experiencing hunger has been linked to compromised behavioral and cognitive development in children (Kleinman *et al.*, 1998).

Hypothesis 2 (maternal characteristics): Children of teenage parents whose mothers are working, enrolled in school, have reached age 18, and have better mental health will be more likely to have positive outcomes and less likely to have negative outcomes. In the School Transition Model, the first three of these factors fall into the social structural category but have direct implications for children's interactions with their mothers, who are almost always the primary parent. Mothers' mental health is considered a social psychological factor. Luster and colleagues (2000) found that children whose teenage mothers worked for pay were more likely to score very high than very low on vocabulary tests at age 4½. Past research has also shown that younger teenage mothers and their children sometimes experience worse outcomes than older teenage mothers (Hoffman, Foster, & Furstenberg, 1993; Levine et al., 2001). Teenage mothers' depression is another important predictor of young children's behavior (Black et al., 2002a; Hubbs-Tait et al., 1994) and cognitive outcomes (Rosman & Yoshikawa, 2001).

Hypothesis 3 (parenting): Children experiencing higher-quality parenting and home environments will be more likely to have positive outcomes and less likely to have negative outcomes. These are considered social psychological factors in the School Transition Model. The quality of teenage mothers' parenting has been linked to the language development of their children at ages 2½ (Luster & Vandenberg, 1999) and 4½ (Luster et al., 2000). The same two studies found home environment factors to be important predictors, as did Oxford and Spieker (2006). A factor related to parenting, the attachment bond between parent and child, has been associated with preschool behavior ratings by Hubbs-Tait (1994).

Hypothesis 4 (parental relationships): Children of teenage parents whose mothers' intimate relationships are more stable and happier will be more likely to have positive outcomes and less likely to have negative outcomes. The School Transition Model considers these to be social psychological factors. Both positive and negative aspects of parent figures' interactions have been found to be consequential for children's development. Black and colleagues (2002a) found that when teenage mothers assessed their partner

interactions more negatively, their children were more likely to experience externalizing behavior problems at ages 4 to 5. Teenage mothers' reports of relationship strain with their child's father have been associated with higher levels of their depression and anxiety (Gee & Rhodes, 2003), which are linked to children's outcomes above. Beyond the dynamics within the parent figures' relationships, their stability also matters for children. The repeated entry and exit of a parent's romantic partners from a child's household has deleterious consequences for children's development, including their school readiness (Fomby & Cherlin, 2007; Osborne & McLanahan, 2007). Research on the effects of union stability has rarely addressed the children of teen parents in particular, but Cooley and Unger (1991) found that relationship stability was positively associated with the development of teenage mothers' children at 6 to 7 years old.

Hypothesis 5 (care provided by other adults): Children living with more adults and fewer other children and those in child care are expected to interact more with adult caregivers and will therefore be more likely to have positive outcomes and less likely to have negative outcomes. These are considered social psychological factors in the School Transition Model, except for nonparental child care, which is an experiential factor because it often occurs outside the family. Brooks-Gunn and Furstenberg (1986) reported that much of the relationship between teenage motherhood and child outcomes was mediated by their higher likelihood of living in single-parent households, which lack the resources that extra adults in the household can provide. Although evidence is mixed, support from the child's father has generally been found to be beneficial for teenage mothers (Gee & Rhodes, 2003; see Royce & Balk, 1996 for a review) and their children (Black et al., 2002a; Cooley & Unger, 1991; Coren, Barlow, & Stewart-Brown, 2003; Luster et al., 2000). Living with parents potentially provides housing, child care, and financial resources, and it improves teenage parents' educational outcomes (Furstenberg & Crawford, 1978; Trent & Harlan, 1994). Although some evidence is mixed (Black et al., 2002b), living in a three-generation household with the child's maternal grandmother is generally thought to be

beneficial for teenage mothers' children's development, at least early in the child's life (Black *et al.*, 2002b; Pope *et al.*, 1993). Even if a grandmother does not live with the child, her involvement in child care in the child's first couple of years is positive for development at age 6 to 7 (Cooley & Unger, 1991). While additional adults may be beneficial for children, the presence of other children can be problematic (Luster *et al.*, 2000). More children means a greater need for resources of time, money, and energy, and multiple teenage births have linked to greater levels of subsequent disadvantage (Furstenberg, Brooks-Gunn, & Morgan, 1987b).

METHOD

Data

The Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) selected a nationally representative sample of about 14,000 children born in 2001 and followed families from infancy through the start of kindergarten (U.S. Department of Education, 2007). It is the first U.S. nationally representative survey to track children throughout this period of early life using parent interviews and reputable direct assessments. The ECLS-B also includes unusually large numbers of children with teenage mothers and fathers. The sample was drawn from births registered in the National Center for Health Statistics vital statistics system based on a clustered, list frame sampling design. Children were sampled from 96 core primary sampling units, which were counties and county groups. Births to mothers younger than 15 were excluded for reasons of confidentiality and sensitivity, so our findings are not representative of children with very young teenage mothers.

This study uses data from the first three waves of the survey, conducted when the children were about 9, 24, and 52 months old. The primary parent, who almost always was the biological mother, was interviewed in person. The weighted response rates for the parent interview were 74%, 93%, and 91% for Waves 1, 2, and 3. Stata software accounted for complex survey design using replication weights that made findings representative of U.S. children born in 2001. The primary

analysis sample for this study was restricted to children who had at least one parent under age 20 at their birth, whose biological mothers participated in the interview at all three waves, and who completed child assessments at all three waves, resulting in about 950 eligible cases.¹ After listwise deletion of missing data, our main analysis samples for the various child outcomes ranged from approximately 750 (for math and reading) to 800 (for behavior and health).² Additional analyses for specific hypotheses were restricted to: (1) cases that included direct parent assessments at Wave 2, resulting in a sample of about 600 children for analyses of math scores, (2) children whose mothers answered the mental health questions in the separate self-administered questionnaire (N≈700), and (3) children whose mothers answered the questionnaire and were married or cohabiting at Wave 2 (N≈450).

Measures

Child preschool outcomes. We examined four measures of health and development at Wave 3 (about age 4½), drawn from in-person child assessments and parent interviews (see Snow *et al.*, 2007 for more information). Table 1 presents descriptive information for all variables. Two measures reflect direct assessments. Children's *reading scores* were calculated based on a 35-item test covering areas appropriate for pre-kindergarten learning such as phonological awareness, letter sound knowledge, letter recognition, print conventions, and word recognition. *Math scores* were calculated using a two-stage assessment routed after the first stage depending on the child's score, involving number sense, counting, operations, geometry, pattern understanding, and measurement.

¹ Because of ECLS-B confidentiality requirements, all Ns are rounded to the nearest 50. We compared Wave 1 maternal education, poverty, and maternal age at birth for eligible cases to the 350 children of teenage parents who did not meet the eligibility requirements. The non-eligible cases exhibited 0.25 years lower Wave 1 maternal education ($p < .05$) but did not differ from eligible cases for maternal or paternal age or household poverty.

² A substantial proportion of deleted cases were due to a lack of math and reading scores. Eligible children without math scores were compared to those with math scores on Wave 1 maternal characteristics, and the comparison indicates that children without math scores had mothers with less education at Wave 1 ($p < .01$) but had similar maternal ages and household poverty levels. Finally, we compared eligible children with math scores, but who were listwise deleted for other non-response, to the analysis sample. The listwise deleted children had mothers with significantly higher education at Wave 1 than those in the analysis sample ($p < .001$) and had a lower prevalence of being below the poverty line at Wave 1 ($p < .01$), but did not differ by maternal age.

Parent reports were the source of the two other measures. Children's *behavior* is represented by a standardized continuous variable, averaged from 24 items in which the parent was asked how frequently the child exhibited specific behaviors, using a 5-point scale ranging from "never" to "very often" (Cronbach alpha=0.86). For example, parents were asked how often the child shares belongings or volunteers to help other children, how often the child is physically aggressive or acts impulsively, and how well the child pays attention. *Child health status* was recoded into three categories from the parent's 5-category report, comparing very good to excellent and to good/fair/poor. Small proportions of parents reporting child health in the three lower categories necessitated combining them.

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Current socioeconomic resources. All independent variables in this study were measured at Wave 1 (9 months old) except where indicated. Our indicator of a household income below the *poverty* line was calculated as an income-to-needs ratio using 2001 federal poverty guidelines, which account for household size and income. In 14% of cases, household income was imputed by ECLS-B using hot deck imputation. *Maternal education* was based on an ECLS-B constructed variable, with highest degrees recoded into approximate years and logical adjustments made to correct inconsistencies across waves. Household *food security* was constructed by ECLS-B, comparing food secure to food insecure households. A final variable indicated whether someone in the household had a *checking or savings account*.

Care provided by adults. Several variables measured the presence of potential caregivers in the household, as well as other children who might reduce the amount of attention received from adults. The *biological father's* coresidence at Wave 1 was included as a dichotomous variable. Dichotomous variables indicated whether any *grandparent* or any *other adult*, excluding parents or their partners, lived in the household. Another variable counted the number of coresident *children* under

age 18 besides the study child. Finally, a dichotomous variable measured whether the study child received any nonparental *child care* at Wave 1.

Maternal characteristics. Four variables measured characteristics of the child's mother. An indicator of *very young maternal age* was scored as 1 if the mother was under 18 at birth and 0 otherwise. Mothers' *paid work* and *school enrollment* at Wave 1 were captured by dichotomous variables for none versus any. Finally, mothers' *depressive symptoms* were measured using a 12-item subset of questions from the Center for Epidemiologic Studies-Distress Scale (CES-D; Radloff, 1977). Mothers reported the frequency of experiencing specific symptoms in the last week, ranging from never or rarely to most or all of the time. To retain cases with missing data on a few items, we calculated the mean of available items, ranging from 0 to 3 (Cronbach alpha=0.87).

Parenting measures. Four measures captured aspects of the parent-child relationship and the mother's parenting at Wave 2 (age 2). Counts of positive versus negative or dangerous factors in children's *home environments* included 21 items ranging from the presence of books in the household, to a consistent bedtime routine, to playing together. *Interviewer-observed parenting behaviors* during the assessment counted mothers' display of behaviors such as smacking, kissing/hugging, ensuring a safe play environment, responding verbally to the child, and interfering with the child's actions. Eight items were coded as 0 for "negative" and 1 for "positive" parenting behaviors and averaged. The *Two Bags Task*, a modification of the Three Bags Task used in prior research (Love *et al.*, 2002), is a videotaped problem-solving task in which parent and child played for 10 minutes with a set of dishes and a picture book. For the parent score, coders rated mothers' sensitivity, positive regard, and stimulation of cognitive development of their child (Nord, Edwards, Andreassen, Green, & Wallner-Allen, 2006). The *Toddler Attachment Sort – 45*, which modified the Attachment Q-Sort (Nord *et al.*, 2006), assessed the child's attachment to the mother. Interviewers scored the child on

behaviors such as “seeks and enjoys being hugged” and “shows no fear, into everything.” The child’s attachment relationship was coded as secure or not.

Mother’s marriage/cohabiting relationship. For all children in the sample, the number of *partner transitions* experienced by the mother between Waves 1 and 3 was calculated. Based on partners/spouses listed in the household roster at the time of each wave, this variable ranged from 0 to 3. The other measures were limited to children whose mothers completed the Wave 2 self-administered questionnaire and who were married or cohabiting at Wave 2. An *argument index* was created as the average of mothers’ reports that they and their coresident partner/spouse often, sometimes, hardly ever, or never argued about 10 topics such as children, sex, and chores. A measure of *positive relationship interaction* was calculated from mothers’ reports about how frequently (ranging from less than once a month to almost every day) they and their coresident partner/spouse talked about their days or their interests, laughed together, and calmly discussed things, worked together on a project. Mothers’ *relationship satisfaction* with their spouse or coresident partner was coded as 1 for “very happy” and 0 for “fairly happy” or “not too happy.”

Control variables. Demographic controls in this study’s multivariate analyses included the child’s centered age in months at the Wave 3 assessment (which is necessary for correctly analyzing the age-sensitive raw scores for math and reading, so it was included in all analyses that use these raw scores), gender, and race/ethnicity (constructed by ECLS-B), the mother’s marital status at birth (obtained from the birth certificate and coded as married versus other), and the father’s age at birth (<20 years versus older). The ECLS-B survey also included maternal background factors that have been found to influence both selection into teenage childbearing and its consequences (Oxford & Spieker, 2006; SmithBattle, 2007): whether the mother’s household received welfare assistance between ages 5 and 16, whether she lived with both parents until age 16, and her mother’s education (less than a high school diploma versus higher).

Analysis Plan

Rather than focusing on means as typical regression analyses do, this study predicted particularly high or low scores on various measures of development and health. To this end, we worked with *quintiles* of the distribution of math, reading, and behavior scores. Health was coded into three categories (excellent, very good, and good/fair/poor) because of very small numbers of parents reporting good, fair, and poor child health and a modal category of excellent. All analyses were weighted to represent children born in the U.S. in 2001. Descriptive analyses display quintiles of math scores for teenage parents' children compared to all children, then compare children of teenage parents who scored in the top versus the bottom quintile on math at Wave 3. Multinomial logistic regression analyses compare children in the bottom quintile of math, reading, and behavior to those in the middle quintile, as well as comparing the top quintile to the middle quintile. Using similar logic, multivariate analyses of health compare good/fair/poor to very good and excellent to very good. These multinomial logit models test our hypotheses. While our longitudinal data allowed us to establish time order because the independent variables are measured years before the child outcomes, the observational nature of the data did not permit us to establish causality.

RESULTS

Descriptive analyses

Figure 1 displays the weighted quintile distribution of preschool (age 4) math scores for children who had valid scores, comparing all children and for teenage parents' children. The figure shows that children in the bottom quintile had a wide range of scores, but the minimum score was similar across the two groups. Teenage parents' quintile cutoffs were lower than those of the full sample. For example, the 20th percentile cutoff among teenage parents' children fell below the 12th percentile for the full sample. These differences accumulated across the distribution, resulting in the 80th percentile cutoff among teenage parents' children falling below the 62nd percentile for the full

sample. In other words, a teenage parent's child would have had to score unusually high in math to even be considered average for the overall ECLS-B sample. Supplementary analyses showed that these cutoffs were similar for children's preschool reading scores (20th percentile=11th percentile in the full sample; 80th percentile=63rd percentile in the full sample), but the two distributions of behavior scores were more similar (20th percentile=18th percentile in the full sample; 80th percentile=75th percentile in the full sample). Importantly, the range of math scores in the top quintile of teenage parents' children was even wider than in the larger sample despite their smaller numbers: Many of these children had quite high math scores. Our goal is to identify factors that are associated with unusually high and low scores.

FIGURE 1 HERE

The ordinal parent-reported measure of child health cannot be directly compared to the other three outcome measures. Table 1 provides useful information about its distribution. Just 46 percent of teenage parents' children reported excellent health, compared to 57 percent of other children ($p < .001$). At the other end of the distribution, 17 percent of these children were in poor, fair, or good health, compared to just 11 percent of others ($p < .001$). The table also compares the health of teenage parents' children whose math scores were in the highest and lowest quintiles. While there were no significant differences between these quintiles in the proportion reporting excellent health, 24 percent of low-scoring children were in poor, fair, or good health compared to just 9 percent of high-scoring children ($p < .05$).

TABLE 1 HERE

Table 1 also reports differences between teenage parents' children and others in the factors hypothesized to be related to unusually positive or negative outcomes. We found differences for every hypothesized measure except one: There were no significant differences in the predicted direction for characteristics of parents' relationships, except for partner transitions. As expected, children of teenage

parents experienced significantly more partner transitions than other children—an average of 0.49 transitions compared to 0.19 for others ($p < .001$).

The right-hand side of Table 1 focuses only on teenage parents' children, comparing those in the top and bottom quintiles of preschool math scores. Over half of the hypothesized relationships were significant in the expected direction. For example, fully 71 percent of children scoring in the lowest quintile lived in households below the poverty line as infants. Only 39 percent of children scoring in the highest quintile were poor ($p < .001$). In another example, just 35 percent of low-scoring children were securely attached to their primary caregiver at age 2, compared to 74 percent of high-scoring children ($p < .001$). Two unexpected findings are worth pointing out. First, the presence of the biological father, grandparents, or other adults was not significantly related to scoring in the highest versus lowest quintile for teenage parents' children. Second, high-scoring children experienced a significantly greater number of transitions in their mothers' coresident partners between infancy and age 4 (0.68 transitions for high-scoring children compared to 0.42 for low-scoring children; $p < .05$).

Multinomial logistic regression models, reported in Table 2, included a variety of sociodemographic control variables, as well as other indicators of social disadvantage in teenage parents' families of origin. For math, reading, and behavior, the models predicted the likelihood that a child would score in the top quintile, or the bottom quintile, compared to the middle quintile of the distribution of teenage parents' children's scores. For health, the models predicted a child's likelihood of reporting good/fair/poor health, or excellent health, compared to very good health. Because of limited sample sizes, we added each hypothesized variable separately to the baseline model including parental ages at birth, marital status, the child's age at assessment, race/ethnicity, and gender, and the teenage parent's background (their mother's education and whether they lived with both parents until age 16 and received welfare between age 5 and 16). Table 2 summarizes all

significant results from this wide variety of models, highlighting findings that were significant in the hypothesized direction.

TABLE 2 HERE

Children's unusually high or low math scores were particularly strongly associated with the variables in our models. Several relationships were significant in the hypothesized direction for reading scores, compared to just a few relationships for behavior and health. More variables significantly predicted children's likelihood of scoring unusually high than unusually low. It is also important to note that perhaps because of limited sample size, the significant relationships were nearly all quite large in magnitude, suggesting that many variables we focused on are quite important for understanding children's outcomes. Eleven hypothesized factors predicted the likelihood that a child would have unusually negative preschool outcomes, all in the hypothesized direction. These significant relationships were split fairly evenly between math and reading, and fewer predicted unusually low-scoring health. Fourteen factors predicted unusually positive outcomes, twelve in the hypothesized direction. Two findings were significant in unexpected directions: the number of partner transitions was positively associated with children's likelihood of high-scoring behavior, and young maternal age was positively related to children's odds of excellent health (see below). Seventeen of the 21 variables that we hypothesized would be related to children's health and development were indeed significant for one or more outcomes.

Each of the four socioeconomic resource variables addressed in *Hypothesis 1* was associated with at least one of the children's outcomes (primarily math scores) as predicted. Children whose household incomes were below the *poverty* line in infancy had a 116% higher likelihood than nonpoor children of scoring in the bottom quintile in math at age 4.³ A one-year increase in *maternal education* in infancy was associated with a 29% decrease in a child's likelihood of scoring in the

³ Percentages and odds reported here and elsewhere come from odds ratios calculated by exponentiating the coefficients reported in Table 2.

bottom quintile in reading. Children from households that experienced *food insecurity* at Wave 1 had a 56% lower chance of scoring in the top quintile in math compared to those from food-secure households. Children whose households had *savings* at Wave 1 were 110% more likely to score in the top quintile for math, 52% less likely to score in the bottom quintile in reading, and 50% less likely to score in the bottom quintile for behavior.

Each of the maternal characteristics addressed in *Hypothesis 2* was related to children's outcomes as expected, except for mothers' school enrollment. *Young maternal age* (15-17 years) was associated with a 67% decrease in the likelihood of scoring in the top quintile for reading and a 64% decrease for math. In an unexpected finding, children of the youngest mothers were 67% *more* likely to report excellent compared to very good health than those with older teenage mothers. Children whose mothers *worked for pay* at Wave 1 were 66% less likely to score in the bottom quintile in math. Mothers who reported a higher level of *depressive symptoms* at Wave 1 were 51% less likely to score in the top quintile for math and were 118% more likely to report that their child was in good, fair, or poor health compared to very good health at age 4.

With the exception of the home environment measure, each of the parenting-related factors from *Hypothesis 3* was significantly associated with children's outcomes as predicted. Moving from the lowest to the highest possible score for *interviewer-observed parenting behaviors* at Wave 1 was associated with 94% lower odds of the child scoring in the bottom quintile in reading. A one-point increase in mothers' *Two Bags Task parenting scores* at age 2 lowered children's likelihood of scoring in the bottom quintile on math at age 4 by 51%. Children who were *securely attached* to their primary caregiver at age 2 were 344% more likely to score in the top quintile in math and 72% less likely to score in the bottom quintile in reading.

The factors related to parents' marriages/cohabiting relationships in *Hypothesis 4* received more limited support. Mothers' happiness with their marriage/cohabiting relationship was not related to

children's outcomes. In a finding that was actually significant in the opposite direction from the hypothesis, each additional *partner transition* experienced by mothers between Waves 1 and 3 was associated with a 79% higher likelihood of a child scoring in the top quintile for behavior. The other two measures supported the hypothesis. More frequent *arguments* with the mother's spouse or cohabiting partner at age 2 were associated with a 57% lower likelihood of children scoring in the top quintile for behavior at age 4 and a 75% greater likelihood of reporting the child as having good, fair, or poor health compared to very good health. More frequent *positive interactions between spouses/partners* at age 2 almost tripled a child's odds of scoring in the top quintile for math at age 4.

Finally, most of the measures included in *Hypothesis 5* were related to one or more of children's preschool outcomes as expected. Children who lived with their *biological fathers* as infants were over 2.5 times as likely to score in the top quintile in math at age 4 as those who did not. Those who lived with at least one *grandparent* were twice as likely to score in the highest quintile in behavior. Each additional child in the household was associated with a 28% lower likelihood of scoring in the top quintile for math. Children of teenage parents who received nonparental *child care* as infants were 56% less likely to score in the bottom quintile for math than those without child care, and 173% more likely to score in the top quintile in reading. The hypothesis was not supported for coresidence with nonparent, nongrandparent adults.

The importance of the factors we have identified for understanding a child's preschool outcomes can be illustrated using predicted probabilities of scoring in the top and bottom quintiles for math. Using the parenting subsample to estimate models that include the baseline variables from Table 2 and the hypothesized variables that are being manipulated for each pair, we compare hypothetical children who have average (for continuous variables) or modal (for categorical variables) values for the sample of teenage parents' children on all variables except those we manipulate (see Figure 2). The first comparison manipulates the factors that were found to predict

scoring in the *bottom* quintile compared to the middle quintile in math. Child A had a household income above the poverty line and a working mother in infancy, as well as a mother with an average Two Bags Task parenting score at age 2. This hypothetical child had just a 2% predicted probability of scoring in the bottom math quintile. Given that 20% of the sample actually fell into this group, this is a very low likelihood. In contrast, Child B, who was poor with a nonworking mother who scored one standard deviation below the mean on the Two Bags Task, had a 33% predicted probability of scoring in the bottom math quintile, which is much higher than expected due to chance. The second comparison manipulates variables (except for depression, which uses a different subsample) that were found to predict scoring in the *top* quintile in math compared to the middle quintile. Child C has a set of advantages that should predict his placement in this high-scoring group: a mother aged 18 or older at birth, a coresident father, no other children in the household at Wave 1, a food-secure household with savings at Wave 1, and secure attachment at Wave 2. This child's predicted probability of scoring in the top quintile for math at Wave 3 was a surprisingly high 61%, compared to 20% predicted by chance. In contrast, Child D (who had a younger mother with no coresident father, food insecurity, no savings, one other child in the household, and was not securely attached) had just a 3% predicted probability of scoring in the top quintile.

FIGURE 2 HERE

Two important conclusions can be drawn from these comparisons. First, the 14-fold to 21-fold difference in children's predicted probabilities of scoring particularly high or low in math based on the significant factors identified in our models suggests that these are important policy levers for improving the outcomes of teenage parents' children. Second, the factors we have identified are particularly useful for predicting whether or not a child will score unusually high. While our models are still clearly useful for understanding why some children score particularly poorly while others do not, other factors also come into play. For example, the domains of child development that we treat

as outcomes are intertwined and most often predict lower scores. Supplemental analyses show that higher interviewer-observed behavior scores at age 2 predict a lower likelihood of scoring in the bottom quintile for math and reading at age 4½.

DISCUSSION

The goal of this study was to identify factors associated with unusually positive or negative health and development just prior to the start of kindergarten among children of teenage parents. Grounded in the School Transition Model, our hypotheses suggested that socioeconomic resources, care provided by adults, maternal characteristics such as age and depressive symptoms, parenting quality, and parental relationship characteristics would all matter for these children's outcomes. We found that despite mean differences that disadvantaged teenage parents' children compared to other children for most of these factors in their first two years of life, many of these children scored quite highly on math, reading, behavior, and health at age 4½. The hypothesized categories of factors identified in this study did a good job predicting which children would score unusually poorly and a better job predicting who would score unusually highly. Each of the five hypothesized domains was important, and two measures (very young maternal age and household savings) were associated with very high or low scores across three of the four outcomes we examined.

Several shortcomings of our study should be addressed in future research. First, confidentiality restrictions precluded an investigation of children with mothers younger than 15, who are an extremely small (Hamilton et al., 2010) but interesting population. Second, it would be useful to understand the processes through which social structural and interpersonal factors are related to the development and health of teenage parents' children. Our ongoing quantitative and qualitative research is working to address this question. Third, including more objective measures of behavior and health in addition to parent reports would be an improvement. Because most health measures in the ECLS-B study were contingent on diagnosis by a medical professional, they conflated health

status with access to health care. Therefore, we relied on parent reports. Finally, our data are longitudinal but cannot firmly establish causality. Randomized interventions are needed to assess the effectiveness of the factors identified here for improving the school readiness of teenage parents' children.

While this study's longitudinal observational data cannot establish causal relationships, we identified many strong associations between children's situations in their first two years of life and their development and health two to four years later. These findings provide important suggestive evidence that policy interventions might be able to keep some children of teenage parents from having problematically low outcomes and spur others to perform quite highly. We identify four key suggestions for policymakers to consider based on this study's findings. First, to keep children from scoring particularly poorly in math, reading, and behavior, high-quality parenting, child care, and financial stability (especially the stability provided by having household savings) were important. Therefore, providing child care that allows young parents to pursue education and work to improve their financial situation, together with supporting high-quality parenting, are promising routes for policy to ensure that children are not underprepared for the start of school. Investments in a basic level of financial security for teenage parents' families (including income levels above poverty, food security, and a modest amount of money in the bank) may pay off in terms of children's cognitive achievements at age 4. Concerns that the mother should be with the child, instead of working or attending school and using child care, were not borne out by this study. Second, the relatively poorer academic (but not behavioral or health) outcomes experienced by children of very young teenage mothers and those with less education have implications for teenage pregnancy prevention programs. Rather than focusing on reducing overall rates of teenage pregnancy, targeting prevention among school-age girls while supporting those who do become pregnant could yield the best results for the children. Third, it appears to be academically beneficial for children to live with their

biological fathers and with grandparents, but at the same time it improves their behavior and health when partner transitions occur. This latter finding is not the typical pattern in the general population (Fomby & Cherlin, 2007; Osborne & McLanahan, 2007), but Fomby and Osborne (n.d.) have found that mothers who start out in unusually low-quality unions and experience multiple transitions tend to end up in higher-quality unions in terms of interpersonal dynamics. If this experience is common among teenage mothers, that may explain our findings. For policymakers, these findings imply that teenage parents' children should not be discouraged from living with fathers or grandparents, but policies that try to enforce lifelong marriage or partner stability may not benefit children. Fourth, family relationships matter a lot for understanding unusually positive or negative development among teenage parents' children. Several aspects of the parent-child relationship were important for understanding particularly positive or negative outcomes, as were aspects of the parent-partner relationship. Reduced spouse/partner relationship conflict and increased positive interaction were important predictors in this study, which may be why mothers' transitions out of at least some partner relationships and into others were beneficial for children. Our findings suggest that successful policies aimed at teenage parents and their children should consider both family processes and structural influences.

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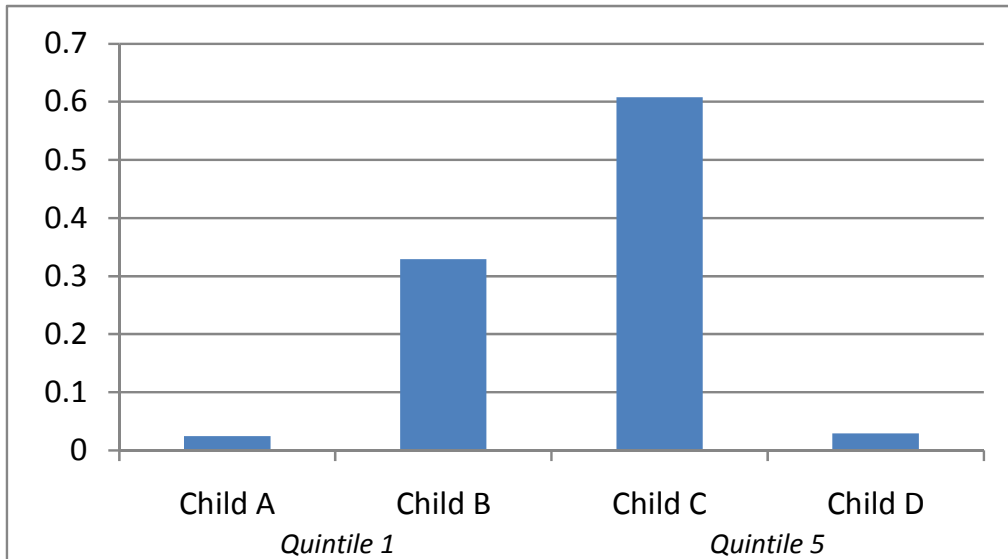
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Figure 1. Minimum, Maximum, and Quintiles for Preschool Math Scores



Notes: Source: Early Childhood Longitudinal Study-Birth Cohort, 2001-2005. Includes all children with Wave 3 math scores (see text). N≈8300 for all children, 950 for teen parents' children.

Figure 2. Predicted Probability of Scoring in a Specified Quintile for Preschool Math, by Key Maternal and Household Characteristics for Teenage Parents' Children



Notes: Source: Early Childhood Longitudinal Study-Birth Cohort, 2001-2005. N≈600.

Predictions use estimates from Table 2's base model with only the manipulated variables added.

Analyses account for sample design effects.

Child A is coded as above the poverty line, mother age ≥ 18 , mother working, Two Bags Task parenting score at mean, and in child care.

Child B is coded as poor, mother age 15-17, mother not working, Two Bags Task parenting score 1 standard deviation below the mean, and no child care.

Child C is coded as mother age ≥ 18 , food secure, savings, coresident father, secure attachment, and no other coresident children.

Child D is coded as mother age 15-17, food insecure, no savings, no coresident father, not securely attached, and one other child in the household.

All other variables are set to weighted means/modes for the subsample of teenage parents' children.

Table 1. Weighted Means and Quintiles for Resources at Wave 1 (9 Months) and Outcomes at Wave 3 (4 Years) for Children of Teenage and Non-Teenage Mothers

Variable	Non-teen parents	Teen parents		Teen Math Q1	Teen Math Q5	
<i>Controls</i>						
Father's age $\geq 20^a$	-	0.63		0.64	0.59	
Biological parents married at birth ^a	0.76	0.24	***	0.22	0.22	
<i>Child race/ethnicity</i>						
Non-Hispanic White	0.59	0.41	***	0.26	0.52	***
Non-Hispanic Black	0.12	0.24	***	0.29	0.16	*
Hispanic	0.21	0.31	***	0.41	0.26	*
Other race	0.07	0.05	*	0.05	0.07	
Child female ^a	0.49	0.49		0.36	0.50	
Mother lived with parents until age 16 ^a	0.62	0.43	***	0.44	0.43	
Grandmother's education < high school ^a	0.32	0.44	***	0.53	0.34	*
Mother ever on welfare age 5-16 ^a	0.10	0.19	***	0.29	0.12	**
<i>Hypothesis 1: SES resources</i>						
Household income under poverty line ^a	0.16	0.47	***	0.71	0.39	***
Mother's education (0-20 years)	13.36	11.00	***	10.62	11.33	**
Food insecure household ^a	0.10	0.15	**	0.13	0.14	
Savings account in household ^a	0.81	0.61	***	0.53	0.69	*
<i>Hypothesis 2: Maternal characteristics</i>						
Maternal age 15-17 ^a	-	0.27		0.36	0.16	**
Mother not working ^a	0.43	0.57	***	0.73	0.48	***
Mother not in school ^a	0.91	0.71	***	0.75	0.74	
Mother's Wave 1 depressive symptoms (0-3)	0.40	0.53	***	0.54	0.46	
<i>Hypothesis 3: Parenting quality</i>						
Wave 2 home environment scale (1-21)	12.39	11.08	***	10.40	11.30	
Wave 2 interviewer-observed parenting behavior (0-1)	0.93	0.90	***	0.86	0.92	**
Two Bags Task parenting score (1-7)	4.50	4.05	***	3.64	4.35	***
Child securely attached to parent ^a	0.64	0.53	***	0.35	0.74	***
<i>Hypothesis 4: Parental relationships</i>						
Wave 1-3 partner transitions (0-3)	0.19	0.49	***	0.42	0.68	*
W2 spouse/partner argument index (0-3)	0.81	0.79		0.93	0.66	*
W2 mother's positive spouse/partner interactions (0-3)	2.25	2.22		2.10	2.33	
Wave 2 mother's relationship less happy ^a	0.26	0.28		0.32	0.28	
<i>Hypothesis 5: Care by other adults</i>						
Biological father in household ^a	0.85	0.51	***	0.52	0.55	
Any grandparents in household ^a	0.11	0.49	***	0.49	0.41	
Any other adults in household ^a	0.09	0.25	***	0.29	0.20	
# people under age 18 in household (0-10)	1.12	0.82	***	1.21	0.57	**
In child care ^a	0.51	0.59	**	0.42	0.69	***
<i>Child outcomes at age 4½</i>						
Preschool math T-score (21-85)	50.89	46.62	***	32.56	59.59	***
Preschool reading T-score (32-87)	50.96	46.44	***	39.29	54.46	***
Parent-reported behavior score (standardized)	0.16	0.13		-0.28	0.47	***
<i>Child's general health, parent-reported</i>						
Poor/fair/good	0.11	0.17	***	0.24	0.09	*
Very good	0.33	0.36		0.33	0.39	
Excellent	0.57	0.46	***	0.44	0.51	
N (rounded) ¹	6400	750		150	150	

Notes: Source: Early Childhood Longitudinal Study-Birth Cohort, 2001-2005.

Analyses account for sample design effects. Q1=lowest quintile. Q5=highest quintile.

* p<.05 ** p<.01 *** p<.001; two-tailed design-based F tests ^a 1=yes

¹ Rounded Ns for parenting measures: teen parents (600), non-teen parents (5100), teen math quintile 1 (100), teen math quintile 5 (150). Rounded N for depression: 700 (teen parents). Rounded N for mother's relationship measures: 450 (teen parents).

Table 2. Coefficients from Multinomial Logistic Regression Models Predicting Children’s Outcomes at Age 4

Variable	Compared to middle quintile (Q3)			
	Math	Reading	Behavior	Health
Base model, teenage father	ns	ns	ns	ns
Base model, married at birth	ns	ns	ns	E (-0.60*)
Base model, child black	ns	Q1 (1.00*)	ns	GFP (0.73*)
Base model child Hispanic	ns	Q1 (1.40**)	ns	ns
Base model, child other race	ns	Q5 (1.04*)	ns	ns
Base model, child female	ns	ns	Q5 (0.76**)	ns
Base model, live with parents until age 16	Q5 (-0.84*)	ns	ns	ns
Base model, grandmother educ <HS	ns	Q5 (-1.45***)	ns	ns
Base model, mother’s welfare history	ns	ns	Q5 (-0.87*)	ns
<i>Hypothesis 1: SES resources</i>				
Under poverty line	Q1 (0.77*)	ns	ns	ns
Mother’s education (years)	ns	Q1 (-0.34**)	ns	ns
Food insecure	Q5 (-0.81*)	ns	ns	ns
Savings	Q5 (0.74*)	Q1 (-0.73*)	Q1 (-0.69*)	ns
<i>Hypothesis 2: Maternal characteristics</i>				
Young maternal age ^a	Q5 (-1.02**)	Q5 (-1.10**)	ns	E (0.51*)
Mother not working	Q1 (1.08**)	ns	ns	ns
Mother not in school	ns	ns	ns	ns
Mother’s W1 depression	Q5 (-0.72*)	ns	ns	GFP (0.78**)
<i>Hypothesis 3: Parenting quality</i>				
W2 Home environment scale	ns	ns	ns	ns
W2 interviewer-observed parenting	ns	Q1 (-2.90*)	ns	ns
Two Bags Task parenting score	Q1 (-0.71**)	ns	ns	ns
Secure child-parent attachment	Q5 (1.49***)	Q1 (-1.29**)	ns	ns
<i>Hypothesis 4: Parental relationships</i>				
W1-3 partner transitions	ns	ns	Q5 (0.58*)	ns
W2 spouse/partner argument index	ns	ns	Q5 (-0.85*)	GFP (0.56*)
W2 positive spouse/partner interactions	Q5 (1.09**)	ns	ns	ns
W2 marriage/cohabitation less happy	ns	ns	ns	ns
<i>Hypothesis 5: Care by other adults</i>				
Bio dad in household	Q5 (0.94*)	ns	ns	ns
Any grandparents	ns	ns	Q5 (0.70*)	ns
Any other adults	ns	ns	ns	ns
# under 18 in HH	Q5 (-0.33*)	ns	ns	ns
In child care	Q1 (-0.82*)	Q5 (1.00**)	ns	ns

Notes: Source: Early Childhood Longitudinal Study-Birth Cohort, 2001-2005. N for base model≈750 for math and reading, N≈800 for behavior and health.

All variables designated “base model” report coefficients from a model including “base model” variables and no others.

All variables not designated “base model” were added one at a time to the base model.

Q1=lowest quintile; Q5=highest quintile; PFG=poor/fair/good; E=excellent

Shaded cells indicate significant findings that supported hypotheses.

Analyses account for sample design effects. * p<.05 ** p<.01 *** p<.001 ns=not significant; two-tailed tests

^a Because it is a key demographic control, maternal age is part of the base model and included in all models summarized here.