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How Resource Dynamics Explain Accumulating Developmental and Health Disparities for Teen Parents' Children

Stefanie Mollborn,
Sociology and Institute of Behavioral Science, 483 UCB, Boulder, CO 80309-0483, USA

Elizabeth Lawrence,
Sociology and Institute of Behavioral Science, 483 UCB, Boulder, CO 80309-0483, USA

Laurie James-Hawkins, and
Sociology and Institute of Behavioral Science, 483 UCB, Boulder, CO 80309-0483, USA

Paula Fomby
Population Studies Center, University of Michigan, Ann Arbor, MI, USA

Stefanie Mollborn: mollborn@colorado.edu

Abstract

This study examines the puzzle of disparities experienced by U.S. teen parents' young children, whose health and development increasingly lag behind those of peers while their parents are simultaneously experiencing socioeconomic improvements. Using the nationally representative Early Childhood Longitudinal Study-Birth Cohort (2001–2007; $N \approx 8{,}600$), we assess four dynamic patterns in socioeconomic resources that might account for these growing developmental and health disparities throughout early childhood and then test them in multilevel growth curve models. Persistently low socioeconomic resources constituted the strongest explanation, given that consistently low income, maternal education, and assets fully or partially account for growth in cognitive, behavioral, and health disparities experienced by teen parents' children from infancy through kindergarten. That is, although teen parents gained socioeconomic resources over time, those resources remained relatively low, and the duration of exposure to limited resources explains observed growing disparities. Results suggest that policy interventions addressing the time dynamics of low socioeconomic resources in a household, in terms of both duration and developmental timing, are promising for reducing disparities experienced by teen parents' children.

Keywords

Socioeconomic resources; Resource dynamics; Early childhood; Teen parenthood; Growth curve analysis

Introduction

Researchers and policymakers have begun to emphasize early childhood as an ideal time for policy interventions to improve people's later life conditions (Duncan et al. 2007b). Scholars have found that every dollar invested in early childhood education returns $8 to $14 (USD) in the long term (Duncan et al. 2007b) because early childhood conditions shape the rest of the life course. This focus on early childhood education is motivated by evidence that developmental disparities by socioeconomic status (SES), race/ethnicity, immigrant status, and other social characteristics emerge prior to the start of school (Entwisle et al. 2004). Burkam and colleagues (2004) identified disparities over a standard deviation between the lowest versus highest socioeconomic quintile in a national sample's kindergarten academic outcomes. Here, we consider developmental and health disparities experienced by children born to teen parents, a status linked to compromised school readiness (Mollborn and Dennis 2012a). School readiness in the school transition, in turn, strongly predicts academic achievement throughout compulsory schooling and shapes adult socioeconomic outcomes (Duncan et al. 2007a; Entwisle et al. 2004). These insights, explored in the burgeoning cumulative advantage/disadvantage literature (Case et al. 2002), have led to a focus on giving children a more level playing field before the school transition starts.

However, these efforts have been hampered by a lack of nationally representative longitudinal data from early childhood. The Early Childhood Longitudinal Study-Birth Cohort (ECLS-B; Snow et al. 2009), which tracked a nationally representative sample of U.S. children from birth in 2001 through kindergarten start, has addressed this gap by combining extensive surveys of multiple caregivers with direct assessments of children and parents. Using these data, our primary aim is to integrate and measure a set of *dynamic and multidimensional socioeconomic processes* to understand how developmental disadvantage accumulates for marginalized groups in early childhood. Using a multilevel growth curve framework that analyzes children's developmental trajectories, we model time-dependent processes, nonlinearities, and overlapping resource domains. The ECLS-B's reputable child assessments permit us to consider developmentally appropriate longitudinal outcomes in the areas of cognition, behavior, and health.

Recent theoretical developments in social stratification and SES facilitate our study (DiPrete and Eirich 2006). Although past research has tended to rely on simple cross-sectional measures of socioeconomic resources, newer work has begun to articulate the dynamic and multidimensional nature of socioeconomic resources. The experience of poverty differs greatly depending on its duration and the other socioeconomic domains in which it is situated (Duncan et al. 1994). For example, a child living in poverty at age 4 may have been poor all her life or may have only recently become poor. Or perhaps she has highly educated parents with low income because they are enrolled in school but with a "safety net" of financial assets. These are examples of resource dynamics that shape the consequences of SES.

Some researchers have worked to articulate and operationalize specific resource dynamics using data from different life stages (Brooks-Gunn and Duncan 1997; Guo 1998). For example, Duncan and colleagues (1994) and the NICHD Early Child Care Research

Network (2005) found that persistent (rather than transient) poverty was an important predictor of school readiness. Guo (1998) identified timing effects of poverty, with childhood and adolescent poverty independently predicting adolescent academic achievement. Examining young adult outcomes, Wagmiller and colleagues (2006) found both the persistence and timing of childhood and adolescent poverty to be consequential. Willson et al. (2007) found that several socioeconomic domains, as well as persistent resource patterns over time, independently predicted later life health.

Although considerable theoretical and empirical ground has been broken in the study of resource dynamics, questions remain. Some resource dynamics have been discussed but not fully articulated or operationalized. Newer analytic approaches for longitudinal data can address these shortcomings. There has also been a disproportionate focus on income and poverty, with much less attention to other aspects of SES, such as education and wealth (for exceptions, see Duncan et al. 2002; Willson et al. 2007). Researchers have documented both dynamic resource processes and the accumulation of disparities in children's development, but the former has not been brought to bear as a possible explanation for the latter.

In integrating and modeling complex resource dynamics, we focus on a specific type of social marginalization linked to accumulating developmental disadvantage: having a teenage parent. With 10% of all births occurring to teen mothers in 2009 (Hamilton et al. 2010) and more than one in every six teenage girls projected to become a mother before age 20 (Perper and Manlove 2009), teen childbearing is a widespread source of social disadvantage in the United States. It is also an inextricable part of socioeconomic marginalization: analyses of the ECLS-B data have found that most babies living in poverty have a teenage mother; similarly, most babies whose mothers did not finish high school have a teen mother (Mollborn and Dennis 2012a). For all of these reasons, teen parenthood is an interesting case for testing whether resource dynamics can explain the accumulation of developmental and health disparities throughout early childhood. It is particularly remarkable because of an important empirical puzzle inherent in the consequences of teen childbearing.

The Puzzle of the Consequences of Teen Parenthood

In the years following a teen birth, the initially fairly severe socioeconomic consequences for young parents begin to moderate (Furstenberg 2007). Teen mothers' education is often disrupted in the short term, but they typically win back some ground over time. Similarly, teen parents' initially compromised income and work status slowly become more similar to those of childless peers. At midlife, teen parents lag behind similar peers in occupational status, educational attainment, and health, but not income or work involvement (Henretta 2007; Taylor 2009). Thus, we know a young parent's socioeconomic situation improves as she moves through adulthood. Meanwhile, what is happening to the teen parent's young child? While the parent is slowly *gaining* socioeconomic ground, the child is rapidly *losing* substantial ground in development and health compared with same-age peers from infancy through the start of school. Children of teen parents experience disadvantages in birth weight and preterm birth (Chen et al. 2007). Disparities in cognitive, behavioral, and health outcomes then increase from infancy to prekindergarten as teen parents' children lose ground compared with same-age peers (Mollborn and Dennis 2012a). Although some

research has found that these disadvantages remain constant during the school years (Turley 2003), others have found that teen parents' children continue to fall farther behind peers from school entry throughout elementary school and adolescence (Brooks-Gunn and Furstenberg 1986).

Why Do Teen Parents' Children Lose Developmental Ground?

Our preliminary analyses in the current study confirm the existence of the empirical puzzle: resource gaps between teen-parent households and others stay the same or decrease slightly across early childhood, while the children's own development and health worsen steadily relative to peers. Thus, we are left with a question: *why do teen parents' children accumulate disadvantages in development and health?* Theories of intergenerational transmission of advantage maintain that children's fates are directly linked with those of parents. In teen-parent families, however, the situation is clearly not so straightforward. We turn to newer, dynamic ideas in the literatures on socioeconomic resources and accumulation of disadvantage, many not yet fully tested empirically, to generate possible answers.

Resources are central for explaining developmental and health disparities experienced by teen parents' children. Using cross-sectional measures of socioeconomic, material, and social resources at age 2, Mollborn and Dennis (2012a) found that resources fully explained why prekindergarten children from similar backgrounds experienced worse developmental outcomes if their mother was 18 or 19 years old at time of birth than if she was 25 to 29. Resources partially explained why children of mothers aged 15 to 17 at time of birth had worse cognitive, behavioral, and health preschool outcomes than those with mothers aged 25 to 29. Mothers' parenting behaviors did not explain nearly as much of the disparities as did resources.

Although this study documents the importance of resources, it does not incorporate key insights about the dynamics of resources that come from literatures on poverty and disadvantage. To varying degrees, researchers have identified several dynamics as important for understanding life course outcomes, including resource thresholds, concurrence, developmental timing, and persistence. Some dynamics involve nonlinear relationships between resources and outcomes, others include multiple resource domains, and yet others incorporate time (developmental timing and duration). In this study, we use multilevel growth curve analysis to incorporate time-varying resource measures across multiple domains, age across early childhood from infancy to school start, and nonlinear resource dynamics.

Our study focuses on the dynamics of socioeconomic resources rather than other types. Three of the four typical SES dimensions—education, wealth, and income—are included (occupational status is not). A large literature (described later) has found family income to be important for understanding child development. Wealth, distinct from income, has received more attention in recent years (Aber et al. 1997; Duncan and Magnuson 2001; Willson et al. 2007) and may be particularly important in early childhood because some families temporarily live on one income and many others have annual child care expenses exceeding the cost of attending a public university (NACCRRA 2012). Wealth can compensate for lower income and may provide cognitively stimulating materials, a better

home environment, or a sense of security. Wealth predicts children's educational outcomes and health beyond income (Conley 2001; Kim and Sherraden 2011; Shanks 2007). Parental education is also distinct: parents of the same income and wealth may allocate resources, cope with stress, or interact with children differently by educational attainment. Thus, it is important to consider multiple types of SES.

We consider four potential explanations for why teen parents' children lose ground in development and health across early childhood compared with same-age peers. See Table 1 for a summary. The first relies on nonlinear relationships between resources and outcomes; the second, on multiple domains; and the last two, on timing. We next outline each explanation, but in actuality, a combination of explanations may be best for explaining the widening of developmental disparities.

1. Teen parents' children have resources below necessary thresholds for normative development—The first potential explanation for the widening disparities between teen parents' children and others relies on the idea that relationships between socioeconomic resources and human development are nonlinear. Researchers have found important effects of income on child development when families are in or near poverty; above this threshold, however, increased income has little impact (Dearing et al. 2001; Duncan and Magnuson 2001; Gershoff et al. 2007; Mayer 1997). Most teen-parent families are in or near poverty, but most other families are above this income threshold (Mollborn and Dennis 2012b). Similarly, the lack of a high school diploma is particularly problematic because it is a minimum requirement for nearly all attractive employment opportunities (Upchurch and McCarthy 1990). Teen parents are much more likely than others to lack this threshold credential (Mollborn 2007). Likewise, the acquisition of a particular asset may be more important for children than a broad indicator of a family's wealth or assets. For example, children of homeowners stay in school longer and are less likely to become teen mothers than children of renters (Green and White 1997). Children who live in households that have not met minimum resource thresholds may not develop optimally. Because children of teen parents are much more likely to live in such households (even after these families' modest gains over time are accounted for), they may lose relative ground in development and health if a lack of sufficient resources generates accumulating disadvantages. We account for time-varying threshold measures here, and in the next two potential explanations, we model more complex dynamics involving these threshold measures.

2. Teen parents' children have concurrently low resources across multiple domains—Studies have identified the accumulation of low socioeconomic resources over time as important for child and adult outcomes (Duncan et al. 1994; Korenman et al. 1995; NICHD Early Child Care Research Network 2005; Wagmiller et al. 2006; Willson et al. 2007). Less attention has been paid to the accumulation of low socioeconomic resources cross-sectionally across domains. Past research has found that different socioeconomic domains (e.g., income, wealth, and education) independently predict health (Duncan et al. 2002; Willson et al. 2007), cognitive and socioemotional behavior (Shanks 2007), and educational attainment (Conley 2001; Kim and Sherraden 2011). Other researchers have

gone a step further to test whether experiencing simultaneous disadvantages in multiple domains is more detrimental than in one. Bauman and colleagues (2006) examined poverty, low parental education, and single-parent households (a marker of social disadvantage rather than SES), finding that children who simultaneously experienced more disadvantaged domains had increasingly higher odds of worse health. The logic underlying these findings is that adversities accumulate across domains, with multiple disadvantages more problematic for child health and development. Our study examines the consequences of multiple socioeconomic domains in teen-parent families, which disproportionately experience low educational attainment, income, occupational status, and assets (Furstenberg 2007; Taylor 2009). Thus, children from teen-parent families may be more often exposed to multiple domains of disadvantage than peers. If experiencing multiple domains of low SES sets in motion a process of cumulative disadvantage, then a time-varying measure of multiple domains may explain why teen parents' children lose developmental ground over time compared with peers.

3. Teen parents' children have lower resource levels earlier in life—The third potential explanation for the widening disparities is that teen parents' children have their lowest socioeconomic resources earlier in childhood, when these resources matter the most for future development. Scholars have been looking increasingly earlier in the life course to identify the roots of cumulative disadvantage. Barker et al. (2002) and others researching birth outcomes (Boardman et al. 2002) have highlighted prenatal conditions as critical. The path-dependent model of cumulative advantage articulated by DiPrete and Eirich (2006) posited that early SES influences early outcomes, which subsequently shape later outcomes. Thus, compromised health or development early in life may be self-sustaining independently of later socioeconomic conditions. The SES-health relationship throughout the life course has evidenced path-dependent cumulative disadvantage processes, with earlier conditions shaping later circumstances (Hayward and Gorman 2004; Willson et al. 2007). As we note earlier, teen-parent families have particularly few resources shortly after the birth, when parents have low human capital and parenting demands are at their highest. The lack of crucial resources during earliest childhood may explain why disparities between teen parents' children and others subsequently widen.

4. Teen parents' children have persistently low resources throughout early childhood—One of the best-documented aspects of resource dynamics is the detrimental effect of persistently low socioeconomic resources. Studies have repeatedly found that persistent poverty has a stronger effect than transient poverty on cognitive and behavioral outcomes (Duncan et al. 1994; Korenman et al. 1995; NICHD Early Child Care Research Network 2005; Wagmiller et al. 2006), although McLeod and Shanahan (1993) found that concurrent and persistent poverty influenced different mental health outcomes among children. Researchers examining persistently low SES have focused almost exclusively on income, but we look more comprehensively at socioeconomic resources. Past research has found that teen-parent families tend to start out with disproportionately low SES and remain so over time (Hoffman 1998). These low absolute levels persist despite modest SES gains. Our final potential explanation posits that if persistently low socioeconomic resources create cumulative disadvantage through a cumulative exposure process (DiPrete and Eirich 2006),

they can explain why teen parents' children experience growing developmental and health disparities compared with peers.

The relationship between socioeconomic resources and child development is conceptualized globally here but is assessed within three specific domains that have been identified as important for understanding readiness for the crucial transition to school (Crosnoe 2006; Entwisle et al. 2004): cognitive and behavioral development, and physical health. Our analyses first assess changes over time in resource disparities between teen-parent families and others for these domains. We then test each explanation outlined earlier.

Method

Data

Our data source is the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B), which followed a nationally representative sample of about 10,600 children born in 2001 from infancy through the fall of kindergarten (U.S. Department of Education 2007).[1] No other nationally representative U.S. study has tracked children through these first years of life using parent interviews and direct assessments. The ECLS-B has the advantage of including relatively large subsamples of children of teen parents, representing 12 % of the Wave 1 sample. All 2001 births registered in the National Center for Health Statistics vital statistics system were eligible, and the sample was drawn using a clustered, list frame design. Children were sampled from 96 counties/county groups. A small number of children with mothers younger than age 15 at their birth were excluded; there were just 0.5 births per 1,000 for ages 10 to 14 in 2009, compared with 39.1 for ages 15–19 (Hamilton et al. 2010).

This study uses data from all waves of the survey, conducted when the children were about 11, 24, and 52 months old (typically the fall before kindergarten); and in the fall of kindergarten, at an average of 66 months old. (Thus, most children were interviewed in 2006 but some entered kindergarten at Wave 5 in 2007.) The primary parent, who was almost always the biological mother, was interviewed in person. Because of budgetary constraints, the kindergarten wave selected a random subsample of about 85 % of the children whose parent had completed the preschool interview, although all American Indian/Alaska Native children who completed either the 24-month or the 52-month wave were included (Snow et al. 2009). The weighted response rates for the parent interview were 74, 93, 91, 92, and 93%, respectively. Attrition between Wave 1 and Wave 3 was similar for teen (20%) and nonteen parents (16%). Our growth curve analysis approach allows us to keep all children who had data for at least two waves (of Waves 1, 2, and 3, and the kindergarten wave). Because some covariates apply to biological mothers, we further restrict our sample to those whose biological mothers completed the parent survey. Thus, our eligible sample—children who had at least two reading or math outcomes, had biological mothers complete the survey, and had valid weights and clustering information—includes about 8,850 children. However, because of missing information on the various outcomes, controls, and resources, analysis samples for the different outcomes are slightly smaller, with 8,500 for reading and math, 8,650 for general health and asthma, and 8,200 for behavior.[2]

[1]Because of ECLS-B confidentiality requirements, all *N*s are rounded to the nearest 50.

Measures

Outcomes—We use five outcome variables to capture different facets of children's development and health: cognitive/reading, cognitive/math, behavior, general health, and asthma. Time-varying outcomes were measured at Waves 1, 2, and 3 and kindergarten wave, with kindergarten information taken from Wave 4 or Wave 5, depending on when the child first enrolled in kindergarten.

The cognitive outcomes come from one-on-one child assessments, some of which were adapted from reputable assessment batteries developed for other studies. Because the children were too young for measuring reading and math in the early waves, they were given the Bayley Short Form-Research Edition (BSF-R) mental assessment at Waves 1 and 2, which measured early cognitive development including communication, expressive and receptive vocabulary, problem-solving, and comprehension.[3] The Wave 1 BSF-R mental scale had an overall item response theory (IRT) reliability coefficient of r_{xx} = .80; for Wave 2, the coefficient was r_{xx} = .98. See Nord and colleagues (2006) and Snow and colleagues (2009) for more information on these and other assessments. In Wave 3 and the kindergarten wave, interviewers administered early reading and math assessments adapted from several reputable assessment batteries developed for other large studies of preschoolers, such as the Peabody Picture Vocabulary Test, the Preschool Comprehensive Test of Phonological and Print Processing, the PreLAS 2000, the Test of Early Mathematics Ability-3, and sister study Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K).[4] Early reading was assessed by a 35-item test covering age-appropriate areas, such as phonological awareness, letter recognition and sound knowledge, print conventions, and word recognition (ECLS-B-reported reliability = .84). Early math was assessed in two stages, routed after the first stage, depending on the child's score and evaluating counting, number sense, operations, geometry, pattern understanding, and measurement (ECLS-B-reported reliability = .89). We use the scale scores for the cognitive, reading, and math evaluations, and then standardize them within each wave, allowing us to compare a child's score relative to peers on the cognitive evaluations in Waves 1 and 2 and early reading and math in Wave 3 and the kindergarten wave.

The behavior measure is the average of a number of behavioral indicators observed by the interviewer (the Interviewer Observations of Child Behavior assessment at Waves 1 and 2), early child care and education provider at Wave 3, and kindergarten teacher (drawn from the Preschool and Kindergarten Behavior Scales-Second Edition, the Social Skills Rating System, and the Family and Child Experiences Study, as well as new questions developed for the ECLS-B at Wave 3 and the kindergarten wave), which are then standardized within each wave.[5] The indicators include items such as the number of times the child displayed positive affect, frequency of social engagement, or how often the child showed cooperation.

[2]Because we use a growth curve approach, the unit of analysis is person-years rather than individuals, so the analysis sample is 27,900 for reading, 27,850 for math, 29,100 for health and asthma, and 23,500 children for behavior. With each child in the analysis sample providing two to four waves of information, the average number of waves per child is 3.3 for reading and math, 3.4 for health and asthma, and 2.9 for behavior.

[3]The BSF-R was developed by ECLS-B based on the Bayley Scales of Infant Development, Second Edition (BSID-II).

[4]The (often copyrighted) items from assessments were not available to users of the data, so we rely on scores constructed by ECLS-B staff using IRT modeling.

The wave: include 6, 10, 15, and 16 behavior items, respectively. Negative behaviors are reverse-coded so that higher behavior scores represent more positive behavior. We use only external, nonparent reports because parent reports do not reflect much diversity, suggesting social desirability bias. Alpha reliability scores were .80, .94, .99, and .93 for Waves 1, 2, and 3, and the kindergarten wave, respectively, suggesting that although the child behavior measure is global, it is reliable.

For a global health indicator, we use the primary parent's report of the child's health status. We code those reporting very good or excellent health as 1; and we code those in good, fair, or poor health as 0.[6] The dichotomous asthma measure is based on whether the parent ever reported that any medical professional diagnosed the child with asthma.[7]

Independent variables—See Table 2 for variable details for all measures except resource dynamics. All independent variables except age and teen parent status are centered on the sample mean. Other than child age and household resources, the independent variables are time-invariant background factors. Many were collected in more than one interview, allowing us to fill in gaps from earlier waves using reports from later waves. We prioritize reports in the ECLS-B survey over birth certificate reports. For the kindergarten wave, information from either Wave 4 or Wave 5 is matched to the child depending on the year that he or she entered kindergarten, with Wave 4 measures filling in for Wave 5 when those measures are not available. Several control variables measure prenatal conditions and birth outcomes. Others measure disadvantaged backgrounds. Although our analyses focus on socioeconomic resources (income, education, and wealth), we include time-varying measures of other financial, material, and social household resources.

Finally, several variables operationalize the socioeconomic resource dynamics outlined in our competing explanations for the widening gap between teen parents' children and others. One analysis interacts each socioeconomic measure with child age to model developmental timing. Other analyses use time-varying threshold measures of low resources for each domain: household income below the poverty line, mother's educational attainment less than a high school diploma, no car owned, no investments, no bank account, no home owned, and receiving subsidized housing. Two additional time-varying measures are then created from these threshold variables. The first counts the number of waves (to date at a given wave) during which a child had experienced a low resource. For example, a child living consistently in poverty would have a value of 2 waves in poverty at Wave 2, and 4 at the kindergarten wave; a child never in poverty would have a value of 0 at all waves. Second, we count how many of the seven domains were below threshold levels at a given wave, with possible values from 0 to 7.

[5]For the Wave 3 measure, we use reports from the early care and education providers (ECEP) when available. Many children who entered kindergarten in Wave 5 were in preschool at Wave 4 but not at Wave 3, and thus would not have information from an ECEP provider in Wave 3. For these children, we fill in data with the ECEP provider information from Wave 4. For children without an ECEP survey in either Wave 3 or Wave 4, we fill in the Wave 3 behavior outcome with an age-adjusted average of their reports from Wave 2 and the kindergarten wave.

[6]The high proportion of reports of favorable child health necessitated this particular dichotomy; for example, only 3% of child health reports at Wave 3 fell into the "fair" or "poor" categories.

[7]Because this question was not asked in the last survey wave, the Wave 4 indicator of asthma is filled in for children who did not enroll in kindergarten until Wave 5.

Analyses

We first analyze descriptive information to document growing developmental disparities among children and identify changes in resource gaps between teen-parent families and others. The multivariate analyses use growth curve models to predict trajectories for each outcome (cognitive/reading, cognitive/math, behavior, general health, and asthma) by analyzing time points (Level 1) nested within individual children (Level 2). Thus, child age is the Level 1 unit, and child is Level 2. Multilevel regression models for continuous outcomes are estimated for all models, including binary measures of health status and asthma diagnosis.[8]

We first compare trajectories by teen parent status, including an interaction between child age and teen parent status to estimate change over time in the trajectories. This interaction term is critical because it represents the widening disparities between teen parents' children and others. Comparing linear and quadratic functions of child age at Level 1, the linear models are the best fit, suggesting that disparities change uniformly with age. These models provide statistically efficient and unbiased estimates of trajectories in child outcomes as linear functions of teen parent status under assumptions of multivariate normality (Raudenbush and Bryk 2002). Including all children who had at least two waves of data minimizes the impact of survey attrition. Because these models focus on within-individual change, unmeasured stable differences across children are inherently controlled.

Subsequent models control first for time-invariant (Level 2) background factors, then time-varying (Level 1) resource measures. We then test the four explanations by introducing into the latter model-specific time-varying (Level 1) resource dynamics one at a time. To test Explanation 1 (resource thresholds), we introduce a time-varying measure of having a low level of each resource. To test Explanation 2 (multiple domains), we use a time-varying measure of the number of domains of low socioeconomic resources experienced at each wave. To test Explanation 3 (early disadvantage), we introduce interactions of child age with each socioeconomic resource. To test Explanation 4 (persistently low resources), we include a time-varying measure, for each socioeconomic resource, of the number of waves to date when the child had experienced a low level of that resource. Explanations are considered successful if they meet mediation criteria (Baron and Kenny 1986) in explaining growth in disparities between teen parents' children and others (i.e., the interaction between teen parent status and child age). These criteria, as well as model fit, help us compare the effectiveness of the different explanations for the widening developmental gaps experienced by teen parents' children. Each explanation is discussed later. We conduct sensitivity analyses for Explanations 1, 2, and 4, using higher thresholds for income (200 % of poverty line) and education (less than a college degree), and substantive conclusions do not change.

[8]Binary logistic regression has advantages for analyzing a dichotomous outcome, but we argue that they are outweighed by the major disadvantage of not being able to include probability or replication weights to adjust for complex survey design. ECLS-B users are strictly advised to incorporate probability weights in their analyses. Additionally, logistic regression is not suitable for making comparisons across different equations for the same outcome (Mood 2010). Because we must compare equations in order to test for mediation of the widening disparity by teen parent status and because of the need to incorporate weights, we use multilevel models for continuous outcomes.

We estimate the models using *xtmixed* in Stata 12. Probability weights make findings representative of all children born in the United States in 2001, and the sandwich estimator of standard errors adjusts for clustering within the primary sampling units. We assign one unique variance parameter per random effect and assume that covariance parameters are zero.

The form of the basic multilevel model for person *i* at time *t* is:

$$S_{ti}=\beta_{0i}+\beta_{1i}(A_{ti}-L)+\sum\beta_{ki}X_{kti}+r_{ti} \quad (1)$$

$$\beta_{0i}=\gamma_{00}+\sum\gamma_{0j}W_{ji}+u_{0i}, \quad (2a)$$

$$\beta_{1i}=\gamma_{10}+\sum\gamma_{1j}W_{ji}+u_{1i}, \quad (2b)$$

$$\beta_{ki}=\gamma_{k0}. \quad (2c)$$

The coefficient β_{1i} is a random effect estimating the linear increase (at the centered value *L* of age 5.5) in the developmental trajectory for each child. We treat the β_{ki} coefficients for *k* Level 1 time-varying variables as fixed (i.e., $\beta_{ki} = \gamma_{k0}$). The γ coefficients for *j* time-invariant *W* variables show how stable background characteristics (e.g., teen parent status) alter the level of each outcome at age 5.5 in Eq. (2a) and the linear age trajectories of each outcome over time in Eq. (2b). We use the Bayesian information criterion (BIC) and the Akaike information criterion (AIC) to assess model fit and improvement in fit across models. The starting value for these fit statistics is not of consequence, but a decrease indicates an improvement in fit.

Results

Documenting the Consequences of Teen Parenthood

Steady or Shrinking Resource Gaps Over Time—The descriptive information in Table 3 assesses how the resources of teen-parent families changed relative to others during early childhood. Teen-parent families held steady or improved their socioeconomic situations from their child's infancy to kindergarten. Among the measures of SES, teen-parent families' gains were not significantly different from peers' gains in income or assets. Mothers in teen-parent families had an average educational attainment gain of 0.76 years compared with 0.15 for others. Half again as many teen mothers had a high school diploma at the kindergarten wave as in the child's infancy, and 25 % fewer teen-parent families were living in poverty at this later time. Although encouraging, these gains still left teen parents and their children in a very disadvantaged resource position at kindergarten start compared with families headed by older parents. Teen parents' average income was 160 % of the federal poverty line compared with 373 % for others, and mothers' educational attainment was 11.90 years compared with 13.83 years for others. One-fifth more mothers were without paid work at the kindergarten wave in teen-parent families.

Descriptive findings also support the possible explanations we posited earlier. Supporting Explanation 1, Table 3 shows that for each of the seven threshold measures, teen-parent families were significantly more likely than others to be below the threshold at either Wave 1 or the kindergarten wave. For example, at both of these waves, children with a teen parent were more than twice as likely as others to be living in poverty, to have a mother with no high school diploma, or to have no family car or homeownership. Supporting Explanation 2, teen parents experienced a significantly higher number of domains with low resources at Wave 1 (2.95 domains compared with 2.01) and at the kindergarten wave (2.71 vs. 1.97). Explanation 3 can be tested only in growth curve models. Supporting Explanation 4, teen parents' children were more likely than peers to experience persistently low resources in every socioeconomic domain. For example, by kindergarten, the average child of a teen parent had spent 1.43 waves with a mother who did not have a high school diploma, compared with 0.52 for others.

Widening Developmental Disparities Over Time—Table 3 also shows that for every outcome, teen parents' children increasingly fell behind their peers across early childhood. Across cognition, behavior, and asthma, teen parents' children started with a level playing field in infancy, but their average outcomes became poorer than those of peers. By kindergarten start, these disparities were substantial. In combination with the findings documenting teen-parent families' resource gains over time, this confirms the existence of the empirical puzzle with which we began.

The baseline models from multivariate growth curve analyses summarized in Table 4 and Fig. 1 (left side) reinforce these findings. Kindergarten disparities are represented by the main effect of having a teen parent in Table 4 and, for the average age at kindergarten start, by the points marked with stars in Fig. 1. Teen parents' children lagged behind peers at kindergarten start by about one-half a standard deviation in reading and math and one-third of a standard deviation in teacher-observed behavior. They also experienced worse parent-reported health and higher levels of asthma compared with peers. The interaction between teen parent status and child age represents the linear change over time in outcomes between teen parents' children and others, showing that the disparity in cognitive/reading and cognitive/math scores increased by about 0.1 of a standard deviation per year; behavior, by about 0.06 of a standard deviation per year; and disparities in health status and asthma diagnosis, by about 1 percentage point per year. These widening disparities are graphically represented by the left-side graphs in Fig. 1.

Subsequent models reported in Table 4 adjust these growth curves for background variables and a wide variety of resources. Past research has found that parents' background characteristics and children's birth circumstances explain all or part of the developmental disparities between teen parents' children and others (Geronimus and Korenman 1993; Levine et al. 2001; Turley 2003). Adding time-invariant controls reduces some of the relationships between teen parent status and kindergarten outcomes. Including a wide variety of time-varying measures of socioeconomic, material, and social resources further explains part of the disparities at average kindergarten start (as evidenced by the main effect for teen parent in the third model), but with the exception of behavior, outcomes at age 5.5 were still significantly different between teen parents' children and others. Interestingly, the

teen parent × age interaction term is not reduced, showing that time-varying resources and controls do not explain the growth in disparities between teen parents' children and peers. They partially explain the developmental gap at kindergarten start rather than how it grew over time. Thus, we should consider resource dynamics as explanations for these increasing gaps.

Explaining Why Teen Parents' Children Lose Developmental Ground

The remaining analyses target the widening developmental disparities of teen parents' children relative to others, testing the four explanations outlined earlier. Multivariate growth curve models, summarized in Table 4, test each explanation in turn. The full models for each outcome are available upon request.

Explanation 1: Resources Below Necessary Thresholds—The first explanation posits that teen parents' children lose developmental ground over time compared with peers because their households disproportionately have resources below threshold levels necessary for normative development. Although measures from all three socioeconomic domains predict cognitive outcomes and health status as expected, the multivariate models in Table 4 do not support the resource threshold explanation for growing disparities between teen parents' children and others. Replacing the time-varying continuous measures of SES with time-varying threshold measures does not reduce the magnitude of the interactions between teen parent status and child age or improve the fit of the models, except for a slight improvement in model fit for health status.

Explanation 2: Concurrently Low Resources in Multiple Domains—The second explanation posits that concurrently low resources in multiple domains disproportionately experienced by teen parents' children would explain why they lagged increasingly behind others over time. Findings do not support this explanation. In Table 4, the time-varying measure of multiple domains of low resources significantly predicts children's health status and asthma, but not their cognitive or behavioral outcomes. The magnitude of the interactions between child age and teen parent status does not decrease with the introduction of a time-varying measure of the number of domains with low household resources. These findings suggest that although concurrently low resources in many domains may be fruitful to consider in the future for understanding child health, they do not explain differing trajectories for teen parents' children compared with others.

Explanation 3: Fewer Resources Earlier in Childhood, When Resources Matter Most—We test the third explanation, which was supported by descriptive statistics about change in resources over time described earlier, by introducing interactions between child age and socioeconomic resources in the "resource timing" model in Table 4. These interactions are added separately because of limitations resulting from having only four waves of data. Interactions between child age and resources show that far from mattering more earlier in childhood (as we expected), socioeconomic resources actually predict children's outcomes more strongly closer to kindergarten. For every outcome and every resource type (except maternal education for behavior), the relationship between the

resource and child outcomes is significantly stronger the older the child becomes. Because it is in the direction opposite of what we expected, this finding does not support Explanation 3.

The interactions between child age and socioeconomic resources do, however, partially and unexpectedly explain the growing disparities in outcomes between teen parents' children and others. Especially because it identifies stronger relationships at the end of the time period we study, this finding does not help us understand how teen parents' improving socioeconomic circumstances can be accompanied by worsening outcomes among their children. However, it is still an interesting finding: teen-parent families experienced sizable resource gaps relative to others throughout early childhood, and resources in the latter part of this period are unequivocally important for understanding how teen parents' children fare at the start of the crucial school transition.

Explanation 4: Persistently Low Resources Throughout Early Childhood—The idea that teen parents' children disproportionately experienced persistently low resources throughout early childhood, and that this persistence would explain why they lagged behind peers developmentally, turns out to be the most powerful explanation. Differences in persistently low socioeconomic resources explain why children of teen parents experienced increasing developmental disparities over time. Table 4 shows that accounting for time-varying measures of persistently low income, maternal education, and assets explains one-half or more of the magnitude of the interaction between child age and teen parent status predicting cognitive/reading, health status, and asthma. In the case of cognitive/math and behavior scores, accounting for persistently low resources eliminates the growing disparity between teen parents' children and others completely. The importance of persistently low resources is apparent for each of the three socioeconomic dimensions, but the long-term financial "safety net" indicators of investments and homeownership are the most consistently predictive of children's outcomes. The single most important persistently low resource (as indicated by coefficient size across the seven dichotomous variables) differs by outcome: for cognitive/reading and cognitive/math, it is a persistent lack of investments; for behavior, homeownership; for health status, maternal high school diploma; and for asthma, income above the poverty line. Comparisons of model fit using the BIC and AIC showed (in supplemental analyses) that these had the best fit of any models. The right side of Fig. 1 displays predicted growth curves of the five outcomes for teen parents' children compared with others after persistently low resources are introduced. The difference between the left and right side shows that the growing disparities are explained by accounting for persistently low resources in teen-parent households.

Beyond being the best explanation for understanding why children of teen parents experienced widening developmental disparities over time, the persistence hypothesis also does the best job of partially or completely explaining kindergarten disparities in children's developmental trajectories by race/ethnicity and primary household language across all outcomes. Because it would have overtaxed the data, we could not interact these variables with child age, so these findings do not address growth in disparities in the way the results for teen parent do.

Discussion

Our overarching theoretical aim was to clarify and operationalize dynamic socioeconomic processes that could be useful for understanding the accumulation of advantage and disadvantage in development and health throughout the life course. Empirically, we set out to explain why children of teen parents lose ground relative to peers across early childhood in cognition, behavior, and health while their families' socioeconomic circumstances are holding steady or improving. We evaluated four potential explanations for growing disparities in development and health. One of our explanations—persistently low resources—received strong support. Teen parents' children were much more likely to experience socioeconomic resources that were persistently below minimum thresholds, even though some socioeconomic outcomes improved marginally over time. This persistence predicted compromised health and development and explained much or all of the growth over time in outcome disparities between teen parents' children and their peers. In DiPrete and Eirich's (2006) influential categorization of cumulative advantage, this explanation is a "cumulative exposure" process. Past studies have identified persistently low income as a major risk factor for development (Duncan et al. 1994; Korenman et al. 1995; McLeod and Shanahan 1993; NICHD Early Child Care Research Network 2005; Wagmiller et al. 2006), and here we also found it to be an important explanation for the accumulation of disadvantage in marginalized children's development and health. We expanded beyond income measures to examine education and assets, and each was the most important predictor for a specific child outcome. We used threshold measures of persistence, but future research could consider whether this mechanism works best when conceptualized as resource thresholds or gradients.

As a first step in modeling resource dynamics in early childhood across multiple socioeconomic measures and child outcomes, this study has limitations to be addressed in future research. One facet of SES—namely, occupational status—was omitted because of data limitations. Further research should model dynamic processes in the many material, financial, and social resources documented in the ECLS-B. Additional sensitivity analyses should establish the exact thresholds for nonlinear resource effects, and teen parents' own socioeconomic resources should be considered separately from those of their households. Analyses of outcomes for teen parents' children should differentiate between children of younger and older teen parents, as well as children who were born to a teen mother, father, or both. A narrower analysis of child outcomes could consider separate subscales of child behavior. Because young children develop so rapidly, the assessments necessarily had to differ across age, but this limited their comparability. Finally, future surveys including more time points may uncover further nonlinearities in relationships over time.

This study found that newer, dynamic ideas about socioeconomic resources can advance understanding of children's development and health throughout early life. Our research suggests that scholars seeking to understand stratification processes in early childhood will be served by modeling key principles of the life course theoretical perspective (Elder 1998) when designing research. For example, a longitudinal, multidimensional focus on early childhood resources appears to be key for understanding the implications of teen parenthood, and cumulative disadvantage in resources over time is crucial. Dynamic ideas

about socioeconomic disadvantage are necessarily more complex to operationalize than static ones, but we have shown that growth curve analysis accommodates them. Time-varying, cumulative measures of resources can be included in a model that captures growth from infancy to kindergarten. Importantly, in a growth curve framework, these cumulative measures can predict the interaction of a source of social stratification (such as teen childbearing) with child age, distinguishing an effect on development at a single point in time (such as kindergarten entry) from an effect on change over time in the developmental disparity. Using this empirical framework, future research could apply the dynamic of persistently low resources to understand other sources of cumulative disadvantage. The modeling of multidomain disadvantage and resource thresholds in this study may also be useful for understanding other sources of early developmental disparities.

Theoretically, our findings imply that cross-sectional measures of resources likely underestimate the effects of socioeconomic disadvantage on child development and health. Studies focusing on one socioeconomic resource, such as poverty, also miss strong relationships of other facets with children's outcomes. Relatedly, cross-sectional approaches or those focused on a single aspect of SES may underrate the importance of resources for understanding the negative consequences of teen childbearing. A multifaceted, longitudinal view of resources highlights their importance for understanding early child development. Similarly, our broad approach to operationalizing child outcomes illuminates overarching patterns across developmental domains. The overall consistency of our findings suggests that despite obvious merit in domain-specific developmental studies, researchers taking a wider view of child outcomes may uncover more general processes of resource dynamics and cumulative disadvantage. Our research points toward prekindergarten and the school transition, as well as the accumulation of resources over time, as a focus of future research on the effects of socioeconomic disadvantage in early childhood.

Because our observational study reports the effects of the "treatment on the treated" by comparing observations of teen parents who have improved their SES with those who have not, it cannot establish causality. Within these constraints, we suggest preliminary implications for social policy. As life course scholars have long known, policies looking to improve a child's development or health need to consider the resource situation the child has experienced throughout life rather than examine a static snapshot. For all their substantial developmental and health disadvantages at the start of schooling, children of teen parents are by no means set on irreversible developmental trajectories. Support for parental education and earned income and the provision of a long-term safety net are promising strategies for intervening before the school transition—and our analyses are consistent with policies focused on "bumping up" household resources above minimum thresholds. Interrupting patterns of persistently low resources may be key. Early interventions that relieve persistently low resources over time are likely to be particularly effective, but because resources in the household matter increasingly more for young children's outcomes as they age, even resource transfers closer to kindergarten are promising. This also suggests that interventions following a teenage birth can help two generations for the price of one: programs that help teen parents improve their own socioeconomic circumstances, such as school and work programs or child care support, may also prevent accumulation of developmental disadvantage in their children. Because past research has shown that teen

parents are highly motivated to improve their socioeconomic lot shortly after the birth (Edin and Kefalas 2005; SmithBattle 2007) and because teen parents' children constitute the majority of children living in poverty (Mollborn and Dennis 2012a), policies that help teen-parent families can also be effective antipoverty policies.

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References

Aber JL, Bennett NG, Conley DC, Li J. The effects of poverty on child health and development. Annual Review of Public Health. 1997; 18:463–483.

Barker DJP, Eriksson JG, Forsen T, Osmond C. Fetal origins of adult disease: Strength of effects and biological basis. International Journal of Epidemiology. 2002; 31:1235–1239. [PubMed: 12540728]

Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology. 1986; 51:1173–1182. [PubMed: 3806354]

Bauman LJ, Silver EJ, Stein REK. Cumulative social disadvantage and child health. Pediatrics. 2006; 117:1321–1328. [PubMed: 16585330]

Boardman JD, Powers DA, Padilla YC, Hummer RA. Low birth weight, social factors, and developmental outcomes among children in the United States. Demography. 2002; 39:353–368. [PubMed: 12048956]

Brooks-Gunn J, Duncan GJ. The effects of poverty on children. Future of Children. 1997; 7(2):55–71. [PubMed: 9299837]

Brooks-Gunn J, Furstenberg FF Jr. The children of adolescent mothers: Physical, academic, and psychological outcomes. Developmental Review. 1986; 6:224–251.

Burkam DT, Ready DD, Lee VE, LoGerfo LF. Social-class differences in summer learning between kindergarten and first grade: Model specification and estimation. Sociology of Education. 2004; 77:1–31.

Case A, Lubotsky D, Paxson C. Economic status and health in childhood: The origins of the gradient. American Economic Review. 2002; 92:1308–1334.

Chen X-K, Wen SW, Fleming N, Demissie K, Rhoads GG, Walker M. Teenage pregnancy and adverse birth outcomes: A large population based retrospective cohort study. International Journal of Epidemiology. 2007; 36:368–373. [PubMed: 17213208]

Conley D. Capital for college: Parental assets and postsecondary schooling. Sociology of Education. 2001; 74:59–72.

Crosnoe R. Health and the education of children from racial/ethnic minority and immigrant families. Journal of Health and Social Behavior. 2006; 47:77–93. [PubMed: 16583777]

Dearing E, McCartney K, Taylor BA. Change in family income-to-needs matters more for children with less. Child Development. 2001; 72:1779–1793. [PubMed: 11768145]

DiPrete TA, Eirich GM. Cumulative advantage as a mechanism for inequality: A review of theoretical and empirical developments. Annual Review of Sociology. 2006; 32:271–297.

Duncan GJ, Brooks-Gunn J, Klebanov PK. Economic deprivation and early childhood development. Child Development. 1994; 65:296–318. [PubMed: 7516849]

Duncan GJ, Daly MC, McDonough P, Williams DR. Optimal indicators of socioeconomic status for health research. American Journal of Public Health. 2002; 92:1151–1157. [PubMed: 12084700]

Duncan GJ, Dowsett CJ, Claessens A, Magnuson K, Huston AC, Klebanov P, Japel C. School readiness and later achievement. Developmental Psychology. 2007a; 43:1428–1446. [PubMed: 18020822]

Duncan GJ, Ludwig J, Magnuson KA. Reducing poverty through preschool interventions. Future of Children. 2007b; 17(2):143–160. [PubMed: 17902264]

Duncan, GJ.; Magnuson, K. Off with Hollingshead: Socioeconomic resources, parenting, and child development. In: Bornstein, MH.; Bradley, RH., editors. Socioeconomic status, parenting, and child development. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.; 2001. p. 83-106.

Edin, K.; Kefalas, M. Promises I can keep: Why poor women put motherhood before marriage. Berkeley: University of California Press; 2005.

Elder GH Jr. The life course as developmental theory. Child Development. 1998; 69:1–12. [PubMed: 9499552]

Entwisle, DR.; Alexander, KL.; Olson, LS. The first-grade transition in life course perspective. In: Mortimer, JT.; Shanahan, MJ., editors. Handbook of the life course. New York, NY: Springer; 2004. p. 229-250.

Furstenberg, FF. Destinies of the disadvantaged: The politics of teenage childbearing. New York, NY: Russell Sage Foundation; 2007.

Geronimus AT, Korenman S. Maternal youth or family background? On the health disadvantages of infants with teenage mothers. American Journal of Epidemiology. 1993; 137:213–225. [PubMed: 8452126]

Gershoff ET, Aber JL, Raver CC, Lennon MC. Income is not enough: Incorporating material hardship into models of income associations with parenting and child development. Child Development. 2007; 78:70–95. [PubMed: 17328694]

Green RK, White MJ. Measuring the benefits of homeowning: Effects on children. Journal of Urban Economics. 1997; 41:441–461.

Guo G. The timing of the influences of cumulative poverty on children's cognitive ability and achievement. Social Forces. 1998; 77:257–287.

Hamilton, BE.; Martin, JA.; Ventura, SJ. Births: Preliminary data for 2009 (National Vital Statistics Reports 59(3)). Hyattsville, MD: National Center for Health Statistics; 2010.

Hayward MD, Gorman BK. The long arm of childhood: The influence of early-life social conditions on men's mortality. Demography. 2004; 41:87–107. [PubMed: 15074126]

Henretta JC. Early childbearing, marital status, and women’s health and mortality after age 50. Journal of Health and Social Behavior. 2007; 48:254–266. [PubMed: 17982867]

Hoffman SD. Teenage childbearing is not so bad after all. Or is it? A review of the new literature. Family Planning Perspectives. 1998; 30:236–239. 243. [PubMed: 9782047]

Kim Y, Sherraden M. Do parental assets matter for children’s educational attainment?: Evidence from mediation tests. Children and Youth Services Review. 2011; 33:969–979.

Korenman S, Miller JE, Sjaastad JE. Long-term poverty and child development in the United States: Results from the NLSY. Children and Youth Services Review. 1995; 17:127–155.

Levine JA, Pollack H, Comfort ME. Academic and behavioral outcomes among the children of young mothers. Journal of Marriage and Family. 2001; 63:355–369.

Mayer, SE. What money can’t buy: Family income and children's life chances. Cambridge, MA: Harvard University Press; 1997.

McLeod JD, Shanahan MJ. Poverty, parenting, and children's mental health. American Sociological Review. 1993; 58:351–366.

Mollborn S. Making the best of a bad situation: Material resources and teenage parenthood. Journal of Marriage and Family. 2007; 69:92–104. [PubMed: 21921967]

Mollborn S, Dennis JA. Explaining the development and health of young children with young parents. Sociological Forum. 2012a; 27:1010–1036. [PubMed: 23630407]

Mollborn S, Dennis JA. Investigating the life situations and development of teenage mothers' children: Evidence from the ECLS-B. Population Research and Policy Review. 2012b; 31:31–66. [PubMed: 22500059]

Mood C. Logistic regression: Why we cannot do what we think we can do, and what we can do about it. European Sociological Review. 2010; 26:67–82.

NACCRRA. Parents and the high cost of child care. 2012. Retrieved from http://www.naccrra.org/sites/default/files/default_site_pages/2012/cost_report_2012_final_081012_0.pdf

NICHD Early Child Care Research Network. Early child care and children's development in the primary grades: Follow-up results from the NICHD study of early child care. American Educational Research Journal. 2005; 42:537–570.

Nord, C.; Edwards, B.; Andreassen, C.; Green, JL.; Wallner-Allen, K. Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), User's manual for the ECLS-B longitudinal 9-month-2-year data file and electronic codebook (NCES 2006-046). Washington, DC: U.S. Department of Education, National Center for Education Statistics; 2006.

Perper, K.; Manlove, J. Estimated percentage of females who will become teen mothers: Differences across states (Publication No. 2009-09). Washington, DC: Child Trends; 2009.

Raudenbush, SW.; Bryk, AS. Hierarchical linear models: Applications and data analysis methods. Thousand Oaks, CA: Sage; 2002.

Shanks TRW. The impacts of household wealth on child development. Journal of Poverty. 2007; 11:93–116.

SmithBattle L. "I wanna have a good future": Teen mothers' rise in educational aspirations, competing demands, and limited school support. Youth & Society. 2007; 38:348–371.

Snow, K.; Derecho, A.; Wheeless, S.; Lennon, J.; Rosen, J.; Rogers, J.; Einaudi, P. Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), Kindergarten 2006 and 2007 data file user's manual. Washington, DC: U.S. Department of Education, National Center for Education Statistics; 2009.

Taylor JL. Midlife impacts of adolescent parenthood. Journal of Family Issues. 2009; 30:484–510. [PubMed: 20216917]

Turley RNL. Are children of young mothers disadvantaged because of their mother's age or family background? Child Development. 2003; 74:465–474. [PubMed: 12705567]

U.S. Department of Education, National Center for Education Statistics. Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), Longitudinal 9-month/Preschool Restricted-Use Data File (NCES 2008-024). Washington DC: U.S. Department of Education, National Center for Education Statistics; 2007.

Upchurch DM, McCarthy J. The timing of a first birth and high school completion. American Sociological Review. 1990; 55:224–234.

Wagmiller RL Jr, Lennon MC, Kuang L, Alberti PM, Aber JL. The dynamics of economic disadvantage and children's life chances. American Sociological Review. 2006; 71:847–866.

Willson AE, Shuey KM, Elder GH Jr. Cumulative advantage processes as mechanisms of inequality in life course health. American Journal of Sociology. 2007; 112:1886–1924.

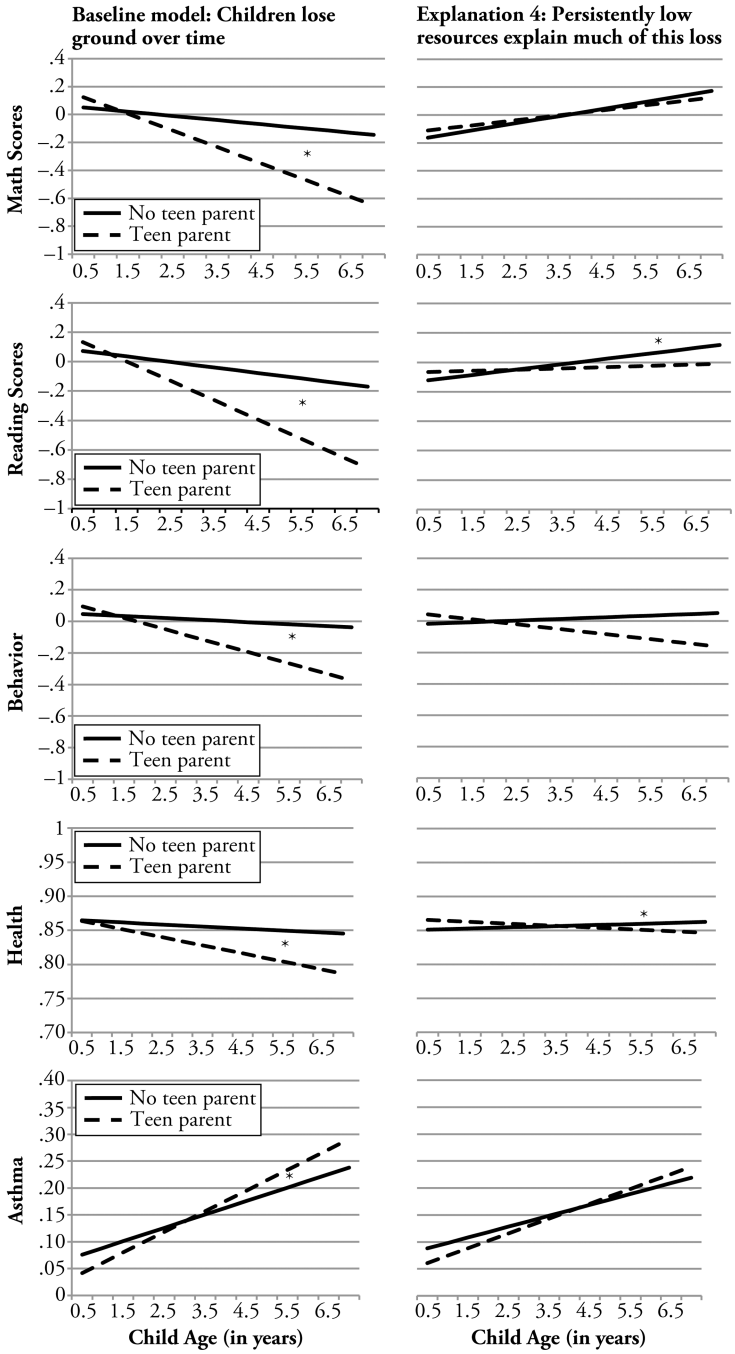

Fig. 1.

Predicted growth curves of child outcomes by teen parent status, before and after mediation by persistently low resources. All variables except age and teen parent status are set to zero, which is the mean of the sample. “Before mediation” is equivalent to predicted values from Table 4, Model 1 (baseline); “after mediation” is equivalent to Table 4, Model 7 (persistently low resources). * = significant difference between children with and without a teen parent at age 5.5 (typical kindergarten start) at $p < .05$. *Source:* Early Childhood

Longitudinal Study-Birth Cohort, 2001–2005. $N \approx 8{,}450$ for cognitive/reading, cognitive/math, and behavior, 8,600 for health status and asthma

Table 1

Hypothesized resource dynamics explanations for widening developmental and health disparities between teen parents' children and their peers

Explanation for Widening Disparities Over Time	Resource Dynamic	Operationalization
1. Teen parents' children tend to have resources below necessary thresholds for normative development.	Nonlinear relationships	Time-varying measure of low resource for each resource type
2. Teen parents' children have concurrently low resources across multiple domains.	Multiple domains	Time-varying measure of number of domains of low resources at wave
3. Teen parents' children have fewer resources in earliest childhood, which sets disparities in motion.	Time (developmental timing)	Negative child age × resource interactions
4. Teen parents' children have persistently low resources throughout early childhood.	Time (duration)	Time-varying measure of number of waves to date with a low resource

Note: All explanations use analyses predicting growth curves in development and health, testing whether each explanation mediates the positive interaction of age with teen parent status.

Table 2

Independent variable construction details

Variable	Wave(s) Measured	Construction Details
Child Age in Months (6–85)	1, 2, 3, K	ECLS-B constructed, centered at 5.5 years (avg. at kindergarten start).
Teen Parent Status	1	Biological mother and/or father under age 20 at birth; used parent's own report, filling missing data from other sources.
Background Controls (time-invariant)		
Male[a]	1	ECLS-B constructed.
Race/ethnicity	1	ECLS-B constructed; white, black, Hispanic, and (because of small sample size among teen-parent families) other race including Asian/Pacific Islander, Native American/Alaska Native, and multiracial.
Non-English household	1	Household's primary language not English.
Birth weight	1	ECLS-B constructed; normal ≥ 2,500 g, moderately low < 2,500 g and ≥1,500 g, very low < 1,500 g.
Preterm birth[a]	1	ECLS-B constructed; before 37 weeks' gestation.
Smoked during pregnancy[a]	1	Biological mother ever smoked in third trimester.
Drank during pregnancy[a]	1	Biological mother drank at least one alcoholic drink per week in third trimester.
Late/no prenatal care[a]	1	Received no prenatal care ever or started receiving after first trimester ended.
Birth order of study child	1	1 for biological mother's first live birth, 2 for second-born, and so on.
Biological mother married at birth[a]	1	Mother was married at time of child's birth.
Biological mother foreign-born[a]	1	Mother was born outside United States.
Grandmother was teen mother	1	Yes, no, or missing information (those not living with their mother as a child or whose mother was dead were not asked).
Mother ever repeated grade[a]	1	Mother ever repeated a grade in school.
Mother on welfare growing up[a]	1	Mother's family ever received welfare when she was age 5 to 16.
Mother lived with two parents until 16[a]	1	Mother lived with both biological parents until age 16.
Household Socioeconomic Resources (time-varying)		
Income (proportion of poverty line)	1, 2, 3, K	ECLS-B constructed (sometimes imputed) household income as % of survey year's poverty threshold for household's size.
Mother's years of education	1, 2, 3, K	Total years of education recoded from ECLS-B constructed categorical measure.
Asset scale	1, 2, 3, K	Averaged dichotomous indicators: owning a car; having stocks or investments; having checking or savings account; owns residence; not in subsidized housing (Cronbach's alpha = .71).
Other Resources (time-varying)		
Received WIC in last 12 months[a]	1, 2, 3, K	Dichotomous measures: wave 1 asked about time since birth, Waves 2 and 3 asked about the last year, and Wave 4 asked about time since the child turned 4.
Household received food stamps[a]	1, 2, 3, K	
Household received TANF[a]	1,2,3,K	
Health insurance type	1, 2, 3, K	Mutually exclusive variable representing coverage through private insurance, Medicaid, other government insurance such as state programs or Bureau of Indian Affairs, or no insurance (for multiple types of insurance, we prioritized private insurance, then Medicaid).
Mother's employment	1, 2, 3, K	Paid work full-time (≥40 hours/week), part-time (<40), none.
Mother currently married[a]	1, 2, 3, K	ECLS-B constructed.

Variable	Wave(s) Measured	Construction Details
Household member with special needs[a]	1, 2, 3, K	Any household member besides study child had a special need or disability.
Grandparent in residence[a]	1, 2, 3, K	Any grandparent versus none.
Other adult in residence[a]	1, 2, 3, K	Any nonparent, nonpartner, nongrandparent adult versus none.
Mother received parenting advice[a]	1, 2, 3, K	Mother received parenting advice since last wave.
Nonparental child care	1, 2, 3, K	Full-time (>30 hours/week), part-time (<30), none.

Source: Early Childhood Longitudinal Study-Birth Cohort, 2001–2007.

[a] 1 = yes, 0 = no. TANF = Temporary Assistance for Needy Families. WIC = The Special Supplemental Nutrition Program for Women, Infants, and Children.

Table 3

Weighted means for time-invariant and time-varying variables

Variable	Wave 1		Kindergarten Wave		Change From Wave 1 to Kindergarten Wave	
	No Teen Parent	Teen Parent	No Teen Parent	Teen Parent	No Teen Parent	Teen Parent
Child Age in Months (6–85)	10.51	10.52	66.14	66.20		
Background Controls (time-invariant)						
Male[a]	0.51	0.52				
Race/ethnicity (white)	0.57	0.37 ***				
Black	0.12	0.22 ***				
Hispanic	0.24	0.35 ***				
Other race	0.07	0.05 **				
Non-English household	0.18	0.21 *				
Birth weight (normal)	0.93	0.90 ***				
Low	0.06	0.08 ***				
Very low	0.01	0.02 ***				
Preterm birth[a]	0.11	0.15 **				
Smoked during pregnancy[a]	0.11	0.15 ***				
Drank during pregnancy[a]	0.01	0.00 ***				
Late/no prenatal care[a]	0.07	0.17 ***				
Birth order of study child	2.13	1.33 ***				
Biological mother married at birth	0.74	0.23 ***				
Biological mother foreign-born[a]	0.20	0.17 *				
Grandmother was teen mom (no)	0.71	0.63 ***				
Yes	0.11	0.14 *				
Unknown	0.18	0.22 *				
Mother ever repeated grade[a]	0.14	0.23 ***				

Variable	Wave 1		Kindergarten Wave		Change From Wave 1 to Kindergarten Wave	
	No Teen Parent	Teen Parent	No Teen Parent	Teen Parent	No Teen Parent	Teen Parent
Mother on welfare growing up[a]	0.09	0.21 ***				
Mother lived with two parents until 16[a]	0.61	0.39 ***				
Child Outcomes (time-varying)						
Cognitive/math	0.19	0.15	−0.04	−0.49 ***	−0.33	−0.73 ***
Cognitive/reading	0.19	0.15	−0.07	−0.53 ***	−0.36	−0.77 ***
Positive behavior	0.11	0.13	0.06	−0.25 ***	−0.01	−0.42 ***
Very good/excellent health[a]	0.89	0.86 *	0.87	0.83	−0.02	−0.05
Ever had asthma diagnosis[a]	0.05	0.06	0.16	0.25 **	0.11	0.18 *
Household Resources (time-varying)						
Income (proportion of poverty line)	3.13	1.26 ***	3.73	1.60 ***	0.53	0.30
Asset scale	0.72	0.46 ***	0.76	0.50 ***	0.04	0.04
Received WIC in last 12 months[a]	0.46	0.89 ***	0.20	0.40 ***	−0.25	−0.51 ***
Household received food stamps[a]	0.17	0.35 ***	0.18	0.48 ***	0.02	0.15 ***
Household received TANF[a]	0.06	0.18 ***	0.05	0.15 ***	−0.01	−0.02
Mother received parenting help[a]	0.10	0.20 ***	0.06	0.06	−0.04	−0.16 ***
Health insurance type (private only)	0.63	0.19 ***	0.69	0.35 ***	0.06	0.13 **
Medicaid	0.28	0.65 ***	0.19	0.49 ***	−0.06	−0.12
Other government	0.06	0.10 **	0.07	0.09	0.00	−0.01
None	0.04	0.06 *	0.04	0.06	0.00	0.00
Household member with special needs[a]	0.07	0.09	0.11	0.09	0.03	−0.01
Mother's years of education	13.55	11.06 ***	13.83	11.90 ***	0.15	0.76 ***
Mother's employment (none)	0.45	0.59 ***	0.35	0.42 *	−0.09	−0.12
Part-time	0.26	0.24	0.27	0.25	0.03	−0.02
Full-time	0.29	0.17 ***	0.37	0.33	0.06	0.14 *

Variable	Wave 1		Kindergarten Wave		Change From Wave 1 to Kindergarten Wave	
	No Teen Parent	Teen Parent	No Teen Parent	Teen Parent	No Teen Parent	Teen Parent
Mother currently married[a]	0.74	0.26 ***	0.75	0.37 ***	0.00	0.16 ***
Grandparent in residence[a]	0.10	0.45 ***	0.16	0.62 ***	0.06	0.13 **
Other adult in residence[a]	0.08	0.26 ***	0.07	0.18 ***	−0.03	−0.09 *
Nonparental child care (none)	0.51	0.44 ***	--	--	--	--
Part-time	0.20	0.25 **	0.26	0.15 ***	0.07	−0.11 ***
Full-time	0.29	0.31	0.73	0.85 ***	0.42	0.51 *
Resource Dynamics (time-varying)						
Count of waves to date with low resource:						
Below poverty line	0.21	0.51 ***	0.75	1.81 ***	0.56	1.32 ***
Mother has less than high school diploma	0.14	0.51 ***	0.52	1.43 ***	0.38	0.95 ***
No car	0.08	0.23 ***	0.29	0.81 ***	0.21	0.58 ***
No investments	0.54	0.89 ***	2.09	3.56 ***	1.56	2.70 ***
No bank account	0.22	0.46 ***	0.84	1.71 ***	0.62	1.29 ***
Not homeowners	0.46	0.86 ***	1.60	3.28 ***	1.13	2.40 ***
Free/subsidized housing	0.11	0.26 ***	0.37	1.12 ***	0.27	0.80 ***
Count of domains at low resource	2.01	2.95 ***	1.97	2.71 ***	−0.01	−0.18 *
Below poverty line[a]	0.21	0.51 ***	0.16	0.38 ***	−0.03	−0.12 *
Mother < high school diploma[a]	0.14	0.51 ***	0.13	0.27 ***	−0.01	−0.21 ***
No car[a]	0.08	0.23 ***	0.06	0.17 ***	−0.03	−0.06
No investments[a]	0.54	0.89 ***	0.51	0.90 ***	−0.02	0.01
No bank accounts[a]	0.22	0.46 ***	0.20	0.39 ***	−0.02	−0.05
Not homeowners[a]	0.46	0.86 ***	0.35	0.78 ***	−0.12	−0.10
Free/subsidized housing[a]	0.11	0.26 ***	0.08	0.27 ***	−0.02	−0.04

Notes: Source: Early Childhood Longitudinal Study-Birth Cohort, 2001–2007. Wave 1, $N \approx 9{,}250$; Wave K, $N \approx 4{,}400$; Change from W1 to WK, $N \approx 4{,}400$. Analyses account for sample design effects. Range for age and continuous outcome variables are in parentheses.

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[a] 1 = yes.

* $p < .05$;

** $p < .01$;

*** $p < .001$; (two-tailed design-based F tests comparing children with a biological parent under the age of 20 with children with both biological parents age 20 or older at time of birth)

Table 4

Summary of unstandardized coefficients from multilevel linear regression models of child outcomes

	Cognitive/ Math	Cognitive/ Reading	Positive Behavior	Very Good/ Excellent Health	Asthma Diagnosis
Variable Information	**Mean = 0, SD = 1**			**0 = no or 1 = yes**	
Model 1: Baseline					
Teen parent	−0.490***	−0.513***	−0.324**	−0.065***	0.085***
Teen parent × child age	−0.090***	−0.095***	−0.060*	−0.009***	0.013***
Model 2: Add Time-Invariant Controls					
Teen parent	−0.372***	−0.412***	−0.249*	−0.046***	0.033***
Teen parent × age	−0.089***	−0.095***	−0.059*	−0.009***	0.013***
Model 3: Add Time-Varying Resources					
Teen parent	−0.277***	−0.314***	−0.197	−0.036***	0.030*
Teen parent × age	−0.091***	−0.097***	−0.059*	−0.011***	0.013***
Model 4: Time-Varying Resource Thresholds (Explanation 1)					
Teen parent	−0.309***	−0.347***	−0.201*	−0.037***	0.031**
Teen parent × age	−0.092***	−0.098***	−0.057*	−0.013***	0.013***
Below poverty	−0.051***	−0.049***	−0.008	−0.023*	0.014***
Less than a high school diploma	−0.081***	−0.089***	0.023	−0.032***	−0.003***
No car	0.016	0.016	−0.010	−0.005***	0.002
No investments	−0.094*	−0.106***	−0.033***	−0.003*	−0.001
No bank accounts	0.018	0.006	−0.010	−0.003	0.001
Not homeowners	−0.034***	−0.042***	−0.090***	−0.011***	0.001
Has subsidized housing	0.013	0.011*	0.055*	−0.003	0.020
Model 5: Multiple Domains of Low Resources (Explanation 2)					
Teen parent	−0.277***	−0.314***	−0.197	−0.036***	0.030*
Teen parent × age	−0.091***	−0.097***	−0.059*	−0.012***	0.013***
Count of low resources	−0.009	−0.008	0.006	−0.016***	0.002**

	Cognitive/ Math	Cognitive/ Reading	Positive Behavior	Very Good/ Excellent Health	Asthma Diagnosis
Variable Information	**Mean = 0, SD = 1**			**0 = no or 1 = yes**	
Model 6: Timing of Resources (Explanation 3)					
Teen parent	−0.118***	−0.159***	−0.156	−0.017***	0.018
Teen parent × age	−0.035***	−0.042***	−0.045	−0.005*	0.008**
Income × age	0.022***	0.022***	0.006*	0.002*	−0.001***
Asset scale × age	0.222***	0.217***	0.055***	0.027***	−0.018***
Mom's education × age	0.025***	0.026***	0.003	0.002*	−0.0005*
Model 7: Persistently Low Resources (Explanation 4)					
Teen parent	−0.024	−0.086***	−0.151	−0.009*	0.009
Teen parent × age	−0.015	−0.028***	−0.042	−0.005***	0.007**
Count of waves to date					
Below poverty	−0.069*	−0.054*	−0.008	−0.011***	0.012*
Less than a high school diploma	−0.026***	−0.026***	0.044***	−0.018***	−0.001
No car	−0.040***	−0.039***	−0.015	−0.0003	0.004
No investments	−0.161***	−0.148***	−0.040	−0.007*	0.007***
No bank accounts	−0.045***	−0.047***	−0.009**	−0.009	−0.005
Not homeowners	−0.054***	−0.050***	−0.039***	−0.004***	0.005***
Has subsidized housing	−0.061***	−0.044***	−0.009	0.008	0.018

Notes: N people ≈8,450 and *N* person-time ≈27,450 for cognitive/math and cognitive/reading, 8,350 and 25,500 for behavior, 8,600 and 28,650 for health and asthma. Model 1 controls for child's age at assessment. Models 2 through 4 add specified variables to the previous model, Model 7 adds specified variables to Model 2, and Models 5 and 6 add specified variables to Model 3. Model 4 shows results for assets × child age, though findings were similar for income × child age and maternal education × child age. "Controls" include control variables specified in the data section. Analyses account for probability weights and clustering.

Source: Early Childhood Longitudinal Study-Birth Cohort, 2001–2007.

* $p < .05$;

** $p < .01$;

*** $p < .001$ (two-tailed tests)