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Trajectories of Developmental Functioning Among Children of Adolescent Mothers: Factors Associated With Risk for Delay

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Abstract

Children of adolescent mothers are at risk for developmental delays. Less is known about the heterogeneity in these children's developmental trajectories, and factors associated with different patterns of development. This longitudinal study used latent class growth analysis (LCGA) to identify distinct trajectories in children of Mexican-origin adolescent mothers ($N = 204$). Three distinct groups emerged: (a) a *Delayed/Decreasing Functioning* group, (b) an *At-Risk/Recovering Functioning* group, and (c) a *Normative/Stable Functioning* group. Children with Delayed/Decreasing Functioning were more likely than those with Normative/Stable Functioning to have families with lower income, fewer learning materials at home, and adolescent mothers with more depressive symptoms and greater coparental conflict with adolescents' mother figures. The results contribute to knowledge about factors associated with risk of delay.

Keywords

developmental trajectories; developmental delays; adolescent mothers; latent class growth analysis

Children of adolescent mothers are three to four times at greater risk for developmental delays in intelligence, language, and social-emotional functioning than children of adult mothers (Black et al., 2002; Borkowski et al., 2004; Chandra, Schivello, Ravi, Weinstein, & Hook, 2002; Furstenberg, Brooks-Gunn, & Morgan, 1987). In infancy, these children appear to function within normal ranges on developmental assessments and social-emotional measures, yet a pattern of declining developmental functioning subsequently appears, with social-emotional difficulties apparent by the end of the first year and delays in intellectual functioning thereafter (Borkowski et al., 2002; Furstenberg et al., 1987; Moore, Morrison, & Greene, 1997; Whitman, Borkowski, Keogh, & Weed, 2001). There is, however, variability

in these children's developmental outcomes, and although few studies to date have examined the heterogeneity in these children's patterns of development over time, one would expect that not all children would show the same pattern of declining development. Indeed, as is the case for other high-risk child populations (Burchinal, Campbell, Brayant, Wasik, & Ramey, 1997; Liaw & Brooks-Gunn, 1993), there may be subgroups of children whose patterns of development reflect meaningful individual differences.

Understanding the factors that support or undermine the developmental functioning of these children is a critical concern. To this end, the current study examined trajectories of developmental functioning among children of Mexican-origin adolescent mothers, who represent the the group with the highest rate of teen births in the United States (Births: Final Data for 2012. National Vital Statistics Report). Moreover, young children of Mexican origin in the United States tend to face early academic challenges (Crosnoe, 2007), and nationally representative data reveal a significant disparity between Mexican American children and their White peers in cognitive and language measures in the preschool years (Guer- rero et al., 2013). Scholars argue that research should move beyond the study of group-level differences to a focus on factors that promote within-person changes across these children's early developmental functioning; such work will move the field toward a better understanding of factors that may facilitate school readiness (Crosnoe, 2006). Thus, using longitudinal data collected from infancy through childhood (i.e., at 10 months, 24 months, 36 months, 48 months, and 60 months of age), we aimed to identify distinct patterns of children's developmental functioning trajectories using latent class growth analysis (LCGA), a technique that enables an identification of subgroups of children as a function of their intra-individual growth in developmental functioning. Because delays in children's developmental functioning could be influenced by various socio-contextual factors, the second goal of our study was to examine factors that predicted trajectory membership. Such work is essential to our understanding of, and future efforts to ameliorate, developmental delays in this high-risk group of children.

Developmental Outcomes of Children of Adolescent Mothers

By the time they reach the preschool years, children of adolescent mothers tend to show delays in several developmental domains, including intellectual functioning (Black et al., 2002; Borkowski et al., 2004; Chandra et al., 2002; Furstenberg et al., 1987). On average, these children exhibit normative development in infancy, and increasing intellectual deficits by preschool age (Sommer et al., 2000). The limited findings on infants of Mexican-origin adolescent mothers paint a similar picture, such that, as a group, these children perform within normal limits (i.e., within 1 standard deviation of the normative mean) on the Bayley Mental Development Index (MDI) at 10 months of age, and show mildly delayed performance (i.e., up to 2 standard deviations below the normative mean) by 24 months (Jahromi, Umana-Taylor, Updegraff, & Lara, 2012). There are few long-term studies that have followed the developmental functioning of children of adolescent mothers from infancy into childhood. Borkowski and colleagues reported that children in their longitudinal sample scored within normal ranges on the Bayley MDI at 6 months, and longitudinal follow-ups revealed that many of these children scored at borderline or mild levels of intellectual disability at age 3 (45%) and age 5 (26%; Borkowski et al., 2002). Moreover, by 8 years of

age (i.e., when children were in the second grade), nearly 40% of Borkowski et al.'s (2002) sample met criteria for a learning disability or intellectual disability.

The present study aims to extend our understanding of changes in the developmental functioning of children of adolescent mothers across early childhood by identifying distinct trajectories of change in children's development from infancy through age 5. This is the first study, to our knowledge, to identify trajectory subgroups *within* a sample of children of adolescent mothers. As such, our assumptions about the number and patterns of trajectories that might emerge are largely exploratory. However, drawing from previous work on children of adolescent mothers that indicates normative functioning in infancy, and mildly delayed performance by age 24 months (Jahromi et al., 2012), we anticipated that one group of children may show a declining performance from infancy through age 5. Further, based on work supporting the notion of stability in early normative mental development (Bornstein et al. 2006), and that from other high-risk populations revealing normative functioning in subgroups of children who are otherwise at high risk for cognitive delay (e.g., children with low-birth- weight; Liaw & Brooks-Gunn, 1993), we also expected to identify a subgroup of children characterized by stable, normative-average performance (i.e., within 1 standard deviation of the normative average) across early childhood. In our attempt to accurately describe variations in children's developmental functioning over time, we also control for child characteristics that may impact children's performance on developmental assessments. Child temperament represents a relatively stable, endogenous characteristic of the child that influences children's performance on standardized developmental measures (e.g., Bornstein et al., 2006) and could confound our assessment of continuity or discontinuity in children's mental developmental functioning. Thus, consistent with prior work that controlled for children's temperamental style in an attempt to better capture "pure" estimates of mental development on standardized measures (Bornstein et al., 2006), we control for children's temperamental effortful control at each time point.

Factors Associated With Children's Developmental Trajectories

Scholars have long argued that there is a critical need for more work exploring *why* cognitive problems increase with age in children of adolescent mothers (Coley & Chase-Landsdale, 1998). The second goal of the present study was to address this gap by examining factors associated with differing trajectories of children's developmental functioning from infancy through the preschool years. Our study was informed by an ecological framework, which emphasizes that human development is shaped in the context of children's interactions with their surrounding environments (Bronfenbrenner, 1989), and a risk and resiliency perspective (Masten & Coatsworth, 1998; Rutter, 1987), by considering how various socio-contextual resources and vulnerabilities may inform infants' developmental functioning and risk for delay. In our study we consider several contextual factors: family's socioeconomic status (i.e., family income), aspects of the child's physical environment (i.e., the presence of learning materials within the home), the adolescent mother's age and psychological well-being i.e., depressive symptoms), and an index of the adolescent mother's coparenting relationship with her mother figure concerning childrearing (i.e., coparenting conflict).

Children's Socioeconomic and Physical Context

It is well established that socioeconomic disadvantage has negative consequences for children's developmental outcomes (see Brook-Gunn & Duncan, 1997, for a review). Because the risk of poverty is high for Mexican-origin adolescent mothers (Berry, Shillington, Peak, & Hohman, 2000; Hoffman, 2008), their children are subsequently faced with multiple risks. Children living in poverty are 1.3 times more likely than their counterparts to suffer from developmental or intellectual disabilities, and these findings persist even after controlling for maternal age and education, marital status, and ethnicity (Brook-Gunn & Duncan, 1997). Indeed, epidemiological studies of intellectual disability have consistently reported that poverty status is significantly linked to mild and moderate levels of intellectual impairment in the general population (Leonard et al., 2005). In the present study we assess family income as an index of children's economic resources that may inform their developmental functioning.

Related to children's socioeconomic circumstances are aspects of their physical environment that could promote their mental development. Specifically, the child's home learning environment, which is comprised of cognitively stimulating materials and experiences (i.e., developmentally appropriate toys that promote learning; exposure to books and trips to the library), is a strong predictor of growth in mental development (Bradley & Corwyn, 2002) and achievement scores in elementary school (Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998). Adolescent mothers are generally found to provide less stimulating learning environments for their children than adult mothers (Luster & Dubow, 1990), possibly as a function of fewer resources and limited knowledge about children's development (Benasich & Brooks-Gunn, 1996). Moreover, research shows that the impact of learning resources on children's development becomes greater in conditions of cumulative risk (Brooks-Gunn & Chase-Lansdale, 1995), possibly because with fewer toys and books to facilitate interactions, parents may engage in even fewer and less meaningful exchanges with their children (Tomopoulos et al., 2006). Given the multiple risks associated with teen parenthood, it is important to understand how learning materials impact the mental functioning of children in this sample. Thus, in the present study, we expect children's home learning environment to promote more positive developmental trajectories.

Adolescent Mothers' Age and Psychosocial Functioning

Characteristics of the adolescent mother reflect another set of contextual factors that may inform children's cognitive development. Specifically, the adolescent's age or level of maturity may impact the quality of her interactions with her child, and thereby influence the child's development. Indeed, maternal age has been shown to significantly predict children's IQ scores at 3 years (Sommers et al., 2000) and at 6 years (Cornelius, et al., 2009) in samples of adolescent mothers.

Adolescents' psychosocial functioning may also impact her child's cognitive functioning. Given the demands faced by adolescent mothers as they simultaneously negotiate the challenges of young motherhood with normative developmental tasks of adolescence, they are at increased risk for depressive symptoms compared to both adult mothers and non-parenting adolescents (Figueiredo, Bifulco, Pacheco, Costa, & Magarinho, 2006; Lanzi,

Bert, & Jacobs, 2009; Mollborn & Morningstar, 2009). This increased risk of depression has consequences for their children's development, as children of depressed mothers are at risk for poorer cognitive functioning (e.g., Campbell, Matestic, von Stauffenberg, Mohan, & Kirchner, 2007; Cogil, Caplan, Alexandra, Robson, & Kumar, 1986; Petterson & Albers, 2001). For example, Campbell et al. (2007) found that, in first grade, children whose mothers showed low or moderate depression performed higher on the Woodcock Johnson cognitive assessment than those who had mothers with increasing trajectories of depressive symptoms. Moreover, in a study of parental depressive symptoms and child outcomes in low-income Latino children, Valdez, Shewakramani, Goldberg and Padilla (2013) found parental depressive symptoms to be linked to children's social competence in the first grade. A consideration of adolescent mothers' depressive symptoms is especially warranted in our study, given that Latina youth have higher suicidal behavior compared to youth in other ethnic and cultural groups (Zayas, Lester, Cabassa, & Fortuna, 2005; Zayas & Pilat, 2008). In the present study, we examine whether adolescent mothers' depressive symptoms predict children's discrete developmental trajectories.

Coparenting Relationship

Support from family, particularly that from adolescents' own mothers, has been identified as an important predictor of Latina adolescents' parenting (Contreras, Narang, Ikhlas, & Teachman, 2002; Grau, Azmitia, & Quattlebaum, 2009). Adolescent mothers frequently reside with their families (Manlove, Mariner, & Papillo, 2000) and are likely to form coparenting relationships with their own mothers (Pittman & Coley, 2011). The quality of the coparenting relationship has important consequences for various domains of children's development, including cognitive functioning. For example, Porter, Wouden-Miller, Silva, and Porter (2003) found that, among married couples, interparental conflict in infancy was associated with concurrently lower cognitive performance (i.e., lower scores on the Bayley MDI). Moreover, in a nationally-representative sample, couples' child-related conflict in infancy was shown to prospectively predict children's cognitive development (Bayley MDI score) at 2 years, even after controlling for confounding factors (Pendry & Adam, 2013). Porter et al. (2003) propose that those parents who experience greater coparental conflict may be less emotionally available to their children and less engaged in cognitively stimulating interactions. It will be important to understand whether there are similar implications for the children of adolescent mothers as a function of their mothers' coparenting relationships with their grandmothers. In the present study, we expect that coparenting conflict between adolescent mothers and their own mother figures will be related to trajectories of poorer developmental functioning among their children.

Current Study

The present study sought to identify trajectories of children's mental development from infancy to 5 years of age. We expected that at least two possible trajectories might emerge, (a) a stable pattern of normative developmental functioning, and (b) a pattern of functioning indicating normative functioning in infancy followed by decreases in mental development across the preschool years up to age 5. The second goal of our study was to identify predictors of these distinct trajectories. We expected that children with greater

socioeconomic resources and access to more learning materials would have higher and more stable levels of mental development across time. Children whose mothers were younger, who reported greater depressive symptoms, and who reported greater coparental conflict with their own mothers were expected to show a declining pattern of developmental functioning over time.

Method

Data for the current study came from a 6-wave longitudinal project focused on Mexican-origin adolescent mothers, their mother figures ($N=204$ dyads), and their young children. Adolescent mothers were recruited into the study (Wave 1) when they were in their third trimester of pregnancy ($M_{\text{weeks}} = 30.9$, $SD = 4.52$). Adolescent mothers and their children were assessed again when the child (42.2% girls) was, on average, 10.15 months (W2; $SD = .26$), 24.14 months (W3; $SD = .23$), 36.21 months (W4; $SD = .45$), 48.39 months (W5; $SD = 1.33$), and 60.41 months old (W6; $SD = .50$). On average, at W1, adolescent mothers were 16.80 years old ($SD = 1.00$), and mother figures were 41.15 ($SD = 7.01$) years old. A majority of adolescent mothers coresided with their mother figures at W1 (86.8%), and this number decreased across time (W2 = 69.4%, W3 = 59.3%, W4 = 50.6%, W5 = 43.9%; W6 = 36.3%). Mother figures included adolescents' biological mothers (88.2%), grandmothers (2.9 %), aunts (2.0%), boyfriend's mothers (3.4%), and other kin (3.5%). With respect to nativity, 64.2% of adolescent mothers and 30.4% of mother figures were born in the United States. The mean family income before the birth of the baby (W1) was \$27,323 ($SD = \$19,893$), and after the birth of the baby (W2) was \$23,414 ($SD = \$18,312$).

Procedures

Adolescent mothers were recruited from high schools, social service agencies, and health and community centers. To be eligible to participate in the study, adolescent mothers had to (a) be of Mexican origin and between the ages of 15 and 18 years old, (b) be unmarried, and (c) have a mother figure who was willing to participate with them in the study. Parental consent and, when applicable, youth assent (when adolescent mothers were under the age of 18 years old) was obtained at the start of the study. Data were collected via face-to-face interviews lasting about 2.5 hours. Adolescents and mother figures were interviewed in their language of choice. At W1 a majority of adolescent mothers chose to be interviewed in English (61.3%), whereas a majority of mother figures chose to be interviewed in Spanish (69.1%).

Measures

Children's developmental functioning (W2–W6).—To assess children's developmental functioning at W2 and W3 (when the child was approximately 10 and 24 months old, respectively) we used the Bayley Scales of Infant Development- Second Edition (BSID-II; Bayley, 1993). The BSID-II measures developmental functioning for children ages 1 to 42 months. The measure was translated for children whose primary language was Spanish. Items were translated into Spanish and translated back into English by two separate bilingual individuals. Discrepancies were resolved following guidelines described by Knight, Roosa, and Umaña-Taylor (2009). The translated version of the measure was

administered in the same standard manner as the English version. The Mental Development Index (MDI) score derived from the BSID was used as a measure of child developmental functioning in the current study. The MDI has demonstrated good scale reliability (Bayley, 1993).

At W4, W5, and W6 (when the child was approximately 36, 48, and 60 months old, respectively), we assessed children's developmental functioning using the Woodcock Johnson III Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2000). Children whose primary language was Spanish were assessed using the *Batería III Woodcock-Muñoz* (Batería-III; Muoz-Sandoval, Woodcock, McGrew, & Mather, 2005). Both tests are designed to be administered to respondents ranging in age from 2 to 90 years and have been reported to show high internal and test-retest reliability by their developers. Each test provides a standardized, normative score that enables a comparison of the respondent's score against the national average for that respondent's age (i.e., age-equivalence). Children were administered three subtests from the WJ-III and Bateria-III that were identified as appropriate for preschool- aged children: (a) Letter-Word Identification (*Identificación de letras y palabras*); (b) Applied Problems (*Problemas aplicados*); and (c) Picture Vocabulary (*Vocabulario sobre dibujos*). On each test, the child's raw score (i.e., sum of correct responses) was converted to a standardized score called a *W* score using the WJ III Compuscore program provided by the test developers. Additionally, children were administered the Peabody Picture Vocabulary Test-IV (PPVT-IV; Dunn & Dunn, 2007) during W4, W5, and W6 to assess their receptive vocabulary skills. For children whose primary language was Spanish, we used the *Test de Vocabulario en Imágenes Peabody* (TVIP; Dunn, Padilla, Lugo, & Dunn, 1986). The TVIP is based on a translation of 125 items from the PPVT-R, a previous version of the PPVT. Like the PPVT, the TVIP requires children to correctly identify an item after hearing the word by pointing to one of four presented pictures. The developers of these measures report high internal and test-retest reliability. In the current study, we averaged children's PPVT/TVIP score and their scores from the Letter-Word Identification, Applied Problems, and Picture Vocabulary scores of the Woodcock Johnson III Test of Achievement to reflect children's developmental functioning.

Children's effortful control (W2–W6).—Across the study period, adolescent mothers reported on their children's effortful control using measures of temperament. First, at W2, the Infant Behavior Questionnaire Revised (IBQ– R; Gartstein & Rothbart, 2003) was used. The questionnaire utilizes four subscales (duration of orienting, 12 items; sociability, 18 items; low pleasure, 13 items; and cuddliness, 17 items) to assess children's behavior related to sleeping, bathing, dressing, playing, and daily activities in the past week, as well as general behaviors (e.g., soothing techniques) over the past 2 weeks. Items on each subscale were scored on a Likert scale from 1 (*never*) to 7 (*always*). An average score was computed across subscales, with higher scores indicating greater effortful control (called “Orienting/ Regulation” at W2). The scale demonstrated adequate reliability for the current study ($\alpha = .90$). At W3, the very short version of the Early Childhood Behavior Questionnaire was used (Putnam, Garstein, & Rothbart, 2006). The effortful control subscale contains 12 items assessing children's effortful control, with responses ranging from 1 (*never*) to 7 (*always*). An average score was computed across items, with higher scores indicating greater effortful

control. The reliability for this scale was $\alpha = .58$. Finally, at W4, W5, and W6, we used the very short form of the Child Behavior Questionnaire (CBQ; Putnam & Rothbart, 2006) to assess mothers' reports of their children's effortful control. Using 12 items, adolescent mothers were asked to indicate whether each item was a "true" or "false" description of the child's typical behavior in the last 6 months. Items on each subscale were scored on a 7-point Likert-type scale from 1 (*extremely false*) to 7 (*extremely true*). The subscale demonstrated adequate reliability in the current study ($\alpha_{W4} = .71$; $\alpha_{W5} = .75$; $\alpha_{W6} = .67$). This construct served as a covariate.

Individual and contextual predictors.—In addition to age and nativity, which were reported at W1, adolescent mothers also reported on a number of individual and contextual predictors at W2. First, *family income* was assessed using self-reports of mother-figures' annual income, funds received from other household members (e.g., adolescent mother), and public assistance.

Adolescent mothers' *coparental conflict* with their mother figure at W2 was assessed using an adapted version of the conflict subscale of the Coparental Communication Scale (Ahrons, 1981; Herzog, Umaña-Taylor, Madden-Derdich, & Leonard, 2007). Using 4 items, adolescent mothers reported on the conflict and tension present when discussing parenting issues (e.g., "Since the baby was born, when you and (mother-figure's name) discuss parenting issues, how often does it result in an argument?"). Responses ranged from 1 (*never*) to 5 (*always*), with higher scores indicating more conflict in the coparenting relationship. Cronbach's alpha for the current study was .86.

Adolescent mothers' W2 *depressive symptoms* were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). Mothers responded to 20 items (e.g., "I was bothered by things that usually don't bother me") that assessed the frequency of depressive symptoms in the past week. Items were scored on a 4-point Likert scale ranging from 0 (*rarely or none of the time (less than 1 day)*) to 3 (*mostly or almost all the time (5–7 days)*), and responses were averaged with higher values indicating more depressive symptoms. The scale demonstrated adequate internal consistency in the current study ($\alpha = .89$).

Learning materials in the home at W2 were assessed using the Home Observation for Measurement of the Environment–Infant Toddler (HOME-IT; Caldwell & Bradley, 2003) learning materials subscale. The assessment measures aspects of the naturalistic environment in which the child is raised. The learning materials subscale consists of 9 items assessing the presence or absence of learning facilitators (e.g., eye-hand coordination toys) in the child's home environment. The ratings were made by home visit infant/child team research assistants, based on their observations during the entirety of the home visit. The lead and assistant interviewer conferred at the end of the home visit, came to consensus, and the final consensus-derived score was reported. Higher scores reflect more learning materials and a more enriched home environment.

Results

To identify distinct patterns of children's developmental trajectories, we conducted latent class growth analysis (LCGA) in Mplus (Version 7.2, Muthén & Muthén, 2010). Similar to latent growth modeling, LCGA is used to identify intra- individual growth in a particular construct over time. LCGA, however, allows for the possibility that not all individuals have similar trajectories and that subgroups of individuals with differing patterns might be present in a given sample. LCGA involves an iterative analytic process; researchers start with a single class solution and increase the number of classes to determine which solution best fits the data. To determine the best fitting LCGA solution, the current study used several criteria (Muthén & Muthén, 2010; Nylund, Asparuhov, & Muthén, 2007). First, we examined the Bayesian information criteria (BIC) and the adjusted BIC (ABIC). BIC and ABIC values closer to zero indicate a better fitting solution. We also examined the Lo-Mendell-Rubin (LMR) likelihood ratio test and the adjusted LMR likelihood ratio test. A significant LMR or adjusted LMR test suggests that the model with k number of classes fits the data better than the model with $k-1$ number of classes. Consistent with recommendations (Collins & Lanza, 2010), we first conducted an LCGA with no covariates or predictors in the model (Step 1). Next, we refit the model with covariates (i.e., effortful control at each time point; Step 2), and then individually included contextual/individual predictors of class membership (i.e. adolescent age, economic hardship, family income, adolescent-mother conflict, adolescent depressive symptoms, in-home learning materials, adolescent nativity; Step 3). For all LCGA analyses, maximum likelihood estimation was used and analyses included the full sample ($N = 204$). Below, we describe each step in detail.

Step 1: Children's Developmental Trajectories

First, four unconditional models were estimated that examined the growth trajectories in developmental functioning over time. Given that the means (as seen in Table 1) demonstrated an initial decline across the sample (from W2 to W3), but then an increase from W3 to W4 and stability from W4 to W6, we estimated both linear and quadratic components of growth in the analyses. We included W1 adolescent mothers' age in the model to account for missing data and allow for full information maximum estimation (Enders, 2010). Table 2 presents the fit indices and class probabilities across the four models. The BIC and ABIC declined across the first three models (i.e., Class 1 to Class 3), but increased (BIC) or stayed the same (ABIC) in the Class 4 model, suggesting that the Class 3 model was the best fitting solution. Aligning with the BIC and ABIC statistics, the LMR and adjusted LMR test were significant for Class 3, but not for Class 4. Given this, the three-class solution was chosen as the best fitting model. Examination of the growth parameters (presented in Table 3, Step 1), revealed that a small group of children ($n = 20$; 9.8%) exhibited a significant initial decline in functioning, that slowed across time. Given that scores dropped below 80 after W2 and ended around 70 (i.e., 2 standard deviations below the normative mean) at W6, the group was named *Delayed/Decreasing Functioning*. The second, and most common pattern to emerge, was a group characterized by an initial decline in developmental functioning that improved across time ($n = 148$; 72.5%). As seen in Figure 1a, children in this trajectory maintained above the score of 80 across time, but ended with a score around 85 at W6 (i.e., one standard deviation below the normative mean).

This group was named *At-Risk/Recovering Functioning*. Finally, a small group ($n = 36$; 17.6%; Figure 1a) emerged that did not change across time (nonsignificant linear and quadratic slope), consistently exhibited scores within normal limits, and ended with a score around 100 at W6 (i.e., the normative mean). Therefore, this group was named *Normative/Stable Functioning*.

Step 2: Children's Developmental Trajectories Controlling for Effortful Control

Next, we refit the 3-class LCGA solution, accounting for children's effortful control. Specifically, children's developmental functioning score at each time point was regressed on their corresponding score of effortful control (e.g., W2 developmental functioning score regressed on W2 effortful control score; W3 developmental functioning score regressed on W3 effortful control score, and so forth). This approach allowed for the developmental growth trajectories to be estimated, accounting for effortful control at each time point. Thus, from a conceptual perspective, the second model is important because it controls for an important factor that is thought to impact performance on developmental functioning assessments. Table 2, Step 2, presents each group's growth parameters, and Figure 1b presents the graphed trajectories.

Step 3: Predictors of Children's Developmental Trajectories

In our final step, we refit the LCGA 3-class solution and included individual and contextual predictors of class membership using the model from Step 2 (i.e., including effort control as a covariate at each wave). Given the model complexities, each individual and contextual predictor was included in a separate model. Our first series of models used the *Normative/Stable Functioning* profile as the reference class; we examined if the individual or contextual predictors differentiated class membership between (a) the *Normative/Stable Functioning* class and the *Delayed/Decreasing Functioning* and (b) the *Normative/Stable Functioning* class and the *At-Risk/Recovering Functioning* class. Results revealed that mothers' age did not differentiate class membership between the *Delayed/Decreasing Functioning* and the *Normative/Stable Functioning* classes (Table 4). Family income ($b = -.06$, Standard Error (SE) = .03), $p < .05$, adolescent-mother conflict ($b = .90$, $SE = .44$, $p < .05$), adolescent mothers' depressive symptoms ($b = 2.19$, $SE = .75$, $p < .01$), and children's in-home learning materials ($b = -.32$, $SE = .16$, $p < .05$) did differentiate the groups, suggesting that lower family income, greater adolescent-mother conflict, greater mothers' depressive symptoms, and fewer in-home learning materials predicted a greater likelihood of being in the *Delayed/Decreasing Functioning* class compared to the *Normative/Stable Functioning* class. Note that maternal nativity ($b = 1.30$, $SE = .76$, $p < .085$) emerged as a marginally significant predictor suggesting that being foreign born related to a greater likelihood of being in the *Delayed/Decreasing Functioning* than in the *Normative/Stable Functioning* class. Similar differences emerged in the comparisons between the *At-Risk/Recovering Functioning* class and the *Normative/Stable Functioning* class. Specifically, younger mothers' age at W1 ($b = -.63$, $SE = .26$, $p < .05$), greater adolescent-mother conflict ($b = .74$, $SE = .33$, $p < .05$), greater adolescent depressive symptoms ($b = 1.52$, $SE = .57$, $p < .01$), and fewer in-home learning materials ($b = -.28$, $SE = .10$, $p < .01$) predicted a greater likelihood of being in the *At-Risk/Recovering Functioning* class compared to the *Normative/Stable Functioning* class.

Mothers' nativity and family income did not differentiate the *At-Risk Recovering Functioning* class and the *Normative/Stable Functioning* Class.

Next, we used the *At-Risk Recovering Functioning* class as the reference class to examine if individual/contextual predictors differentiated membership between the At-Risk Recovering Functioning class and the Delayed/Decreasing Functioning class. Results revealed that family income was a marginally significant predictor ($b = -.05$, $SE = .03$, $p < .099$), suggesting that lower family income predicted a greater likelihood of being in the Delayed/Decreasing Functioning class compared to the *At-Risk Recovering Functioning* class. All other individual and contextual predictors were not significant, suggesting that mothers' age, maternal nativity, adolescent-mother conflict, adolescent depressive symptoms, and in-home learning materials did not predict membership differences in the two classes (Table 4).

Discussion

The present study extends research on the developmental functioning of children of adolescent mothers across early childhood by identifying distinct trajectories of change in children's development from infancy through age 5. Among the notable findings from our study was the fact that, despite the known cumulative risks affecting families of children of Mexican-origin adolescent mothers, many children in our sample were performing at or near normative levels of developmental functioning by age 5. Importantly, the study also revealed that not all children showed the same patterns of functioning across early development; and our findings offer important information about the significant role of the home environment and the parenting context, in particular, that may serve as points of intervention for families of adolescent mothers.

Our findings revealed three distinct patterns of children's development functioning trajectories. Two groups were consistent with our expectations. The first was a subgroup of children who consistently scored within 1 standard deviation of the normative mean across all time points, and was considered to have *Normative/Stable Functioning*. Just under one-fifth of the sample fell into this trajectory group. Given the host of challenges affecting many families of adolescent mothers, this group could represent children who show resilience in the face of adversity. Findings from other environmentally high-risk groups have found a similar group of high or average performing children. For example, in a study of longitudinal changes in the cognitive performance of low-income African American children, researchers have found both above-average/increasing and above-average/stable groups of children who, despite ecological disadvantages, showed positive development when offered early intervention (Burchinal et al., 1997; Ramey, Lee, & Burchinal, 1989). Similarly, in children who are at risk for developmental delay due to low-birth-weight status, Liaw and Brooks-Gunn (1993) also found groups of children with high and average-stable trajectories of development. This group of children can be particularly informative to us as we strive to better understand what factors enable some children to thrive in the face of disadvantage.

In contrast to the previously mentioned group, we identified a subgroup of children who showed a significant decline in developmental functioning after 10 months. When compared

to norm-referenced levels of performance (i.e., $M = 100$ and $SD = 15$), this group initially scored in the normative average range (i.e., within normal limits) at 10 months, but fell to more than 1 standard deviation below the mean by 24 months (i.e., mildly delayed performance), approximately 2.5 standard deviations below the mean by age 36 and 48 months (i.e., delayed performance), and ended at approximately 2 standard deviations below the mean (delayed performance) at 60 months. Thus, this group, which was composed of just under one-tenth of the children in our sample, reflected a *Delayed/Decreasing* trajectory of developmental change. This group is consistent with much of the work on children of adolescent mothers, which reports various levels of intellectual disabilities in this population (Borkowski et al., 2004). Our finding also reveals that the most significant deficits may appear around age 3, when children's performance dips from mildly delayed levels to delayed levels of performance. This pattern of a dip after infancy is also consistent with that found for children in Burchinal et al.'s (1997) study of at-risk African American children, who showed approximately average cognitive performance in infancy (i.e., 6 months) followed by a marked dip at around 24 months, when the standardized developmental testing becomes more verbal.

Finally, and perhaps most interesting, a third group of children emerged who showed developmental functioning that fell from a normative average level at 10 months to mildly delayed functioning at 24, 36, and 48 months, followed by an increase in performance to within normal limits by 60 months. Thus, although this group showed an initial decline in performance through age 48 months, they regained performance to a normative level by 60 months. As such, this group of children, the largest group identified by our study (almost three-fourths of the sample), was considered to show an *At Risk/Recovering* pattern of developmental functioning. It is interesting that this group of children began to show their recovery from their initial at-risk status after 3 years of age, which is a period when many children begin to attend preschool and may be exposed to many socially and cognitively stimulating experiences that may facilitate their developmental functioning. It is conceivable that those children who had more exposure to language-rich environments with peers and adults may have shown the most recovery. Indeed the high-risk African American children in Burchinal et al.'s (1997) study who were enrolled in a high-quality preschool intervention showed higher cognitive performance and less of a decline in cognitive performance over time. Thus, future work should thoroughly explore whether quality preschool has an impact on the developmental trajectory patterns of children of adolescent parents.

Considering normative developmental patterns may also help explain the growth that occurred in this subgroup after 36 months. At about this time in development, many children begin to show marked improvements in aspects of their development related to their executive function, an umbrella term describing a constellation of skills necessary for purposeful, goal-directed activity (Pennington & Ozonoff, 1996). Children generally show a spurt in development of executive function between 3 and 7 years of age (Diamond, 2002). Although such development may not directly inform children's IQ, it may be that as children develop greater executive function (EF) skills, they are more receptive to, and engaged with, the stimulating aspects of their environment that may positively impact their overall developmental functioning. Thus, perhaps for this subgroup of children, their burgeoning EF capacities after age 3 may have served to facilitate growth in developmental functioning

between 36 and 60 months. Future work should aim to understand how growth in such skills impacts these children's developmental functioning trajectories. Understanding how these children fare through their early elementary school years and beyond will be an important next step for research.

It is also important to note how the performance of children in our study compared to that observed in larger samples of Mexican American children. No study, to our knowledge, has identified distinct developmental trajectories among Mexican American children to which we could compare the trajectories identified in the current study. However, nationally representative studies comparing the cognitive and language performance of Mexican American children to their White peers have revealed that, although gross disparities are not discernible before about two years of age (Fuller et al., 2009), there is a gap in performance that emerges between ages 2 to 4 years, such that Mexican American children perform at roughly three-fourths of a standard deviation below their White peers on cognitive and language measures (Guerrero et al., 2013). Interestingly, data from the present study suggest that children's average developmental functioning by 5 years of age (i.e., aggregated across trajectory groups) is approximately three-fourths of a standard deviation below *normative* averages, suggesting a similar degree of disparity between children of Mexican-origin adolescent mothers with the broader population on which the tests were normed.

Socio-Contextual Predictors of Developmental Functioning Trajectories

In addition to identifying children's different patterns of developmental functioning, we sought to understand the sociocontextual factors that predicted these distinct trajectories in an effort to extend knowledge on possible intervention targets to reduce some of the developmental disparities between groups of children. We expected that children with greater socioeconomic resources and access to more learning materials would have higher and more stable levels of mental development across time, whereas those whose mothers were younger, who reported greater depressive symptoms, and who reported greater coparental conflict with their own mothers were expected to show a declining pattern of developmental functioning over time.

Findings concerning economic circumstances and children's physical environment revealed that families of children in the Delayed/Decreasing group had lower reported incomes and fewer learning materials than those in the *Normative/Stable Functioning* group, who also had more learning materials than those in the *At Risk/Recovering* group. Together, these findings point to the importance of material resources for children's developmental functioning across early childhood. Family incomes may affect their development through a multitude of factors, including exposure to household stress, access to proper nutrition and healthcare, and even exposure to environmental toxins that may undermine cognitive development (Johnson, Theberge, & National Center for Children in Poverty, 2007; Koger, Schettler, & Weiss, 2005). Moreover, although the households of adolescent mothers are believed, on average, to provide less cognitive stimulation (Luster & Dubow, 1990), our findings revealed that those children who were exposed to more learning materials fare better in developmental functioning. These findings highlight the potential importance of interventions that promote knowledge of stimulating activities and practices (e.g., trips to the

library; reading books to their children) to young mothers, who may have more limited knowledge of children's development than adult mothers.

Finally, several aspects of the adolescent's psychosocial well-being and coparental relationship with her mother figure were related to her child's developmental trajectories. Specifically, children in the *Normative/Stable Functioning* group had mothers with lower depression, and lower coparental conflict with their mother figures as compared to both the *Delayed/Decreasing* group and *At-Risk/Recovering* group. Thus, our findings are consistent with studies indicating that, in general, aspects of the environment that may be related to less stress and improved emotional well-being of adolescent mothers can have important consequences for their children. Our work is in line with previous findings that children of depressed mothers are at risk for poorer cognitive functioning (e.g., Campbell et al., 2007; Cogill, Caplan, Alexandra, Robson, & Kumar, 1986; Petterson & Albers, 2001). It may be that family-based interventions designed to not only address parental depression in Latino families, but also to promote families' understanding of how depressive symptoms may impact family members' relational patterns and ultimately their children (e.g., Fortalezas Familiares; Valdez, Abegglen, & Hauser, 2013), could be particularly effective for the families of Mexican-origin adolescent mothers. Moreover, our findings extend work on the role of couples' coparental relationship for their children's development (e.g., Pendry & Adam, 2013) to the adolescent mother-mother figure dyad. It may be, as Porter et al. (2003) suggest, that those adolescent mothers who perceive greater coparental conflict with their own mothers may be less emotionally available to their children and less engaged in cognitively stimulating interactions. It may also be that conflict with the grandmother arises as a function of adolescents' inadequate parenting practices, which have negative influences on their children, or that conflict arises *because of* children's delays. Future work is needed to further explore the influence of the parenting dynamics of adolescent mothers and their mother figures, as well as those of the adolescent mother and the child's father on children's development. Moreover, future studies should explore antecedents of adolescent mothers' coparenting conflict to identify possible family-level risk factors (e.g., differences in acculturation between adolescent and her mother figure; e.g., Phinney & Vedder, 2006), that may promote poorer children's outcomes through coparenting conflict.

With respect to demographic predictors, adolescent mothers' age at the time of the child's birth predicted children's likelihood of membership in the *At-Risk/Recovering* group compared to the *Normative/Stable Functioning* group. Prior work has demonstrated differences in the risk factors associated with adjustment to adolescent parenthood at different developmental periods, with females who become pregnant during *early* adolescence versus *late* adolescence having poorer outcomes for themselves and their children (Miller-Johnson et al., 1999). In addition, we found that nativity was a marginally significant predictor of greater likelihood of being in the *Delayed/Decreasing* group than the *Normative/Stable* group. Although only a trend, this finding may reflect adolescent mothers' access to resources, as there is some evidence that Latino immigrant families are more likely to reside in more disadvantaged neighborhoods with more problematic, under-resourced schools (Crosnoe & Lopez-Turley, 2011). It will be important for future work to continue to examine within group processes with larger, and more adequately powered, samples of immigrant families to detect potential nativity differences. Overall, our study

offers an important first step to understanding the role of significant ecological risk and promotive factors that inform patterns of children's developmental functioning. It should be noted that ours was not an exhaustive list of possible individual and contextual factors, and that, due to model complexity, we considered the role of each predictor separately. Future work should aim to identify those factors that are most salient and have the greatest relative impact on children's development.

Limitations and Future Directions

This study is the first, to our knowledge, to identify developmental latent trajectory subgroups within a sample of children of adolescent mothers across early childhood, and to link children's developmental patterns with specific sociocontextual promotive and risk factors. Despite its strengths, our study is not without limitations. First, there are several important factors that may have influenced children's developmental functioning (e.g., adolescent mothers' IQ), that were not measured in the current study. To fully capture predictors of individual differences in children's mental development, future studies would benefit from measuring such processes. Moreover, our study did not examine the mechanism of influence between predictors and children's developmental trajectories. For example, as has been suggested by previous research, learning materials may negatively affect child outcomes via parent-child interactions, such that exposure to fewer such material resources undermines parents' stimulating interactions and vocalizations with their children, thereby impacting children's development (Tomopoulos et al., 2006). Future work would benefit from a more nuanced examination of these possible mechanisms of influence.

Given the importance of studying developmental trajectories in children of adolescent mothers, a strength of our study was its ethnic-homogenous design, which enabled us to explore within-group variability and identify discrete trajectories of development among a high-risk group of children. Nevertheless, our findings pertain to a specific population of adolescent mothers (i.e., Mexican-origin 15 to 18 year olds living in a southwest metropolitan area) and future work should aim to extend these findings to other populations of adolescent mothers. Finally, because of our modest sample size, and because one of the trajectory subgroups was comprised of less than 10% of the sample, our examination of predictors of developmental trajectories was conservative due to limited statistical power resulting from the relatively small cell sizes in some trajectory subgroups. Future studies with larger samples will be important for expanding on our understanding of the predictors of within-group variability in samples of adolescent mothers.

Finally, given the need to use developmentally appropriate measures to assess children's developmental functioning from infancy to childhood, there was an unavoidable change in measures across time (i.e., Bayley MDI at 10 months and 24 months; Woodcock Johnson and PPVT at 36, 48, and 60 months) that may have contributed measurement error to the findings. However, consistent with prior longitudinal work examining patterns of growth in children's development (e.g., Burchinal, Campbell, Wasik, & Ramey, 1997; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Liaw & Brooks-Gunn, 1993) that also changed measures across developmental periods, assessments used in the present study were chosen based on methodological and conceptual consistency across time (i.e., all were

age-normed scales that have a standard score with Mean = 100 and $SD = 15$ in the general population, allowing us to consistently capture the broader notion of developmental functioning and delay at each time point). Thus, although not without limitation, our study is an important first step in understanding different patterns of change over time in children's developmental functioning.

Conclusion

Our study makes an important contribution to our knowledge of the developmental functioning of children of Mexican-origin adolescent mothers from infancy through the preschool years. Specifically, our study identified distinct developmental trajectory groups that show different patterns of developmental functioning across early childhood. Despite finding a clear risk of disability among some children in our sample, we also found evidence of healthy development among others, and in some cases, improving outcomes over time. Moreover, we found that children whose families had higher income and more learning materials in the house had better developmental outcomes than those whose mothers experienced greater depressive symptoms and those whose adolescent mother/mother figure coparental relationship was marked with greater conflict. Our study informs interventions serving Mexican-origin adolescent mothers and their children as to the aspects of adolescent well-being and familial relationships that may help promote better outcomes for their young children.

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Figure 1. LCGA initial 3-class solution (a) and controlling for effortful control (b). *Note:* LCGA latent class growth analysis.

Table 1

Descriptive Information for Study Variables

Item	Mean	SD	Range
W2 developmental functioning score	93.27	7.17	70.00–115.00
W3 developmental functioning score	84.12	11.83	60.00–124.00
W4 developmental functioning score	87.14	8.64	63.50–111.75
W5 developmental functioning score	86.28	10.65	56.00–108.25
W6 developmental functioning score	88.02	10.42	56.50–111.25
W2 effortful control	4.66	.60	3.24–6.66
W3 effortful control	4.38	.68	2.42–6.64
W4 effortful control	4.97	.75	2.67–7.00
W5 effortful control	5.22	.71	2.33–7.00
W6 effortful control	5.31	.64	3.00–7.00
Mother's nativity (0 = Mexico-born; 1 = U.S.-born)	.64	.48	0.00–1.00
W2 Mothers' age at birth	17.76	1.00	15.92–19.92
W2 Family income	\$23,415	\$18,312	\$500–\$110,000
W2 Mother-Grandmother conflict	1.99	.85	1.00–5.00
W2 Mother depressive symptoms	.87	.56	.00–2.35
W2 In-home learning materials	2.91	2.74	.00–9.00

Note. For descriptive information, sample size varied from 133 to 204 due to missing data. For all latent class growth analyses (LCGAs), however, maximum likelihood estimation was used and included the full sample ($N = 204$). W2 = Wave 2; W3 = Wave 3; W4 = Wave 4; W5 = Wave 5; W6 = Wave 6. W2 and W3 developmental functioning assessed using scores were the Bayley Scales of Infant Development; W4, W5, and W6 developmental functioning scores were assessed using the Woodcock Johnson III Tests of Achievement and the Peabody Picture Vocabulary Test.

Table 2

Model Fit Indices for Initial Latent Class Growth Analyses (N = 204 Children)

Class	BIC	ABIC	LMR <i>p</i> Value	Adjusted LMR <i>p</i> Value	Class Assignment Probabilities
1	6173.14	6154.13	-	-	-
2	6063.65	6028.80	.16	.17	.83, .84
3	6022.13	5971.43	.000	.000	.90, .86, .87
4	6037.63	5971.09	.48	.49	.87, .86, .76, .68

Note. BIC = Bayesian information criteria; ABIC = adjusted Bayesian information criteria; LMR = Lo-Mendal-Rubin; Bolded solution was the final solution.

Table 3

Growth Parameters for Children's Developmental Trajectories

Step	Intercept	Linear Slope	Quadratic Slope
Step 1: LCGM			
Delayed/decreasing functioning (n = 20)	87.78 (2.04) ***	-14.13 (2.98) ***	2.52 (0.70) ***
At-risk/recovering functioning (n = 148)	92.00 (0.65) ***	-7.45 (0.89) ***	1.58 (0.21) ***
Normative/stable functioning (n = 36)	95.60 (1.16) ***	-.61 (1.61)	.41 (0.38)
Step 2: LCGA with effortful control			
Delayed/decreasing functioning (n = 18)	83.87 (4.81) ***	-14.09 (6.65) *	2.75 (1.48) †
At-risk/recovering functioning (n = 151)	88.49 (4.17) ***	-8.27 (4.90) †	2.03 (1.20) †
Normative/stable functioning (n = 35)	92.45 (4.02) ***	-2.06 (4.91)	1.03 (1.25)

Note. LCGA = latent class growth analysis.

† $p < .10$,

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Table 4

Individual and Contextual Predictors of Developmental Functioning Profiles

Item	Delayed/Decreasing vs. Normative/Stable Logit (SE)	At-Risk/Recovering vs. Normative/Stable Logit (SE)	Delayed/Decreasing vs. At-Risk/Recovering Logit (SE)
Mothers' age	-1.10 (.72)	-.63 (.26) [*]	-.48 (.68)
Maternal nativity	1.30 (.76) [†]	.82 (.54)	.49 (.62)
Family income	-.06 (.03) [*]	-.01 (.01)	-.05 (.03) [†]
Adolescent-mother conflict	.90 (.44) [*]	.74 (.33) [*]	.17 (.34)
Adolescent depressive symptoms	2.19 (.75) ^{**}	1.52 (.57) ^{**}	.67 (.51)
Learning materials	-.32 (.16) [*]	-.28 (.10) ^{**}	-.05 (.14)

Note.

[†] $p < .10$,

^{*} $p < .05$,

^{**} $p < .01$;

Given the model complexities, each individual and contextual predictor was included in a separate model. Maternal nativity coded 1 = U.S.-born, 2 = Mexico-born. Note that the inclusion of predictor variables can change the grouping structure of the previously identified classes; however, in the current analyses, these changes were minimal—the *Delayed/Decreasing Functioning* class sample size ranged from 17 to 21; the *At-Risk/Recovering Functioning* class sample size ranged from 145 to 156, and the *Normative/Stable Functioning* class sample size ranged from 30 to 41.