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The Health and Cognitive Growth of Latino Toddlers: At Risk or Immigrant Paradox?

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Abstract Epidemiologists have shown how birth outcomes are generally robust for immigrant Latina mothers, despite often situated in poor households, advanced by their strong prenatal and nutritional practices. But little is known about (1) how these protective factors may differ among Latino subgroups, (2) the extent to which birth outcomes, ongoing maternal practices, and family supports advance Latino toddlers' health and physical growth, and (3) whether the same processes advance toddlers' early cognitive growth. We drew on a national probability sample of 8,114 infants born in 2001, including 1,450 of diverse Latino origins. Data come from birth records, maternal interviews when the child was 9 and 24 months of age, and direct assessments of health status, physical growth, and cognitive proficiencies. Descriptive analyses compared Mexican-heritage and other Latino mothers and toddlers relative to middle-class whites. Multivariate regression techniques identified predictors of child health, weight, and BMI, as well as cognitive proficiencies at 24 months. Infants of Mexican-heritage or less acculturated Latina mothers displayed robust birth outcomes, compared with other ethnic groups. The low incidence of premature births and low birthweight among these mothers continued to advance their cognitive growth through 24 months of age. Yet Latino children overall displayed smaller gains in cognitive proficiencies between 9 and 24 months, compared with middle-class populations, attributable to Latinas' lower levels of maternal education, weaker preliteracy practices, and a higher ratio of children per resident adult. Health practitioners should recognize that many Latina mothers display healthy prenatal practices and give birth to robust infants. But these early protective factors do not necessarily advance early cognitive growth. Screening practices, early interventions, and federal policy should become more sensitive to these countervailing dynamics.

Keywords Latino child health · Early cognitive growth · Maternal practices

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Background

The "culture of poverty" framework continues to shape how many researchers cast Latino families. Indeed, just under half (47%) of Mexican-American mothers with an infant live in a household that falls in the bottom quintile of socioeconomic status, compared with just 10% of (non-Latino) white mothers [1]. Latino 4-year-olds display lower rates of cognitive development prior to entering kindergarten (whether assessed in English or Spanish), when compared with middle-class white children [2, 3].

Yet epidemiologists and pediatric researchers have detailed how Latino newborns display robust birthweight and low mortality rates, comparable to infants of white parents, despite sizeable disparities in economic status [4]. This similar vitality of Latino newborns, along with generally strong prenatal practices, is consistently observed among immigrant subgroups, families that often live in

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poor conditions [5]. What's not known is whether these unexpected dynamics, termed the *immigrant paradox*, contribute to early health status, physical growth, and cognitive development over the child's initial two years of life.

Drawing on a national probability sample of 8,114 infants born in 2001, we describe mean differences in prenatal practices and birth outcomes among Latino subgroups, focusing on Mexican-Americans, when compared with whites. Second, we examine whether generally robust birth outcomes and protective factors displayed by Latino subgroups persist and contribute to toddlers' *health status* and *physical growth* through 24 months of age. Third, we estimate the influence of these predictors on children's early *cognitive development* between 9 and 24 months of age, testing whether protective and risk factors differentially affect development in health versus cognitive domains.

The epidemiological literature has detailed low mortality rates for Latino newborns nationwide, equaling 5.4 per 1,000 live births in 2001, compared with 5.7 for whites and 13.5 for African Americans [4]. In the same year, 6.5% of live births to Latina mothers were of low birth weight (<2,500 g) and 1.1% of very low birth weight (<1,500 g), compared with 6.8% and 1.2% for non-Latina white mothers, respectively. These paradoxical patterns are associated with healthy diets and lower smoking rates among pregnant Latina women [5]. But we know little about whether such protective factors persist to advance children's early health status, physical growth, or cognitive development.

Ecocultural theory, stemming from cultural psychology and pediatric research, offers a framework for explaining how culturally bounded maternal practices may condition biological determinants of early development, and how certain protective factors may diminish among second- and third-generation Latinas. We know much about how social behavior during pregnancy, variably sustained within ethnic groups, conditions the biological determinants of child health and cognitive growth. Low intake of calories or folic acids during pregnancy can lead to neural tube defects and low birthweight [6]. Prenatal smoking or alcohol consumption, spurred by proximal social norms or poor mental health, also contributes to infant mortality or the vitality of newborns [7]. Similarly, unhealthy mothers may fail to nurture secure attachment with their infant, placing the child's emotional security and early cognitive growth at risk. The interaction of social and biological dynamics is typically represented as moving from the pregnant mother's health and nutrition practices, shaping fetal development, and then influencing the vitality of newborns and infants' early health and cognitive growth [8].

But we know little about how this pathway may be conditioned by the mother's membership in a particular cultural group, or how prenatal and home practices may shift as immigrant mothers acculturate to novel social environments. Ecocultural theorists argue that parents reproduce child-rearing practices that are adaptive to the economic demands and implicit norms that hold utility within a particular ethnic or linguistic group [9, 10]. In turn, the child occupies a developmental niche in which normative behavior is socialized and cognitive demands are placed on the young child, representing adaptations to the expectations of the heritage culture or the novel environment [11]. Parents and children alike learn and reproduce expected behavioral scripts or cultural models, ranging from nutritious prenatal practices to whether reading with a toddler is tacitly expected within the group [12].

When the immigrant family's social ecology changes, maternal practices from the heritage culture may no longer hold utility, such as when first-generation Latina mothers report less frequent reading and preliteracy activities with their toddlers, compared with white middle-class mothers [13, 14]. Or, adaptations to the new environment, like acquiring the habit of consuming high-fat, processed foods among second- and third-generation parents lead to new risks for young Latino children [5].[1]

But little is known about how prenatal and early maternal practices may vary among Latino subgroups, and the extent to which these differences influence the health, physical growth, and cognitive development of young children. We examine four sets of factors—earlier theorized without specific regard to Latino populations—but which may help to explain children's health and cognitive development during the first two years of life.

Healthy Births and Brain Growth

Neuroscientists focusing on the interaction of prenatal practices and biological mediators emphasize the impact of low birthweight on infants' health and cognitive growth, at times constrained by damage to neurological structures caused by intracranial hemorrhaging, hypoglycemia, or malnutrition [17, 18]. Premature infants often display smaller head circumference and behavioral or attention problems [8].

[1] Initial evidence suggests that first-generation Latino children, paradoxically, are more engaged in school and often perform at higher levels, compared with the second generation, whether due to stronger family obligations, optimism about opportunities, or the selectivity parents migrating to the United States [15, 16].

Maternal Health and Parenting Practices

It remains unclear whether prenatal nutrition or postnatal practices, such as breastfeeding and healthy meal preparation, continue to advance the physical or cognitive development of toddlers. We do know that the mother's mental health can severely constrain her efficacy in nurturing an infant or toddler, manifest in unhealthy practices and weak attachment [19, 20]. Toddlers display steeper cognitive growth when a parent structures playful or engaging tasks which involve rich language and sensitivity to the child's utterances [21, 22]. Latina mothers overall engage less frequently in such purposeful cognitive facilitation, compared with white mothers [23].

Maternal Relationships and Efficacy

The mother's own relationships serve to model the attachment and warmth experienced by her infant. As Shonkoff and Phillips [8, p. 226] emphasize, "Starting with the mother's reproductive health and behavior… research has confirmed that what young children learn, how they react to events and people around them… are deeply affected by their relationships with parents" [8]. A family's sustained economic hardship, uneven social support, or when the mother perceives low efficacy in raising the child can undercut effective parenting and early development [20].

Family Support of Mother and Child

Maternal supports linked to the home's economic resources and social structure may further contribute to toddlers' health status and cognitive growth. The presence of an engaged father is associated with robust child development, operating via emotional support, learning activities, and guiding the child's socialization [15, 21, 23].[2] The presence of other adults may stimulate greater language use and place richer cognitive demands on the child. We know that each child situated in larger families receives less direct interaction and more constrained forms of language [25].

These four pathways have been theorized to help explain variation in young children's health and cognitive development for broad populations. But how do these predictive factors vary among mothers and toddlers among Latino subgroups, and vis-à-vis middle-class white populations? Second, do robust birth outcomes and associated protective factors persist to contribute to toddlers' *health status* and *physical growth* through 24 months of age. Third, do these or other protective factors advance the *cognitive development* of Latino toddlers? Our multivariate modeling strategy examines whether the four sets of predictors effectively unpack advantages or disadvantages experienced by Latino children, or whether unobserved cultural practices (not captured by the predictors) also operate on their early health, physical growth, and cognitive development.

Methods

Study Design

Drawing on a nationally representative sample of newborns, we first describe the birth outcomes, health, physical growth, and cognitive proficiencies of Latino children at 9 and 24 months of age, along with mean between-group differences in the theorized predictors. We then employ a panel-regression design, estimating child health and cognitive outcomes at 24 months for all children, after controlling for prior levels at 9 months and all covariates (reducing concern over endogeneity). We then test whether the mother's Latino membership or acculturation status further explains child health and cognitive outcomes, indicating whether unobserved risk or protective factors operate differently for certain subgroups.

Sample and Data

The Early Childhood Longitudinal Study (ECLS-B), directed by the National Center for Education Statistics, sampled 13,921 births from 114 primary sampling units (counties) in 2001, and successfully fielded 10,688 home visits and child assessments at about 9 months following each birth (77%) [14, 26]. ECLS-B statisticians calculated sampling weights to ensure that estimated means can be generalized to the nation. Since our study focused on the effects of maternal practices, we set aside households in which the birth mother was not present (2% of sample) and a smaller count of children who suffered from serious birth defects, such as spina bifida or heart defects, bringing the count of weighted cases with complete demographic data at 9 and 24 months to 8,114 children.

Measurement

Child Health, Physical Growth, and Cognitive Outcomes

Birth certificates provided data on prematurity (more than 21 days pre-term) and birthweight status (normal, greater than 2,500 g; moderately low, 1,500–2,500; very low, less than 1,500). The child's weight was taken at 9 months; at 24 months a body mass index (BMI) score was calculated

[2] See Landale et al. review [24] on how the family structure of Latino subgroups is changing across generations.

based on measurement during the home visit. Health measures included the mother's report of the child's overall health, asked at 9 and 24 months using the standard question, "Would you say [child's] health is…," yielding a five-level set of response categories, ranging from "excellent" to "poor".[3]

Children's cognitive proficiencies were assessed during home visits at 9 and 24 months of age using reduced forms of the Bayley mental and motor subscales. The 24-month instrument gauges children's early communication skills, expressive vocabulary, receptive vocabulary, listening comprehension, and rudimentary problem solving skills [26]. The 9-month Bayley focuses on infants' comprehension and use of words, and purposeful action with objects. Inter-item reliabilities were high for the 9-month (Cronbach $\alpha = 0.76$) and 24-month ($\alpha = 0.88$) scales. Bayley motor-skill scales were administered as well, given inclusion of cognitively related subscales ($\alpha = 0.89$ at 9- and 24-months).[4]

Child Background

Control variables were entered for the child's age and gender. While the ECLS-B study is anchored to data panels located at birth, 9 and 24 months of age, home visits were fielded during a year-long period for each of the latter two data panels.

Proximal Predictors—Maternal Health and Nutrition Practices

The mother reported at 24 months whether the child received "balanced meals" each day, and whether unhealthy beverages were served during or between meals, including soda or flavored juice. We included a marker if the mother participated in the federal Supplemental Nutrition Program for Women, Infants, and Children (WIC). The mother's mental health was gauged with the short form of the Center for Epidemiological Studies Depression Scale, consisting of 12 items related to the mother's absence or presence of negative emotions, for example, "How often in the past week did you… feel depressed?" "Have crying spells?"

Maternal Discipline and Preliteracy Practices

Two indices of strict discipline were constructed. The first, an additive index, combined three interview questions, each starting with the stem: "Most children get angry at their parents from time to time. If [child] got so angry the [he or she] hit you, yelled at you or threw a temper tantrum, what would you do?" Three possible harsh responses were summed to form an index (0–3). The second measure was derived from an interview question: "Here are some statements that parents of young children say about themselves… I teach [child] that misbehavior or breaking the rules will always be punished one way or another" (5-point scale).

Field staff asked mothers about reading, preliteracy practices, and exposing the child to print materials, from the HOME scale [30]. We combined the reported frequency of reading, telling stories, or singing together ($\alpha = 0.62$). The mother's propensity to foster the child's cognitive growth was measured at 9 months with the Nursing Child Assessment Satellite Training (NCAST) scales in which the mother and infant engage in teaching tasks, such as, grasping a rattle, taking a lid off a container, and turning pages of a book. Interactions were videotaped and scored on several dimensions, including the mother's ability to communicate the task clearly, stimulate the child's interest and progress, and express warm affect [31, 32]. Principal components analysis yielded five factors.[5]

Distal Predictors—Maternal Relationships and Family Supports

Dichotomous predictors indicated whether the child's father resided in the home, and whether the mother worked full-time (35 h or more) or part-time outside the home. Each mother was asked about her relationship with her own mother; responses were scored on a 4-point scale, ranging from "not very close" to "extremely close". A measure of the mother's perceived efficacy in raising the focal child was derived from an interview question, "How difficult is it to raise [focal child]?" (5-point scale). An index of the family's socioeconomic status (SES) was calculated by

[3] Child health researchers have questioned whether Latino parents may under report children's health problems or fail to recognize certain disabilities. Recent work has found lower reports of health problems by parents utilizing different interview measures, and lower incidence among Mexican-heritage parents, compared with other Latino subgroups [27–29]. This suggests that biases may occur for specific subgroups, but not severely for Latinos overall. We entered a control variable to account for the mother's frequency of visiting a doctor or health practitioner to guard against bias in the perceived health of the child.

[4] Field staff were trained and certified to administer the reduced form Bayley scales; they achieved inter-rater reliability for scoring accuracy at 97% or better [24].

[5] Factor scores were calculated for inclusion in regression models: mother's encouragement of the child to complete the task (Cronbach $\alpha = 0.80$), responsiveness when child in distress ($\alpha = 0.76$), display of warmth and emotional support ($\alpha = 0.79$), verbal specificity and careful instructions ($\alpha = 0.57$), and avoidance of negative affect or sanctions when the child made slow progress ($\alpha = 0.59$). The latter index was highly skewed (92% of mothers avoided negative sanctions). So the variable was dichotomized.

ECLS-B statisticians, drawing on the mother's and father's education levels and occupational status (if employed).

Unobserved Cultural Factors Related to Group Membership

To capture unobserved factors associated with the mother's ethnic membership or acculturation level, we entered dichotomous indicators of whether the mother was of Mexican heritage, a member of another Latino subgroup, African American, or Asian or Pacific Islander. White mothers made-up the reference group in all regression models. To measure the mother's acculturation status we entered whether she was foreign born, spoke Spanish in the home, spoke another non-English language, and years resident in the United States.[6]

Data Analysis

Weighted means are reported for child health and cognitive outcomes, and for the four major blocks of predictors. We then employed weighted least-squares (WLS) or logistic regression to estimate the child's health status, weight, body-mass index (BMI), and cognitive and motor proficiencies at 24-months of age. Given the large sample size, mean differences or regression coefficients may be statistically significant but represent small differences. For those of moderate or large magnitude we report differences as fractions of pooled standard deviations.[7]

Results

We highlight distinguishing features of Latino subgroups for children's health and cognitive outcomes and for the theorized predictors, given space constraints. Table 1 shows that Mexican-American mothers were significantly younger than other groups, perhaps stemming from immigration patterns.[8] School attainment was substantially lower for Mexican-American mothers, with about one-fifth

Table 1 Characteristics of mothers by ethnic and linguistic group at 9 month home visit (weighted means and standard deviations reported; significance tests relative to whites)

	Ethnic groups					Latina mothers		Statistical differences viz. whites[a]			
	Asian and Pacific Islander	African-American	White	Mexican-American	Other Latinas	Spanish speaking	English speaking	Mexican-American	Other Latinas	Latina mothers: Spanish speaking	Latina mothers: English speaking
Mother's age (years)	30.0 (5.8)	26.2 (6.2)	29.3 (6.0)	26.7 (6.0)	27.5 (5.8)	27.4 (5.8)	26.4 (6.0)	−9.21***	−2.96**	−7.00***	−7.40***
Mother's schooling, with some college or more (%)	66	38	63	22	35	19	37	291.85***	12.47**	315.98****	62.74***
Married (%)	85	32	81	58	57	59	54	152.19***	43.95***	105.52***	122.16***
Households earning $25,000 or less yearly (%)	19	57	20	57	40	61	40	247.23***	15.15**	262.73***	53.64***
Count of children in household	1.9 (1.0)	2.4 (1.4)	2.0 (1.1)	2.4 (1.4)	2.0 (1.1)	2.3 (1.4)	2.2 (1.3)	4.57**	1.67	4.15***	2.81**
Subsample (n)[b]	1,252	1,469	3,777	999	436	766	591	–	–	–	–

[a] Reporting t-values for continuous variables; chi-square statistics for binary variables. ** $P < .01$, *** $P < .001$

[b] Subgroup counts do not total to full sample (n), given missing data. Under "Latina mothers" column, non-English, non-Spanish mothers are excluded

[6] For mothers born in the United States, the number of years resident was set to equal their age. Multiple measures of acculturation are somewhat collinear but not sufficiently so to bias parameter estimates, as assessed by the variance inflation factor, using the Stata VIF procedure [33].

[7] To properly estimate regression coefficients and compute standard errors, given sampling weights, stratification, and clustering, we used the suite of "svy" commands available in Stata software. Due to missing data, strata at times were combined to ensure that sufficient PSUs per stratum were available in order to compute standard errors.

[8] Mexican-American mothers reported being 24.0-years-old when first giving birth, compared with 23.7 years for whites and African American mothers. In contrast, non-Mexican Latinas first gave birth almost two years younger than Mexican mothers (22.2 years of age).

completing any postsecondary education, compared with over three-fifths of white mothers. Almost three-fifths of Mexican-American mothers lived in households earning $25,000 or less annually, compared with one-fifth of whites. The mean count of children resident in the homes of Mexican-American mothers equaled 2.4, compared with 2.0 in white households.

Birth Events, Child Health, and Early Cognitive Gaps

The between-group differences detailed in Table 2 generally confirm elements of the immigrant paradox. The incidence of premature births for Latina mothers in Spanish-speaking (less acculturated) homes equaled 2.1 per 1,000 live births, compared with 1.8 for whites, despite the wide gaps in maternal education and income reported above. Yet health issues did arise by 24 months, with Mexican-American children weighing 0.5 kg more than white children on average. About one-fifth fewer Mexican-American mothers rated their toddler's health as excellent (52%), compared with white mothers (68%). Doctor-diagnosed incidence of childhood asthma ranged higher for non-Mexican Latino children.

Most striking were emergent differences in toddlers' Bayley mental scores at 24 months. White children scored 0.73 standard deviation (SD) higher than Mexican-American toddlers from Spanish-speaking homes, on average, and 0.45 SD above Latino toddlers in English-speaking homes. (The cognitive growth of the median kindergartner nationwide increases about 1.0 SD over a nine-month period.) Table 3 details lower levels of *change* (between 9 to 24 months of age) for Mexican-American and other Latino children. The bottom row shows that Latino children in Spanish-speaking homes grew at about one-third of a SD less than white children (−0.42 and −0.07, respectively).

Predictors of Child Health, Physical Growth, and Cognitive Development

Table 4 reports mean differences for major predictors across the three data panels. Again we see traces of the immigrant paradox: Spanish-speaking and Mexican-American mothers engaged in healthy prenatal and postnatal nutrition practices overall. The mean count of cigarette packs smoked during the last trimester equaled 70 per 1,000 white mothers, compared with just 7 for Mexican-American and 1 for Latinas in Spanish-speaking homes. For every 10,000 white mothers, 161 reported at least one drink containing alcohol per week in the final trimester, compared with 16 Mexican-American mothers and less than 1 for Spanish-speaking Latinas.

Turning to maternal relationships and family structure, we see that the focal child's father resided in the home in 83% of all Mexican-American cases (higher than the marital rate, 58%, Table 1), compared with 90% for whites. Just 26% of Mexican mothers were employed full-time, and another 13% part-time. The ratio of children-per-adult in the home was slightly higher for Mexican-American families (1.1), compared with whites (1.0). Mean differences were large for the index of preliteracy activities. The gap between white and Mexican-American mothers equaled 0.74 SD, widening to almost one standard deviation between white and Spanish-speaking Latina mothers. One-fourth of Mexican-American mothers spoke a language other than Spanish or English, emigrating from indigenous Latin American communities (not shown).

Estimating Child Health, Physical Growth, and Cognitive Development

In Table 5 we first estimate the likelihood that mothers rated their toddler in excellent health at 24 months, after taking into account the same rating at 9 months and the sequentially entered blocks of predictors. We see that toddlers of moderate or very low weight at birth were significantly less likely to be rated in excellent health. This helps to assuage concern over the reliability of the child health measure (note 3). We see that the odds of Mexican-American mothers rating their toddler's health as excellent were 55% less, compared with the odds for whites (reference group), even with all covariates in the model.

Columns 2 and 3 report regression estimates of the child's weight and BMI at 24 months, respectively. Girls weighed significantly less than boys. Toddlers who were of moderate or very low birthweight continued to lag behind other toddlers in their 24-month weight. Toddlers assessed by their mother as in excellent health at 9 months weighed about 0.70 kg more than other toddlers at 24 months. Child weight at 24 months was negatively related to the ratio of children-per-adult in the home. No Latino subgroup displayed significantly different weight or BMI levels after taking into account the covariates.

Regression estimates of toddlers' Bayley mental and motor skill scores at 24 months (again, controlling for respective 9-month levels) appear in Table 6. The control for child age at the 24-month assessment, not surprisingly, was significantly related to higher Bayley mental scores. Girls showed stronger growth than boys between 9 and 24 months. The effects of earlier birth outcomes remained discernible at 24 months, as very low weight and multiple births were associated with slower cognitive growth (almost one-half SD in the level of change).

Maternal depression was negatively related to toddlers' cognitive growth. Mothers' preliteracy practices were positively related to growth (the coefficient is twice the standard error, significant at $P < .06$). When mothers

Table 2 Descriptive statistics for child health, physical growth, and cognitive developmental at birth, 9 months, and 24 months by ethnic and linguistic group (weighted means and standard deviations reported; significance tests relative to whites)

	Ethnic groups					Latina mothers[a]		Statistical differences viz. whites[b]			
	Asian and Pacific Islander	African-American	White	Mexican-American	Other Latinas	Spanish speaking	English speaking	Mexican-American	Other Latinas	Latina mothers: Spanish speaking	Latina mothers: English speaking
Birth events ($n = 6{,}419$)[c]											
Premature newborns per 100 births	1.7	3.5	1.8	2.4	2.6	2.1	3.2	0.13	5.28**	0.01	3.45**
Birth weight (kg)	3.2 (0.5)	3.2 (0.6)	3.4 (0.6)	3.3 (0.6)	3.3 (0.6)	3.3 (0.6)	3.3 (0.6)	−2.28***	−2.5*	−2.35*	−3.04**
9-month health and cognitive status ($n = 7{,}869$)											
Weight (kg)	9.0 (2.6)	9.0 (3.6)	9.2 (2.9)	9.7 (2.4)	9.7 (2.9)	9.8 (2.5)	9.5 (2.5)	3.73***	0.56	4.48***	0.44
Mother rates child's health as "excellent" (%)	58	60	68	52	62	49	63	45.59***	0.08	59.27***	3.06
Respiratory illness diagnosed since birth (%)	6	15	14	12	8	10	13	4.96*	0.02	6.00**	0.01
Bayley mental score	76.8 (9.3)	76.4 (9.9)	77.1 (9.7)	76.3 (9.2)	77.6 (10.0)	76.3 (9.4)	77.4 (9.6)	−1.58	−2.17*	−3.22**	0.92
Bayley motor score	51.5 (16.7)	52.4 (15.3)	51.5 (16.2)	52.2 (16.4)	52.1 (15.6)	52.4 (15.3)	52.4 (15.3)	0.60	−0.09	−0.82	1.74
24-month health and cognitive status ($n = 6{,}796$)											
Weight (kg)	12.5 (1.8)	12.9 (2.0)	12.8 (1.8)	13.3 (2.0)	13.2 (2.1)	13.3 (2.0)	13.2 (2.1)	4.34***	2.21***	5.81***	1.14
Body-mass index (BMI)	17.0 (2.0)	17.5 (2.1)	17.4 (2.2)	18.0 (2.4)	17.7 (2.4)	17.9 (2.4)	17.6 (2.5)	3.08**	1.54	4.08***	1.05
Mother rates child's health as "excellent" (%)	54	59	69	49	63	48	63	61.77***	1.30	65.66***	9.04**
Asthma diagnosed since birth (%)	7	17	8	8	15	9	13	0.24	4.77*	0.01	7.88**
Bayley mental score	127.6 (10.4)	124.7 (10.0)	130.1 (10.0)	122.8 (9.6)	124.1 (9.8)	122.0 (8.8)	125.1 (10.7)	−6.37***	−5.53***	−17.42***	−6.79***
Bayley motor score	80.7 (5.2)	81. (4.8)	80.7 (5.4)	80.8 (5.4)	80.7 (5.1)	81.0 (5.4)	80.7 (5.0)	0.94	−0.49	0.92	0.51
Child securely attached to mother (%)	65	54	66	61	50	60	55	15.75***	15.48***	12.75***	17.34***

[a] Non-English, non-Spanish mothers are excluded

[b] Reporting t-values for continuous variables; chi-square statistics for binary variables. * $P < .05$, ** $P < .01$, *** $P < .001$

[c] The birth forms the case, given the lack of independence among newborns involved in multiple births. In this case, one twin is randomly selected

Table 3 Change in children's cognitive proficiencies, 9–24 months years of age, by ethnic and linguistic group (weighted mean Bayley mental scales scores and standardized change scores reported, $n = 6{,}415$ children with complete data)

Data panel and change scores	Ethnic groups					Latino children		Statistical differences viz. whites[a]			
	Asian and Pacific Islander	African-American	White	Mexican-American	Other Latinas	Spanish speaking	English speaking	Mexican-American	Other Latinas	Latino children: Spanish speaking	Latino children: English speaking
9 months	76.9 (9.65)	75.9 (9.87)	76.5 (9.33)	76.3 (9.47)	77.0 (9.43)	76.1 (9.2)	77.8 (9.9)	−1.58	−2.17*	−3.22**	0.92
24 months	129.9 (10.27)	124.4 (10.29)	126.7 (10.33)	123.1 (10.10)	123.6 (10.62)	121.9 (9.15)	124.8 (11.39)	−6.37***	−5.53***	−17.42***	−6.79***
Change in scale scores	52.0 (12.64)	48.6 (12.10)	50.3 (12.98)	46.7 (12.89)	46.5 (12.57)	45.8 (11.88)	47.0 (14.19)	−12.28***	−3.58***	−12.18***	−6.32***
Standardized change score	0.13 (0.99)	−0.20 (0.95)	−0.07 (1.02)	−0.35 (1.01)	−0.36 (0.98)	−0.42 (0.93)	−0.32 (1.11)	−9.78***	−2.46**	−8.91***	−5.72***

[a] Reporting t-values for continuous variables. * $P < .05$, ** $P < .01$, *** $P < .001$

reported lower efficacy in child rearing (e.g., "difficult to raise"), their toddlers displayed slower rates of cognitive growth. Toddlers with a mother employed full-time showed stronger growth, compared with children whose mothers did not work outside the home. Change in Bayley mental scores remained significantly lower for Mexican-American and non-Mexican Latino toddlers, compared with whites, even with all covariates in the model (equaling 0.45 SD for Mexican-American toddlers).

Our ability to explain change in Bayley motor skills between 9- and 24-months was more limited ($r^2 = 0.13$). The father's presence did contribute significantly to motor-skill growth. Ethnic membership per se was unrelated to growth. However, toddlers of foreign-born mothers showed considerably less growth in motor skills (0.50 SD).

Discussion

These findings offer limited confirmation of the immigrant paradox with regard to healthy prenatal practices among Latina mothers and robust birth outcomes. Most notable are the practices of Mexican-heritage mothers and less acculturated (Spanish-speaking) Latinas, despite being situated in poor families. These subgroups display very low rates of tobacco or alcohol use during the last trimester, along with comparable rates of breast feeding and strong mental health, compared with white mothers. Mexican-American mothers report less frequent deployment of harsh discipline as they socialize their toddlers.

Generally healthy birth attributes, displayed by Latino newborns, continue to exert positive health and cognitive-developmental effects through 24 months of age. At the same time, Latino toddlers begin to display weaker health status, compared with whites. Mexican-American children weigh 0.5 kg (0.27 SD) more than white toddlers at 24 months, and the former are less likely to be judged in excellent health by their mothers. Most striking is the slowing of cognitive growth among Mexican-American toddlers and Latino children in Spanish-speaking homes, even after taking into account the family's SES and a variety of maternal attributes and home practices. The standardized disparity in Bayley mental scores between white and Mexican-American toddlers (in Spanish-speaking homes) equaled 0.49 SD at 24 months, before adjusting for covariates. In sum, the protective factors that contribute to healthy Latino births do not carry-over to the health status of toddlers, or to their cognitive growth.

This emerging gap in cognitive development is likely explained by the lower school attainment of Mexican-American mothers, along with weaker preliteracy practices and the higher ratio of children to adults in households, compared to white middle-class populations. In addition,

Table 4 Predictors of child's health, physical growth, and cognitive development (weighted means and standard deviations reported; significance tests relative to Whites)

	Ethnic groups					Latino children		Statistical differences viz. Whites[a]			
	Asian and Pacific Islander	African-American	White	Mexican-American	Other Latinas	Spanish speaking	English speaking	Mexican-American	Other Latinas	Latino children: Spanish speaking	Latino children: English speaking
Mother's prenatal practices and early feeding ($n = 8{,}422$)											
Smoked in last trimester (packs reported per 1,000 mothers)	8	35	70	7	18	1	25	64.62***	1.05	95.45***	6.73**
Drank alcohol at least once per week, last trimester (per 10,000 mothers)	75	66	161	16	94	0	87	13.34***	0.50	4.40*	3.66
Breastfed infant in last 7 days (% at 9-month interview)	23	7	18	17	14	20	12	0.91	3.06	0.42	13.07***
Feeds unhealthy beverages: soda, artificial juice (%)	19	32	20	39	22	40	26	65.95***	2.21	68.13***	6.86**
Maternal relationships, support, mental health (at 9 months)											
Father resident in home (%)	90	44	90	83	76	85	75	35.56***	32.29***	7.39**	77.36***
Mother employed (%):											
Full-time	35	41	31	26	36	26	36	0.94	0.20	5.62*	5.79*
Part-time	14	16	24	13	18	13	16	20.44***	2.51	22.37***	6.84**
Ratio of childen:adult resident in the home (%)	0.9	1.5	1.0	1.1	0.9	1.0	1.2	1.26	1.38	−0.18	2.58
Mother's closeness to own mother (% close or very close)	96	95	93	90	91	88	92	12.00***	0.01	12.30***	3.16
Mother's efficacy in raising child (% reporting "very difficult")	9	7	6	8	11	10	7	2.61	0.53	3.29	0.57
Mental health, depressive symptoms CESD score	16.8 (5.0)	18.5 (6.1)	16.7 (5.2)	16.8 (5.8)	16.5 (5.5)	16.3 (5.6)	17.2 (5.6)	1.22	−1.30	−0.11	2.58
Parental discipline and pre-literacy practices (at 9 months)											
Mother punishes misbehavior (%)	60	63	60	56	56	56	52	3.71	0.22	1.18	3.66
Harsh discipline index score (1–3)	0.5 0.7)	0.9 (0.8)	0.6 (0.7)	0.4 (0.6)	0.4 (0.7)	0.4 (0.6)	0.5 (0.7)	−5.56***	−0.14	−7.26***	−1.41
Preliteracy—reading, storytelling, singing index score (24 months)	9.3 (2.0)	8.7 (1.9)	9.8 (1.8)	8.4 (2.1)	8.6 (2.0)	8.0 (2.0)	9.1 (1.9)	−12.88***	−3.59***	−14.03***	−5.43***
NCATS teaching-task scores:											
Praises effort, encouragement	2.0 (1.9)	1.8 (1.8)	2.1 (1.9)	1.8 (1.8)	2.0 (1.8)	1.6 (1.7)	2.0 (2.0)	−5.01***	−1.29	−5.03***	−0.98
Responds to child distress	4.2 (1.6)	3.8 (1.7)	3.9 (1.6)	3.8 (1.7)	3.8 (1.5)	3.6 (1.7)	4.0 (1.6)	−2.85**	−1.42	−4.19***	0.06
Mother–father SES, standardized z-scores	0.4 (0.9)	−0.5 (0.8)	0.2 (0.8)	−0.7 (0.6)	−0.3 (0.7)	−0.7 (0.6)	−0.3 (0.7)	−26.74***	−5.58***	−31.63***	−10.97***

Table 4 continued

	Ethnic groups					Latino children		Statistical differences viz. Whites[a]			
	Asian and Pacific Islander	African-American	White	Mexican-American	Other Latinas	Spanish speaking	English speaking	Mexican-American	Other Latinas	Latino children: Spanish speaking	Latino children: English speaking
Acculturation indicators (at 9 months)											
Dominant language spoken in the home (%):											
English	47	96	97	33	41	–	–	–	–	–	–
Spanish	0	0	0	40	39	–	–	–	–	–	–
Other Language	53	4	3	25	18	–	–	–	–	–	–
Mother, foreign born (%)	71	10	5	64	63	90	19	937.55***	134.41***	1583.89***	41.42***
Years resident in the U.S.[b]	17.7 (11.2)	24.4 (7.6)	28.3 (7.4)	16.7 (10.5)	17.3 (10.7)	10.5 (8.2)	24.2 (7.6)	−28.96***	−6.83***	−41.94***	−7.63***

[a] Reporting *t*-values for continuous variables; chi-square statistics for binary variables. * $P < .05$, ** $P < .01$, *** $P < .001$

[b] If mother is native born, then years resident in the United States is set to her age

the residual effect of Mexican-American membership on toddlers' cognitive growth, after accounting for covariates, highlights the importance of future qualitative research on mothers' developmental practices. We know, for example, that parents hold differing ethnotheories for how to raise healthy young children and advance their nutrition and cognitive skills, as well as which adults at home or preschool should play influential roles [10, 22, 34]. What's not understood is how Latina mothers might preserve beneficial protective factors while acquiring more focused learning activities for their toddlers.

This study is limited by reliance on maternal reports of their todder's health status. Researchers, uncertain over whether some Latino subgroups are reticent to report high levels, are employing multiple measures in similar field studies (note 3). Future work should also investigate how specific elements of child health (e.g., suffering from chronic respiratory problems or flagging nutrition) may affect toddlers' early cognitive growth.

Multiple measures of cognitive proficiencies are advisable as well. A portion of the Bayley mental and motor subscales relied on verbalization between the mother and child, perhaps introducing measurement error. The marker of home language mismatch between mother and field researcher was not significantly related to any child outcome. Still, future work should employ cognitive measures that have been culturally validated.

Two implications for health practitioners and designers of early interventions should be emphasized—even more pressing as the federal government shows renewed interest in home visiting programs for mothers of infants and toddlers. First, the major lesson from recent work on the immigrant paradox is that many Latina mothers display healthy prenatal and ongoing nutritional practices, and these protective factors are often most robust among the poorest Latino families. Thus, health practitioners should not assume that risk factors always swamp the paradoxically strong protective factors. At the same time, these early benefits of culturally bounded practices are exercised most strongly by first-generation Mexican-American mothers, and then dissipate among later generations and acculturated subgroups.

Second, maternal practices that advance infants' early health may not be sufficiently strong to ensure robust health or prevent childhood obesity during toddlerhood or the preschool years. Nor can we assume that health-related practices will lift the cognitive development of Latino toddlers, especially when the mother displays low school attainment, infrequent learning activities, and struggles to raise a larger number of children, compared with middle-class populations. In sum, health practitioners must be attentive to individual and subgroup differences, and ask Latino patients or clients about the maternal attributes and

Table 5 Estimation of child health and physical growth at 24 months of age (logistic or weighted least-squares regression, nonstandardized coefficients and standard errors reported)

	Mom's rating of child's health Odds ratio (SE)	Child's weight WLS (SE)	BMI WLS (SE)
Predictor Block 1—Basic child attributes	*F* 1.72	*F* 8.54***	*F* 8.78***
Female child	1.25 (0.21)	−0.37 (0.12)*	−0.41 (0.17)*
Child age	1.00 (0.07)	−0.00 (0.06)	−0.33 (0.07)
Child age, squared	1.00 (0.01)	0.02 (0.01)	0.03 (0.01)*
Predictor Block 2—Birth events and health status at 9 mos.	*F* 15.93***	*F* 19.87***	*F* 4.88***
Premature birth	1.65 (0.59)	0.45 (0.31)	0.61 (0.35)
Child's weight (moderate to low)	0.64 (0.12)*	−0.68 (0.17)***	−0.25 (0.21)
Child's weight (very low)	0.33 (0.13)*	−1.36 (0.30)***	−0.60 (0.36)
Multiple births	1.56 (0.33)*	0.21 (0.17)	0.22 (0.21)
Fertility intervention	0.55 (0.21)	−0.15 (0.28)	0.56 (0.43)
Child's health excellent at 9 mos.	11.0 (8.90)*	0.51 (0.18)*	−0.08 (0.17)
Child's health very good at 9 mos.	4.93 (3.95)	0.49 (0.19)*	−0.03 (0.20)
Child's health good at 9 mos.	1.90 (1.50)	0.35 (0.21)	−0.14 (0.26)
Child's weight at 9 mos.	–	0.37 (0.05)***	0.28 (0.04)
Predictor Block 3 - Parenting behaviors, nutrition, mother's mental health	*F* 1.88	*F* 0.88	*F* 0.99
Maternal depression	0.97 (0.02)	0.01 (0.02)	0.01 (0.03)
Providing balanced meals	0.86 (0.32)	0.11 (0.18)	0.22 (0.26)
Soda, fruit drink at or between meals	1.17 (0.21)	−0.08 (0.14)	−0.05 (0.15)*
Harsh discipline	1.06 (0.11)	−0.05 (0.07)	−0.10 (0.09)
Punish child when rules are broken	1.05 (0.16)	0.18 (0.13)	0.23 (0.16)
Doctor's visit	1.03 (0.03)	–[a]	–[a]
Preliteracy activities	1.06 (0.03)	0.07 (0.04)	0.06 (0.05)
Predictor Block 4—Maternal relationships and efficacy	*F* 0.69	*F* 1.70	*F* 1.75
Maternal rating of child as average difficulty	0.86 (0.13)	0.09 (0.13)	−0.05 (0.17)*
Maternal rating of child as difficult	0.85 (0.20)	0.17 (0.19)	0.28 (0.24)**
Closeness to her own mother as fairly close	1.01 (0.23)	0.42 (0.20)*	0.35 (0.22)
Closeness to her own mother as not close	1.01(0.27)	0.05 (0.19)	−0.15 (0.20)
Predictor Block 5—Family support	*F* 1.92	*F* 3.57*	*F* 3.70*
Father at home	1.09 (0.22)	−0.39 (0.18)*	0.54 (0.23)
Social class index	0.74 (0.09)*	−0.21 (0.13)	−0.21 (0.15)
Child's health insurance	1.32 (0.55)	0.40 (0.40)	0.48 (0.34)
Children to adults ratio	0.77 (0.08)*	−0.30 (0.11)*	−0.28 (0.12)
Maternal employment (Full-time)	1.12 (0.19)	0.25 (0.14)	0.24 (0.19)
Maternal employment (Part-time)	0.95 (0.20)	−0.10 (0.13)	−0.06 (0.17)
WIC Benefits	0.85 (0.12)	−0.10 (0.16)	−0.05 (0.16)
Predictor Block 6—Ethnic and linguistic group membership	*F* 5.85***	*F* 1.25	*F* 0.35
Latino, Mexican heritage	0.45 (0.13)**	0.03 (0.20)	0.00 (0.20)
Latino, Other heritage	1.12 (0.39)	−0.40 (0.30)	0.22 (0.31)
Black	0.63 (0.16)	0.05 (0.23)	−0.08 (0.23)
Asian-Pacific Islander	0.78 (0.25)	−0.30 (0.20)	−0.17 (0.23)
Predictor Block 7—Acculturation	*F* 4.50***	*F* 0.61	*F* 0.68
Home language, Spanish	0.88 (0.31)	0.15 (0.30)	0.04 (0.35)
Home language, other non-English	0.68 (0.25)	0.14 (0.27)	−0.17 (0.26)
Foreign born	1.25 (0.48)	0.27 (0.30)	0.44 (0.30)
Years residing in U.S.	1.02(0.01)	0.01 (0.01)	0.01 (0.01)
N of cases (births)	7,551	6,955	6,832

Table 5 continued

	Mom's rating of child's health Odds ratio (SE)	Child's weight WLS (SE)	BMI WLS (SE)
F-statistic, complete model	4.50***	12.41***	4.97***
Strata and PSUs with sufficient data	88, 114	88, 112	88, 112
R^2 (for WLS regressions)	–	0.20	0.11

* $P < .05$, ** $P < .01$, *** $P < .001$

[a] Direct assessment at home visit, so no bias possible vis-à-vis access to doctor or medical clinic

Table 6 Estimation of change in children's cognitive and motor skills, 9–24 months of age (weighted least-squares or logistic regression; unstandardized coefficients and standard errors reported)

	Bayley mental score WLS (SE)	Bayley motor score WLS (SE)
Predictor Block 1—Basic child attributes	*F* 16.04***	*F* 2.16*
Female child	3.34 (0.70)***	−0.23 (0.41)
Child age	1.63 (0.36)***	0.51 (0.22)*
Child age, squared	−0.04 (0.07)	−0.08 (0.04)
Predictor Block 2—Bayley score, birth and health status at 9 months	*F* 14.24***	*F* 5.74***
Bayley scale score at 9 months	0.10 (0.03)*	0.16 (0.02)***
Premature birth	−2.08 (1.52)	1.57 (1.43)
Child's weight (moderate to low)	−0.37 (0.96)	−0.32 (0.54)
Child's weight (very low)	−4.74 (1.66)*	−1.05 (1.36)
Multiple births	−3.45 (1.10)*	0.61 (0.63)
Fertility intervention	1.55 (2.26)	−0.92 (0.87)
Child's health excellent at 9 mos.	3.89 (3.27)	0.71 (1.47)
Child's health very good at 9 mos.	3.94 (3.30)	0.65 (1.49)
Child's health good at 9 mos.	3.29 (3.35)	−0.51 (1.53)
Predictor Block 3—Parenting behaviors, nutrition, mother's mental health	*F* 12.26***	*F* 1.83
Maternal depression	−0.58 (0.12)***	−0.02 (0.07)
Providing balanced meals to child	4.08 (1.26)*	−1.19 (1.21)
Soda, fruit drink at or between meals	−0.93 (0.73)	0.39 (0.56)
Harsh discipline	−0.12 (0.40)	0.54 (0.27)
Punish child when rules are broken	0.01 (0.68)	0.87 (0.41)*
Preliteracy activities	0.36 (0.18)[a]	−0.09 (0.10)
NCATS factor 1 (Praises effort & encourage)	0.20 (0.21)	0.04 (0.13)
NCATS factor 2 (Responds to child distress)	0.08 (0.19)	−0.13 (0.15)
NCATS factor 3 (Warm affect, emotional support)	0.43 (0.34)	0.13 (0.22)
NCATS factor 4 (Cognitive fostering, verbal guidance)	0.17 (0.37)	−0.22 (0.29)
NCATS factor 5 (Avoids negative comments)	−3.48 (1.68)*	0.71 (1.25)
Predictor Block 4—Maternal attitudes and knowledge	*F* 2.02	*F* 2.58*
Raising child, average difficulty	−1.40 (0.77)	−0.44 (0.50)
Raising child, difficult	−2.03 (1.19)	−0.17 (0.80)
Closeness to her own mother as fairly close	−0.85 (1.19)	0.92 (0.66)
Closeness to her own mother as not close	−1.52 (0.97)	−0.90 (0.61)
Predictor Block 5—Family support	*F* 5.25***	*F* 0.61
Father at home	−0.61 (0.95)	1.35 (0.58)*
Social class index	1.43 (0.63)*	−0.38 (0.46)
Child health insurance	−0.54 (3.28)	1.79 (1.93)
Children to adults ratio	−1.27 (0.56)*	0.05 (0.38)

Table 6 continued

	Bayley mental score WLS (SE)	Bayley motor score WLS (SE)
Maternal employment (Full-time)	1.68 (0.72)*	0.14 (0.56)
Maternal employment (Part-time)	0.78 (0.98)	0.50 (0.71)
WIC Benefits	0.41 (0.67)	0.19 (0.52)
Predictor Block 6—Ethnic and linguistic group membership	*F* 10.17***	*F* 0.72
Latino, Mexican heritage	−5.01 (1.42)*	0.66 (0.63)
Latino, Other heritage	−3.44 (1.69)*	1.33 (0.99)
Black	−3.91 (1.05)***	0.97 (0.60)
Asian-Pacific Islander	−1.54 (1.40)	0.63 (0.74)
Predictor Block 7—Acculturation	*F* 1.29	*F* 1.84
Home language, Spanish	1.41 (1.88)	1.58 (1.59)
Home language, other non-English	−0.91 (1.45)	2.93 (1.46)*
Foreign born	−1.58 (1.70)	−2.68 (1.33)*
Years residing in U.S.	0.03 (0.05)	0.01 (0.04)
Language mismatch	−0.03 (1.67)	0.34 (1.07)
N of cases	6,413	5,322
F-statistic, complete model	15.85***	4.06**
Strata and PSUs with sufficient data	88, 114	88, 114
R^2	0.28	0.13

* $P < .05$, ** $P > .01$, *** $P < .001$. [a] $P < .06$

practices that shape the health, physical growth, and cognitive development of their infants and toddlers.

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