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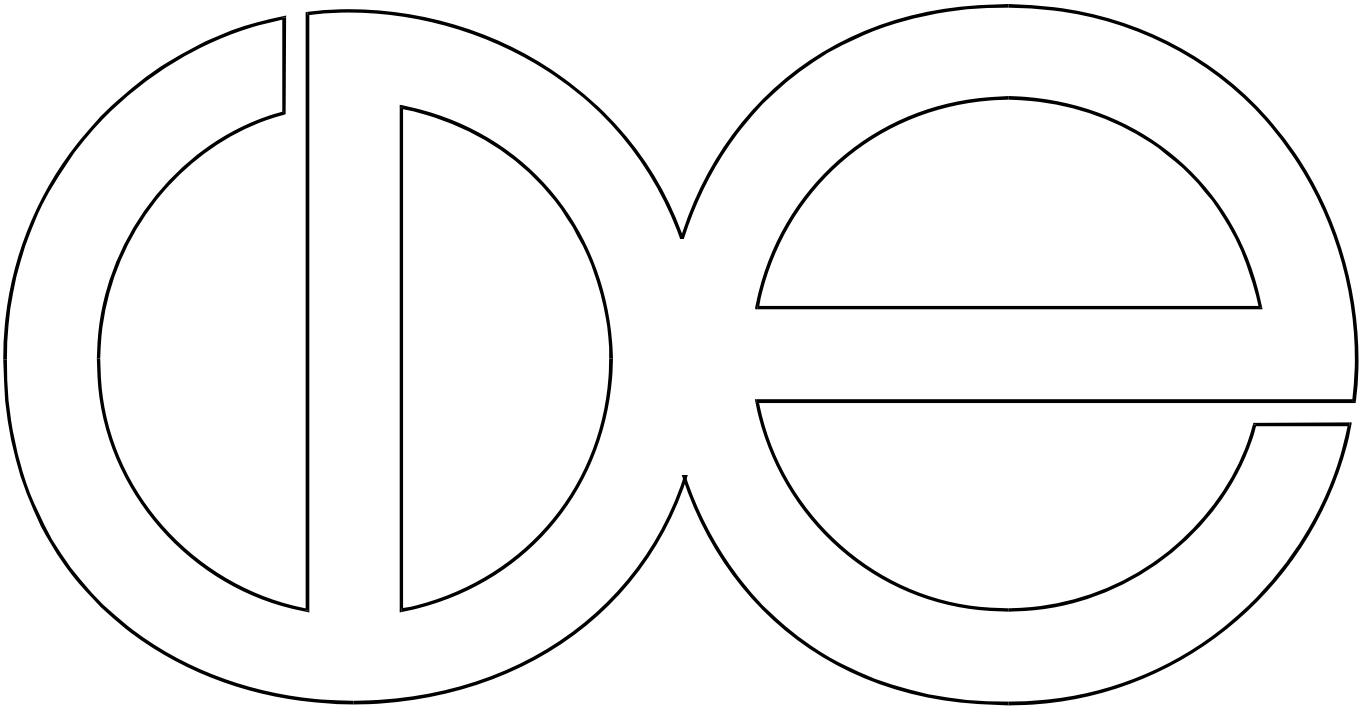

Selective return migration and the maternal and infant health of the Mexican-origin population in the United States: a sibling analysis*

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ABSTRACT

Background: A significant body of research on minority health shows that while Hispanic immigrants experience unexpectedly favorable outcomes in maternal and infant health, their advantage deteriorates with increased time of residence in the US. This is referred to as the "acculturation paradox." We assess two hypotheses explaining the "acculturation paradox" for birth and child health outcomes. The first attributes deterioration to negative effects of acculturation and behavioral adjustments made by immigrants while living in the US, and the second accredits this deterioration to a process of selective return migration. We use a sample of Mexican immigrant women living in two Midwestern communities in the US to conduct a sibling analysis using the community sample to control for unmeasured factors shared in a household that may be responsible for selective return migration. The sibling analysis shows no significant differences between the birth outcomes of the two siblings providing indirect evidence supporting the selective return migration hypothesis.

INTRODUCTION

A significant body of research on minority health in the United States shows that Hispanics[1] experience an advantage in maternal and infant health outcomes (referred to as the "Hispanic paradox"). Indeed, birth outcomes of infants born to Hispanic immigrants are nearly equal to, or better than, birth outcomes of infants born to US-born White women (Albrecht et al. 1996; Becerra et al. 1991; de la Rosa 2002; Markides and Coreil 1986). However, this health advantage appears to deteriorate either with each subsequent generation or with increased acculturation (Guendelman and English 1995; Guendelman et al. 1990; Scribner and Dwyer 1989) referred to here as the "acculturation paradox."

While the health advantage among Hispanics has been widely investigated, albeit not yet fully understood, research on the deterioration of Hispanic health remains poorly studied and even less understood. Furthermore, few studies have examined this diminishing health among Hispanics within the first generation of immigrants (Balcazar and Krull 1999; Guendelman and English 1995; Zambrana et al. 1997) only Balcazar and Krull differentiated the effects of length of residences from those of acculturation, and none have been based on nationally representative data. Our study fills this research gap by examining the distinct effects of length of residence in the US and acculturation on birth outcomes within the first generation of Mexican immigrant women, and comparing the results from a local study with a national sample. Our objective is to explain this acculturation paradox by assessing the two hypotheses explaining the deterioration in health outcomes among Hispanics with increased duration in the US. The first hypothesis

[1] Hereinafter we use the term "Hispanics" to refer to "Latinos" or individuals born in Mexico and in countries of Central and South America and the Caribbean but living in the US. We also include those of Hispanic origins (ancestry) born and living in the US. Unless otherwise specified this category includes Puerto Ricans living in the US.

attributes this deterioration to the negative effects of acculturation and the associated behavioral shifts made by immigrants while living in the US. The second hypothesis proposes that the observed deterioration results from a process of selective return migration, whereby immigrant mothers in better health return to their home countries at higher rates than those who experience worse health.

For this study we conduct a sibling analysis using the community sample to generate estimates of acculturation and duration that control for unmeasured factors shared in a household, including those that may influence maternal and child health status and be responsible for selective return migration.

BACKGROUND

In the 1960s, a study by Teller and Clyburn (Teller and Clyburn 1974) found the surprising result that the infant mortality rate among the Spanish-speaking population in Texas was only slightly higher than that of Whites. Since then, numerous studies using local, state, and national data from the US show that birth and health outcomes of infants (including low birth weight, prematurity, intrauterine growth restriction (IUGR), and survival during the first year) born to Hispanics (except Puerto Ricans) in general, and Mexican-origin women in particular, are nearly equal to, or better than, the birth and health outcomes of infants born to US-born White women (Franzini, Ribble, and Keddie 2001; Markides and Coreil 1986). This finding is commonly referred to as the Hispanic paradox because the observed high level of favorable health outcomes is unexpected, particularly when compared to other US racial and ethnic minority groups who possess a low socioeconomic profile similar to that of Hispanics. There are two primary explanations for this paradox: favorable behavioral health profiles and strong social

support, and the health selection of migration at origin and destination (Goldman et al. 2006; Harley and Eskenazi 2006; Palloni and Morenoff 2001).

Simultaneously with the Hispanic paradox it has been observed that the initial health advantages, particularly for Mexican women, are not sustained and diminish with increased duration of residence in the US. For example, several studies found that birth outcomes for Mexicans deteriorate for later generations (Cobas et al. 1996; Guendelman et al. 1990; Landale, Oropesa, and Gorman 1999; Scribner and Dwyer 1989). When comparing health differences among generations, it is found that US-born Hispanics have higher rates of infant mortality and low birth weight than non-US-born Hispanics. Two hypotheses that could explain this paradox – negative acculturation and selective return migration – are described below.

Negative acculturation

The first hypothesis proposes that changes in behaviors and social conditions for immigrants, due to acculturation and adjustment, result in negative effects on maternal and infant health outcomes. Studies have found that after settling in the US, changes in tastes, preferences, and health-related behaviors (such as diet, smoking, and alcohol consumption) may have deleterious effects on the health of Hispanic immigrants (English, Kharrazi, and Guendelman 1997; Guendelman et al. 1990; Scribner and Dwyer 1989). The immigrant enters the US having left contexts that supply protective social relations and promote behaviors and practices associated with favorable infant health outcomes (Kana'iaupuni et al. 2005). Accommodation is not swift and requires painful changes in preferences and behaviors and may also entail the weakening of social support.

As they settle into a new life, some of these traits and environments are lost and replaced by others with more dubious health benefits, such as changes in dietary habits, increased levels

of smoking and alcohol consumption during pregnancy, and, in some cases, having less access to preventative healthcare.

Selection via return migration

The second hypothesis proposes that the effect of acculturation is an artifact of higher rates of return migration among the healthiest mothers (and their families). That is, on average women who are in ill-health or whose children experience health problems are less likely to return to their home country than others, perhaps as a consequence of needed health services either anticipated or received. One will then observe a negative gradient of health outcomes with respect to duration of stay. The gradient will be sharper if the rate of return is inversely associated with acculturation and/or duration. This phenomenon produces the illusion of initial favorable health outcomes among immigrants and of a subsequent deterioration among those remaining in the US. But it is entirely accounted for by a health-selected return migrant stream. As a result, at longer durations the composition of the remaining immigrant population will be disproportionately represented by those with poorer health outcomes. Such a pattern is consistent with studies finding that Mexican immigrants with a longer duration in the US are more likely to have higher levels of healthcare access and utilization than those with shorter duration (Durden 2007; LeClere, Jensen, and Biddlecom 1994).

Although a negative gradient of health outcomes due to selection bias is a plausible scenario, the reverse situation has been invoked more frequently; that is, adults in ill health are more likely to return to Mexico because the adverse conditions they experience are insufficiently serviced in the US healthcare system (Abraido-Lanza et al. 1999; Palloni and Arias 2004). However, if this scenario dominates among Hispanics one would expect to find better health outcomes among women who remain in the US for longer durations, and not worse and predicted

by the selective return migration hypothesis for maternal health. Furthermore, recent evidence has found that Mexican mothers experiencing infant mortality with newborns of less than one month old were very unlikely to have returned to Mexico (Hummer et al. 2007).

Previous research has not addressed the possible effect of a selective return migration as an explanation for the acculturation paradox since the bulk of this work focuses on differences in health status across first and higher order generations. Arguably, for this type of research the issue of return migration is of rather muted importance. However, when one studies health status changes within a single generation, the effect of return migration cannot be ignored, particularly since rates of return migration are not trivial. The streams of migrants returning to Mexico each year is significant, yielding cumulated rates of return of up to 50% after 2 years in the US and as high as 70% after 10 years (Massey, Durand, and Malone 2002; Reyes 2001; Reyes and Mameesh 2002). In addition, the return migration rate varies by characteristics of the migrant, including gender, legal status, and proximity to the US-Mexico border. Migrants who are male, undocumented, or living in states close to the US-Mexico border are more likely to return than migrants who are female, documented, or living in states farther from the border. This suggests that the potential of selective return migration influencing the distribution of remaining immigrants by health status is significant. Given these facts, how much of the negative gradient by duration and acculturation is accounted for by selective return migration?

METHODS

The data

We use data from a survey of Mexican women living in two predominantly Mexican communities located in two large Midwestern cities, Chicago and Milwaukee. The data contain information on infant and maternal health before, during, and after the pregnancy, including birth

outcomes, the mother's pregnancy history and previous pregnancies, and include information on a range of characteristics associated with infant and maternal health, including maternal health behaviors, socioeconomic status, socio-demographic characteristics, migration history, and acculturation. The information was collected on two random samples (one in each community) with a total of 545 women drawn from the rosters of two prenatal clinics between 1999 and 2001. Eligible women included all those who were pregnant at the time of the interview or who had just completed a pregnancy immediately prior to the interview. In addition, 152 of these respondents were randomly selected from those women who had at least one previous birth in order to conduct an analysis of siblings (see Ceballos and Palloni (2010) for a more thorough description of the data).

We limit the sample to Mexican-origin women living in the US who were born in Mexico and who had complete information on all relevant variables. Altogether we retain a sample size of 414 women out of 545. Table 1 describes the variables in this analysis.

The variables

The literature on the epidemiological and acculturation paradoxes relies primarily on measuring birth outcomes using birth weight, gestational age, or infant mortality. In this paper we use a combined approach that includes intrauterine growth, birth weight, and gestational age (Frisbie, Forbes and Pullum 1996). First, we construct the indicator of Fetal Growth Ratio (FGR) (Balcazar 1993) to determine cases with Intrauterine Growth Restriction (IUGR). An IUGR birth equals zero if FGR is less than the 0.85 threshold, and 1.0 if not IUGR. Second, we construct a zero/one indicator using birth weight with the conventional 2500 grams set as a cut-off point (zero equals low birth weight). Third, we define a binary variable for gestational age using 37 weeks as the cut-off point (zero equals preterm births). Births in the sample are then assigned to

one of two classes: favorable health (one) and unfavorable health (zero). A birth outcome is assigned as favorable (dependent variable equal to one) if all of the aforementioned indicators are assigned a value of one and unfavorable (dependent variable equal to zero) otherwise (see Table 1).

(Table 1 about here)

Duration is based on the respondent's reported date of entry and the number of years living in the US. The average duration lived in the US is seven years, with over half of the sample having lived in the US for less than six years. See Ceballos and Palloni (2010) for a more complete description of the variables.

RESULTS

Previous analysis of this data found that birth outcomes experience an initial improvement in the short run and deterioration over the longer term (Ceballos and Palloni 2010). However, the analysis failed to identify mediating pathways through which these effects take place. There is no attenuation of the estimates of duration or acculturation when measures of behavioral profile, exposure to stress, social relations, maternal characteristics, and socioeconomic and demographic characteristics are added to the model.

In this analysis we provide estimates from fixed effects models obtained from a sibling analysis using the study sample of the two communities to control for unmeasured factors shared in a household, including those influencing health and return migration. We first make the case for a sibling model. Suppose that return migration of mothers occurs at a rate only dependent on a factor, or variable *W,* that influences the joint health status of her children and possibly her own. Suppose further that *W* changes only moderately over time and that favorable health shocks are infrequent. It must then be the case that unmeasured conditions reflecting child (and possibly

maternal) health status are roughly constant across mothers' most recent births. Thus, if we estimate effects of duration of stay on the health of recent siblings using fixed effects models we could eliminate the contribution of variables that induce selection effects. In particular, we can remove the effects of *W*. Estimating a difference model using the most recent child siblings of mothers who remain in the US should produce results that are consistent with those that we would obtain from the sample of all mothers (including those who return migrate). Such would be the case providing that return migration only depends on *W*, the factor affecting child (and possibly maternal) health status, and that the effects of *W* are the same across siblings. If only selection were operating to distort our original results, we would also expect the effects of duration to disappear and those of acculturation to reveal their true nature.[2]

The fixed effects approach (Chamberlain 1980) has been used in a variety of contexts, including as a device to purge the effects of family characteristics on neighborhood effects and to estimate effects of personal characteristics on wages (Budig and England 2001; Plotnick and Hoffman 1995). The model permits us to estimate the differences between the outcomes and covariates for the two siblings and is equivalent to regressing the differences of birth outcomes between the siblings on the differences in the mother's characteristics between the two births (Chamberlain 1980).

A unique characteristic of our study data is that information was also collected on the birth outcomes from respondents. The full sample of those respondents born in Mexico contains 372 cases (72% of the sample) who had a previous pregnancy while living in the US. This information on the sibling's birth permits within-case comparisons of the effects of residential

[2] If other factors are involved in promoting return migration or if health factors affect birth outcomes differently across siblings, this assumption is violated and one cannot remove effects of selection using pairs of siblings.

duration and acculturation on birth outcomes. By the same token though, we will not be able to retrieve estimates of maternal-level factors, including direct effects of acculturation, maternal education, employment, maternal health, and other measures of pathways that are invariant across siblings. The following are the patterns of estimates we expect to see in two general cases:

Case I: The effect of residential duration does not reflect selection effects due to return migration but instead it proxies for adoption of tastes and behaviors deleterious to health status.
In this case we expect to see significant differences in the birth outcomes of siblings born in the US. These differences should increase as the birth interval between siblings increases. For example, we would expect a higher probability for a favorable birth outcome of a child born when the Mexican immigrant mother has lived in the US less than *T* years, than when the mother has lived in the US for over *T* years for the most recent sibling. The most important issue here is not merely that there is a difference in health outcomes between the younger and the older sibling, but that the likelihood of there being a difference increases with the interbirth interval.
Case II: Residential duration only reflects selection via the return migration of mothers whose sibling children are healthier and who are themselves healthier.
In this case we would expect to see no relation between the length of an interbirth interval between siblings and the difference in their health status.

Estimating models for siblings that are comparable with those estimated before presents some complications. First, the information collected in the survey focuses on maternal behaviors and background characteristics *at the time of the most recent pregnancy (sibling two).* Thus, we have less detailed information on sibling one than we do for sibling two. However, maternal

characteristics that can be safely assumed to vary or that could be calculated for the previous pregnancy are included in the analysis. Data available for both siblings and the mother for each birth include birth outcomes, number of years in the US, mother's age, sex of the infant, and the sibling order (n = 332). Second, the dependent variable for both siblings, as in the earlier analysis of the focal sibling, is based on the Fetal Growth Ratio, birth weight, and gestational age. For the previous sibling, the birth outcome is based solely on the mother's report since only the focal sibling contains information from the clinic and hospital records.

Testing the consistency of results in the pooled sample of siblings

We first examine estimates for the pooled sample of siblings to ensure that results are similar to those obtained in the first analysis despite the changes imposed in the definition of variables. These estimates are corrected for within household clustering Table 4). Model A, which includes only the duration measure, shows a pattern of results similar to that found in our earlier analysis (compare with Model A in Table 2). Notably, mothers who have lived in the US 0 to 3 years and over 12 years are more likely to have unfavorable birth outcomes than are mothers who have lived in the US 4 to 12 years; the effect of duration is statistically significant at the .10 level. The results of Models B and C are also very similar to those in Table 2. Adding acculturation and covariates measuring social, behavioral, and environmental characteristics has increased the significance of the longest duration coefficients, the effect of acculturation is positive but not significant, and the mediating factors do not influence the gross effects of duration or acculturation. Finally, adding sibling order in Model D has no significant effect on the main model.

(Table 2 about here)

Estimates from the fixed effects model

The fixed effects model controls for characteristics common to the maternal-sibship entity while estimating the effect of the differences in duration in the US that is determined by the birth intervals separating the two chosen siblings.[3] As argued before, if return migration only depends on these common characteristics, the effects of duration (as reflected in the birth interval between siblings) will be an unbiased estimate of length of residence in the US. According to the acculturation paradox, one would expect the health outcomes for the most recent pregnancy (sibling two) to be worse than for the previous pregnancy (sibling one) and *that the likelihood of this outcome would increase with the length of the birth interval.* Because the variable measuring acculturation is identical for both siblings (measured only once), we cannot retrieve its direct estimates from sibling models. We, however, can test if there are differences in its effects between siblings. Thus, we also introduce an interaction effect between birth order and acculturation that should partially control for unmeasured factors associated with acculturation.

Table 5 presents the results of the fixed effects model. The estimation only includes cases from the sample in which women had at least two births in the US. Because the fixed effects method estimates the differences in the outcome variables, only those cases in which birth outcomes vary between siblings are retained in the analysis. Controlling for common and shared characteristics for both siblings, the effect of duration on health in Model A is positive, although not statistically significantly. A child born to a mother when she had lived in the US for four or more years is twice as likely to have favorable birth outcomes than a younger sibling born when the mother had lived in the US three years or fewer, though these differences are not statistically

[3] In a difference model, such as the one we are estimating, the effects of birth order on birth outcomes are captured by the difference of the constants.

significant. In this model we are forced to use a shorter duration interval than in the main and pooled models because duration is measuring the interval between births of siblings. An interval such as 14 years between births, as used in the cross-sectional model, would not only be atypical but may also signal characteristics of a mother that are unique and non-random. Of the respondents with a previous child, 33% had three or fewer years of duration between sibling births. Adding covariates for the sex of the infant, mother's age, and the interaction of sibling order and acculturation in Model B further reduces the effect of duration on birth outcomes.

(Table 3 about here)

More importantly for this analysis, the lack of a significant effect of duration in the US on the difference between two siblings' birth outcomes suggests that there are no differences in sibling health outcomes attributable to changes in maternal behaviors not included in the model. Thus, these results provide no support for the acculturation paradox hypothesis and suggest that the results obtained previously may be due to return migration.

DISCUSSION

Unlike most studies of the acculturation paradox that focused on the health deterioration of Mexican immigrants across generations, we study health changes over a span of years within the first generation. Doing so enables us to examine more closely the mechanisms explaining the association between the duration in the US and birth outcomes.

Using the sibling data enables us to analyze differences in birth outcomes between sequential births and to assess changes in factors affecting the health status of the mother-sibship entity. Our results from fixed effects models on siblings finds no statistically significant decline in health over time (duration), thus suggesting that the decline found in the cross-sectional data may be due to a return migration of the healthiest maternal-sibship entities. Using data collected

in two predominantly Mexican communities located in the Midwest, we found indirect evidence supporting the selective return migration hypothesis.

A final caveat is important to consider. All our results are based on first generation migrants. Therefore, they do not run counter to previous studies of the acculturation paradox, which primarily considered the effects across generations. Indeed, it is unlikely the deterioration in birth outcomes across generations would be due to a selective return migration, since return migration is improbable among second or higher order generation immigrants.

Our unique results of an indirect support of the return migration hypothesis, at least suggest that there is much work to do before one settles the issue of how we explain the deterioration of birth outcomes within the first generation.

Tables

Table 1. Descriptive statistics of the variables (n = 414).

Variable	mean	s.d.	min	max
Birth outcome[a] (favorable=1)	0.91		0	1
Years lived in the US	6.85		1	28
Acculturation scale	-0.13	-0.13	-0.5	3.09
Diet (healthy=1)	0.47		0	1
Tobacco, alcohol, drugs	0.08		0	1
Social support	0.14		0	1
Stress	0.73		0	1
Prenatal care	0.86		0	1
Mother's health (excellent/very good=1)	0.43		0	1
Parity (zero parity=1)	0.26		0	1
Mother's age	26.49	5.56	15	45
Marital status (married=1)	0.62		0	1
Schooling (10+ years)	0.39		0	1
Income (>150% of poverty level)	0.14		0	1
Mother employed	0.48		0	1
Sample location	0.87		0	1

[a] Birth outcome is measured by birth weight, gestational age, intrauterine growth retardation (IUGR), and the fetal growth rate.

Table 2. Logistic regression estimates of birth outcome[a] on duration, acculturation, and social determinants of the pooled sibling data from the sample.[b]

Variable	Model A	Model B	Model C	Model D
0-3 years in the US	-0.54	-0.51	-0.08	0.01
(4-12 years omitted)	(0.37)	(0.37)	(0.51)	(0.52)
13+ years in the US	-0.94 †	-1.05 *	-1.25 *	-1.31 *
	(0.51)	(0.50)	(0.50)	(0.52)
Acculturation scale		0.26	0.30	0.33
		(0.32)	(0.43)	(0.43)
Diet (healthy=1)			0.14	0.12
			(0.38)	(0.39)
Social support			0.02	0.03
			(0.45)	(0.45)
Stress			-0.77 †	-0.78 †
			(0.42)	(0.42)
Parity (zero parity=1)			-0.90	-0.64
			(0.55)	(0.60)
Mother's age			-0.22	-0.20
			(0.48)	(0.49)
Marital status (married=1)			0.46	0.50
			(0.36)	(0.36)
Schooling (10+ years)			0.22	0.20
			(0.40)	(0.40)
Income			-0.29	-0.32
(>150% of poverty level)			(0.57)	(0.57)
Mother employed			-0.29	-0.29
			(0.47)	(0.47)
Sample location (Chicago=1)			0.22	0.25
			(0.56)	(0.55)
Sibling order (recent birth=1)				0.52
				(0.51)
Constant	2.45 ***	2.48 ***	2.85 ***	2.50 **
	(0.27)	(0.27)	(0.70)	(0.72)
Log likelihood	-111.81	-111.41	-104.76	-104.20
Wald χ^2	4.24	5.49	21.59 †	22.72 †
Degrees of freedom	2	3	13	14

† p<=.10; * p<=.05; ** p<=.01; *** p<=.001.

[a] Birth outcome is measured by birth weight, gestational age, intrauterine growth retardation (IUGR), and the fetal growth rate.

[b] Standard errors are in parentheses, n=332.

Table 3. Fixed effects logistic regression estimates of favorable birth outcomes[a] on duration, sex of infant, age, sibling order and acculturation of the sample data.[b]

Variable	Model A	Model B
4+ years in the US	0.85	0.52
(0-3 years omitted)	(0.69)	(0.82)
Sex of infant		-0.12
		(0.54)
Mother's age <= 20yrs		-0.21
		(0.99)
Sibling order X acculturation		-0.29
		(0.78)
Observations	60	58
Log likelihood	-19.97	-19.49
Likelihood Ratio χ^2	1.65	1.22
Degrees of freedom	1	4

† p<=.10; * p<=.05; ** p<=.01; *** p<=.001.

[a] Birth outcome is measured by birth weight, gestational age, intrauterine growth retardation (IUGR), and the fetal growth rate.

[b] Standard errors are in parentheses.

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