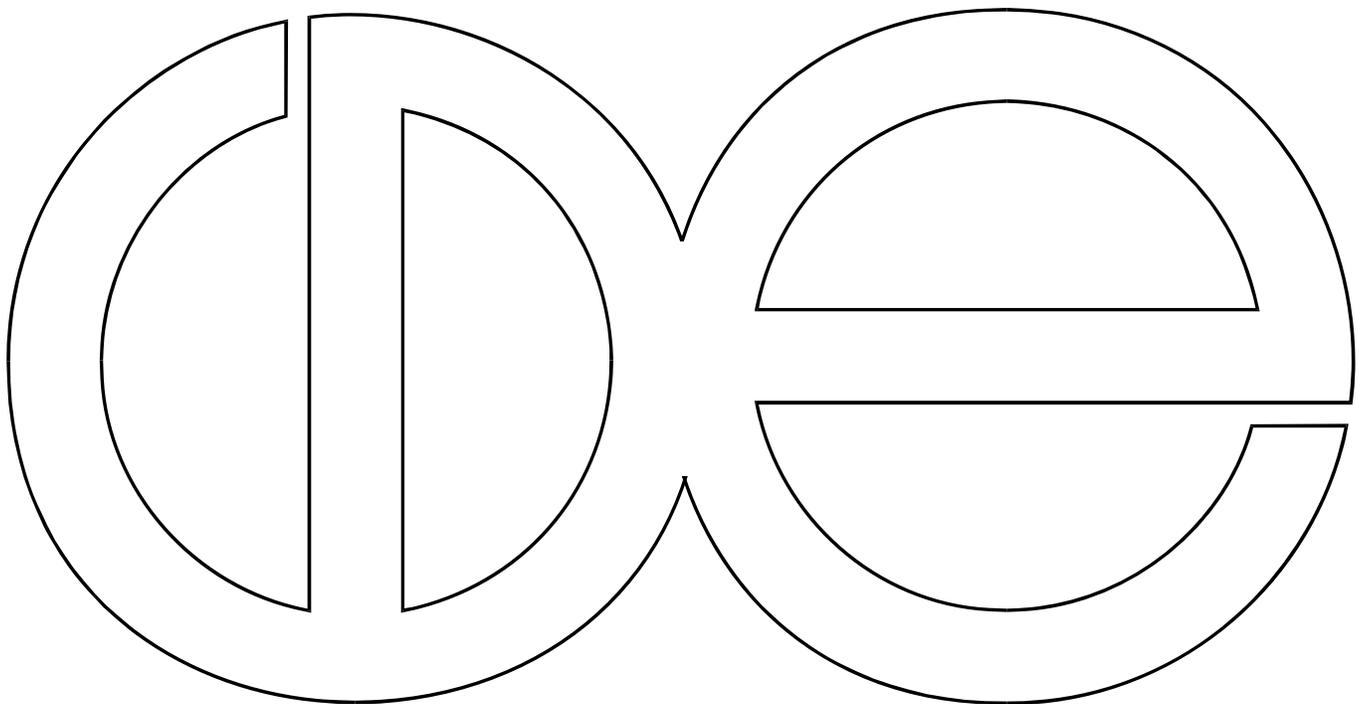# Center for Demography and Ecology

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Maternal and infant health of the Mexican-origin population in the United States: The role of acculturation, duration, and selection

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ABSTRACT

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 United States. This is referred to as the "acculturation paradox." Utilizing a sample of first generation Mexican immigrant women living in two Midwestern communities, we test two hypotheses explaining this "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 U.S., and the second to a process of a return migration selection. These results are verified by conducting a similar analysis with a nationally representative sample of Mexican immigrants. We find duration to have a nonlinear relationship and acculturation to be positively associated with birth outcomes. Finally, a sibling analysis of birth outcomes is conducted to test for migration selection. We find indirect evidence supporting the return migration selection hypothesis.

INTRODUCTION

A significant body of research on minority health shows that Hispanic[1] immigrants experience an advantage in maternal and infant health outcomes (referred to as the "Hispanic paradox"). Indeed, birth outcomes of infants born to Hispanics (except Puerto Ricans) are nearly equal to, or better than, birth outcomes of infants born to United States-born White women (Albrecht, Clarke, Miller, and Farmer 1996; Becerra, Hogue, Atrash, and Perez 1991; Franzini, Ribble, and Keddie 2001; Frisbie, Forbes, and Hummer 1998; Markides and Coreil 1986). However, this health advantage appears to wither away either with increased duration of residence in the United States or across generations (Cobas, Balcazar, Benin, Keith, and Chong 1996; de la Rosa 2002; Guendelman, Gould, Hudes, and Eskenazi 1990; Scribner and Dwyer 1989). This finding is inconsistent with a widely-held expectation that lives of immigrants and their descendants ought to improve with increased exposure to U.S. lifestyle (Alba and Nee 1997; Gordon 1964; Park 1921). Because this expectation rests on the idea that a pervasive acculturation processes transforms individuals' tastes, preferences, behavior, and opportunities into a more beneficial profile, the unexpected finding is 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 with increased duration in the United States remains poorly-studied and even less understood. This study fills this gap in the research by examining the association between length of residence in the U.S. and birth outcomes of first generation Mexican women. Our objective in this article is to test two

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

hypotheses explaining the "acculturation paradox" for birth and child health outcomes. The first hypothesis attributes this deterioration to negative effects of acculturation and behavioral adjustments made by immigrants while living in the U.S. The second hypothesis proposes that the observed deterioration is due to a process of selection whereby immigrant mothers in better health condition return to their home countries at higher rates than those who experience worse health status.[2] By contrast to most extant studies that conflate duration of stay and acculturation, assuming that the former is a good indicator of the latter, we attempt to separate their effects. The complexity of the relationship between acculturation and residential duration has been demonstrated by studies showing seemingly contrary results, better birth outcomes among both the least acculturated and longest residents, and among the Mexican-born and English-speaking (Balcazar and Krull 1999; English, Kharrazi, and Guendelman 1997). We accept this complexity and suggest that separate estimation of duration and acculturation effects respectively might reveal the operation of different processes. Furthermore, unlike most of the current literature, we address head-on the possibility of return migration of the healthiest. While a limitation of our study is that we do not examine processes across generations as do many previous studies, the strength of our approach is that we are able to focus more closely on the process of acculturation by evaluating a cohort of individuals over a single generation.

The plan of this study is as follows: first, we analyze the strength of the relationship between length of stay in the U.S. and birth outcomes, and acculturation and birth outcomes, using a sample of Mexican immigrant women living in two Midwestern communities. This is done controlling for several behavioral, social, and environmental factors. Second, we verify

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[2] The 'salmon effect' invoked by some researchers to explain much lower levels of mortality among older Hispanics requires return migration of the least healthy, just the opposite of what we are hypothesizing that may happen among young mothers. An alternative way of viewing the phenomena we are trying to explain is to propose that mothers in ill health or with children in ill health are much less likely to return to their home countries (perhaps as a consequence of health services either expected or received).

that our results are comparable to those applicable to the U.S. Hispanic community in general by conducting a similar analysis with a nationally representative sample. Third, we use the sample from the two Midwestern communities to generate estimates of acculturation and duration that control for unmeasured factors shared in a household, including those that influence maternal and child health status and that may be responsible for return migration. Thus, in this third analysis we identify effects of acculturation and duration partially purged for the effects of migration selection.

BACKGROUND

A study of infant mortality in Texas in the early 1960s by Teller and Clyburn (1974) found the surprising result that infant mortality rates 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 show that birth and health outcomes of infants (low birth weight, pre-maturity, 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, birth outcomes of infants born to U.S.-born White women (Albrecht et al. 1996; Becerra et al. 1991; Frisbie et al. 1998; Williams, Binkin, and Clingman 1986). This finding is widely referred to as the 'Hispanic paradox' because the observed high level of favorable health outcomes is unexpected relative to other U.S. racial and ethnic minorities (Cramer 1987; Shiono, Klebanoff, Graubard, Berendes, and Rhoads 1986) and populations whose members are predominantly from a lower socioeconomic background. But, simultaneously, it has been observed that these health advantages, particularly for Mexican women, are not sustained with increased duration of residence in the United States. Several studies find that birth outcomes for Mexicans, for example, deteriorate for later generations

(Cobas et al. 1996; English et al. 1997; Guendelman et al. 1990; Landale, Oropesa, and Gorman 1999; Scribner and Dwyer 1989). When comparing health differences among generations, it is found that U.S.-born Hispanics have higher rates of infant mortality and of low birth weight than non-U.S.-born Hispanics. This finding is inconsistent with a widely-held expectation based on an assumed acculturation process of immigrants to the U.S that should lead to improvements in their lives with increased time spent in the United States. We label this regularity the 'acculturation paradox.' Two hypotheses that could explain this phenomenon are described below.

Negative acculturation

Changes in tastes, preferences, health-related behaviors and new opportunities experienced after settling in the U.S. may have deleterious effects (Cobas et al. 1996; English et al. 1997; Guendelman and English 1995; Guendelman et al. 1990; Scribner and Dwyer 1989; Zambrana, Scrimshaw, Collins, and Dunkel-Schetter 1997). Hispanic immigrants enter the U.S. having left contexts that presumably supply protective social relations and where they engaged in behaviors and practices associated with favorable infant health outcomes. As they settle into a new life some of these traits are lost and replaced by others with more dubious health benefits, including changes in dietary habits, increasing smoking and alcohol consumption during pregnancy and, in some cases, less access to preventative health care. Furthermore, migration itself and the experience of living in the United States, frequently in high-crime, segregated communities and at the mercy of language or racial discrimination, surely augment stressful experience. Accommodation is not swift and requires painful changes in preferences and behaviors and it probably also entails a weakening of social support.

National studies provide evidence that first generation Mexican women have healthier nutrient-intake, including higher levels of protein, vitamins A and C, folic acid, and calcium than do second generation Mexican American women or White women of childbearing age, even after controlling for a number of confounders (Abrams and Guendelman 1995; Cobas et al. 1996; Guendelman and Abrams 1995). Research on smoking, alcohol consumption, and substance abuse finds significant differences between Mexican-origin women and White women, and between U.S.-born and non-U.S.-born Mexican-origin women. Hispanic women are significantly less likely to smoke during pregnancy than non-Hispanic women (6% vs. 17%) and Mexicans have the lowest levels of smoking of the three Hispanic subgroups, Mexicans, Puerto Ricans and Cubans for both sexes (Cobas et al. 1996; Guendelman and Abrams 1994; Haynes, Harvey, Montes, Nickens, and Cohen 1990; LeClere and Wilson 1997; Zambrana, Dunkel-Schetter, Collins, and Scrimshaw 1999; Zambrana et al. 1997). Increased smoking and alcohol consumption are correlated with acculturation and moderated by family ties (Balcazar, Krull, and Peterson 2001; Cobas et al. 1996). Second and third generation Mexican women born in the U.S. have significantly higher levels of alcohol consumption than Mexican women born in Mexico (Cobas et al. 1996; Gilbert 1987; Guendelman and Abrams 1994; Haynes et al. 1990).

An important component of the literature on acculturation and health focuses on the influences that social support and exposure to stress have on maternal and infant health among Hispanics (Balcazar et al. 2001; Zambrana et al. 1997). A qualitative study of 41 Mexican immigrant mothers found that family support promotes favorable birth outcomes among Mexican women (Sherraden and Barrera 1996). In general, it is hypothesized that a family-oriented Mexican culture, based on a system of strong social support, is vital for diluting effects of increased stress related to the migration process (Berry, Kim, Minde, and Mok 1987; Keefe

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1979). Erosion of this system of support as a result of the act of migration itself can lead to isolation and experiences that undermine the ability to healthily cope with pregnancy and with early infant and child care. Indeed, prenatal stress, measured by an inventory of stressful events during pregnancy, has been found to be highest among Hispanics with higher levels of acculturation and integration and prenatal stress is associated with increased substance use and low social support (Zambrana et al. 1999; Zambrana et al. 1997).

Selection via return migration

The second hypothesis is that the assumed effect of acculturation is an artifact of higher rates of return migration of mothers (and their families) that are among the healthiest.[3] Even if there is a constant rate of return migration, invariant with duration and acculturation, the composition of the remaining immigrant population will be disproportionately and increasingly represented by those with poorer health outcomes if the healthier are more likely to migrate. 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 U.S. But it is entirely accounted for by a health-selected return migrant stream.

Although such a scenario of selection bias is a plausible phenomenon, the reverse situation has been invoked more frequently, that is, that mothers (or adults in general) in ill health or with children in ill health, are more likely to return to Mexico as they cannot cope with adverse conditions insufficiently serviced in the U.S. health care system (Abraido-Lanza,

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[3] An alternative way of viewing this is to argue that women who are in ill-health or whose children experience health problems are less likely to return than others. This could happen if, with increased duration of stay, they secure access to health services and care. In either case, the outcome is the same: the composition by health status of mothers and children of the U.S. immigrant populations is worse at longer durations of stay.

Dohrenwend, Ng-Mak, and Turner 1999). However, if this scenario dominates among Hispanics in general and Mexican mothers in particular, the gradient of child health outcomes by duration and acculturation would be the opposite of what we observe: we would find better health outcomes among women who remain in the U.S. and among those who remain for longer durations and experience higher levels of acculturation.

Previous research has not addressed the possible effect of a return-migration selection 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. But when one studies health status changes within a single generation, the effect of return-migration cannot be ignored. And rates of return-migration are not trivial, particularly at shorter durations of residence. There is evidence of significant streams of migrants returning to Mexico each year yielding cumulated rates of return of up to 50% after two years in the U.S. and even as high as 70% after 10 years (Reyes 2001; Reyes and Mameesh 2002). The return-migration rate varies by characteristics of the migrant, including gender, legal status, and proximity to the U.S.-Mexico border. Migrants who are male, undocumented, or living in states close to the U.S.-Mexico border are more likely to return than migrants who are female, documented, or living in states in the U.S. that do not share a border with Mexico. Given these facts, how much of the negative gradient by duration and acculturation is accounted for by selective return migration?

MODEL AND FRAMEWORK

Figure 1 illustrates the conceptual model that guides this analysis. It includes the mediating influences of socio-cultural determinants as mechanisms through which duration and acculturation affect infant and maternal health in general and birth outcomes in particular. We

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hypothesize that the acculturative and adaptive process operates through social, behavioral, and environmental conduits (Guendelman et al. 1990; Scribner and Dwyer 1989; Zambrana et al. 1997). These processes may involve changes in culture, (language adoption), in taste and diet preferences, in behaviors (smoking, alcohol consumption, sedentary life styles), in density of social support, and in environmental exposure (living conditions, occupational exposure). Each of these is influenced, among other factors, by duration of residence and by the degree to which immigrants are either willing or required to alter tastes and behaviors to adapt to the host country. Each of them in turn influences the proximate determinants that directly affect maternal and infant health.

[FIGURE 1 ABOUT HERE]

This framework suggests that to properly assess the effects of duration and acculturation we must control for conditions (migrant characteristics) that can influence both of them. To the extent that we do not do so, we will face an endogeneity threat and could attribute effects to duration and acculturation that are due to health-relevant migrant characteristics. The figure also suggests that to understand the mediating pathways through which duration and acculturation influence health status we must identify effects associated with behavioral, social and environmental determinants as well as with the more proximate determinants of health status. Finally, the figure highlights the fact that the unobserved process of return migration is also implicated and that it must be addressed explicitly.

DATA AND METHODS

Description of 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. Several features

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of the survey data make them unique and optimal for this study of acculturation and health. First, the data were collected in collaboration with two community clinics that are well-established local health providers, offering comprehensive medical services to large and growing Spanish-speaking communities. Second, 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. Third, the data contain 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 were all those pregnant at the time of the interview, or those 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. The survey questionnaire was administered by clinic staff, thereby reassuring respondents of confidentiality, improving the validity of the responses, and increasing the rate of response (only eight potential respondents refused to participate in the study).

In addition, we were given access to clinic and hospital records of the pregnancy and birth. Because both clinics receive federal funding for providing free prenatal services to low-income mothers, they are financially accessible to all community residents. Furthermore, as these clinics have a well-trained, Spanish-speaking staff with strong ties to residents in the areas; their clientele is more than likely to draw widely from the communities' populations. Indeed, interviews with clients and clinic personnel strongly suggest that there were very few women, if

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any, with impaired health and high-risk pregnancies living in the communities who would choose to bypass the clinics' services to receive prenatal care directly from the local hospitals.

A comparison with national data on the Mexican-origin population in the U.S. shows that our sample is slightly healthier, more likely to have immigrated, and slightly less educated than the national U.S. Mexican-origin population (National Center for Health Statistics 2000). In fact, there is a smaller proportion of low birth weight births (1% vs. 6%) and pre-term births (6% vs. 11%), a smaller fraction of U.S.-born respondents (8% vs. 39%), and a slightly lower mean years of completed schooling (nine years vs. ten years). These differences are expected as the sample is taken from respondents receiving prenatal care and in a predominantly Mexican community with a high immigrant population.

We limited the sample to Mexican-origin women living in the United States who were born in Mexico and to those who had complete information on all relevant variables. Altogether we retain a sample size of 414 women out of 545 (Appendix, Table A.1). A comparison of characteristics between deleted cases and those included in the analysis reveals that there are no significant differences between the two groups[4] (Appendix, Table A.2).

Assessing health outcomes

The literature on the epidemiological and acculturation paradoxes relies primarily on measuring birth outcomes using birth weight, gestational age, and infant mortality. In this paper we use a combined approach (Frisbie, Forbes, and Pullum 1996). First, we construct the indicator of Fetal Growth Ratio (FGR) (Balcazar 1993; Balcazar, Keefer, and Chard 1994; Kline, Stein, and Susser 1989; Kramer, McLean, Olivier, Willis, and Usher 1989) to determine cases

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[4] We also estimated our main models using all cases and imputing missing values of variables among the deleted cases. Even in extreme cases, where the missing values were the dependent variables (health outcomes), estimation using alternatively imputing favorable and negative outcomes resulted in estimates of effects that were almost identical to those obtained from the reduced sample. As a consequence, from here on out we only work with the reduced sample.

with IUGR. In this sample 9% of the cases fall below the .85 FGR level set as a threshold to

identify IUGR as compared to a national rate of 14% for all live births. Second, we construct a

zero/one indicator using birth weight with the conventional 2,500 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: unfavorable health (zero) and favorable health (one). A birth is in

unfavorable health (dependent variable equals zero) if at least one of the aforementioned

indicators is assigned a value of zero and is in favorable health (dependent variable equals one)

otherwise.

Independent variables

Acculturation is measured using 13 items that comprise a scale of language usage,

proficiency, and fluency, based on the Los Angeles Epidemiologic Catchment Area (LAECA)

scale (Burnam, Hough, Telles, Karno, and Escobar 1987). The scale includes questions asked of

the respondents about the language they rely upon (Spanish only, English and Spanish, English

only) when talking to immediate family, close relations, and community members; when reading

magazines or newspapers; when listening to television or radio; and their ethnic identification

(see Appendix II). The items of the scale are standardized and range from -0.5 to 3.1. The scale

has a Cronbach alpha score of .94.[5]

Our analyses also include variables reflecting conditions associated with the acculturation

process, including levels of stress, social support, diet, high-risk behaviors (use and consumption

of tobacco, alcohol, or illicit drugs), and socioeconomic and demographic characteristics. The

stress variable is a sum of scores assigned to responses (always, sometimes, never) to questions

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[5] Although we present results obtained when the continuous score of acculturation is used, all results are invariant if
one had used instead a dichotomous variable capturing some of the clustering detected in the sample.

probing isolation and loneliness, appreciation by others, feeling threatened, of being treated

unfairly, or of being surrounded by unfriendly people. Social support measures whether or not

the respondent receives help with childcare and housework by her spouse or partner and/or her

parents. Diet is measured as a dichotomous variable distinguishing healthy from unhealthy diets.

A healthy diet consists of routine consumption of foods rich in protein, calcium, and vitamins

such as dairy products, fruits and vegetables, beef, poultry, and fish.

Because the use of tobacco, alcohol, or illicit drugs is a rare event among pregnant

Mexican women in these two communities, we create a composite variable to measure high risk

behaviors for pregnant mothers. These include whether or not the respondent was exposed to, or

used tobacco, alcohol, or illicit drugs during the focal pregnancy or at the time of the interview,

including whether her spouse/partner used "substances such as marijuana". We also use

respondent's own health assessed by self-reports of health at the time of the interview (five point

scale), parity at the time of pregnancy, and the timing of prenatal care received during the

pregnancy. The latter is a dummy based on the Kotelchuck Adequacy of Initiation of Prenatal

Care scale (Kogan, Alexander, Kotelchuck, and Nagey 1994; Kotelchuck 1994) that contrasts the

women's experience of prenatal care with expected prenatal care given respondent's gestational

age. Finally, demographic, socioeconomic, and environmental measures included in the model

are mother's age, marital status (married vs. not married), schooling (10 years of schooling or

greater), mother's employment status, and income (150% or greater than the poverty level). We

also include a dummy variable to distinguish the communities where the mother resided because

of the differences in birth outcomes and characteristics associated with health found in the two

samples (Appendix, Table A.1).

RESULTS

We describe three sets of results. The first correspond to estimates from the sample of mothers in both Midwestern communities. The second compares these with estimates obtained using the Mexican-origin population included in the National Survey of Family Growth. The third are estimates from fixed effects models obtained from a sibling analysis using the study sample of Midwestern communities.

[FIGURE 2 ABOUT HERE]

Simple Models Estimated in the Two Communities

We then estimate a logistic regression of the dichotomous IUGR-FGR birth outcome measure on the number of years lived in the U.S. grouped into three categories that reflect the non-linear shape, 0-3 years, 4-12 years, and 13 or more years, and conduct the same analysis as with the continuous measures. The graph in Figure 2 shows similar non-linear results, though the confidence interval narrows significantly at the middle category. Table 1 displays estimates of effects (and associated standard errors) from alternative logistic models. In all cases the dependent variable is zero for unfavorable health outcomes and one otherwise. Thus negative coefficients indicate contribution to unfavorable health. Model A shows that the effects of duration are concave downward: mothers of shortest (less than four years) and longest (more than 12 years) duration of stay in the U.S. experience have poorer outcomes than those with intermediate duration. The inclusion of the indicator for acculturation (Model B) does nothing to change this pattern and, in addition, reveals that acculturation leads to better health status, though the magnitude of the effect is not statistically significant. So far we established one fact: that birth outcomes are unfavorable initially, improve within a few years of having migrated, and then deteriorate sharply after 12 years of residence. In addition, we also know that while

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duration and acculturation may be associated with health, they may be measuring different processes. Duration benefits health over the short-term but impairs it over the long-term, while acculturation is broadly beneficial or neutral (zero effects). What can we say about the mediating mechanisms?

[TABLE 1 ABOUT HERE]

Note in Table 1 that healthy diet, tobacco, alcohol, and illicit drug use, social support, and stress have effects in the expected direction and healthy diet is statistically significant, and social support is significant at the .10 level (Model C). A control for the intermediate pathways enhances the direct effects of duration (at short durations) and leaves unchanged the effects of acculturation. Table 2 shows bivariate relations between mediating variables and health status, on the one hand, and mediating variables and duration, on the other (column A).[6] Increased duration is associated with poor diet, increased tobacco, alcohol, and illicit drug use, less social support, and lower stress. Intermediate variables are associated as expected with birth outcomes: healthy diet and social support are positively associated with favorable outcomes and tobacco, alcohol, and drug use, and stress are negatively associated (column B). The fact that the gross effects of duration and acculturation are not attenuated upon controlling for intermediate pathways (Model C in Table 1) suggests either that these variables are not the most important mediators or that they are not adequately measured.

[TABLE 2 ABOUT HERE]

As shown in the remaining columns of Table 1 (Models D and E), controls for other maternal characteristics, socioeconomic and demographic variables makes little difference as the estimated effects of duration and acculturation remain identical to the gross effects.

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[6] Table 3 displays results obtained from the sample of valid cases only. The main features of this table remain unchanged if we instead use all cases.

In sum, these results replicate findings from other studies suggesting a deterioration of health among Mexican immigrants with increased duration of residence in the U.S. Guendelman and English (1995) found Mexican immigrant women living in the U.S. for more than five years are more likely to give birth to low birth weight and preterm birth infants. We also find that acculturation has a positive but statistically insignificant effect on birth outcomes, consistent with the findings by English et al. (1997) who found Mexico-born women who are fluent in the English language are less likely to have low birth weight and preterm infants. However, we fail 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.

The absence of effects of acculturation and the lack of evidence for effective mediating pathways are entirely consistent with the return migration conjecture. In addition, negative effects at short durations are also consistent with the return migration hypothesis and may very well reflect deleterious health effects experienced by migrants shortly after their arrival that are only poorly captured by the mediating pathways identified in the model.

Comparisons with Estimates from a National Sample of Mexicans in the U.S.

We now compare the results obtained from our study sample with results from a national sample. We do this to satisfy ourselves that our previous findings are quite general rather than a reflection of peculiarities in the study sample. We use the 1995 National Survey of Family Growth Cycle V (NSFG V), a complex sample survey conducted by the National Center for Health Statistics (NCHS) under a contract with the Research Triangle Institute (RTI). The survey includes data on family growth, formation, and dissolution, and births, infants, and fetal

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deaths, marriages and divorces, and other information on childbearing, reproductive health, migration history, and language usage for 10,847 women aged 15-44 years (Mosher 1998; Potter, Iannacchione, Mosher, Mason, and Kavee 1998). The NSFG V drew its sample from the 1993 National Health Interview Survey (NHIS), a national probability sample of 14,000 women aged 15-44, in order to enrich the data with variables of the NHIS that provided more detailed background data (Kelly, Mosher, Duffer, and Kinsey 1997). The NHIS is a stratified multistage household survey covering the civilian noninstitutionalized population of the U.S. The sample size for Latinos is 1,553 and includes respondents from nearly every state and all of the largest metropolitan areas in the U.S. The NSFG V also contains information on length of stay in the U.S., language spoken during the interview, and behavioral and social variables of interest, including measures of stress, smoking, parity, education, and marriage. In this analysis we select all Mexican-origin mothers with children 0-9 years old – a total of 190 mothers representing a population of 554,037. Unlike the sample data for the two Midwestern communities, the NSFG V infant birth data is based on retrospective information and might conceivably be affected by recall errors.[7]

There are important differences between the selected NSFG V population of mothers and those from our sample of the two Midwestern communities. Those in the national sample have a longer average duration of residence in the U.S. (9.6 vs. 6.9 years), a higher level of education (45% vs. 39% have completed some high school), a higher rate of marriage (74% vs. 62%), and a lower level of first-parity pregnancies (15% vs. 26%). All indicators used in the national sample were constructed to maximize similarity to the variables used the analysis of our main sample.

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[7] As recall errors should increase with the age of the child, inferences drawn using a subsample of the most recently born should lead to more robust inferences. However, our results are the same in the subsample as they are in the entire sample (results not shown).

Table 3 displays estimates of a model analogous to those in Table 1 using the NSFG V data. The results show remarkable similarities in the association between U.S. residential duration and birth outcomes. In particular, the effects of duration are concave downward and negative at both the shortest and longest duration, just as in our data set. The effect of the longest duration on birth outcomes is persistently statistically significant after controlling for other covariates. Similarly, the indicator of acculturation is positively associated with birth outcomes, but is not statistically significant. Finally, adding behavioral and social measures has little effect on the main model. In sum, the direction and magnitude of effects as well as all the inference drawn from this sample are either the same or broadly consistent with those obtained from the study's sample. This provides support for the generalizability of the results from the study's samples and justifies the third step to shed light on the role of migration selection more generally.

[TABLE 3 ABOUT HERE]

Sibling Model

Making a case for the use of the 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 children (and possibly maternal) health status are roughly constant across mothers' most recent sibling children. 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 induces selection effects. In particular, we can remove the effects of *W*. Estimating a difference model using the sibling

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children of mothers who remain in the U.S. should produce results that are consistent with those that we would have obtained from the sample of all mothers (including those who returned) provided that return migration only depends on *W*, the factor affecting children (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.[8]

The fixed effects approach (Chamberlain 1980) has been used in a variety of contexts: as a device to purge the effects of family characteristics on neighborhood effects, to estimate effects of public policy on teen fertility decision-making, and to estimate the effects of personal characteristics on wages (Budig and England 2001; Jackson and Klerman 1993; Plotnick and Hoffman 1995). A computational simplification of 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 of a previous pregnancy for those respondents with more than one child ever born at the time of the pregnancy. In addition, 152 of the respondents were randomly selected from those women who had at least one previous birth. 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 U.S. The information on the sibling's birth permits within-case comparisons of the effects of residential duration and acculturation on birth outcomes

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[8] 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.

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: 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 U.S. 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-origin mother had lived in the U.S. less than *T* years than for the most recent sibling born when the mother has lived in the U.S. for over *T*. 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 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 discussed below. 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 do not have as much detailed information on sibling one as we do for sibling two.

However, maternal characteristics that can be safely assumed to remain invariant 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 United States, 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. However, the birth outcome of the previous sibling 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 before, despite the changes imposed in the definition of variables. These estimates are corrected for (within household) clustering. They are displayed in 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 1): mothers who have lived in the U.S. zero to three years and over 12 years are more likely to have unfavorable birth outcomes than mothers who have lived in the U.S. four to twelve years, and the effect of duration is statistically significant to the .10 level. The results of Models B and C are also very similar to those in Table 1: adding acculturation and covariates measuring social, behavioral, and environmental characteristics has little impact on the 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 4 ABOUT HERE]

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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 U.S. determined by the birth intervals separating the two chosen siblings. As argued before, if return migration only depends on these common characteristics, the effect of duration (as reflected in the birth interval between siblings) will be an unbiased estimate of duration of residence in the U.S. According to the acculturation paradox, one would expect health outcomes for the most recent pregnancy (sibling two) be worse than for the previous pregnancy (sibling one) and *that the likelihood of this outcome increases with the length of the birth interval.* Since the variable measuring acculturation is identical for both siblings (measured only once) we cannot retrieve its direct estimates from sibling models. But we can test for differences in its effects across 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 U.S. Because the model estimates the differences in the outcome variables, all cases for which the outcomes between siblings are the same are dropped from 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 U.S. 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 U.S. less than three years. But these differences are not statistically significant. In this model we are forced to use a shorter duration interval than in the main and pooled models because duration is measuring 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% have three or less years of duration between sibling births. Adding

covariates for sex of the infant, mother's age, and the interaction of sibling order and

acculturation in Model B, reduces even more the effect of duration on birth outcomes.

[TABLE 5 ABOUT HERE]

More important for this analysis, the lack of a significant effect of duration in the U.S. on

the difference of two siblings' birth outcomes suggests that there are no differences in siblings'

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 which focus on the health deterioration

of Mexican immigrants across generations, we studied health changes over a span of years

within a single generation. Doing so enables us to examine more closely the mechanisms

explaining the association between lengths of time an immigrant lives in the U.S. and birth

outcomes. Using data collected in two predominantly Mexican communities located in the

Midwest, we find evidence of a nonlinear relationship between duration in the U.S. and birth

outcomes. Mexican-origin women who had lived in the U.S. for 13 or more years were one-fifth

as likely to have favorable birth outcomes as those who had lived in the U.S. for 4 to 12 years.

In addition, women who had lived in the U.S. fewer than four years were one-third as likely to

have favorable birth outcomes as the reference group. Perhaps those with the least number of

years in the U.S. go through an adjustment period as newcomers, experiencing higher levels of stress and having far less access to resources that contribute to a healthy pregnancy and birth.

We also find that acculturation, as measured by English usage, has a large and positive effect on health. Mothers who most use English in their daily lives were over one and three-fourths as likely to have had a favorable birth outcome as those who mostly used Spanish. Although the estimates are not statistically significant (perhaps due to poor power), these effects are large and ubiquitous enough to be of some note.

Our results are consistent with previous local studies that have separately tested the effects of duration and acculturation on birth outcomes of first-generation Mexican immigrant women (English et al. 1997; Guendelman and English 1995). One study, however does provide what appears to be contradictory results (Balcazar and Krull 1999) in which longer duration was found to be associated with favorable outcomes and higher levels of acculturation to be associated with unfavorable outcomes. However, our study differs in two important ways: we measure the dependent variable using the fetal growth ratio which is based on low birth weight and preterm gestational age indices (consistent with the Guendelman and English study that studies low birth weight and preterm births) while the Balcazar and Krull study uses a moderate to low birth weight (less than 2900 grams) measure for the dependent variable and we only include Mexico-born immigrants (Balcazar and Krull include U.S.-born Mexican-origin women in their sample). Furthermore, our measure of acculturation differs: the Balcazar and Krull study measures acculturation with a 5-item scale composed of language usage, childhood experience in Mexico, ethnicity of friends, and cultural pride, as compared to our acculturation variable which uses a 13-item scale, comprised primarily of language usage and fluency, and ethnic identification (more consistent with the English et al. study that uses language fluency to

measure acculturation). Hence our studies are not strictly comparable and the different measures of the outcome and independent variables may help explain the differences in effects of duration and acculturation on birth outcomes.

Our analysis of a national sample of Mexican-origin women confirms our results with the Chicago and Milwaukee sample. In the national sample, women living in the U.S. over 12 years were one-fourth as likely to have favorable birth outcomes as those who had lived in the U.S. four to twelve years. In addition, the effect of acculturation is also positive but not significant. While our analysis of cross-sectional data from the two local and the national samples of Mexican-origin mothers supports the acculturation paradox (and is also consistent with migration selection), it does not support the notion that an unfavorable birth outcome is caused or mediated by conditions that are normally thought to accompany the acculturation process. Controlling for the effects of behavioral and social determinants does not reveal evident mediating effect of duration or acculturation on birth outcomes. Rather, this result is consistent with the return migration hypothesis.

Sibling data enables us to analyze differences in birth outcomes between sequential births and to assess changes in factors that affect the health status of the mother-sibship entity. Our results from fixed effects models on siblings finds no statistically significant declines in health over time, thus suggesting that the decline found in the cross-sectional data may be due to selection of the healthiest mother-sib entities through migration.

In sum, our results from local and national data of birth outcomes of Mexican immigrant women using cross-sectional and sibling analysis provide indirect support for the return migration hypothesis, that is, the deterioration in birth outcomes with increased duration in the U.S. among first generation may likely be due to an artifact of higher return migration rates of

the healthiest immigrants. Additionally, our results did not find evidence supporting the negative acculturation hypothesis that would suggest the deterioration in birth outcomes with increased duration to be caused by behavioral and social determinants associated with acculturation.

Two caveats are important. First, all our results are based on first-generation migrants. Therefore they do not run counter to previous studies of the acculturation paradox, which primarily considers the effects across generations. And second, the lack of a mediation effect of behavioral and social determinants associated with acculturation may be due to inadequately measured or omitted variables, thus further study is necessary to ensure that appropriate and sufficient controls of these mediators are accounted for in the analysis. These results at least suggest that there is much work to do before one settles the issue of whether or not there are acculturation paradoxes, at least over the first generation.

APPENDIX I

Table A.1: Comparison of Variable Means from Chicago and Milwaukee Samples

Variable	Chicago	Milwaukee	Full sample
Birth Outcome (favorable=1)	0.92	0.83	0.91
Years lived in the U.S.	6.88	6.64	6.85
Acculturation scale	-0.14	-0.03	-0.13
Diet (healthy=1)	0.45 *	0.58	0.47
Tobacco, alcohol, drugs	0.07 †	0.13	0.08
Social support	0.15 †	0.08	0.14
Stress	0.73	0.70	0.73
Prenatal care	0.85 *	0.94	0.86
Mother's health (excellent/very good=1)	0.45 *	0.32	0.43
Parity (zero parity=1)	0.27	0.23	0.26
Mother's age	26.45	26.77	26.49
Marital status (married=1)	0.60 *	0.74	0.62
Schooling (10+ years)	0.40	0.36	0.39
Income (>150% of poverty level)	0.16 *	0.06	0.14
Mother employed	0.50 **	0.32	0.48
N	361	53	414

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

T-test comparing means of Chicago sample relative to Milwaukee sample

Table A.2: Comparison of Variable Means of Missing and Non-missing Cases

Variable	Missing cases mean	n	Non-missing cases mean	n
Years lived in the U.S.	6.38	61	7.21	450
Acculturation scale	-0.21 †	62	-0.08	448
Diet *(healthy=1)*	0.48	61	0.47	427
Tobacco, alcohol, drugs	0.13	63	0.09	450
Social support	0.14	63	0.13	448
Stress	0.77	62	0.72	448
Prenatal care	0.89	63	0.87	450
Mother's health (excellent/very good=1)	0.23 **	62	0.43	439
Parity *(zero parity=1)*	0.13 **	63	0.28	450
Mother's age	27.43 †	63	26.32	450
Marital status *(married=1)*	0.59	63	0.61	449
Schooling *(10+ years)*	0.33 *	63	0.39	450
Income (>150% of poverty level)	0.06	62	0.15	450
Mother employed	0.40 †	62	0.50	450

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

T-test comparing means of missing relative to non-missing cases.

APPENDIX II

Interview Questions used for Measures of Independent Variables

A. Acculturation Scale Measures Questions:
The acculturation measure is based on a three-item scale from the following measures: what language(s) do you use: Spanish only, both English and Spanish, or English only in the following situations?

1. When communicating with the following persons?: Spouse, children, close family, friends, neighbors, city or government agencies, doctors, nurses, midwives, shopkeepers, co-workers.
2. When reading newspapers or magazines?
3. When watching television programs?
4. When listening to the radio?
5. In what language(s) is/are used the religious services conducted that you attend?

B. Stress
The stress measure is based on a two and three-item scale from the following questions asked of the interviewee:

1. Does the following statement reflect your situation always, sometimes, or never?:
   a. I feel there is no one I can confide in.
   b. I feel unappreciated by others.
   c. I feel isolated.
   d. I feel threatened by others.
   e. Others treat me fairly.
2. I will list some feelings or behaviors that you may have had during the past month. Tell me if you have done or felt any of the following. Answer yes or no:
   a. Felt that people are unfriendly to you.
   b. Felt very lonely.

C. Social Support
The social support measure is based on the following questions:

1. Does your spouse/partner help with child care?
2. Does your spouse/partner help with house-cleaning?
3. Does your spouse/partner help with repairs around the home?
4. Do your parents help with house-cleaning?
5. Compared to before your pregnancy, did you do less of the following during your pregnancy?
   i.   Taking children to the doctor/clinic.
   ii.   Putting the children to bed.

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Table 1: Logistic Regression Estimates of Favorable Birth Outcome on Duration, Acculturation, and Behavioral, Social, and Environmental Determinants of the Sample Data

Variable	Model A	Model B	Model C	Model D	Model E
0-3 Years in the U.S.	-1.09 **	-1.01 **	-1.04 *	-1.06 *	-1.23 *
(4-12 years omitted)	(0.39)	(0.39)	(0.41)	(0.45)	(0.48)
13+ Years in the U.S.	-1.34 **	-1.50 *	-1.40 **	-1.48 **	-1.64 **
	(0.49)	(0.35)	(0.52)	(0.55)	(0.6)
Acculturation scale		0.41	0.40	0.43	0.58
		(0.35)	(0.38)	(0.39)	(0.44)
Diet (healthy=1)			0.84 *	0.84 *	1.05 *
			(0.39)	(0.39)	(0.42)
Tobacco, alcohol, drugs			-0.65	-0.61	-0.62
			(0.57)	(0.57)	(0.61)
Social support			1.84 †	1.92 †	1.68
			(1.03)	(1.05)	(1.08)
Stress			-0.82	-0.89 †	-0.97 †
			(0.52)	(0.53)	(0.57)
Prenatal care				-0.42	-0.50
				(0.53)	(0.57)
Mother's health				0.22	0.27
(excellent/very good=1)				(0.37)	(0.4)
Parity (zero parity=1)				0.17	0.04
				(0.45)	(0.48)
Mother's age				0.01	0.00
				(0.04)	(0.04)
Marital status (married=1)					0.80 *
					(0.4)
Schooling (10+ years)					-0.05
					(0.4)
Income					-1.60 **
(>150% of poverty level)					(0.51)
Mother employed					0.97 *
					(0.45)
Sample location (Chicago=1)					1.15 *
					(0.48)
Constant	2.93 ***	3.00 ***	3.26 ***	3.28 **	2.36 †
	(0.3)	(0.31)	(0.54)	(1.2)	(1.34)
Observations	414	414	414	414	414
Log likelihood	-121.31	-120.48	-112.01	-110.14	-103.16
Likelihood Ratio χ²	11.29**	12.94**	29.89***	33.63***	47.59***
Degrees of freedom	2	3	8	11	16

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

Birth outcome is measured by birth weight, gestational age, intrauterine growth retardation (IUGR), and the fetal

growth rate. Standard errors are in parentheses. N=414.

Table 2: Mediation Effects of Duration on Covariates and Covariates on Birth Outcomes

Variable	*Duration=>* Covariate	*Covariate=>* Birth Outcomes
	A	B
Acculturation scale	0.04 ***	0.35
	(0.01)	(.032)
Diet	-0.06 **	0.72 *
(healthy=1)	(0.02)	(0.36)
Tobacco, alcohol, drugs	0.05 †	-0.63
	(0.03)	(0.52)
Social support	0.01	1.89 †
	(0.03)	(1.02)
Stress	-0.06 **	-0.97 †
	(0.02)	(0.49)
Prenatal care	-0.01	-0.06
	(0.03)	(0.50)
Mother's health	0.001	0.28
(excellent/very good=1)	(0.02)	(0.35)
Parity (zero parity=1)	-0.17 ***	-0.42
	(0.03)	(0.36)
Mother's age	0.38 ***	0.02
	(0.05)	(0.03)
Marital status (married=1)	0.02	0.55
	(0.02)	(0.34)
Schooling (10+ years)	0.04 †	-0.005
	(0.02)	(0.35)
Income	0.07 **	-0.70 †
(>150% of poverty level)	(0.02)	(0.41)
Mother employed	0.05 *	0.61 †
	(0.02)	(0.36)
Sample location	0.01	0.85 *
(Chicago=1)	(0.03)	(0.41)

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

Birth outcome is measured by birth weight, gestational age, intrauterine growth retardation (IUGR), and the fetal

growth rate. Standard errors are in parentheses. N=414

Table 3: Logistic Regression Estimates of Birth Outcome on Duration, Acculturation, and Social Determinants of 1995 NSFG V Sample

Variable	Model A	Model B	Model C
0-6 Years in the U.S.	-1.10	-1.08	-1.36 *
(7-10 years omitted)	(0.69)	(0.7)	(0.67)
11+ Years in the U.S.	-0.96	-1.02 †	-1.37 *
	(0.61)	(0.57)	(0.63)
Acculturation		0.43	0.49
(medium/high=1)		(0.41)	(0.4)
Smoking			-0.40
			(0.6)
Stress			-1.24 **
			(0.42)
First born			-0.19
			(0.5)
Married			0.82
			(0.53)
Schooling (10+ years)			-0.10
			(0.3)
Constant	2.24 ***	1.96 **	1.94 *
	(0.54)	(0.71)	(0.77)
F-distribution	1.43	3.76*	4.92***
Design degress of freedom	2	3	8

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

Birth outcome is measured by birth weight, gestational age, intrauterine growth retardation (IUGR), and the fetal growth rate. Standard errors are in parentheses.

The estimates were computed accounting for the complex survey design with 4 strata and 51 probability sampling units. The estimates represent a population= 724,621 and a design degrees of freedom=47, and contain linearized standard errors. N=190.

Table 4 Logistic Regression Estimates of Birth Outcome on Duration, Acculturation, and Social Determinants of the Pooled Sibling Data from the Sample

Variable	Model A	Model B	Model C	Model D
0-3 Years in the U.S.	-0.54	-0.51	-0.08	0.01
(4-12 years omitted)	(0.37)	(0.37)	(0.51)	(0.52)
13+ Years in the U.S.	-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

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

Birth outcome is measured by birth weight, gestational age, intrauterine growth retardation (IUGR), and the fetal growth rate. Standard errors are in parentheses. N=332.

Table 5: **Fixed-Effects Logistic Regression Estimates of Favorable Birth Outcomes on Duration, Sex of Infant, Age, Sibling Order and Acculturation of the Sample Data**

Variable	Model A	Model B
4+ Years in the U.S.	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

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

Birth outcome is measured by birth weight, gestational age,

intrauterine growth retardation (IUGR), and the fetal growth rate.

Standard errors are in parentheses.

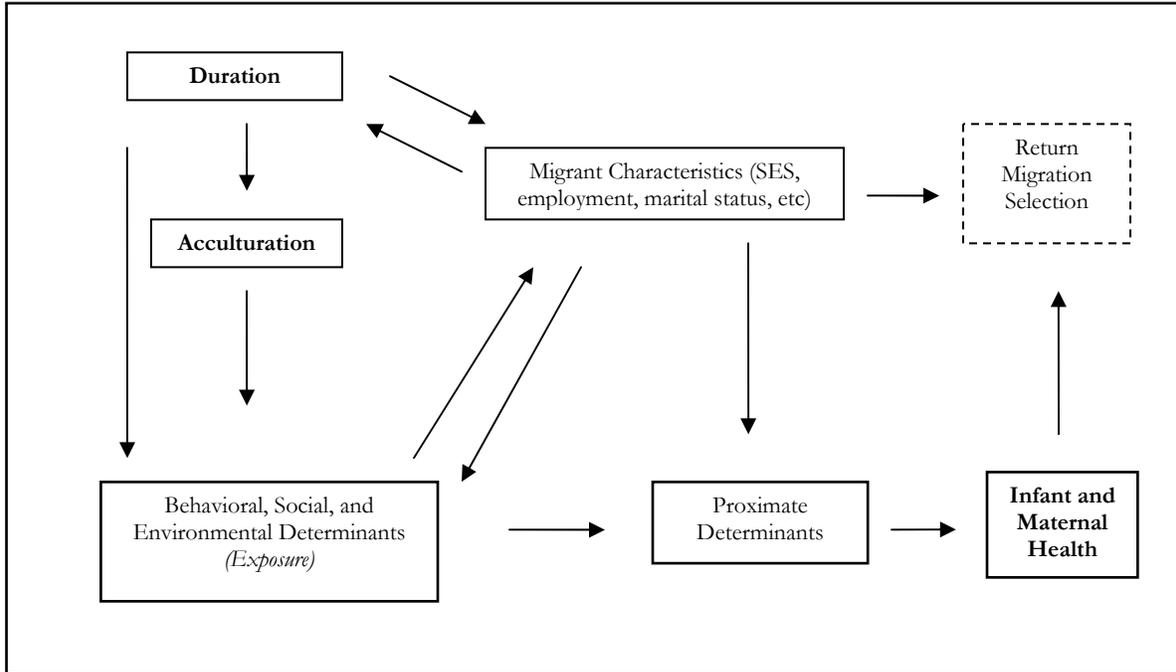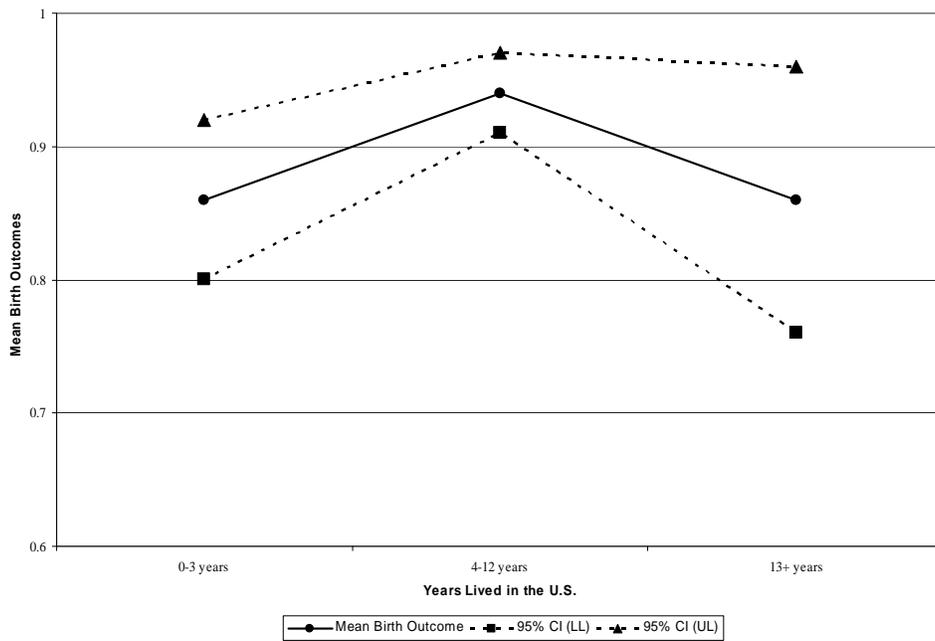**Figure 1: Conceptual Framework of the Effect of Duration and Acculturation on Infant and Maternal Health**

Figure 2: Mean Birth Outcomes by Years Lived in the U.S. with 95% Confidence Intervals, by Categories