DO NOT CITE WITHOUT PERMISSION OF AUTHORS

MATERNAL AND INFANT HEALTH OF THE MEXICAN-ORIGIN POPULATION IN THE UNITED STATES: ACCULTURATION, DURATION, AND SELECTION

Miguel Ceballos
Population Studies Center
Institute of Social Research
University of Michigan

Alberto Palloni
Department of Sociology
Center for Demography and Ecology
University of Wisconsin-Madison

March 18, 2005

For presentation at the Population Association of American Annual Meetings,
Philadelphia, Pennsylvania, April 2, 2005

Correspondence: Miguel Ceballos, Population Studies Center, Institute for Social Research, University of Michigan, 426 Thompson St., Ann Arbor, Michigan 48106-1248. (734) 763-2410, miguelc@isr.umich.edu

INTRODUCTION

The role of the acculturation process on the health of the Mexican-origin[1] population in the United States is a growing concern because of the persistent finding that health declines with increased duration lived in the U.S. While many studies have shown Mexican immigrant women give birth to infants that are as healthy as, or healthier than, infants born to White women in the United States (called the "epidemiological paradox"), other studies have found that this health advantage of birth outcomes for Mexican women deteriorates for subsequent generations, in this study this is referred to as the 'acculturation paradox.' (Guendelman et al. 1990; Scribner and Dwyer 1989; Zambrana et al. 1997; Notzon, Bobadilla, and Coria 1992).

Two explanations for this decline in health with increased duration lived in the U.S. will be analyzed in this paper. The first is the acculturation or cultural behavior hypothesis, which posits that Mexicans enter this country with a set of protective social relations, behaviors, and maternal characteristics associated with maternal health that contribute to positive birth outcomes. However, the process of acculturation brings with it changes to the migrants' lives, such as increased stress, changes in social relations, and the adaptation of behaviors that may have negative consequences for maternal and infant health (Guendelman et al. 1990). The second explanation is the return migration selection hypothesis which posits that the deterioration of health is due to migrants selectively returning to Mexico based, in part, on their health characteristics (Abraido-Lanza et al. 1999; Franzini, Ribble, and Keddie 2001). Mexican mothers with good health may be more likely to return to

[1] The term 'Mexican-origin' will refer to the population of Mexican ancestry including Mexican immigrants born in Mexico and the Mexican population born in the United States, such as those identified as Mexican Americans or Chicanos. The terms Mexican and Mexican-origin will be used interchangeably.

Mexico than those with poor health, thus resulting in an observed decline in health of the Mexican population remaining in the U.S. Although this is a plausible phenomenon, some authors lean toward the belief that the reverse situation is more likely, that is, that mothers in ill health or with children in ill health are more likely to return to Mexico as they find adverse conditions to be serviced in the U.S. health care system. Clearly this second phenomenon would not lead to better health status among those remaining but to the opposite situation. In this case the explanation for the apparent advantage ought to be searched in mechanisms other than return-migration selection.

The object of this study is to test these two hypotheses by disentangling the relationship between duration lived in the U.S. and acculturation. Most studies often conflate these two processes assuming duration measures acculturation. However, while most studies that have found a negative association between health and the number of generations in the U.S., when using number of years to measure length of time in the U.S., acculturation and duration have been found to move in the opposite direction with respect to health. Balcazar and Krull (1999) found that while health deteriorated among Mexican migrants with greater levels of acculturation, it improved for those who lived in the United States for longer periods. These findings demonstrate the complexity in the relationships between acculturation and duration and their effect on health.

In this paper we explore the relationship between duration and acculturation, assessing their separate and joint effects to discern the mechanisms that explain their association with infant and maternal health and to determine if they measure different processes. We first analyze the strength of the relationship between the length of stay in the U.S. and acculturation and birth outcomes from a sample on Mexican immigrant women

living in two Midwestern Latino communities, and then evaluate the effect that behavioral, social, and environmental determinants have on this relationship. Second, we conduct a similar analysis using a nationally representative sample to test the generalizability of our results. Third, we control for unmeasured common effects in the household and the effects of return-migration selection by analyzing sibling data.

DATA AND METHODS

This study addresses these questions by using data collected from a survey of Mexican women in two predominantly Mexican-origin communities in Chicago and Milwaukee. Several important features of the data make this study unique and optimal for this study of acculturation and health. First, the data collection was done in collaboration with two community clinics that are well-established local health providers offering comprehensive medical services to two large and growing, Spanish-speaking communities. Second, the survey includes information on infant and maternal health before, during, and after the pregnancy, including birth outcomes and the mother's pregnancy history. Third, the study contains information on characteristics associated with infant health, such as maternal health behaviors, socioeconomic status, migration history, and acculturation.

The sample of 550 cases was randomly selected from a list of pregnant mothers who were clients of two clinics in Chicago and Milwaukee between 1999 and 2001. The survey questionnaire was administered by clinic staff, thereby improving the confidence of the interviewee in responding to the interviewer, and contributing to the study's high rate of response (only eight respondents were estimated to have refused to participate in the study). In addition, the research material included health records of the pregnancy and birth, and a follow-up of a random sample of respondents.

Because the clinics receive federal funding for providing free prenatal services to low-income mothers residing in the neighborhood and are highly accessible, endowed with a well-trained, Spanish-speaking staff with strong relations to residents in the area, the clinic's clientele is undoubtedly drawn from a broad based, representative sample of the communities' population. Indeed, interviews with clients and clinic personnel with whom we probed the issue, strongly suggests that the number of women with impaired health and with high-risk pregnancies who receive prenatal care directly from the local hospitals, bypassing the clinic's services, is insignificant.

A comparison with national data on the Mexican-origin population in the U.S. shows that our sample has better birth outcomes and is of marginally lower socioeconomic standing than the national average (Natality Detail File 1999, 2000): the sample's proportion of low birth weight and pre-term births is lower (1% vs. 6% low birth weight and 6% vs. 11% preterm births), fewer respondents are born in the U.S. (8% vs. 39%), and the mean years of completed schooling is lower (9 vs. 10 years). We expect that these differences would permit an in depth analysis of recent migrants without affecting the nature of the association between acculturation, duration in the U.S., and health.

This analysis is limited to Mexican-origin women living in the U.S. who were born in Mexico, because it has been shown that birth outcomes for Latinos vary by subgroup. The data was casewise deleted on those cases with missing information on the outcomes of the completed pregnancy, the dependent variable, and length of time lived in the U.S., the independent variable of interest. This gives us a sample size of 428 (Table 1).

[TABLE 1 ABOUT HERE]

Because access to clinic and hospital records were made available for only the Chicago sample, most of the cases excluded due to missing information on the dependent variable (70%), were from the Milwaukee sample. Hence, the differences between the analyzed sample and missing cases, in part reflects the differences between the two communities. The possible influence these differences may have on the analysis is discussed below.

The literature on the epidemiological and acculturation paradoxes has relied primarily on measuring birth outcomes using birth weight, gestational age, and infant mortality. There are two problems with this approach. First, analyzing data with a small sample size becomes problematic because these birth outcomes are relatively rare events in highly developed countries, including the immigrant population in the U.S. and elsewhere. This presents us with an obstacle to make clean, convincing inferences from small samples. In our sample there are only 2 cases of infant deaths, 6 cases of low birth weight births, and 27 cases of preterm births (6%). Second, the conventional demographic measurements of low birth weight and gestational age have been found to substantially underestimate the proportion of compromised births across all populations (Frisbie et al 1996).

For this analysis we use the approach of Frisbie et al. (1996) which utilizes the fetal growth ratio (FGR) to disentangle the relationship among the three measures of birth outcomes, IUGR, birthweight, and gestational age. This method makes it possible to examine outcomes that are often neglected, such as 'heavy premies.' The fetal growth ratio, proposed by Kramer et al. (2001) incorporates the non-linearities of infant health measures by identifying immature (IUGR) births that would not otherwise be detected when using

typical demographic measurements. The FGR is the ratio of the observed birth weight at a given gestational age to a standard fetal growth distribution of the average birth weight for gestational age by sex and, if appropriate, by ethnicity (Balcazar et al. 1994). The accepted fetal growth rate cut-off point indicating relative immaturity has been found to be valid at .85. In this sample 9% of the cases fall below the .85 fetal growth ratio level, as compared to a national rate of 14% for all live births (Balcazar 1993). This ratio is useful as a standardized measure representing a population for evaluating IUGR reported in a sample (Frisbie et al. 1996). In the case of the fetal growth ratio, while .85 is the accepted cut-off point indicating relative immaturity, it is still possible to have unhealthy outcomes with an FGR above that level. An infant can be born at normal weight with preterm gestation or born with low birth weight with full-term gestation.

This method by Frisbie et al. (1996) classifies birth outcomes by IUGR and the different combinations of outcomes of birth weight, and gestational age outcomes; a total of eight classifications: either IUGR outcomes (FGR less than .85) or non-IUGR outcomes (FGR greater than or equal to .85) and four classes of birth weight and gestational age: low birthweight and preterm births, low birthweight and full-term births, normal birthweight and preterm births, normal birthweight and full-term births. Only in one case is the outcome normal in all respects: non-IUGR with normal birth weight (>=2,500 grams) and full-term births (gestation>=37 weeks).

For our analysis we use this approach by constructing a dichotomous dependent variable measuring IUGR and FGR birth outcomes as which attains the value 1 for a normal birth outcome which is defined as a birth with these three birth outcomes are normal in all respects, and 0 otherwise. In all, 90% of respondents fall into the category of normal health

outcomes. In this study we use an ethnicity-specific distribution for estimating the fetal growth rate of a national sample of Mexicans-origin women taken from the U.S. 1999 Natality Detail File (Natality Detail File 1999, 2000; Kramer et al. 1989; Frisbie et al. 1996).

While this analysis focuses on low birth weight outcomes (IUGR and FGR), a substantial body of literature also addresses the effect of excessively high birth weight outcomes. It is often assumed that the relationship between these indicators is monotonic, linear and positively related to health. However poor birth outcomes are also found at the higher ranges of these measures: large-for-gestational age (LGA) births, those births above 4000 grams and those above the 90^{th} percentile at any week of gestation are associated with such complications and conditions as fetal macrosomia, dystocia, cephalopelvic disproportion, respiratory distress syndrome, congenital anomalies, prematurity, intrauterine death, and placental insufficiency (Beischer et al. 1997; Alden 1997).

In addition, high fetal birth weight is also associated with over weight and diabetes at later ages. In our sample a significant number of cases (14%) have birth weights above 4000 grams and 4% of the cases exceed the postterm pregnancy period of 42 weeks. Since overweightness and diabetes is very high in the Latino community (Vega and Amaro 1994) a separate analysis was conducted using a multinomial logistic model comparing the IUGR-FGR birth outcomes, high birth weight outcomes (greater than 4000 grams), and favorable birth outcomes to determine if there were differences. The tests found that high birth weight and favorable birth outcomes were indistinguishable with respect to the variables in the model (see Table 9 in Appendix II). Hence favorable birth outcomes and high birth weight outcomes were combined for the final analysis of the data.

The two main independent variables of interest are length of time lived in the U.S. and acculturation. The duration variable measuring the number of years the respondents has lived in the United States is calculated based on the number of years the respondent reported living in the U.S. and of the respondent's date of entry into the U.S. The mean duration in the U.S. is 6.9 years for those born in Mexico and over half of the sample has lived in the U.S. for less than six years. In our analysis, the duration variable is divided into three intervals: 0-3 years, (comprising 32% of the sample), 4-13 years (57%), and 14 or more years (12%).

The acculturation measure used in this study includes fifteen items that comprise a scale of language usage, proficiency, and fluency, based on the Los Angeles Epidemiologic Catchment Area (LAECA) scale (Burnam et al. 1987). These include language spoken among family and close relations, in the community, and when reading magazines or newspapers or listening to television or radio, (see Appendix II). The dichotomous variable measures medium and high vs. low levels of acculturation, where medium and high acculturation is indicated by those respondents who speak both English and Spanish in at least six of these measures or speaks only English for any of these single items (21% fall into this high acculturation level).

The analysis includes those measures which are hypothesized to be associated with the acculturation process, including stress, social support, diet, and high-risk behaviors such as smoking, drinking, and drug use, and socioeconomic, demographic, and environmental characteristics. The stress variable measures the experience by the mother as a migrant in her interactions with others, including feelings of isolation and loneliness, of not being appreciated, of feeling threatened, of being treated unfairly, or of being surrounded by

unfriendly people. The social support variable measures the level of help the mother receives during her pregnancy with childcare and housework by her spouse or partner or her parents. Diet is measured by the level of an unhealthy diet the mother consumed at the time of the interview, including reports of consuming a lot of candy or soft drinks, and having a diet with little protein, calcium, and other vitamins, found in beef, chicken, milk, fruits, and vegetables. The smoking, drinking, and drugs variable measures the level of high-risk behaviors of the mother during and after the pregnancy, first and second hand smoking, alcohol consumption, and drug use by her or her partner (see Appendix II).

Mother's health is assessed by a self-report of her health before, during, and after the pregnancy, her parity at the time of pregnancy (whether this was her first pregnancy), and the timing of prenatal care received during the pregnancy based on the Kotelchuck Adequacy of Initiation of Prenatal Care scale (Kotelchuck 1994; Kogan et al. 1994).

Mother's age is a categorical variable, less than 21 years, between 21 and 29 years, and over 29 years old. Studies have found higher levels of unfavorable birth outcomes at the high and lower age levels for African Americans and Latinos (Geronimus 1986, 1992). Demographic, socioeconomic, and environmental measures included in the model are, marital status, schooling (at least some high school level), mother's employment status, income (less than 150% the poverty level), homeownership, conditions and cleanliness of the home, and conditions of the community (safety, cleanliness, economy). Finally, because of the differences in birth outcomes and characteristics associated with health found in the Chicago and Milwaukee samples, a location variable indicating the Chicago sample is included in the analysis with Milwaukee as the residual category (see Table A.2 in Appendix II).

RESULTS

Figure 1 is a conceptual model that guides this analysis, incorporating the emphasis on sociocultural determinants and the role of acculturation on infant and maternal health and for understanding the mechanism of the effect of the acculturative process of infant and maternal health. It is hypothesized that the acculturative process operates through the sociocultural and socioeconomic factors (Scribner and Dwyer 1989; Guendelman et al. 1990; Balcazar and Krull 1999; Zambrana et al. 1994). Acculturation, as defined by Gordon (1964), is the immigrant's adoption of cultural or behavioral patterns found in the host society. For this study this may include such behaviors as dietary preferences, smoking or alcohol consumption, and social relations, which, in this case, may have an effect on infant and maternal health.

Duration, on the other hand, is expected to operate through the acculturation process; time in the host country is expected to exert influence on the acculturation of the migrant. Such a model would predict that the effect of duration on health should be attenuated after including acculturation in the model and both the effect of duration and acculturation on health should be attenuated after including measures representing behavioral, social, and environmental determinants of infant and maternal health. Furthermore, since length of time in the host community is expected to increase the level or likelihood of acculturation, duration and acculturation are expected to be highly correlated. Many studies, using duration as a proxy for acculturation, have modeled duration's effect upon acculturation which has an effect on socioeconomic and sociocultural determinants.

[FIGURE 1 ABOUT HERE]

However, it is also known that there is a significant stream of migrants returning to Mexico. One study (Reyes 1997) found that about 50% of Mexican immigrants return to Mexico after two years and up to 70% return after ten years. This return-migration rate varies by characteristics of the migrant, for example, those migrants that are male, young and living in states close to the U.S.-Mexico border are more likely to return migrate than women, older migrants, and those who live in states that do not share a border with Mexico. If the return-migration population is randomly selected from the U.S. migrant population, then we would not expect this to affect the health status distribution among those who stay. However, if those who return to Mexico are more likely to come from the healthier segment of the migrant community, we would expect to observe a decline in health status among those who remain. Furthermore, the existence of such a selection would cause the observed association of duration and health to persist even after controlling for behavioral, social, and environmental determinants. Therefore, we will analyze the data with a model that first enables us to assess the strength of the relationship between duration and acculturation and birth outcomes. Second, we evaluate the effect that behavioral, social, and environmental determinants have on this relationship. Third, to assess the robustness of our tests to the nature of the sample we are using, we test the hypotheses using a nationally representative sample to determine if our results are generalizable to the Mexican population living in the U.S. at the national level. Finally, we conduct an analysis using sibling data to control for

unmeasured common effects in the household and assess its affect on the association of duration in the U.S. and birth outcomes.

Figure 2 graphs the mean of the IUGR-FGR birth outcomes by the number of years lived in the U.S. with confidence intervals. The graph shows a non-linear shape of the relationship between duration and birth outcome, with an improvement in health over the first 12 years followed by a precipitous decline for cases living in the U.S. over 12 years. However, this curve falls within the width of the 95% confidence intervals indicating the apparent decline in birth outcomes over time may be random. Estimating a logistic regression of the dichotomous IUGR-FGR birth outcome measure on the number of years lived in the U.S. in Models A and B of Table 2, showing no significant effect with and without a squared term, although the squared-term is negative as expected by the shape of the curve.

[FIGURES 2 AND 3 ABOUT HERE]

We then group the years lived in the U.S. into three categories, 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 3 shows similar results, though the confidence interval narrows significantly at the middle category. Table 2 displays estimates of effects of duration and acculturation separately and jointly showing a statistically significant association between duration and birth outcomes. In Model C we regress the IUGR-FGR birth outcome measure onto the categorical duration measure. These results show that migrants with the shortest duration in the U.S. are significantly disadvantaged relative to those with duration of 4-12 years (O.R. =

.37; CI = .18, .77; p=.008). Similarly, those migrants who have the longest duration in the U.S. are significantly disadvantaged to the reference category (O.R. = .38; CI = .14, .98; p= .046). Thus, the effects of duration are non-linear, with those at the shortest and longest durations fairing worse than everybody else. A Mexican mother who has lived in the United States less four years or more than 12 years is 60% less likely to have a normal birth outcome as one who has been living in the United States for 4-12 years. Model D shows that acculturation exerts a positive effect on birth outcomes, the more acculturated are over twice as likely as the least acculturated to have favorable birth outcomes, although the effects are not statistically significant. According to our model, when we introduce simultaneously indicators of acculturation and duration we expect that the effects of duration on health should be attenuated. However, the results for Model E do not bear this expectation out as the estimated effects of the 0-4 year duration interval remain virtually unchanged, though with a reduced level of significance (p = 0.14) and the category with the longest duration slightly reduced (O.R. = .30; CI=.11, .81) but remained statistically significant (p=0.02), thus reinforcing the idea of curvilinear effects. The effect of acculturation also slightly increases in this model (the highly acculturated are over 2 1/3 times as likely to have normal outcomes as compared to those with low levels of acculturation), but the effect, here again, does not reach statistical significance. These results indicate a nonlinear, inverted u-shaped relationship between health and duration that is significant, as birth outcomes deteriorate initially, improve within a few years of having migrated and the deteriorates after living in the United States for 13 or more years. These results also suggest that while 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 higher

levels of acculturation appear to be beneficial, although the effects are not statistically significant.

[TABLE 2 ABOUT HERE]

The Acculturation Hypothesis

To test the acculturation hypothesis we add the behavioral, social, and environmental determinants to the model with the expectation that their inclusion will attenuate the effect of acculturation and duration on the outcome measure. Table 3 displays the main results. Model A adds measures of stress, social support, diet, and risky health behaviors including smoking, alcohol consumption, and illicit drug use. Social support is positive and the only one of these only measure approaching statistical significance ($p=.07$) but above than the $p<.05$ level, suggesting that those with social support may be twice as likely to have normal outcomes as those without social support. The introduction of these variables creates little change to the effects on the duration variables, and only a small increase in the effect of acculturation which increases its level of statistical significance ($p=.09$), but remains higher than $p<.05$ level. These results imply that these variables are not the right mediating mechanisms between acculturation (or duration) and birth outcomes as they show little change to the main model.

Model B adds maternal characteristics, maternal health, parity, and prenatal care. This model shows that these variables also have no effect on birth outcomes and have no effect on the main model. The effects of the duration and acculturation variables remain the unchanged. Model C adds socioeconomic and demographic variables as well as indicators of

social environment, including mother's age, marital status, education level, income, employment status, homeownership status, household and community conditions, and location of the sample. In this model we find that high income is negatively associated with birth outcomes, mothers who are living above 150% of the poverty level are 60% as likely to have favorable birth outcomes as those living below 150% the poverty level. This runs contrary to our understanding of the relationship between socioeconomic status and health. This seems to be due to the fact that duration in the U.S. is associated with socioeconomic status. A likelihood-ratio chi-squared test of the association between these duration and income was found to be highly and significantly associated (p=.0001). An explanation may be that those who live in the U.S. a longer time are more likely to have more time to increase their income. This association would fit well with the acculturation hypothesis; however the effect these variables have on the main model is to make the duration variables more significant and stronger. Household cleanliness is also negatively associated with birth outcomes and significant as is living in Chicago, as compared to Milwaukee. However, again these variables have no significant effect on length of time lived in the U.S.

Finally, Model D introduces interaction effects of duration and acculturation. The rationale for this model is that the beneficial effects of acculturation may strengthen with duration in the U.S. as the individuals are not only well integrated to the local culture but are also more familiar and savvy about access to and use of health services and of other resources available to U.S. residents. Model D also tests for interaction effects of duration and income. The results show that the interaction effects are not statistically significant and that they increase the magnitude of the main effects of acculturation and the level of significance. Thus, after controlling for all health and social determinants, we find that the

effect of the 0-3 years and 13+ years duration intervals remain negative and significant; mothers living in the U.S. the fewest and most years in the U.S. are between 60% and 90% less likely to have favorable birth outcomes as a mother living in the U.S. 4-12 years, even after controlling for interactions. In addition, those mothers who are more acculturated are over 2 ¾ times more likely to have favorable birth outcomes as the least acculturated, although these effects are increase in statistical significance ($p=.08$), they remain above the $p<.05$ level when not including interactions.

Returning to the differences in characteristics of the analyzed sample and the missing cases, we find that most of the variables of the missing cases whose mean vary significantly from the analyzed sample have no significant effect on the main model (see Table A.3 in Appendix II). The only variables whose means are significantly different and are also significant in the model are the income and location variables. However, from the model, adding these variables have little effect on the main model and a separate analysis that tested effect of these two variables on the main model found little effect. Thus we can infer that the differences in the missing cases would not have a significant effect on the main model. Furthermore, the results of a test of the extreme cases (not shown here) in which the missing were all assigned a favorable birth outcomes and then assigned unfavorable birth outcomes showed little significant changes to the main results of the model.

[TABLE 3 ABOUT HERE]

In sum, these results reinforce findings from other studies suggesting a deterioration of health among Mexican immigrants with increased duration in the U.S. We also find that acculturation matters to a lesser extent and is positive, but we fail to identify the mechanisms through which this effect takes place. Indeed, there is no attenuation of effects associated with duration and acculturation when measures of behavior profile, exposure to stress, social relations, maternal characteristics, and socioeconomic, demographic, and environment characteristics are added to the model. These results are consistent with the return-migration conjecture but do not prove it. Indeed, the above pattern of results could be observed if the healthiest but least acculturated among those with short and long duration in the U.S. return to Mexico.

Estimates from a national samples of Mexicans in the U.S.

We now compare the results obtained from the Chicago and Milwaukee sample with a national sample. We do this to determine whether or not our results are a reflection of peculiarities in the samples.

We use the 1995 National Survey of Family Growth Cycle 5 (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 deaths, marriages and divorces, and other information on childbearing and reproductive health and migration history and language usage for 10,847 women, 15-44 years of age (Mosher 1998; Potter et al. 1998). The NSFG V drew its sample from the 1993 National Health Interview Survey (NHIS), a national probability sample of 14,000 women, ages 15-44, in order to enrich the data with variables of the NHIS that provided more detailed background data (Kelly et al.

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 the sample includes nearly every State and all of the largest metropolitan areas in the United States.

The NSFG also contains information on length of stay in the U.S., language spoken during the interview, and some behavioral and social variables of interest, including measures of stress, smoking parity, education, and married. In this analysis we select all Mexican-origin mothers with children 0-4 years old, a total of 135 mothers representing a population of 554,037. Unlike the Chicago/Milwaukee sample, the NSFG infant birth information is based on retrospective information. While this may result in errors due to recall errors, they are likely to be minimal as we only require information on infant survival, birth weight, and gestational age and we focus only on children born not longer than five years prior to the interview.

[TABLE 4 ABOUT HERE]

There are important differences between the selected NSFG population of mothers and those from the Chicago-Milwaukee sample, including, the average duration of stay for those born in Mexico is longer among those in the national sample (9.6 vs. 6.9 year), the national sample are characterized by higher educational levels (45% vs. 39% have completed some high school), higher levels of marriage (74% vs. 62%), and lower levels of firstborn pregnancies (15% vs. 28%). All indicators used in the national sample were constructed to

be as close as possible to the variables used in the Chicago/Milwaukee sample analysis (see Table 4).

Table 5 displays estimates of a model analogous to those in Table 3, but using the NSFG data. The results show remarkable similarities in the association between duration and health. In particular, the negative effects of the longest duration in the U.S. on and birth outcomes persists and is statistically significant after controlling for other covariates. Similarly, acculturation is positively associated with health but is not statistically significant. Finally, adding behavioral and social measures and interactions of duration and acculturation (not shown here) has little or no effect on the main model. Thus, the direction and magnitude of effects are consistent with those obtained from the Chicago and Milwaukee sample for the longest duration interval and acculturation measure, and support the same conjectures except, of course, that related to return migration.

[TABLE 5 ABOUT HERE]

Siblings Model

A unique characteristic of these data is that information was also collected on the birth outcomes of a previous pregnancy for those respondents with parity of one or greater at the time of the pregnancy. There are a total of 368 cases, or 66% of the respondents, who had a previous pregnancy in the sample. The information concerning the sibling's birth permits a comparison of the effects of duration in the United States and of acculturation on both pregnancy outcomes. If, as differences in birth outcomes reveal, time in the United States affects maternal and infant health then one could expect to find differences in birth

outcomes between siblings that are both born in the U.S. That is, if infant health deteriorates the longer an immigrant lives in the U.S., then we could expect that between two siblings of an immigrant born in the U.S., the younger would have worse health outcomes of the two. Here we first test this hypothesis using pooled data to determine if there is a significant difference in the health status of the infants at the two births, and then use a fixed effects model to estimate the differences in health between the two siblings while controlling for characteristics shared by the siblings and the effects of selection.

Beginning with an analysis of a pooled sample we estimate a model including the most recently born infant (sibling 2) and the previously born sibling of that infant (sibling 1), treating them as unrelated individuals. The health status of the infants is regressed on the mother's length of time in the U.S. at the time of the birth and other characteristics of the infant and mother known at the time of the birth. Since the information collected in the survey focused on the mother's behaviors and background characteristics at the time of the most recent pregnancy (sibling 2), information on the previous pregnancy was limited to the birth and pregnancy outcomes. This limits the information for this analysis to that known at time of both births. However, information of the mother that could be assumed to have remained constant or could be calculated for the previous pregnancy is included in the analysis.

Data that is available for both siblings and the mother for each birth include the birth outcomes, the number of years in the United States, parity, whether or not the mother received WIC during the pregnancy, mother's age, sex of the infant, and the sibling order. Because there are some important differences between the measurements of the birth

outcomes of siblings, a new outcome variable is constructed for sibling 2 to enable it to match the information available on the outcome variable for sibling 1.

[TABLE 6 ABOUT HERE]

The number of years the mother has lived in the U.S. and the mother's age at the time of the birth of each sibling are calculated from the birth date of sibling 1 and the mother's date of entry into the U.S., and parity for each infant is calculated on the basis of the mother's birth history. Table 6 describes the variables used in this analysis.

Table 7 presents the results of the pooled analysis of the sibling data estimating the effects of the IUGR-FGR birth outcome. Model A which includes only the duration measure shows a similar pattern in the coefficients of earlier analyses; the odds of a mother who has lived in the U.S. 0-3 years and over 12 years are more likely to have less favorable birth outcomes than a mother who lived in the U.S. 4-12 years, with the longest interval being statistically significant. The results of Models B through D are similar to the main model, adding acculturation and the covariates measuring social, behavioral, and environmental characteristics have little effect on the duration coefficients and acculturation is positive but not significant.

[TABLE 7 ABOUT HERE]

One problem in dealing with data that has a group structure, as in the case of this model, is the omitted variable bias. The pooled model includes characteristics and behaviors

of the mother for each pregnancy and some general characteristics of the mother that are common to both pregnancies. However, there may be some characteristics of the mother and household that is not included in the model, including maternal health, and behavioral, socioeconomic, and sociocultural measures. The fixed effects model addresses the problem of data with a group structure that may have common parameters that are not specified (Chamberlain 1980). The method controls those variables that vary between groups by matching characteristics within the group. In this analysis, this method can also be used for controlling the effects of return migration selection by purging the differences in maternal health over time. If the differences in infant outcomes are due to migrants selectively returning to Mexico due to health, and resulting in an artifactual deterioration in birth outcomes, then estimating the change in health by comparing the outcomes of different pregnancies from the same mother would control for differences in health between different mothers.

A computational simplification of the model estimating the differences between the outcomes and covariates for the two siblings 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).

The fixed effects approach has been used in a variety of contexts, including controlling for the effects of family characteristics on neighborhood effects, effects of public policy on teen fertility decision-making, and the effect of personal characteristics on wages (Budig and England 2001; Jackson and Klerman 1993; Plotnick and Hoffman 1995). For this study, the fixed effects model will control for the effects duration that vary between migrants and estimate the effects of the time the mother has spent in the U.S. between the

births of her children on the differences in the outcomes of the births. This not only permits us to cancel out the effect of selection which is determined by time, but also control for the effects of all characteristics shared between the siblings. This model measures the effect of years in the U.S. on birth outcomes conditional on having a previous child. That is, any maternal characteristic that is common to both infants is controlled so that we can estimate the effects of differences between siblings on the outcome.

According to the acculturation paradox, one would expect that health outcomes for the most recent pregnancy (sibling 2) would be worse than for the previous pregnancy (sibling 1). If the model shows significant effects of duration on health, then this cannot be attributed to selection based on the mother's health, since we are estimating the change in health between two infants born from the same mother. Finding such a result would be a stronger indication of the effect of duration since medically, the health of the second sibling is typically better that of than the previous sibling, except in the case of parity five or more. So if health worsens it would suggest there is a process at work that is more powerful than the effect of a second sibling's better health.

Table 8 presents the results of the fixed effects model which includes only those cases in which there were at least two pregnancies and with both of the infants of interest having been born in the U.S. Because the model estimates the differences in the outcome variables, all cases where the outcomes between siblings are the same are dropped from the model in the estimation. Controlling for common and shared characteristics for both siblings, the effect of duration on health in model A is positively associated with IUGR-FGR birth outcomes. A mother who has lived in the U.S. for four our more years is twice as likely to have favorable birth outcomes than if she were to live in the U.S. less than three years, but

these differences are not statistically significant. Here we use a shorter duration interval from the main and pooled models because the duration is measuring the interval between the two births. An interval such as 14 years between births would not only be atypical but may also signal characteristics of a mother that are unique and non-random. Adding the covariates, sex of the infant, mother's age, and parity, reduces the effect of duration on birth outcomes but the effect remains positive and not statistically significant.

[TABLE 8 ABOUT HERE]

This fixed effects model shows no significant effect of duration in the U.S. when analyzing the differences of birth outcomes between two siblings of the same mother. Hence, since the model controls for the effects of selection by estimating changes in the health of a single individual, as opposed to comparing the different individuals in the main model, the results provide additional evidence that the negative effect of duration on health, found in the cross-sectional analysis of the main model, may be due to the effect of a return-migration selection.

DISCUSSION

Unlike most studies of the acculturation paradox, instead of focusing on the deterioration of the health of Mexican immigrants across generations, we set out to determine if there is evidence to support the acculturation hypotheses over a span of years within a single generation. Using data collected in two Latino communities, one in Chicago and one in Milwaukee, we find evidence of a decline in health with increased duration lived in the

U.S. Mothers of Mexican-origin who have lived in the U.S. for 13 or more years are one-tenth as likely to have favorable birth outcomes as mothers who have lived in the U.S. for 4-12 years. In addition, mothers who have lived in the U.S. less than four years are also less likely to have favorable birth outcomes as the reference group, although this group is one-third as likely. Perhaps those with the least number of years in the U.S. go through an adjustment period as newcomers, in which they experience higher levels of stress as they take time to learn about services available to them that may be necessary for a healthy birth.

We also find that acculturation has a large and positive effect on health, among the most acculturated mothers, those who use both English and Spanish or mostly English in their daily lives, are over 2 ½ times as likely to have a favorable birth outcome as the least acculturated mothers, those who mostly use Spanish. The estimates are not statistically significant (perhaps due to restriction in sample size) but they are large and ubiquitous enough to be of some note.

Analysis of a national sample of Mexican-origin women provided results that are consistent with the Chicago and Milwaukee sample. Mothers living in the U.S. over 12 years are one-fifth as likely to have favorable birth outcomes as those who have lived in the U.S. 4-12 years. In addition, the effect of acculturation was also positive and not significant.

Our analysis of cross-sectional data from Chicago and Milwaukee and of a national sample of Mexican-origin mothers does not support the notion that this poorer 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 mediate the effect of duration or acculturation on birth outcomes. Instead these results provide indirect support for the return-migration selection hypothesis.

Furthermore, our longitudinal analysis provides additional support for the return-migration selection hypothesis as the model controls for the effects of selection. Because the model analyzes differences in health between siblings, any decline in health could not be attributed to selection, since the model estimates the change in health of individual mothers. The results found no statistically significant declines in health over time, suggesting that the declines found in the cross-sectional data may have been due to the effects of selection.

Because these results are based on first generation migrants, the findings do not run counter to previous studies on the acculturation hypothesis; as most studies have been concerned with effects spread across generations. A return-migration selection hypothesis is much less plausible as an explanation for the decline in health over generation because it is unlikely that young second and third generation mothers would return to Mexico.

In sum, this analysis provides important preliminary evidence in support of the selection hypotheses and illustrates the significant the role of the return-migration process on the apparent levels of health among Latinos in the U.S. However, this study also reveals the need for additional study to address two limitations of this analysis. First, the small sample size of the sibling data may influence the results. However, if an increase in sample were only to contribute to increasing statistical significance, the results would show a positive effect of duration on health rather than a negative one. Secondly, the results provide only indirect support for the selection hypotheses, in part because of the limitation in the longitudinal variables available for analysis. A more complete analysis would require data measuring changes in maternal characteristics over time. Hence a longitudinal study with a larger sample size would be necessary for providing a more definitive answer for explaining

the relationship between duration in the U.S., acculturation, and Mexican maternal and infant health.

Acknowledgements

The authors acknowledge appreciation for the collaborators on these projects, including, Dr. Robert E. Jones, Research Scientist at the University of Wisconsin-Madison; Dr. Jeffrey Morenoff, Associate Professor of Sociology at the University of Michigan; and Mary Sommers, director of a midwifery program, Dr. Shawn Kanaiaupuni, and Dr. Kristin Espinosa, Assistant Professor at the University of Wisconsin-Milwaukee. This research is supported by the National Science Foundation Grant No. SES-0082704, the National Institute of Child Health and Human Development Grant No. 3-F31-HD08740-02, funding from the International Migration Program of the Social Science Research Council with funds provided by the Andrew W. Mellon Foundation, and a grant from the Robert Wood Johnson Foundation. Any opinions, findings and conclusions or recommendations expressed in this dissertation are my own and do not necessarily reflect the views of these agencies and foundations.

APPENDIX I

Table 1: Descriptive Statistics of the Variables

	mean	*s.d.*	*min*	*max*
Birth Outcome *(favorable=1)*	0.91		0	1
Years in the U.S.	6.87	5.33	1	28
Acculturation *(medium/high=1)*	0.22		0	1
Stress (feelings of despair)	0.21		0	1
Social support *(from spouse/partner)*	0.34		0	1
Diet *(unhealthy=1)*	0.46		0	1
Smoking, drinking, drugs	0.08		0	1
Mother's health *(poor=1)*	0.08		0	1
Parity *(zero parity=1)*	0.28		0	1
Prenatal Care	0.86		0	1
Mother's Age	26.27	5.59	15	45
Marital Status *(married=1)*	0.62		0	1
Schooling *(10+ years)*	0.39		0	1
Income *(>150% of poverty level)*	0.15		0	1
Mother employed	0.49		0	1
Lives in a house	0.16		0	1
Household conditions *(poor=1)*	0.20		0	1
Community conditions *(poor=1)*	0.39		0	1
Sample Location *(Chicago=1)*	0.88		0	1
n=428				

Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

Figure 1: Conceptual Framework of Duration and Acculturation's Effect on Infant and Maternal Health

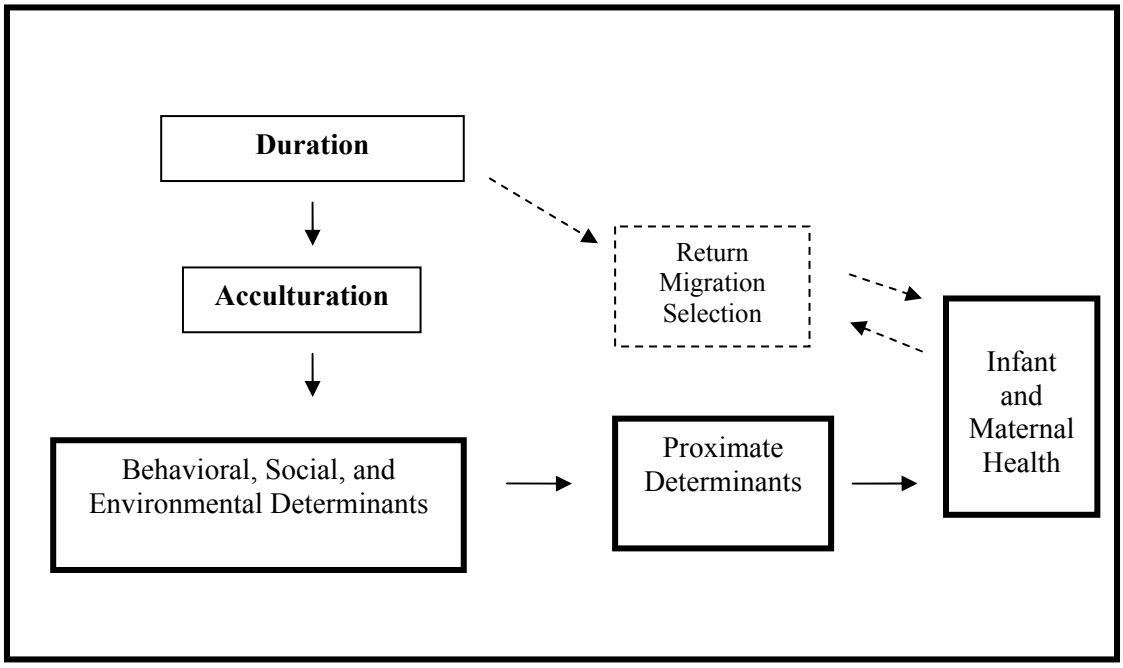

Figure 2: Mean Birth Outcomes by Years Lived in the U.S. with 95% Confidence Intervals

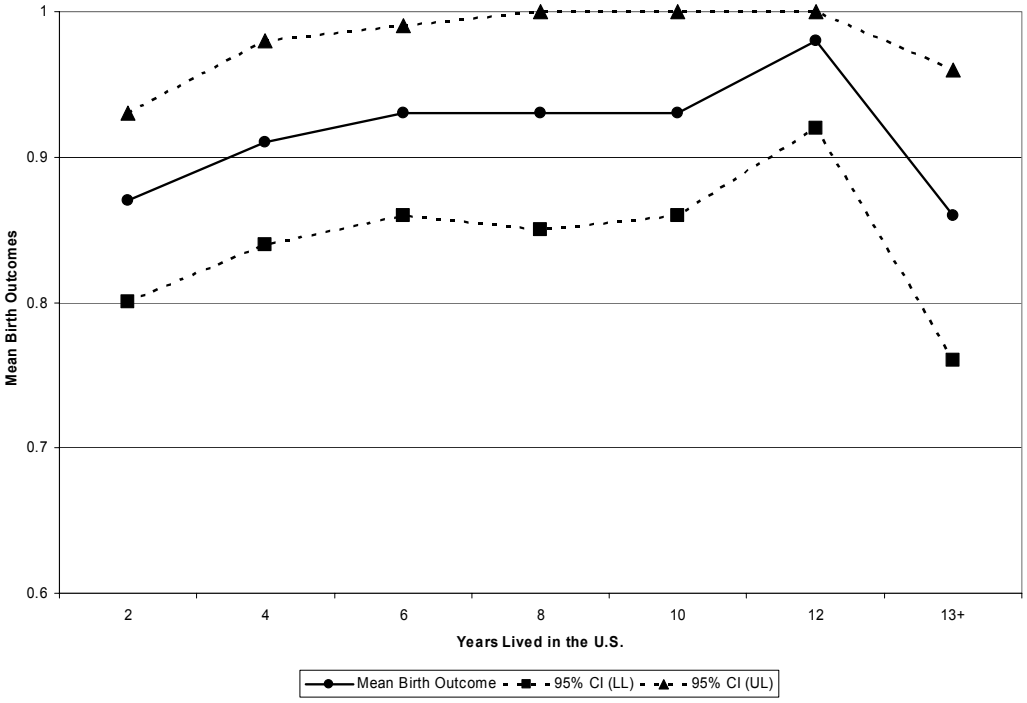

Figure 3: Mean Birth Outcomes by Years Lived in the U.S. with 95% Confidence Intervals, by Categories

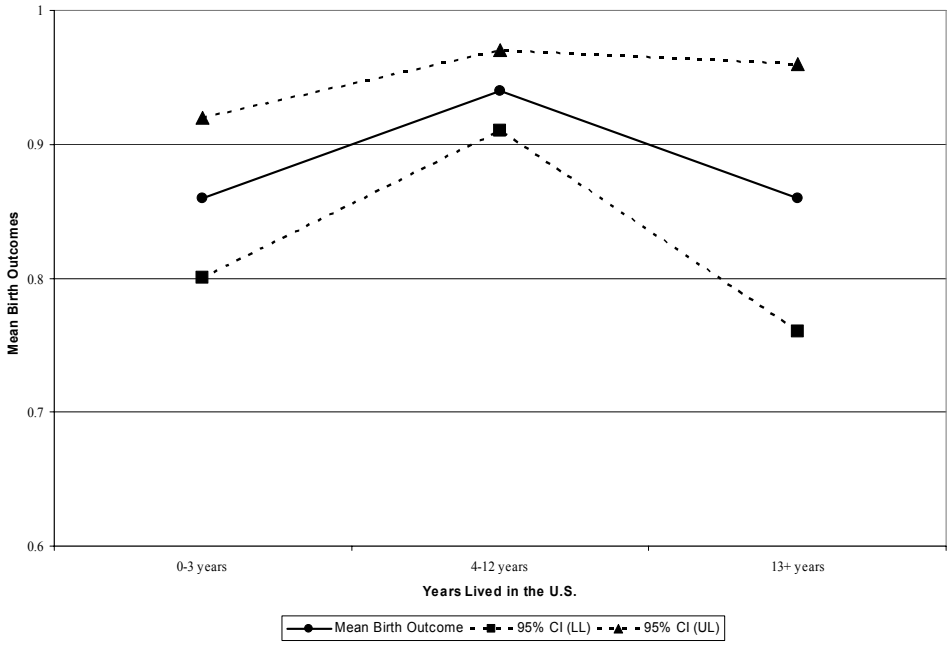

Table 2: Logistic Regression Estimates of the Odds Ratios of Favorable Birth Outcome on Years Lived in the U.S. and Acculturation of Chicago and Milwaukee Sample

	A *OR*	B *OR*	C *OR*	D *OR*	E *OR*
Years in the U.S.	1.04 *(0.04)*	1.07 *(0.07)*			
Years in the U.S. *(squared)*		.998 *(.002)*			
0-3 Years in the U.S. *(4-12 years omitted)*			*0.37*** *(0.14)*		*0.40** *(0.15)*
13+ Years in the U.S.			0.38* *(0.18)*		0.30* *(0.15)*
Acculturation *(Medium-high=1)*				2.11 *(1.04)*	2.35 (1.23)
Observations	428	428	428	428	428
Log likelihood	-132.47	-132.20	-128.64	-131.53	-127.10
Likelihood Ratio χ^2	0.83	1.36	8.47*	2.70	11.56**
Degrees of freedom	1	2	2	1	3

*† p<=.10 * p<=.05 ** p<=.01 *** p<=.001 (Standard errors in parentheses)*
Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

Table 3: Logistic Regression Estimates of the Odds Ratios of Favorable Birth Outcome on Duration, Acculturation, and Behavioral, Social, and Environmental Determinants of Chicago and Milwaukee Sample

	A	B	C	D
	OR	OR	OR	OR
0-3 Years in the U.S. *(4-12 years omitted)*	0.43* *(0.16)*	0.44* *(0.18)*	0.39* *(0.17)*	0.33* *(0.17)*
13+ Years in the U.S.	0.33* *(0.18)*	0.33* *(0.18)*	0.21* *(0.13)*	0.10** *(0.08)*
Acculturation *(Medium-high=1)*	2.53† *(1.36)*	2.57† *(1.40)*	2.82† *(1.66)*	0.97 *(0.72)*
Stress: despair	0.65 (0.25)	0.65 (0.25)	0.77 (0.32)	0.73 *(0.30)*
Support from partner	2.14† *(0.90)*	2.15† *(0.94)*	2.09 *(0.98)*	2.14 *(1.01)*
Unhealthy diet now	0.72 *(0.25)*	0.72 *(0.25)*	0.80 *(0.29)*	0.82 *(0.30)*
Smoking, drinking, drugs	0.48 *(0.25)*	0.49 *(0.25)*	0.60 *(0.35)*	0.58 *(0.35)*
Mother in poor health		0.88 *(0.52)*	1.18 *(0.75)*	1.04 *(0.69)*
Firstborn		0.98 *(0.40)*	0.98 *(0.45)*	0.87 *(0.41)*
Prenatal Care		0.84 *(0.44)*	0.82 *(0.46)*	0.85 *(0.49)*
Mother Age <= 20yrs *(21-29 years omitted)*			0.87 *(0.45)*	0.86 *(0.46)*
Mother Age 30+ yrs			1.81 *-1.02*	2.00 *(1.19)*
Married			1.69 *(0.66)*	1.69 *(0.68)*
Some high school (10th+)			1.07 *(0.42)*	1.00 *(0.39)*
Income (> 150% poverty level)			.32* *-1.63*	0.26* *(0.18)*
Mother works(ed)			2.26† *(0.94)*	2.53* *(1.08)*
Lives in a house			1.43 *(0.84)*	1.47 *(0.87)*
Household hygiene *(poor=1)*			0.44* *(0.18)*	0.42* *(0.17)*
Community conditions *(poor=1)*			0.87 *(0.33)*	1.00 *(0.39)*
Sample Location *(Chicago=1)*			3.36** *-1.54*	3.55** *(1.67)*
‡Interaction *(13 years in U.S. x acculturation)*				5.53 *(7.07)*
Interaction *(0-3 years in U.S. x income)*				0.56 *(0.65)*
Interaction *(13 years in U.S. x Income)*				2.91 *(3.72)*
Observations	428	428	428	413
Log likelihood	-123.02	-122.94	-112.19	-109.04
Likelihood Ratio χ^2	19.71**	19.89*	41.38**	44.68**
Degrees of freedom	7	10	20	23

*† p<=.10 * p<=.05 ** p<=.01 *** p<=.001 (Standard errors in parentheses)*

‡ Interaction of 0-3 years in U.S. x acculturation dropped because predicts success perfectly

Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

Table 4: Descriptive Statistics for 1995 NSFG V Sample

	mean	*s.d.*	*min*	*max*
Birth Outcome *(favorable=1)*	0.84		0	1
Years in the U.S.	9.61	7.13	1	30
Acculturation *(medium/high=1)*	0.24		0	1
Smoking, drinking, drugs	0.06		0	1
Firstborn	0.15		0	1
Stress	0.14		0	1
Schooling *(10+ years)*	0.45		0	1
Married	0.74		0	1
n=135				

Birth outcome measured by intrauterine growth retardation (IUGR)

Table 5: Logistic Regression Estimates of the Odds Ratios of Birth Outcome on Duration, Acculturation, and Social Determinants of 1995 NSFG V Sample

	A	B	C
	OR	OR	OR
0-3 Years in the U.S.	1.15	1.11	1.78
(4-12 years omitted)	*(.77)*	*(.74)*	*(.83)*
13+ Years in the U.S.	.29†	.27†	.18*
	(.21)	*(.18)*	*(.13)*
Acculturation		1.69	1.86
(medium/high=1)		*(.89)*	*(1.12)*
Smoking			1.34
			(1.41)
Firstborn			0.75
			(.41)
Stress			0.38
			(.29)
Schooling			1.70
(10+ yrs)			(.86)
Married			2.09
			(1.37)
Observations	135	135	135
Population size	544037	544037	544037
F distribution	1.59	1.50	1.29
Degrees of freedom	2	3	8

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

(Standard errors in parentheses)

Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

Table 6: Descriptive Statistics of Siblings Data

	mean	*s.d.*	*min*	*max*
Birth outcome *(favorable=1)*	0.86		0	1
Years in the U.S.	6.69	5.26	0	34
Acculturation *(medium/high=1)*	0.23		0	1
Stress during pregnancy	0.18		0	1
Social support	0.47		0	1
Diet *(unhealthy=1)*	0.47		0	1
First born *(parity 0=1)*	0.29		0	1
Prenatal care	0.92		0	1
Mother's age <=20 yrs.	0.18		0	1
Schooling *(10+ years)*	0.35		0	1
Income *(>150% of poverty level)*	0.17		0	1
Mother employed	0.46		0	1
Home ownership	0.17		0	1
Household conditions *(poor=1)*	0.20		0	1
Community conditions *(poor=1)*	0.41		0	1
Sample location *(Chicago=1)*	0.87		0	1
n=266				

Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

Table 7: Logistic Regression Estimates of the Odds Ratios of Birth Outcome on Duration, Acculturation, and Social Determinants of the Pooled Data from the Chicago and Milwaukee Sample

	A	B	C	D
	OR	OR	OR	OR
0-3 Years in the U.S.	0.61	0.63	0.95	1.02
(4-11 years omitted)	*(0.25)*	*(0.26)*	*(0.48)*	*(0.53)*
12+ Years in the U.S.	0.36*	0.35*	0.28*	0.27*
	(0.16)	*(0.16)*	*(0.14)*	*(0.14)*
Acculturation		1.31	1.68	1.70
(medium-high=1)		*(0.60)*	*(0.92)*	*(0.94)*
Stress during pregnancy			0.37*	0.37*
			(0.17)	*(0.17)*
Social support			1.23	1.25
			(0.50)	*(0.51)*
Diet			0.55	0.56
(unhealthy=1)			*(0.22)*	*(0.22)*
Firstborn			*0.40* †	*0.48*
			(0.20)	*(0.27)*
Mother's age			0.93	0.95
(<=20 yrs)			*(0.48)*	*(0.49)*
Married			*1.57*	*1.60*
			(0.64)	*(0.65)*
Schooling			1.37	1.37
(10+ years)			*(0.64)*	*(0.62)*
Income			0.81	.80
(>150% of poverty level)			*(0.42)*	*(0.42)*
Mother employed			0.71	0.71
			(0.29)	*(0.29)*
Home ownership			0.62	0.64
			(0.33)	*(0.34)*
Household conditions			0.84	0.84
(poor=1)			*(0.41)*	*(0.42)*
Community conditions			1.45	1.46
(poor=1)			*(0.62)*	*(0.62)*
Sample location			1.14	1.16
(Chicago=1)			*(0.70)*	*(0.71)*
Sibling order				1.46
(recent birth==1)				*(0.74)*
Observations	266	266	266	266
Log likelihood	-103.05	-102.88	-93.89	-93.63
Likelihood Ratio χ^2	4.79†	5.13	23.10	23.64
Degrees of freedom	2	3	16	17

*† p<=.10, * p<=.05, ** p<=.01, *** p<=.001 (Standard errors in parentheses)*
Birth outcome measured by intrauterine growth retardation (IUGR)
and the fetal growth rate (FGR)

Table 8: Fixed-Effects Logistic Regression Estimates of the Odds Ratios of Favorable Birth Outcomes on Duration, Sex of Infant, Age, and Parity of Mother of Chicago and Milwaukee Sample

	A OR	B OR
4+ Years in the U.S. *(0-3 years omitted)*	2.00 *(1.41)*	1.10 *(0.97)*
Sex of infant		0.61 *(0.38)*
Mother's age <= 20yrs		0.99 *(1.03)*
Parity=0 *(at most recent pregnancy)*		0.56 *(0.38)*
Observations	56	54
Log likelihood	-18.90	-17.86
Likelihood Ratio χ^2	1.02	1.71
Degrees of freedom	1	4

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

(Standard errors in parentheses)

Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

APPENDIX II

Table A.1: Multinomial Logistic Regression Estimates of the Odds Ratios of Birth Outcomes based on Low Birth Weight (LBWT), High Birth Weight (HBWT) , and Favorable Birth Weight on Duration, Acculturation, and Social Determinants

	LBWT Outcomes		HBWT Outcomes		LBWT with HBWT Outcomes Constrained	
	RRR	SE	RRR	SE	RRR	SE
0-3 Years in the U.S. *(4-12 years omitted)*	2.40*	*1.07*	0.63	*0.24*	2.5*	*1.13*
13+ Years in the U.S.	4.92**	*3.00*	1.22	*0.56*	4.79**	*2.89*
Acculturation *(Medium-high=1)*	0.38	*0.23*	1.88†	*0.68*	0.35†	*0.21*
Stress: despair	1.34	*0.55*	1.31	*0.47*	1.29	*0.53*
Support from partner	0.50	*0.24*	1.33	*0.41*	0.48	*0.22*
Unhealthy diet now	1.25	*0.46*	1.05	*0.30*	1.25	*0.46*
Smoking, drinking, drugs	1.49	*0.88*	0.19	*0.20*	1.68	*0.98*
Mother in poor health	0.79	*0.51*	0.56	*0.37*	0.85	*0.54*
Firstborn	0.99	*0.45*	0.72	*0.31*	1.02	*0.46*
Prenatal Care	1.20	*0.68*	0.90	*0.37*	1.23	*0.69*
Mother Age <= 20yrs *(21-29 years omitted)*	1.09	*0.57*	0.52	*0.34*	1.15	*0.60*
Mother Age 30+ yrs	*0.56*	*0.32*	*1.15*	*0.41*	*0.55*	*0.31*
Married	0.58	*0.23*	0.92	*0.29*	0.59	*0.23*
Some high school *(10th+)*	0.89	*0.35*	0.72	*0.23*	0.94	*0.37*
Income *(> 150% of poverty level)*	0.31*	*0.16*	0.87	*0.35*	0.32*	*0.16*
Mother works(ed)	0.43*	*0.18*	0.78	*0.24*	0.44*	*0.18*
Lives in a house	0.69	*0.41*	0.94	*0.38*	0.70	*0.41*
Household hygiene *(poor=1)*	2.29*	*0.93*	1.13	*0.43*	2.27*	*0.91*
Community conditions *(poor=1)*	1.14	*0.43*	0.87	*0.27*	1.15	*0.44*
Sample Location *(Chicago=1)*	0.31*	*0.15*	1.61	*0.86*	0.30**	*0.14*
Observations	428				428	
Log likelihood	-275.25				-285.96	
Likelihood Ratio χ^2	62.74*				41.31**	
Degrees of freedom	40				20	
Likelihood Ratio test	---				21.42	

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

Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

Table A.2: Comparison of Descriptive Statistics of Variables from Chicago and Milwaukee Samples

	Chicago				Milwaukee			
	mean	***s.d.***	***min***	***max***	***mean***	***s.d.***	***min***	***max***
Birth Outcome *(favorable=1)*	0.92**		0	1	0.80		0	1
Years in the U.S.	6.95	5.46	1	28	6.28	4.19	1	21
Acculturation *(medium/high=1)*	0.22		0	1	0.26		0	1
Stress (feelings of despair)	0.19*		0	1	0.32		0	1
Social support *(from spouse/partner)*	0.33*		0	1	0.48		0	1
Diet *(unhealthy=1)*	0.46		0	1	0.48		0	1
Smoking, drinking, drugs	0.07*		0	1	0.14		0	1
Mother's health *(poor=1)*	0.07**		0	1	0.16		0	1
Parity *(zero parity=1)*	0.29		0	1	0.26		0	1
Prenatal Care	0.85*		0	1	0.94		0	1
Mother's Age	26.28	5.64	15	45	26.22	5.25	17	42
Marital Status *(married=1)*	0.60*		0	1	0.74		0	1
Schooling *(10+ years)*	0.39		0	1	0.34		0	1
Income *(>150% of poverty level)*	0.17*		0	1	0.06		0	1
Mother employed	0.51**		0	1	0.30		0	1
Lives in a house	0.15*		0	1	0.26		0	1
Household conditions *(poor=1)*	0.19**		0	1	0.34		0	1
Community conditions *(poor=1)*	0.38*		0	1	0.50		0	1
	n=378				*n=50*			

*p<=.05 ** p<=.01 *** p<=.001*
Chicago sample means are significantly different relative to the Milwaukee sample mean
Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

Table A.3: Comparison of Descriptive Statistics of Analyzed and Missing Samples

	mean	*s.d.*	*min*	*max*	*obs*
Years in the U.S.	6.60	5.77	1	24	60
Acculturation *(medium/high=1)*	0.12*		0	1	59
Stress (feelings of despair)	0.28		0	1	61
Social support *(from spouse/partner)*	0.39		0	1	61
Diet *(unhealthy=1)*	0.33*		0	1	61
Smoking, drinking, drugs	0.11		0	1	61
Mother's health *(poor=1)*	0.20**		0	1	61
Parity *(zero parity=1)*	0.11**		0	1	61
Prenatal Care	0.89		0	1	61
Mother's Age	27.75*	5.78	16	41	61
Marital Status *(married=1)*	0.62		0	1	61
Schooling *(10+ years)*	0.31		0	1	61
Income *(>150% of poverty level)*	0.07*		0	1	61
Mother employed	0.45		0	1	60
Lives in a house	0.23		0	1	60
Household conditions *(poor=1)*	0.28		0	1	61
Community conditions *(poor=1)*	0.53*		0	1	60
Sample Location *(Chicago=1)*	0.30***		0	1	61

*p<=.05 ** p<=.01 *** p<=.001*

Means of missing cases are significantly different relative to the analyzed sample mean
Birth outcome measured by intrauterine growth retardation (IUGR) and the fetal growth rate (FGR)

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.

D. Diet

The diet measures are based on three-scale items from the following questions:
Do you eat a lot, a little, or none of the following foods:

1. fish and chicken

2. beef
3. vegetables and fruit
4. bread, cereals, and flour tortillas
5. corn tortillas
6. legumes such as beans
7. dairy products, such as milk, cheese, or yoghurt
8. rice, pastas, or potatoes
9. sweets, such as candy bars or chocolates
10. soft drinks, such as Coke or Pepsi.

E. Tobacco, alcohol, drugs

1. Did you smoke during your pregnancy?
2. Did you drink alcohol during pregnancy?
3. Did you use substances such as marijuana during your pregnancy?
4. Did you use substances such as marijuana sometime in the year before your pregnancy?
5. Does your spouse/partner use substances such as marijuana?

F. Community Conditions

a. Do you consider your neighborhood to be very safe, moderately safe, unsafe, and very unsafe.

b. Please tell me if you happen to believe that this neighborhood has or does not have the following problems:

i. prostitution
ii. the use and sale of drugs
iii. frequent thefts
iv. gang activity
v. people are hostile and aggressive

References

Abraido-Lanza, A. F., Dohrenwend, B. P., Ng-Mak, D. S., and Turner, J. B. The Latino Mortality Paradox: a Test of the "Salmon Bias" and Healthy Migrant Hypotheses.[Comment]. American Journal of Public Health 89(10), 1543-8. 99.

Alden, Katherine R. 1997. Endocrine and Metabolic Disorders. In *Maternity and Women's Health Care.* 6th ed. Edited by Dietra Leonard Lowdermilk, Shannon E. Perry, and Irene M. Bobak. St. Louis, Missouri: Mosby-Year Book Inc.

Balcazar, H. Mexican Americans' Intrauterine Growth Retardation and Maternal Risk Factors. Ethnicity & Disease 3(2), 169-75. 93.

Balcazar, H., Keefer, L., and Chard, T. Use of Anthropometric Indicators and Maternal Risk Factors to Evaluate Intrauterine Growth Retardation in Infants Weighing More Than 2500 Grams at Birth. Early Human Development 36(3), 147-55. 94.

Balcazar, H. and Krull, J. L. Determinants of Birth-Weight Outcomes among Mexican-American Women: Examining Conflicting Results about Acculturation. Ethnicity & Disease 9(3), 410-22. 99.

Beischer, N. A., E. V. Mackay, and P. B. Colditz. 1997. Perinatal Mortality. In *Obstetrics and the Newborn: An Illustrated Textbook.* 3rd ed. London: W.B. Saunders Company Ltd.

Budig, Michelle Jean and Paula A. England, "The Wage Penalty for Motherhood," *American Sociological Review* 66 (2): 204-225 (2001).

Burnam, Audrey M. et al., "Measurement of Acculturation in a Community Population of Mexican Americans," *Hispanic Journal of Behavioral Science* 9 (2): 105-130 (1987).

Chamberlain, Gary, "Analysis of Covariance with Qualitative Data," *The Review of Economic Studies* 47 (1): 225-238 (1980).

Franzini, L., Ribble, J. C., and Keddie, A. M. Understanding the Hispanic Paradox. [Review] [94 Refs]. Ethnicity & Disease 11(3), 496-518. 2001.

Frisbie, W. P., Forbes, D., and Pullum, S. G. Compromised Birth Outcomes and Infant Mortality Among Racial and Ethnic Groups.[Comment]. Demography 33(4), 469-81. 96.

Geronimus, A. T. The Effects of Race, Residence, and Prenatal Care on the Relationship of Maternal Age to Neonatal Mortality. American Journal of Public Health 76(12), 1416-21. 86.

Geronimus, A. T. The Weathering Hypothesis and the Health of African-American Women

and Infants: Evidence and Speculations. [Review] Ethnicity & Disease 2(3), 207-21. 92.

Gordon, Milton M. 1964. *Assimilation in American Life.* Vol. . . . ed. Edited by . New York: Oxford University Press.

Guendelman, S., Gould, J. B., Hudes, M., and Eskenazi, B. Generational Differences in Perinatal Health among the Mexican American Population: Findings from HHANES 1982-84. American Journal of Public Health 80 Suppl, 61-5. 90.

Jackson, Catherine A. and Klerman, Jacob Alex. Labor and Population Program. Fixed Effects, Public Policy and Teenage Fertility. 93. Santa Monica, California, RAND.

Kelly, J. E., Mosher, W. D., Duffer, A. P. Jr., and Kinsey, S. H. Plan and Operation of the 1995 National Survey of Family Growth. Vital & Health Statistics - Series 1: Programs & Collection Procedures (36), 1-89. 97.

Kogan, Michael D. et al., "Relation of the Content of Prenatal Care to the Risk of Low Birth Weight: Maternal Reports of Health Behavior Advice and Initial Prenatal Care Procedures," *Journal of the American Medical Association* 271 (17): 1340-1345 (1994).

Kotelchuck, Milton, "An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index," *American Journal of Public Health* 84 (9): 1414-1421 (1994).

Kramer, M. S. et al., "Socio-economic disparities in preterm birth: causal pathways and mechanisms," *Paediatr Perinat Epidemiol* 15 Suppl 2: 104-23 (2001).

Kramer, M. S., McLean, F. H., Olivier, M., Willis, D. M., and Usher, R. H. Body Proportionality and Head and Length 'sparing' in Growth-Retarded Neonates: a Critical Reappraisal. Pediatrics 84(4), 717-23. 89.

Mosher, W. D. Design and Operation of the 1995 National Survey of Family Growth. Family Planning Perspectives 30(1), 43-6. 98.

Notzon, F. C., Bobadilla, J. L., and Coria, I. Birthweight Distributions in Mexico City and Among Us Southwest Mexican Americans: the Effect of Altitude. American Journal of Public Health 82(7), 1014-7. 92.

Plotnick, Robert D. and Hoffman, Saul D. Fixed Effect Estimates of Neighborhood Effects. 95. Seattle, Washington, University of Washington, Seattle Population Research Center.

Potter, F. J., Iannacchione, V. G., Mosher, W. D., Mason, R. E., and Kavee, J. D. Sample Design, Sampling Weights, Imputation, and Variance Estimation in the 1995 National Survey of Family Growth. Vital & Health Statistics - Series 2: Data Evaluation &

Methods Research (124), 1-63. 98.

Reyes, Belinda I. "Dynamics of Immigration: Return Migration to Western Mexico." Public Policy Institute of California. San Francisco, California. 1997.

Scribner, Richard and James H. Dwyer, "Acculturation and low birthweight among Latinos in the Hispanic HHANES," *American Journal of Public Health* 79 (9): 1263-1267 (1989).

Natality Detail File, 1999. U.S. Dept. of Health and Human Services, National Center for the Health Statistics. Hyattsville, MD: U.S. Dept. of Health and Human Services.

Vega, W. A. and Amaro, H. Latino Outlook: Good Health, Uncertain Prognosis. [Review] Annual Review of Public Health 15, 39-67. 94.

Zambrana, R. E., Ell, K., Dorrington, C., Wachsman, L., and Hodge, D. The Relationship Between Psychosocial Status of Immigrant Latino Mothers and Use of Emergency Pediatric Services. Health & Social Work 19(2), 93-102. 94.

Zambrana, R. E. et al., "Prenatal health behaviors and psychosocial risk factors in pregnant women of Mexican origin: the role of acculturation," *Am J Public Health* 87 (6): 1022-6 (1997).