Impact of Language Access Laws on LEP Infant Mortality Rates

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Abstract

Starting with Executive Order 13166 in 2000, the United States federal government began to address the language disparity issues in health care. Around the same time, several states have begun to pass language access (LA) legislation mandating translation and interpretation services at hospitals for limited English proficient (LEP) individuals. This study uses these multiple discontinuities to evaluate the effect of language access laws on infant mortality rates, adequacy of care, Apgar scores, and the number of prenatal visits from the years 1995 to 2004 for limited English proficient families. I find ambiguous results of language access laws positively impacting infant mortality rates or Apgar scores, but I find clear positive impacts on the adequacy of care and the number of prenatal visits. These findings suggest that language access laws have a clear effect on reducing barriers for limited English proficient mothers, and improving the care mothers receive. Furthermore, there is limited evidence that it improves infant health or outcomes, but the increase of prenatal visits and adequacy of care likely indirectly leads to improving infant mortality rates and Apgar scores. More research is needed into discovering how those mechanisms work and the costs of language services.

JEL classification: I10, I18, I19

Keywords: Health Economics, Infant Mortality, Obstetric Care

Introduction

This paper investigates is the relationship between the availability of language services and patient outcomes for limited English proficient (LEP) individuals. Several federal policies legally support language services, such as Title VI of the Civil Rights Act of 1964, which prohibits discrimination based on national origin under any program or activity receiving federal financial assistance. Thus, federal government policy has aimed at prohibiting linguistic discrimination and addressing language disparities. In August 2000, President Bill Clinton issued Executive Order 13166 requiring programs receiving federal assistance, which include hospitals, to identify any need for interpretation services for LEP citizens and develop a system to provide those services, so LEP persons can meaningfully access to them. Policy guidance issued by the Office for Civil Rights of the Department of Justice suggest four factors to be considered: (1) the number or portion of LEP persons in the region, (2) the frequency in which LEP persons encounter the program, (3) the importance of the service provided by the program, and (4) the resources available to the program. Because of the second and third factors, hospitals are often obligated to provide language access services.

However, anecdotal and limited empirical evidence has demonstrated that the availability and accessibility of language services in hospitals is insufficient to meet the standards laid out by EO 13166 (Schiaffino 2016). Moreover, there is still a gap in literature regarding measuring the effect that language access has on patient outcomes for LEP individuals. This impact is important to measure the benefit of language services and the cost of not meeting the needs of the LEP population. I use a county fixed effects model to estimate the effect of state language access laws on obstetric care from 1995 to 2004.

The United States was chosen because of its linguistically diverse population and consistently high immigration rate. The American Community Survey (ACS) shows that the national LEP proportion was approximately 2.5% in 1990 and has grown to 3.6% in 2010. Additionally, the LEP population is not equally spread across the nation. Rather, the population is concentrated in states such as California, Texas, Hawaii, Arizona, New York, and Nevada. For example, 9.6% of the Californian population were considered LEP in 2010 and in one county it was as high as 17.88% (Ruggles 2022). Therefore, the use of county fixed effects accounts for the myriad of differences between the regions such as socio-economic factors or medical innovations that are region specific. These trends support an analysis investigating the effect of language access laws on the LEP population, which may constitute a large proportion of the population in certain counties. This study will contribute to the literature aiming to measure the cost of social determinants of health, such as limited English proficiency, on patient outcomes, and measuring the efficacy of policy on alleviating that cost.

I use infant mortality rate, Apgar score, adequacy of care, and the total number of prenatal visits as measures of patient outcomes since the ability to communicate effectively with the doctor during obstetric care is an important factor in decreasing childbirth complications. Furthermore, clinical care has been shown to be sensitive to interpreters (Karliner 2007), and this study aims to expand that research to obstetric care at the national level. Because obstetric care requires a lot of communication between the mother and the doctor, it is intuitive to think that language services will lead to lower infant mortality rates. The current literature typically focuses on the state or lower level and has supported those intuitions. A study in Hawaii linked LEP status to a higher risk of obstetric trauma during vaginal birth (Sentell et al. 2016). Another study looked at the barriers and facilitators to obstetric care using a small group of women in North

Carolina, which found themes of racism and cultural incompetency in the prenatal clinic (Fryer et al. 2021). Therefore, the literature is currently growing to close the gap in understanding the impact of language services, but there is evidence linking limited language proficiency with poor obstetric outcomes and social challenges in receiving prenatal care. Therefore, my study hopes to provide more insight into the benefit of language services and its ability to improve obstetric outcomes, while providing a more comprehensive national analysis.

Literature Review

In 2007, Karliner performed a systematic review of the various medical interpreter studies demonstrating that hospitals may not rely on *licensed* interpreters, and instead, non-English speaking patients often have a family member interpreting for them, or *ad hoc* interpreters, such as nurses or doctors, who happen to speak another language. Overall, the study affirmed that the use of professional interpreters has led to better medical outcomes and higher satisfaction of care (Karliner 2007). However, the studies reviewed by Karliner (2007) focused on case studies of their own respective hospitals. Therefore, these studies provide support to the positive effect of medical interpreters, but there needs to be more empirical studies investigating the marginal benefit of interpretation services and the cost of not supplying this service to the LEP population. Overall, there is a gap in the literature on a comprehensive national study on the effect of increasing language accessibility on patient outcomes in the United States.

There has only been limited studies looking at the availability of medical interpreters by hospital region and case studies on the effect of interpreters on patient outcomes. Schiaffino et al. (2016) demonstrated that there are areas across the United States where there is a high proportion of LEP people, but no language services offered in hospitals. This study demonstrates that some hospitals are not satisfying the EO 13166 guidelines, which may lead to worse patient outcomes.

They also note that hospitals that offer language services differed by their ownership status: 62.5% - 70.2% of not-for-profit hospitals offered language services, less than 18.6% of private for-profit hospitals offered language services, and government hospitals offered the services at rates similar to private for-profit hospitals (Schiaffino 2016). Taken together, this study provides a way to look at hospital regions by need and provides evidence that hospitals are failing to fulfill the obligations of EO 13166, which provides the basis to look at language access services at the county level since there is a lot of heterogeneity in the distribution of LEP individuals, and there are locations where there may be increased benefits to patient outcomes if language services were implemented to meet the needs of the LEP population.

Infant mortality rate is a reliable measure of patient outcome utilized by the CDC across the United States and can be provided on a very granular level. Furthermore, effective communication, provided by medical interpreters, or language services generally, has been linked to less complications during childbirth. For example, in 2016, Sentell et al. performed statewide analysis of Hawaiian hospitalization data and maternal English proficiency. The study used a descriptive and multivariable log-binomial regression models, which controlled for race, ethnicity, age, and payer. They found that non-English speakers had a significantly higher risk of obstetric trauma and high-risk deliveries (Sentell et al. 2016). Furthermore, in 2021, eleven North Carolinian Spanish speaking women were studied to identify barriers and facilitators to prenatal care, which they defended as important because it allows for early intervention and risk stratification. They found lack of cultural competency, discrimination, and denial of care at the clinical level (Fryer et al. 2021). Since LEP status negatively affects the ability to receive adequate care and safer obstetric outcomes, then it is important to measure whether language access policies have facilitated access to care and improved obstetric outcomes for LEP families.

Theoretical Framework

I build upon the general methodology of Liou (2018) to estimate LEP status in the context of Medicaid and private insurance take-up rates. I first apply Liou's methodology to the CDC infant mortality data set where LEP status is not directly recorded. Liou (2018) first identifies a person as LEP if they satisfy the following conditions: (1) was born in a country that did not have English has an official, primary, or widely spoken secondary language, and (2) earned less than a high school degree, and (3) arrived to the USA after 9 years of age. Then, if at least one person above the age of 16 in the household is not LEP, then the individual - as well as all household members - is re-coded as not being LEP because these family members could provide adequate language services that would render the treatment null.

I, therefore, identify a mother as LEP if she: (1) is Hispanic or Asian and (2) earned less than a high school degree, and (3) was born outside Canada, or outside US and its possessions. The third criterion only considers, Canada, or the US and its possessions since those are the only English-speaking countries that are specifically mentioned within the infant mortality data set. For my study, I want to consider the LEP status of the household since a husband could provide adequate language services that would render the treatment null. Therefore, I consider the family as LEP under two conditions: (1) if the mother is married then the husband must also be considered LEP or (2) if the mother is unmarried then the family will be considered LEP only on whether the mother was identified as LEP. Since the only information available regarding the father is race, age, and ethnicity, then the father will be considered LEP if: (1) Hispanic ethnicity or Asian. Under these specifications, approximately 8% of the families in the data set were identified as being LEP.

I use the data set of all state laws addressing language needs in health care provided by the National Health Law Program (Youdelman 2019). This data set catalogues all state laws related to language need in health care passed until 2018. For every state, I identify laws that mandate interpretation or translation services for maternal and obstetric care. The laws that are relevant to this study specifically mentioned one or more of the following terms: maternity care, pregnancy, prenatal/neonatal care, fetal, abortion, maternal health, infant risk screening, family planning, case management services, obstetrics, gynecology. These will provide the time periods in which the state language access law will have an impact on infant mortality rates for that state. Seventeen states, between the years of 1994 to 2005, had language access laws concerned with obstetric care, which encompasses approximately 26% of the data. Six of these states had already passed the laws prior to 1994 (approximately 9% of the data), and the remaining eleven states passed the language access law during this time period.

Empirical Specification

My first regression will be estimating the effect of state language access laws on the infant mortality rates of LEP families.

$$IM_{i,j,t} = \beta_0 + \beta_1 LA_{j,t} + \beta_2 LEP_{i,t} + \beta_3(LA_{j,t} * LEP_{i,t}) + \theta X^b_{i,j,t} + \lambda_2 C_i + \varepsilon_{i,j,t} \quad (1)$$

$IM_{i,t}$ is an indicator variable that is 1 if infant *i* at location *j* at time *t* died within the infant's first year of life. $LA_{j,t}$ is the treatment variable that is 1 when the infant was delivered in location *j* that has a language access law regarding obstetric care enacted during time period *t.* $X^b_{i,j,t}$, is a vector of the infant *i's* characteristics that are known to impact infant mortality rates as well as hospital *j's* characteristics that are known to impact infant mortality rates. These include

variables such as total family income, mother's age, mother's nativity, mother's residence status, mother's race, mother's ethnicity, mother's education, father's age, father's race, father's ethnicity, marital status, birthplace, number of prenatal visits, cigarette use, risk factors (diabetes, chronic hypertension, pregnancy hypertension, eclampsia), and birth year. LEP is 1 if the family was classified as limited English proficient by the factors adapted from Liou (2018). C is county fixed effects. ε is the classical error term. Finally, regression (1) will be a logit regression since the dependent variable is a binary variable, and I am looking to discover the change in relative risk due to the effect of language access laws on LEP mothers.

My next regressions will use a similar construction with different dependent variables:

$$ADQ_{i,j,t} = \beta_0 + \beta_1 LA_{j,t} + \beta_2 LEP_{i,t} + \beta_3(LA_{j,t} * LEP_{i,t}) + \theta X^b_{i,j,t} + \lambda_2 C_i + \varepsilon_{i,j,t} \quad (2)$$

$$APGAR_{i,j,t} = \beta_0 + \beta_1 LA_{j,t} + \beta_2 LEP_{i,t} + \beta_3(LA_{j,t} * LEP_{i,t}) + \theta X^b_{i,j,t} + \lambda_2 C_i + \varepsilon_{i,j,t} \quad (3)$$

$$PNV_{i,j,t} = \beta_0 + \beta_1 LA_{j,t} + \beta_2 LEP_{i,t} + \beta_3(LA_{j,t} * LEP_{i,t}) + \theta X^b_{i,j,t} + \lambda_2 C_i + \varepsilon_{i,j,t} \quad (4)$$

ADQ will be the adequacy of obstetric care score for the mother of infant *i* at location *j* during time *t.* For this paper, I inverted the typical adequacy score so that it now ranges from 1 – inadequate care to 3 – adequate care. This number is provided by the CDC and is based on a modified Kessner criterion, which considers the month prenatal care began, number of prenatal visits, and gestation. Similarly, APGAR will be the five-minute Apgar score given to infant *i* at location *j* during time *t.* The score reflects the measure of need for resuscitation and predicts the chances of survival in the first year of life. It is based on the infant's heart rate, respiratory effort, muscle tone, reflex irritability, and color. Each category is given a value from 0 to 2, so the total Apgar score ranges from 0 to 10. A score of 0 to 3 indicates a need of resuscitation; a score of 4

to 6 is intermediate health; a score of 7 or greater indicates a good to excellent physical condition. Unfortunately, neither California nor Texas collects the Apgar score on their birth certificates, which affects the usefulness of these scores since California passed a language access law regarding obstetric care in 1997. Moreover, both states have large LEP populations indicated by the American Community Survey (ACS). Since infant mortality is determined within the first year of the infant's life then some infants could also have an Apgar score as well as being indicated as dead. Furthermore, stillbirths are indicated as 0 on the Apgar score. Finally, PNV will be the total number of prenatal visits of the mother of infant *i* at location *j* during time *t.* This variable will be included following the insights from Fryer et al. (2021) where LEP mothers face higher barriers to adequate care during prenatal visits. The rest of the equation will remain the same as regression (1), but regressions (2) – (4) will be OLS regressions.

Data

I constructed Table A.1, included in the Appendix, using the infant mortality data to look at the periods before and after any state language access (LA) law regarding obstetric care was passed. I included the variables for infant mortality, adequacy of care, Apgar scores, family LEP status, mother's foreign-born status, mother's foreign residency status, diabetes status, chronic hypertension status, pregnancy hypertension status, eclampsia status, sex of infant, birth weight, total number of prenatal visits, alcohol use, tobacco use, mother's age, mother's education, marital status, mother's demographic, and father's demographics. The first two columns of Table A.1 provide the means of the variables by language access law enactment status, and the last column provides the difference of those means, as well as the t-statistic as a measure of whether the two groups are statistically different. Table A.2 provides the means and differences for the log of the estimated family income by language access law enactment.

Table A.1 and Table A.2 indicate that these two categories are statistically different on every variable. There is strong evidence that, in the states with language access laws, there is decreased infant mortality rates, improved adequacy scores, similar Apgar scores, and increased prenatal visits. Moreover, these tables suggest all variables are important to include in the regression since they are statistically different between the two treatment groups.

Moreover, it seems likely that my identification of LEP status is too broad as the estimated proportion of LEP status seems to be bigger than the estimated LEP status from the American Community Survey (ACS) data set. This data set is a yearly survey conducted by the American Census Bureau, and during the years of 1995 to 2004, it collected information on English proficiency. Therefore, I considered the person as LEP if they did not speak English, or they spoke English but not well. According to the ACS, the average foreign-born LEP proportion of the population between 1990 to 2004 is 2.1% while I estimate it to be 8% in the infant mortality data set. Moreover, the ACS estimates that 23.5% of the foreign-born population is LEP while the infant mortality data suggests 37.7% of the foreign-born mothers are in LEP families. Overall, my identification of LEP families is likely to be higher than the true amount of LEP families, but it is also possible that a higher proportion of LEP families exist in the data because they have a higher propensity to have babies than English proficient mothers.

I included Table B.1 and Table B.2, provided in the Appendix, as way to compare the two fundamental types of people that my study aims to look at: English proficient (EP) Families, and limited English proficient (LEP) Families. They list the mean of each variable included in Table A.1 and Table A.2, but now it is sorted by family LEP status. The third column then takes the difference of the means between the two groups and indicates statistical significance.

Interestingly, Table B.1 and Table B.2 shows that LEP families on average have a lower infant mortality rate and Apgar score than English proficient families. However, this difference may be caused by race effects since LEP families, as defined here, are composed of a larger percentage of white mothers and a much lower percentage of black mothers and American Indian Mothers. In addition to mortality rates, I also consider adequacy of care scores and total prenatal visits as alternative dependent variables to see if language access laws improve these scores for LEP mothers. On average, it appears that LEP families receive lower scores on the adequacy of care and attend less prenatal visits than English proficient families.

I have also included Table C in the Appendix to show the summary statistics of every variable. It includes the number of observations, mean, minimum value, and maximum value of each variable. This is another way to compare the means of the variable for LEP families or states with language access laws enacted to the national mean from 1995 to 2005.

For Table 1 through Table 4, I run the same four regressions for infant mortality, adequacy of care, Apgar score, and total prenatal visits. Additionally, each regression is limited to the mothers of which we have full demographic information. The first column reflects no other restrictions. The second column reflects including the log of family total income adjusted to 2010 dollars. The third column only considers foreign-born mothers, which allows for a more precise control group. The fourth column only considers foreign-born mothers and the family income data. The log of the family total income data is an estimate provided by the Current Population Survey (CPS), which is a monthly survey that provides characteristics of the labor force and population as whole. I used the CPS to create an average income and matched it to the infant mortality database by considering the county, year, foreign-born status, if they have a child younger than five years of age, race, ethnicity, and education level. Unfortunately, there

were a lot of mothers in the infant mortality data base that could not be matched to get an estimated family income level. Approximately, 49% of mothers in the infant mortality database received an estimated family total income based on the CPS. Because of the loss of observations, regressions that include income are included in separate columns.

Table 1: Logit Regressions for Infant Deaths in the First Year per 1,000 Live Births (1995 – 2004)

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Obstetric LA Law Enacted	-0.0452***	-0.0403**	-0.0534**	-0.0195
	(-3.75)	(-2.27)	(-1.99)	(-0.44)
Limited English Proficiency	-0.173***	-0.226***	-0.0501**	-0.0375
	(-9.92)	(-7.37)	(-2.08)	(-0.84)
Obstetric LA Law Enacted X Limited English Proficiency	0.0213	0.0533	0.0463	0.0494
	(0.93)	(1.50)	(1.62)	(1.07)
Total Prenatal Visits	-0.0389***	-0.0398***	-0.0349***	-0.0273***
	(-62.63)	(-43.58)	(-22.98)	(-10.91)
Mother is Foreign Born	-0.0878***	-0.0850***	0	0
	(-8.93)	(-4.51)	(.)	(.)
Mother is Foreign Resident	-0.225**	-0.398**	-0.354***	-0.761***
	(-2.08)	(-2.20)	(-2.80)	(-3.20)
Yes Diabetes	0.188***	0.206***	0.0909***	0.109*
	(12.45)	(9.41)	(2.68)	(1.90)
Unknown Diabetes Status	0.0578**	0.0400	0.0280	0.166
	(2.12)	(0.94)	(0.44)	(1.34)
Yes Chronic Hypertension	-0.403***	-0.381***	-0.520***	-0.562***
	(-18.22)	(-11.53)	(-8.43)	(-4.76)
Yes Pregnancy Hypertension	-0.791***	-0.778***	-0.819***	-0.763***
	(-60.53)	(-41.80)	(-24.58)	(-13.66)

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Yes Eclampsia	-0.691***	-0.701***	-0.707***	-0.745***
	(-22.44)	(-15.38)	(-8.11)	(-4.04)
Sex of Infant (Female)	-0.317***	-0.330***	-0.237***	-0.260***
	(-60.56)	(-43.74)	(-19.10)	(-12.41)
Birth Weight (Grams)	-0.00208***	-0.00210***	-0.00220***	-0.00222***
	(-742.61)	(-520.69)	(-334.21)	(-202.61)
Mother's Age	-0.00480***	-0.00561***	0.00156	0.00170
	(-7.12)	(-5.64)	(1.11)	(0.72)
Yes Alcohol Use	0.0249	0.0938**	0.0883	0.164
	(0.94)	(2.39)	(0.78)	(0.63)
Unknown Alcohol Use	-0.00647	0.103**	0.0320	0.414*
	(-0.19)	(2.06)	(0.31)	(1.72)
Yes Tobacco Use	0.0464***	0.0344***	0.0719	0.0744
	(5.55)	(2.90)	(1.56)	(0.66)
Unknown Tobacco Use	0.0641***	0.0425	0.0972	-0.195
	(2.81)	(1.25)	(1.34)	(-1.00)
Hispanic Ethnicity Mother	-0.0655***	-0.0845***	-0.0376	0.0678
	(-5.18)	(-3.86)	(-1.19)	(1.06)
Year of Birth	-0.0158***	-0.0182***	-0.0221***	-0.0310***
	(-14.38)	(-11.42)	(-7.95)	(-6.11)
Black Mother	-0.127***	-0.147***	-0.0245	0.200*
	(-8.49)	(-5.84)	(-0.55)	(1.80)
American Indian/ Alaskan Native Mother	0.133***	0.165**	-0.313*	0
	(4.40)	(2.52)	(-1.89)	(.)
Asian/ Pacific Islander Mother	-0.0992***	-0.121***	-0.0690**	-0.0285
	(-4.45)	(-2.85)	(-1.98)	(-0.41)
Mother's Education	-0.0461***	-0.0515***	-0.0264***	-0.0198***

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Level	(-35.47)	(-21.81)	(-10.12)	(-3.63)
Mother's Marital Status	0.0686***	0.0726***	0.110***	0.139***
	(10.20)	(5.66)	(6.87)	(4.05)
Father's Age	-0.000335	0.00111	0.00326***	0.00477**
	(-0.60)	(1.34)	(2.73)	(2.35)
Hispanic Father	-0.0616***	-0.0647***	0.0409	0.0118
	(-5.02)	(-3.32)	(1.33)	(0.21)
Unknown Ethnicity Father	-0.358***	-0.325***	-0.411***	-0.0965
	(-10.72)	(-6.02)	(-4.42)	(-0.50)
Black Father	0.126***	0.123***	0.0904**	-0.0888
	(8.67)	(5.14)	(2.15)	(-0.91)
American Indian/ Alaskan Native Father	0.189***	0.152***	0.281**	0.299
	(6.41)	(3.22)	(2.03)	(0.98)
Asian/ Pacific Islander Father	-0.110***	-0.0428	-0.0913***	-0.0438
	(-4.87)	(-1.13)	(-2.60)	(-0.67)
Unknown Race Father	0.0130	0.0640	-0.0595	0.0202
	(0.44)	(1.28)	(-1.19)	(0.19)
Log of Family Income (2010 adjusted)		-0.0166***		-0.0171
		(-2.60)		(-1.16)
Constant	33.32***	39.17***	44.85***	63.24***
	(14.84)	(12.18)	(8.04)	(6.22)
Observations	*31,798,338*	*16,940,277*	*6,940,056*	*2,580,015*
County Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*

*t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01*

Table 2: OLS Regressions for Adequacy Score (1995 – 2004)

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Obstetric LA Law Enacted	0.00431***	0.000317	0.0106***	0.00613***
	(10.71)	(0.57)	(12.10)	(4.47)
Limited English Proficiency	-0.0148***	-0.0285***	-0.0208***	-0.0370***
	(-27.98)	(-32.52)	(-26.45)	(-26.12)
Obstetric LA Law Enacted X Limited English Proficiency	0.0756***	0.101***	0.0452***	0.0578***
	(103.32)	(94.55)	(46.33)	(37.94)
Total Prenatal Visits	0.0766***	0.0731***	0.101***	0.0971***
	(3336.29)	(2310.53)	(1843.46)	(1064.47)
Mother is Foreign Born	-0.0372***	-0.0383***	0	0
	(-120.60)	(-67.15)	(.)	(.)
Mother is Foreign Resident	-0.247***	-0.276***	-0.186***	-0.212***
	(-89.22)	(-69.88)	(-56.48)	(-43.61)
Yes Diabetes	-0.0564***	-0.0553***	-0.0640***	-0.0670***
	(-110.77)	(-79.33)	(-56.21)	(-33.68)
Unknown Diabetes Status	-0.0258***	-0.0295***	-0.0273***	-0.0200***
	(-25.90)	(-20.62)	(-10.77)	(-3.99)
Yes Chronic Hypertension	-0.0717***	-0.0675***	-0.0679***	-0.0610***
	(-71.43)	(-49.92)	(-21.14)	(-10.06)
Yes Pregnancy Hypertension	-0.0144***	-0.0143***	-0.00738***	-0.00320
	(-31.70)	(-24.10)	(-5.38)	(-1.33)
Yes Eclampsia	-0.00645***	-0.000833	0.00871*	0.0167*
	(-4.18)	(-0.39)	(1.84)	(1.68)
Sex of Infant (Female)	-0.00344***	-0.00335***	-0.00489***	-0.00440***
	(-20.25)	(-14.67)	(-12.00)	(-6.49)
Birth Weight (Grams)	-0.0000238***	-0.0000213***	-0.0000423***	-0.0000360***
	(-160.93)	(-105.05)	(-114.46)	(-57.84)

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Mother's Age	0.00248***	0.00206***	0.00351***	0.00323***
	(107.44)	(64.70)	(72.46)	(39.99)
Yes Alcohol Use	-0.0642***	-0.0587***	-0.0107***	-0.00937
	(-64.84)	(-41.97)	(-2.70)	(-0.99)
Unknown Alcohol Use	-0.0139***	-0.0152***	-0.0115***	-0.0351***
	(-11.95)	(-9.28)	(-3.13)	(-3.81)
Yes Tobacco Use	-0.0469***	-0.0473***	-0.0335***	-0.0379***
	(-147.56)	(-113.55)	(-18.99)	(-9.12)
Unknown Tobacco Use	-0.0113***	-0.00712***	-0.0186***	-0.0151***
	(-15.79)	(-7.51)	(-8.12)	(-2.60)
Hispanic Ethnicity Mother	-0.0147***	-0.0131***	0.00535***	0.00457**
	(-36.10)	(-19.21)	(5.26)	(2.25)
Year of Birth	-0.00409***	-0.00356***	-0.00588***	-0.00476***
	(-111.66)	(-71.83)	(-65.18)	(-29.66)
Black Mother	-0.0347***	-0.0333***	-0.00458***	-0.00852**
	(-61.75)	(-36.08)	(-2.86)	(-2.19)
American Indian/ Alaskan Native Mother	-0.0652***	-0.0928***	-0.00125	-0.0325
	(-60.82)	(-42.10)	(-0.22)	(-0.56)
Asian/ Pacific Islander Mother	-0.00823***	-0.00414***	0.0173***	0.0121***
	(-12.01)	(-3.27)	(15.54)	(5.37)
Mother's Education Level	0.0150***	0.0130***	0.00860***	0.00538***
	(349.90)	(183.26)	(96.24)	(29.79)
Mother's Marital Status	0.0549***	0.0448***	0.0354***	0.0228***
	(231.51)	(103.59)	(65.74)	(20.69)
Father's Age	-0.000227***	-0.000168***	-0.0000397	-0.000202***
	(-11.80)	(-6.33)	(-0.98)	(-2.95)
Hispanic Father	-0.0237***	-0.0214***	-0.0263***	-0.0238***

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
	(-59.60)	(-35.67)	(-26.42)	(-13.35)
Unknown Ethnicity Father	-0.0158***	-0.0142***	-0.00537*	-0.00290
	(-15.35)	(-9.22)	(-1.95)	(-0.46)
Black Father	-0.0293***	-0.0316***	-0.0254***	-0.0213***
	(-54.58)	(-37.31)	(-16.66)	(-6.37)
American Indian/ Alaskan Native Father	-0.0390***	-0.0404***	-0.0175***	-0.00464
	(-36.37)	(-25.91)	(-3.55)	(-0.42)
Asian/ Pacific Islander Father	-0.0202***	-0.0163***	-0.0234***	-0.0140***
	(-29.35)	(-14.51)	(-20.78)	(-6.66)
Unknown Race Father	-0.0281***	-0.0290***	-0.0226***	-0.0200***
	(-29.86)	(-18.87)	(-13.77)	(-5.56)
Log of Family Income (2010 adjusted)		0.00871***		0.00376***
		(41.60)		(7.80)
Constant	9.864***	8.809***	13.18***	11.01***
	(134.73)	(88.96)	(73.07)	(34.21)
Observations	*24,905,047*	*12,885,378*	*5,247,091*	*1,859,702*
County Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*

t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: OLS Regressions for Apgar Score (1995 – 2004)

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Obstetric LA Law Enacted	-0.00535***	-0.0110***	-0.000752	-0.0232***
	(-7.40)	(-10.70)	(-0.48)	(-6.73)
Limited English Proficiency	-0.00732***	-0.00591***	0.00489***	0.00487*
	(-7.24)	(-2.82)	(3.96)	(1.80)
Obstetric LA Law Enacted X Limited English Proficiency	0.0118***	0.00548	0.00884***	0.0201***
	(6.70)	(1.44)	(4.73)	(4.92)
Total Prenatal Visits	0.00576***	0.00517***	0.00433***	0.00422***

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
	(149.03)	(95.48)	(49.47)	(24.79)
Mother is Foreign Born	0.00568***	0.000725	0	0
	(10.61)	(0.64)	(.)	(.)
Mother is Foreign Resident	0.0290***	0.0513***	0.0263***	0.0661***
	(3.71)	(4.02)	(3.18)	(4.56)
Yes Diabetes	-0.0807***	-0.0807***	-0.0514***	-0.0514***
	(-100.05)	(-72.09)	(-31.44)	(-16.35)
Unknown Diabetes Status	-0.0276***	-0.0219***	-0.0199***	-0.0177***
	(-17.23)	(-9.53)	(-5.79)	(-2.70)
Yes Chronic Hypertension	-0.0767***	-0.0788***	-0.0740***	-0.0866***
	(-49.97)	(-37.67)	(-17.01)	(-9.89)
Yes Pregnancy Hypertension	-0.0567***	-0.0623***	-0.0677***	-0.0679***
	(-78.54)	(-65.25)	(-33.21)	(-17.13)
Yes Eclampsia	-0.132***	-0.137***	-0.140***	-0.138***
	(-56.17)	(-41.31)	(-22.65)	(-10.26)
Sex of Infant (Female)	0.0561***	0.0554***	0.0432***	0.0394***
	(200.91)	(144.76)	(68.29)	(32.10)
Birth Weight (Grams)	0.000277***	0.000255***	0.000242***	0.000223***
	(1144.02)	(753.58)	(423.78)	(199.43)
Mother's Age	-0.00142***	-0.00132***	-0.00225***	-0.00180***
	(-36.75)	(-24.13)	(-29.83)	(-12.09)
Yes Alcohol Use	-0.0197***	-0.0231***	-0.0117**	-0.0314***
	(-12.76)	(-10.55)	(-2.29)	(-2.72)
Unknown Alcohol Use	-0.0365***	-0.0479***	-0.0409***	-0.0676***
	(-20.27)	(-18.99)	(-8.65)	(-6.26)
Yes Tobacco Use	0.0594***	0.0588***	0.0330***	0.0220***
	(123.30)	(91.22)	(14.67)	(4.26)

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Unknown Tobacco Use	0.0336***	0.0336***	0.0470***	0.0633***
	(31.77)	(23.49)	(16.69)	(9.24)
Hispanic Ethnicity Mother	0.00938***	0.00679***	-0.000263	-0.00373
	(12.43)	(4.73)	(-0.18)	(-1.22)
Year of Birth	-0.00322***	-0.00423***	-0.00420***	-0.00575***
	(-56.03)	(-54.03)	(-31.20)	(-21.93)
Black Mother	-0.0111***	-0.0139***	-0.0310***	-0.0338***
	(-12.46)	(-9.34)	(-14.89)	(-6.45)
American Indian/ Alaskan Native Mother	0.0103***	0.0101***	0.0220***	0.0413
	(6.09)	(3.06)	(3.12)	(0.61)
Asian/ Pacific Islander Mother	0.0317***	0.0269***	0.0155***	0.00335
	(25.89)	(10.67)	(9.61)	(0.95)
Mother's Education Level	-0.00114***	-0.00201***	0.000865***	0.000885**
	(-16.03)	(-16.40)	(6.31)	(2.56)
Mother's Marital Status	0.00634***	0.00926***	0.00408***	0.00639***
	(15.90)	(12.37)	(4.80)	(2.91)
Father's Age	0.000431***	0.000567***	0.000444***	0.000405***
	(13.51)	(12.56)	(7.11)	(3.33)
Hispanic Father	0.00742***	0.00508***	-0.00166	-0.00582**
	(10.19)	(4.37)	(-1.14)	(-2.05)
Unknown Ethnicity Father	0.000315	0.00253	-0.0151***	-0.0193**
	(0.20)	(1.06)	(-4.34)	(-2.35)
Black Father	-0.0140***	-0.0128***	-0.0331***	-0.0315***
	(-16.25)	(-9.25)	(-16.35)	(-6.55)
American Indian/ Alaskan Native Father	0.00901***	0.00415*	-0.00521	-0.0108
	(5.30)	(1.66)	(-0.78)	(-0.66)
Asian/ Pacific	0.0373***	0.0329***	0.0313***	0.0325***

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Islander Father	(30.15)	(15.24)	(18.82)	(9.27)
Unknown Race Father	0.00378***	-0.00480**	0.0177***	0.0228***
	(2.63)	(-2.01)	(8.40)	(4.91)
Log of Family Income (2010 adjusted)		-0.00114***		-0.000532
		(-3.05)		(-0.70)
Constant	14.59***	16.80***	16.67***	19.65***
	(124.83)	(105.77)	(59.57)	(37.44)
Observations	*24,127,463*	*12,909,485*	*3,949,335*	*982,306*
County Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*

t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01

Table 4: OLS Regressions for Total Prenatal Visits (1995 – 2004)

	(1) No Income	*(2) Income Included*	*(3) Foreign Born Only*	*(4) Foreign Born and Income*
Obstetric LA Law Enacted	0.0787***	0.0916***	0.171***	0.183***
	(26.34)	(22.49)	(28.07)	(18.73)
Limited English Proficiency	-0.276***	-0.459***	-0.250***	-0.277***
	(-66.95)	(-67.50)	(-45.17)	(-27.90)
Obstetric LA Law Enacted X Limited English Proficiency	0.669***	0.810***	0.446***	0.453***
	(125.17)	(102.46)	(69.02)	(44.12)
Mother is Foreign Born	-0.472***	-0.497***	0	0
	(-201.25)	(-117.71)	(.)	(.)
Mother is Foreign Resident	-1.447***	-1.628***	-1.011***	-1.283***
	(-67.34)	(-52.93)	(-43.32)	(-36.86)
Yes Diabetes	1.295***	1.292***	1.110***	1.148***
	(334.29)	(244.79)	(143.26)	(86.88)
Unknown Diabetes Status	-0.260***	-0.369***	-0.694***	-0.504***
	(-32.99)	(-33.05)	(-40.13)	(-15.73)
Yes Chronic	1.425***	1.498***	1.018***	0.922***

Hypertension	(186.33)	(145.82)	(46.13)	(22.57)
Yes Pregnancy Hypertension	0.714*** (203.32)	0.762*** (165.59)	0.390*** (40.97)	0.313*** (19.03)
Yes Eclampsia	0.118*** (9.85)	0.197*** (11.92)	-0.0859*** (-2.62)	-0.0304 (-0.46)
Sex of Infant (Female)	0.119*** (90.55)	0.113*** (64.45)	0.111*** (39.23)	0.103*** (22.24)
Birth Weight (Grams)	0.000566*** (497.66)	0.000512*** (329.53)	0.000582*** (228.60)	0.000528*** (124.89)
Mother's Age	0.0107*** (60.25)	0.00547*** (22.32)	0.0252*** (75.32)	0.0213*** (38.44)
Yes Alcohol Use	-0.683*** (-86.98)	-0.591*** (-53.59)	-0.229*** (-8.21)	-0.124** (-1.97)
Unknown Alcohol Use	0.0541*** (5.78)	-0.0180 (-1.38)	0.0384 (1.44)	-0.637*** (-10.17)
Yes Tobacco Use	-0.193*** (-77.44)	-0.173*** (-52.87)	-0.122*** (-9.67)	-0.155*** (-5.36)
Unknown Tobacco Use	0.121*** (21.39)	0.197*** (26.29)	0.216*** (13.11)	0.591*** (14.32)
Hispanic Ethnicity Mother	-0.250*** (-80.35)	-0.324*** (-63.44)	0.0283*** (4.00)	0.0177 (1.28)
Year of Birth	0.00123*** (4.45)	0.00390*** (10.42)	0.0173*** (27.29)	0.0487*** (43.24)
Black Mother	-0.340*** (-79.32)	-0.442*** (-63.65)	-0.209*** (-18.87)	-0.478*** (-17.96)
American Indian/ Alaskan Native Mother	-0.756*** (-91.43)	-1.110*** (-66.46)	-0.309*** (-8.04)	0.957*** (2.64)
Asian/ Pacific Islander Mother	-0.329*** (-63.06)	-0.334*** (-35.51)	-0.124*** (-16.05)	-0.127*** (-8.41)

Mother's Education Level	0.134*** (407.25)	0.116*** (213.03)	0.121*** (196.10)	0.114*** (91.88)
Mother's Marital Status	0.360*** (197.72)	0.339*** (103.73)	0.188*** (50.80)	0.173*** (22.77)
Father's Age	-0.00263*** (-17.77)	-0.00144*** (-7.04)	-0.00353*** (-12.57)	-0.00293*** (-6.27)
Hispanic Father	-0.262*** (-86.35)	-0.258*** (-56.80)	-0.436*** (-63.08)	-0.540*** (-43.85)
Unknown Ethnicity Father	-0.258*** (-31.88)	-0.188*** (-15.51)	-0.700*** (-36.26)	-1.058*** (-23.95)
Black Father	-0.194*** (-47.18)	-0.196*** (-30.70)	-0.207*** (-19.63)	-0.200*** (-8.71)
American Indian/ Alaskan Native Father	-0.490*** (-59.10)	-0.395*** (-32.82)	-0.137*** (-4.00)	-0.160** (-2.11)
Asian/ Pacific Islander Father	-0.132*** (-25.20)	-0.133*** (-15.85)	-0.247*** (-31.66)	-0.346*** (-24.29)
Unknown Race Father	-0.0546*** (-7.55)	-0.0311*** (-2.65)	-0.0422*** (-3.72)	0.0410* (1.70)
Log of Family Income (2010 adjusted)		0.0270*** (16.69)		0.00803** (2.45)
Constant	6.428*** (11.39)	0.808 (1.06)	-27.37*** (-20.38)	-90.44*** (-40.02)
Observations	*31,803,203*	*16,947,996*	*6,959,183*	*2,586,478*
County Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*

t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Findings

Table 1 provides the results of a logit regression of infant mortality rates, but the results are unclear whether language access laws that targeted obstetric care improved the infant mortality rate for LEP families. Column 1 of Table 1 suggests that the laws generally decrease

infant mortality by approximately 4.1%, being LEP reduces infant mortality by 15.9%, and there is not a statistically significant effect of language access laws on LEP families. These trends and magnitudes are similar across all columns. Thus, it is unclear whether the language access laws are correctly targeting and improving the infant mortality rates of LEP families. However, they do seem to have an overall effect of reducing infant mortality. Moreover, LEP status seems to have a large effect at reducing infant mortality rates, but that is likely because these results are relative to other demographics. It is possible that being LEP affords other characteristics that help infant mortality rates that is not included in the controls. Furthermore, the estimated family income shows wealth is correlated with reductions in infant mortality. Finally, the total number of prenatal visits has a statistically significant effect at reducing infant mortality rates.

Table 2 focuses on the effect of language access laws and LEP status on adequacy of care score, which is the result of prenatal care timing and gestational age of the newborn. Across all columns, language access laws have an overall positive effect on increasing the adequacy score, LEP status has a negative effect on adequacy scores, and there is a large positive statistically significant effect of language access laws on LEP families. Overall, LEP status results in lower adequacy scores, but language access laws can compensate for that and bring LEP families to a higher adequacy score. Thus, language access laws can erase the deficit in adequacy scores correlated with LEP status.

Table 3 shows language access laws have a very small, but statistically significant negative effect on Apgar scores. LEP status has an unclear effect as the first two columns suggest a small and statistically significant negative effect, but when it is restricted to only foreign-born mothers, then it has a positive effect. In every column, language access laws have a larger positive effect for LEP families. The coefficients may be statistically significant, but none

of them have a large magnitude. The Apgar scale ranges from 0 – 10, but each of the coefficients affect the score by less than 0.1 points. This is consistent with the insights from Table A.1 and Table B.1, which showed that the average Apgar score is approximately the same for both LEP and English proficient families and across treatment groups. Therefore, language access laws may have a statistically significant effect on Apgar scores, but the effect is barely noticeable. Finally, the Apgar scores do not include observations from Texas and California, which makes drawing conclusions difficult. Both states have a large portion of LEP families, and California had language access laws enacted during this period. Thus, the true effect on Apgar scores may be positive or larger if Texas and California were included.

Table 4 provides the most compelling evidence of the positive effect of language access laws on LEP families. Overall, language access laws have a small but statistically significant positive overall effect on the total number of prenatal visits. LEP status has a large and significant negative effect on the number of prenatal visits ranging from -0.25 to -0.459, but the language access effect on LEP families overcomes that negative effect and leaves them better off than an English proficient family. It appears language access laws increase the total number of prenatal visits by 0.446 to 0.81 for LEP families. Moreover, this large and statistically significant effect likely explains the positive effect of language access laws on adequacy scores because prenatal visits are one of the factors considered in determining the adequacy score. Therefore, language access laws seem successful in eliminating the impeding effect of LEP status. Instead, language access laws act as a facilitator for all mothers and have an increased ability to help LEP mothers.

Discussion and Conclusion

It seems likely that the reason the regression showed ambiguous results for the infant mortality rates and Apgar scores, while showing clear results for the adequacy scores and total number of prenatal visits is due to how language access laws are implemented and what they act upon. Both the infant mortality rates and Apgar score are likely less sensitive language access laws and more sensitive to other determinants of health. However, adequacy of care and total number of prenatal visits are mainly social variables and are influenced by social inputs. Therefore, language access laws affect the social inputs by increasing cultural competency and decreasing impediments. Moreover, improving the adequacy of care and increasing the number of prenatal visits are ways of reducing infant mortality rates and improving Apgar scores. Thus, language access laws likely have a positive effect on infant mortality rates and Apgar scores, but they act through a secondary mechanism that obfuscates the specific impact of the language access laws on LEP mothers.

Overall, the strongest evidence of the effect of language access laws on LEP families is on the number of prenatal visits, which is consistent with the insights from Fryer et al. (2021). Moreover, while the effect on infant mortality is unclear, the total number of prenatal visits reduces infant mortality rates, so if language access laws increase the total number of prenatal visits, they may indirectly decrease infant mortality rates. Similarly, the positive effect seen in the Apgar score and adequacy score is likely driven by the positive impact on prenatal care visits. These results also support the conclusion that language access laws have a positive and statistically significant effect on the mother's health while being ambiguous on its impact on infant health.

This study contributes to the literature by further examining the social determinants of health on national level and providing empirical support for the role of language access laws in facilitating care, but future studies should look to creating an improved and more accurate LEP measurement as it is likely that my measurement misidentifies people as LEP who are actually English proficient. Therefore, the effects of language access laws on LEP families may be larger in magnitude when LEP status is perfectly identified. There needs to be more studies into the mechanisms by which language access laws improve these outcomes.

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Appendix

Table A.1: Summary Statistics by Obstetric Law Enacted (1995 – 2004)

	(1) No Obstetric LA Law Enacted	*(2) Obstetric LA Law Enacted*	*(3) Difference of Enacting LA Law*
Infant deaths per 1,000 live births	7.05	6.58	-0.469*** (-15.73)
Adequacy Score	2.69	2.72	0.0353*** (138.85)
Apgar Score	8.91	8.90	-0.00742*** (-22.20)
Family LEP Status	0.07	0.10	0.0313*** (320.11)
Mother is Foreign Born	0.20	0.26	0.0626*** (425.87)
Mother is Foreign Resident	0.001	0.001	-0.000750*** (-60.72)
No Diabetes	0.96	0.97	0.0124*** (176.09)
Yes Diabetes	0.03	0.03	-0.00323*** (-53.48)
Unknown Diabetes Status	0.01	0.004	-0.00921*** (-244.01)
No Chronic Hypertension	0.98	0.99	0.0112*** (229.65)
Yes Chronic Hypertension	0.01	0.01	-0.00200*** (-63.86)
Unknown Chronic Hypertension Status	0.01	0.004	-0.00921*** (-244.01)
No Pregnancy Hypertension	0.95	0.96	0.0158*** (205.80)
Yes Pregnancy Hypertension	0.04	0.03	-0.00660*** (-97.45)

	(1) No Obstetric LA Law Enacted	*(2) Obstetric LA Law Enacted*	*(3) Difference of Enacting LA Law*
Unknown Pregnancy Hypertension Status	0.01	0.004	-0.00921*** (-244.01)
No Eclampsia	0.98	0.99	0.0107*** (249.88)
Yes Eclampsia	0.004	0.002	-0.00146*** (-72.17)
Unknown Eclampsia Status	0.01	0.004	-0.00921*** (-244.01)
Sex of Infant (Female)	0.49	0.49	-0.0000641 (-0.36)
Birth Weight (Grams)	3305.36	3320.06	14.69*** (67.30)
Total Prenatal Visits	11.43	11.83	0.407*** (277.06)
No Alcohol Use	0.90	0.61	-0.284*** (-2187.51)
Yes Alcohol Use	0.01	0.01	-0.00428*** (-129.11)
Unknown Alcohol Use	0.09	0.38	0.289*** (2273.86)
No Tobacco Use	0.78	0.51	-0.276*** (-1756.04)
Yes Tobacco Use	0.11	0.08	-0.0283*** (-263.32)
Unknown Tobacco Use	0.11	0.41	0.304*** (2294.96)
Mother's Age	27.18	27.40	0.218*** (96.83)
Mother's Education Level	12.82	12.76	-0.0605***

	(1) No Obstetric LA Law Enacted	*(2) Obstetric LA Law Enacted*	*(3) Difference of Enacting LA Law*
			(-58.83)
Mother's Marital Status	0.67	0.66	-0.0117*** (-69.04)
Non-Hispanic Mother	0.81	0.74	-0.0673*** (-459.36)
Hispanic Mother	0.18	0.25	0.0672*** (467.69)
Unknown Ethnicity Mother	0.01	0.01	0.000103*** (2.76)
White Mother	0.79	0.80	0.0138*** (94.34)
Black Mother	0.16	0.13	-0.0312*** (-241.95)
American Indian/ Alaskan Native Mother	0.01	0.01	-0.00275*** (-76.24)
Asian/ Pacific Islander Mother	0.04	0.06	0.0201*** (262.29)
Father's Age	30.23	30.52	0.297*** (112.72)
Non-Hispanic Father	0.69	0.64	-0.0570*** (-339.88)
Hispanic Father	0.16	0.23	0.0699*** (513.46)
Unknown Ethnicity Father	0.15	0.14	-0.0128*** (-100.47)
White Father	0.69	0.71	0.0199*** (120.47)
Black Father	0.11	0.09	-0.0216*** (-194.69)

	(1) No Obstetric LA Law Enacted	*(2) Obstetric LA Law Enacted*	*(3) Difference of Enacting LA Law*
American Indian/ Alaskan Native Father	0.01	0.01	-0.00153*** (-49.84)
Asian/ Pacific Islander Father	0.04	0.05	0.0179*** (252.22)
Unknown Race Father	0.15	0.14	-0.0147*** (-114.98)
Observations	*29,440,801*	*10,488,212*	*39,929,013*

t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01

Table A.2: Summary Statistics of Income by Obstetric Law Enacted (1995 – 2004)

	(1) No Obstetric LA Law Enacted	*(2) Obstetric LA Law Enacted*	*(3) Difference of Enacting LA Law*
Log of Family Income (2010 adjusted)	10.80	10.85	0.0537*** (107.82)
Observations	*14,111,384*	*5,268,456*	*19,379,840*

t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01

Table B.1: Summary Statistics by LEP Status (1995 – 2004)

	(1) EP Family	*(2) LEP Family*	*(3) Difference of Being LEP*
Infant deaths per 1,000 live births	7.00	5.38	-1.629*** (-33.74)
Adequacy Score	2.71	2.45	-0.268*** (-667.75)
Apgar Score	8.91	8.92	0.00676*** (10.50)
Total Prenatal Visits	11.65	10.21	-1.443*** (-601.36)
Obstetric LA Law Enacted	0.26	0.34	0.0822*** (320.11)
Mother is Foreign Born	0.14	1	0.856*** (4346.34)
Mother is Foreign Resident	0.001	0.004	0.00273*** (141.36)

	(1) EP Family	*(2) LEP Family*	*(3) Difference of Being LEP*
No Diabetes	0.96	0.96	0.00160*** (13.96)
Yes Diabetes	0.03	0.03	0.00150*** (15.25)
Unknown Diabetes Status	0.01	0.01	-0.00310*** (-51.10)
No Chronic Hypertension	0.98	0.99	0.00819*** (104.00)
Yes Chronic Hypertension	0.01	0.003	-0.00510*** (-100.10)
Unknown Chronic Hypertension Status	0.01	0.01	-0.00310*** (-51.10)
No Pregnancy Hypertension	0.95	0.97	0.0191*** (153.44)
Yes Pregnancy Hypertension	0.04	0.02	-0.0160*** (-145.48)
Unknown Pregnancy Hypertension Status	0.01	0.01	-0.00310*** (-51.10)
No Eclampsia	0.99	0.99	0.00449*** (65.38)
Yes Eclampsia	0.003	0.002	-0.00140*** (-42.58)
Unknown Eclampsia Status	0.01	0.01	-0.00310*** (-51.10)
Sex of Infant (Female)	0.49	0.49	0.00214*** (7.32)
Birth Weight (Grams)	3307.99	3326.33	18.33*** (51.72)
No Alcohol Use	0.84	0.60	-0.239***

	(1) EP Family	*(2) LEP Family*	*(3) Difference of Being LEP*
			(-1086.14)
Yes Alcohol Use	0.01	0.001	-0.00774*** (-143.72)
Unknown Alcohol Use	0.15	0.40	0.246*** (1145.38)
No Tobacco Use	0.72	0.59	-0.129*** (-490.71)
Yes Tobacco Use	0.11	0.01	-0.101*** (-582.15)
Unknown Tobacco Use	0.17	0.40	0.231*** (1022.70)
Mother's Age	27.33	26.26	-1.065*** (-291.57)
Mother's Education Level	13.26	7.45	-5.807*** (-4070.55)
Mother's Marital Status	0.68	0.57	-0.108*** (-393.49)
Non-Hispanic Mother	0.85	0.09	-0.760*** (-3710.36)
Hispanic Mother	0.14	0.91	0.768*** (3831.20)
Unknown Ethnicity Mother	0.01	0	-0.00795*** (-159.71)
White Mother	0.78	0.89	0.111*** (468.40)
Black Mother	0.16	0.03	-0.128*** (-615.93)
American Indian/ Alaskan Native Mother	0.01	0.002	-0.00935*** (-159.70)

	(1) EP Family	*(2) LEP Family*	*(3) Difference of Being LEP*
Asian/ Pacific Islander Mother	0.05	0.07	0.0267*** (214.49)
Father's Age	30.37	29.57	-0.802*** (-185.77)
Non-Hispanic Father	0.73	0.08	-0.656*** (-2604.44)
Hispanic Father	0.12	0.79	0.663*** (3390.80)
Unknown Ethnicity Father	0.15	0.14	-0.00687*** (-33.36)
White Father	0.69	0.76	0.0624*** (233.04)
Black Father	0.11	0.02	-0.0975*** (-542.63)
American Indian/ Alaskan Native Father	0.01	0.001	-0.00683*** (-137.10)
Asian/ Pacific Islander Father	0.04	0.06	0.0224*** (194.16)
Unknown Race Father	0.14	0.16	0.0196*** (94.88)
Observations	*36,603,298*	*3,184,454*	*39,787,752*

t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01

Table B.2: Summary Statistics of Income by LEP Status (1995 – 2004)

	(1) EP Family	*(2) LEP Family*	*(3) Difference of Being LEP*
Log of Family Income (2010 adjusted)	10.85	10.11	-0.744*** (-790.51)
Observations	*18,273,501*	*1,106,161*	*19,379,662*

t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01

Table C: Summary Statistics of Nation (1995 – 2004)

	count	*mean*	*min*	*max*
Infant deaths per 1,000 live births	39,929,013	6.93	0	1,000
Adequacy Score	29,534,275	2.69	1	3
Apgar Score	30,876,901	8.91	0	10
Total Prenatal Visits	38,582,846	11.53	0	49
Family LEP Status	39,787,752	0.08	0	1
Obstetric LA Law Enacted	39,929,013	0.26	0	1
Mother is Foreign Born	39,812,888	0.21	0	1
Mother is Foreign Resident	47,231	0.001	0	1
Log of Family Income (2010 adjusted)	19,379,840	10.81	0	13.66
No Diabetes	39,929,013	0.96	0	1
Yes Diabetes	39,929,013	0.03	0	1
Unknown Diabetes Status	39,929,013	0.01	0	1
No Chronic Hypertension	39,929,013	0.98	0	1
Yes Chronic Hypertension	39,929,013	0.01	0	1
Unknown Chronic Hypertension Status	39,929,013	0.01	0	1
No Pregnancy Hypertension	39,929,013	0.95	0	1
Yes Pregnancy Hypertension	39,929,013	0.04	0	1
Unknown Pregnancy Hypertension Status	39,929,013	0.01	0	1
No Eclampsia	39,929,013	0.99	0	1
Yes Eclampsia	39,929,013	0.003	0	1
Unknown Eclampsia Status	39,929,013	0.01	0	1
Male Infant	39,929,013	0.51	0	1
Female Infant	39,929,013	0.49	0	1
Birth Weight (Grams)	39,912,244	3309.23	227	8,165
No Alcohol Use	39,929,013	0.82	0	1
Yes Alcohol Use	39,929,013	0.01	0	1
Unknown Alcohol Use	39,929,013	0.17	0	1
No Tobacco Use	39,929,013	0.71	0	1
Yes Tobacco Use	39,929,013	0.10	0	1
Unknown Tobacco Use	39,929,013	0.19	0	1
Mother's Age	39,929,013	27.24	10	54
Mother's Education Level	38,379,182	12.81	0	17
Mother's Marital Status	39,929,013	0.67	0	1
Non-Hispanic Mother	39,929,013	0.79	0	1
Hispanic Mother	39,929,013	0.20	0	1
Unknown Ethnicity Mother	39,929,013	0.01	0	1
White Mother	39,929,013	0.79	0	1
Black Mother	39,929,013	0.15	0	1
American Indian/ Alaskan Native Mother	39,929,013	0.01	0	1
Asian/ Pacific Islander Mother	39,929,013	0.05	0	1

	count	*mean*	*min*	*max*
Father's Age	34,329,513	30.30	10	98
Non-Hispanic Father	39,929,013	0.68	0	1
Hispanic Father	39,929,013	0.17	0	1
Unknown Ethnicity Father	39,929,013	0.15	0	1
White Father	39,929,013	0.70	0	1
Black Father	39,929,013	0.11	0	1
American Indian/ Alaskan Native Father	39,929,013	0.01	0	1
Asian/ Pacific Islander Father	39,929,013	0.04	0	1
Unknown Race Father	39,929,013	0.15	0	1
Total Observations	*39,929,013*			