

Original Contribution

Restrictive Immigration Law and Birth Outcomes of Immigrant Women

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Unauthorized immigration is one of the most contentious policy issues in the United States. In an attempt to curb unauthorized migration, many states have considered restrictive laws intended to make life so difficult for unauthorized immigrants that they would choose to leave the country. Arizona's Senate Bill 1070, enacted in 2010, was a pioneering example of these efforts. Using population-level natality data and causal inference methods, we examined the effect of SB1070 on infants exposed before birth in Arizona. Prenatal exposure to the bill resulted in lower birth weight among Latina immigrant women, but not among US-born white, black, or Latina women. The decline in birth weight resulted from exposure to the bill being signed into law, rather than from its (limited) implementation. The findings indicate that the threat of a punitive law, even in the absence of implementation, can have a harmful effect on the birth outcomes of the next generation.

birth weight; immigrants; immigration policy; infant health; prenatal stress

Abbreviation: DID, difference-in-difference; SB1070, Senate Bill 1070.

Immigration is one of the most contentious policy issues in the United States. There are currently about 11 million immigrants without authorization living in the country, most of whom come from Mexico and Central America (1, 2). Facing a deadlock at the federal level, states have taken an increasingly active role in setting immigration policy. Some states have chosen an inclusive approach, preventing law enforcement involvement in immigration enforcement ("sanctuary cities") and extending benefits such as driver's licenses to undocumented immigrants (3). Others have opted for a restrictive stance, expanding local involvement in the enforcement of federal immigration law, mandating that employers verify work eligibility, and blocking access to driver's licenses, in-state tuition, and other benefits (4, 5).

These "internal border control" measures have large implications for the target undocumented population. Research suggests they shape immigrants' residential choices (6–8), labor force participation (9, 10), health-care utilization (11, 12), and health and psychosocial well-being (13, 14). Their effects can expand beyond intended targets, affecting authorized immigrants and even co-ethnic citizens. Spillover effects could emerge from proximity, given that many authorized immigrants and US-born co-ethnic persons live and work in the same mixed-status

families, communities, and workplaces as their unauthorized peers (15–17). In contexts in which authorization status is conflated with ethnicity, those who speak the same language or share physical similarities with the unauthorized could be the target of profiling and harassment or feel directly threatened by immigration enforcement (18–22).

To date, the literature has focused on the consequences of immigration enforcement for adults and children (14). We shifted attention to those exposed in utero, a less visible but relevant population. Because the prenatal period is highly sensitive to the environment and consequential for health and development, exposures during pregnancy can have enduring consequences over the life course (23, 24).

We examined the effect of Arizona's Senate Bill 1070 (SB1070), "Support Our Law Enforcement and Safe Neighborhoods Act," on infant health among Latina immigrants. We focus on birth weight, a critical measure of early health and well-being. Signed into law in 2010, SB1070 is an omnibus bill intended to achieve "attrition through enforcement" (25) by targeting all undocumented immigrants and tying their legal status directly to law enforcement. The bill established that being an immigrant in Arizona without carrying registration documents was a state misdemeanor, prevented "sanctuary city" policies, and

imposed penalties for hiring or transporting unauthorized immigrants. Its most prominent provision, the so-called “show me your papers” component, required law enforcement agents to determine individuals’ immigration status during lawful stops or arrests if there was reasonable suspicion that the individual was an unauthorized immigrant. According to critics, this provision induced profiling based on ethnicity, language, and skin tone (26).

SB1070 was not an isolated event. Rather, it provided a blueprint for about a dozen states, which have introduced comparable enforcement bills (27) (see Web Figure 1, available at <https://academic.oup.com/aje>). More recently, federal immigration policy has adopted a more restrictive and aggressive immigration enforcement approach similar to Arizona’s in communities across the country (28).

Recent research using natural experiments provides evidence of an effect of prenatal exposure to environmental stressors on birth weight, rendering our question plausible. To date, however, these studies have tended to focus on discrete events, such as a land-mine explosion, a natural disaster, an immigration raid, or the death of a family member (22, 29–31). In all these cases, the event can be dated with accuracy. In contrast, the passage and implementation of immigration law is a process that unfolds over time, making the timing of its impact an empirical question.

SB1070 was never fully implemented. The bill was signed into law in April 2010, and its constitutionality was immediately challenged in court. On July 28 of that year, the day before the bill was scheduled to come into effect, most of its provisions—including the “show me your papers” component—were enjoined, and a very partial version came into effect the following day. The injunction was upheld until June 2012, when the US Supreme Court struck down the entire bill with the exception of the “show me your papers” provision. Even after the Supreme Court ruling, the application of the law was very limited, with authorities usually following local ordinances rather than the new ones established by SB1070 (32, 33). In spite of its partial implementation, the passage of SB1070 is reported to have affected self-reported health (34), fear and distress (35–37), and health-care utilization (38) among Latinos. Although the consequences appear to have been stronger among undocumented immigrants, evidence suggests that the psychological distress might have extended to documented peers and even US-born Latinos (37).

We examined indicators of awareness and concern about the bill to ascertain when it was experienced as a stressor. We relied on Google Trends, a web tool that uses Google search data to analyze how often a particular term is searched relative to the total search volume in a particular locality and language. We also analyzed mention counts of SB1070 from the 2 local newspapers with the highest circulation in Arizona. Figure 1 shows monthly trends in Google searches for “SB1070” in Arizona (Figure 1A), references to “SB1070” in the main local newspapers (Figure 1B), and Google searches for the Spanish words “illegal” (illegal) and “derechos” (rights) in Arizona (Figure 1C). While the first 2 indicators capture awareness and concern about the law, the third reflects reactions by Arizona’s Spanish-speaking community, conceivably intended to evaluate risk and develop protective strategies.

Although SB1070 was introduced to the Arizona legislature in January 2010, these indicators suggest that the bill did

not become a major topic of public discussion until April 2010, when it was signed into law. There is a sharp spike in both Google searches and newspaper mentions immediately after the law’s passage until its (partial) implementation in July 2010, followed by a marked drop. There is also a minor spike around June 2012 when the “show me your papers” provision was upheld by the Supreme Court, but it is slight compared with the initial reaction. The spike in alertness and concern about the bill contrasts with the stability in deportations of unauthorized immigrants. Figure 2, based on the Secure Communities deportation program, shows no increase in fingerprints submitted to federal authorities (Figure 2A) or in deportations (Figure 2B) after the passage of SB1070.

Combined, these trends suggest that the bill induced concern and anxiety but did not result in an increase in detentions or deportations of undocumented immigrants during or after the implementation of the law. Based on this evidence, we expected that Latina immigrants experienced the bill as a stressor immediately after it was passed and before it was enjoined by the courts, in the period between April and July of 2010. The effect of prenatal exposure on birth weight, if any, should then be most evident among births occurring in the second half of 2010. The effects of the bill might have extended to US-born Latinas, driven by proximity to the immigrant population and vulnerability to ethnic profiling.

METHODS

We relied on natality microdata containing all US births between January 2007 and December 2012, obtained from the Centers for Disease Control and Prevention. Since 2005, the public-use birth data sets excluded information on geography, so we obtained restricted-access data sets with location information. Because birth records compiled by the Centers for Disease Control and Prevention lack information on some variables for Arizona, we obtained natality data from the Arizona Department of Health Services and merged them with data for other states included in the analysis.

Difference-in-difference model

We used a difference-in-difference (DID) model, combining temporal and geographic variation in exposure to SB1070 to define a control population that would provide a counterfactual to Arizona. For privacy reasons, these birth records did not include precise information about day or week of birth, so it is not possible to calculate date of conception. Accordingly, we used a temporal dimension that distinguished the following periods based on date of birth: t_0 for January 2007 to June 2009; t_1 for July to December 2009; t_2 for January to June 2010; t_3 for July to December 2010; t_4 for January to June 2011; t_5 for July to December 2011; and t_6 for January to December 2012. The first 3 periods (t_0 – t_2) capture pre-treatment prenatal exposure, and the last 4 describe posttreatment exposure, assuming a standard gestational length of 39 weeks. We hypothesized that the law had its strongest effect during the interval between its passage in April 2010 and its injunction in July 2010 and that this would result in an effect on infants born between July and December 2010 (t_3).

Rather than arbitrarily selecting control states, we compared Arizona with a synthetic cohort of states that resemble

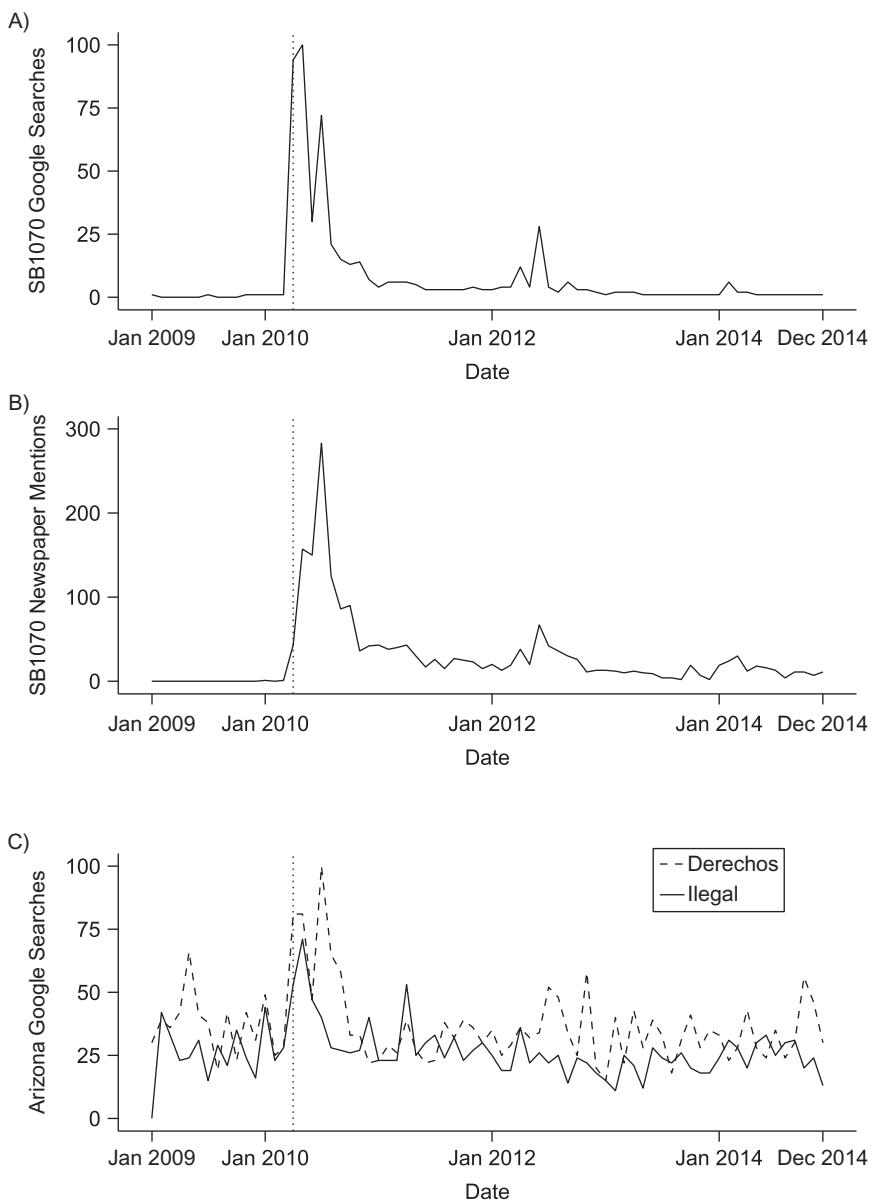


Figure 1. Monthly trends in awareness and concern about Senate Bill 1070 (SB1070) in Arizona, January 2009 to December 2014. A) Monthly trends in Google searches for "SB1070" in Arizona. B) References to "SB1070" in the main local newspapers. C) Google searches for the Spanish words "illegal" (illegal) and "derechos" (rights) in Arizona. Google search data obtained from Google Trends. Trends normalized by coding the highest frequency as 100. Newspaper-mention counts are from the 2 state newspapers with highest circulation, *The Arizona Republic* and *Arizona Daily Star*. The vertical line marks the signing into law of SB1070 in 2010.

Arizona in terms of pretreatment trends (39). The synthetic cohort was empirically obtained by assigning weights to a donor pool of states to minimize the difference between the treated and the control units. It is shaped as follows: California (0.522), Louisiana (0.168), New Mexico (0.177), and Texas (0.133). Web Appendix 1 and Web Table 1 provide details on the construction of the synthetic cohort.

The DID model captured the difference in mean birth weight between children of Latina immigrants in Arizona and children of Latina immigrants in the synthetic cohort of control states across periods of exposure. Because we considered 7 time

points between January 2007 and December 2012, we compared each period with the first period, between January 2007 and June 2009 (t_0). This model is expressed in regression form as follows:

$$Y_{ist} = \beta_0 + \beta_s x_s + \beta_t x_t + \beta_{st} x_{st}$$

where Y identifies the dependent variable, i indexes individual, s indexes state (1 = Arizona, 0 = synthetic cohort), t indexes time of birth (t_0 = January 2007 to December 2009, \dots , t_6 = January to December 2012), and the population was restricted

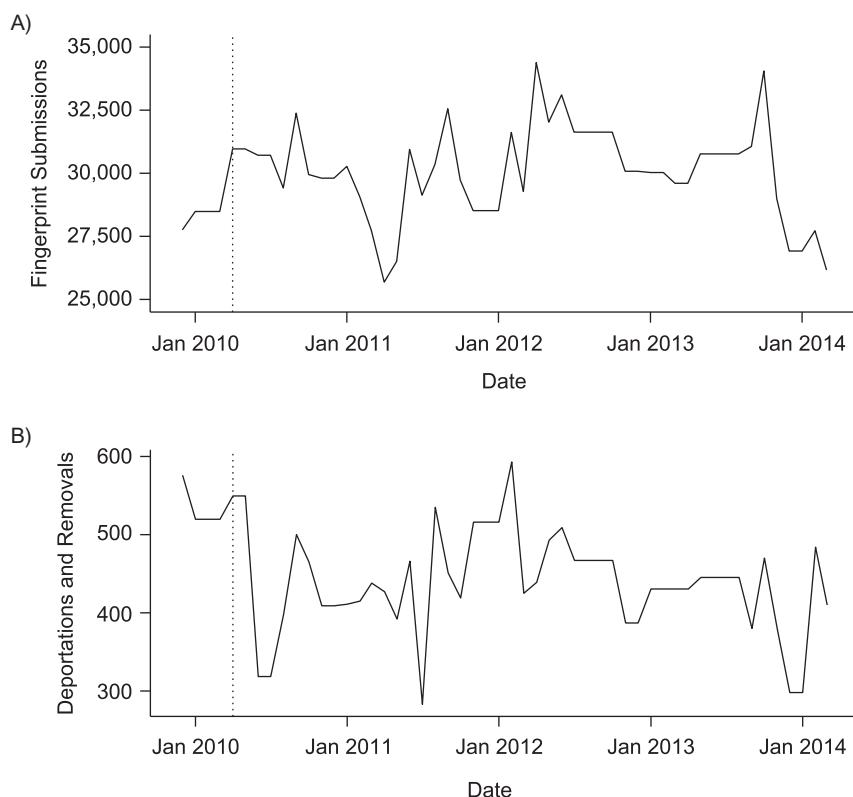


Figure 2. Monthly trends in fingerprint submissions and deportation via the Secure Communities program in Arizona, December 2009 to March 2014. Data obtained from the Department of Homeland Security (2014): A) fingerprint submissions; B) deportations. The vertical line marks the signing into law of SB1070 in April 2010.

to Latina immigrants. β_s is a fixed state effect capturing time-invariant differences in the outcome between treatment and control states (e.g., differences in population composition), and β_t is a set of fixed period effects capturing temporal and seasonal trends shared across states (e.g., the economic cycle). The estimates identifying the effect of exposure to SB1070 on birth outcomes are β_{st} , which capture changes in birth weight between the 2007 and 2009 pretreatment period and each subsequent period among Latina immigrant women in Arizona compared with Latina immigrants in control states. All models include county fixed effects and control for characteristics of the mother (age, education, marital status) and the birth (sex, parity, occurrence in state of residence). We fitted a similar model restricting the population to US-born Latinas to test the hypothesis of spillover effects onto this group. The dependent variables include birth weight (grams) and its 2 proximate determinants: gestational age (weeks) and intrauterine fetal growth (sex- and gestational age-specific weight percentile).

Falsification test

The main threat to unbiasedness of the DID estimator is the violation of the parallel-trend assumption—that counterfactual trends in birth weight would be the same in Arizona and the control states in the absence of the law. If Arizona had experienced a change coinciding with the passage of the bill, such as

an economic downturn or health-care reform, the DID estimates would be biased. To address this possibility, we used a falsification approach and examined the effect of SB1070 on US-born non-Hispanic white and black women, a group for whom no effect from the bill was expected.

RESULTS

Model 1 in Table 1 reports changes in mean birth weight for Latina immigrants across periods of exposure. The main finding is a significant decline in birth weight of 15 g ($P < 0.01$) for immigrants giving birth in the second half of 2010 (t_3), who were exposed to the passage of the law during gestation. No other significant effects for Latina immigrants were detected before or after the passage of the law. This finding suggests that the decline in birth weight resulted from exposure to SB1070 becoming law rather than from its (partial) implementation. Model 2 examined the effect of the bill for US-born Latinas. No adverse effects are detected for this group (and a significant increase in birth weight is found for infants born between July and December 2011). Nor are there negative effects of the bill for US-born black and white women, a “placebo” group for whom no effects were expected, and a small positive effect is detected for infants born between January and June of 2010 (model 3). Figure 3 compares the effect estimates obtained from Table 1 across different groups among

Table 1. Difference-in-Difference Estimates of the Impact of Senate Bill 1070 on Birth Weight for Latina Immigrant Mothers, US-Born Black and White Mothers, and US-Born Latina Mothers in Arizona, and on Gestational Age and Intrauterine Fetal Growth for Latina Immigrant Mothers in Arizona, 2007–2012^a

| Variable ^b | Model 1: Latina Immigrant | | Model 2: US-Born Latina | | Model 3: US-Born Black and White | | Latina Immigrant | | | |
|------------------------------------|--|--------------|--|---------------|--|----------------|--|----------------|--|--------------|
| | Birth Weight (n = 1,444,541 Observations), g | | Birth Weight (n = 1,504,561 Observations), g | | Birth Weight (n = 2,403,044 Observations), g | | Model 4: Gestational Age (n = 1,444,541 Observations), weeks | | Model 5: Intrauterine Growth (n = 1,444,541 Observations), Percentile ^c | |
| | Estimate | 95% CI | Estimate | 95% CI | Estimate | 95% CI | Estimate | 95% CI | Estimate | 95% CI |
| Time period | | | | | | | | | | |
| t_0 : January 2007 to June 2009 | 0 | Referent | 0 | Referent | 0 | Referent | 0 | Referent | 0 | Referent |
| t_1 : July 2009 to December 2009 | -14.2 ^d | -21.1, -7.3 | -4.7 | -11.4, 2.1 | -2.6 | -9.1, 3.8 | 0.008 | -0.016, 0.032 | -1.24 ^d | 0.86, 1.61 |
| t_2 : January 2010 to June 2010 | -5.4 ^e | -11.2, 0.4 | -1.9 | -10.86, 7.07 | -6.4 | -16.3, 3.5 | 0.010 | -0.012, 0.032 | -0.57 ^d | -0.89, -0.25 |
| t_3 : July 2010 to December 2010 | -6.9 ^f | -12.8, -1.0 | -7.6 ^f | -14.7, -0.5 | -2.5 | -4.6, 1.9 | 0.026 ^f | 0.004, 0.05 | -1.08 ^d | -1.46, -0.70 |
| t_4 : January 2011 to June 2011 | -8.3 ^f | -15.3, -1.4 | -3.7 | -9.4, 2.0 | 0.7 | -4.3, 5.7 | -0.006 | -0.033, 0.021 | -0.60 ^g | -1.00, -0.19 |
| t_5 : July 2011 to December 2011 | -8.0 ^e | -17.1, 1.1 | -12.6 ^d | -19.7, -5.5 | 3.2 | 7.0, 2.2 | 0.032 ^e | -0.01, 0.065 | -1.08 ^d | -1.54, -0.62 |
| t_6 : January to December 2012 | -8.7 ^f | -14.0, -3.4 | -5.3 ^e | -11.1, 0.5 | 7.3 ^f | 2.4, 12.3 | 0.028 ^f | 0.001, 0.055 | -0.95 ^d | -1.32, -0.59 |
| Treatment group × time period | | | | | | | | | | |
| Arizona × t_0 | 0 | Referent | 0 | Referent | 0 | Referent | 0 | Referent | 0 | Referent |
| Arizona × t_1 | -3.0 | -11.8, 5.8 | 1.3 | -15.4, 18.0 | -1.7 | -10.11, 6.8 | -0.007 | -0.037, 0.037 | -0.08 | -0.48, 0.32 |
| Arizona × t_2 | -8.1 ^e | -17.3, 1.2 | -3.4 | -16.5, 9.8 | 11.6 ^f | 0.8, 22.4 | -0.022 | -0.061, 0.021 | -0.29 | -0.80, 0.22 |
| Arizona × t_3 | -14.9 ^g | -25.6, -4.1 | 11.3 ^e | -0.6, 23.2 | -0.7 | -6.2, 4.7 | -0.019 | -0.051, 0.031 | -0.68 ^f | -1.28, -0.09 |
| Arizona × t_4 | 10.6 | -11.2, 12.4 | 5.2 | -4.7, 15.1 | 0.6 | -9.0, 10.2 | 0.011 | -0.02, 0.042 | 0.28 | -0.34, 0.90 |
| Arizona × t_5 | -1.3 | -14.8, 12.3 | 29.8 ^d | 21.3, 38.3 | 3.7 | -5.5, 13.1 | -0.045 ^e | -0.096, 0.006 | 0.51 | -0.25, 1.27 |
| Arizona × t_6 | 6.1 | -5.9, 18.0 | 10.8 ^f | 1.8, 19.7 | 9.7 ^e | -0.9, 20.4 | -0.021 | -0.065, 0.025 | 0.54 ^e | -0.07, 1.15 |
| Female sex | -95.4 ^d | -97.8, -93.0 | -95.9 ^d | -101.2, -90.4 | -117.6 ^d | -119.6, -114.4 | 0.145 ^d | 0.133, 0.157 | 0.40 ^d | 0.28, 0.51 |
| Educational level | | | | | | | | | | |
| Less than HS | 0 | Referent | 0 | Referent | 0 | Referent | 0 | Referent | 0 | Referent |
| Some HS | 10.7 ^d | 6.8, 14.6 | 1.4 | -16.1, 18.9 | 15.1 ^f | 0.9, 29.3 | -0.005 | -0.016, 0.016 | 0.64 ^d | 0.35, 0.92 |
| HS graduate | 4.6 | -2.8, 12.0 | 24.5 ^f | 3.1, 45.9 | 80.5 ^d | 65.7, 95.3 | -0.015 | -0.030, 0.010 | 0.39 ^e | -0.06, 0.84 |
| Some college | 11.8 ^g | 4.0, 19.6 | 35.4 ^g | 12.3, 58.6 | 115.5 ^d | 99.0, 131.9 | -0.007 | -0.033, 0.039 | 0.78 ^d | 0.34, 1.21 |
| College graduate | 12.9 ^f | 1.0, 24.8 | 64.0 ^d | 32.7, 95.2 | 161.3 ^d | 142.2, 180.2 | 0.074 ^d | 0.039, 0.109 | -0.21 | -0.99, 0.57 |
| Birth order | | | | | | | | | | |
| 1 | 0 | Referent | 0 | Referent | 0 | Referent | 0 | Referent | 0 | Referent |
| 2–3 | 75.8 ^d | 69.8, 81.9 | 55.0 ^d | 50.4, 59.5 | 46.3 ^d | 41.2, 51.4 | -0.162 ^d | -0.178, -0.142 | 5.63 ^d | 5.30, 5.96 |
| 4–5 | 98.4 ^d | 90.5, 106.3 | 52.2 ^d | 45.6, 58.8 | 27.6 ^d | 17.7, 37.5 | -0.229 ^d | -0.256, -0.202 | 7.59 ^d | 7.15, 8.03 |
| ≥6 | 100.3 ^d | 89.4, 111.2 | 27.0 ^d | 16.4, 37.7 | -3.3 | -10.8, 13.1 | -0.314 ^d | -0.349, -0.279 | 8.50 ^d | 8.00, 9.00 |

Table continues

Table 1. Continued

| Variable ^b | Model 1: Latina Immigrant | | | Model 2: US-Born Latina | | | Model 3: US-Born Black and White | | | Latina Immigrant | | |
|-----------------------------|--|--|--|--|----------------------|------------------|--|----------------|--------------------|------------------|----------|--------|
| | Birth Weight (<i>n</i> = 1,444,541 Observations), g | Birth Weight (<i>n</i> = 1,504,561 Observations), g | Birth Weight (<i>n</i> = 2,403,044 Observations), g | Model 4: Gestational Age (<i>n</i> = 1,444,541 Observations), weeks | | | Model 5: Intrauterine Growth (<i>n</i> = 1,444,541 Observations), weeks | | | | | |
| | Estimate | 95% CI | Estimate | 95% CI | Estimate | 95% CI | Estimate | 95% CI | Estimate | 95% CI | Estimate | 95% CI |
| Mother's age | 30.6 ^d | 27.7, 33.5 | 22.8 ^d | 19.6, 26.0 | 12.6 ^d | 10.3, 14.9 | 0.106 ^d | 0.090, 0.122 | 1.16 ^d | 1.00, 1.32 | | |
| Mother's age ² | -0.5 ^d | -0.5, -0.6 | -0.4 ^d | -0.4, -0.3 | -0.2 ^d | -0.3, -0.2 | -0.002 ^d | -0.002, -0.002 | -0.02 ^d | -0.02, -0.01 | | |
| Mother was married | 12.7 ^d | 9.0, 16.5 | 36.8 ^d | 28.7, 44.9 | 104.8 ^d | 96.8, 112.6 | 0.038 ^d | 0.014, 0.062 | 0.50 ^d | 0.31, 0.70 | | |
| Birth in state of residence | 283.8 ^d | 201.6, 266.0 | 201.4 ^d | 142.3, 260.5 | 137.7 ^f | 32.1, 243.3 | 1.111 ^d | 0.944, 1.278 | 5.80 ^d | 3.74, 7.86 | | |
| Constant | 2,627.0 ^d | 2,570.0, 2,684.0 | 2,726.1 ^d | 2,644.9, 2,807.1 | 2,846.6 ^d | 2,738.3, 2,953.7 | 36.523 ^d | 36.251, 36.789 | 21.34 ^d | 19.08, 23.60 | | |

Abbreviations: CI, confidence interval; HS, high school.

a Difference-in-difference models compare trends in Arizona with trends in a synthetic cohort of control states (see text for details). *P* values are for 2-tailed tests.

b Indicator for the treatment group (Arizona) dropped because of perfect collinearity with the county fixed effects.

c Sex- and gestational age-specific weight percentile.

d *P* < 0.001.e *P* < 0.10.f *P* < 0.05.g *P* < 0.01.

infants born in the second half of 2010 (t_3), who were in utero during the period between the bill's passage and partial implementation.

Proximate determinants of birth weight

Models 4 and 5 in Table 1 examined the effects of the bill on the 2 proximate determinants of birth weight, gestational age and fetal growth, among Latina immigrants. Evidence indicated a decline in both measures among infants born in the second half of 2010 (t_3), but the decline is significant only for fetal growth, and it reaches 0.7 percentage points.

The population-level impact of exposure to SB1070 is similar to the effect of exposure to other environmental stressors discussed in the literature. For example, a study found a decline in birth weight of approximately 8 g resulting from prenatal exposure to a land-mine explosion in the municipality of mother's residence (29). Early-pregnancy exposure to an earthquake resulted in a decline in birth weight of 50 g (30), and the effect of the death of one of the mother's parents during pregnancy was found to reach approximately 20 g (31). While these studies vary methodologically, the negative effect of exposure to SB1070 on birth weight is within the range defined by the studies capturing the effect of major environmental stressors.

Behavioral responses and population composition

Among Latina immigrants, behavioral responses to the threat posed by the law, such as outmigration or fertility postponement, could have altered the population of births exposed to the bill. For example, if highly educated immigrants had left Arizona to avoid exposure, the negative effect attributed to the bill could be an artifact of population sorting inducing negative selectivity.

To assess compositional change of the exposed population, we tested for changes in the birth rate of Latina immigrants in Arizona in the second half of 2010 (t_3) compared with Latina immigrants in control states using DID models (see Web Table 2 for reports of the full models). Figure 4A shows a significant decline of 2.72 births per thousand population. This decline is much larger than the one experienced by US-born black and white women, suggesting that Latina immigrants might have reduced their fertility, voluntarily or involuntarily, as the bill was being signed into law. Figure 4B–D (and Web Table 3) shows changes in sociodemographic characteristics of women that are known to be correlated with birth outcomes, including age, marital status, and education (40–43). Latina immigrants exposed to SB1070 during pregnancy were less likely to be teens ($P < 0.001$) and less likely to be single ($P < 0.001$). The decline in the proportion of immigrants with low education is not significantly different from zero ($P = 0.80$). However, for all 3 sociodemographic markers, these declines are much larger than those experienced by US-born black and white women.

Attributing trends in population composition solely to the passage of SB1070 would be inaccurate. The changes preceded the law's passage and persisted afterward (Web Tables 2 and 3), likely driven by the impact of the Great Recession (starting in 2008) and by prior immigration enforcement regulation in Arizona (44, 45). Regardless of their causes, this analysis indicates

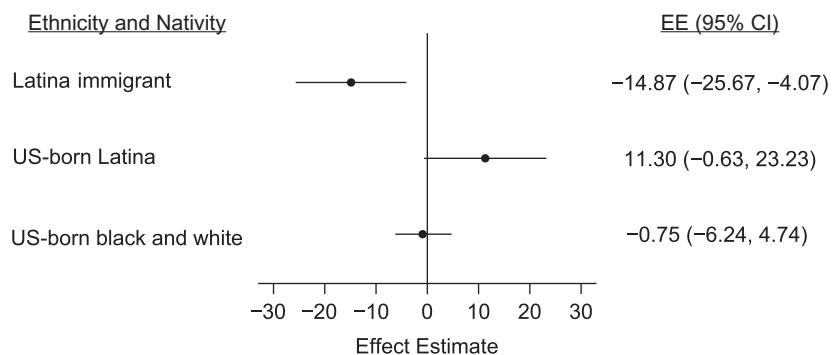


Figure 3. Comparison of effect estimates (EEs) associated with exposure to the signing of SB1070 into law in the first half of pregnancy for different groups of women defined by ethnicity and nativity, Arizona, December 2009 to March 2014. Confidence intervals (CIs) based on tests for the null hypothesis that the parameter estimate is different from zero at the 0.05 confidence level.

a reduction in fertility in a positively selected group of Latina immigrants exposed to SB1070 during pregnancy.

DISCUSSION

Existing literature suggests that the passage of a restrictive immigration bill in Arizona had a negative effect on health-care utilization, psychological well-being, and self-rated health among Latino immigrants (34–38). Here we examined a less visible but still relevant outcome: the effect of restrictive immigration law on infants exposed before birth. We found that exposure to the bill's passage had a negative effect on birth weight among Latina immigrant women, which was driven largely by a decline in intrauterine fetal growth. Web Appendix 1 offers a battery of robustness checks and shows that the findings are robust to alternative specifications and significance calculations (Web Tables 4–7). This effect was not observed among US-born Latinas or US-born black and white women, and its magnitude is comparable to the effect of major environmental stressors documented by the literature. This finding should be interpreted in the context of the birth outcomes of Latina immigrants, which compare favorably to those of US-born white women despite immigrants' lower levels of education, income, and health insurance (46–48). Even if the decline in birth weight resulting from exposure to SB1070 has limited clinical impact at the individual level, its consequences at the aggregate level erode part of the health advantages of an already vulnerable population.

We also detected a decline in fertility and a reduction in the proportion of teen, low-education, and single mothers among Latina immigrants exposed to the immigration bill. These changes suggest that more disadvantaged Latina immigrants might have reduced their fertility in the face of the bill. Even if these sociodemographic factors are controlled for in our models, if they are correlated with unobserved sources of maternal selectivity, they could result in an underestimate of the true effect of the law's passage on birth weight that would have been observed had the composition of the group (Latina immigrants giving birth) not changed.

An important question that we cannot address with the available data is the mechanism(s) accounting for the negative effect

of restrictive immigration law on birth weight. The literature suggests several pathways through which prenatal exposure to environmental stressors can affect birth outcomes. These include the mother's physiological, neuroendocrine, and immune stress responses, which could affect the developing fetus, and the mother's behavioral responses to anxiety, such as reducing prenatal care use or consuming alcohol or cigarettes (49–51). The fact that the effect of exposure to the bill's passage was discrete and short-term is consistent with an acute stress response among immigrant mothers. A plausible mechanism for the observed effect on intrauterine growth is a stress-induced increase in levels of placental corticotropin-releasing hormone, resulting in decreased uteroplacental flow and hypoxemia restriction, which are well-known risk factors for fetal growth restriction (52). Our ancillary analysis of prenatal care utilization and smoking as potential behavioral mechanisms (Web Tables 8 and 9) suggests that these behavioral pathways did not play a significant role in this setting. There are, however, several other plausible pathways—such as economic hardship, change in diet, and decline in the quality of health care—that call for further investigation (14).

We found no evidence that the effect of the bill on birth weight extended to US-born Latinas, departing from other research reporting a negative impact of restrictive immigration policy on this population (22). We can only speculate about the sources of divergence. It is possible that the absence of a spillover effect in this case resulted from contextual factors. In the context of a large and established Latino population in Arizona, the differences between immigrant and US-born Latinos in terms of economic standing, language, and demeanor might be more pronounced and visible than in contexts with a smaller and more homogeneous Latino population. Alternatively, it has been established that Latino immigrants lose their health advantage in birth outcomes across generations, plausibly because subsequent generations are more exposed to and more aware of racialized exclusion than recent immigrants (53). As a result, a novel shock such as a restrictive immigration law might be less consequential for a population already accustomed to racialized exclusion.

It is important to note that the effect captured in this analysis is an "intent to treat" outcome measured among all Latina immigrant women exposed to the bill, regardless of immigration status and

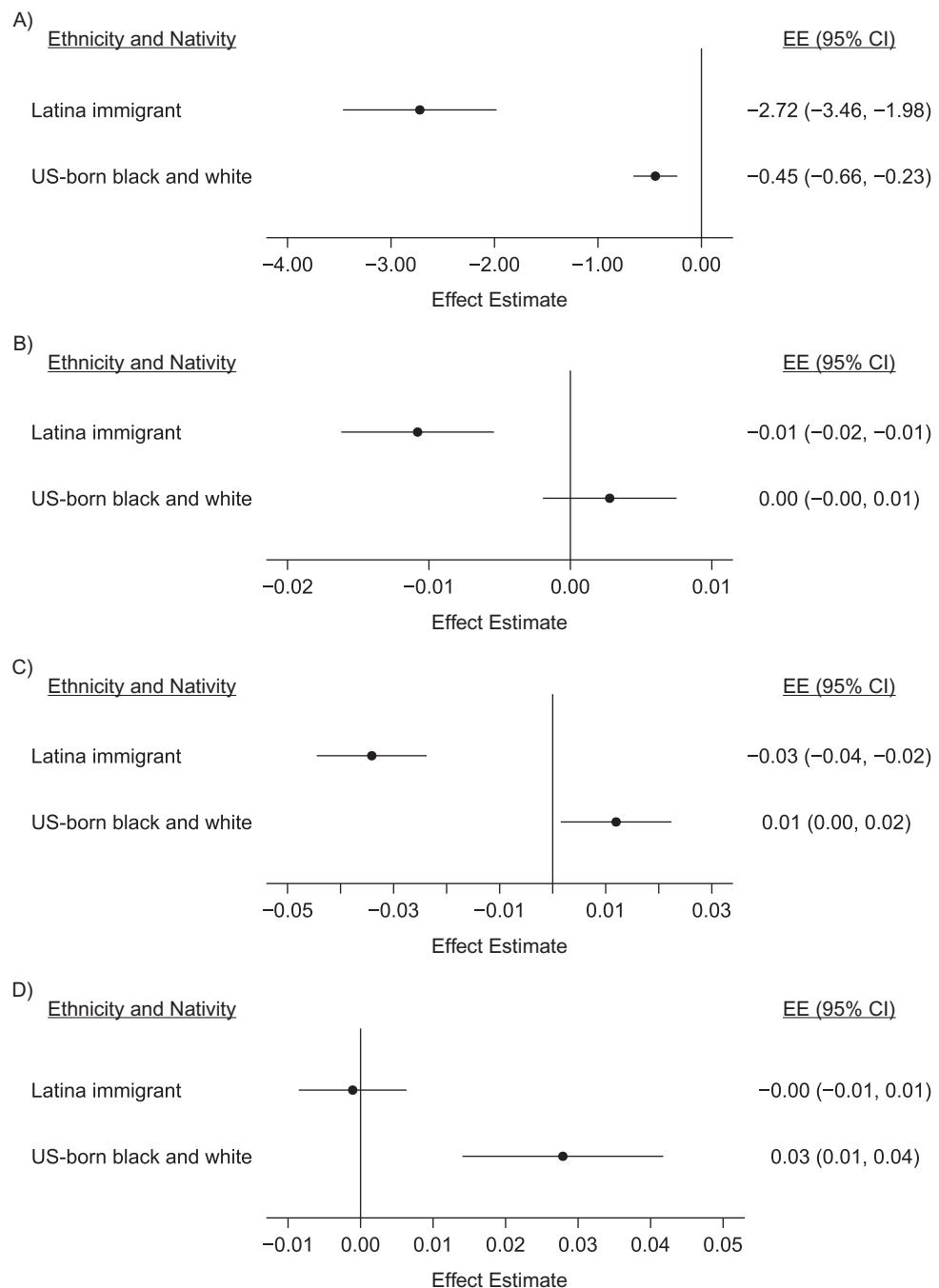


Figure 4. Indicators of change in the composition of births occurring in the second half of the year for different groups of women defined by ethnicity and nativity, Arizona, 2010. Measures are: A) births per thousand population; B) proportion of mothers aged 19 years or younger; C) proportion of mothers who were single; and D) proportion of mothers with a high-school diploma or less. CI, confidence interval; EE, effect estimate.

socioeconomic advantage. It is likely, however, that the effect varied within the population. For those interested in overall population well-being, the intent-to-treat effect is a central result. If the focus is on mitigation and compensation policies, identifying the women most affected is critical. Ancillary analysis offered in Web Table 10 examines heterogeneity in SB1070's effect among Latina immigrants based on mother's educational

attainment, distinguishing immigrants with an educational level of high-school diploma or less from those with some college or more. Prenatal exposure to the bill's passage resulted in a decline in birth weight of 12 g ($P = 0.04$) among immigrants with low education and 29 g ($P = 0.05$) among immigrants with higher levels of education (while these estimates differ in magnitude, they are statistically indistinguishable ($P = 0.29$)). The

negative effect among highly educated immigrants, most of whom are authorized, suggests that the detrimental effect of restrictive immigration law might have extended to documented immigrants.

We found that the effect on infant health resulted only from exposure to the signing of the bill into law rather than from its (partial) implementation. This suggests that it is not necessary for a proposed institutional change to become the law of the land to have harmful consequences. This finding is noteworthy given the recent proliferation of restrictive immigration enforcement initiatives at the state and, more recently, federal level. Even though most of these proposals have been blocked by the legislative or judicial systems and have not been implemented, our findings indicate that the threat might be sufficient to alter birth outcomes among vulnerable populations. While the Arizona bill did not increase deportations, nor does it appear to have achieved a substantial reduction in the unauthorized population (54, 55), it affected the birth outcomes of infants born to Latina immigrants who were exposed during pregnancy. The infants affected will most likely become the next generation of students, workers, and taxpayers. To the extent that birth weight predicts later health, development, and achievement, these infants could be scarred by an institutional shock experienced before birth.

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REFERENCES

1. Warren R. US undocumented population drops below 11 million in 2014, with continued declines in the Mexican undocumented population. *J Migr Hum Secur.* 2016;4(1):1–15.
2. Passell J, Cohn D. Overall Number of Unauthorized Immigrants Holds Steady since 2009. *Pew Res. Center, Sept.* 2016; <http://www.pewhispanic.org/2016/09/20/overall-number-of-u-s-unauthorized-immigrants-holds-steady-since-2009/>. Accessed February 9, 2017.
3. Lueders H, Hainmueller J, Lawrence D. Providing driver's licenses to unauthorized immigrants in California improves traffic safety. *Proc Natl Acad Sci U S A.* 2017;114(16):4111–4116.
4. Karoly LA, Perez-Arce F. A Cost-Benefit Framework for Analyzing the Economic and Fiscal Impacts of State-Level Immigration Policies. Santa Monica, CA: 2016. https://www.rand.org/pubs/research_reports/RR1397.html. Accessed January 13, 2017.
5. Waters M, Pineau M. *The Integration of Immigrants into American Society.* Washington, DC: National Academies Press; 2015. <http://www.nap.edu/catalog/21746>. Accessed May 24, 2018.
6. Bohn S, Pugatch T. US border enforcement and Mexican immigrant location choice. *Demography.* 2015;52(5):1543–1570.
7. Leerkes A, Leach M, Bachmeier J. Borders behind the border: an exploration of state-level differences in migration control and their effects on US migration patterns. *J Ethn Migr Stud.* 2012;38(1):111–129.
8. Watson T. Enforcement and Immigrant Location Choice. *NBER Work. Pap.* 19626. 2013; <http://www.nber.org/papers/w19626.pdf>. Accessed April 8, 2017.
9. Amuedo-Dorantes C, Bansak C. The labor market impact of mandated employment verification systems. *Am Econ Rev.* 2012;102(3):543–548.
10. Lofstrom M, Bohn S, Raphael S. Lessons from the 2007 Legal Arizona Workers Act. *Work. Pap. Public Policy Inst. Calif.* 2011; http://www.ppic.org/content/pubs/report/R_311MLR.pdf. Accessed April 30, 2017.
11. Rhodes SD, Mann L, Simán FM, et al. The impact of local immigration enforcement policies on the health of immigrant Hispanics/latinos in the United States. *Am J Public Health.* 2015;105(2):329–337.
12. White K, Yeager VA, Menachemi N, et al. Impact of Alabama's immigration law on access to health care among Latina immigrants and children: implications for national reform. *Am J Public Health.* 2014;104(3):397–405.
13. Martinez O, Wu E, Sandfort T, et al. Evaluating the impact of immigration policies on health status among undocumented immigrants: a systematic review. *J Immigr Minor Health.* 2015;17(3):947–970.
14. Philbin MM, Flake M, Hatzenbuehler ML, et al. State-level immigration and immigrant-focused policies as drivers of Latino health disparities in the United States. *Soc Sci Med.* 2018;199:29–38.
15. Enriquez LE. Multigenerational punishment: shared experiences of undocumented immigration status within mixed-status families. *J Marriage Fam.* 2015;77(4):939–953.
16. Santos C, Menjivar C, Godfrey E. Effects of SB 1070 on children. In: Magaña L, Lee E, eds. *Latino Policies and Arizona's Immigration Law SB 1070.* New York, NY: Springer; 2013:79–92.
17. Fix M, Zimmerman W. All under one roof: mixed-status families in an era of reform. *Int Migr Rev.* 2001;35(2):397–419.
18. Asad AL, Clair M. Racialized legal status as a social determinant of health. *Soc Sci Med.* 2018;199:19–28.
19. Brown HE. Race, legality, and the social policy consequences of anti-immigration mobilization. *Am Sociol Rev.* 2013;78(2):290–314.

20. Jiménez TR. *Replenished Ethnicity: Mexican Americans, Immigration, and Identity*. Berkeley, CA: University of California Press; 2010.

21. Viruell-Fuentes EA, Miranda PY, Abdulrahim S. More than culture: structural racism, intersectionality theory, and immigrant health. *Soc Sci Med*. 2012;75(12):2099–2106.

22. Novak NL, Geronimus AT, Martinez-Cardoso AM. Change in birth outcomes among infants born to Latina mothers after a major immigration raid. *Int J Epidemiol*. 2017;46(3):839–849.

23. Almond D, Currie J. Killing me softly: the fetal origins hypothesis. *J Econ Perspect*. 2011;25(3):153–172.

24. Conley D, Strully KW, Bennett NG. *The Starting Gate: Birth Weight and Life Chances*. Berkeley, CA: University of California Press; 2003.

25. Senate Bill 1070. Support Our Law Enforcement and Safe Neighborhoods Act. 49th Legislature Arizona; 2010. <https://www.azleg.gov/legtext/49leg/2r/bills/sb1070s.pdf>. Accessed January 13, 2017.

26. Magaña L. Arizona's immigration policies and SB 1070. In: Magaña L, Lee E, eds. *Latino Politics and Arizona's Immigration Law SB 1070*. New York: Springer; 2013:19–26.

27. National Conference of State Legislatures. State Omnibus Immigration Legislation and Legal Challenges. 2012; <http://www.ncsl.org/research/immigration/omnibus-immigration-legislation.aspx>. Accessed August 10, 2017.

28. Blitzer J. Trump's ideas man for hard-line immigration policy. *New Yorker* [electronic article]. 2016; www.newyorker.com/news/news-desk/trumps-ideas-man-for-hard-line-immigration-policy. Accessed May 25, 2018.

29. Camacho A. Stress and birth weight: evidence from terrorist attacks. *Am Econ Rev*. 2008;98(2):511–515.

30. Torche F. The effect of maternal stress on birth outcomes: exploiting a natural experiment. *Demography*. 2011;48(4):1473–1491.

31. Black SE, Devereux PJ, Salvanes KG. Does grief transfer across generations? Bereavements during pregnancy and child outcomes. *Am Econ J Appl Econ*. 2016;8(1):193–223.

32. Dinan S. A year later, Ariz. Immigration fights rage. *Washington Times*. April 21, 2011.

33. Trevizo P, Brosseau C. Lax record-keeping blurs SB1070 impact. *Arizona Daily Star*. March 2, 2014.

34. Anderson KF, Finch JK. Racially charged legislation and Latino health disparities: the case of Arizona's S.B. 1070. *Sociol Spectr*. 2014;34(6):526–548.

35. Ayón C, Becerra D. Mexican immigrant families under siege: the impact of anti-immigrant policies, discrimination, and the economic crisis. *Adv Soc Work*. 2013;14(1):206–228.

36. Hardy LJ, Getrich CM, Quezada JC, et al. A call for further research on the impact of state-level immigration policies on public health. *Am J Public Health*. 2012;102(7):1250–1254.

37. Szkupinski Quiroga S, Medina DM, Glick J. In the belly of the beast: effects of anti-immigration policy on Latino community members. *Am Behav Sci*. 2014;58(13):1723–1742.

38. Toomey RB, Umaña-Taylor AJ, Williams DR, et al. Impact of Arizona's SB 1070 immigration law on utilization of health care and public assistance among Mexican-origin adolescent mothers and their mother figures. *Am J Public Health*. 2014;104(suppl 1):S28–S34.

39. Abadie A, Diamond A, Hainmueller J. Synthetic control methods for comparative case studies: estimating the effect of California's tobacco control program. *J Am Stat Assoc*. 2010;105(490):493–505.

40. Buckles KS, Price J. Selection and the marriage premium for infant health. *Demography*. 2013;50(4):1315–1339.

41. Roth J, Hendrickson J, Schilling M, et al. The risk of teen mothers having low birth weight babies: implications of recent medical research for school health personnel. *J Sch Health*. 1998;68(7):271–275.

42. McCrary J, Royer H. The effect of female education on fertility and infant health: evidence from school entry policies using exact date of birth. *Am Econ Rev*. 2011;101(1):158–195.

43. Wu L, Wolfe B. *Out of Wedlock: Causes and Consequences of Nonmarital Fertility*. New York, NY: Russell Sage; 2001.

44. Bohn S, Lofstrom M, Raphael S. Did the 2007 legal Arizona workers act reduce the state's unauthorized immigrant population? *Rev Econ Stat*. 2014;96(2):258–269.

45. Thiede BC, Monnat SM. The great recession and America's geography of unemployment. *Demogr Res*. 2016;35:891–928.

46. Singh GK, Yu SM. Adverse pregnancy outcomes: differences between US- and foreign-born women in major US racial and ethnic groups. *Am J Public Health*. 1996;86(6):837–843.

47. Acevedo-Garcia D, Soobader MJ, Berkman LF. Low birthweight among US Hispanic/Latino subgroups: the effect of maternal foreign-born status and education. *Soc Sci Med*. 2007;65(12):2503–2516.

48. Hummer RA, Powers DA, Pullum SG, et al. Paradox found (again): Infant mortality among the Mexican-origin population in the United states. *Demography*. 2007;44(3):441–457.

49. Dunkel Schetter C. Psychological science on pregnancy: stress processes, biopsychosocial models, and emerging issues. *Annu Rev Psychol*. 2011;62:531–558.

50. Beijers R, Buitelaar JK, de Weerth C. Mechanisms underlying the effects of prenatal psychosocial stress on child outcomes: beyond the HPA axis. *Eur Child Adolesc Psychiatry*. 2014;23(10):943–956.

51. Hobel CJ, Goldstein A, Barrett ES. Psychosocial stress and pregnancy outcome. *Clin Obstet Gynecol*. 2008;51(2):333–348.

52. Wadhwa PD, Garite TJ, Porto M, et al. Placental corticotropin-releasing hormone (CRH), spontaneous preterm birth, and fetal growth restriction: a prospective investigation. *Am J Obstet Gynecol*. 2004;189(4):1063–1069.

53. Viruell-Fuentes EA. Beyond acculturation: immigration, discrimination, and health research among Mexicans in the United States. *Soc Sci Med*. 2007;65(7):1524–1535.

54. Amuedo-Dorantes C, Lozano F. On the effectiveness of SB1070 in Arizona. *Econ Inq*. 2015;53(1):335–351.

55. Hoekstra M, Orozco-Aleman S. Illegal immigration, state law, and deterrence. *Am Econ J Econ Policy*. 2017;9(2):228–252.