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County-level racial prejudice and the black-white gap in infant health outcomes

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A B S T R A C T

Objective: Black mothers are 60 percent more likely than white mothers to have preterm births and twice as likely to have a baby with low birth weight. We examine whether these black-white gaps in birth outcomes are larger in counties with higher levels of racial prejudice.
Method: We use data from the restricted-use natality files in the United States, which provide information on birth weight, gestation, and maternal characteristics for over 31 million births from 2002 to 2012, combined with county-level data measures of both explicit and implicit racial prejudice from Project Implicit from over a million individuals who took the Implicit Association Test during this same period. We compare counties that are one standard deviation above the mean (high prejudice) with those that are one standard deviation below the mean (low prejudice) in terms of their average level of racial prejudice.
Results: The black-white gap in low birth weight is 14 percent larger in counties with high implicit racial prejudice compared to counties with low prejudice. The black-white gap in preterm births is 29 percent larger in the high prejudice counties. The gaps are even larger when we use explicit measures of racial prejudice with high prejudice counties having a black-white gap that is 22 percent larger for low birth weight and 36 percent larger for preterm births. These relationships do not appear to be biased by the way the prejudice sample is constructed, since the racial gap in birth outcomes is unrelated to other county-level biases such as those based on gender or sexual orientation.
Conclusion: The black-white gap in United States' birth outcomes is larger in those counties that have the highest levels of racial prejudice. This is true for both implicit and explicit racial prejudice, though the strength of the relationship is strongest for explicit racial prejudice.

Black mothers in the US are more likely than white mothers to experience a low birth weight delivery or preterm birth and similar black-white gaps exist for other health outcomes (Institute of Medicine, 2002). Disparities in infant outcomes are particularly worrisome since these early life gaps are also associated with a greater risk of major diseases later in life (Barker, 1995) and contribute to broader forms of inequality including educational attainment (Chay et al., 2009). Some of the causes of this racial gap in birth outcomes include differences in maternal education, adherence to medical recommendations, and exposure to environmental pollutants (Currie, 2011; Simeonova, 2013; Rich-Edwards et al., 2001).

Recent evidence indicates that another important cause of this racial gap in birth outcomes is racial prejudice. Racial prejudice can influence a mother's access to quality health care and can also act as a psychological stressor in the mother's life, which can negatively impact the health of the baby (Rich-Edwards et al., 2001; Mustillo et al., 2004; Collins et al., 2000; Dole et al., 2003; Earnshaw et al., 2013). This role of racial prejudice as a psychological stressor suggests that community-level measures of racial prejudice may play an important role in determining the sources of black-white health disparities (Krieger and Sidney, 1996; Bell, 2010).

The analysis in this article examines whether the black-white gap in adverse birth outcomes is larger in those counties with higher levels of racial prejudice. Our analysis combines information from two very large datasets. First, we construct county-level measures of racial prejudice using data on over 1.8 million individuals in the US who took the race-based Implicit Association Test from 2002 to 2012 on the Project Implicit website and

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answered questions about their explicit racial prejudice. Second, we use data from the 2002–2012 US Natality Files, which include birth outcomes (birth weight and gestation) for nearly every birth during that period, providing a total sample of over 31 million births. Birth outcomes provide a unique opportunity to observe individual-level data for almost the entire relevant population for an important health outcome.

We expand this analysis in three ways. First, since we observe measures of both explicit and implicit racial prejudice, we examine what type of racial prejudice is a stronger predictor of the black-white differences in birth outcomes. Second, we use data on other forms of prejudice (gender-career bias and sexual orientation bias) as a falsification test to see if they also predict race-based gaps in birth outcomes; other forms of prejudice should not be correlated with racial gaps in birth outcomes. Third, we analyze the subset of mothers in our sample who give birth in a county other than the county where they live. We use this sample to examine whether the racial prejudice in the county of birth or the county of residence is a stronger predictor of the black-white gap in birth outcomes. Combined, these analyses examine the degree to which county-level variation in racial prejudice is correlated with black-white gaps in birth outcomes.

1. Background

In 2002, the Institute of Medicine issued a report entitled “Unequal Treatment” based on a meta-analysis of over 100 articles and concluded that there were widespread differences in health-care given to members of different racial and ethnic groups, even when controlling for factors such as socioeconomic status. Racial gaps in infant health are especially critical since adverse birth outcomes place individuals at greater risk for other negative health conditions later in life (Barker, 1995), and individuals with better birth outcomes give birth to healthier offspring when they themselves are mothers (Royer, 2009). In addition, efforts to close the black-white gap in birth outcomes can help close educational gaps for those children (Chay et al., 2009).

Prejudice is one of the factors speculated to contribute to the black-white gap in adverse birth outcomes. Leitner et al. (2016a) note other causal pathways through which prejudice can influence health outcomes including discrimination on the part of the health care system and workers (structural), hostile interactions (interpersonal), maladaptive coping strategies (behavioral), and psychological stress (emotional). The role of psychological stress is particularly problematic for adverse birth outcomes, like preterm delivery, by increasing the levels of placental corticotrophin releasing hormones (Rich-Edwards et al., 2001). Several studies confirm that mothers who report greater amounts of racial discrimination in the various aspects of their life are more likely to experience a preterm or low birth-weight delivery (Mustillo et al., 2004; Dole et al., 2003; Collins et al., 2000).

Because mothers can experience prejudice in various aspects of their life, minority women who live in communities with higher levels of racial prejudice will face a higher risk of the psychological stress that can accompany prejudice. Beyond the individual level, community-level prejudice may also influence the level of social capital including trust and bonding between community members, which can also influence health outcomes (Hall et al., 2015; Leitner et al., 2016a). The main challenge with constructing community-level measures of racial prejudice is having a dataset that includes a large enough sample and is sufficiently geographically dispersed to exploit the large variation in racial prejudice that exists across counties in the United States. Project Implicit provides the best dataset available with measures of both implicit and explicit racial bias (Xu et al., 2014) and has been used in a few recent studies to examine the relationship between county-level racial prejudice and death rates (e.g., Leitner et al., 2016a, 2016b).

The database from Project Implicit provides a measure of explicit prejudice based on a survey question and an implicit measure of racial bias based on the Implicit Association Test (IAT). The IAT is a potentially important tool for measuring prejudice, as it reduces the potential bias in self-reported measures of racial prejudice that stem from lack of awareness or social desirability bias (Greenwald et al., 1998), though it may not entirely remove the effect of social desirability influences (Conrey et al., 2005). Explicit and implicit measures of racial prejudice are strongly correlated in our dataset (with a correlation of 0.86), though research suggests that they are in fact separate constructs (Hofmann et al., 2005).

The individual strength of implicit and explicit bias may depend on the focus of the study. In studies on race, explicit bias seems to be a stronger predictor, however when explicit bias is relatively absent, such as in Greenwald et al.'s (2009) study related to gender, implicit prejudice still holds predictive power; this team found that women perform worse in math and science classes if they hold stronger implicit biases that women are not naturally good at math, even though relatively few people explicitly support gender-science stereotypes. However, Leitner et al. (2016a) found that explicit community attitudes toward blacks are more influential for circulatory-disease-related deaths than implicit attitudes.

The aim of this study is to examine the relationship between county-level measures of racial prejudice and adverse birth outcomes for black mothers. Based on these previous studies, we hypothesize that adverse birth outcomes for black mothers will occur at a higher rate in counties with higher levels of racial prejudice, with a larger black-white gap in adverse birth outcomes in the high prejudice counties. We also hypothesize that explicit forms of racial prejudice at the county level will be more strongly related to adverse birth outcomes than implicit measures of prejudice.

2. Method

2.1. Vital Statistics Natality Birth Data (2002–2012)

We use data on infant health outcomes from the restricted-use Vital Statistics Natality Birth Data (2002–2012), which include birth weight, gestation, and maternal characteristics for over 30 million births during this period. We use the restricted-use version of this database, which provides information on the county where the birth occurs and the county where the mother lives. The two measures of adverse birth outcomes that we use in our analysis are preterm birth (birth before 37 weeks of gestation) and low birth weight (infants weighing less than 2500 g). Both measures are associated with a variety of later health complications (Barker, 1995; Oreopoulos et al., 2008) and are two of the most widely used measures of adverse birth outcomes.

The data also include characteristics of the mother, such as her age, education, marital status, and whether she has one of the 17 different pregnancy risk factors (e.g., high blood pressure, previous preterm birth, etc.). We use these measures as controls in our analysis, and summary statistics for each of these maternal characteristics are included in Table 1 separately by the mother's race. We restrict our sample to singleton births of black or white mothers for which we have complete data on our full set of controls. This provides a final sample of about 31.5 million births from 2002 to 2012.

2.2. Implicit Association Test, Project Implicit website (2002–2012)

We also use data from the 1.8 million adult respondents in the US who took the race-based Implicit Association Test (IAT) between

Table 1
Summary statistics.

Variable	White	Black
Birth Outcomes (per 1000 births)		
Preterm births	95.95	153.74
	(294.53)	(360.70)
Low Birth Weight (<2500 g)	53.89	112.75
	(225.80)	(316.30)
Maternal Characteristics		
Mother's Age	27.78	25.84
	(6.04)	(6.22)
Mother Finished High School	0.59	0.61
	(0.49)	(0.48)
Mother Finished College	0.16	0.08
	(0.37)	(0.27)
Married	0.66	0.29
	(0.48)	(0.46)
Pregnancy Risk Factors	0.11	0.14
	(0.32)	(0.34)
N	26,123,529	5,340,922

Note. Standard deviations appear in parentheses. The sample includes singleton births to black or white mothers in the United States from 2002 to 2012. Pregnancy risk factors are defined by the National Center for Health Statistics as one of 17 different conditions (such as high blood pressure, previous preterm birth, etc.) that are related to adverse birth outcomes.

2002 and 2013 on the Project Implicit website. The IAT asks participants to match positive and negative words, as well as pictures of African Americans and European Americans into categories in two different sorting conditions. In one condition, respondents match positive words (e.g., laughter, joy) and pictures of European Americans using one response key, and negative words (e.g., hurt, nasty) and pictures of African Americans using another response key. In the other condition, the pairing is reversed (i.e., positive words with pictures of African Americans and negative words with European Americans). The order of the conditions is randomly assigned. The test measures the latency between the respondent assigning a certain face to a category and then a positive or negative word to that same category. Those with more prejudiced tendencies towards African Americans will be slower to assign a positive word to the same (Greenwald et al., 1998). We use the scoring algorithm developed by Greenwald et al. (2003), which provides scores that range between −2 (extreme preference for African-Americans) and 2 (extreme preference for European-Americans).

A measure of explicit racial prejudice was collected either before or after the IAT test was administered (the order was random). It asked respondents to describe how they felt toward European and African Americans using a scale that ranged from “I strongly prefer African Americans to European Americans”, to “I strongly prefer European Americans to African Americans.” Until 2006, a five-point scale was used. Afterwards, a seven-point scale was used. Both scores were normalized to be between −2 and 2. The county-level measures of explicit and implicit prejudice were highly correlated ($r = 0.86$).

The average age of these respondents was 28, and 59 percent were women. To make our measures of prejudice more representative of the population, we weighted our measures of prejudice using the same procedure as Lohr (2010). We grouped scores for each county together into four subgroups based on gender and age (18–35 or over 35). We combined these counts with population statistics from the 2013 five-year sample of the American Community Survey (ACS) to assign each respondent a weight based on their representativeness of the county population and used it to create a weighted average prejudice score for each county that is representative of the adult population of the county. We dropped counties with fewer than 20 implicit and explicit prejudice questionnaire respondents from our analysis—765 counties were dropped out of 3144 total. We also performed a set of robustness checks with other weighting methods (including no weights) and our results were similar across methods.

To provide a falsification test, we also constructed similar county-level measures for gender-career bias and sexual orientation bias. These measures were also constructed using data from Project Implicit. The datasets for gender-career bias and sexual orientation bias were significantly smaller than the dataset for racial prejudice (396 thousand and 1.08 million observations, respectively), which resulted in an additional 1099 counties dropped from our analysis. Altogether, 1280 of 3144 counties had more than 20 respondents to all three IAT tests (racial, gender-career, and sexual orientation). A similar analysis, dropping only counties without sufficient racial bias data, yielded similar results to those presented here.

Of the approximately 40.6 million singleton births to black and white mothers from 2002 to 2012, lost are approximately 5 million observations for births that occur in the 1864 counties without sufficient IAT data. Our final sample lost another 4 million observations, because the birth records lacked some of the information used as controls. Remaining was a final sample of about 31.5 million observations. Our results are robust to alternative specifications with differing trade-offs between sample size and the controls we include.

2.3. Analyses

Our empirical strategy identifies the relationship between county-level racial prejudice and the black-white infant gap in adverse birth outcomes. We regress our infant health outcomes on the interaction between the mother being black and the county-level prejudice measure and include the main effects for each of these measures. The coefficient on the interaction term indicates the relationship between county-level prejudice and the black-white gap in adverse birth outcomes. We use weighted least squares and cluster the standard errors at the county level (since our measures of racial prejudice vary only at the county level). Our results are similar if we use a logistic regression and estimate the average marginal effects of each of the covariates. The analyses in this article were estimated using STATA MP version 14.

We include additional covariates to reduce the possibility of county-level prejudice being correlated with other individual and county characteristics. As county-level controls, we include the unemployment rate, the fraction of the population that are college graduates, the total population, the fraction of the population that is black, and the black poverty rate. We also include an interaction between these last two measures and the race of the mother. As individual-level controls, we include the mother's age, marital status, medical risk factors, and education. We also control for the gender and birth order of the child and include state and year fixed effects. We conduct our analysis first with implicit and then explicit racial prejudice separately and then combine them in the same empirical specification.

One concern about using the Project Implicit data is that the self-selection of IAT respondents may create a potential threat to the validity of our inference. Similar to Nosek et al.'s (2009) approach, we construct falsification test, in which we use data from the sexual orientation and gender-career IAT tests on the Project Implicit website. These tests were available on the Project Implicit website in the same format and available around the same time as the race-based IAT test. We conduct our falsification tests by including these biases in our analysis and test whether they help to explain variation in the racial gaps in infant health. This test ensures that our results are driven by patterns in racial prejudice rather than some mechanical bias created by the way the IAT data is gathered.

For about 20 percent of the births in our sample, the mother gave birth in a county different from the county where she lived. In these cases, the county where the birth occurred has a population that is 3.5 times larger, on average, than the county where the mother lived, which suggests that mothers travel to access larger health care markets. For this set of mothers, we estimate a model that includes the racial prejudice of the county of residence and the county of birth in the regression (both in separate regressions and then together in a combined regression). One challenge with interpreting these results is that our dataset does not include information on whether the mother receives prenatal care in the county where the birth occurs or in the county where she lives. We present these results as an interesting area of future research.

3. Results

Table 1 provides summary statistics of our sample separately by race with 26 million births to white mothers and 5 million births to black mothers. The incident rates in Table 1 for the preterm and low birth weight births are reported per 1000 births, and we use a similar measure in our regressions. We find that black mothers are 60.2 percent more likely to have a preterm birth (153.7 vs 96.0) and more than twice as likely to have a low birth weight baby (112.8 vs 53.9). We also find that, on average, black mothers are about two years younger, half as likely to have finished college, and half as likely to be married.

In Table 2, we estimate whether the black-white gap in adverse birth outcomes that we observe in Table 1 are larger in counties that have higher levels of racial prejudice. The two key coefficients in this table are the measure of prejudice and the interaction term between this measure and whether the mother is black. Both implicit and explicit prejudice are measured in standard deviation units so the interpretation of the coefficient is the change in the birth outcome per 1000 births that accompanies a one standard deviation increase in that type of prejudice in the county. The coefficient on the main effect of prejudice is the change in birth outcomes for white mothers and the interaction term indicates how that relationship differs for black mothers. The change in birth outcomes for black mothers is the sum of the two coefficients.

Models 1 and 4 in Table 2 include only the implicit measure of prejudice. A one standard deviation increase in the implicit prejudice in the county of birth is correlated with almost no change in the birth outcomes for white mothers. The coefficients for white mothers are statistically significant and the magnitude of the coefficients are small and, if anything, indicate that white mothers are slightly less likely to experience adverse birth outcomes in counties with higher racial prejudice. In contrast, black mothers experience significantly worse birth outcomes in counties with higher levels of racial prejudice. A standard deviation increase in the racial prejudice in a county is associated with 7.8 more preterm births and 4.1 more low birth weight births per 1000 births (these estimates come from summing the first two coefficients in Table 2). These figures are a 5.1 percent increase in preterm births and 3.6 percent increase in low birth weight births relative to the sample means for black mothers reported in Table 1.

We can also use these regression estimates to compare the difference in the black-white gap in birth outcomes between counties that are one standard deviation below the mean (low prejudice) and counties that are one standard deviation above the mean (high prejudice). In low prejudice counties, 9.7 percent of births to white mothers are preterm births compared to 15.1 percent for black mothers. In high prejudice counties, 9.5 percent of births to white mothers are preterm births compared to 16.5 percent for black mothers. Thus, the black-white gap in preterm births is about 1.6 percentage points higher in the high prejudice counties, which is 29 percent higher relative to the gap in the low prejudice counties. For low-birth weight births, the gap is about 0.7 percentage points higher in the high prejudice counties, which is 14 percent higher relative to the gap in the low prejudice counties.

Models 2 and 5 in Table 2 include only the explicit measure of prejudice. A one standard deviation increase in the implicit prejudice in the county of birth is associated with a small, but statistically significant, decrease in preterm births for white mothers and a smaller and statistically insignificant decrease in low-birth-weight deliveries. In contrast, black mothers experience significantly worse birth outcomes in counties with higher levels of racial prejudice and this relationship is even larger in magnitude than

Table 2
County-level racial prejudice, mother's race, and birth outcomes.

Predictor(s)	Models for preterm births			Models for low birth weight		
	1	2	3	4	5	6
Implicit Prejudice	−0.94	–	1.41	−0.59	–	0.96
	(1.30)		(1.41)	(0.76)		(1.03)
Explicit Prejudice	–	−3.20*	−4.03*	–	−1.81	−2.41*
		(1.47)	(1.66)		(1.16)	(1.20)
Black	35.05**	34.89**	34.94**	41.90**	41.79**	41.81**
	(1.19)	(1.18)	(1.19)	(1.19)	(1.20)	(1.18)
% Black	5.85**	3.92*	4.48*	5.96**	4.83**	5.16**
	(1.77)	(1.96)	(2.00)	(1.43)	(1.51)	(1.62)
% Black in Poverty	2.72**	2.81**	2.84**	2.57**	2.63**	2.64**
	(0.47)	(0.47)	(0.47)	(0.38)	(0.37)	(0.37)
% Black × Black	9.984**	11.56**	11.56**	6.54**	8.21**	7.88**
	(1.73)	(1.84)	(1.85)	(1.51)	(1.60)	(1.61)
Implicit Prejudice × Black	7.81**	–	1.65	4.94***	–	−1.94
	(2.00)		(3.40)	(1.30)		(2.90)
Explicit Prejudice × Black	–	9.36**	7.90*	–	6.04**	7.46**
		(1.88)	(3.28)		(1.49)	(2.68)
% Black in Poverty × Black	3.96**	3.35**	3.42**	5.76**	5.19**	5.18**
	(1.24)	(1.22)	(1.21)	(1.15)	(1.12)	(1.11)

Note. The sample includes 31,464,451 births. Standard errors are clustered at the county level and are reported in parentheses. Implicit prejudice is the average race-based IAT score in the county where the child was born and is measured in standard deviation units centered at the sample mean. Each regression includes state and year fixed effects, and controls for birth order, gender; the mother's age, marital status, education, and pregnancy risk factors; and county unemployment rate, the percentage of the county that are college graduates, and the county population.
*$p < 0.05$. **$p < 0.01$.

what we found for implicit prejudice. A standard deviation increase in the explicit prejudice in a county is associated with 9.4 more preterm births and 6.0 more low birth weight births per 1000 births. This is a 6.1-percent increase in preterm births and 5.3 percent increase in low birth weight births relative to the sample means for black mothers.

Models 3 and 6 in Table 2 include both measures of prejudice in the same regression and show that the relationship is strongest for the explicit (than implicit) measures of racial prejudice. In the combined regression, the coefficients on implicit racial prejudice are no longer statistically significant, indicating that explicit racial prejudice plays a stronger role in explaining differences in the black-white gap in birth outcomes across counties.

Figs. 1 and 2 visually depict the regression results from Table 2, which show the difference in the absolute birth outcomes for black and white mothers and the change in the black-white gap in birth outcomes between the low and high prejudice counties. These Figures display the same general trend for both prejudice measures, with the health disparity widening as prejudice increases. These Figures also show that most of the widening occurs from black mothers experiencing worse outcomes; yet, our analysis using explicit prejudice shows that the increase in the health gap is partially a result of white mothers having fewer adverse birth outcomes as prejudice increases.

3.1. Falsification test

As a falsification test, we examine racial differences in infant outcomes based on other types of implicit biases measured by Project Implicit. Since the key measure of our analysis is based on

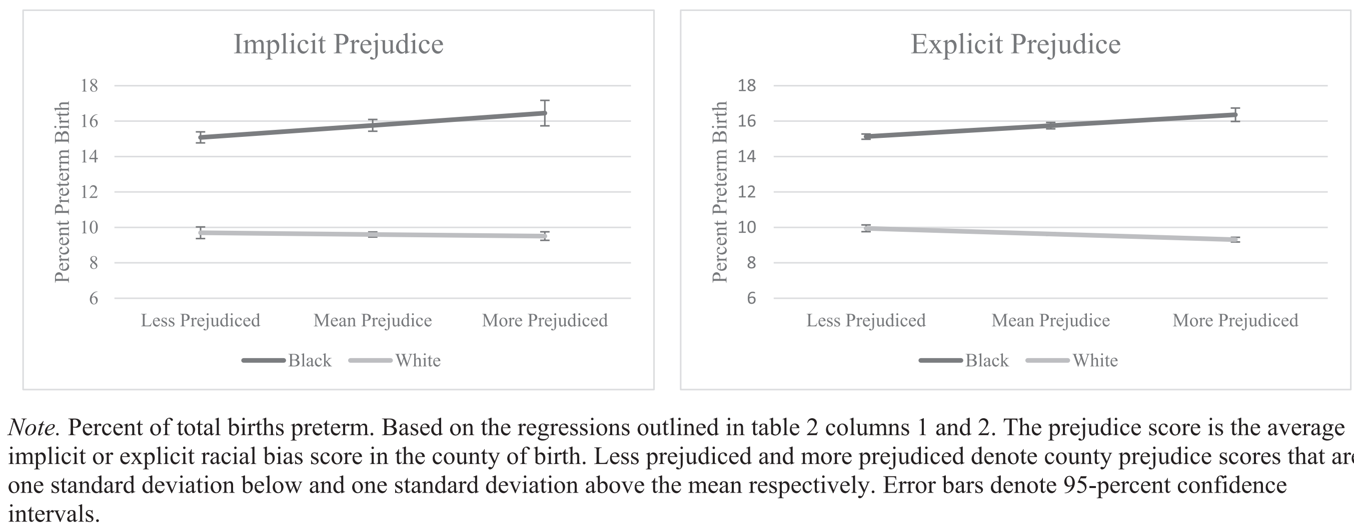

Fig. 1. Relationship between prejudice and preterm births.
Note. Percent of total births preterm. Based on the regressions outlined in Table 2 columns 1 and 2. The prejudice score is the average implicit or explicit racial bias score in the county of birth. Less prejudiced and more prejudiced denote county prejudice scores that are one standard deviation below and one standard deviation above the mean respectively. Error bars denote 95-percent confidence intervals.

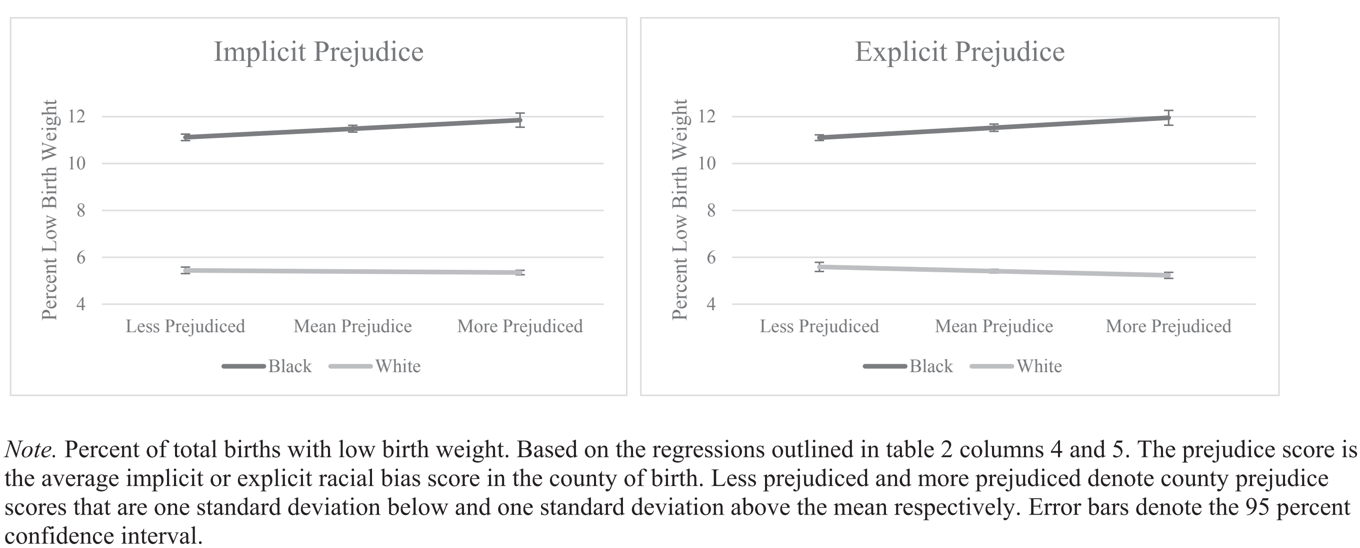

Fig. 2. Relationship between prejudice and low birth weight.
Note. Percent of total births with low birth weight. Based on the regressions outlined in Table 2 columns 4 and 5. The prejudice score is the average implicit or explicit racial bias score in the county of birth. Less prejudiced and more prejudiced denote county prejudice scores that are one standard deviation below and one standard deviation above the mean respectively. Error bars denote the 95 percent confidence interval.

racial prejudice measures from Project Implicit, this falsification test is designed to ensure that the results we observe are driven by patterns in racial prejudice rather than some mechanical bias generated by the way that IAT data are collected. In Table 3, we present results in which we examine the degree to which the black-white gap in adverse birth outcomes is related to prejudice based on gender and sexual orientation using data from Gender-Career Implicit Association test and the Sexual Orientation Implicit Association test.

The results summarized in Table 3 indicate that counties with higher levels of prejudice with regards to gender or sexual orientation experience slightly better infant health outcomes for all mothers, yet these biases are not associated with statistically significantly higher levels of racial gaps in infant health. In fact, the coefficient on the interaction between mother's race and these other measures of prejudice are about 3–17 times smaller than the coefficient on the interaction between racial prejudice and the mother's race. These estimates suggest that the results in this article are specific to race-based measures of prejudice and not driven by a bias in the way that we constructed county-level race-based IAT measures.

3.2. County of birth versus county of residence

Finally, we examine whether the association between racial prejudice and adverse birth outcomes for black mothers is more strongly related to the county in which the mother lives or the county in which the birth occurs. About 20 percent of mothers give birth in a county that is different from where they live. The counties where these mothers give birth have, on average, a population that is about 3.5 times larger than their residence county. The results from the estimates using this subset of cross-county births appear in Table 4 and are based on explicit measures of prejudice; the estimates and conclusions are very similar if we use implicit measures of prejudice.

We find that the black-white birth outcomes gap is more strongly correlated with the prejudice in the county where the mother gives birth than with the prejudice in the county where she lives. In fact, the strength of the correlation is about four times larger for the county of birth than it is for county of residence, which is true whether we estimate the relationship using separate regressions or together in the same regression. When we include both measures in the same regressions, we find that the coefficient on the prejudice in the county of birth is statistically different (at the one percent level) from the coefficient on the prejudice in the county of residence.

This differential effect of the role of county-level racial prejudice was originally designed to test for the specific role of medical care providers compared to factors that operate in the individual's community. One challenge with this conclusion is that we originally assumed that the county where the mother gives birth might be a proxy for where she receives her prenatal care, but there is no information available to establish this claim. In addition, we find that the results in Table 2 are similar with or without the control for prenatal care. In addition, this pattern of having a stronger relationship based on racial prejudice in the county of birth is true even when we limit the sample to the 5 percent of mothers who reported having the least prenatal care (less than 5 visits). We have included this analysis as an interesting result for future research to examine.

Table 3
Falsification test: Comparison of results using other measures of prejudice.

Predictor(s)	Preterm birth	Low birth weight
Race IAT × Black	6.93**	3.41*
	(1.97)	(1.67)
Race IAT	−0.50	−0.04
	(1.28)	(1.05)
Gender IAT × Black	0.89	0.20
	(0.96)	(0.86)
Gender IAT	−1.22*	−0.92*
	(0.48)	(0.37)
Sexual Orientation IAT × Black		0.94
		(1.04)
Sexual Orientation IAT	−1.21	−1.72**
	(0.88)	(0.63)

Note. The sample includes 31,464,451 mothers. Standard errors are clustered at the county level and are reported in parentheses. Each of the IAT measures are in standard deviation units. Each regression includes state and year fixed effects, and controls for birth order, gender; the mother's age, marital status, education, and pregnancy risk factors; and county unemployment rate, the percentage of the county that are college graduates, the fraction of the county that are black, the black poverty rate, and the county population.
*$p < .05$. **$p < .01$.

4. Discussion

Our study examined whether the black-white gap in adverse birth outcomes in the U.S. is larger in counties that have higher levels of implicit or explicit racial prejudice, joining and exploiting large databases on these subjects. We find that counties with the highest levels of racial prejudice also have the largest black-white gaps in adverse birth outcomes. In fact, when we compare counties that are either one standard deviation above or one standard deviation below the mean in terms of implicit racial prejudice, the high prejudice counties have a black-white gap in low birth weights deliveries that is 14% larger than in low prejudice counties. There is an even larger increase in the black-white gap in preterm births, which are about 28 percent larger in high prejudice

Table 4
Comparison of role of racial prejudice in county of birth and county of residence.

Predictor(s)	Preterm birth			Low Birth Weight		
County of Birth Explicit Prejudice × Black	11.89**	–	10.88**	10.92**	–	9.33**
	(2.67)	–	(2.63)	(2.81)	–	(2.61)
County of Birth Explicit Prejudice	−1.82	–	−2.18	−0.56	–	−1.23
	(1.61)	–	(1.63)	(1.41)	–	(1.27)
County of Residence Explicit Prejudice × Black	–	2.42**	2.59*	–	2.05	2.75**
	_	(1.09)	(1.04)	–	(1.12)	(1.00)
County of Residence Explicit Prejudice	–	0.79	1.90**	–	1.27*	2.41**
	_	(0.62)	(0.65)	–	(0.53)	(0.55)

Note. The sample includes 8,539,713 mothers. Standard errors are clustered at the county level and are reported in parentheses. IAT is the county-level measure of explicit racial prejudice and is measured in standard deviation units. Each regression includes state and year fixed effects, and controls for birth order, gender; the mother's age, marital status, education, and pregnancy risk factors; and county unemployment rate, the percentage of the county that are college graduates, the fraction of the county that are black, the black poverty rate, and the county population.
$p < .05$. **$p < .01$.

counties, and both of these results are even larger when we use explicit measures of racial prejudice instead of implicit measures.

Our analysis complements the results of Leitner et al. (2016a), which also used Project Implicit data to construct county-level measures of racial prejudice. They compared changes in the black-white gap in death rates due to circulatory disease between high and low prejudice counties. In high prejudice counties, the difference in the annual black and white death rate is 62 deaths per 100,000 compared to a black-white gap of 35 deaths per 100,000 in the low prejudice counties. The difference they observe in the black-white gap in circulatory-disease-related death rates across counties with high or low prejudice is larger than what we observe for birth outcomes. In addition, like our study, they find that when you control for both implicit and explicit measures of prejudice, that the strength of the statistical relationships falls solely on the measure of explicit racial prejudice.

It is also helpful to contrast the size of the correlation that we observe with other interventions that could potentially reduce the black-white gap in birth outcomes. For example, Bakemeier et al. (2011) examines the effect of various interventions that might reduce the black-white infant mortality gap and find that access to prenatal care reduced the gap by about 6.5 percent. While the adverse birth outcomes in our study are less severe than infant mortality, the percent decline that we observe in the black-white gap in birth outcomes is striking between the high and low prejudice counties (based on explicit bias) with a 22 percent decline for low birth weight and a 36 percent decline for preterm births.

4.1. Limitations

One limitation of our study is that, whereas it uses Project Implicit data to construct county-level measures of prejudice, which includes people from across the country, the database is not nationally representative. We addressed this concern by using inverse probability weights to adjust the sampling weights we employed to make sure that the demographic characteristics of our sample correspond to a nationally representative sample. It is still possible that the self-selection of individuals into Project Implicit may create a potential threat to the validity of our prejudice measures. We addressed this possibility by conducting a falsification test in which we use other prejudice measures (based on gender bias and sexual orientation bias) and find that the results we observe in this article are specific to race-based measures of prejudice and not driven by a bias in the way we construct the county-level prejudice measures. As additional prejudice data become available (potentially as part of a nationally-representative samples), the ability to conduct this type of research will improve.

Another concern is that the relationship that we estimate between county-level prejudice and the black-white gap in birth outcomes is essentially correlational and may suffer from omitted variable bias. We attempt to address this concern by including observable county-level controls in our analysis, including the racial mix, educational level, and unemployment rate in the county, as well as the percentage of the black population in the county that is below the poverty line. Our results are very similar with or without these additional controls indicating that omitted variable bias is less of a concern. Nonetheless, it does limit our ability ascribe a causal interpretation to the correlation we observe between county-level racial prejudice and black-white gap in adverse birth outcomes.

5. Conclusion

The results in this article suggest that county-level racial prejudice is a key factor in the black-white gap in adverse birth outcomes and this relationship is robust to the inclusion of a broader set of individual and county-level controls. Black mothers have significantly more adverse birth outcomes in counties with higher levels of racial prejudice and this relationship is more strongly associate with explicit forms of racial prejudice. Our analysis is based on county-level data and future research might exploit datasets with more detailed geographic data to examine variation in racial prejudice at a tighter definition of community. Future research might also examine how other health outcomes are associate with community-level prejudice and identify ways to better understand the different pathways through which these relationships operate.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2017.03.036.

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