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## The Association of U.S. State Policy Orientation with Adverse Birth Outcomes: A Longitudinal Analysis

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### Abstract

**Background:** The current U.S. context is marked by extreme right-left partisanship, which means that state policies tend to bundle together and are not experienced in isolation. While prior work has leveraged abrupt shifts in single policies to examine the effects of state policy on birth outcomes, we examined a holistic measure that captures political polarization.

**Methods:** Data were drawn from national birth certificates for 2003–2017 (N = 56,770,470). Outcomes included preterm birth, low birthweight, small-for-gestational-age, and other perinatal health measures. The primary exposure was a composite index of right-left state policy orientation, generated from historical data on 135 state policies. Multivariable regressions were used to estimate the association between state policy orientation and each outcome, adjusting for relevant covariates.

**Results:** Compared to infants born in states with right-leaning policy orientations, those born in left-leaning states had lower odds of adverse birth outcomes (e.g., low birthweight: OR 0.95 (0.93, 0.97), preterm birth: OR 0.94 (0.92, 0.95)). Subgroup analyses revealed stronger associations for U.S.-born and White mothers. With the inclusion of state fixed effects, left-leaning policy orientation was no longer associated with lower odds of adverse birth outcomes. Models were otherwise robust to alternative specifications.

**Conclusion:** While left-leaning state policy orientation has protective associations with a range of birth outcomes, the associations may be explained by stable characteristics of states, at least during the study period. Future studies should examine state policy orientation in association with other health outcomes and study periods.

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**Contributions:** A.R. Riley led the writing and assisted with interpretation of results. D.F. Collin completed the analyses and created figures and tables. J.M. Grumbach created the exposure variable and assisted with interpretation of results. J.M. Torres assisted with the study design and interpretation of results. R. Hamad conceived and supervised the study and writing. All authors contributed to revising the manuscript critically for intellectual content and approved of the final submitted version.

**Competing interests:** None.

## INTRODUCTION

Adverse birth outcomes like preterm birth and low birthweight (LBW) are known to have lasting consequences for a child's health across the lifecourse (1,2). In the U.S., there are dramatic and widening geographic disparities in adverse birth outcomes across states, suggesting the importance of state policy environments as determinants (3,4). For instance, the percent of births that were preterm in 2018 ranged from a minimum of 7.8% in Oregon to a maximum of 13.0% in Louisiana(5).

Recent studies have shown that birth outcomes are affected by specific state policies in the short-term, such as Medicaid expansion(6), increased minimum wage(7), or presence of a state earned income tax credit(8). Potential mechanisms that link social policies with birth outcomes include economic security, healthcare access, stress, toxic exposures, and other pathways, depending on the policy and outcome of interest(9). Many studies leverage abrupt shifts in specific policies or occurrence of major events (e.g. a large immigration raid(10) or presidential election(11)) to isolate the effects of a *single* policy or political event on health. Any policy clustering is generally treated as a nuisance to be controlled for using quasi-experimental research designs or other techniques.

However, the current U.S. context is marked by extreme right-left partisanship(12), such that state policies bundle together along partisan lines and policies are not experienced in isolation from the underlying partisan policy context(13,14). When policy positions in one domain are highly correlated with a state's overall policy orientation, one may overestimate the health effects of any one policy by not accounting for the overall policy context (13). Drawing on existing research, we conceptualize state policy orientation as a latent variable that captures a state's partisanship across policy domains (12). A recent study that adopted this approach found trends in state policy orientation are associated with the widening geographic disparities in life expectancy across states (15).

In addition to increased state policy polarization, the power to legislate access to the social determinants of health has been shifting from the federal level to the state level since the 1970s, a process called devolution(16). As a result, everything from a pregnant woman's access to the earned income tax credit to her abortion access is increasingly determined by whether she is living in a state with a liberal or conservative policy context (12,17). Indeed, we see examples of this in the policy actions taken in response to the COVID-19 pandemic, which vary across states and are correlated with the political party in control of state government(18).

Political scientists often classify policies along a unidimensional right-left political spectrum(12). In the context of American politics, left-leaning or liberal policies expand the use of state power for economic regulation, redistribution, or protection of marginalized social groups, and they restrict state power for punishment(12). In contrast, right-leaning or conservative policies protect "traditional" social values, punish deviant social behavior, and restrict state power to intervene in markets(12). Cross-national comparative research suggests that policy environments characterized by lower investment in social and economic programs and public health prevention are likely to result in worse population health(19).

In this study, we acknowledge the multiple mechanisms that link various policy domains to infant health (1) and take a holistic view of state policy by applying a recently developed index of state policy orientation (12). We examine whether right-left policy orientation at the state level has consequences for infant health in the U.S. To do so, we test the association between state policy orientation and adverse birth outcomes using longitudinal nationwide birth certificate data. We also examine subgroup effects to evaluate whether marginalized populations are more affected by the overall state policy environment. Our study is the most comprehensive analysis to date of state policy's impact on birth outcomes.

## METHODS

### Sample

The sample was constructed from 2003–2017 National Center for Health Statistics (NCHS) Vital Statistics Birth Data Files(20), which contain 100% of all live births nationwide. Figure 1 shows the sample selection process. We included live singleton births with a gestational age of 22 to 44 weeks at delivery and with birthweight-for-gestational-age within three standard deviations of the mean (N = 56,770,470).

### Exposure

The main exposure was a composite measure of a state's right-left policy orientation in the year prior to the infant's birth, intended to capture the latent variable of state policy context. Specifically, we draw on a recently-developed index of state policy orientation to classify entire state policy contexts along the right-left spectrum using a policy orientation score based on 135 specific state policies across 16 issue areas (See Supplemental Table 1 in Appendix)(12). This measure is available through 2014. Each policy is coded along the right-left spectrum and normalized between 0–1(12). Within each issue domain, the number of conservative policies is subtracted from the number of liberal policies to get an index. These 16 domain-specific indices are then averaged to get the composite score for each state-year. Each score represents how right- or left-leaning the state policy environment is during that year, with higher scores indicating a more left-leaning or liberal state policy environment. Figure 2 illustrates how states' right-left policy orientation varies over the study period. A more detailed description of the administrative data sets and classification process used to construct the score is available in prior work(12).

### Outcomes

Outcomes drawn from birth certificates included continuous variables for birthweight and weeks of gestation at delivery, and binary variables representing whether the infant was born preterm (before 37 weeks' gestation), whether the infant was LBW (<2,500g), very LBW (<1,500g), appropriate-for-gestational-age (AGA), small-for-gestational-age (SGA), or large-for-gestational-age (LGA), and whether the infant had a 5-minute Apgar score  $\geq 9$ . Prior work has suggested that each of these may have long-term negative health consequences on child and adult health and wellbeing(21). Finally, we also examined the impact of the policy orientation score on whether the infant was male. Maternal stress is associated with a reduced likelihood of having a male infant(22,23); scholars have

hypothesized that stressful conditions during pregnancy may reduce male conception and promote male fetal death(24,25).

### Covariates

Covariates, representing potential confounders of the relationship between state of residence and birth outcomes, included the mother's age, race, parity, marital status, education, and whether she was born outside the U.S., the infant's sex (except where this variable was an outcome), and indicator variables (i.e., fixed effects) for year to adjust for secular trends.

### Analysis

For descriptive purposes, we split the state policy orientation score at the median and tabulated sample characteristics based on whether an infant was born in a state that was right- or left-leaning. We then estimated the effect of state policy orientation in the year prior to the infant's birth on each outcome separately using multivariable regression models. For these initial models, we employed linear regressions for continuous outcomes and logistic models for binary outcomes, adjusting for covariates listed above. Robust standard errors were clustered at the state level to account for correlated observations.

**State Fixed Effects Models**—We re-estimated the models from our initial analysis with the addition of state fixed effects (FE) to adjust for potential confounding from time-invariant state-level characteristics. These models leverage variation within states only, rather than across states. The inclusion of state FE restricts the variation used to estimate the state policy orientation coefficient and gives less influence to births in states, such as Louisiana, with low variance in policy orientation during the study period.

**Secondary Analyses**—We conducted several analyses to explore the robustness of our results. First, we allowed for the possibility of lagged effects by measuring state policy orientation A) two years and B) three years before an infant's birth. Birth outcomes are sensitive to shifts in the maternal environment during the prenatal period (26) and possibly even the preconception period (27,28). In addition, state policy changes are not always implemented in the year they are passed. Depending on how long it takes for a policy shift to influence maternal health, we estimated that birth outcomes may reflect the policy environment of up to three years prior. Second, we decomposed the state policy orientation score into its 16 issue-specific domains (e.g. immigration, labor), and examined the association of each domain with each outcome. With these analyses we checked whether polarization in any specific domain had a differing association than the overall policy orientation score. Finally, since dynamics in a state's policy orientation may impact disparities between subgroups more than population averages, we conducted stratified analysis by mother's nativity, race (White, Black, Hispanic, other), age (35 years or older vs. under 35), and marital status.

**Ethics Approval**—This study was approved by the institutional review board at University of California San Francisco (protocol #18-26719).

## RESULTS

The right-left policy orientation score ranged from  $-2.35$  to  $2.99$  (mean  $0.07$ ; SD  $1.29$ ). The between-state standard deviation was  $1.29$  and the within-state standard deviation was  $0.18$ . The state of Louisiana had the lowest within-state variation (mean  $-1.03$ ; SD  $0.04$ ) over the study period, while New Mexico had the highest (mean  $0.71$ ; SD  $0.62$ ). The maximum between-state difference in policy scores was between Mississippi (mean  $-2.04$ ; SD  $0.12$ ) and California (mean  $2.72$ ; SD  $0.14$ ).

Mothers' characteristics were generally similar between right- and left-leaning states, although mothers of infants in right-leaning states were more likely to be younger and U.S.-born (Table 1).

In the initial analysis (Table 2), more left-leaning state policy was associated with better infant health for nearly every outcome. For example, each 1-point increment from right to left along the policy orientation spectrum was associated with a lower risk of LBW (OR  $0.948$ , 95%CI:  $0.932, 0.965$ ) and preterm birth (OR  $0.936$ , 95%CI:  $0.923, 0.949$ ).

In the analyses that adjusted for state FE, there was no association between state policy orientation and any of the outcomes except slightly lower odds of a male infant with more left-leaning policy.

When the exposure was lagged by two or three years, results were similar to the models with a 1-year lag (Supplemental Table 2). When examining the association between birth outcomes and each of the 16 policy domains that make up the policy orientation score, orientation across some domains was more strongly associated with birth outcomes than others in models without state FE, but generally null in models with FE (Supplemental Tables 3A and 3B). For instance, in models without state FE, we found that more left-leaning policy in the health/welfare domain and the immigration domain was associated with reduced risk of LBW, yet there was no association with outcomes for the criminal justice or education domains. Stratifying by subgroup, there were differences in the association between right-left policy orientation and birth outcomes in models without FE (Supplemental Figures 1–5). For example, the negative association of left-leaning state policy with adverse birth outcomes was attenuated for foreign-born mothers compared to U.S.-born mothers (interaction term for LBW:  $1.04$ , 95%CI:  $1.03–1.05$ ; interaction term for preterm birth:  $1.03$ , 95%CI:  $1.02–1.05$ ). Similarly, left-leaning state policy orientation was more strongly protective against adverse outcomes for White mothers compared with Black mothers, Latina mothers, and non-White mothers of another race (Black-White interaction term for LBW:  $1.03$ , 95%CI:  $1.02, 1.05$ ; Latina-White interaction term for LBW:  $1.04$ , 95%CI:  $1.02, 1.07$ ). These associations were generally null with the addition of state FE, with the exception of a persistent negative association with LBW for Latina mothers.

## DISCUSSION

To complement the growing body of evidence that examines effects of shifts in single policies on birth outcomes, we explored the influence of overall state policy environment using a composite measure that captures right-left policy orientation across 16 policy

domains. This is among the first studies to examine the association of such policy bundles—rather than single policies—with health, and it is particularly important in light of the tremendous public health and socioeconomic legislation taken on by states in the wake of the COVID-19 pandemic. We found that more left-leaning state policy was associated with better infant health for nearly all birth outcomes examined, but the association was not robust to the inclusion of state FE. Subgroup analyses suggest that the protective associations between left-leaning state policy and birth outcomes were stronger for infants born to U.S.-born and White mothers in models without state FE, while state FE models showed a protective association in LBW only for Latina mothers only.

There are numerous mechanisms that may link left-leaning state policy with improved infant health. Social conditions may influence conception, viability, selective fertility, and infant health at birth, and may shape access to prenatal care, maternal nutritional and health behaviors, and maternal stress. Evidence from previous studies suggests that left-leaning states may improve infant health through expanded access to health care (6), through greater economic stability for the pregnant mother (8,29), or through changes in maternal health behaviors such as fertility decisions, early prenatal care, reduced smoking (30), and improved nutrition (31). But many state policies or laws are passed concurrently making it challenging to tease apart the health effects of a single policy using current methods (32). It is likely that overall state policy orientation influences infant health through multiple (correlated) policy domains and through multiple related mechanisms, and for this reason, analysis of the domain-specific models should be interpreted cautiously. Beyond the effects of specific policies, there is evidence that exposure to a political climate in which aspects of one's identity are stigmatized and marginalized can result in adverse birth outcomes (11,33). In the U.S. context, right-leaning policy orientation has been characterized by a less inclusive social safety net and even hostile rhetoric toward immigrant communities and low-income communities of color (34).

While the right-left policy orientation score is associated with variation in birth outcomes across states, *changes* in policy polarization within a state during the study period were not associated with birth outcomes (i.e., in the state FE models). There are several possible explanations for the null results from the models with state FE. First, these findings may reflect the fact that some state policy environments, particularly those with the most extreme left and right scores, had already polarized to a large extent prior to 2003. While polarization has continued steadily since the 1970s (12), some states were stable in their policy orientation over our study period (Figure 2). With approximately 56 million observations, our models were well-powered to detect effects, but FE methods have limited utility when state policy orientation itself is a stable characteristic of many states. Second, it is possible that detecting effects in birth outcomes from an upstream policy exposure requires a more dramatic shift in state policy, rather than the kind of gradual change captured in the policy orientation score, which is steadied by its inclusion of many policies spanning 16 domains. Our policy orientation score does not weight the components differentially with respect to what might matter most for infant health. To the extent that the score combines some features that have been shown to matter for birth outcomes and some features that do not, the influence of any single feature could be washed out. Finally, it is possible that correlations between state population composition, or other state characteristics (e.g., environmental

toxins), and policy regime may confound observed associations. For instance, previous research shows that welfare spending is less generous in states with larger Black populations (35,36).

This study has several limitations. First, changes in some issue areas (e.g. abortion and immigration policy) may affect birth outcomes in the short-term, while changes in other issue areas (e.g. education, criminal justice, or gun policy) may not show effects for many years, if at all. Future studies could examine this possibility with more detailed domain-specific analyses. Second, our study did not measure policy enforcement. While on paper a state may have a more left-leaning policy environment, other institutional differences between states may lead to variation in policy enforcement. For example, a state may adopt a generous State Children's Health Insurance Program in policy, but the program's implementation may be inhibited by historic barriers to eligibility and problematic biases that limit the policy's benefits to health (37). Third, though theory suggests that states with policy regimes that promote greater social inequality will have wider disparities in infant health (38), this may not be detectable in average health at the state level. Thus, while our study design is well-powered to detect effects on the incidence of adverse birth outcomes in the short term, there may be other dynamics that result from variation in state right-left policy orientation that would need to be explored through alternative approaches. Fourth, constrained by the availability of birth outcomes data, our study period does not extend far enough back in time to capture the polarization process for all states. As a result, there may be insufficient within-state variation to detect associations in the state FE models. Finally, this study examined associations between the exposure and outcomes; in the absence of a quasi-experimental design, these associations are not necessarily causal.

## CONCLUSIONS

In the current era of political polarization across states, exposure to more left-leaning state policies was associated with better birth outcomes, although our study does not suggest that shifts in policy orientation within a state are associated with birth outcomes. We interpret our results as evidence that infant health is associated with the holistic state policy environment, but further research is needed to clarify the basis of the association. On one hand, some states may have been successful in protecting infant health through policies across multiple domains, implying that there may be steps to improve infant health through social policy. Unfortunately, this work supports the idea that mothers will experience a differential risk of adverse birth outcomes simply due to their state of residence.

The implications of this study may extend beyond birth outcomes. Understanding the role of state policy orientation is essential to understanding population health and health disparities across the U.S. This has been made especially clear by the COVID-19 pandemic as we see that different state policy actions are correlated with the political orientation of the state's leadership (18). Future studies should examine the role of state policy orientation on other health outcomes and in different study periods.



## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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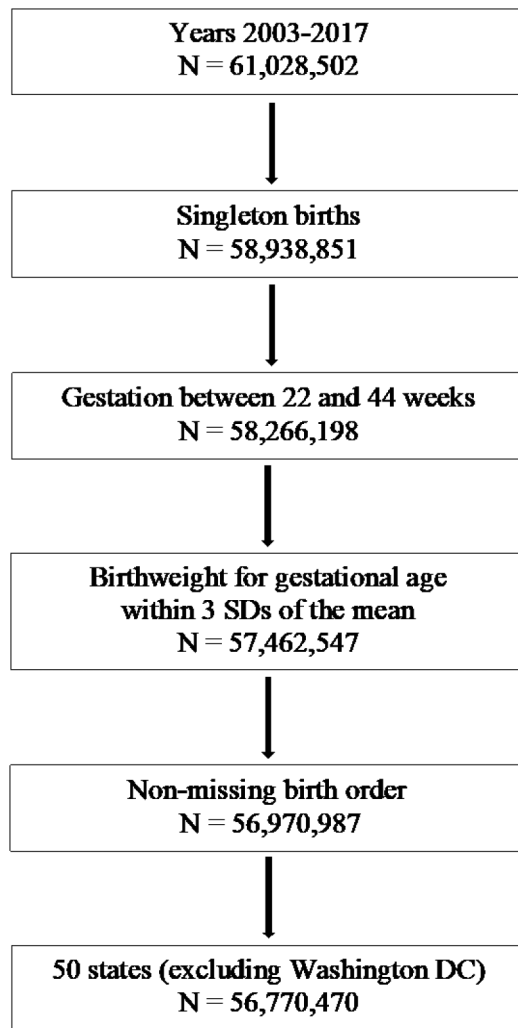
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**What is already known on this subject?**

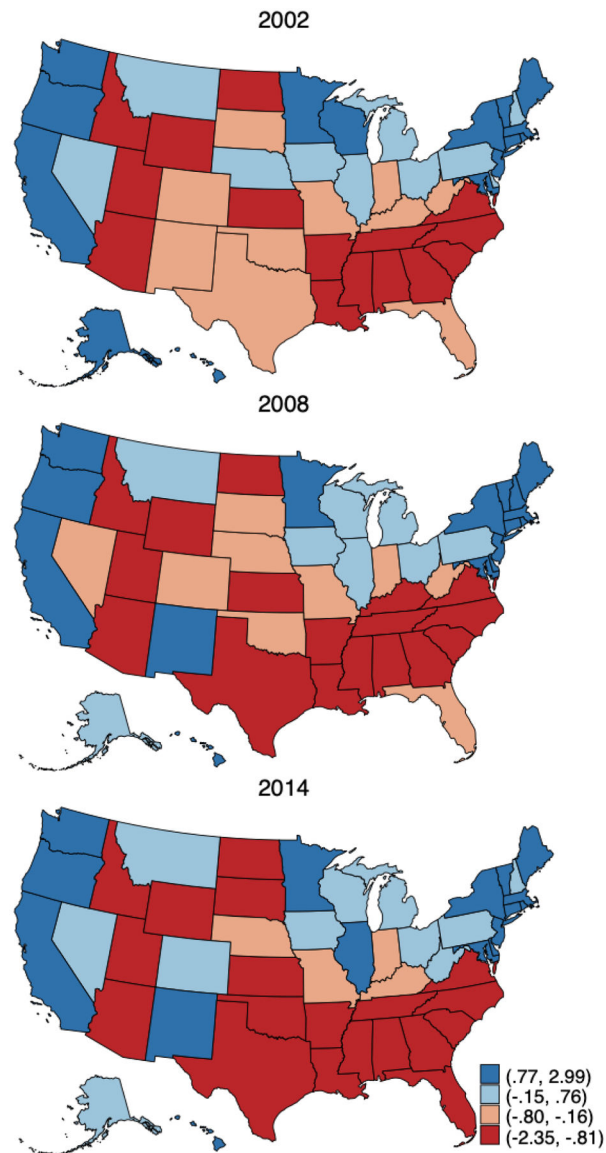
There is increasing interest in how state policies influence birth outcomes. A growing body of evidence suggests birth outcomes are highly sensitive to policy influence in the short term, including policies to reduce poverty and improve maternal nutrition. It is critical to clarify how the political partisanship that characterizes state policy in the U.S. matters for infant health.

**What this study adds?**

This study is among the first to examine a holistic measure of partisanship in state policy, better capturing the clustering and polarization of state policy in the current climate. This study provides evidence that mothers will experience a differential risk of adverse birth outcomes simply due to their state of residence, and it supports greater attention to the role of state governments in geographic disparities in infant health.



**Figure 1. Sample Flowchart**  
Description of analytic sample selection.



**Figure 2. Variation in Right-Left State Policy Orientation, by State and Year**

Note: The right-left policy orientation score summarizes the ideological content of a state's policies along a "policy liberalism" spectrum. The map distinguishes quartiles of the right-left policy orientation score, with a higher score in blue indicating a more left-leaning policy orientation and a lower score in red indicating a more right-leaning policy orientation.

**Table 1.**

Sample Characteristics by Right-Left Policy Orientation Score (Median Split), 2003–2015

Characteristic	Right-Leaning (N = 28,383,747)	Left-Leaning (N = 28,386,723)
	Mean (SD) or %	Mean (SD) or %
<b>Mother</b>		
Race		
White	55.22	53.31
Black	16.97	11.38
Hispanic	22.90	25.16
Other	4.91	10.15
Age		
<20	10.04	7.25
20–24	26.61	20.87
25–29	28.87	27.75
30–34	22.30	26.99
35–39	10.01	13.87
40+	2.17	3.27
Married	59.27	62.08
Foreign-born	19.80	27.86
Parity		
0	33.57	33.26
1	28.51	28.61
2+	37.92	38.13
Education		
Less than high school	19.71	17.45
High school	28.50	25.34
Some college	26.94	25.76
Bachelor's or more	24.85	31.44
<b>Infant</b>		
Female	48.82	48.78
Birthweight, grams	3,275 (544)	3329 (539)
Gestational age, weeks	38.60 (2.12)	38.83 (2.04)
Low birthweight	6.57	5.52
Very low birthweight	1.05	0.89
Preterm birth	10.07	8.37
Small for gestational age	10.59	9.503
Large for gestational age	10.05	10.88
Appropriate for gestational age	79.37	79.62
5-minute Apgar 9–10	86.04	89.28

Note: Sample includes singleton infants live-born in the 50 U.S. states (excluding Washington DC) with a gestational age of 22 to 44 weeks at delivery and with birthweight-for-gestational-age within three standard deviations of the mean.

**Table 2.**

Association of Right-Left Policy Score with Infant Health Outcomes, 2003–2015

Continuous Outcomes	Initial Analysis	Analysis Including State Fixed Effects
	$\beta$ (95% CI)	
Birthweight	14.6 <sup>***</sup> (10.4, 18.9)	-2.2 (-7.5, 3.0)
Gestational age	0.074 <sup>***</sup> (0.053, 0.094)	-0.002 (-0.047, 0.043)
Binary Outcomes	OR (95% CI)	
Low birthweight	0.948 <sup>***</sup> (0.932, 0.965)	1.001 (0.979, 1.024)
Very low birthweight	0.956 <sup>***</sup> (0.934, 0.978)	1.007 (0.970, 1.046)
Preterm birth	0.936 <sup>***</sup> (0.923, 0.949)	1.026 (0.998, 1.054)
Small for gestational age	0.972 <sup>**</sup> (0.955, 0.990)	1.015 (0.980, 1.052)
Large for gestational age	1.016 <sup>*</sup> (1.001, 1.030)	1.011 (0.985, 1.038)
Appropriate for gestational age	1.007 (0.999, 1.014)	0.986 (0.963, 1.009)
5-Minute Apgar 9–10	1.178 <sup>***</sup> (1.086, 1.278)	1.155 (0.883, 1.510)
Male infant	1.000 <sup>*</sup> (1.000, 1.001)	0.995 <sup>*</sup> (0.991, 1.000)

Note: N = 56,770,470. Coefficients represent the association between right-left policy score and birth outcomes.

All models adjust for mother's age, race, parity, marital status, nativity, and education, and infant's sex (except where male sex is the outcome), and year fixed effects.

\* p < 0.05

\*\* p < 0.01

\*\*\* p < 0.001