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THE IMPACT OF FISCAL POLICY TO PROMOTE HEALTHY DIETS: EVIDENCE FROM THE NAVAJO NATION

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This study used restricted-use National Vital Statistics System (NVSS) birth certificate / natality data obtained through the National Center for Health Statistics (NCHS). These data contain detailed county information and are not publicly available. Access was granted under an approved research proposal and data use agreement. Researchers may request access by submitting a proposal to the NCHS as outlined here: https://www.cdc.gov/nchs/nvss/nvss-restricted-data.htm. The authors have no conflicts to report. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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The Impact of Fiscal Policy to Promote Healthy Diets: Evidence from the Navajo Nation
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ABSTRACT

One of the most comprehensive fiscal policies to improve diet was adopted by the Navajo Nation; the Healthy Diné Nation Act (HDNA) of 2014-15 consists of two parts: 1) an exemption from sales tax for healthy foods and beverages; and 2) a tax increase on unhealthy foods and beverages. Together, they create a price wedge of 7-8% between healthy and unhealthy foods. We estimate difference-in-difference models and event studies that estimate the effect of the HDNA on a variety of health conditions relating to diet and weight for newborns and mothers which are recorded in birth certificate data. We find no evidence that the HDNA improved these outcomes; our estimates are precise enough to rule out improvements in gestational diabetes as large as those reported for U.S. city SSB taxes. Possible explanations for the null results include incomplete retailer implementation and cross-border shopping.

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1 Introduction

In this paper, we estimate the health impacts of the Healthy Diné Nation Act (HDNA) which was enacted in the Navajo Nation in 2014–2015 and which taxed unhealthy foods and subsidized healthy foods. We estimate difference-in-differences models using birth certificate data in order to estimate the effect of the HDNA on a variety of measures of the health of infants (e.g. birth weight, premature birth) and mothers (e.g. pre-pregnancy weight of mother, pregnancy-related weight gain, and gestational diabetes).

Understanding the impact of the HDNA is important because diet-related chronic diseases are rising globally (NCD Risk Factor Collaboration, 2024). For example, in the U.S., the prevalence of diabetes doubled from 6.8% in 1988–94 to 14.2% in 2017–20 (Fang et al., 2022), and the prevalence of obesity tripled from 13.3% in 1960–62 to 40.3% in 2021–23 (Centers for Disease Control and Prevention, 2025). Yet the evidence on whether dietary policies can change these trends is uneven. On the one hand, evaluations of SSB taxes consistently find that they reduce purchases of the taxed beverages (Cawley et al., 2019). On the other hand, there is limited evidence that this translates into clinical improvements, such as a lower prevalence of diabetes or fewer cardiovascular events.

Diet-related chronic diseases are expensive to the health care system. Estimates suggest that that over $260 billion is spent annually treating obesity-related diseases in the U.S. (Cawley et al., 2021). Because these costs are heavily borne by public and private health insurance, they represent fiscal externalities. This provides a neoclassical economics rationale for taxes on foods that promote diet-related chronic disease, with the goal of internalizing the external costs. Behavioral economics adds a complementary rationale: if consumers have time-inconsistent preferences, fiscal policies can help reduce "internalities"(Cutler et al., 2003; Cawley, 2015; Allcott et al., 2019).

The outcomes of interest in this paper relate to maternal and infant health. A growing body of evidence suggests that dietary exposures in early life, especially in-utero, can have large and lasting effects. The fetal origins hypothesis argues that environmental exposures

during fetal development, particularly maternal nutrition, shape health and human capital across the life course (Almond and Currie, 2011; Currie and Rossin-Slater, 2015). Quasi-experimental evidence from historical nutritional shocks supports this view, as studies of famine conditions, such as the Dutch Hunger Winter and the Chinese famine, find elevated risk of metabolic and cardiovascular disease later in life among those exposed in-utero (Ramirez and Haas, 2022; Roseboom et al., 2006; Li et al., 2011). Recent quasi-experimental evidence exploiting the ending of sugar rationing in the United Kingdom in 1953 finds that exposure to sugar restrictions within the first 1,000 days after conception reduced later-life risk of type-2 diabetes by roughly 35% and hypertension by 20%, with in-utero exposure accounting for a substantial share of the effects (Gracner et al., 2024; Gertler and Gracner, 2022). This evidence suggests that even moderate reductions in sugar consumption among pregnant women has the potential to improve infant health.

Fiscal policies to promote healthy diets have been recommended by a wide range of medical and public health organizations, including the World Health Organization (World Health Organization, 2016a,b), World Bank (World Bank, 2024), United Nations (UNICEF, 2024), Pan American Health Organization (Pan American Health Organization, 2020), American Public Health Association (American Public Health Association, 2012), and American Academy of Pediatrics (Muth et al., 2019). The most common way that this has been implemented worldwide is as a narrow tax on sugar-sweetened beverages (SSBs) (see, e.g. Cawley et al., 2019). In the U.S., numerous cities, including San Francisco, Philadelphia, and Seattle, have implemented SSB taxes since 2014. Less common, globally, are taxes on a broad range of unhealthy foods; examples of these include: Mexico's 8% tax on "nonessential" foods which are energy-dense and nutrient-poor (Hernández-F et al., 2019; Colchero et al., 2016), Hungary's tax on foods high in salt or sugar (Biró, 2015), and Norway's taxes on chocolate and sugar (Øvrebø et al., 2020). Denmark briefly taxed foods high in saturated fat; this was implemented in 2011 but repealed the following year (Vallgårda et al., 2015; Jensen and Smed, 2013). Within the U.S., the Navajo Nation's HDNA is unique in combining a tax

on SSBs with a tax on a wide range of energy-dense, low-nutrient foods, and a subsidy for healthy food, making it the most comprehensive policy to incentivize healthy diets in the U.S.

The Navajo Nation is the largest Native American reservation in the U.S., consisting of roughly 27,000 square miles, which makes it larger than ten states. [1]It spans northeast Arizona, northwestern New Mexico, and southeastern Utah. The Navajo Nation has approximately 350,000 enrolled members, approximately half of whom live on the tribal lands. They refer to themselves as Diné or "The People."

In general, American Indian and Alaska Native (AIAN) individuals experience a variety of health challenges relative to non-Hispanic whites in the U.S.; for example, they have the lowest life expectancy of any racial/ethnic group in the U.S., which is 7 years shorter than that of non-Hispanic whites: 71.8 versus 78.8 (Arias et al., 2021). In 2023, the prevalence of obesity was 22% higher among AIAN adults than the general population: 40.9% vs 33.4% (Office of Minority Health, 2026). Infant morbidity and mortality, and maternal conditions like gestational diabetes are more common among AIAN individuals than among non-Hispanic white individuals (Stotz et al., 2020; Palacios and Portillo, 2009). In 2022, the rate of infant mortality was twice as high among AIAN infants than white infants: 9.06 compared to 4.52 per 1,000 infants (Ely and Driscoll, 2024). High birth weight or fetal macrosomia (weighing more than 4000g at birth) which is related to maternal diabetes, weight and weight gain, is more common among AIAN mothers than any other racial/ethnic group (Palacios and Portillo, 2009; Dennis, 2019). In contrast, the rate of low birth weight is only slightly higher for AIAN births than for white births (Dennis, 2019).

The USDA classifies much of the Navajo Nation as a food desert, defined as having low access to healthy food. In addition, many residents of the Navajo Nation are food insecure, which is defined by the USDA as "the disruption of food intake or eating patterns because of lack of money and other resources" (Coleman-Jensen et al., 2014). Approximately

[1]Its geographic size is in between that of West Virginia and South Carolina.

three-quarters of Navajo Nation residents experience some level of food insecurity, which is the highest rate of food insecurity ever found for any racial/ethnic group in the U.S. (Pardilla et al., 2014). A reservation-wide study of the Navajo Nation in the 1990s that used oral glucose tolerance testing found a prevalence of diabetes among adults of 22.9%, which is four times higher than that of the U.S. as a whole (Will et al., 1997). Evidence from CDC survey data for all Native Americans since then suggests that the prevalence of diabetes has risen by 26.9% (Jernigan et al., 2010). The Navajo Nation's health survey, modeled on the Behavioral Risk Factor Surveillance Survey, collects information on self-reported weight and height; based on that, Navajo Nation residents have an average BMI of 30.1, and 47.4% have obesity (Francisco et al., 2017). Nearly 1 in 5 adults in the Navajo Nation report having been diagnosed with diabetes and another 11.3% with prediabetes or borderline diabetes (Navajo Nation Health Survey, n.d.).

Motivated by a concern about poor diets and the resulting chronic disease, the Navajo Nation Council enacted fiscal policy to improve diets (Eddie et al., 2022), which consisted of two steps:

1. Healthy foods and drinks (including fresh fruits, fresh vegetables, nuts, seeds, nut butters, and water) were exempted from sales tax, which was initially 5% but increased to 6% in 2018. The tax exemption took effect October 1, 2014.

2. Foods and drinks of minimal-to-no nutritional value (including soda, energy drinks, sweetened tea, candy, cookies, baked goods, ice cream, pudding and gelatins, and chips) were taxed an additional 2% on top of the sales tax. This took effect April 1, 2015.

Together, they are collectively referred to as the Healthy Diné Nation Act (HDNA), and create a price wedge between a wide range of healthy and unhealthy foods of 7% from 2015 until mid-2018 and 8% since mid-2018.

It is useful to situate the HDNA within the broader U.S. policy landscape. The Supplemental Nutrition Assistance Program or SNAP (Almond et al., 2011; Bitler et al., 2020) has

experimented with subsidies for healthy foods. The USDA's Healthy Incentives Pilot (HIP), for instance, offered a 30 percent subsidy on fruits and vegetables and significantly increased produce purchases among SNAP households (Klerman et al., 2014). Local and nonprofit initiatives, such as Double Up Food Bucks, have also demonstrated that dollar-matching schemes can expand fruit and vegetable consumption among low-income families (Young et al., 2013). Building on these successes, Congress authorized the Food Insecurity Nutrition Incentive (FINI) program and its successor, the Gus Schumacher Nutrition Incentive Program (GusNIP), scaling produce subsidies nationally (Vericker et al., 2021). In contrast, U.S. agricultural subsidies have often been criticized for lowering the relative prices of inputs like corn and soy that feed into processed foods and sugar-sweetened beverages (Alston et al., 2008). These food and agriculture policies also relate to a broader economics literature on the design, incidence and effectiveness of nutritional assistance (Hoynes and Schanzenbach, 2012, 2015).

There has been limited research on the effects of the HDNA. Store audits suggest that healthy produce became more widely available over time, and at lower prices (George et al., 2021). Revenue from the tax on unhealthy food items decreased an average of 3% per year between 2016 and 2019 (Yazzie et al., 2020); however, it is unclear to what extent this decline in purchases in the Navajo Nation may have been offset by cross-border shopping. These store audit and tax revenue findings are the only available insights into the consumption response to the HDNA. The commercial scanner and household panel datasets typically used to estimate the first-stage effects of these taxes on purchases offer little coverage of the Navajo Nation. As a result, our estimates should be interpreted as reduced-form, intent-to-treat effects of the policy on health.

The outcomes of interest in this paper relate to the health of newborns and mothers. One motivation for the HDNA was that nearly one-third of Navajo pregnancies were complicated by maternal overweight or obesity (Navajo Nation, 2014). Excessive weight gain during pregnancy (known as gestational weight gain) has been linked to increased risk of gestational

hypertension, gestational diabetes, and delivery complications (Institute of Medicine, 2009; Godfrey et al., 2017; Black et al., 2013). At the other extreme, inadequate maternal nutrition and insufficient weight gain during pregnancy are strong predictors of low birth weight, preterm birth, and adverse long-term health outcomes among children (Victora et al., 2008; Black et al., 2013). Gestational weight gain is considered to be a modifiable risk factor in prenatal care, and there are recommended guidelines for weight gain based on pre-pregnancy weight to lead to healthy maternal and infant birth outcomes (Institute of Medicine, 2009).

We examine CDC birth certificate data for 2010–2018; i.e. for more than 4 years before to 3 years after the two components of the HDNA. We estimate difference-in-difference models and event studies that estimate the effect of the HDNA on a variety of health outcomes for both infants (e.g. birth weight, premature birth) and mothers (e.g. pre-pregnancy weight of mother, pregnancy-related weight gain, and gestational diabetes). The treatment group consists of mothers whose self-reported race is American Indian or Alaska Native (AIAN) and who live in the counties of the Navajo Nation. The primary comparison group consists of mothers whose self-reported race is also AIAN and who also reside in counties that include a reservation or tribal lands, but who live outside the three states that include the Navajo Nation (AZ, NM, UT). We hypothesize that the HDNA, given that it was designed to promote healthy diets, improved maternal and infant health outcomes. As discussed above, the fetal origins literature implies that changes in maternal nutrition during pregnancy are a plausible channel for effects on these outcomes.

It is reasonable to ask whether the HDNA's 7-8% price wedge is large enough to have detectable effects on these health outcomes. In general, studies of beverage and food taxes more commonly estimate their impact on prices, purchases, or sales - consumption and health outcomes are rarer (Cawley and Frisvold, 2023; Pineda et al., 2024). There is consistent and strong evidence that food and beverage taxes raise prices and decrease purchases or sales of the taxed items (Cawley and Frisvold, 2023; Pineda et al., 2024). Two studies that did examine health outcomes are particularly relevant. The 8% tax on nonessential foods

in Mexico (which is similar to the price wedge created by the HDNA) was estimated to reduce purchases by 5.1%, which in turn was estimated, in microsimulation models, to have reduced youth overweight by 1.7 ppts and youth obesity by 0.4 ppts (Illescas-Zárate D and T, 2021). Another study estimated the impact of SSB taxes in 5 U.S. cities on perinatal complications (Jackson et al., 2023), using a difference-in-differences approach that compared births in the taxing cities to those in other cities in the same Census Divisions or states. They estimated that these SSB taxes had large effects—a 2.2 percentage point (or 41.4%) reduction in gestational diabetes, a 7.9% reduction in weight-gain-for-gestational-age z score, and a 4.3 percentage point reduction in infants born small for gestational age.

To our knowledge, no previous study has estimated the impact of the HDNA on birth outcomes in the Navajo Nation. In contrast to the sizeable effects of Mexico's nonessential food tax and city-level SSB taxes, we find that the HDNA had no detectable effect on the maternal and infant health outcomes we examine. The few statistically significant estimates are opposite in sign to the hypothesis that the HDNA improved diet, and they are not robust to inference that accounts for the small number of treated clusters or the number of outcomes tested. The comprehensive nature of the HDNA, as well as the prevalence of diet-related chronic disease and maternal and infant health conditions among the Navajo Nation population, make this an important contribution to the evidence base.

2 Data

We examine data on infant and maternal health outcomes from the Center for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS) restricted-use natality files. Data available to us spanning 2010 to 2018 are used in this analysis, providing more than 4 years before to more than 3 years after the implementation of the HDNA.[2]

To define the treated group exposed to the HDNA, we identify mothers who self-report

[2]Our data extend through 2018, providing more than three post-implementation years while ending well before the Covid-19 pandemic.

their race as American Indian or Alaskan Native (AIAN), and whose county of residence is in the Navajo Nation. We observe 44,308 births in the treatment group. Because these counties extend beyond reservation boundaries and birth certificates do not record tribal enrollment, some treatment-group mothers likely faced limited exposure to the HDNA; our estimates are therefore intent-to-treat effects, attenuated relative to the effect on fully exposed residents.

Our primary control group is births to mothers who self-identify as AIAN and who reside in states outside of Arizona, New Mexico, and Utah and in counties where there is tribal land or a reservation. We observe 142,754 such births.

As a robustness check, we also use two alternate control groups. The second control group is births to mothers who self-identify as AIAN and who reside in states outside of Arizona, New Mexico, and Utah, but we do not impose the requirement that they reside in a county with tribal land or reservations. There are 315,342 births in this second control group. The third control group is births to mothers and fathers who are not AIAN who reside in Arizona, New Mexico, and Utah but outside the counties constituting the Navajo Nation. This is the set of births to non-Native Americans who live near the treatment group. We observe 1,311,945 births in this third control group.

The outcomes related to maternal health include pre-pregnancy weight in pounds, weight gain during pregnancy in pounds, gestational diabetes, and gestational hypertension. The outcomes related to infant health include birth weight in grams and as well as indicators for low birthweight (<2500 grams), very low birthweight (<1500 grams), healthy birthweight (1500–4000 grams), and high birthweight (>4000 grams). We also examine the effect on premature births by examining the impact on weeks of gestation and indicators for extremely premature (<28 weeks), very premature (28–31 weeks), moderately premature (32–36), premature to any extent (<37 weeks), and full-term (>37 weeks). We also examine the probability the infant has an abnormally low Apgar score (i.e. <7).

3 Methods

We estimate difference-in-differences models of the impact of the Navajo Nation's Healthy Diné Act on the health outcomes of infants and mothers. Our primary regression specification seeks to separately estimate the two parts of the HDNA: the tax cut on healthy foods effective October 2014 and the tax increase on unhealthy foods effective April 2015:

$$Y_{ist} = \beta_0 + \beta_1 \,\text{Treat}_i \times \text{PostOct2014}_t + \beta_2 \,\text{Treat}_i \times \text{PostApr2015}_t + X_i\delta + \gamma_t + \lambda_s + \varepsilon_{ist} \quad (1)$$

where the coefficients of interest are β_1 (effect of the tax cut on healthy foods) and β_2 (effect of the tax hike on unhealthy foods). These two coefficients are differentiated only by the data for October 2014 – March 2015, when only the first but not the second part of the policy was in place. Because this window is short, the decomposition is imprecise, and we treat the combined-policy model in equation (2) as the primary basis for inference.

The dependent variables Y_{ist} are the health outcomes of the mother and infant. We include a vector of controls, X_i, which include maternal age and its square, and indicator variables for parity, gestational age in months (these are omitted when gestational age is the outcome), whether birth was by Caesarian section as opposed to a vaginal birth, whether the birth took place in a hospital, plurality, and race. γ_t is a month-year fixed effect and λ_s is a state fixed effect.

As robustness checks, we re-estimate the models controlling for a wider variety of factors, some of which are endogenous (which is why they are excluded from the main model): marital status, payer type (i.e. type of insurance coverage), education, use of cigarettes, WIC receipt, and when prenatal care began. We estimate the same model for the two alternate control groups as robustness checks, and we re-estimate the model using inverse propensity score weights to match the control group to the treated group for better covariate balance. We also explore heterogeneity by WIC status by including an interaction term for

$\text{Treat}_i \times \text{PostOct2014}_t \times \text{WIC}_i$ and $\text{Treat}_i \times \text{PostApr2015}_t \times \text{WIC}_i$.

In addition to the primary model which differentiates the effects of the two parts of the HDNA (tax cut for healthy food and tax hike on unhealthy food), we also estimate a model that has only a single treatment effect for when both parts of the policy were in place (after April 2015). When estimating this model, we drop the six months during which only the first part of the policy was in place (October 2014 and March 2015).

$$Y_{ist} = \beta_0 + \beta_3 \,\text{Treat}_i \times \text{PostApr2015}_t + X_i\delta + \gamma_t + \lambda_s + \varepsilon_{ist} \tag{2}$$

The coefficient of interest is β_3 (effect of both the tax cut on healthy foods and the tax hike on unhealthy foods).

The difference-in-difference model relies on the parallel trends assumption: that, in the absence of the HDNA, the time trend in the outcomes would have been the same for the treatment and control group. While one can never observe the counterfactual (what would have happened if the treatment had never occurred) one can test whether the two groups had parallel trends prior to the treatment and whether there is evidence of anticipation of the coming treatment prior to the effective date of the policy. We estimate event studies in order to investigate the identifying assumptions. The event studies are also useful for looking at the dynamics of treatment effects after the HDNA was implemented.

Many mothers and infants in the treatment group are exposed to the policy for none of the pregnancy (for births prior to HDNA implementation) or for the entire pregnancy (for births 9 or more months after HDNA implementation). However, within 9 months of implementation there are infants and mothers who are exposed to the HDNA for only a fraction of the pregnancy. To investigate whether a dose-response effect between exposure to the policy and health outcomes exists, we estimate an additional model, in which the regressor of interest is the number of months of exposure to the HDNA during the gestational period.

$$Y_{ist} = \sum_{m} \beta_m \cdot \mathbf{1}[\text{months exp} = m] + X_{it}\delta + \lambda_t + \gamma_c + \varepsilon_{it} \tag{3}$$

Where β_m measures the association of the outcome with exposure to the policy for m months, where m ranges from 0 to 11. Note that for $m = 1$ through 6, exposure is solely to the tax cut, but for $m = 7$ through 11, exposure is to both the tax cut for healthy food and the tax hike for unhealthy food. For this dose-response model, we limit the data from October 2012 to October 2016; i.e. from two years before to two years after the first part of the policy was enacted in October 2014. The set of regressors, X_i is the same as in the earlier difference-in-difference models.

Because treatment is assigned at the county level (we identify births to women in counties of the Navajo Nation), we cluster standard errors on county throughout the primary specification and other model specifications. However, inference is complicated by the fact that the Navajo Nation spans only nine counties, so the number of treated clusters is small. With few treated clusters, conventional cluster-robust standard errors can understate uncertainty. We supplement our main specification standard errors with two forms of permutation-based inference. First we conduct randomization inference where we hold the number of treated clusters fixed, reassign treatment at random across all clusters (999 iterations), re-estimate the model, and compute the share of placebo coefficients at least as large in magnitude as the estimate. We also implement the placebo inference procedure of Conley and Taber (2011) which is designed for difference-in-differences with a small number of treated units. We assign a placebo policy to randomly selected control clusters that were never treated. We build a placebo distribution over 999 iterations and use this to compute the p-value and confidence interval. Because we examine seventeen outcomes, we also report p-values adjusted for multiple comparisons.

4 Empirical Results

4.1 Summary Statistics

Table 1 provides summary statistics for the treatment group (AIAN women living in the counties of the Navajo Nation) and the control group (AIAN women living outside the three states that are home to the Navajo Nation and in a county with a reservation or tribal lands). The table provides means for the two groups as well as the difference in means and the p-value and Cohen's D statistic associated with the hypothesis of equality of the two means. Figure 1 displays standardized differences using Cohen's D, with a threshold of 0.2 indicating imbalance. The greatest differences between the treatment and control group concern the frequency of missing data on the birth certificate. In addition, treatment group mothers are modestly less likely to be high school dropouts (1.6 ppts) and slightly more likely to have exactly a high school graduate education (1.4 ppts). More substantial differences are observed in payment types, as treated mothers are 19.4 ppts more likely to have births paid by Medicaid and 12.4 ppts less likely to be covered by private insurance. All of these differences are statistically significant. Delivery types (vaginal vs. Caesarian section), marital status, smoking during pregnancy, and father race also exceed the Cohen's D threshold of 0.2. [3]

4.2 Event Studies to Examine Parallel Trends Assumption

In order to visually examine the parallel trends assumption, we estimate event studies. Graphs are shown in Figure 2 (for infant birthweight outcomes), Figure 3 (for infant gestational age), Figure 4 (for abnormal Apgar), and Figure 5 (for maternal health outcomes). Each event study graph has two dashed red lines: the first indicates the timing of the tax cut on healthy foods, and the second the timing of the tax hike on unhealthy foods. Results differ by

[3] In an additional analysis, we use inverse propensity score weighting to match the treated and control groups on covariates, and our results are robust (see Table 25)

outcome (for example, there are outlier periods in Figure 3 for weeks gestation and Figure 5 for gestational diabetes), but in general there is no evidence of a secular trend in outcomes of the treatment group relative to the control group prior to the HDNA, which is consistent with the identifying assumptions of the DiD model.

4.3 Difference-in-Differences Models

We first estimate difference-in-differences models that estimate separate effects for the two parts of the policy. Results are provided in Table 2 (infant birth weight outcomes), Table 3 (gestational age outcomes), Table 4 (abnormal Apgar score), and Table 5 (maternal health outcomes). Our hypothesis is that the HDNA, by improving maternal diet and nutrition, improves health outcomes around birth for mothers and infants. To preview the results: across outcomes and specifications we find null effects on infant outcomes, with precision sufficient to rule out moderate or larger effects (see Section 4.4), and the few statistically significant coefficients are concentrated among maternal outcomes and carry the opposite of the hypothesized sign. After accounting for robust inference and statistical power, we find no robust evidence that the HDNA affected infant or maternal health. The few significant, wrong-sided coefficients do not survive more conservative inference, and our study is powered to rule out effects of moderate or larger magnitudes.

The point estimates in Table 2 suggest that both parts of the HDNA are associated with a slight reduction in birth weight: a reduction of 8.4 grams following the tax cut for healthy foods plus an additional 3.8 gram reduction following the tax hike on unhealthy foods; however, neither is statistically significant. Subsequent columns concern the infant being very low birth weight, low birth weight, healthy birth weight, or high birth weight. There was no detectable effect of the policy on the probability of any of those categorical outcomes.

Table 3 presents results for gestational age and preterm birth categories. The tax hike on unhealthy foods was associated with a 0.054 week decrease in gestational age, roughly one-third of a day against a mean of 38.5 weeks; while statistically significant, an effect of this

size is clinically negligible, and there is no detectable impact on any category of preterm birth. The event studies in Figure 3 show no corresponding break in trend at either implementation date.

Table 4 shows no detectable effect of either component of the HDNA on the probability of an abnormally low Apgar score. The point estimates of 0.4 and 0.1 ppts are small relative to the mean of 2.8 percent, and the power analysis in Appendix Part 6 indicates we can rule out effects larger than 0.8 ppts, so the data are informative about the absence of moderate or large effects on this summary measure of newborn health.

Table 5 turns to maternal health, where the results depart from the pattern of precise nulls. The tax cut on healthy foods has no detectable effect on gestational diabetes, gestational hypertension, pre-pregnancy weight or pregnancy-related weight gain. The tax hike on unhealthy foods, however, is associated with a 2.6 ppt increase in the probability of gestational diabetes, a 37 percent increase relative to the mean of 7.0 percent, and a 1.4 pound increase in pre-pregnancy weight. Both estimates are opposite in sign to the hypothesis that the HDNA improved maternal diet. In Section 5, we interpret this result and consider the role of chance given the number of outcomes examined, income effects of the tax, and the possibility that the gestational diabetes result reflects increased detection rather than incidence. In Section 4.9 we show that although the gestational diabetes estimate survives placebo inference, it does not survive correction for testing seventeen outcomes.

We also estimated models that estimate a single effect of the combined policy; these models exclude the months October 2014 – March 2015, which is when only the first part of the policy was in place. The results are presented in Tables 6–9.

The pattern mirrors the two-coefficient model: infant birth weight, preterm, and Apgar outcomes show no detectable effects, apart from a marginal 0.2 ppt increase in very low birth weight (significant at the 5% level) that is consistent with chance given the number of outcomes examined, and a 0.069 week reduction in gestational age with no corresponding change in any preterm category. The maternal estimates are slightly larger than in the

two-coefficient model: a 2.8 ppt increase in gestational diabetes and a 1.78 pound increase in pre-pregnancy weight, both significant at the 5% level or better and again opposite in sign to expectation.

We also estimate dose-response models that examine how the number of months of exposure to the HDNA is associated with outcomes, where 0 months exposure is the omitted reference category. Graphs of these results are presented in Figure 6 for infant birthweight, Figure 7 for abnormal Apgar, and Figure 8 for maternal outcomes. These models require an important caveat. Because exposure is accumulated in-utero, the number of months of policy exposure is equal to the smaller of the two quantities: the length of gestation and the number of months the HDNA had been in effect at the time of the birth. A birth can fall into the lower-exposure number of months for one of two reasons: either the policy had just taken effect or the pregnancy itself was short (a preterm birth). Months of exposure is thus correlated with gestational age, so outcomes that are also correlated with gestational age may show significant effects. We thus interpret these results cautiously and find no clear dose-response relationship. In Figure 6 for infant birthweight, there does not appear to be a dose-response relationship between months of exposure and the outcomes. Birthweight in grams does not appear to be significantly related to the exposure to the policy, except for those who have only 4 months of exposure or 11 months of exposure, which is more likely an artifact of gestational age than policy exposure. In Figure 7, there is no evidence of a dose-response relationship between exposure to the HDNA and the probability of an abnormally low Apgar score. In Figure 8, there is also no evidence of a dose-response relationship for maternal health outcomes, other than the pre-pregnancy weight after month 8, which—similar to the gestational age outcomes—may be more related to the correlation between higher weight individuals and longer gestational periods. For gestational hypertension, which is linked to higher risk of preterm birth, the increase in the likelihood of gestational hypertension at 6 months of policy exposure may also be driven more by the gestational age than the policy exposure.

4.4 Statistical Power and Minimum Detectable Effects

Because most of our estimates are statistically insignificant, we conduct a simulation-based power analysis to determine what magnitude of effects our data can detect so that the null results can be interpreted appropriately. Using a cluster bootstrap that resamples counties and adds a hypothesized treatment effect to treated post-period observations, we compute the minimum detectable effect (MDE) for each outcome—the smallest effect detectable with 80% power at the 10% level. Full results are reported in Appendix Part 6, Table 34. The analysis indicates that the study is powered to detect moderate but not very small effects. For several outcomes, our point estimates are smaller in magnitude than the corresponding MDEs. These insignificant results should be read as ruling out large policy impacts rather than establishing the absence of any effect. For other outcomes like gestational diabetes and pre-pregnancy weight, the study is powered to detect effects of the magnitude of our point estimates.

4.5 Robustness Check 1: Richer Set of Covariates

In the primary models estimated above, we limited the set of regressors in the model to those that are strictly exogenous; specifically: maternal age and its square, and indicator variables for parity, gestational age in months (omitted when gestational age is the outcome), whether birth was by Caesarian section as opposed to a vaginal birth, whether the birth took place in a hospital, plurality, race, month-year fixed effects and state fixed effects.

As a robustness check, we re-estimate the models controlling for a wider variety of factors, some of which are endogenous and thus excluded from the main model: marital status, payer type (i.e. type of insurance coverage), education, use of cigarettes, WIC receipt, and when prenatal care began. The results, which are presented in the Appendix in Tables 10–13, are extremely similar to the main results.

4.6 Robustness Check 2: Alternative Control Groups

In the primary models estimated above, the control group consists of births to mothers who self-identify as AIAN and reside in counties with reservations or tribal lands in states outside of Arizona, New Mexico, and Utah. As another robustness check, we re-estimate the models using alternative control groups. The second control group is births to mothers who self-identify as AIAN and who reside in states outside of Arizona, New Mexico, and Utah, but we do not impose the requirement that they reside in a county with tribal land or reservations. This includes a broader set of births to Native American women nationwide. There are 315,342 births in this second control group. Results are provided in the Appendix, with summary statistics in Table 14, DiD results in Tables 15–18, and event study graphs in Figures 10–13. The results are very similar to the main results, with the exception that in Table 15, we now see a reduction in birth weight associated with each of the two parts of the HDNA, though not a change in the probability of any category of birth weight.

The third control group is births to mothers and fathers who are not AIAN who reside in Arizona, New Mexico, and Utah but outside the counties constituting the Navajo Nation. This allows us to compare our treatment group to other births happening in the same states, but to non-Native-Americans. We observe 1,311,945 births in this third control group. Results are provided in the Appendix, with summary statistics in Table 19, DiD results in Tables 20–23, and event study graphs in Figures 14–17. These results are also very similar to the main results, with the exception that, as for the second control group, we see a reduction in birth weight associated with each of the two parts of the HDNA. In addition, the first part is associated with a 0.6 ppt reduction in the probability of the baby being high birth weight and the second part being associated with a 1.0 ppt increase in the probability that the baby is low birth weight.

Overall, the results of the primary model are robust to the inclusion of a richer (though endogenous) set of regressors and to the use of alternative control groups of interest.

4.7 Robustness Check 3: Propensity Score Matching

Because of the observed imbalance in certain characteristics between the treated group and our preferred specification of the control group of AIAN moms in counties with reservations outside of AZ, NM, and UT, we use inverse propensity score weights to match the treated and control group. The weights come from a logit model of maternal age, parity, education, marital status, insurance status, and WIC status. The balance between the treatment group and the reweighted control group is shown in Appendix Table 25. In general, the reweighted control group is similar with respect to the treated group as observed by the Cohen's D statistics being within the 0.2 threshold.

The results from the reweighted model are very similar to our main specification. The direction and significance of the estimates are nearly identical. For birthweight and Apgar outcomes, the results are not significant and consistent. For gestational age, both models indicate a modest but consistent decrease of about 0.04 to 0.05 weeks. For maternal health, the estimate from the reweighted model is a 2.4 percentage point increase compared to 2.6 percent points for the main specification, both of which are statistically significant. Overall, our findings are robust to the reweighting of the control group.

4.8 Robustness Check 4: WIC Status

We also allow the effect of the HDNA to vary by maternal WIC participation by adding triple interactions $\text{Treat}_i \times \text{Post}_t \times \text{WIC}_i$, so that the $\text{Treat}_i \times \text{Post}_t$ coefficients capture the effect among non-WIC mothers and the triple interactions capture the differential effect among WIC participants. Results are reported in the Appendix in Tables 30–33. There is limited evidence of heterogeneity by WIC status. For infant birthweight, the interactions are generally insignificant, except for a marginally significant reduction in birthweight among WIC participants following the tax cut (at the 10% level). For gestational age, a few interactions are significant but all are extremely small in magnitude, and based on our power analysis (see Table 34), we likely do not have the power to detect effects of this size. For abnormal Apgar,

the interaction is positive and significant following the tax cut, but it does not persist into the April 2015 period. For maternal pre-pregnancy weight, WIC participants show statistically significant relative reductions in both periods, partially offsetting the positive base effect. Overall, allowing the effects to vary by WIC participation does not change the conclusions from our main analysis.

4.9 Robustness Check 5: Inference with Few Treated Clusters, Multiple Testing, and Placebo Inference

Because our treated group contains only nine counties, and because we examine seventeen outcomes, we assess whether the few statistically significant estimates from our primary models are robust to more conservative inference. We report the full results in Appendix Part 7. With randomization inference, the estimates for weeks of gestation and pre-pregnancy weight are no longer statistically significant (p-values of approximately 0.55 for both). The estimate for gestational diabetes remains significant at the 5% level. Adjusting for multiple comparisons across the seventeen outcomes, we find that none of the Post-April 2015 estimates survive the false discovery rate control, which is consistent with the roughly one false positive expected by chance under a global null. Using placebo inference from Conley and Taber (2011) for difference-in-differences with few treated clusters finds similar results—gestational diabetes remains statistically significant but the estimates for weeks of gestation and pre-pregnancy weight are no longer significant. Together, these checks indicate that the few statistically significant coefficients are not robust to inference that accounts for the small number of treated clusters and the number of outcomes examined, reinforcing our interpretation of null results.

4.10 Robustness Check 6: Medicaid Expansion

Because our sample period (2010–2018) overlaps with the Affordable Care Act's Medicaid expansions, which took effect in 2014 in many states, we assess whether our estimates are confounded by Medicaid expansion. Appendix Table 38 reports the Post-April 2015 estimates under three alternatives to the baseline: adding a state Medicaid expansion indicator, and restricting the comparison group to expansion states only and non-expansion states only. The three states containing the Navajo Nation differ in expansion status as Arizona and New Mexico both expanded Medicaid effective January 1, 2014, while Utah did not expand until after our study window. The estimates are stable across the specifications, indicating that differential Medicaid expansion does not drive the results.

5 Discussion

This paper estimates the effect of the Navajo Nation's Healthy Diné Nation Act (HDNA), which exempted healthy foods from a 5% (later, 6%) sales tax and imposed a 2% additional sales tax on unhealthy foods, creating a price wedge between healthy and unhealthy foods of 7% (later, 8%). One of the goals of taxing SSB and calorie-dense foods is to reduce consumption by increasing the prices, thus improving health and reducing health-related expenses. The HDNA is noteworthy for being one of the most comprehensive fiscal policies to promote healthy diets in the world.

We estimate the impact of the HDNA on a variety of related health conditions for newborns and mothers. By doing so, our study adds to the relatively limited U.S. evidence on the health effects of food-related fiscal policies. Whereas SNAP incentive evaluations have demonstrated increases in fruit and vegetable purchases, there is little evidence on downstream health outcomes, and almost no work on tax–subsidy combinations. In contrast to a previous study of SSB taxes (Jackson et al., 2023), which found that city-level SSB taxes in the U.S. led to large and significant reductions in gestational diabetes, reductions in maternal weight gain

during pregnancy and a decrease in the probability of the newborn being small (in terms of birth weight) for gestational age, we do not find improvements in health for mothers or infants after the HDNA. In general, we cannot reject the null hypothesis of no effect, and in the rare cases in which the coefficients are statistically significant, they tend to be of the opposite sign—for example, when we estimate models with a single treatment indicator for both parts of the HDNA, the policy is associated with an increase in the probability of very low birth weight and an increase in the risk of gestational diabetes and an increase in pre-pregnancy weight for the mother. None of these significant estimates are robust to inference that accounts for the small number of treated clusters or correction for multiple testing (Appendix Part 7), reinforcing that we find no robust evidence of an effect of the HDNA on maternal or infant health.

We now consider further points to investigate the question of why the HDNA policy had no detectable effects, or perhaps the opposite effect intended. One relevant question is: to what extent were consumers aware of the policy? The HDNA's passage was preceded by sustained grassroots advocacy, especially from the Diné Community Advocacy Alliance (Eddie et al., 2022). The Navajo Times and Indian Country Today ran news and opinion pieces as the policy was debated, vetoed, and passed, and reported on local reactions when the tax took effect (Begay, 2014; Foxworth, 2013; Abrahamson-Richards, 2013; ICT Staff, 2013; Landry, 2014; ICT Staff, 2014b; Saunders, 2014; ICT Staff, 2014a; Navajo Times, 2014, 2015). National and regional media coverage described the law as historic, with the Associated Press, Time, NPR, and The Guardian reporting that it was the first junk food tax in the United States and could serve as a model for other communities (Fonseca, 2014; Morales, 2015; Barclay, 2015b,a; The Guardian, 2014). Evidence suggests there was widespread community support and understanding of the HDNA. A survey administered in 2018 involving the Navajo Epidemiology Center found that approximately two-thirds of respondents knew the law at least "moderately well" (Curley et al., 2023). The same study found that 85% of the community supported or were neutral towards the HDNA (Curley et al., 2023). Collectively,

this suggests that consumers were aware of the HDNA.

Another potential factor is implementation of the HDNA. According to an evaluation in 2019 by the Navajo Epidemiology Center, 87% of surveyed stores were properly taxing unhealthy foods but only 55% were exempting healthy foods from the sales tax (Navajo Epidemiology Center, 2019). Because we are unable to study the first-stage consumption response, we cannot examine the purchasing responses or if there were uneven responses to the tax and subsidy at certain retailers. However, this point-in-time evidence on the limited implementation of the HDNA subsidy suggests that not all consumers were exposed to the healthy alternatives subsidy. In this case, there may have been limited incentive to purchase healthier alternatives, and the two-part instrument may not have been effective.

It may be that, among Navajo Nation consumers, the demand for taxed foods is relatively price inelastic, leading to limited changes in purchases or diets. Another potential factor is cross-border shopping. It is estimated that more than half of residents shop for groceries off the Navajo Nation (Landry, 2015). Qualitative evidence from focus groups suggests that factors influencing this cross-border shopping include lower prices and greater availability and quality of fresh foods (Nicholson, 2018). Tax revenue from the HDNA decreased from 2015 to 2019; this could be due to either consumers buying less of the taxed unhealthy items, or due to increased cross-border shopping. Studies of city-level SSB taxes have found some evidence of increased cross-border shopping in response to the tax (see, e.g. Cawley and Frisvold, 2023). The distances involved are likely much greater for the reservation-level HDNA than a city-level tax, but the scope for savings is higher given the larger number of food and beverages subject to the tax. These findings also resonate with the broader tax incidence literature, where market structure and consumer mobility determine whether intended relative price wedges translate into behavioral change (Poterba, 1996; Finkelstein, 2009). In the case of the Navajo Nation, limited retail coverage and easy access to off-reservation shopping may have muted the effective incidence of the policy.

In our study, we also find that a few estimates are of the opposite sign and statistically

significant. This is most likely spurious and due to chance: across the seventeen outcomes we examine, roughly one significant result would be expected by chance under a global null hypothesis. We also find that the marginally significant coefficients are not robust to randomization or placebo inference, and none are robust to false discovery rate correction. Another possible explanation relates to the income effect of the tax hike on unhealthy items—reduced low-income residents' purchasing power may have itself worsened their health. Alternatively, for middle-income residents, the tax could have led to a shift away from food at home (prepared using groceries) and toward food away from home (prepared at restaurants), and the latter may be more energy-dense.

Limitations of this study include that we do not observe individuals' food purchases or consumption. The control group of AIAN families living in counties with reservations or tribal lands but outside of Arizona, New Mexico, and Utah may not be the optimal control group for the AIAN families living on the Navajo Nation. While our treated group includes women who are AIAN and live in Navajo Nation counties, we are not able to directly observe tribal membership in the birth certificate data. However, our results are robust to matching the control group using inverse propensity score weighting and different specifications of the control group. More generally, situating our null findings alongside the economics of sin taxes and subsidies emphasizes that institutional context—salience, enforcement, and consumer alternatives—may be as important as statutory design in shaping outcomes. Taken together, the power analysis in Appendix Part 6 indicates that our design can rule out moderate-to-large effects of the HDNA across these outcomes, but is not powered to exclude small effects; our null findings should be read accordingly. Despite these limitations, the comprehensive nature of the HDNA and the high prevalence of chronic disease and food insecurity on the Navajo Nation, make this the setting in which fiscal diet policy had a plausible chance to show detectable health effects; however, we find none, with power to rule out effects of the size reported for city SSB taxes.

Finally, by focusing on birth outcomes, our study connects food tax policy to the economics

of early-life health and long-run human capital formation (Almond and Currie, 2011; Currie and Rossin-Slater, 2015). That literature shows how even modest nutritional shocks can have durable impacts on children's trajectories. Notably, the strongest quasi-experimental evidence in this literature, from the end of U.K. sugar rationing, reflects a large restriction in sugar exposure sustained over the first 1,000 days after conception (Gracner et al., 2024); the consumption change induced by a 2 percentage point tax over a portion of a single pregnancy is far smaller on both margins. Although we do not find such effects here, our results highlight the limits of fiscal policy in settings with high poverty and food insecurity, and suggest that complementary policies may be needed to translate fiscal incentives into measurable health gains.

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Table 1: Summary statistics comparing Treated Group and Control Group of Births to AIAN Moms Outside of AZ, NM, UT

Variable	Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Prenatal Care	1.548	1.546	-0.001	0.821	-0.001
Number of Prenatal Visits	9.590	9.504	-0.086	0.000	-0.020
Smoked During Pregnancy	0.207	0.021	-0.186	0.000	-0.507
Mother's Age	25.737	26.382	0.645	0.000	0.111
Married	0.330	0.219	-0.111	0.000	-0.243
Medicaid	0.638	0.831	0.194	0.000	0.420
Private Insurance	0.197	0.073	-0.124	0.000	-0.331
Self Pay	0.020	0.009	-0.012	0.000	-0.087
Indian Health Service	0.070	0.072	0.003	0.081	0.011
Other Payment	0.076	0.015	-0.061	0.000	-0.250
WIC	0.644	0.628	-0.016	0.000	-0.034
Vaginal Delivery	0.681	0.798	0.117	0.000	0.259
C-Section	0.319	0.201	-0.117	0.000	-0.260
1st Trimester Prenatal Care Started	0.578	0.457	-0.121	0.000	-0.245
2nd Trimester Prenatal Care Started	0.249	0.201	-0.047	0.000	-0.112
3rd Trimester Prenatal Care Started	0.092	0.073	-0.019	0.000	-0.067
No Prenatal Care	0.029	0.021	-0.007	0.000	-0.045
First Birth	0.329	0.314	-0.016	0.000	-0.034
Second Birth	0.268	0.246	-0.022	0.000	-0.051
Third Birth	0.188	0.187	-0.001	0.667	-0.002

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Variable	Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Fourth Birth	0.107	0.119	0.012	0.000	0.038
Fifth or Higher Birth	0.104	0.128	0.023	0.000	0.075
AIAN Father	0.332	0.651	0.318	0.000	0.674
Black Father	0.015	0.002	-0.013	0.000	-0.120
White Father	0.126	0.016	-0.110	0.000	-0.372
Asian/Pacific Islander Father	0.004	0.000	-0.003	0.000	-0.059
Missing Race Father	0.523	0.331	-0.192	0.000	-0.390
Unknown Pre-pregnancy Weight	0.051	0.246	0.195	0.000	0.687
Unknown Delivery Weight	0.044	0.239	0.196	0.000	0.715
Unknown Weight Gain	0.045	0.040	-0.005	0.000	-0.025
Unknown BMI	0.157	0.341	0.185	0.000	0.470
Unknown Gestational Hypertension	0.024	0.224	0.200	0.000	0.824
Unknown Birthweight	0.001	0.002	0.001	0.000	0.027
Unknown Prenatal Care	0.052	0.247	0.195	0.000	0.680
Unknown Number of Prenatal Visits	0.032	0.016	-0.016	0.000	-0.100
Unknown Smoked During Pregnancy	0.038	0.228	0.190	0.000	0.721
Unknown Delivery Type	0.000	0.000	0.000	0.989	0.000
Unknown Marital Status	0.023	0.000	-0.023	0.000	-0.178
Unknown Payment	0.031	0.253	0.222	0.000	0.853
Unknown Birth Order	0.003	0.006	0.003	0.000	0.057
Unknown WIC	0.047	0.246	0.200	0.000	0.716

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Variable	Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Less than High School	0.241	0.225	-0.016	0.000	-0.037
High School Graduate	0.362	0.375	0.014	0.000	0.028
Some College	0.236	0.277	0.041	0.000	0.095
Associate Degree	0.067	0.070	0.003	0.038	0.013
Bachelor's Degree	0.062	0.032	-0.030	0.000	-0.132
Graduate Degree	0.020	0.010	-0.010	0.000	-0.073
Unknown Education	0.012	0.011	-0.002	0.006	-0.016
Hospital Birth	0.992	0.995	0.004	0.000	0.044
Not in Hospital	0.008	0.004	-0.004	0.000	-0.044
Unknown Facility	0.000	0.000	-0.000	0.189	-0.006
Unknown Apgar	0.004	0.002	-0.002	0.000	-0.027
Single Birth	0.972	0.983	0.011	0.000	0.068
Multiple Birth	0.028	0.017	-0.011	0.000	-0.068

Table 2: DID Model of Infant Birthweight Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Birthweight Grams (Mean = 3324.432)	VLBW (Mean = 0.013)	LBW (Mean = 0.075)	Healthy BW (Mean = 0.825)	High BW (Mean = 0.1)
Treat x Post Oct 2014	-8.493	0.001	0.004	0.001	-0.004
	(5.424)	(0.002)	(0.005)	(0.007)	(0.004)
Treat x Post April 2015	-3.813	0.001	0.003	-0.005	0.002
	(7.274)	(0.001)	(0.003)	(0.006)	(0.005)
N	186651	186651	186651	186651	186651
SEs	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X
FE: State	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 3: DID Model of Infant Gestational Age Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Weeks of Gestation (Mean = 38.528)	Extremely Preterm (Mean = 0.007)	Very Preterm (Mean = 0.014)	Moderate Preterm (Mean = 0.116)	Preterm (Mean = 0.137)	Full Term (Mean = 0.863)
Treat x Post Oct 2014	0.026	0.002	-0.002	-0.006	-0.007	0.007
	(0.044)	(0.001)	(0.002)	(0.004)	(0.005)	(0.005)
Treat x Post April 2015	-0.054*	0.000	-0.001	-0.001	-0.001	0.001
	(0.023)	(0.001)	(0.002)	(0.005)	(0.005)	(0.005)
N	186651	186651	186651	186651	186651	186651
SEs	by: County	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X	X
FE: State	X	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 4: DID Model of Apgar Score Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Abnormal Apgar
	(Mean = 0.028)
Treat x Post Oct 2014	0.004
	(0.003)
Treat x Post April 2015	0.001
	(0.003)
N	186651
SEs	by: County
FE: Month-Year	X
FE: State	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 5: DID Model of Maternal Health Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Gest Diabetes	Gest Hypertension	Pre Preg Weight	Weight Gain
	(Mean = 0.07)	(Mean = 0.061)	(Mean = 168.283)	(Mean = 28.718)
Treat x Post Oct 2014	-0.009	0.004	0.077	-0.168
	(0.006)	(0.005)	(0.507)	(0.248)
Treat x Post April 2015	0.026*	0.002	1.452*	0.259
	(0.011)	(0.007)	(0.655)	(0.224)
N	173353	173353	173353	173353
SEs	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X
FE: State	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 6: DID Model of Infant Birthweight Outcomes Excluding Oct 2014–Mar 2015 with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Birthweight Grams (Mean = 3324.05)	VLBW (Mean = 0.013)	LBW (Mean = 0.075)	Healthy BW (Mean = 0.825)	High BW (Mean = 0.1)
Treat x Post April 2015	-10.960	0.002*	0.004	-0.003	-0.001
	(8.520)	(0.001)	(0.003)	(0.004)	(0.004)
N	176233	176233	176233	176233	176233
SEs	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X
FE: State	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 7: DID Model of Infant Gestational Age Outcomes Excluding Oct 2014–Mar 2015 with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Weeks of Gestation (Mean = 38.527)	Extremely Preterm (Mean = 0.007)	Very Preterm (Mean = 0.014)	Moderate Preterm (Mean = 0.115)	Preterm (Mean = 0.137)	Full Term (Mean = 0.863)
Treat x Post April 2015	-0.069**	0.000	-0.001	-0.001	-0.001	0.001
	(0.022)	(0.001)	(0.002)	(0.004)	(0.005)	(0.005)
N	176233	176233	176233	176233	176233	176233
SEs	by: County	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X	X
FE: State	X	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 8: DID Model of Apgar Outcomes Excluding Oct 2014–Mar 2015 with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Abnormal Apgar
	(Mean = 0.028)
Treat x Post Oct 2014	0.001
	(0.003)
N	176233
SEs	by: County
FE: Month-Year	X
FE: State	X

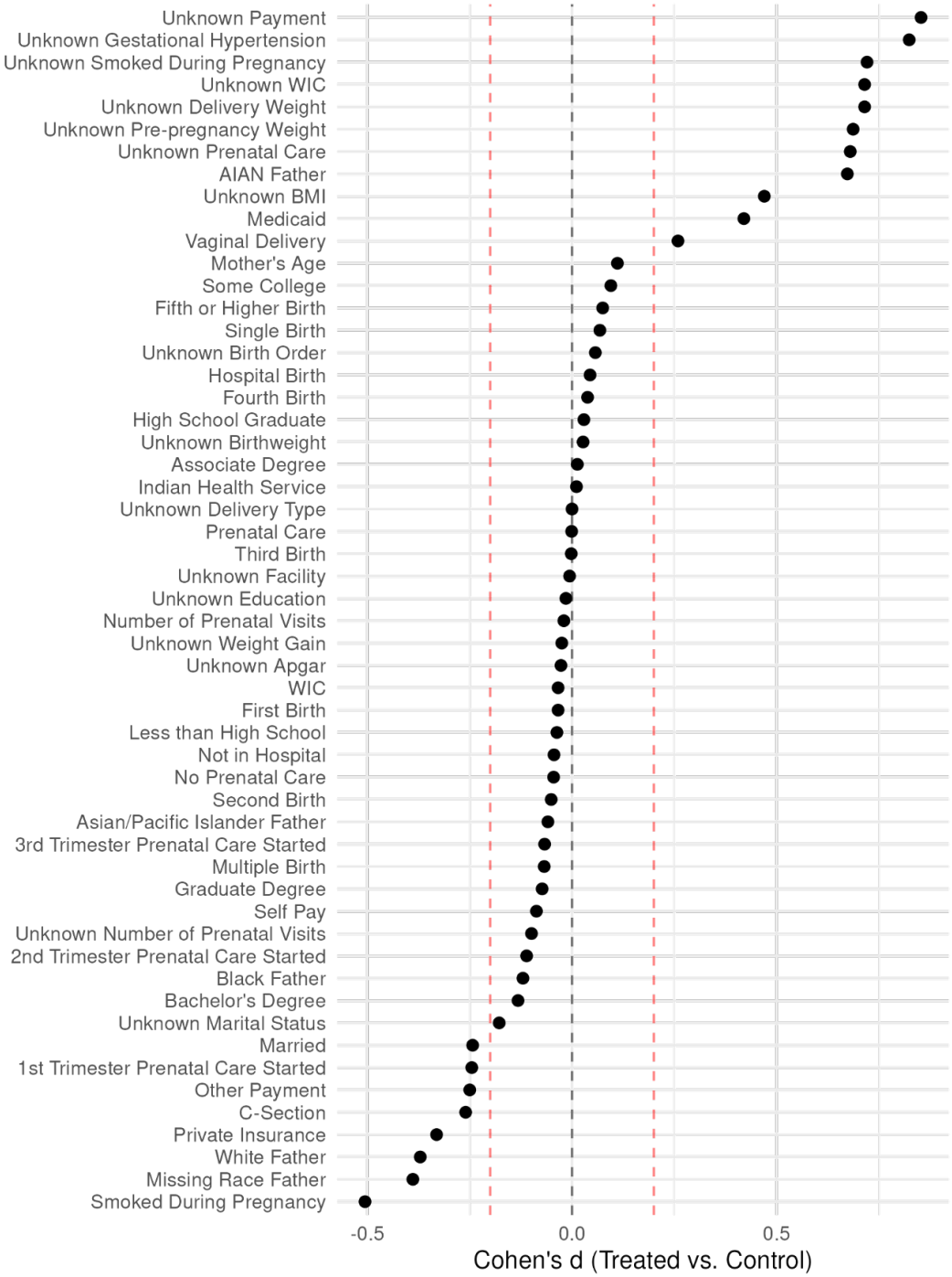
Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 9: DID Model of Maternal Health Outcomes Excluding Oct 2014–Mar 2015 with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Gest Diabetes	Gest Hypertension	Pre Preg Weight	Weight Gain
	(Mean = 0.069)	(Mean = 0.061)	(Mean = 168.272)	(Mean = 28.715)
Treat x Post April 2015	0.028*	0.006	1.784**	0.268
	(0.014)	(0.010)	(0.581)	(0.262)
N	162941	162941	162941	162941
SEs	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X
FE: State	X	X	X	X

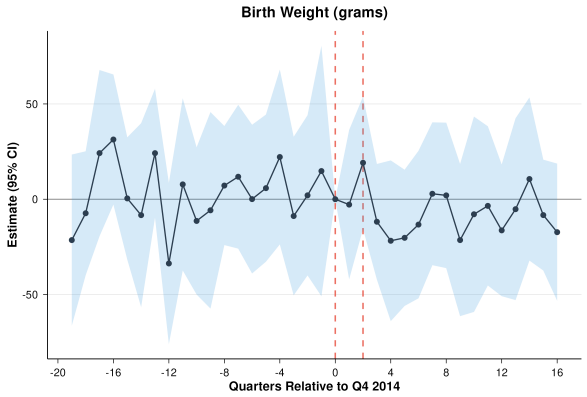
Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 1: Balance between Treated and Control Group Using Cohen's D Statistic

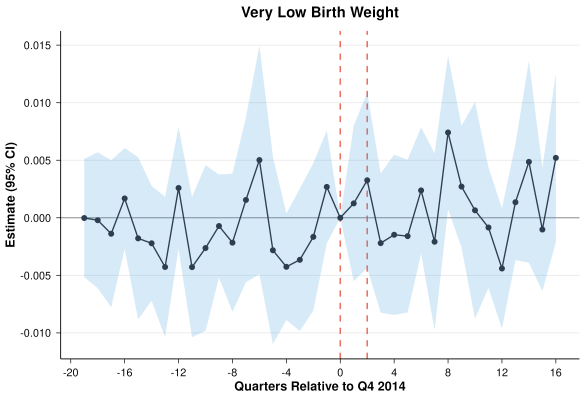


Note: Cohen's D shows the standardized mean difference between treated and control groups. It is calculated as the difference in means divided by the pooled standard deviation. The vertical red lines at -0.2 and 0.2 are used as a threshold for determining covariate balance.

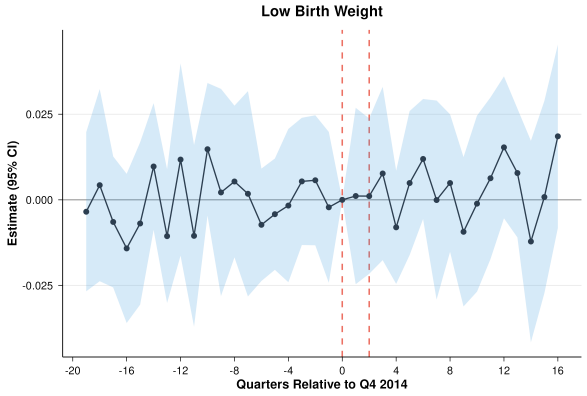
Figure 2: Quarterly Event Study of Infant Birthweight Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT



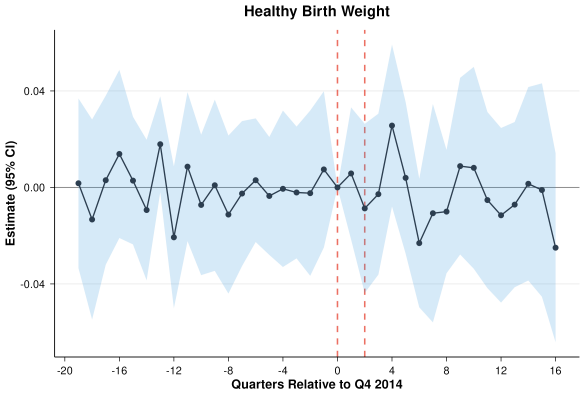
(a) Birth Weight (grams)



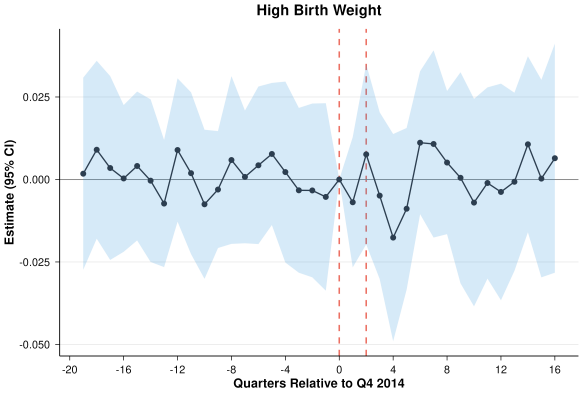
(b) Very Low Birth Weight



(c) Low Birth Weight

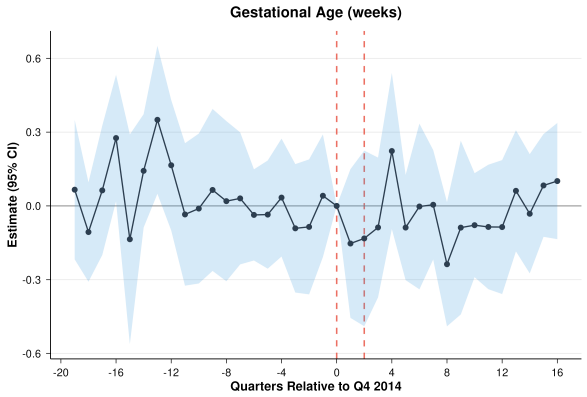


(d) Healthy Birth Weight

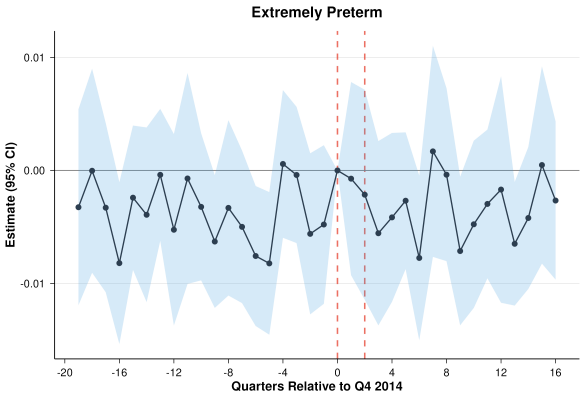


(e) High Birth Weight

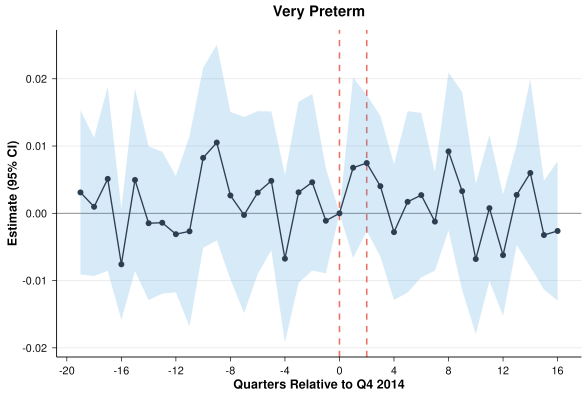
Figure 3: Quarterly Event Study of Infant Gestational Age Birth Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT



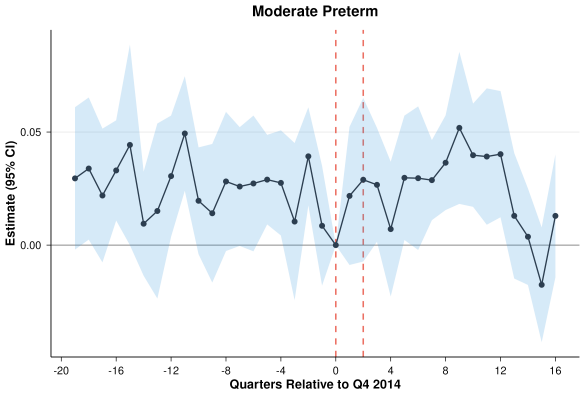
(a) Weeks of Gestation



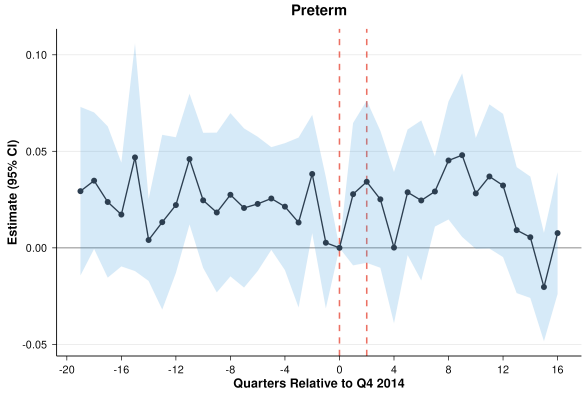
(b) Extremely Preterm



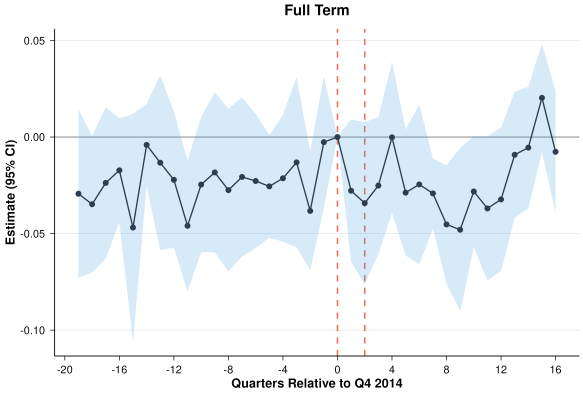
(c) Very Preterm



(d) Moderately Preterm



(e) Preterm



(f) Full Term

Figure 4: Quarterly Event Study of Abnormal Apgar with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

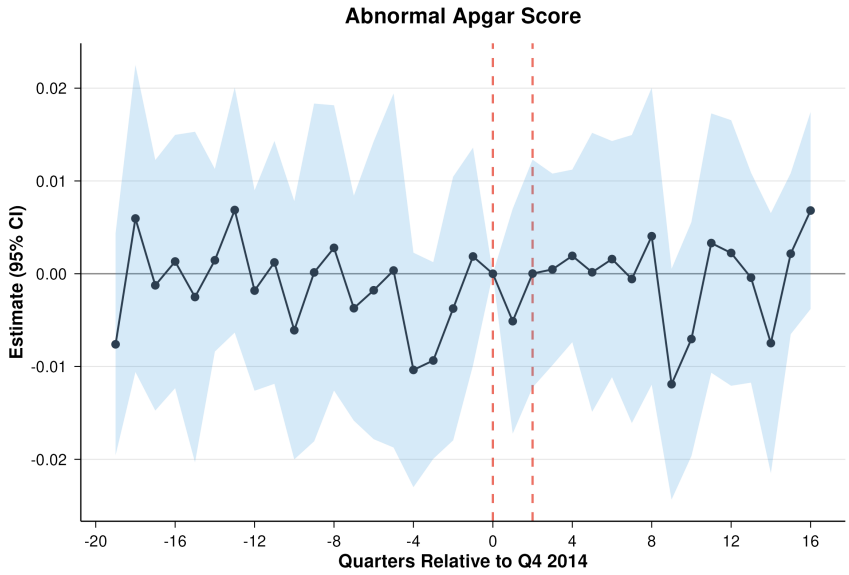
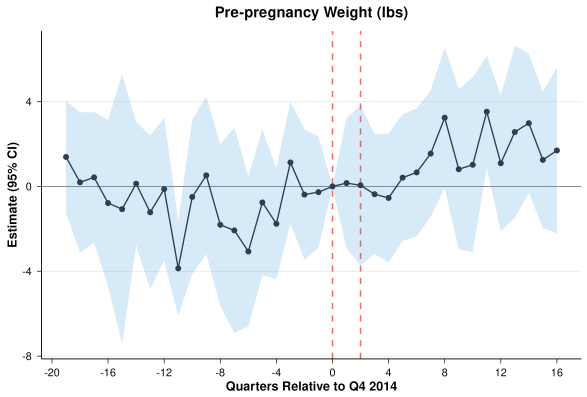
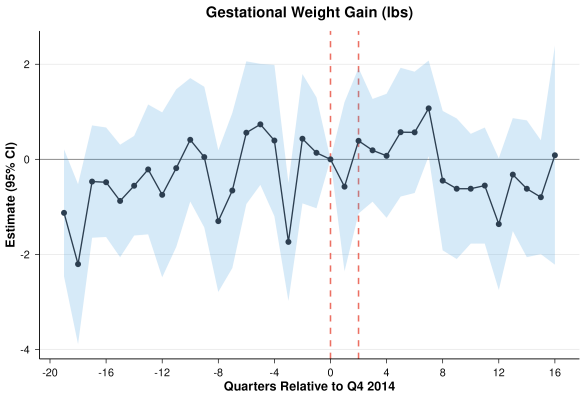


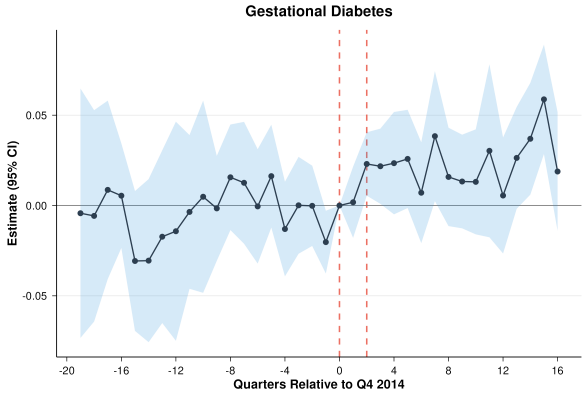
Figure 5: Quarterly Event Study of Maternal Health Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT



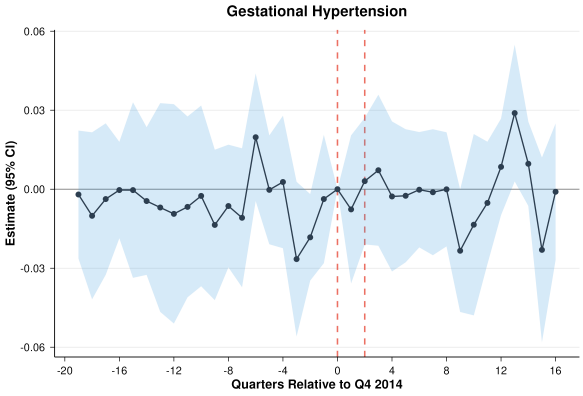
(a) Pre-Pregnancy Weight



(b) Pregnancy Weight Gain

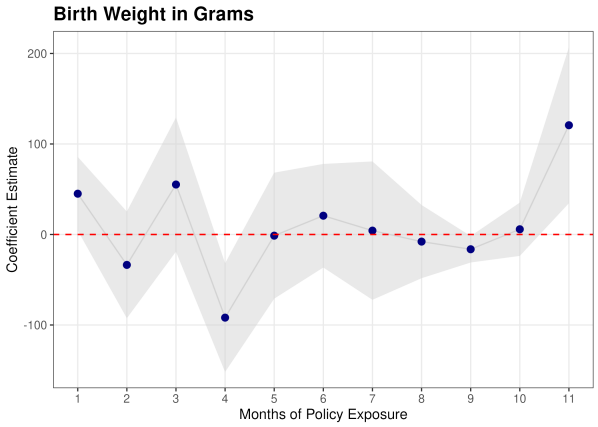


(c) Gestational Diabetes

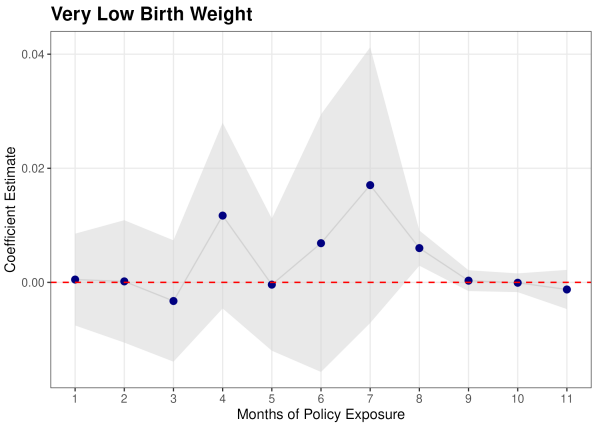


(d) Gestational Hypertension

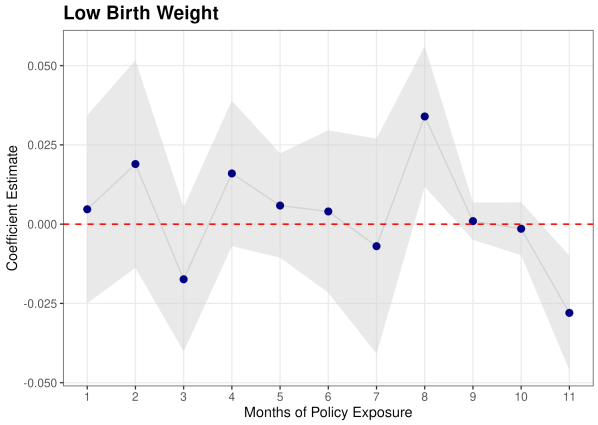
Figure 6: Months Exposure Model of Infant Birthweight Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT



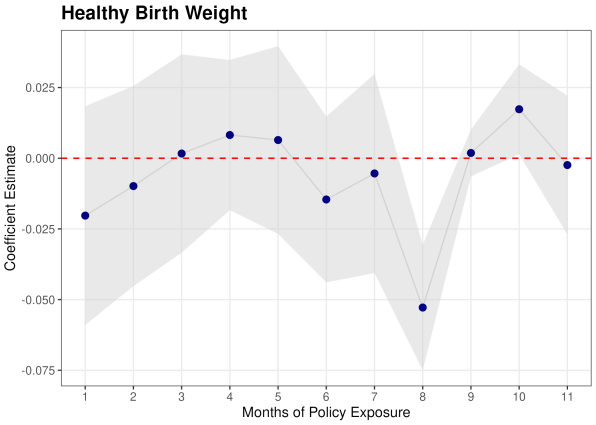
(a) Birth Weight (grams)



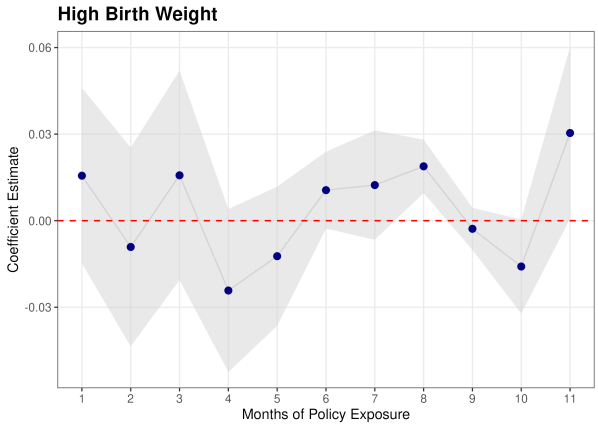
(b) Very Low Birth Weight



(c) Low Birth Weight



(d) Healthy Birth Weight



(e) High Birth Weight

Figure 7: Months Exposure Model of Abnormal Apgar with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

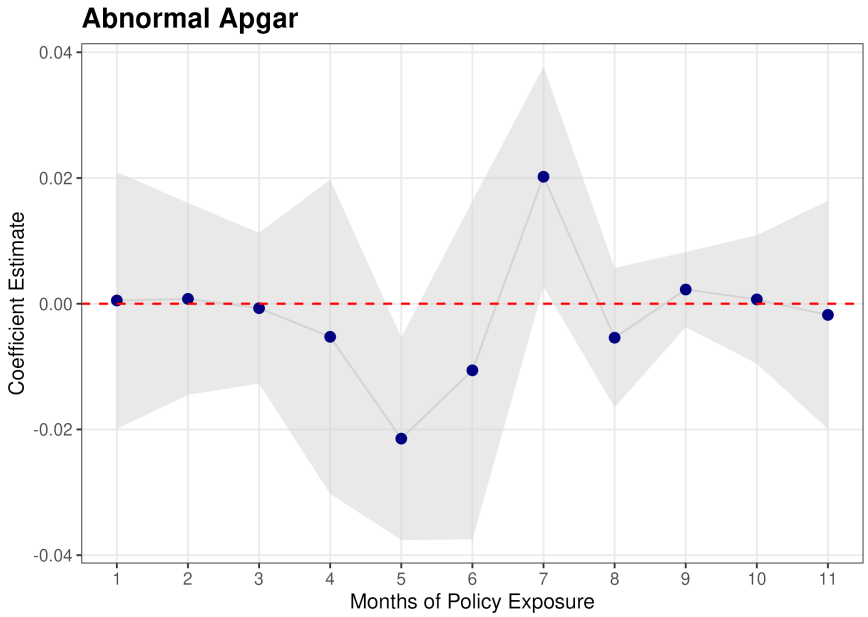
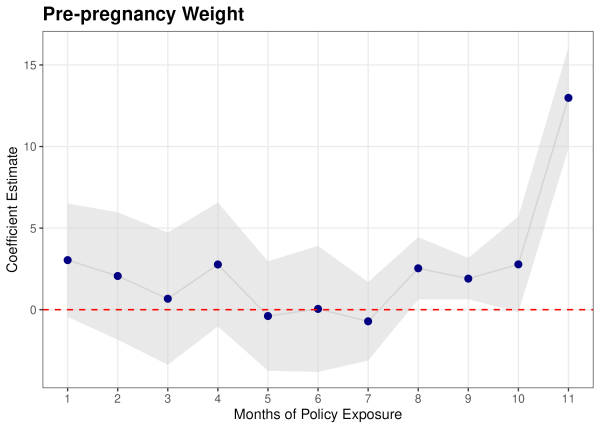
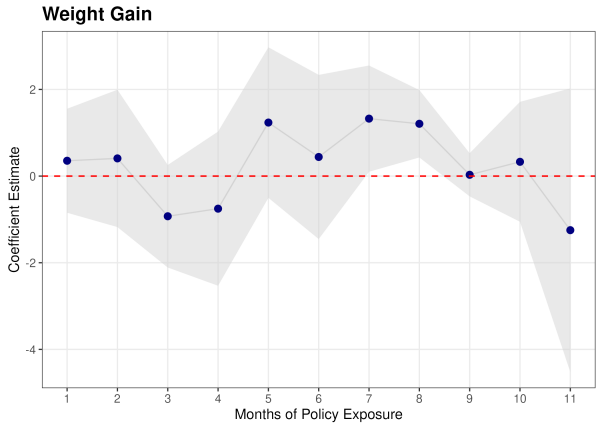


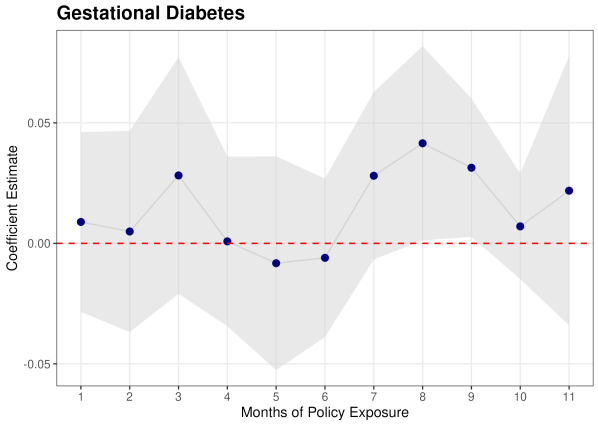
Figure 8: Months Exposure Model of Maternal Health Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT



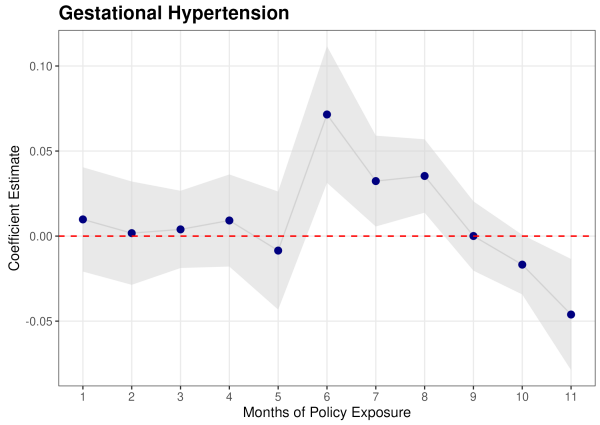
(a) Pre-Pregnancy Weight



(b) Pregnancy Weight Gain

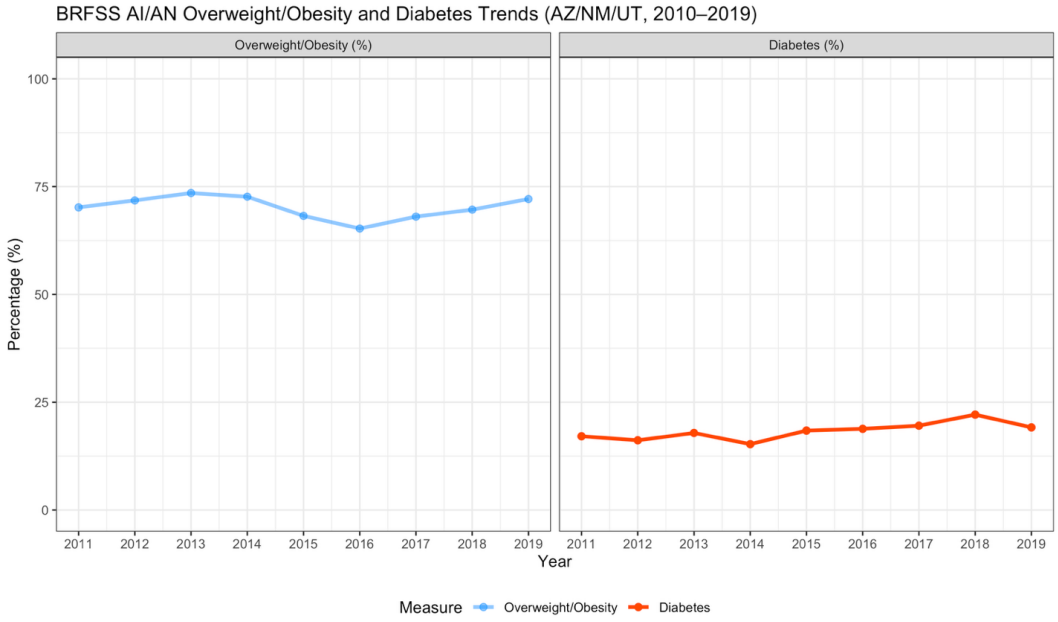


(c) Gestational Diabetes



(d) Gestational Hypertension

Figure 9: Trend in Overweight / Obesity and Diabetes Prevalence among AIAN in AZ, NM, UT from BRFSS



6 Appendix

The appendix includes results from our robustness checks and alternative specifications. The first part of the appendix includes the results from the alternative specification of the primary model which adds the additional endogenous covariates. This is reported for our primary control group.

The second part of the appendix includes the results using our first alternative control group (births to AIAN mothers outside of AZ, NM, and UT) using the primary specification, which is the model that includes both the Post Oct 2014 and Post April 2015 variables and does not control for the additional endogenous covariates. We estimate the model that excludes births between October 2014 and April 2015, the model with endogenous covariates, and the exposure model for all three versions of the control group, but we do not include all of these results in the appendix. The third part of the appendix includes the results using our second alternative control group (births to non-AIAN mothers in AZ, NM, and UT but not in Navajo Nation counties); again, just for the primary specification. We also estimate our event studies for each outcome and control group at both the monthly and quarterly levels. The results from the event studies for each alternative control group are also presented.

The fourth part of the appendix shows the results for a control group that is matched using inverse propensity score weighting to have better covariate balance compared to the treated group. The results are consistent for our matched control sample. We also show the results with an interaction term added for WIC status to explore heterogeneity by maternal WIC receipt.

In Part 6, we present the results from our simulation-based power analysis to estimate statistical power and minimum detectable effect sizes. For several outcomes, the estimated treatment effects are smaller in magnitude than our bootstrapped MDEs. Our power analysis results indicate that the study is powered to detect moderate changes in outcomes but not very small effects.

In Part 7, we address the robustness of our inference by considering few treated clusters,

multiple testing, and placebo inference. Because we are testing seventeen outcomes, we adjust for multiple comparisons and report the false discovery rate and multiple-testing adjusted p-values. We also implement two different randomization and placebo inference procedures. In our randomization inference for few treated clusters approach, we reshuffle treatment over the entire pool of counties, estimating if the policy had instead been in effect in 9 other counties. In our placebo inference, based on (Conley and Taber, 2011), we limit the placebo inference to the control counties only and get the sampling distribution of estimators from the placebo assigned laws.

In the last part of the appendix, we consider whether the results are affected by the roll-out of Medicaid expansion. We add a state expansion indicator and also run the analysis on the expansion and non-expansion states separately.

Appendix Part 1: Results for Primary Control Group 1 including Additional Covariates

Part 1 of the appendix presents the results from the DID model including the additional endogenous covariates, which include marital status, payer type (i.e. type of insurance coverage), education, use of cigarettes, WIC receipt, and when prenatal care began.

Table 10: DID Model with Additional Covariates of Infant Birthweight Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Birthweight Grams (Mean = 3324.432)	VLBW (Mean = 0.013)	LBW (Mean = 0.075)	Health BW (Mean = 0.825)	High BW (Mean = 0.1)
Treat x Post Oct 2014	-8.790	0.001	0.004	0.002	-0.005
	(5.512)	(0.002)	(0.005)	(0.007)	(0.004)
Treat x Post April 2015	-5.244	0.001	0.003	-0.004	0.001
	(8.182)	(0.001)	(0.003)	(0.006)	(0.005)
N	186651	186651	186651	186651	186651
SEs	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X
FE: State	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 11: DID Model with Additional Covariates of Infant Gestational Age Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Weeks of Gestation (Mean = 38.528)	Extremely Preterm (Mean = 0.007)	Very Preterm (Mean = 0.014)	Moderate Preterm (Mean = 0.116)	Preterm (Mean = 0.137)	Full Term (Mean = 0.863)
Treat x Post Oct 2014	0.038	0.002	-0.002	-0.007+	-0.007	0.007
	(0.043)	(0.001)	(0.001)	(0.004)	(0.005)	(0.005)
Treat x Post April 2015	-0.053	0.001	0.000	-0.001	0.000	-0.000
	(0.033)	(0.001)	(0.002)	(0.006)	(0.006)	(0.006)
N	186651	186651	186651	186651	186651	186651
SEs	by: County	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X	X
FE: State	X	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 12: DID Model with Additional Covariates of Apgar with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Abnormal Apgar (Mean = 0.028)
Treat x Post Oct 2014	0.003
	(0.003)
Treat x Post April 2015	0.000
	(0.003)
N	186651
SEs	by: County
FE: Month-Year	X
FE: State	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 13: DID Model with Additional Covariates of Maternal Health Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Gest Diab	Gest Hyp	Pre Preg Wgt	WTGAIN
	(Mean = 0.07)	(Mean = 0.061)	(Mean = 168.283)	(Mean = 28.718)
Treat x Post Oct 2014	-0.009	0.004	0.200	-0.119
	(0.006)	(0.005)	(0.469)	(0.260)
Treat x Post April 2015	0.025*	0.001	1.011	0.227
	(0.011)	(0.007)	(0.644)	(0.259)
N	173353	173353	173353	173353
SEs	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X
FE: State	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix Part 2: Results for Control Group 2: Births to AIAN Moms Outside of AZ, NM, UT

This section presents the results using the control group of mothers who identify as AIAN outside of AZ, NM, and UT, but they are not required to live in tribal land. This control group is $N = 315{,}342$, which is larger than the primary control group. The summary table and results from the primary specification are presented.

Table 14: Summary statistics comparing Treated Group and Control Group of Births to AIAN Moms Outside of AZ, NM, UT

Variable	Control (N = 315,342)	Treated (N = 44,308)	Difference	P-value
Pre-pregnancy Weight (lbs)	165.385	166.150	0.765	0.001
Delivery Weight (lbs)	194.863	191.726	-3.137	0.000
Weight Gain (lbs)	29.699	25.730	-3.969	0.000
Gestational Diabetes	0.067	0.104	0.037	0.000
Gestational Hypertension	0.059	0.084	0.025	0.000
Birthweight (grams)	3324.772	3265.841	-58.931	0.000
Extremely Preterm	0.007	0.006	-0.001	0.001
Very Preterm	0.014	0.015	0.001	0.248
Moderate Preterm	0.111	0.113	0.003	0.102
Preterm	0.132	0.134	0.002	0.250
Full Term	0.868	0.866	-0.002	0.250
Prenatal Care	1.500	1.546	0.046	0.000
Number of Prenatal Visits	10.019	9.504	-0.514	0.000
Hospital Birth	0.990	0.995	0.006	0.000
Not in Hospital	0.010	0.004	-0.006	0.000
Smoked During Pregnancy	0.191	0.021	-0.171	0.000

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Variable	Control (N = 315,342)	Treated (N = 44,308)	Difference	P-value
Mother's Age	26.243	26.382	0.139	0.000
Married	0.367	0.219	-0.148	0.000
Medicaid	0.624	0.831	0.208	0.000
Private Insurance	0.236	0.073	-0.163	0.000
Self Pay	0.028	0.009	-0.020	0.000
Indian Health Service	0.049	0.072	0.024	0.000
Other Payment	0.064	0.015	-0.049	0.000
WIC	0.608	0.628	0.020	0.000
Very Low Birthweight	0.014	0.012	-0.002	0.002
Low Birthweight	0.078	0.076	-0.001	0.360
Healthy Birthweight	0.818	0.853	0.036	0.000
High Birthweight	0.105	0.070	-0.034	0.000
Vaginal Delivery	0.698	0.798	0.100	0.000
C-Section	0.301	0.201	-0.100	0.000
1st Trimester Prenatal Care Started	0.575	0.457	-0.118	0.000
2nd Trimester Prenatal Care Started	0.231	0.201	-0.030	0.000
3rd Trimester Prenatal Care Started	0.075	0.073	-0.002	0.214
No Prenatal Care	0.024	0.021	-0.003	0.000
Less than High School	0.240	0.225	-0.015	0.000
High School Graduate	0.340	0.375	0.035	0.000
Some College	0.243	0.277	0.033	0.000

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Variable	Control (N = 315,342)	Treated (N = 44,308)	Difference	P-value
Associate Degree	0.067	0.070	0.003	0.032
Bachelor's Degree	0.071	0.032	-0.039	0.000
Graduate Degree	0.027	0.010	-0.017	0.000
Weeks Gestation	38.528	38.618	0.090	0.000
Unknown Weeks Gestation	0.002	0.001	-0.000	0.038
First Birth	0.340	0.314	-0.026	0.000
Second Birth	0.273	0.246	-0.027	0.000
Third Birth	0.183	0.187	0.004	0.066
Fourth Birth	0.102	0.119	0.017	0.000
Fifth or Higher Birth	0.098	0.128	0.030	0.000
Black Mother	0.000	0.000	0.000	NaN
White Mother	0.000	0.000	0.000	NaN
Asian/Pacific Islander Mother	0.000	0.000	0.000	NaN
Missing Race Mother	0.000	0.000	0.000	NaN
AIAN Father	0.276	0.651	0.374	0.000
Black Father	0.022	0.002	-0.020	0.000
White Father	0.127	0.016	-0.111	0.000
Asian/Pacific Islander Father	0.005	0.000	-0.005	0.000
Missing Race Father	0.570	0.331	-0.239	0.000
Unknown Pre-pregnancy Weight	0.095	0.246	0.151	0.000
Unknown Delivery Weight	0.088	0.239	0.151	0.000
Unknown Weight Gain	0.045	0.040	-0.005	0.000
Unknown BMI	0.203	0.341	0.138	0.000

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Variable	Control (N = 315,342)	Treated (N = 44,308)	Difference	P-value
Unknown Gestational Hypertension	0.070	0.224	0.154	0.000
Unknown Birthweight	0.001	0.002	0.001	0.000
Unknown Prenatal Care	0.096	0.247	0.152	0.000
Unknown Number of Prenatal Visits	0.033	0.016	-0.017	0.000
Unknown Smoked During Pregnancy	0.095	0.228	0.134	0.000
Unknown Delivery Type	0.001	0.000	-0.000	0.000
Unknown Marital Status	0.021	0.000	-0.021	0.000
Unknown Payment	0.078	0.253	0.175	0.000
Unknown Birth Order	0.004	0.006	0.003	0.000
Unknown WIC	0.086	0.246	0.160	0.000
Unknown Education	0.011	0.011	-0.001	0.243
Unknown Facility	0.000	0.000	-0.000	0.000
Abnormal Apgar	0.026	0.023	-0.003	0.000
Normal Apgar	0.970	0.975	0.005	0.000
Unknown Apgar	0.004	0.002	-0.002	0.000
Single Birth	0.972	0.983	0.011	0.000
Multiple Birth	0.028	0.017	-0.011	0.000

Table 15: DID Model of Infant Birthweight Outcomes with Control Group of Births to AIAN Moms Outside of AZ, NM, UT

	Birthweight Grams (Mean = 3317.512)	VLBW (Mean = 0.013)	LBW (Mean = 0.077)	Healthy BW (Mean = 0.822)	High BW (Mean = 0.1)
Treat x Post Oct 2014	-10.500**	0.002	0.005	0.000	-0.005
	(3.758)	(0.002)	(0.005)	(0.007)	(0.003)
Treat x Post April 2015	-9.097	0.002+	0.005	-0.006	0.001
	(6.508)	(0.001)	(0.003)	(0.006)	(0.004)
N	359002	359002	359002	359002	359002
SEs	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X
FE: State	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 16: DID Model of Infant Gestational Age Outcomes with Control Group of Births to AIAN Moms Outside of AZ, NM, UT

	Weeks of Gestation (Mean = 38.54)	Extremely Preterm (Mean = 0.007)	Very Preterm (Mean = 0.014)	Moderate Preterm (Mean = 0.111)	Preterm (Mean = 0.132)	Full Term (Mean = 0.868)
Treat x Post Oct 2014	0.011	0.002*	-0.003**	-0.006	-0.007	0.007
	(0.042)	(0.001)	(0.001)	(0.004)	(0.005)	(0.005)
Treat x Post April 2015	-0.073***	0.000	0.000	-0.002	-0.002	0.002
	(0.019)	(0.001)	(0.002)	(0.005)	(0.004)	(0.004)
N	359002	359002	359002	359002	359002	359002
SEs	by: County	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X	X
FE: State	X	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 17: DID Model of Apgar with Control Group of Births to AIAN Moms Outside of AZ, NM, UT

	Abnormal Apgar
	(Mean = 0.026)
Treat x Post Oct 2014	0.003
	(0.003)
Treat x Post April 2015	0.000
	(0.003)
N	359002
SEs	by: County
FE: Month-Year	X
FE: State	X

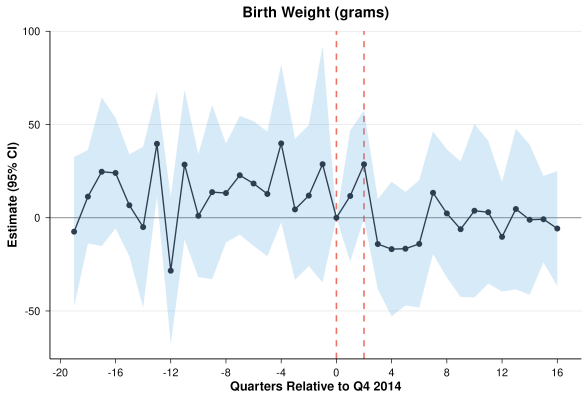
Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 18: DID Model of Maternal Health Outcomes with Control Group of Births to AIAN Moms Outside of AZ, NM, UT

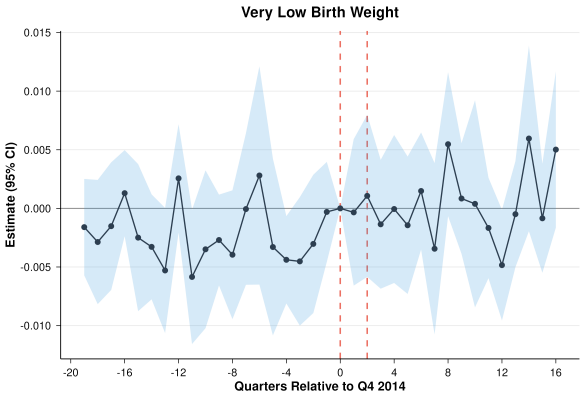
	Gest Diabetes	Gest Hypertension	Pre Preg Weight	Weight Gain
	(Mean = 0.071)	(Mean = 0.062)	(Mean = 165.466)	(Mean = 29.208)
Treat x Post Oct 2014	-0.008	0.001	-0.383	-0.281
	(0.005)	(0.005)	(0.435)	(0.230)
Treat x Post April 2015	0.026*	0.004	1.375*	0.225
	(0.010)	(0.007)	(0.635)	(0.184)
N	327117	327117	327117	327117
SEs	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X
FE: State	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

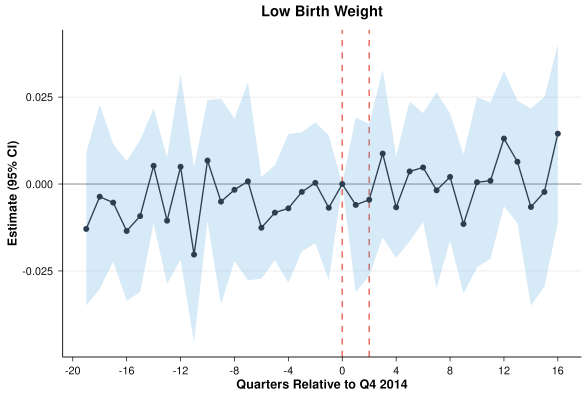
Figure 10: Quarterly Event Study of Infant Birthweight Outcomes with Control Group of Births to AIAN Moms Outside of AZ, NM, UT



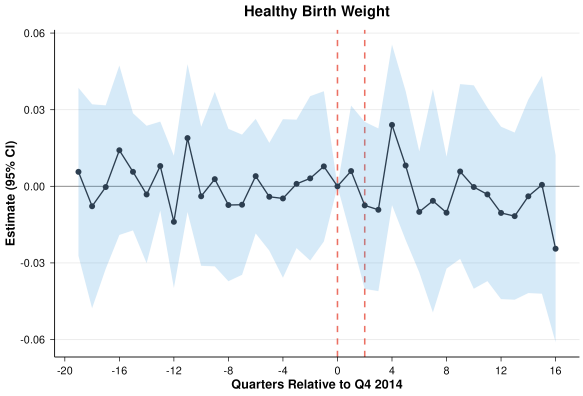
(a) Birth Weight (grams)



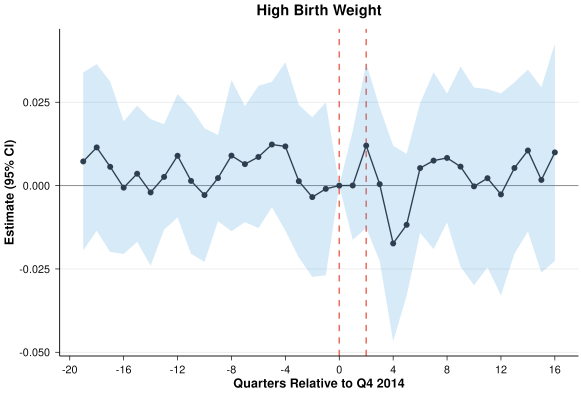
(b) Very Low Birth Weight



(c) Low Birth Weight

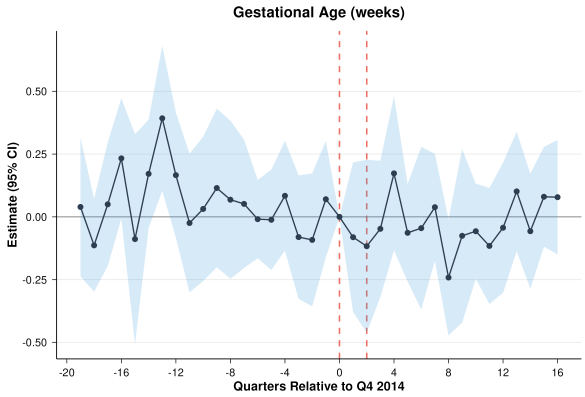


(d) Healthy Birth Weight

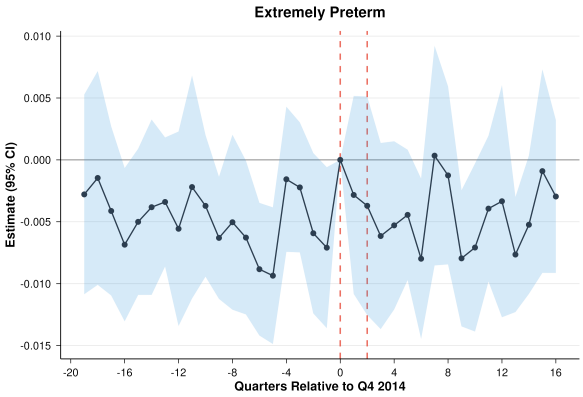


(e) High Birth Weight

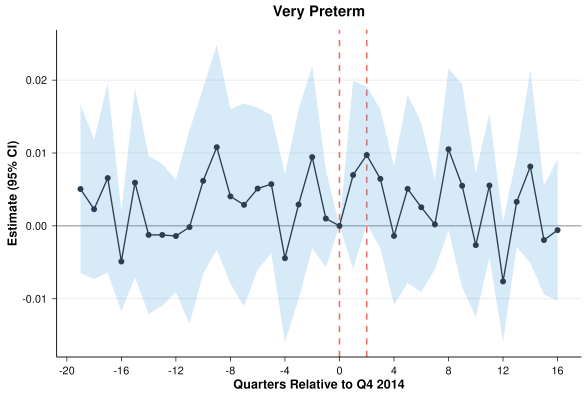
Figure 11: Quarterly Event Study of Infant Gestational Age Birth Outcomes with Control Group of Births to AIAN Moms Outside of AZ, NM, UT



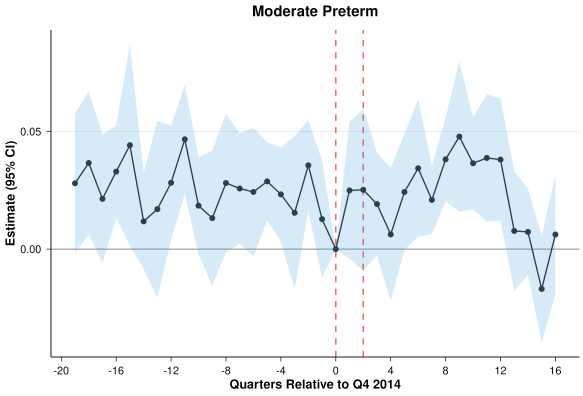
(a) Weeks of Gestation



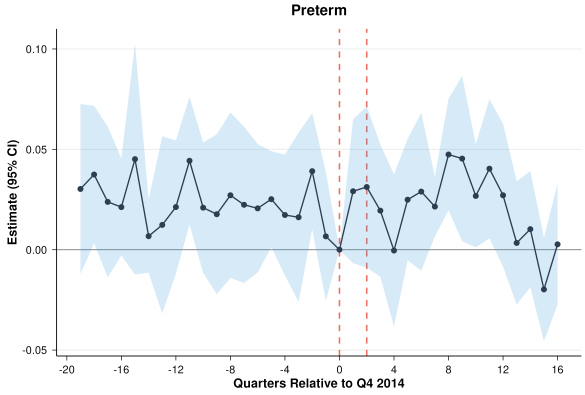
(b) Extremely Preterm



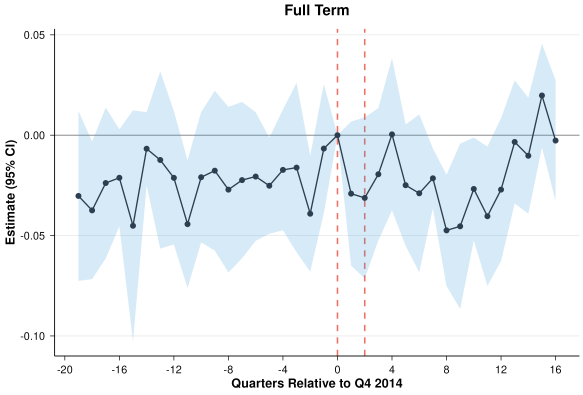
(c) Very Preterm



(d) Moderately Preterm



(e) Preterm



(f) Full Term

Figure 12: Quarterly Event Study of Abnormal Apgar with Control Group of Births to AIAN Moms Outside of AZ, NM, UT

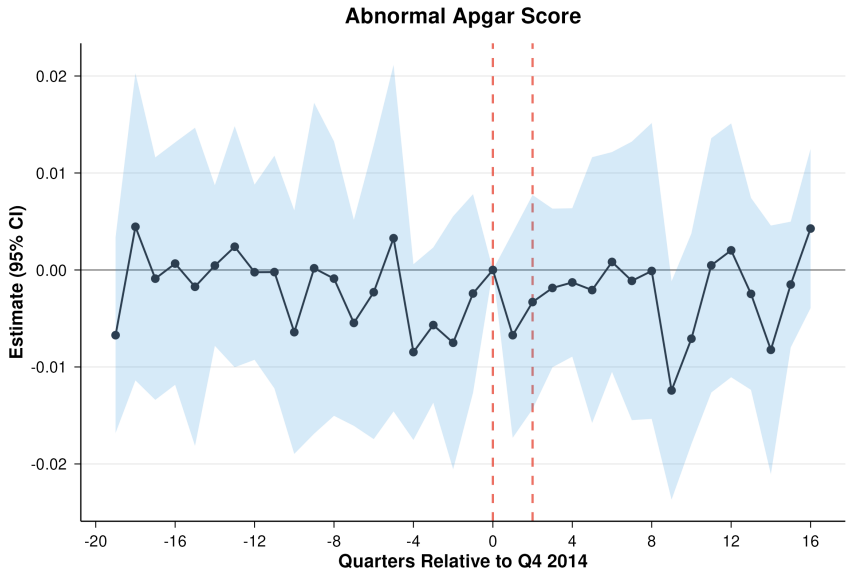
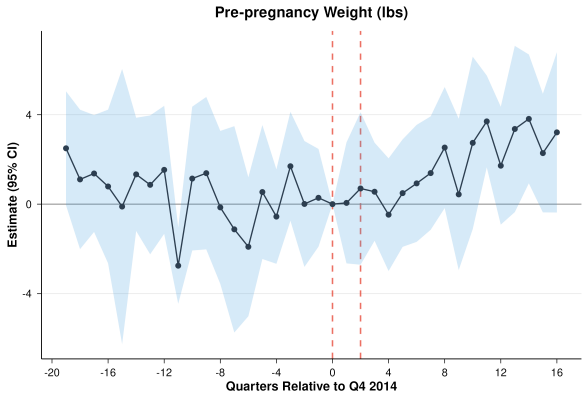
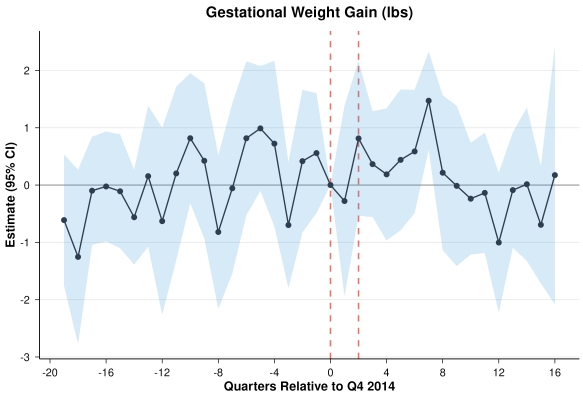


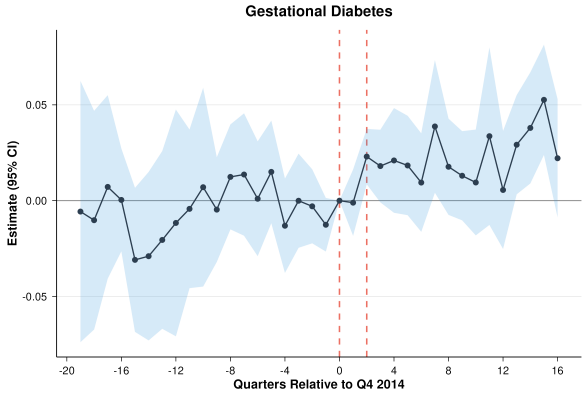
Figure 13: Quarterly Event Study of Maternal Health Outcomes with Control Group of Births to AIAN Moms Outside of AZ, NM, UT



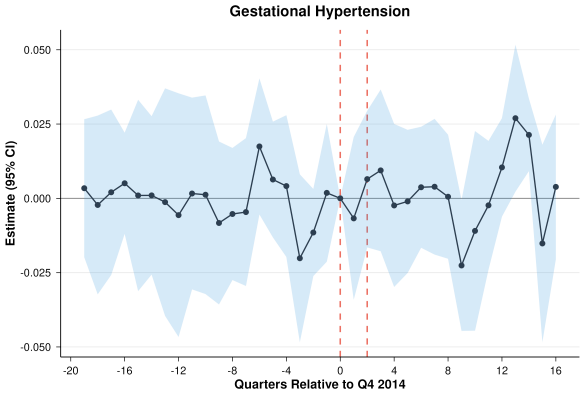
(a) Pre-Pregnancy Weight



(b) Pregnancy Weight Gain



(c) Gestational Diabetes



(d) Gestational Hypertension

Appendix Part 3: Results for Control Group 3: Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties

This section presents the results using the control group of mothers who are not AIAN who live in AZ, NM, and UT but are not in any of the Navajo Nation counties. This control group is $N = 1{,}311{,}105$, which is larger than the primary control group. The summary table and results from the primary specification are presented.

Table 19: Summary statistics comparing Treated Group and Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties

Variable	Control (N = 1,311,945)	Treated (N = 44,308)	Difference	P-value
Pre-pregnancy Weight (lbs)	154.185	166.150	11.966	0.000
Delivery Weight (lbs)	184.452	191.726	7.273	0.000
Weight Gain (lbs)	30.420	25.730	-4.690	0.000
Gestational Diabetes	0.056	0.104	0.048	0.000
Gestational Hypertension	0.056	0.084	0.028	0.000
Birthweight (grams)	3271.275	3265.841	-5.433	0.071
Extremely Preterm	0.006	0.006	0.000	0.462
Very Preterm	0.010	0.015	0.005	0.000
Moderate Preterm	0.095	0.113	0.019	0.000
Preterm	0.110	0.134	0.024	0.000
Full Term	0.890	0.866	-0.024	0.000
Prenatal Care	1.315	1.546	0.231	0.000
Number of Prenatal Visits	11.098	9.504	-1.593	0.000
Hospital Birth	0.979	0.995	0.016	0.000
Not in Hospital	0.021	0.004	-0.016	0.000
Smoked During Pregnancy	0.047	0.021	-0.027	0.000

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Variable	Control (N = 1,311,945)	Treated (N = 44,308)	Difference	P-value
Mother's Age	27.864	26.382	-1.482	0.000
Married	0.647	0.219	-0.428	0.000
Medicaid	0.405	0.831	0.426	0.000
Private Insurance	0.498	0.073	-0.425	0.000
Self Pay	0.053	0.009	-0.045	0.000
Indian Health Service	0.001	0.072	0.072	0.000
Other Payment	0.043	0.015	-0.028	0.000
WIC	0.341	0.628	0.287	0.000
Very Low Birthweight	0.011	0.012	0.000	0.367
Low Birthweight	0.073	0.076	0.003	0.018
Healthy Birthweight	0.856	0.853	-0.002	0.172
High Birthweight	0.071	0.070	-0.001	0.602
Vaginal Delivery	0.744	0.798	0.055	0.000
C-Section	0.255	0.201	-0.054	0.000
1st Trimester Prenatal Care Started	0.572	0.457	-0.115	0.000
2nd Trimester Prenatal Care Started	0.128	0.201	0.073	0.000
3rd Trimester Prenatal Care Started	0.035	0.073	0.037	0.000
No Prenatal Care	0.012	0.021	0.009	0.000
Less than High School	0.147	0.225	0.078	0.000
High School Graduate	0.222	0.375	0.154	0.000
Some College	0.247	0.277	0.030	0.000

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Variable	Control (N = 1,311,945)	Treated (N = 44,308)	Difference	P-value
Associate Degree	0.097	0.070	-0.027	0.000
Bachelor's Degree	0.201	0.032	-0.170	0.000
Graduate Degree	0.072	0.010	-0.061	0.000
Weeks Gestation	38.596	38.618	0.023	0.071
Unknown Weeks Gestation	0.000	0.001	0.001	0.000
First Birth	0.351	0.314	-0.038	0.000
Second Birth	0.293	0.246	-0.046	0.000
Third Birth	0.186	0.187	0.001	0.610
Fourth Birth	0.097	0.119	0.022	0.000
Fifth or Higher Birth	0.070	0.128	0.058	0.000
Black Mother	0.029	0.000	-0.029	0.000
White Mother	0.706	0.000	-0.706	0.000
Asian/Pacific Islander Mother	0.029	0.000	-0.029	0.000
Missing Race Mother	0.236	0.000	-0.236	0.000
AIAN Father	0.000	0.651	0.651	0.000
Black Father	0.004	0.002	-0.002	0.000
White Father	0.168	0.016	-0.152	0.000
Asian/Pacific Islander Father	0.005	0.000	-0.005	0.000
Missing Race Father	0.823	0.331	-0.492	0.000
Unknown Pre-pregnancy Weight	0.246	0.246	-0.000	0.891
Unknown Delivery Weight	0.244	0.239	-0.005	0.015
Unknown Weight Gain	0.019	0.040	0.021	0.000
Unknown BMI	0.353	0.341	-0.012	0.000

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Variable	Control (N = 1,311,945)	Treated (N = 44,308)	Difference	P-value
Unknown Gestational Hypertension	0.236	0.224	-0.012	0.000
Unknown Birthweight	0.001	0.002	0.001	0.000
Unknown Prenatal Care	0.252	0.247	-0.005	0.027
Unknown Number of Prenatal Visits	0.014	0.016	0.001	0.014
Unknown Smoked During Pregnancy	0.239	0.228	-0.010	0.000
Unknown Delivery Type	0.001	0.000	-0.001	0.000
Unknown Marital Status	0.000	0.000	-0.000	0.000
Unknown Payment	0.272	0.253	-0.018	0.000
Unknown Birth Order	0.003	0.006	0.003	0.000
Unknown WIC	0.268	0.246	-0.022	0.000
Unknown Education	0.015	0.011	-0.004	0.000
Unknown Facility	0.000	0.000	0.000	0.673
Abnormal Apgar	0.019	0.023	0.004	0.000
Normal Apgar	0.979	0.975	-0.004	0.000
Unknown Apgar	0.002	0.002	0.000	0.069
Single Birth	0.968	0.983	0.014	0.000
Multiple Birth	0.032	0.017	-0.014	0.000

Table 20: DID Model of Infant Birthweight Outcomes with Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties

	Birthweight Grams (Mean = 3271.097)	VLBW (Mean = 0.011)	LBW (Mean = 0.073)	Healthy BW (Mean = 0.856)	High BW (Mean = 0.071)
Treat x Post Oct 2014	-21.360***	0.002	0.009+	-0.002	-0.006*
	(2.852)	(0.001)	(0.005)	(0.007)	(0.003)
Treat x Post April 2015	-30.430***	0.002	0.010**	-0.007	-0.004
	(7.204)	(0.001)	(0.003)	(0.006)	(0.004)
N	1355584	1355584	1355584	1355584	1355584
SEs	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X
FE: State	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 21: DID Model of Infant Preterm Outcomes with Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties

	Weeks of Gestation (Mean = 38.596)	Extremely Preterm (Mean = 0.006)	Very Preterm (Mean = 0.01)	Moderate Preterm (Mean = 0.095)	Preterm (Mean = 0.111)	Full Term (Mean = 0.889)
Treat x Post Oct 2014	-0.036	0.002*	-0.001	0.001	0.002	-0.002
	(0.040)	(0.001)	(0.001)	(0.004)	(0.004)	(0.004)
Treat x Post April 2015	-0.110***	0.001	-0.000	0.005	0.006	-0.006
	(0.022)	(0.001)	(0.002)	(0.005)	(0.005)	(0.005)
N	1355584	1355584	1355584	1355584	1355584	1355584
SEs	by: County	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X	X
FE: State	X	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 22: DID Model of Apgar with Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties

	Abnormal Apgar
	(Mean = 0.019)
Treat x Post Oct 2014	0.004
	(0.003)
Treat x Post April 2015	0.001
	(0.003)
N	1355584
SEs	by: County
FE: Month-Year	X
FE: State	X

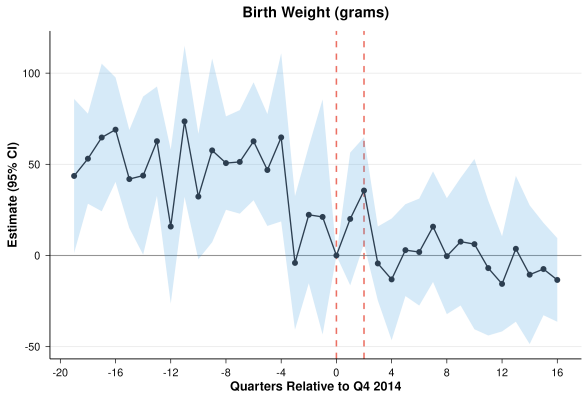
Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 23: DID Model of Maternal Health Outcomes with Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties

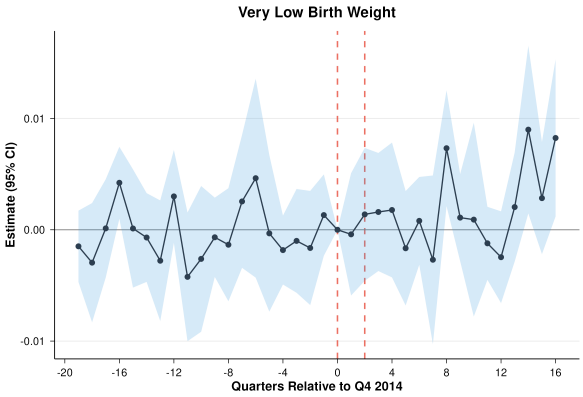
	Gest Diabetes	Gest Hypertension	Pre Preg Weight	Weight Gain
	(Mean = 0.057)	(Mean = 0.057)	(Mean = 154.576)	(Mean = 30.27)
Treat x Post Oct 2014	-0.005	0.001	-0.044	-0.392*
	(0.005)	(0.005)	(0.441)	(0.200)
Treat x Post April 2015	0.030**	0.008	1.940**	0.101
	(0.009)	(0.007)	(0.680)	(0.203)
N	1036433	1036433	1036433	1036433
SEs	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X
FE: State	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

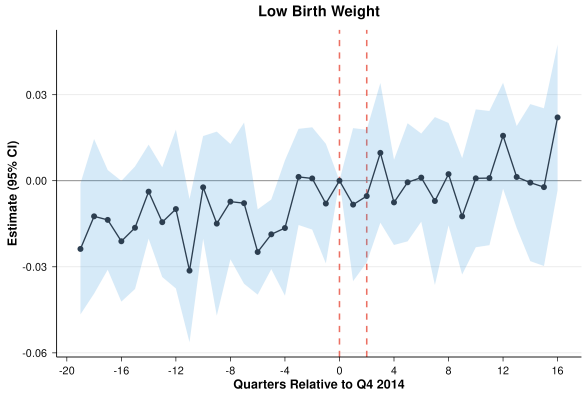
Figure 14: Quarterly Event Study of Infant Birthweight Outcomes with Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties



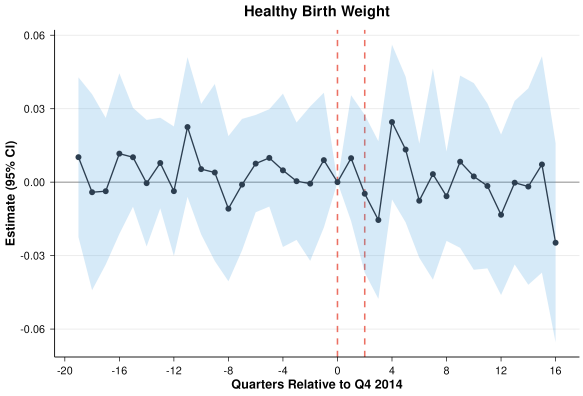
(a) Birth Weight (grams)



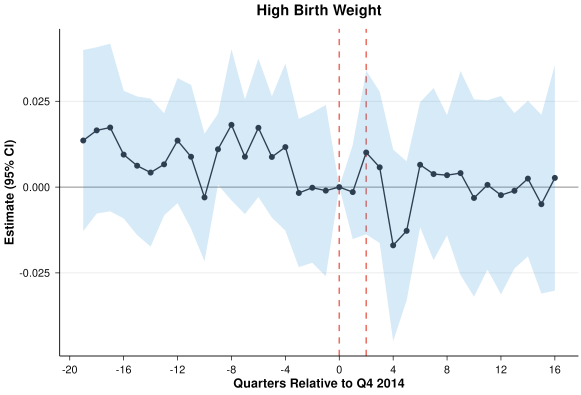
(b) Very Low Birth Weight



(c) Low Birth Weight

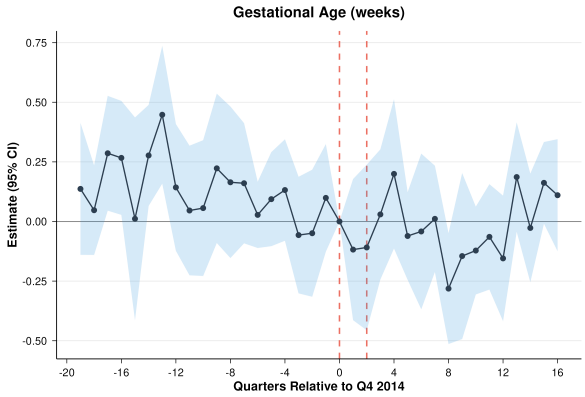


(d) Healthy Birth Weight

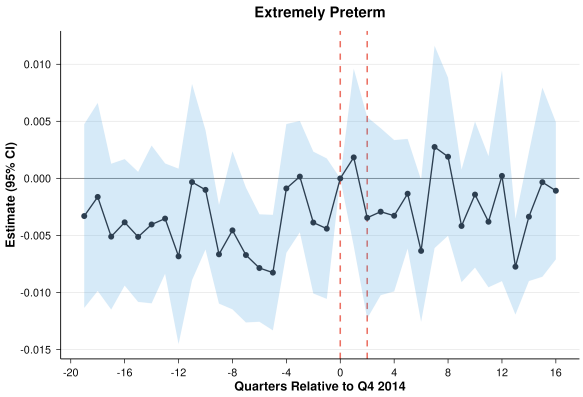


(e) High Birth Weight

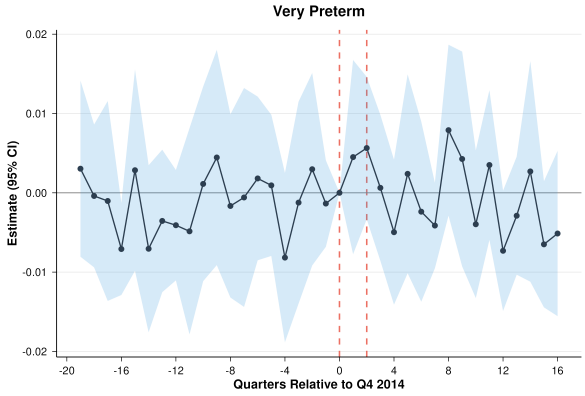
Figure 15: Quarterly Event Study of Infant Gestational Age Birth Outcomes with Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties



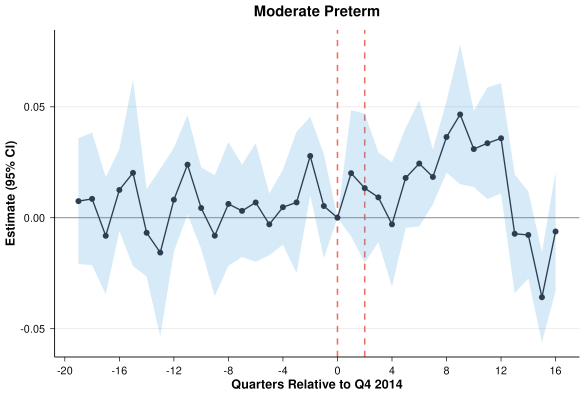
(a) Weeks of Gestation



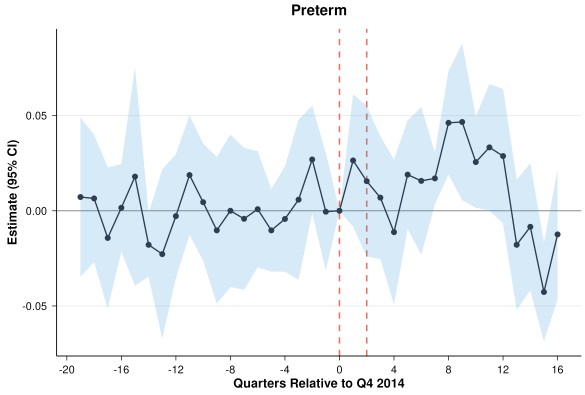
(b) Extremely Preterm



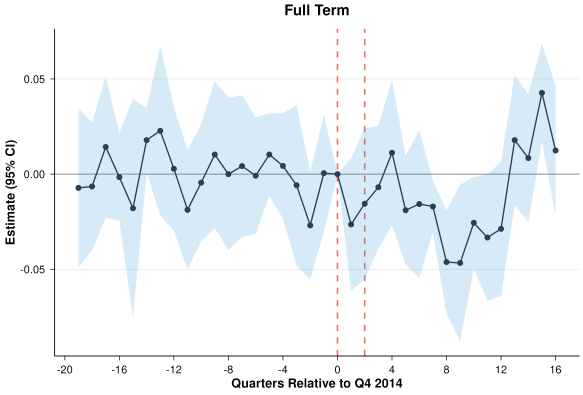
(c) Very Preterm



(d) Moderately Preterm



(e) Preterm



(f) Full Term

Figure 16: Quarterly Event Study of Abnormal Apgar with Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties

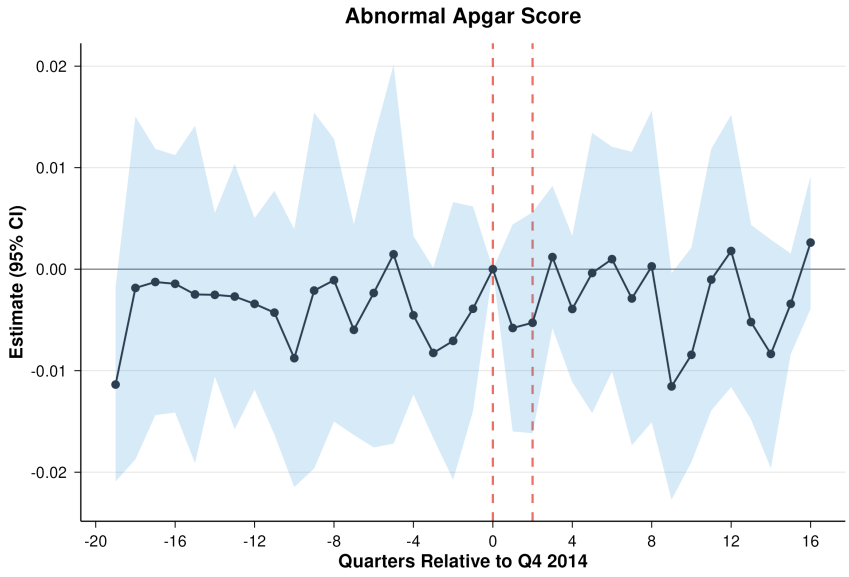
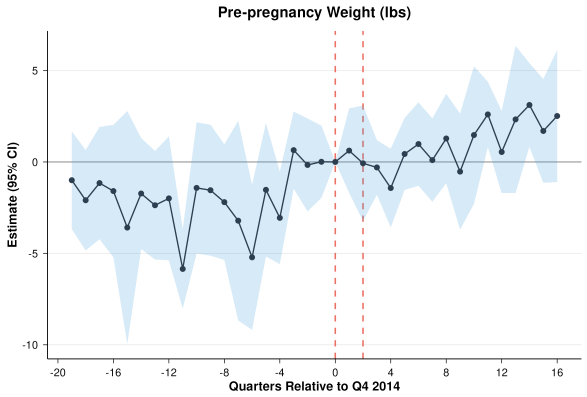
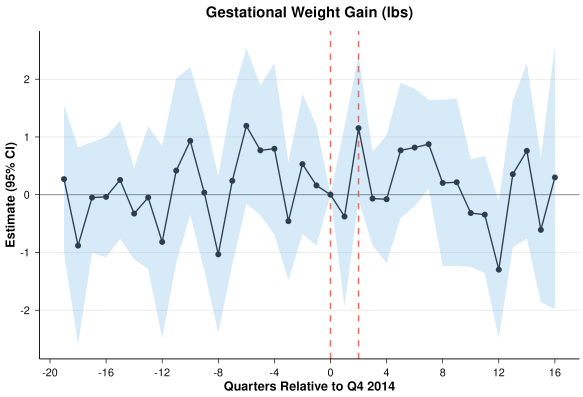


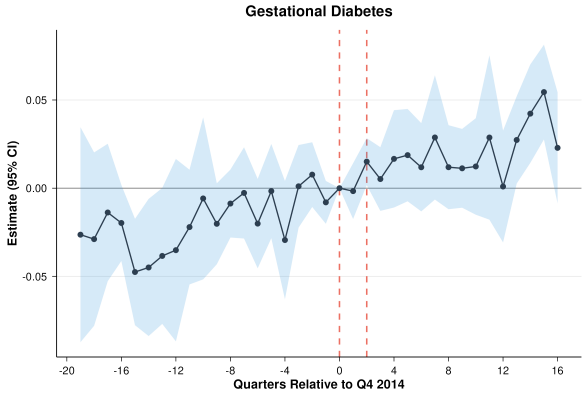
Figure 17: Quarterly Event Study of Maternal Health Outcomes with Control Group of Births to Non-AIAN Moms in AZ, NM, UT but not in the Navajo Nation Counties



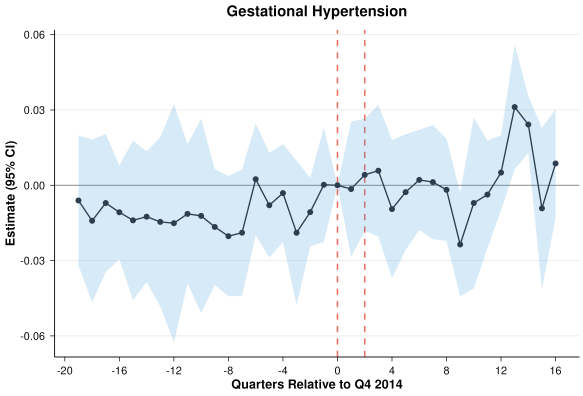
(a) Pre-Pregnancy Weight



(b) Pregnancy Weight Gain



(c) Gestational Diabetes



(d) Gestational Hypertension

Appendix Part 4: Results with Reweighted Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

This section presents the inverse propensity score reweighted results using the control group of mothers who are AIAN who do not live in AZ, NM, and UT and live in reservation counties. Because there are covariates that exceed the Cohen's D threshold of 0.2, we performed propensity score matching so that the control group members who best match the treated group are weighted higher. The weights come from a logit model of maternal age, parity, education, marital status, insurance status, and WIC status. The balance table and the results from our reweighted sample using our primary DID specification are presented in this appendix. The results from the matched sample are consistent with our preferred specification using the unweighted control group.

Table 24: Summary statistics comparing Treated Group and Reweighted Control Group of Births to AIAN Moms Outside of AZ, NM, UT

Variable	Reweighted Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Prenatal Care	1.207	1.164	-0.043	0.000	-0.044
Number of Prenatal Visits	9.023	9.356	0.333	0.000	0.073
Smoked During Pregnancy	0.184	0.016	-0.168	0.000	-0.584
Mother's Age	26.386	26.382	-0.004	0.935	-0.001
Married	0.215	0.219	0.004	0.119	0.010
Medicaid	0.620	0.621	0.001	0.774	0.002
Private Insurance	0.054	0.054	-0.000	0.971	-0.000
Self Pay	0.006	0.006	-0.000	0.997	-0.000
Indian Health Service	0.054	0.054	0.000	0.924	0.001
Other Payment	0.011	0.011	0.000	0.886	0.001

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Variable	Reweighted Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
WIC	0.472	0.473	0.001	0.734	0.002
Vaginal Delivery	0.670	0.798	0.128	0.000	0.294
C-Section	0.328	0.201	-0.127	0.000	-0.291
1st Trimester Prenatal Care Started	0.426	0.457	0.031	0.000	0.063
2nd Trimester Prenatal Care Started	0.208	0.201	-0.007	0.003	-0.018
3rd Trimester Prenatal Care Started	0.082	0.073	-0.009	0.000	-0.033
No Prenatal Care	0.030	0.021	-0.008	0.000	-0.052
Unknown Weeks Gestation	0.004	0.001	-0.003	0.000	-0.055
First Birth	0.312	0.314	0.001	0.687	0.003
Second Birth	0.246	0.246	0.000	0.952	0.000
Third Birth	0.187	0.187	-0.000	0.934	-0.001
Fourth Birth	0.120	0.119	-0.000	0.866	-0.001
Fifth or Higher Birth	0.127	0.128	0.001	0.804	0.002
Black Mother	0.000	0.000	0.000	NaN	NaN
White Mother	0.000	0.000	0.000	NaN	NaN
Asian/Pacific Islander Mother	0.000	0.000	0.000	NaN	NaN
Missing Race Mother	0.000	0.000	0.000	NaN	NaN
AIAN Father	0.339	0.651	0.312	0.000	0.657
Black Father	0.013	0.002	-0.011	0.000	-0.126
White Father	0.091	0.016	-0.075	0.000	-0.338

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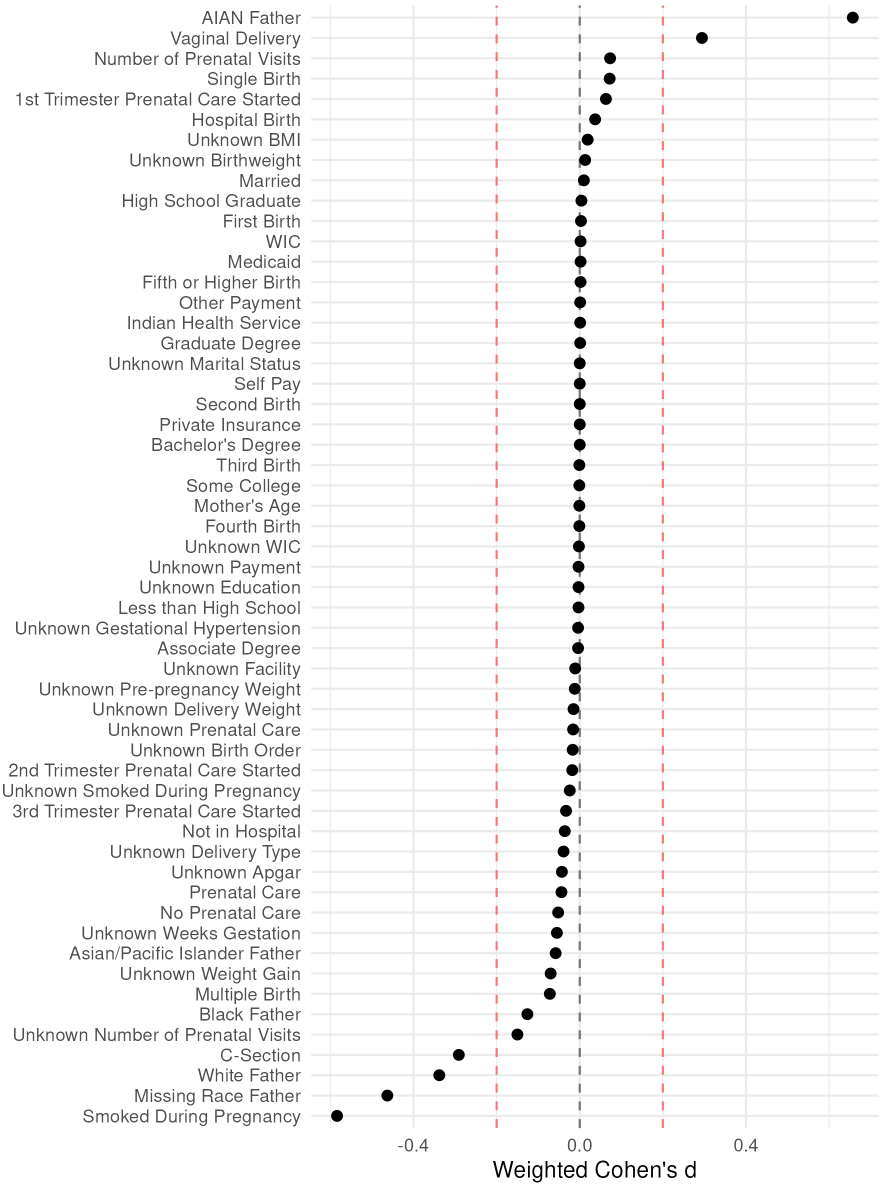
Variable	Reweighted Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Asian/Pacific Islander Father	0.003	0.000	-0.002	0.000	-0.058
Missing Race Father	0.555	0.331	-0.224	0.000	-0.463
Unknown Pre-pregnancy Weight	0.251	0.246	-0.005	0.153	-0.012
Unknown Delivery Weight	0.246	0.239	-0.007	0.083	-0.015
Unknown Weight Gain	0.055	0.040	-0.015	0.000	-0.070
Unknown BMI	0.333	0.341	0.009	0.017	0.019
Unknown Gestational Hypertension	0.226	0.224	-0.002	0.683	-0.004
Unknown Birthweight	0.001	0.002	0.000	0.068	0.013
Unknown Prenatal Care	0.254	0.247	-0.007	0.067	-0.016
Unknown Number of Prenatal Visits	0.040	0.016	-0.025	0.000	-0.150
Unknown Smoked During Pregnancy	0.239	0.228	-0.010	0.007	-0.024
Unknown Delivery Type	0.002	0.000	-0.001	0.000	-0.039
Unknown Marital Status	0.000	0.000	-0.000	0.000	-0.000
Unknown Payment	0.255	0.253	-0.001	0.755	-0.003
Unknown Birth Order	0.008	0.006	-0.001	0.043	-0.017
Unknown WIC	0.247	0.246	-0.001	0.833	-0.002
Less than High School	0.176	0.175	-0.001	0.603	-0.003
High School Graduate	0.289	0.291	0.002	0.528	0.004
Some College	0.215	0.215	-0.000	0.876	-0.001
Associate Degree	0.055	0.054	-0.001	0.525	-0.004

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Variable	Reweighted Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Bachelor's Degree	0.024	0.024	-0.000	0.995	-0.000
Graduate Degree	0.008	0.008	0.000	0.793	0.001
Unknown Education	0.008	0.008	-0.000	0.617	-0.003
Hospital Birth	0.993	0.995	0.003	0.000	0.037
Not in Hospital	0.007	0.004	-0.003	0.000	-0.036
Unknown Facility	0.000	0.000	-0.000	0.129	-0.011
Single Birth	0.972	0.983	0.011	0.000	0.072
Multiple Birth	0.028	0.017	-0.011	0.000	-0.072
Unknown Apgar	0.005	0.002	-0.003	0.000	-0.043

Figure 18: Balance between Treated and Reweighted Control Group Using Weighted Cohen's D Statistic



Note: Weighted Cohen's D shows the standardized mean difference between the treated group and the inverse-propensity-score-reweighted control group. It is calculated as the difference in weighted means divided by the pooled standard deviation. The vertical red dashed lines at -0.2 and 0.2 mark the threshold used for determining covariate balance. After reweighting, the large majority of covariates fall within the threshold.

Table 25: Summary statistics comparing Treated Group and Reweighted Control Group of Births to AIAN Moms Outside of AZ, NM, UT

Variable	Reweighted Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Prenatal Care	1.207	1.164	-0.043	0.000	-0.044
Number of Prenatal Visits	9.023	9.356	0.333	0.000	0.073
Smoked During Pregnancy	0.184	0.016	-0.168	0.000	-0.584
Mother's Age	26.386	26.382	-0.004	0.935	-0.001
Married	0.215	0.219	0.004	0.119	0.010
Medicaid	0.620	0.621	0.001	0.774	0.002
Private Insurance	0.054	0.054	-0.000	0.971	-0.000
Self Pay	0.006	0.006	-0.000	0.997	-0.000
Indian Health Service	0.054	0.054	0.000	0.924	0.001
Other Payment	0.011	0.011	0.000	0.886	0.001
WIC	0.472	0.473	0.001	0.734	0.002
Vaginal Delivery	0.670	0.798	0.128	0.000	0.294
C-Section	0.328	0.201	-0.127	0.000	-0.291
1st Trimester Prenatal Care Started	0.426	0.457	0.031	0.000	0.063
2nd Trimester Prenatal Care Started	0.208	0.201	-0.007	0.003	-0.018
3rd Trimester Prenatal Care Started	0.082	0.073	-0.009	0.000	-0.033
No Prenatal Care	0.030	0.021	-0.008	0.000	-0.052
Unknown Weeks Gestation	0.004	0.001	-0.003	0.000	-0.055
First Birth	0.312	0.314	0.001	0.687	0.003

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Variable	Reweighted Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Second Birth	0.246	0.246	0.000	0.952	0.000
Third Birth	0.187	0.187	-0.000	0.934	-0.001
Fourth Birth	0.120	0.119	-0.000	0.866	-0.001
Fifth or Higher Birth	0.127	0.128	0.001	0.804	0.002
Black Mother	0.000	0.000	0.000	NaN	NaN
White Mother	0.000	0.000	0.000	NaN	NaN
Asian/Pacific Islander Mother	0.000	0.000	0.000	NaN	NaN
Missing Race Mother	0.000	0.000	0.000	NaN	NaN
AIAN Father	0.339	0.651	0.312	0.000	0.657
Black Father	0.013	0.002	-0.011	0.000	-0.126
White Father	0.091	0.016	-0.075	0.000	-0.338
Asian/Pacific Islander Father	0.003	0.000	-0.002	0.000	-0.058
Missing Race Father	0.555	0.331	-0.224	0.000	-0.463
Unknown Pre-pregnancy Weight	0.251	0.246	-0.005	0.153	-0.012
Unknown Delivery Weight	0.246	0.239	-0.007	0.083	-0.015
Unknown Weight Gain	0.055	0.040	-0.015	0.000	-0.070
Unknown BMI	0.333	0.341	0.009	0.017	0.019
Unknown Gestational Hypertension	0.226	0.224	-0.002	0.683	-0.004
Unknown Birthweight	0.001	0.002	0.000	0.068	0.013
Unknown Prenatal Care	0.254	0.247	-0.007	0.067	-0.016
Unknown Number of Prenatal Visits	0.040	0.016	-0.025	0.000	-0.150

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Variable	Reweighted Control (N=142,754)	Treated (N=44,308)	Difference	P-value	Cohen's D
Unknown Smoked During Pregnancy	0.239	0.228	-0.010	0.007	-0.024
Unknown Delivery Type	0.002	0.000	-0.001	0.000	-0.039
Unknown Marital Status	0.000	0.000	-0.000	0.000	-0.000
Unknown Payment	0.255	0.253	-0.001	0.755	-0.003
Unknown Birth Order	0.008	0.006	-0.001	0.043	-0.017
Unknown WIC	0.247	0.246	-0.001	0.833	-0.002
Less than High School	0.176	0.175	-0.001	0.603	-0.003
High School Graduate	0.289	0.291	0.002	0.528	0.004
Some College	0.215	0.215	-0.000	0.876	-0.001
Associate Degree	0.055	0.054	-0.001	0.525	-0.004
Bachelor's Degree	0.024	0.024	-0.000	0.995	-0.000
Graduate Degree	0.008	0.008	0.000	0.793	0.001
Unknown Education	0.008	0.008	-0.000	0.617	-0.003
Hospital Birth	0.993	0.995	0.003	0.000	0.037
Not in Hospital	0.007	0.004	-0.003	0.000	-0.036
Unknown Facility	0.000	0.000	-0.000	0.129	-0.011
Single Birth	0.972	0.983	0.011	0.000	0.072
Multiple Birth	0.028	0.017	-0.011	0.000	-0.072
Unknown Apgar	0.005	0.002	-0.003	0.000	-0.043

Table 26: DID Model of Infant Birthweight Outcomes with Reweighted Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Bwt Grams	LBW	VLBW	Healthy BW	High BW
	(Mean=3324.432)	(Mean=0.075)	(Mean=0.013)	(Mean=0.825)	(Mean=0.1)
Treat x Post Oct 2014	-6.077	0.004	0.000	0.000	-0.004
	(7.222)	(0.005)	(0.002)	(0.008)	(0.004)
Treat x Post Apr 2015	-1.442	0.003	0.001	-0.008	0.004
	(8.793)	(0.004)	(0.001)	(0.007)	(0.005)
N	186651	186651	186651	186651	186651
SEs	by: County	by: County	by: County	by: County	by: County
FE: Month Year	X	X	X	X	X
FE: State	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 27: DID Model of Preterm Outcomes with Reweighted Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Weeks Gestation	Extremely Preterm	Very Preterm	Moderate Preterm	Preterm	Full Term
	(Mean=38.528)	(Mean=0.007)	(Mean=0.014)	(Mean=0.116)	(Mean=0.137)	(Mean=0.863)
Treat x Post Oct 2014	0.062	0.000	-0.002	-0.007	-0.008	0.008
	(0.047)	(0.001)	(0.002)	(0.005)	(0.005)	(0.005)
Treat x Post Apr 2015	-0.043	0.001	-0.002	-0.006	-0.007	0.007
	(0.031)	(0.001)	(0.002)	(0.006)	(0.006)	(0.006)
N	186651	186651	186651	186651	186651	186651
SEs	by: County	by: County	by: County	by: County	by: County	by: County
FE: Month Year	X	X	X	X	X	X
FE: State	X	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 28: DID Model of Apgar Outcomes with Reweighted Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Abnormal Apgar
	(Mean = 0.028)
Treat x Post Oct 2014	0.001
	(0.003)
Treat x Post April 2015	-0.001
	(0.003)
N	186651
SEs	by: County
FE: Month-Year	X
FE: State	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 29: DID Model of Maternal Outcomes with Reweighted Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Gest Diab	Gest Hyp	Pre Preg Wgt	Weight Gain
	(Mean=0.07)	(Mean=0.061)	(Mean=168.283)	(Mean=28.718)
Treat x Post Oct 2014	-0.006	0.004	0.049	-0.316
	(0.006)	(0.005)	(0.561)	(0.293)
Treat x Post Apr 2015	0.024*	0.003	1.787**	0.128
	(0.011)	(0.007)	(0.693)	(0.265)
N	173353	173353	173353	173353
SEs	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X
FE: State	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix Part 5: DID Results with Interaction Term for WIC Status with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

This section presents the DID results with an interaction term for WIC status and uses the control group of mothers who are AIAN who do not live in AZ, NM, and UT and live in reservation counties. This is a triple-difference in differences. The coefficients on the Treat×Post variables captures the average effect among non-WIC mothers while the triple interactions WIC×Treat×Post captures the differential effect among WIC participants relative to non-participants.

Across birthweight outcomes, there is limited evidence of differential effects by WIC status. Similarly for gestational age outcomes, there are some statistically significant coefficients, though the magnitudes are extremely small. For APGAR outcomes, the coefficient is positive and statistically significant for the Post October coefficient, though this does not persist into the April 2015 period. For maternal outcomes, WIC participants experience statistically significant relative reductions in pre-pregnancy weight in both periods. Overall, these results suggest that allowing treatment effects to vary by WIC participation does not materially alter the overall conclusions from the main analysis.

Table 30: DID Model with WIC Interaction Term of Birthweight Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Bwt Grams	LBW	VLBW	Healthy BW	High BW
	(Mean=3324.432)	(Mean=0.075)	(Mean=0.013)	(Mean=0.825)	(Mean=0.1)
Treat×Post Oct 2014	8.506	-0.001	0.001	0.001	0.001
	(11.190)	(0.006)	(0.002)	(0.009)	(0.005)
Treat×Post Apr 2015	-5.680	0.005	0.002+	-0.006	0.000
	(9.241)	(0.007)	(0.001)	(0.009)	(0.004)
WIC×Treat×Post Oct 2014	-27.950+	0.008	0.000	0.000	-0.009
	(15.530)	(0.006)	(0.002)	(0.009)	(0.006)
WIC×Treat×Post Apr 2015	3.166	-0.004	-0.001	0.002	0.002
	(16.900)	(0.008)	(0.002)	(0.007)	(0.004)
N	186651	186651	186651	186651	186651
SEs	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X
FE: State	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 31: DID Model with WIC Interaction Term of Gestational Age Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Weeks Gestation (Mean=38.528)	Extremely Preterm (Mean=0.007)	Very Preterm (Mean=0.014)	Moderate Preterm (Mean=0.116)	Preterm (Mean=0.137)	Full Term (Mean=0.863)
Treat×Post Oct 2014	-0.032	0.002	0.001	-0.006	-0.004	0.004
	(0.076)	(0.002)	(0.003)	(0.005)	(0.006)	(0.006)
Treat×Post Apr 2015	-0.099*	0.002	0.000	-0.000	0.002	-0.002
	(0.049)	(0.002)	(0.002)	(0.007)	(0.007)	(0.007)
WIC×Treat×Post Oct 2014	0.087	0.000	-0.004	-0.001	-0.005	0.005
	(0.132)	(0.004)	(0.005)	(0.008)	(0.012)	(0.012)
WIC×Treat×Post Apr 2015	0.040	-0.002	-0.001	0.000	-0.002	0.002
	(0.073)	(0.002)	(0.001)	(0.006)	(0.006)	(0.006)
N.	187079	187079	187079	187079	187079	187079
SEs	by: County	by: County	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X	X	X
FE: tate	X	X	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 32: DID Model with WIC Interaction Term of Apgar Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Abnormal Apgar
	(Mean=0.028)
Treat×Post Oct 2014	-0.001
	(0.002)
Treat×Post Apr 2015	0.003
	(0.003)
WIC×Treat×Post Oct 2014	0.007**
	(0.002)
WIC×Treat×Post Apr 2015	-0.004
	(0.003)
N	186651
SEs	by: County
FE: Month-Year	X
FE: State	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 33: DID Model with WIC Interaction Term of Maternal Outcomes with Control Group of AIAN Moms in Counties with Reservations Outside AZ, NM, UT

	Gest Diab	Gest Hyp	Pre Preg Wgt	Weight Gain
	(Mean=0.07)	(Mean=0.061)	(Mean=168.283)	(Mean=28.718)
Treat×Post Oct 2014	-0.011	-0.001	1.862**	-0.543
	(0.010)	(0.005)	(0.660)	(0.363)
Treat×Post Apr 2015	0.028*	-0.000	2.263**	0.391
	(0.011)	(0.007)	(0.858)	(0.249)
WIC×Treat×Post Oct 2014	0.004	0.009	-2.931*	0.600
	(0.008)	(0.006)	(1.169)	(0.551)
WIC×Treat×Post Apr 2015	-0.004	0.004	-1.848*	-0.264
	(0.010)	(0.004)	(0.906)	(0.382)
N	173353	173353	173353	173353
SEs	by: County	by: County	by: County	by: County
FE: Month-Year	X	X	X	X
FE: State	X	X	X	X

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix Part 6: Minimum Detectable Effect Sizes and Power

We conducted a simulation-based power analysis using a clustered bootstrap procedure to estimate statistical power and minimum detectable effects (MDEs) for the difference-in-differences models used in the main analysis. This approach uses the observed data structure and variance, accommodates county-level clustering, and reflects the complexity of the empirical specification. We use the model that excludes the October to March period to simplify the bootstrapping process and use our preferred control group.

For each outcome, we evaluated a grid of hypothetical treatment effects. At each effect size, we resampled counties with replacement and constructed simulated outcomes by adding the hypothesized treatment effect to treated observations in the post-period. We then re-estimated the DID model on the simulated data, clustering standard errors at the county level, and recorded whether the treatment effect was statistically significant at the 10 percent level. This procedure was repeated for 500 bootstrap iterations per effect size. Statistical power was defined as the proportion of bootstrap iterations in which the treatment effect was detected. We report the smallest MDE for which the power was greater than 80%. For the formula-based MDE, we use the standard power formula as a comparison to the bootstrapped MDE. This is defined as $\text{MDE} = (z_{1-\alpha/2} + z_{\text{power}}) \times \text{SE}(\hat{\beta})$.

For several outcomes, the estimated treatment effects are smaller in magnitude than the bootstrapped MDEs. In these cases, the statistically insignificant estimates should not be interpreted as evidence of no effect but may indicate that any true effect is smaller than what the data is powered to detect. For outcomes with null or small effects, such as LBW or VLBW, we cannot rule out effects smaller than the MDE. For other outcomes, such as gestational diabetes and pre-pregnancy weight, we do have power to detect effects of the magnitude of our point estimates. Our power analysis results indicate that the study is powered to detect moderate changes in outcomes but not very small effects. The results should be interpreted as ruling out large policy impacts but provides less evidence about smaller changes below the MDEs.

Table 34: Minimum Detectable Effects (MDE) and Bootstrapped Power

Outcome	Bootstrap MDE	Power for Bootstrapped MDE	Formula-Based MDE (for 80% power)
Birth Weight (grams)	33.90	0.87	20.08
High Birth Weight	0.0152	0.95	0.0127
Low Birth Weight	0.0041	0.84	0.0095
Normal Birth Weight	0.0199	0.86	0.0173
Very Low Birth Weight	0.0017	0.92	0.0033
Gestational Weeks	0.04	0.81	0.0319
Extremely Preterm	0.0012	0.87	0.0012
Very Preterm	0.0048	0.80	0.0036
Moderate Preterm	0.0031	0.84	0.0032
Gestational Diabetes	0.0099	0.84	0.0300
Gestational Hypertension	0.0134	0.87	0.0189
Pre-pregnancy Weight (lbs)	0.47	0.80	1.83
Weight Gain (lbs)	0.74	0.92	0.63
Abnormal Apgar	0.0076	0.89	0.0084
Normal Apgar	0.0136	0.89	0.0090

Note: To conduct the simulation power analysis, we performed a bootstrapped procedure with 500 iterations per effect size. Statistical power was evaluated at a significance level of $\alpha = 0.10$, with a target power of 80%. All estimates from the bootstrap accounted for clustering at the county level.

Appendix Part 7: Robustness of Inference (Few Treated Clusters, Multiple Testing, and Placebo Inference)

Because the treated group comprises only nine county clusters, we assess whether our conclusions are sensitive to the small number of treated clusters and to testing multiple outcomes. All results in this section use the preferred control group (AIAN mothers in reservation counties outside AZ, NM, and UT) and the primary specification.

First, because we test seventeen outcomes, we adjust for multiple comparisons. Table 35 reports Benjamini–Hochberg false-discovery-rate and Bonferroni-adjusted p-values for the Post-April 2015 coefficients. Under the global null, roughly one nominally significant result would be expected by chance across the seventeen tests; the number of results surviving false-discovery-rate control is consistent with that benchmark.

Second, we recompute inference using randomization inference, which is valid with few treated clusters. For each outcome we permute treatment assignment across clusters (999 draws) and compute a two-sided permutation p-value for the Treat$\times$Post coefficients. Table 36 reports the point estimates alongside these randomization-inference p-values. Under this more conservative inference, the estimates that were marginally significant under cluster-robust standard errors are no longer distinguishable from the permutation distribution, consistent with our interpretation of precise nulls rather than detected effects.

Third, we implement the placebo-based inference procedure of Conley and Taber (2011), which is designed for difference-in-differences with a small number of treated units or policy changes. In such settings, the usual cluster-robust standard errors can understate uncertainty, because the asymptotic approximation relies on the number of treated clusters growing large. We assign a placebo HDNA to randomly selected sets of control clusters that were never exposed to the policy and re-estimate the models for each placebo assignment. We do 999 draws, and we use the distribution from these estimators to compute a two-sided placebo p-value as the share of placebo estimates as least as large in magnitude as the actual estimate. Table 37 reports the estimate, the analytic 95% confidence interval, and the placebo

p-value and confidence interval for each outcome. In our primary results, three coefficients are significant, but under placebo inference, only the gestational diabetes result remains significant. Despite the fact that gestational diabetes remains significant under placebo inference, it does not survive the multiple-testing correction in Table-35.

Table 35: Multiple-Testing Adjustment of Post-April 2015 DID Estimates (Control Group: AIAN Moms in Reservation Counties Outside AZ, NM, UT)

Outcome	Estimate	p (analytic)	p (FDR)	p (Bonferroni)
Birthweight (grams)	-3.81	0.601	0.942	1.000
Low Birth Weight	0.003	0.387	0.942	1.000
Very Low Birth Weight	0.001	0.310	0.942	1.000
Healthy Birth Weight	-0.005	0.391	0.942	1.000
High Birth Weight	0.002	0.597	0.942	1.000
Weeks of Gestation	-0.054	0.017	0.146	0.291
Extremely Preterm	0.000	0.685	0.942	1.000
Very Preterm	-0.001	0.753	0.942	1.000
Moderate Preterm	-0.000	0.930	0.942	1.000
Preterm	-0.001	0.881	0.942	1.000
Full Term	0.001	0.881	0.942	1.000
Normal Apgar	-0.000	0.942	0.942	1.000
Abnormal Apgar	0.001	0.639	0.942	1.000
Gestational Diabetes	0.026	0.016	0.146	0.268
Gestational Hypertension	0.002	0.725	0.942	1.000
Pre-pregnancy Weight	1.452	0.028	0.156	0.468
Gestational Weight Gain	0.259	0.250	0.942	1.000

Note: p-values for the Treat × Post-April 2015 coefficient across 17 outcomes. FDR = Benjamini–Hochberg false-discovery-rate adjustment; Bonferroni = family-wise adjustment. Under the global null 0.85 nominally significant results would be expected by chance; 3 are significant at the nominal 5% level and 0 survive BH-FDR control.

Table 36: Randomization-Inference p-values for Few Treated Clusters (Control Group: AIAN Moms in Reservation Counties Outside AZ, NM, UT)

	Post-Oct 2014		Post-April 2015	
Outcome	$\hat{\beta}$	RI p	$\hat{\beta}$	RI p
Birthweight (grams)	-8.49	0.679	-3.81	0.878
Low Birth Weight	0.004	0.715	0.003	0.666
Very Low Birth Weight	0.001	0.759	0.001	0.585
Healthy Birth Weight	0.001	0.959	-0.005	0.629
High Birth Weight	-0.005	0.723	0.002	0.817
Weeks of Gestation	0.026	0.804	-0.054	0.545
Extremely Preterm	0.002	0.633	0.000	0.892
Very Preterm	-0.002	0.751	-0.001	0.868
Moderate Preterm	-0.007	0.642	-0.000	0.972
Preterm	-0.007	0.613	-0.001	0.962
Full Term	0.007	0.588	0.001	0.956
Normal Apgar	-0.003	0.678	-0.000	0.973
Abnormal Apgar	0.004	0.587	0.001	0.811
Gestational Diabetes	-0.009	0.450	0.026	0.048
Gestational Hypertension	0.004	0.694	0.002	0.792
Pre-pregnancy Weight	0.078	0.956	1.452	0.549
Gestational Weight Gain	-0.168	0.796	0.259	0.813

Note: Randomization-inference p-values from 999 permutations reassigning treatment across clusters; 9 treated clusters vs. 236 control clusters (245 total, N = 187,062). $\hat{\beta}$ is the point estimate; RI p is the two-sided permutation p-value, which is valid with few treated clusters.

Table 37: Placebo Inference for Post-April 2015 DID Estimates (Control Group: AIAN Moms in Reservation Counties Outside AZ, NM, UT)

Outcome	Estimate	Analytic 95% CI	placebo p	placebo 95% CI	Survives
Birthweight (grams)	-3.81	[-18.07, 10.44]	0.841	[-52.79, 41.56]	No
Low Birth Weight	0.003	[-0.004, 0.010]	0.665	[-0.012, 0.017]	No
Very Low Birth Weight	0.001	[-0.001, 0.004]	0.626	[-0.004, 0.006]	No
Healthy Birth Weight	-0.005	[-0.018, 0.007]	0.631	[-0.027, 0.019]	No
High Birth Weight	0.002	[-0.007, 0.011]	0.892	[-0.020, 0.024]	No
Weeks of Gestation	-0.054	[-0.099, -0.010]	0.546	[-0.249, 0.125]	No
Extremely Preterm	0.000	[-0.001, 0.002]	0.894	[-0.004, 0.005]	No
Very Preterm	-0.001	[-0.004, 0.003]	0.785	[-0.010, 0.007]	No
Moderate Preterm	-0.000	[-0.011, 0.010]	0.948	[-0.022, 0.023]	No
Preterm	-0.001	[-0.010, 0.009]	0.926	[-0.025, 0.023]	No
Full Term	0.001	[-0.009, 0.010]	0.968	[-0.025, 0.024]	No
Normal Apgar	-0.000	[-0.006, 0.006]	0.946	[-0.013, 0.014]	No
Abnormal Apgar	0.001	[-0.004, 0.007]	0.954	[-0.014, 0.013]	No
Gestational Diabetes	0.026	[0.005, 0.047]	0.013	[0.004, 0.045]	Yes
Gestational Hypertension	0.002	[-0.011, 0.016]	0.782	[-0.018, 0.024]	No
Pre-pregnancy Weight	1.452	[0.169, 2.736]	0.600	[-3.796, 6.743]	No
Gestational Weight Gain	0.259	[-0.181, 0.698]	0.791	[-1.630, 2.557]	No

Note: Placebo inference drawing on Conley–Taber (2011) for the Treat × Post-April 2015 coefficient, using 999 placebos drawn across control clusters. placebo p is the placebo-based two-sided p-value and the placebo 95% CI inverts the placebo distribution; "Yes" marks outcomes significant at the 5% level under placebo inference. Analytic 95% CI uses cluster-robust SEs by county.

Appendix Part 8: Medicaid Expansion

Because the study period overlaps the Affordable Care Act Medicaid expansions, Table 38 assesses whether the Post-April 2015 estimates are sensitive to Medicaid expansion by (i) adding a state expansion indicator and (ii) restricting the comparison group to expansion and to non-expansion states separately. The estimates are stable across these specifications, indicating that differential Medicaid-expansion timing does not drive our results.

Table 38: Sensitivity of Post-April 2015 DID Estimates to ACA Medicaid Expansion (Control Group: AIAN Moms in Reservation Counties Outside AZ, NM, UT)

Outcome	Baseline	+ Expansion Control	Expansion Controls	Non-Exp. Controls
Birthweight (grams)	-3.813	-0.829	-5.214	-2.559
	(7.274)	(7.102)	(7.641)	(8.699)
Low Birth Weight	0.003	0.002	0.003	0.003
	(0.003)	(0.003)	(0.004)	(0.004)
Very Low Birth Weight	0.001	0.002	0.003*	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Healthy Birth Weight	-0.005	-0.006	-0.003	-0.007
	(0.006)	(0.006)	(0.007)	(0.007)
High Birth Weight	0.002	0.005	0.001	0.004
	(0.005)	(0.005)	(0.005)	(0.005)
Weeks of Gestation	-0.054*	-0.046+	-0.064*	-0.045+
	(0.023)	(0.024)	(0.031)	(0.027)
Extremely Preterm	0.000	0.000	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Very Preterm	-0.001	-0.001	0.000	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Moderate Preterm	-0.000	-0.000	-0.000	-0.000

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Outcome	Baseline	+ Expansion Control	Expansion Controls	Non-Exp. Controls
	(0.005)	(0.006)	(0.006)	(0.006)
Preterm	-0.001	-0.001	-0.000	-0.001
	(0.005)	(0.005)	(0.006)	(0.005)
Full Term	0.001	0.001	0.000	0.001
	(0.005)	(0.005)	(0.006)	(0.005)
Normal Apgar	-0.000	0.003	0.006+	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)
Abnormal Apgar	0.001	-0.001	-0.004	0.006+
	(0.003)	(0.003)	(0.003)	(0.003)
Gestational Diabetes	0.026*	0.026*	0.025*	0.028*
	(0.011)	(0.010)	(0.011)	(0.011)
Gestational Hypertension	0.002	0.002	0.003	0.002
	(0.007)	(0.007)	(0.007)	(0.007)
Pre-pregnancy Weight	1.452*	1.613*	1.971*	1.084
	(0.655)	(0.679)	(0.787)	(0.670)
Gestational Weight Gain	0.259	0.167	0.090	0.352
	(0.224)	(0.255)	(0.337)	(0.222)

Note: Each cell is the Treat × Post-April 2015 coefficient (cluster-robust SE by county below). *Baseline* = primary specification; *+ Expansion Control* adds a state ACA-expansion indicator; *Expansion / Non-Exp. Controls* restrict the comparison group to states that did / did not expand Medicaid. + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.