WHAT HAPPENED IN DELAWARE? UNINTENDED BIRTHS AND UNPLANNED BIRTHS AMONG ALL WOMEN AND AMONG MEDICAID-INSURED WOMEN FOLLOWING A STATEWIDE CONTRACEPTIVE INITIATIVE

INTRODUCTION

A major statewide contraceptive-access program, running from 2015 to 2020, the Delaware Contraceptive Access Now Initiative (DelCAN),[1] promoted free contraception of all types, and included a particular focus on increased access to free or low-cost long-acting reversible contraceptive methods (LARCs), consisting of implants and intrauterine devices. The initiative included extensive medical provider and administrative training,[2] with an emphasis on same-day LARC insertions. Title X clinics received not only training in LARC insertion and removal, but also free stocks of LARC devices.[1,3] A media campaign early in the intervention raised awareness of the availability of low-cost or free contraception at sites that received LARC training.[4] Policy changes facilitating Medicaid reimbursement to providers for immediate post-partum (IPP) LARC were accompanied by training in IPP LARC insertion across most Delaware hospitals with maternity units.[5]

The DelCAN Initiative followed other LARC-focused contraceptive initiatives in Colorado [6,7] and in St. Louis, Missouri,[8] and preceded statewide contraceptive access initiatives in South Carolina,[9] Massachusetts,[10] and North Carolina,[11] with additional initiatives planned.[12,13] One of the motivations of DelCAN, and of the similar initiatives in other states, was to address high rates of unintended pregnancy, substantially higher in the U.S. than in other high-income countries.[13] From 1982 to 2010, approximately half of all pregnancies and one-third of

births in the U.S. were unintended.[14–16] Explanations for high rates of unintended pregnancies and births have included low access to contraception generally, and to the most effective contraceptive methods in particular, and to associated high rates of contraceptive failure.[17–20] Unintended pregnancies and those ending in births (hereafter "unintended births") also reflect persistent social inequalities by education and race/ethnicity.[14–16,19–23] Contraceptive access initiatives have accordingly been designed in ways that may address these inequalities through targeting contraceptive access towards more disadvantaged sociodemographic groups. Delaware's fraction of unintended pregnancies in 2010 was the 7th highest in the United States, at 57%, and its rate of unintended pregnancies, at 62 per 1,000 women of childbearing age 15-44, was the country's highest.[24,25] Delaware also had the highest percentage of 'unwanted' pregnancies (23%) among the 42 states with disaggregated data by categories of unintended pregnancies.[24,25] In this context, the DelCAN Initiative was notably very successful in engaging state stakeholders in a highly-collaborative public-private partnership to reduce unintended pregnancies in the state.[1]

The role of contraceptive method effectiveness has been motivated in part by statistics such as that 48% of unintended pregnancies that occur while using contraception in the month of conception,[20] although more recent estimates indicate a trend of general decline in contraceptive failure in the U.S.[17] The promotion of long-acting reversible contraceptive methods (LARCs), consisting of implants and intrauterine devices, has been a major focus of recent contraceptive initiatives such as DelCAN. LARC-focused programs have been both supported from a public health outcomes perspective,[6,8,26,27] and critiqued from a reproductive autonomy perspective.[28–30]

Reductions in poverty and increases in economic wellbeing, including through reducing non-marital childbearing, have also been cited as potential benefits of increased LARC access and use,[31–33] although with concerns expressed about the potential for pressure or coercion to use LARC to enable the achievement of these goals.[34]

'Unintended' pregnancies and 'unplanned' pregnancies are concepts that are often conflated or used interchangeably (e.g., Finer and Sonfield 2012).[35] The widely-used definition of 'unintended' pregnancy (e.g., Mosher et al. 2012)[14] includes a pregnancy that is either 'mistimed', meaning earlier than wanted, or 'unwanted' in the case that the woman who did not want to be pregnant then or at any time in the future. Klerman (2000),[36] noting that pregnancy planning involves not only intentions but also (contraceptive) behavior, remarks that "it is puzzling that so much more attention seems to be given to the percentage of unintended pregnancies compared to the percentage of unplanned ones. It would seem that planning status would be more important to program planners" (p.159). 'Unintended' or 'unplanned' pregnancies have elsewhere been argued to represent different aspects of women's pregnancy experiences.[37–40] Reducing 'unintended pregnancies' was the explicit goal of the DelCAN and of the other contraceptive initiatives cited above, and reducing 'unintended' pregnancies continues to be the explicit U.S. public health goal.[41]

In the present study, we investigate both 'pregnancy intentions' and 'pregnancy planning', treating them as separate concepts with distinct empirical operationalizations, and we investigate multiple components of each. The data that allow us to do this are from a state-representative survey data source, the Pregnancy Risk Assessment Monitoring System (PRAMS)

database, a CDC-coordinated, annual surveillance system that combines birth certificate data and survey responses from a representative sample of women who delivered a live-born child in a given calendar year.[42] To evaluate the success of DelCAN in decreasing the proportion of unintended births in Delaware, we estimate whether fractions of unintended births decreased more in Delaware between the pre-DelCAN and DelCAN periods compared to in other states over the same period. We also consider separately the two components of 'unintended births,' being births from pregnancies that were 'wanted later' and births from pregnancies that were 'unwanted.' In a challenge to the use of 'mistimed' as confined to pregnancies that were 'wanted later,' we investigate also births from pregnancies that were 'wanted sooner.' We apply the same comparative approach between Delaware and other states across the pre-DelCAN to DelCAN periods to evaluate whether DelCAN increased the proportion of 'planned births.' We investigate alternately two types of births resulting from an 'unplanned' pregnancy: those in which the woman and her partner were not using contraception, and those in which they were using contraception.

Finally, because certain components of the DelCAN were targeted towards low-income and Medicaid-enrolled women,[3,43] and because contraceptive initiatives typically aim to address health and economic disparities associated with the higher rates of unintended pregnancies and births in low-income sociodemographic groups,[15,20] we conduct both an overall analysis and separate analyses for Medicaid-covered and non-Medicaid-covered births. These group-specific analyses are conducted both for binary classifications of 'unintended births' and 'planned births' and for multiple 'intention' and 'planning' categories.

Our study's aims, therefore, are three: first, to answer the simple question of whether DelCAN reduced unintended births; second, to illuminate a more nuanced set of women's retrospective reports of their attitudes and behaviors around the time that they became pregnant; and third, to investigate whether any impacts of DelCAN were differentially experienced by socioeconomic status, as represented by Medicaid-insured versus non-Medicaid groups of women. To preview the answers we provide in this paper: (1) we find no impact of DelCAN on reducing 'unintended' births nor on reducing births 'wanted later' or that were 'unwanted'; (2) we find that DelCAN did increase the fraction of 'planned' births, and that it decreased specifically the fraction of 'unplanned births' that occurred while not using contraception, that it increased the fraction of births 'wanted sooner'; and (3) we find that DelCAN's (positive) impact on 'planned births' was specific to Medicaid-insured women, while DelCAN's (also positive) impact on births 'wanted sooner' was general across Medicaid-insured and non-Medicaid-insured women.

DATA AND METHODS

DATA

The analyses of the study come from the Pregnancy Risk Assessment Monitoring System (PRAMS) database. The PRAMS is a Centers for Disease Control and Prevention (CDC)-coordinated, ongoing state-level (exceptionally, New York City in the PRAMS constitutes a separate geographical unit from the rest of New York state) surveillance system that combines birth certificate data and survey data on a representative sample of women who delivered a live-

born child in a given calendar year.[44] Each participant state designs a stratification methodology that allows for oversampling based on characteristics of interest such as low birth weight. The CDC's weighting schemas allow researchers to combine state-level estimates to compare results between them [42]. For all analyses, we use the weights recommended by the CDC to account for the state stratification methodology and differential non-response. The PRAMS questionnaire is administered two to six months after the delivery of the sampled ('index') birth. Data are released by the CDC-PRAMS for each year that a state satisfies the CDC's response-rate threshold, which was 65% in years 2007-2011, 60% in 2012-2014, 55% in 2015-2017, and 50% in 2016-2020.

The PRAMS questionnaire is answered by mail or telephone. The questionnaire covers maternal behaviors and experiences before, during, and after the index birth. Crucially for the present study, it includes questions that ask about what were the woman's pregnancy intentions, plans, and contraceptive behavior around the time that she became pregnant with the index birth. In all states, a question is included in the core PRAMS questionnaire that asks about pregnancy *intention*, as follows: *"Thinking back to just before you got pregnant with your new baby, how did you feel about becoming pregnant?"* Beginning in 2012, response options have been: "I wanted to be pregnant later", "I wanted to be pregnant sooner", "I wanted to be pregnant then", "I didn't want to be pregnant then or at any time in the future", and "I wasn't sure what I wanted." Unintended births are classified, following standard usage,[14] as those that either result from a pregnancy 'wanted later' or from a pregnancy not wanted then or anytime in the future ('unwanted'). Before 2012, the 'unsure' response option was not available to respondents, and

the fractions of women choosing it since 2012 have been substantial.[45] Because of the resulting discontinuity in the other four response options, we analyze births by '*intentions'* statuses only since 2012.

Since 2007, states have had the option of including a question asking women about whether they were trying to get pregnant when they conceived the index birth: *"When you got pregnant with your new baby, were you trying to get pregnant?"* Those who responded 'yes' we classify as having had a "planned birth." For those who responded 'no', they were then asked if they were using contraception: *"When you got pregnant with your new baby, were you or your husband or partner doing anything to keep from getting pregnant?*" We refer to those who were using contraception at the time they got pregnant as having experienced 'contraceptive failure,' as distinct from those who were 'not trying to get pregnant and not using contraception'. We refer to these questions used since 2007 as the '*planning*' questions, as they allow us to separate 'planned' from 'unplanned' births (two categories) and to further distinguish 'unplanned' births between those from conceptions when using versus when not using contraception (three categories). The only studies we are aware of that have analyzed responses obtained from these '*planning*' questions present descriptive tabulations.[46–48]

Based on which states implemented the optional 'planning' questions in their PRAMS survey questionnaire, and based on for which years the state exceeded the CDC response-rate thresholds, we create two balanced samples of states, meaning either for all years 2007-2020 ('planning' sample) or for all years 2012-2020 ('intentions' sample). Seven states asked the '*planning'* questions and exceeded the response-rate thresholds in all years 2007 to 2020:

Delaware, Illinois, Massachusetts, Maine, New Jersey, Pennsylvania, and Washington. Eight additional states and New York City participated in PRAMS in the years 2012 to 2020 and therefore included the core '*intention*' question, and exceeded the response-rate thresholds in all those years: Alaska, Maryland, Missouri, New Mexico, Utah, Wisconsin, Vermont, and Wyoming (Vermont data were sufficient only to conduct the binary-outcome analyses). We exclude 5.2% of the 2007-2020 'planning' sample and 5.5% of the 2012-2020 'intentions' sample because of missing data (unweighted percentages).

We also create subsamples of respondents by the woman's Medicaid-coverage status around the time of the conception and birth. This is derived from responses to: "*During the month before you got pregnant with your new baby, what kind of health insurance did you have*?", "*During your most recent pregnancy, what kind of health insurance did you have for your prenatal care*?", and "*What kind of health insurance do you have now?*" We classified women as 'Medicaid-covered' when they were enrolled in Medicaid before or during the pregnancy or at PRAMS questionnaire administration. The '*intentions*' sample comprises 144,867 respondents, of whom 78,138 were 'non-Medicaid' and 66,729 'Medicaid' insured. The '*planning*' sample includes 109,971 respondents: 62,318 'non-Medicaid' and 47,653 'Medicaid'.

Measures

Pre-DelCAN versus DelCAN period:

We use two measures of when respondents from Delaware were exposed to the DelCAN Initiative: first, by the year of the birth, where we identify 2007 to 2015 or 2012 to 2015 as the pre-DelCAN birth years, and 2016 to 2020 as the DelCAN years; second, by the year of the

conception, calculated using the number of weeks of pregnancy (gestation) and the date of birth. The conception-year measure allows us to more precisely identify whether the respondents were exposed to DelCAN around the time they got pregnant and carried the pregnancy to term. Based on this variable, we identify 2007 to 2014 or 2012 to 2014 as the pre-DelCAN conception years, and 2015 to 2019 as the DelCAN conception years. We use the 'conception-year' samples for our binary-outcome analyses. However, using the conception-year measure introduces additional missing data on the variables used to calculate the year of conception. We therefore exclude 8.9% observations from the 2012-2019 '*intention*' sample and 9.1% observations from the 2007-2019 '*planning*' sample (using an alternative measure of 'conception year' that reduced the fraction of missing data to around 5% did not change the results). The final number of observations for the analyses by conception year is 133,392, with 72,853 'non-Medicaid' and 60,539 'Medicaid,' for the '*intention*' sample; and is 93,174, with 53,293 'non-Medicaid' and 39,881 'Medicaid,' for the '*planning*' sample.

Socio-demographic characteristics.

To better isolate the association between DelCAN and our five-category '*intention*' and three-category '*planning*' outcomes, we code sociodemographic and reproductive characteristics potentially associated with having an unintended or unplanned birth: mother's age [21,49]; whether the mother was married [14,50] (PRAMS has no information about other relationship statuses such as cohabitation); educational attainment [51]; race/ethnicity [52,53]; and parity.[14] Finally, because mothers' experiences with their newborns may shape perceptions about their 'intentions' and

'planning' around the time of the pregnancy,[54] we code a variable for the number of months after the baby was born when the PRAMS survey was completed.

STATISTICAL ANALYSES

We use two complementary difference-in-difference (DiD) analytical strategies: the first we use to evaluate the associations of DelCAN with the binary outcomes of unintended versus intended births and of planned versus unplanned births; the second we use to evaluate the associations of DelCAN with multi-category 'intentions' outcomes and with multi-category 'planning' outcomes. For the binary outcomes, we estimate two types of Linear Probability Model (LPM) DiD estimators that emphasize year-by-year trends in Delaware versus comparison states between and within the pre-DelCAN and DelCAN periods: respectively 'basic' DiD analyses without controlling for pre-DelCAN trends differences, and 'residualized' DiD analyses with controls for differences in pre-DelCAN trends between Delaware and comparison states. For the multi-category 'intentions' and 'planning' outcomes, we conduct multivariate multinomial logistic (MNL) regressions with a DiD estimator obtained from change-in-probabilities, average marginal effects analyses.

Binary outcome 'Basic' and 'Residualized' estimators:

We first estimate DiD LPMs on the two binary outcomes of unintended births and planned births. The 'basic' DiD estimator (see, for example, Arora and Wolf 2018)[55] comes from an interaction term between Delaware (versus comparison states) and DelCAN conception years (versus pre-DelCAN conception years). In this model, we include state and year fixed effects to account for unobserved invariant characteristics at the state level, and changes that affected

respondents from all states over time. Following,[56,57] we exclude sociodemographic control characteristics from these 'basic' and 'residualized' DiD models to prevent overfitting.

The LPM specification for the 'basic' DiD estimator is shown in Equation (a) below for the 'unintended birth' outcome (an equivalent equation is estimated for the 'planned birth' outcome). Denoting y as the year of conception, j as the state, and γ_y and γ_j respectively for year and state fixed effects, our DiD estimator is given by the value of coefficient β_1 in:

$$(a)\ Unintended\ Birth_{yj} = \beta_0 + \beta_1\ Delaware * DelCAN + \gamma_y + \gamma_j + \varepsilon_{yj}$$

The observations used in the estimation are of individual women, but we omit that subscript. A key assumption of our 'basic' DiD estimator is that the potential trends of the outcome (unintended births) in Delaware and other states would be parallel in the absence of an intervention.[56] Evidence in support of this is sought through examination of whether trends were parallel in the pre-DelCAN period. This is the 2012-2014 year of conception for unintended births and 2007-2014 for planned births. Visual examination of the pre-DelCAN trends suggests parallel linear trends of unintended and planned births before 2015 (see Figures 1A and 2A below). However, we cannot be certain, either statistically or theoretically, whether these trends would have continued to be parallel after 2014. Our 'residualized' DiD model accordingly accounts for differences between Delaware and comparison states' pre-treatment trends (that is, non-parallel trends). For this purpose, we first estimate a regression of a Delaware (vs. other states) indicator interacted with a continuous year of conception variable ('trend'), estimated on pre-DelCAN data only (2012 to 2014 or 2007 to 2014) as shown in Equation (b), where β_2 and β_3 denote the linear trends estimated for births from other states and from Delaware respectively:

$$(b)\ Unintended\ Birth_{yj} = \beta_0 + \beta_1\ Delaware + \beta_2\ Year\ of\ Conception + \beta_3\ Delaware * Year\ of\ Conception + \varepsilon_{yj}$$

Using the coefficients of Equation (b) we next compute the predicted values for observations from the entire period 2012-2019 (or 2007-2019 for '*Planned Births*'), as shown by Equation b':

$$(b')\ Predicted\ Unintended\ Birth_{yj} = \hat{\beta}_0 + \hat{\beta}_1\ Delaware + \hat{\beta}_2\ Year\ of\ Conception + \hat{\beta}_3\ Delaware * Year\ of\ Conception$$

A 'residualized' unintended birth measure is then computed for each individual as the difference between their observed (0,1) value and their predicted value. We next estimate the same LPM as in Equation (a) above, but replacing the observed outcome with the residualized outcome.[58,59] The 'residualized' DiD estimate, corresponding to β_1 in Equation (a), represents the difference between the 'gap' in observed and predicted unintended births in the pre-DelCAN and DelCAN years in Delaware and the 'gap' in other states.

For both the 'basic' and 'residualized' DiD estimators, we use permutation tests to calculate the probability that the (non-zero) magnitude of our DiD estimates is due to chance (Abadie et al. 2010).[60] These p-values show the relative position of the DiD calculated for Delaware as the 'treated' state compared to those estimated for the 'non-treated' states, with p-values < 0.10 statistically significant. For 'unintended births' and 'planned births', we estimate a 'basic' DiD and a 'residualized' DiD for all, non-Medicaid, and Medicaid births.

Multi-category outcome, Multinomial Logistic Regression estimators:

We use a multinomial logit DiD design with multivariate predictors to assess whether DelCAN may have modified any of the five categories of 'intentions,' or three categories of 'planning.' DelCAN might, for example, have reduced one of the two components of unintended births, either 'wanted later' or 'unwanted' births, but not the other.[61] Alternatively, DelCAN may have affected particular intentions outcomes.[49] The DelCAN might also have impacted one but not the other unplanned birth categories, for example, it may have reduced 'contraceptive failures' through more use of highly-effective LARC methods but not births occurring through non-use of contraception. We estimate multivariate multinomial logistic regressions (MNLs) to predict four 'intentions' outcome categories (reference category: 'wanted then') and to predict two 'unplanned' outcome categories (reference category: 'planned birth'). These models include state fixed effects, a linear association with the year of the birth, sociodemographic characteristics (described above and see Appendix), and an interaction term between Delaware (versus comparison states) and DelCAN year (versus pre-DelCAN year). The largely similar findings between the 'basic' and 'residualized' DiD estimators (which we report in Tables 1 and 2 below) support our not attempting to account for differences in 'pre-DelCAN' trends in this multi-category, multivariate DiD modeling. For these MNL analyses, our time variable is year of the index birth rather than year of the conception leading to that birth, and we use a simple 'pre-DelCAN' and 'DelCAN' categorization of time in which we define DelCAN as the years 2016-2020, reflecting births resulting from conceptions after March 2015.

The coefficients for the MNL interaction terms, and the adjusted relative risk ratios (aRRRs) derived from them, because they are from a non-linear model, may be misleading (Ai

and Norton 2003), and accordingly be improved upon by a DiD estimator based on changes in predicted probabilities. Following (Mize 2019),[62] we estimate the Average Marginal Effect (AME) across each value of the covariates in the MNL. Long and Mustillo (2021)[63] refer to this as the Average Discrete Change (ADC), which here refers to the change from the pre-DelCAN to DelCAN period for Delaware residents minus the change from the pre-DelCAN to DelCAN period for residents of other states. The predicted probabilities of each category of 'intentions' or of 'planning' are calculated for four groups: women from Delaware pre-DelCAN, women in Other States pre-DelCAN, women from Delaware during the DelCAN, and women in Other States during the DelCAN. Supplementary tables of aRRRs for the interaction of a dichotomous DelCAN versus pre-DelCAN period and Delaware versus Other States, and descriptive tables of the sociodemographic characteristics across the four groups, are provided in the Appendix. All regression analyses were conducted in Stata 17 (StataCorp) using robust standard errors.

RESULTS

We present our results first for the binary outcomes of unintended versus intended births and of planned births versus unplanned births. This is followed by our results for the multi-category (five) 'intentions' outcomes and (three) 'planning' outcomes.

Binary Outcomes: Unintended Births and Planned Births

[TABLE 1 AND FIGURES 1A, 1B, AND 1C ABOUT HERE]

The fractions of *unintended births* ('wanted later' plus 'unwanted') by conception year between 2012 and 2019, for Delaware and comparison states, are shown separately for all

women in Figure 1A and by Medicaid status in Figures 1B and 1C. For all women in each year, both pre-DelCAN (2012-2014 years of conception) and during the DelCAN (2015-2019 years of conception), the fraction of births from an 'unintended' pregnancy is higher in Delaware than in the comparison states. The pre-DelCAN year 2013 stands out for its much higher unintended-birth fraction in Delaware than in the comparison states. In the DelCAN period, the year 2018 stands out for its similar fraction unintended-birth fraction between Delaware and the comparison states. Other than these two years, 2013 and 2018, the gap between Delaware and the comparison states appears to show little change over time. There is clear visual evidence, however, of decreases in the unintended-birth fraction for both Delaware and the comparison states, and clear visual evidence of a higher unintended-birth fraction in Delaware than in the comparison states. There is suggestive visual evidence of a larger gap between Delaware and the comparison states in the pre-DelCAN than in the DelCAN years.

For the non-Medicaid group (Figure 1B) there is no evidence of decreases in the unintended-birth fraction for either Delaware or the comparison states, nor is there evidence of differences in the unintended-birth fraction between Delaware and the comparison states. In contrast, for the Medicaid group (Figure 1C), there is evidence of decreases in the unintended-birth fraction both in Delaware and in the comparison states, and there is evidence that the unintended-birth fraction is higher among Medicaid women in Delaware than in the comparison states throughout the 2012-2019 period.

Quantitative difference-in-differences estimates (Table 1), before and after adjusting for pre-DelCAN period trends, indicate no statistically-significant differences in the trends of

unintended births in Delaware relative to Other States: either in the all births 'basic' DiD estimate of -2.61, p=0.13, or in the 'residualized' DiD estimate of -2.78, p=0.73. Similarly, when broken down by Medicaid status, none of the DiD estimates is statistically significant: non-Medicaid 'basic' DiD estimate of -1.20, p=0.67, 'residualized' DiD estimate -9.90, p=0.13; and Medicaid 'basic' DiD estimate of 4.00, p=0.13, 'residualized DiD estimate 4.90, p=0.60. In summary, we find no evidence of statistically-significant differences of the trend in *unintended births* between Delaware and the comparison states, neither overall nor separately by Medicaid status.

[TABLE 2 AND FIGURES 2A, 2B, AND 2C ABOUT HERE]

Figure 2 presents trends in *planned births* by conception year, 2007 to 2019, for Delaware and comparison states, overall (Figure 2A) and by Medicaid-coverage status (Figures 2B and 2C). Upward trends in the fraction of planned births are seen across the 2007-2019 period, both in Delaware and in the Other States. Lower fractions of planned births are seen in Delaware compared to in the Other States. There appears to be some narrowing of the gap in this planned-birth fraction between Delaware and Other States over time for the Medicaid-covered group, with the first DelCAN year (conception-year 2015) being the year in which the gap appears to become noticeably narrower.

'Basic' difference-in-differences estimates (see Table 2) indicate that the overall increase in *planned births* in Delaware (Figure 2A) was not statistically-significantly different from the overall increase in comparison states ('basic' DiD 2.00, p=0.17). However, after adjusting for differences in pre-DelCAN period trends in which the Delaware series was not increasing as

much as the Other-States series, the 'residualized' DiD is 4.20 and is statistically significant (p <0.001), indicating a greater overall increase in planned births in Delaware than in Other States. We find a larger pre-DelCAN-to-DelCAN increase in the fraction of planned births in the Medicaid group in Delaware than in comparison states, and this is statistically significant (p <0.001) for both 'basic' and 'residualized' DiD estimates. We estimate that DelCAN 'added' a 4.40 percentage-point increase in planned births to the Medicaid group before accounting for pre-DelCAN trends, and an 8.10 percentage-point increase after accounting for pre-DelCAN trends. We do not find statistically-significant differences between the change in the planned-birth fraction among the non-Medicaid group comparing Delaware and Other States ('basic' DiD 2.60, p=0.17; and 'residualized' DiD -0.40, p=1.00).

In summary, we find suggestive evidence for an overall increase in *planned births* in Delaware attributable to DelCAN (from the 'residualized' DiD estimate), and we find robust evidence for an increase in planned births among the Medicaid-covered group in Delaware attributable to DelCAN (from both the 'basic' and 'residualized' DiD estimates).

Multi-Category Outcomes of 'Intentions' and of 'Planning'

Descriptive statistics for the variables used in the MNL models for the multi-category outcomes of 'Intentions' and of 'Planning' are shown in Appendix Tables A1 and A2. Adjusted Relative Risk Ratios (aRRRs) are shown in Appendix Table A3. Figures 3 and 4 illustrate the adjusted average predicted probabilities derived from the MNL models. They include results of statistical tests for difference in probabilities (letters a, b, or c respectively for $p < 0.001$, $p < 0.01$, and $p < 0.05$) and for difference-in-difference in probabilities ('average marginal effects') for each

category of 'intentions' or 'planning' ('*' for $p < 0.05$). The difference-in-differences indicate whether there is a greater change in the probability between the pre-DelCAN and DelCAN periods for Delaware women than for women in the comparison states. An advantage of the difference-in-difference in probabilities over aRRRs is that they provide a metric with a more useful substantive interpretation: of magnitude of change in the proportions of women having a birth of that particular outcome ('intention' or 'plan') associated with the DelCAN. Another advantage of the difference-in-difference in probabilities is that the components – the simple 'differences in probabilities' – are useful for our being able to interpret whether the difference-in-difference was because in Delaware the direction of change was the same as in the Other States, but with a magnitude of change that was different in Delaware from the Other States, versus because of a difference in direction (for example, a change in Delaware simultaneous with no change in the Other States). Note that the predicted probabilities shown in Figures 3 and 4 are calculated controlling for the sociodemographic characteristics of women in each category.

[FIGURES 3A, 3B, AND 3C ABOUT HERE]

The predicted probabilities for the 'intentions' outcomes are shown in Figure 3A for all women and in Figures 3B and 3C respectively for non-Medicaid and Medicaid women. Importantly for our main research question, for all women (Figure 3A) we find no statistically-significant differences-in-differences in either of the components of unintended births: from pregnancies '*wanted later*' or from pregnancies '*not wanted then or any other time*'. Births from pregnancies 'wanted later' decreased in both Delaware and Other States, but there is no statistically-significant difference between these decreases (no 'difference in difference'). The

probability of an 'unwanted' birth, meanwhile, did not change between the pre-DelCAN period in either Delaware or in Other States. For the all-women 'intentions' outcomes, in both Delaware and in Other States, the increase in the proportion of births 'wanted sooner' is statistically-significant. The difference-in-difference in probabilities, however, indicates a larger increase in the proportions of births from a '*wanted sooner'* pregnancy in Delaware compared to Other States ($p \leq 0.05$). The 'wanted sooner' proportion increased in Delaware by 3.6 percentage points, from 0.125 to 0.161, whereas it increased by only 1.2 percentage points, from 0.150 to 0.162, in the Other States, implying a 2.4 percentage-point larger increment in Delaware.

We find no statistically-significant differences-in-differences in the other components of intentions ('*wanted then*', '*unsure'*) associated with the DelCAN. There appear to be small increases in the fractions of births 'wanted then' in both Delaware and Other States, but only for Other States is this a statistically-significant increase. For the proportions of births from a '*wanted sooner'* pregnancy to have increased in Delaware more than in Other States, there must have been some offsetting categories of 'intention' that increased less or decreased more in Delaware than in Other States. But our results suggest that it was through some combination of changes in the other intention categories, none of which was large enough to be statistically detectable.

Figures 3B and 3C respectively show analogous results to those of Figure 3A, but now for the non-Medicaid and Medicaid groups separately. Among non-Medicaid women (Figure 3B), births in the '*wanted sooner'* category increased from 0.175 to 0.215 in Delaware and from 0.192 to 0.206 in Other States. These increases in the predicted probabilities '*wanted sooner'*

from the pre-DelCAN to DelCAN period are statistically significant both in Delaware and in Other States. The difference-in-difference in probabilities is also statistically significant ($p \leq 0.05$). That is, the substantially greater (4.0 percentage-point) increase in births 'wanted sooner' in Delaware than in Other States (1.4 percentage-point increase) implies a positive DelCAN impact on '*wanted sooner'* births for non-Medicaid women. The magnitude of that impact is 2.6 percentage points (4.0 – 1.6).

For Medicaid women in Delaware too (Figure 3C), the difference-in-difference in probabilities in '*wanted sooner'* births is statistically significant ($p \leq 0.05$), representing a substantially greater increase (by 2.0 percentage points) in Delaware compared to in Other States between the pre-DelCAN and DelCAN periods. The '*wanted sooner'* birth probability increased statistically significantly in Delaware, from 0.063 to 0.087, whereas this probability was little changed among Medicaid-covered women in Other States (0.095 and 0.099 for pre-DelCAN and DelCAN respectively). In summary, DelCAN's impact on increasing births from pregnancies 'wanted sooner' is seen overall and for both Medicaid and non-Medicaid women.

Finally, as for the findings for all women (Figure 3A), we do not observe statistically-significant differences-in-differences in probabilities between Delaware and Other States for any other intentions outcome category (not for 'wanted later', 'wanted then', 'unwanted', or 'unsure'), neither for the non-Medicaid group (Figure 3B) nor for the Medicaid group (Figure 3C).

Summarizing the findings from changes in average predicted probabilities for the 2012-2020 analyses of birth timing *intentions*, we find no evidence of greater decreases in births from

pregnancies 'wanted later' or 'unwanted' in Delaware than in Other States during the DelCAN period compared to the pre-DelCAN period. We do, however, find evidence of a greater increase in the fraction of births from pregnancies *'wanted sooner'* in Delaware compared to in Other States. Moreover, each of these findings hold for both Medicaid-covered and non-Medicaid women.

[FIGURES 4A, 4B, AND 4C ABOUT HERE]

The predicted probabilities for the '*planning*' outcomes are shown in Figure 4A for all women. We find evidence of statistically-significantly higher increases of planned births for all women in both Delaware and Other States. The probability of having a planned birth increased by 7.9 percentage-points, from 0.503 to 0.582, in Delaware and by 5.7 percentage-points, from 0.538 to 0.595, in comparison states. The larger increase in Delaware than in comparison states is statistically significant ($p \leq 0.05$), implying that DelCAN contributed a 2.2 percentage-point increase in 'planned' births between the pre-DelCAN and DelCAN periods. That is, slightly more than a quarter of the observed 7.9 percentage-point increase in the 'planned' fraction of births in Delaware between 2007-2015 and 2016-2020 we infer to have been a 'DelCAN' effect.

'Unplanned' births may occur either when not using contraception or when using contraception ('contraceptive failure'). Of these possibilities, only the larger decrease of births resulting from 'not using contraception' in Delaware than in Other States is statistically significant as a difference-in-difference ($p \leq 0.05$). The decrease is by 3.5 percentage-points in Delaware, from 0.271 to 0.236, whereas the decrease is by 1.7 percentage-points in the Other States, from 0.253 to 0.236, implying a 1.8 percentage-point decrease attributable to DelCAN

(3.5 – 1.7). ‘Contraceptive failure’ also decreased in both Delaware and in Other States, but the magnitudes of those decreases are not statistically-significantly different. We cannot, therefore, conclude that DelCAN caused any reduction in births occurring due to contraceptive failure in Delaware.

Figures 4B and 4C show results of the ‘planning’ outcomes by Medicaid status. Difference-in-differences in probabilities indicate that the overall larger increase of planned births in Delaware was entirely due to increases in planned births by Medicaid-covered women. The increase of planned births in this group was quite notable (see Figure 4C). Before DelCAN, the average probability of a ‘planned birth’ among Medicaid-covered women was 0.289 in Delaware, whereas it was 0.381 in the DelCAN period, an increase of 9.2 percentage points. The average probability of a planned birth meanwhile increased by 5.6 percentage points, from 0.352 to 0.408, among Medicaid-covered women in Other States over this period. The ‘additional’ 3.6 percentage-points of planned births in Delaware relative to in Other States (9.2 – 5.6) is statistically significant ($p \leq 0.05$). This may therefore be interpreted as indicating that more than one third of the 9.2 percentage-point increase in the planned-birth fraction for Medicaid-covered women in Delaware can be attributed to the DelCAN. We do not find a statistically-significant difference-in-difference in probabilities of planned births among the non-Medicaid group (Figure 4B). We also do not find a statistically-significant difference-in-difference in probabilities for either the ‘not trying, not using contraception’ outcome, or in ‘not trying, using contraception’ (contraceptive failure), for either the Medicaid or non-Medicaid group.

Summarizing the findings on changes in average predicted probabilities for the 2007-2020 analyses of pregnancy *planning*, we find evidence of an overall higher increase in the fraction of planned births in Delaware than in comparison states in the DelCAN period relative to the pre-DelCAN period. This increase, however, is confined to the Medicaid-covered group. Moreover, the estimated addition in the planned-births fraction that can potentially be attributed to DelCAN is higher for Medicaid women (3.6 percentage points) than it is for all women (2.2 percentage points). The greater increase in planned births in Delaware than in Other States is noteworthy in three ways. First, it is a consistent finding between our binary-outcome DiD estimates (both 'basic' and 'residualized' DiD estimators) and our multi-category-outcome multivariate DiD estimates. Second, it is entirely due to an increase for the population at higher risk of an unplanned births (those covered by Medicaid). Third, it contrasts with the null 'unintended births' findings. Consistently across the binary and multi-category DiD analyses, and for both the Medicaid and non-Medicaid groups, we find no DelCAN impact on reducing unintended births, whereas we find a clear and consistent impact of DelCAN on increasing planned births.

DISCUSSION

The DelCAN Initiative's first explicit goal, similar to that of other contraceptive initiatives before it and those that are now ongoing in or planned for other states, was to reduce unintended pregnancies. This was in the context of Delaware's having among the highest proportions and rates of unintended pregnancies and births in the country prior to the DelCAN's rollout.[24,25]

Reducing the proportion of pregnancies that are unintended continues to be a U.S. public health priority.[41]

Approximately 40% of unintended pregnancies are terminated by an abortion,[15] with approximately 60% being carried to term and resulting in a live birth, referred to here as an 'unintended birth.' Our principal conclusion from the findings of the present study is that, with respect to reducing the fraction of births from unintended pregnancies in Delaware over the course of the DelCAN Initiative, the DelCAN did not achieve its goal. This conclusion adds importantly to the findings of a previous study of trends in abortions in Delaware relative to in other states also across the periods before and during the DelCAN Initiative.[64] That study's main finding was parallel to that of the present study of unintended births: abortion trends across the pre-DelCAN and DelCAN periods were not found to be different between Delaware and the comparison states. Because approximately 95% of abortions correspond to 'unintended pregnancies',[65] this and the present study together point to the DelCAN's not having reduced either component of unintended pregnancies, whereas reducing unintended pregnancies was the primary stated goal of the DelCAN Initiative.

The apparent lack of any reduction in unintended pregnancies is in some ways surprising, since by the metrics of the DelCAN's having improved contraceptive access (the third of the Initiative's stated goals), it had some notable successes, and these successes might have been expected to deliver also reductions in unintended pregnancies. The contraceptive-access successes were primarily on metrics of the provision of long-acting reversible contraceptives (LARC). A media campaign early in the intervention raised awareness of the availability of low-

cost or free contraception[4] and, with a wide-ranging medical and administrative training effort,[2] practices were able to achieve progress towards a 'process' goal of increased same-day LARC insertions.[66] Policy changes in Medicaid reimbursement coupled with LARC training led to substantial increases in post-partum LARC,[5,43] not only among Medicaid-covered women but also among privately-insured women.[67] At Delaware's Title X clinics, which received not only training in LARC insertion, but also stocks of LARC devices,[1] increases in LARC uptake by the mostly-low-income patients were found to have occurred relative to patients in other states' Title X clinics over the pre-DelCAN to early-DelCAN period.[3] Increasing the provision of LARC at Title X clinics was similarly a focus of the Colorado Initiative.[7] We note that while previous initiatives were judged to have been successful,[6–8,68–70] in no study was the 'success' metric that of all unintended pregnancies or of unintended births.

In the present study, we were both able to evaluate the performance of the DelCAN against the criterion of 'unintended births', and to evaluate the performance of the DelCAN separately against the criteria of births that were 'too soon' and births that were 'unwanted', being the two separate components that sum to 'unintended births.' We did not find that either of these two components separately were changed by the DelCAN. However, we did find that there were impacts of the DelCAN on certain 'birth intentions' and 'birth planning' dimensions. First, while 'unintended births' were not reduced by the DelCAN, 'unplanned births' were. In both binary and multi-category difference-in-difference analyses, we found that 'planned births' *did* increase more in Delaware than in comparison states over the pre-DelCAN to DelCAN periods. Second, we found that while there was no DelCAN impact on reducing births 'wanted later',

there was a DelCAN impact of increasing births 'wanted sooner.' These two new conclusions are, we argue, mutually consistent. Although a birth 'wanted sooner' is indicative of a sub-optimal outcome for a woman judged against the ideal timing for her reproductive life course, the 'wanted sooner' birth may still be, and indeed is very likely to be, a 'planned' birth, given that for her to declare 'wanted sooner' is also for her to have not declared it to be 'unwanted' nor to have expressed that she was 'unsure' about what she wanted when she got pregnant.

The paradox of such a singular narrative focus of contraceptive-access initiatives (including the DelCAN) on 'unintended births' by their program designers has been previously pointed out by Klerman (2000).[36] Had the DelCAN's stated goal been to reduce unplanned births, we would argue that the findings of the present study point to success on that metric. Moreover, given the implicit goal of the DelCAN and similar contraceptive initiatives to address socioeconomic disparities in contraceptive-care access, our finding that the reduction in unplanned births as a result of the DelCAN occurred entirely through reductions in Medicaid-insured women's unplanned births might also be noted as a program success. We estimated that of the 9 percentage point increase in planned births between 2007-2015 and 2016-2020 in Delaware, more than a third may be attributed to the DelCAN Initiative. This would constitute additional evidence for a favorable impact of DelCAN on the arguably-reasonable public-health goal of increasing the fraction of planned births especially for those at highest risk of unplanned births.

However, we may then ask whether the attainment of increases in planned births occurred at the expense of Delaware women's reproductive autonomy. Contraceptive-access initiatives

including the DelCAN emphasize initiating contraception, whereas for many women, ability to control the stopping of contraception (e.g., LARC removals) has been shown to be paramount in their choice of method,[71,72] including in Delaware specifically.[73] Also not typically considered in contraceptive-access initiatives are births that occur later than desired. Kost et al (2023)[49] find that 'wanted sooner' births have increased contemporaneously with decreases in 'wanted later' births in the U.S. Both may be considered to be suboptimal 'family planning' outcomes.[74] 'Wanted sooner' outcomes may be increased in contraceptive initiatives that attend more to counseling on contraceptive initiation than on contraceptive discontinuation, or in which providers may attempt to thwart women's expressed wishes for discontinuing provider-controlled contraception.[75] The extent to which the increase in 'wanted sooner' births in Delaware was a consequence of contraceptive counseling focused on initiating contraception without planning also for its subsequent discontinuation, or of intentional non-cooperation by providers in responding to patients' requests for LARC removal, are open questions meriting additional investigation. Also meriting additional investigation is the potential extent to which there was reluctance of women to initiate LARC or other provider-controlled methods in Delaware. Distrust of the provider to discontinue the method, in particular by removing the LARC device at the time of the woman's choosing, may explain such a reluctance.

Another facet of our more nuanced examination of change in reproductive outcomes was our distinguishing 'unplanned' births when the woman and her partner were using versus not using contraception. The former we refer to as 'contraceptive failure.' Somewhat surprisingly given the DelCAN's emphasis on highly-effective contraceptive methods (LARCs), we did not

find any impact of the DelCAN on reducing contraceptive failure. Despite an observed large decrease in contraceptive failure in Delaware between 2007-2015 and 2016-2020, it was not differentially greater than decreases occurring in other states over the same period. We did find, however, a modest impact of the DelCAN in reducing unplanned births occurring when not using contraception: a 2 percentage-point decrease out of an overall 8 percentage-point decrease in unplanned births when not using contraception. This finding has potential implications for program emphasis on shifts to more effective contraception (LARCs in particular) versus shifts to using any contraception instead of none. Karpilow and Thomas (2017)[76] argue based on simulations conducted for a previous LARC-focused contraceptive initiative (that of St. Louis) that shifts to using any contraception will have a greater impact on reducing unintended pregnancies and births than will shifts to LARC use in place of less effective contraceptive methods. Among the mostly low-income women who attended Delaware's Title X clinics [3] and among Medicaid-insured women who made outpatient visits to providers,[77] increases in LARC initiation, but not in other prescription contraceptive method initiation, were found. This suggested shifts from moderately-effective to highly-effective methods was an outcome of the DelCAN, although of relatively modest magnitudes. Such shifts, however, have also been found nationally (Eeckhaut 2022). Without data before and after DelCAN on contraceptive use by all women in the state, we unfortunately do not know about shifts away from non-use of contraception that may have occurred partly as a result of the DelCAN.

Finally, although DelCAN did not achieve its stated goal of reducing unintended births, which are primarily those from 'mistimed' pregnancies,[22] we suggest that the definition of

'mistimed' as conventionally used in the field (e.g., Mosher et al. 2012), and that has been the focus of evaluations of the impacts of previous contraceptive-access initiatives,[7,69] is itself questionable. Recent studies point to large increases in births 'wanted sooner' as an underemphasized type of 'mistimed' birth,[49] and of associated increases in maternal age.[78] For contraceptive initiatives to move towards a focus on enabling women to achieve their reproductive goals, we suggest a shift towards a goal of increasing the fraction of on-time pregnancies and births. This would involve reducing both births that are 'wanted later' and births that are 'wanted sooner,' in favor of births 'wanted then.' We note in this regard that because 'wanted sooner' births were already more prevalent among higher socioeconomic status (as represented in our study by 'non-Medicaid-insured') women in Delaware, we found that the absolute percentage-point increase in 'wanted sooner' births attributed to the DelCAN was slightly greater for this group than it was for lower socioeconomic-status (here 'Medicaid-insured') women. However, for both groups to have seen increases in 'wanted sooner' births suggests a need for designs of contraceptive initiatives' to incorporate the goal of increasing 'wanted then' births across all socioeconomic groups.

REFERENCES

1. Choi, Y.S., Rendall, M.S., Boudreaux, M, and Roby. Summary of the Delaware Contraceptive Access Now (DelCAN) Initiative. Published online June 4, 2020. https://popcenter.umd.edu/delcaneval/summary-init

2. Skračić I, Lewin AB, Roy KM. Evaluation of the Delaware Contraceptive Access Now (DelCAN) initiative: A qualitative analysis of site leaders' implementation recommendations. *Contraception*. 2021;104(2):211-215. doi:10.1016/j.contraception.2021.03.015

3. Boudreaux M, Xie L, Choi YS, Roby DH, Rendall MS. Changes to Contraceptive Method Use at Title X Clinics Following Delaware Contraceptive Access Now, 2008-2017. *Am J Public Health*. 2020;110(8):1214-1220. doi:10.2105/AJPH.2020.305666

4. Marthey D, Rashid H, Xie L, Boudreaux M. An evaluation of the Be Your Own Baby public awareness campaign. *Health Serv Res*. 2021;56(5):766-776. doi:10.1111/1475-6773.13698

5. Gifford K, McColl R, McDuffie MJ, Boudreaux M. Postpartum long-acting reversible contraceptive adoption after a statewide initiative. *Health Services Research*. 2024;59(3):e14300. doi:10.1111/1475-6773.14300

6. Ricketts S, Klingler G, Schwalberg R. Game change in Colorado: widespread use of long-acting reversible contraceptives and rapid decline in births among young, low-income women. *Perspect Sex Reprod Health*. 2014;46(3):125-132. doi:10.1363/46e1714

7. Goldthwaite LM, Duca L, Johnson RK, Ostendorf D, Sheeder J. Adverse Birth Outcomes in Colorado: Assessing the Impact of a Statewide Initiative to Prevent Unintended Pregnancy. *Am J Public Health*. 2015;105(9):e60-e66. doi:10.2105/AJPH.2015.302711

8. Peipert JF, Madden T, Allsworth JE, Secura GM. Preventing Unintended Pregnancies by Providing No-Cost Contraception. *Obstet Gynecol*. 2012;120(6):1291-1297.

9. Smith MG, Hale N, Kelley S, Satterfield K, Beatty KE, Khoury AJ. South Carolina's Choose Well Initiative to Reduce Unintended Pregnancy: Rationale, Implementation Design, and Evaluation Methodology. *Am J Public Health*. 2022;112(S5):S484-S489. doi:10.2105/AJPH.2022.306889

10. White KO, Lerner NM, LeRoy L, Decker E, Clark J. Massachusetts Initiative to Improve Contraception Services: A Tale of Two Programs. *Am J Public Health*. 2022;112(S5):S478-S483. doi:10.2105/AJPH.2022.306905

11. Upstream North Carolina (no date). Upstream USA. https://upstream.bwstg.com/partnerships/north-carolina/

12. U.S. Department of Health and Human Services. Biden-Harris Administration Announces Public-Private Partnership to Expand Access to Contraceptive Care. 2023. https://www.hhs.gov/about/news/2023/06/21/biden-harris-administration-announces-public-private-partnership-expand-access-contraceptive-care.html

13. The Office of the Governor Wes Moore. Governor Moore Announces Expanded Access to Contraceptive Care Across Maryland. 2023. Accessed August 24, 2024. https://governor.maryland.gov/news/press/pages/governor-moore-announces-expanded-access-to-contraceptive-care-across-maryland.aspx

14. Mosher WD, Jones J, Abma JC. Intended and unintended births in the United States: 1982-2010. *Natl Health Stat Report*. 2012;(55):1-28.

15. Finer LB, Zolna MR. Unintended pregnancy in the United States: incidence and disparities, 2006. *Contraception*. 2011;84(5):478-485. doi:10.1016/j.contraception.2011.07.013

16. Kost K, Forrest JD. Intention status of U.S. births in 1988: differences by mothers' socioeconomic and demographic characteristics. *Fam Plann Perspect*. 1995;27(1):11-17.

17. Sundaram A, Vaughan B, Kost K, et al. Contraceptive Failure in the United States: Estimates from the 2006–2010 National Survey of Family Growth. *Perspect Sex Reprod Health*. 2017;49(1):7-16. doi:10.1363/psrh.12017

18. Dehlendorf C, Rodriguez MI, Levy K, Borrero S, Steinauer J. Disparities in family planning. *American Journal of Obstetrics and Gynecology*. 2010;202(3):214-220. doi:10.1016/j.ajog.2009.08.022

19. Guttmacher Institute. *Unintended Pregnancy in the United States [Fact Sheet]*.; (n.d). Accessed February 7, 2023. https://www.guttmacher.org/fact-sheet/unintended-pregnancy-united-states

20. Finer LB, Henshaw SK. Disparities in Rates of Unintended Pregnancy In the United States, 1994 and 2001. *Perspectives on Sexual and Reproductive Health*. 2006;38(2):90-96. doi:10.1363/3809006

21. Finer LB, Zolna MR. Shifts in intended and unintended pregnancies in the United States, 2001-2008. *Am J Public Health*. 2014;104 Suppl 1(Suppl 1):S43-48. doi:10.2105/AJPH.2013.301416

22. Finer LB, Zolna MR. Declines in Unintended Pregnancy in the United States, 2008-2011. *N Engl J Med*. 2016;374(9):843-852. doi:10.1056/NEJMsa1506575

23. Finer LB, Kost K. Unintended pregnancy rates at the state level. *Perspect Sex Reprod Health*. 2011;43(2):78-87. doi:10.1363/4307811

24. Guttmacher Institute. *State Facts About Unintended Pregnancy: Delaware*. Guttmacher Institute; 2016. Accessed April 25, 2023. https://www.guttmacher.org/sites/default/files/factsheet/de_8_0.pdf

25. Kost K. Unintended Pregnancy Rates at the State Level: Estimates for 2010 and Trends Since 2002. Accessed April 25, 2023. https://www.guttmacher.org/report/unintended-pregnancy-rates-state-level-estimates-2010-and-trends-2002

26. Horvath S, Bumpus M, Luchowski A. From uptake to access: a decade of learning from the ACOG LARC program. *American Journal of Obstetrics and Gynecology*. 2020;222(4, Supplement):S866-S868.e1. doi:10.1016/j.ajog.2019.11.1269

27. Wu JP, Moniz MH, Ursu AN. Long-acting Reversible Contraception-Highly Efficacious, Safe, and Underutilized. *JAMA*. 2018;320(4):397-398. doi:10.1001/jama.2018.8877

28. Gomez AM, Fuentes L, Allina A. Women or LARC First? Reproductive Autonomy and the Promotion of Long-Acting Reversible Contraceptive Methods. *Perspect Sex Reprod Health*. 2014;46(3):171-175. doi:10.1363/46e1614

29. Holt K, Reed R, Crear-Perry J, Scott C, Wulf S, Dehlendorf C. Beyond same-day long-acting reversible contraceptive access: a person-centered framework for advancing high-quality, equitable contraceptive care. *American Journal of Obstetrics & Gynecology*. 2020;222(4):S878.e1-S878.e6. doi:10.1016/j.ajog.2019.11.1279

30. Dehlendorf C, Perritt J. Statewide Contraceptive Access Initiatives: A Critical Perspective. *Am J Public Health*. 2022;112(S5):S490-S493. doi:10.2105/AJPH.2022.306930

31. Sawhill LV. *Generation Unbound*. Washington, DC: Brookings Institution Press; 2014.

32. Wu LL, Mark NDE. Could We Level the Playing Field? Long-Acting Reversible Contraceptives, Nonmarital Fertility, and Poverty in the United States. *RSF: The Russell Sage Foundation Journal of the Social Sciences*. 2018;4(3):144-166. doi:10.7758/RSF.2018.4.3.08

33. Lindo JM. Weighing the evidence on the likely effects of expanding access to LARCs on poverty. *Am J Obstet Gynecol*. 2020;222(4S):S864-S865. doi:10.1016/j.ajog.2020.01.057

34. Foster DG. The problems with a poverty argument for long-acting reversible contraceptive promotion. *American Journal of Obstetrics & Gynecology*. 2020;222(4):S861-S863. doi:10.1016/j.ajog.2020.01.051

35. Finer LB, Sonfield A. The evidence mounts on the benefits of preventing unintended pregnancy. *Contraception*. 2013;87(2):126-127. doi:10.1016/j.contraception.2012.12.005

36. Klerman LV. The Intendedness of Pregnancy: A Concept in Transition. *Matern Child Health J*. 2000;4(3):155-162. doi:10.1023/A:1009534612388

37. Aiken ARA, Borrero S, Callegari LS, Dehlendorf C. Rethinking the Pregnancy Planning Paradigm: Unintended Conceptions or Unrepresentative Concepts? *Perspectives on Sexual and Reproductive Health*. 2016;48(3):147-151. doi:10.1363/48e10316

38. Barrett G, Wellings K. What is a "planned" pregnancy? Empirical data from a British study. *Soc Sci Med*. 2002;55(4):545-557. doi:10.1016/s0277-9536(01)00187-3

39. Moreau C, Bohet A, Le Guen M, Loilier AR, Bajos N, FECOND Group. Unplanned or unwanted? A randomized study of national estimates of pregnancy intentions. *Fertil Steril*. 2014;102(6):1663-1670. doi:10.1016/j.fertnstert.2014.08.011

40. Santelli JS, Lindberg LD, Orr MG, Finer LB, Speizer I. Toward a Multidimensional Measure of Pregnancy Intentions: Evidence from the United States. *Studies in Family Planning*. 2009;40(2):87-100. doi:10.1111/j.1728-4465.2009.00192.x

41. U.S. Department of Health & Human Services. Healthy People 2030: Reduce the proportion of unintended pregnancies — FP 01. n.d. Accessed July 21, 2024. https://health.gov/healthypeople/objectives-and-data/browse-objectives/family-planning/reduce-proportion-unintended-pregnancies-fp-01

42. Shulman HB, D'Angelo DV, Harrison L, Smith RA, Warner L. The Pregnancy Risk Assessment Monitoring System (PRAMS): Overview of Design and Methodology. *Am J Public Health*. 2018;108(10):1305-1313. doi:10.2105/AJPH.2018.304563

43. Caudillo ML, Hurtado-Acuna C, Rendall MS, Boudreaux M. Association of the Delaware Contraceptive Access Now Initiative with Postpartum LARC Use. *Matern Child Health J*. 2022;26(8):1657-1666. doi:10.1007/s10995-022-03433-2

44. CDC. PRAMS Data. Pregnancy Risk Assessment Monitoring System (PRAMS). May 20, 2024. Accessed July 25, 2024. https://www.cdc.gov/prams/php/data-research/index.html

45. Maddow-Zimet I, Kost K. Effect of Changes in Response Options on Reported Pregnancy Intentions: A Natural Experiment in the United States. *Public Health Rep*. 2020;135(3):354-363. doi:10.1177/0033354920914344

46. CDC. Prepregnancy Contraceptive Use Among Teens with Unintended Pregnancies Resulting in Live Births — Pregnancy Risk Assessment Monitoring System (PRAMS), 2004–2008. *MMWR 2012*. 2012;61(2):25-29.

47. D'Angelo D, Williams L, Morrow B, et al. Preconception and interconception health status of women who recently gave birth to a live-born infant--Pregnancy Risk Assessment

Monitoring System (PRAMS), United States, 26 reporting areas, 2004. *MMWR Surveill Summ*. 2007;56(10):1-35.

48. Robbins CL, Zapata LB, Farr SL, et al. Core State Preconception Health Indicators — Pregnancy Risk Assessment Monitoring System and Behavioral Risk Factor Surveillance System, 2009. *Morbidity and Mortality Weekly Report: Surveillance Summaries*. 2014;63(3):1-62.

49. Kost K, Zolna MR, Murro R. Pregnancies in the United States by Desire for Pregnancy: Estimates for 2009, 2011, 2013, and 2015. *Demography*. 2023. doi:10.1215/00703370-10690005

50. Musick K, England P, Edgington S, Kangas N. Education Differences in Intended and Unintended Fertility. *Social Forces*. 2009;88(2):543-572. doi:10.1353/sof.0.0278

51. Jones J, Mosher W, Daniels K. Current contraceptive use in the United States, 2006-2010, and changes in patterns of use since 1995. *National health statistics reports*. 2012;(60):1-25.

52. Kim TY, Dagher RK, Chen J. Racial/Ethnic Differences in Unintended Pregnancy: Evidence From a National Sample of U.S. Women. *American Journal of Preventive Medicine*. 2016;50(4):427-435. doi:10.1016/j.amepre.2015.09.027

53. Sweeney MM, Raley RK. Race, Ethnicity, and the Changing Context of Childbearing in the United States. *Annu Rev Sociol*. 2014;40:539-558. doi:10.1146/annurev-soc-071913-043342

54. Arteaga S, Caton L, Gomez AM. Planned, unplanned and in-between: the meaning and context of pregnancy planning for young people. *Contraception*. 2019;99(1):16-21. doi:10.1016/j.contraception.2018.08.012

55. Arora K, Wolf DA. Does Paid Family Leave Reduce Nursing Home Use? The California Experience. *J Policy Anal Manage*. 2018;37(1):38-62. doi:10.1002/pam.22038

56. Kahn-Lang A, Lang K. The Promise and Pitfalls of Differences-in-Differences: Reflections on 16 and Pregnant and Other Applications. *Journal of Business & Economic Statistics*. 2020;38(3):613-620. doi:10.1080/07350015.2018.1546591

57. Sant'Anna PHC, Zhao J. Doubly robust difference-in-differences estimators. *Journal of Econometrics*. 2020;219(1):101-122. doi:10.1016/j.jeconom.2020.06.003

58. Bailey MJ, Bart L, Lang VW. The Missing Baby Bust: The Consequences of the COVID-19 Pandemic for Contraceptive Use, Pregnancy, and Childbirth Among Low-Income Women. *Popul Res Policy Rev*. 2022;41(4):1549-1569. doi:10.1007/s11113-022-09703-9

59. Kearney MS, Levine PB, Pardue L. The Puzzle of Falling US Birth Rates since the Great Recession. *Journal of Economic Perspectives*. 2022;36(1):151-176. doi:10.1257/jep.36.1.151

60. Abadie A, Diamond A, Hainmueller J. Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program. *Journal of the American Statistical Association*. 2010;105(490):493-505. doi:10.1198/jasa.2009.ap08746

61. D'Angelo DV, Gilbert BC, Rochat RW, Santelli JS, Herold JM. Differences Between Mistimed and Unwanted Pregnancies Among Women Who Have Live Births. *Perspectives on Sexual and Reproductive Health*. 2004;36(5):192-197. doi:10.1363/3619204

62. Mize TD. Best practices for estimating, interpreting, and presenting nonlinear interaction effects. *Sociological Science*. 2019;6:81-117.

63. Long JS, Mustillo SA. Using Predictions and Marginal Effects to Compare Groups in Regression Models for Binary Outcomes. *Sociological Methods & Research*. 2021;50(3):1284-1320. doi:10.1177/0049124118799374

64. Kim T, Marthey D, Boudreaux M. Contraceptive access reform and abortion: Evidence from Delaware. *Health Serv Res*. 2023;58(4):781-791. doi:10.1111/1475-6773.14156

65. Kost K, Maddow-Zimet I, Little AC. Pregnancies and Pregnancy Desires at the State Level: Estimates for 2017 and Trends Since 2012. 2021. doi:10.1363/2021.33141

66. McColl R, Gifford K, McDuffie MJ, Boudreaux M. Same-day long-acting reversible contraceptive utilization after a statewide contraceptive access initiative. *Am J Obstet Gynecol*. 2023;228(4):451.e1-451.e8. doi:10.1016/j.ajog.2022.12.304

67. Yoder M, Boudreaux M. The effect of contraceptive access reform on privately insured patients: Evidence from Delaware Contraceptive Access Now. *PLoS One*. 2023;18(1):e0280588. doi:10.1371/journal.pone.0280588

68. Lindo JM, Packham A. How Much Can Expanding Access to Long-Acting Reversible Contraceptives Reduce Teen Birth Rates? *American Economic Journal: Economic Policy*. 2017;9(3):348-376. doi:10.1257/pol.20160039

69. Secura GM, Madden T, McNicholas C, et al. Provision of No-Cost, Long-Acting Contraception and Teenage Pregnancy. *New England Journal of Medicine*. 2014;371(14):1316-1323. doi:10.1056/NEJMoa1400506

70. Yeatman S, Flynn JM, Stevenson A, Genadek K, Mollborn S, Menken J. Expanded Contraceptive Access Linked To Increase In College Completion Among Women In Colorado. *Health Aff (Millwood)*. 2022;41(12):1754-1762. doi:10.1377/hlthaff.2022.00066

71. Craig AD, Dehlendorf C, Borrero S, Harper CC, Rocca CH. Exploring young adults' contraceptive knowledge and attitudes: disparities by race/ethnicity and age. *Womens Health Issues*. 2014;24(3):e281-289. doi:10.1016/j.whi.2014.02.003

72. Jackson AV, Karasek D, Dehlendorf C, Foster DG. Racial and ethnic differences in women's preferences for features of contraceptive methods. *Contraception*. 2016;93(5):406-411. doi:10.1016/j.contraception.2015.12.010

73. Eeckhaut MCW, Hara Y. Reproductive Oppression Enters the Twenty-First Century: Pressure to Use Long-Acting Reversible Contraception (LARC) in the Context of "LARC First." *Socius*. 2023;9:23780231231180378. doi:10.1177/23780231231180378

74. Rendall MS, Harrison EY, Caudillo ML. Intentionally or Ambivalently Risking a Short Interpregnancy Interval: Reproductive-Readiness Factors in Women's Postpartum Non-Use of Contraception. *Demography*. 2020;57(3):821-841. doi:10.1007/s13524-020-00859-7

75. Manzer JL, Bell AV. "We're a Little Biased": Medicine and the Management of Bias through the Case of Contraception. *J Health Soc Behav*. 2021;62(2):120-135. doi:10.1177/00221465211003232

76. Karpilow QC, Thomas AT. Reassessing the importance of long-acting contraception. *Am J Obstet Gynecol*. 2017;216(2):148.e1-148.e14. doi:10.1016/j.ajog.2016.10.012

77. Boudreaux M, Gifford K, McDuffie MJ, McColl R, Kim T, Knight EK. Delaware Contraceptive Access Now and Contraceptive Initiation Among Medicaid Enrollees, 2015–2020. *Am J Public Health*. 2022;112(S5):S537-S540. doi:10.2105/AJPH.2022.306938

78. Mathews TJ, Hamilton BE. *Mean Age of Mothers Is on the Rise: United States, 2000-2014*. Centers for Disease Control and Prevention, National Center for Health Statistics; 2016. https://www.cdc.gov/nchs/data/databriefs/db232.pdf

Table 1. Difference-in-Difference Estimates for Unintended Births, All births and by Medicaid status. Conception Years 2012-2019.

	All births			Non-Medicaid births			Medicaid births		
	Est.	Robust SE	Permutation P-Value	Est.	Robust SE	Permutation P-Value	Est.	Robust SE	Permutation P-Value
Basic Outcomes									
Difference-in-Difference Estimate	-2.61	0.013	0.13	-1.20	0.015	0.67	-4.01	0.020	0.13
Pre-DelCAN Delaware mean percentage unintended	33.7			20.5			46.9		
Residualized Outcomes									
Difference-in-Difference Estimate	-2.78	0.013	0.73	-9.90	0.015	0.13	-4.90	0.020	0.60

Source: 2012-2020 PRAMS.

Notes: Weighted estimates. Basic Outcomes estimation uses observed values. Residualized Outcomes estimation removes the group specific pre-DelCAN mean and linear trend. Permutation p-values are the share of permutations in which the absolute value of the difference-in-differences coefficient exceeds the one observed for Delaware.

Number of observations: all births = 133,392; non-Medicaid births = 72,853, Medicaid births = 60,539.

Table 2. Difference-in-Difference Estimates for the Percent of Planned Births, All births and by Medicaid status. Conception Years 2007-2019.

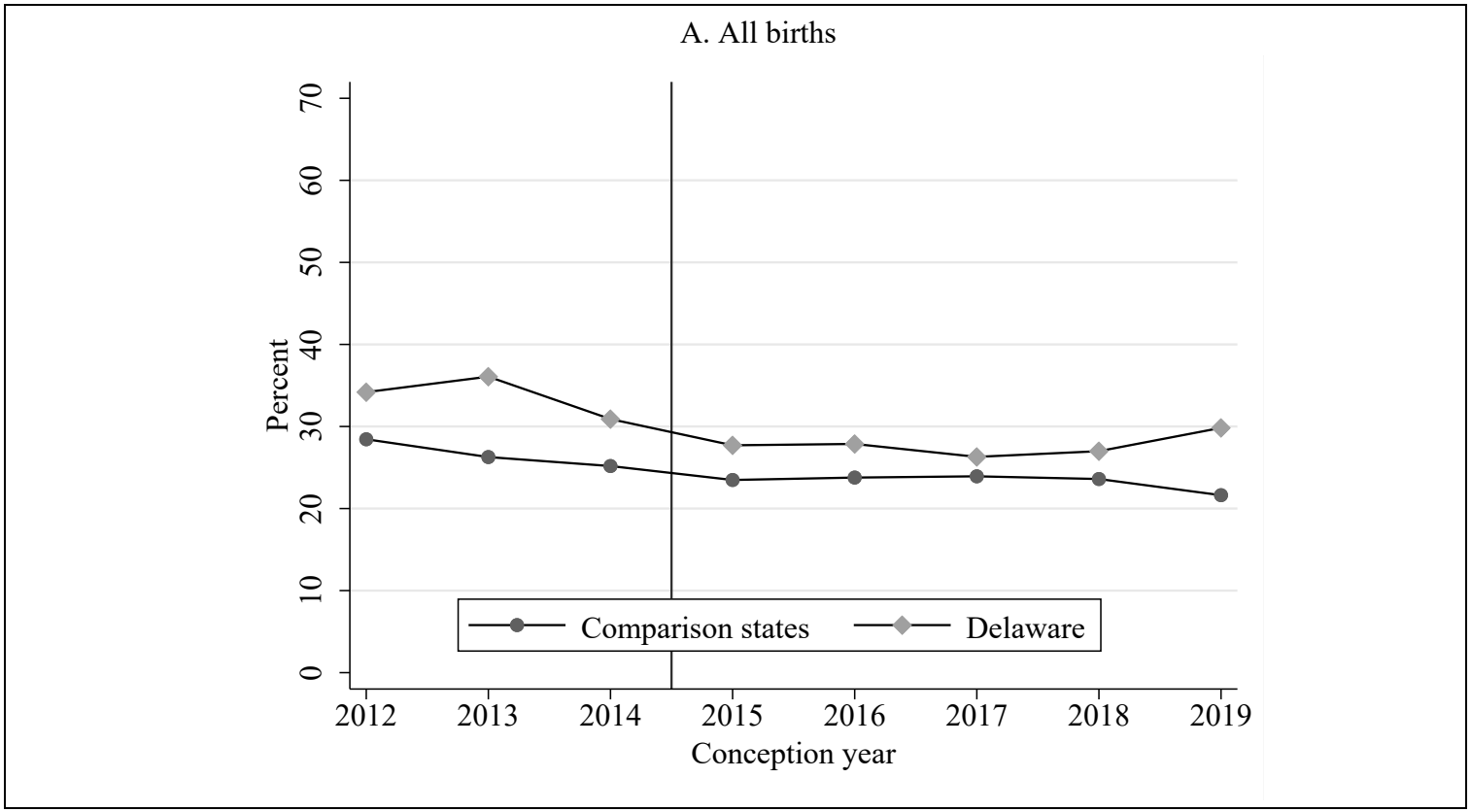
	All births			Non-Medicaid births			Medicaid births		
	Est.	Robust SE	Permutation P-Value	Est.	Robust SE	Permutation P-Value	Est.	Robust SE	Permutation P-Value
Basic Outcomes									
Difference-in-Difference Estimate	2.00	0.012	0.17	2.60	0.015	0.17	4.40	0.017	<0.001
Pre-DelCAN Delaware mean percentage planned birth	46.1			62.4			27.2		
Residualized Outcomes									
Difference-in-Difference Estimate	4.20	0.012	<0.001	-0.40	0.015	1.00	8.10	0.017	<0.001

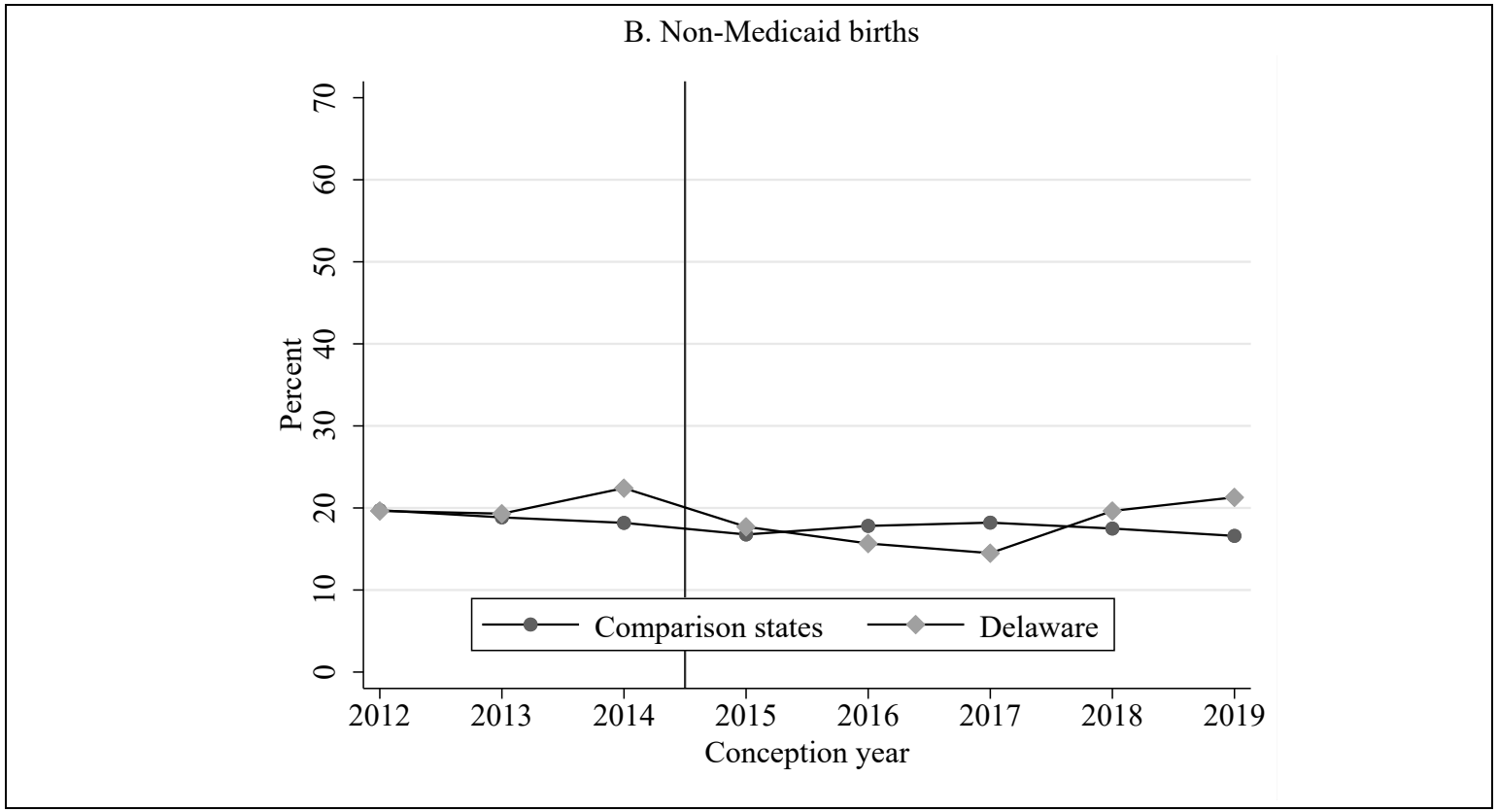
Source: 2007-2020 PRAMS.

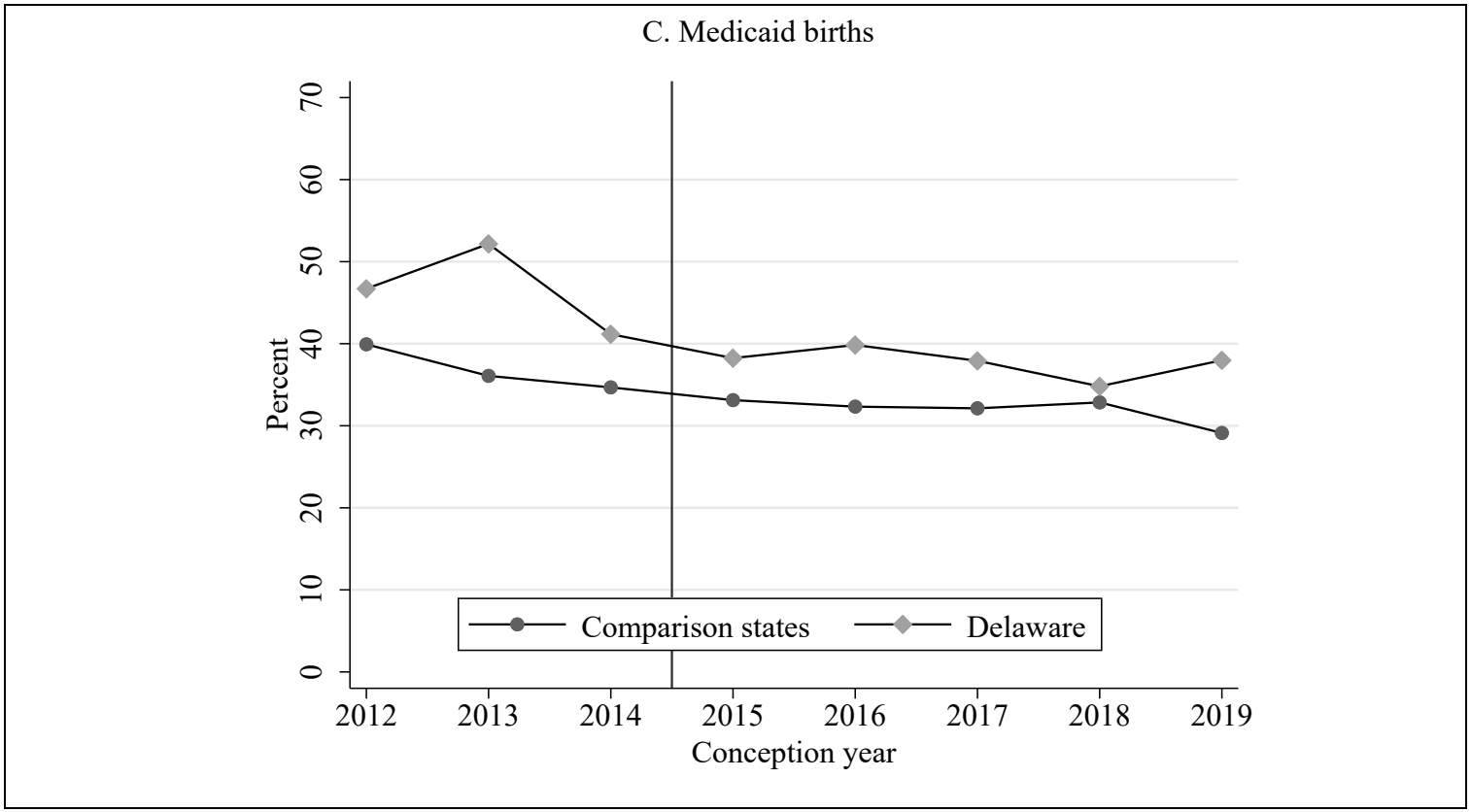
Notes: Weighted estimates. Basic Outcomes estimation uses observed values. Residualized Outcomes estimation removes the group specific pre-period mean and linear trend. Permutation p-values are the share of permutations in which the absolute value of the difference-in-differences coefficient exceeds the one observed for Delaware.

Number of observations: all births = 93,174; non-Medicaid births = 53,293; Medicaid births= 39,881.

Figure 1: Unintended Birth Percent by Conception Year, All births and by Medicaid status. 2012-2019.

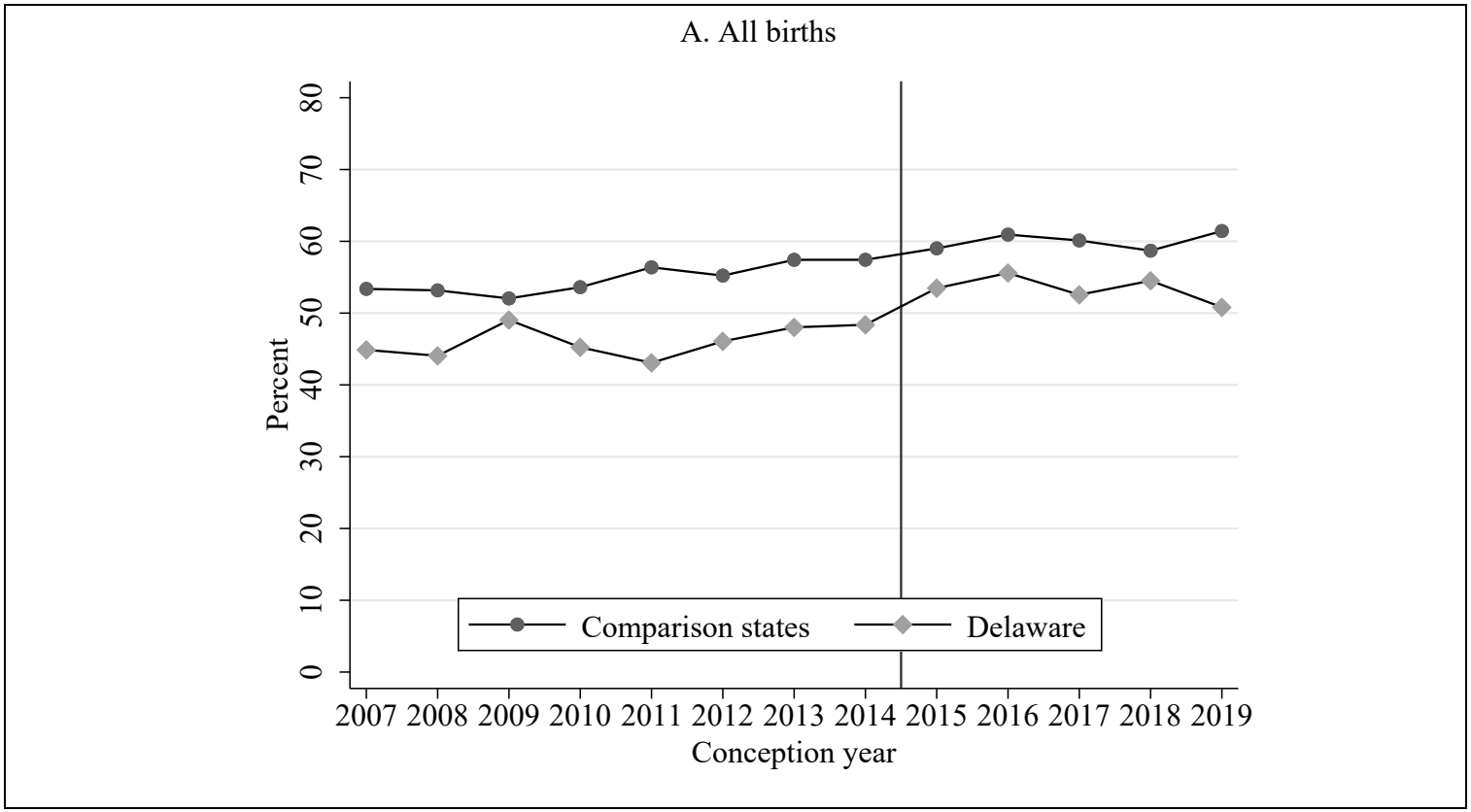


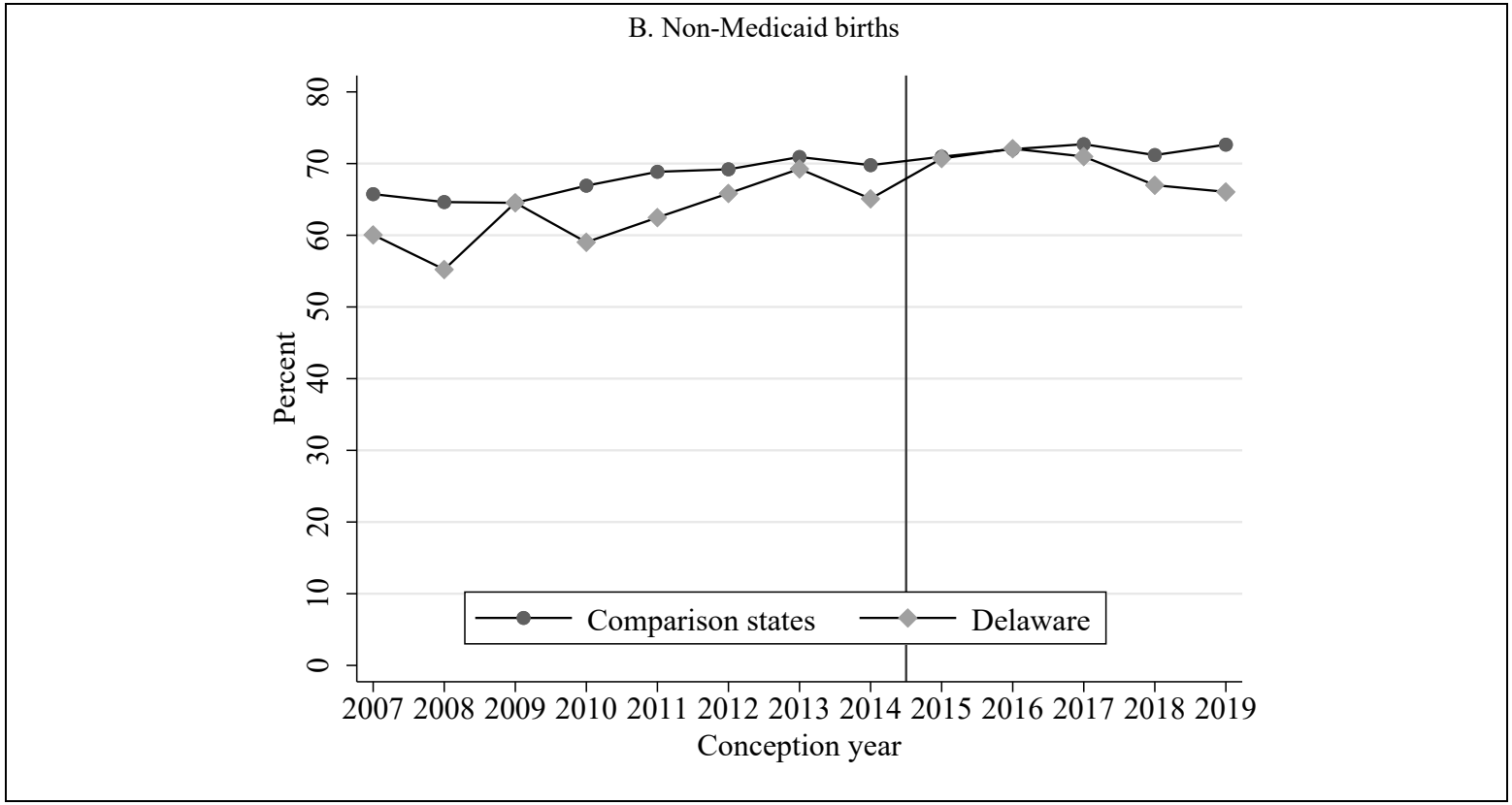

B. Non-Medicaid births
Percent
0
10
20
30
40
50
60
70
2012
2013
2014
2015
2016
2017
2018
2019
Conception year
Comparison states
Delaware

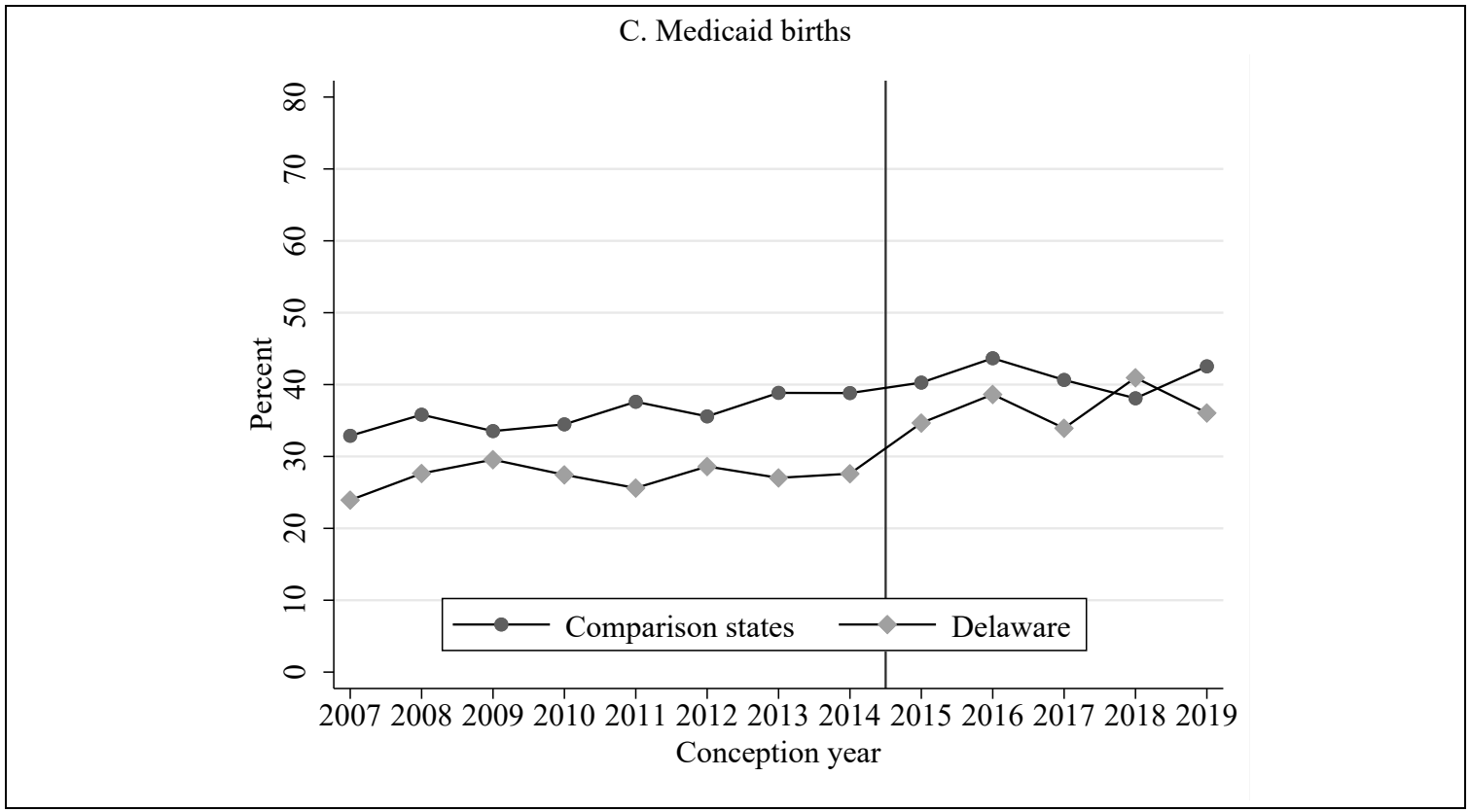


Source: 2012-2020 PRAMS. Comparison states are AK, IL, ME, MD, MA, MO, NJ, NM, NYC, PA, UT, VT, WA, WI and WY.
Notes: Weighted. Number of observations: all births = 133,392; non-Medicaid births = 72,853, Medicaid births = 60,539.

Figure 2: Planned Births Percentage by Conception Year, All births and by Medicaid status. 2007-2019.




B. Non-Medicaid births
Percent
0
10
20
30
40
50
60
70
80
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Conception year
Comparison states
Delaware

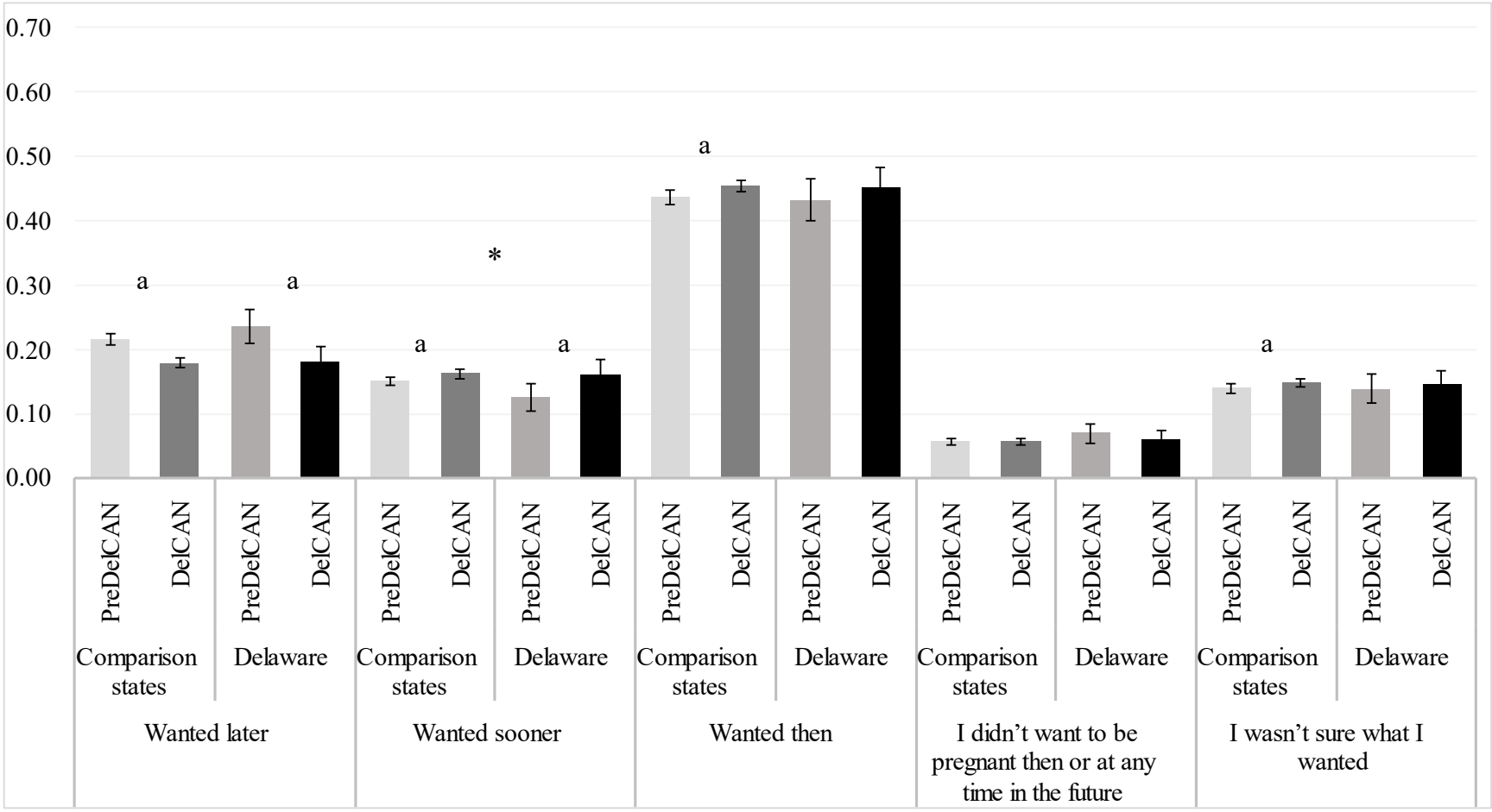


Source: 2007-2020 PRAMS. Comparison states are IL, ME, MA, NJ, PA and WA.

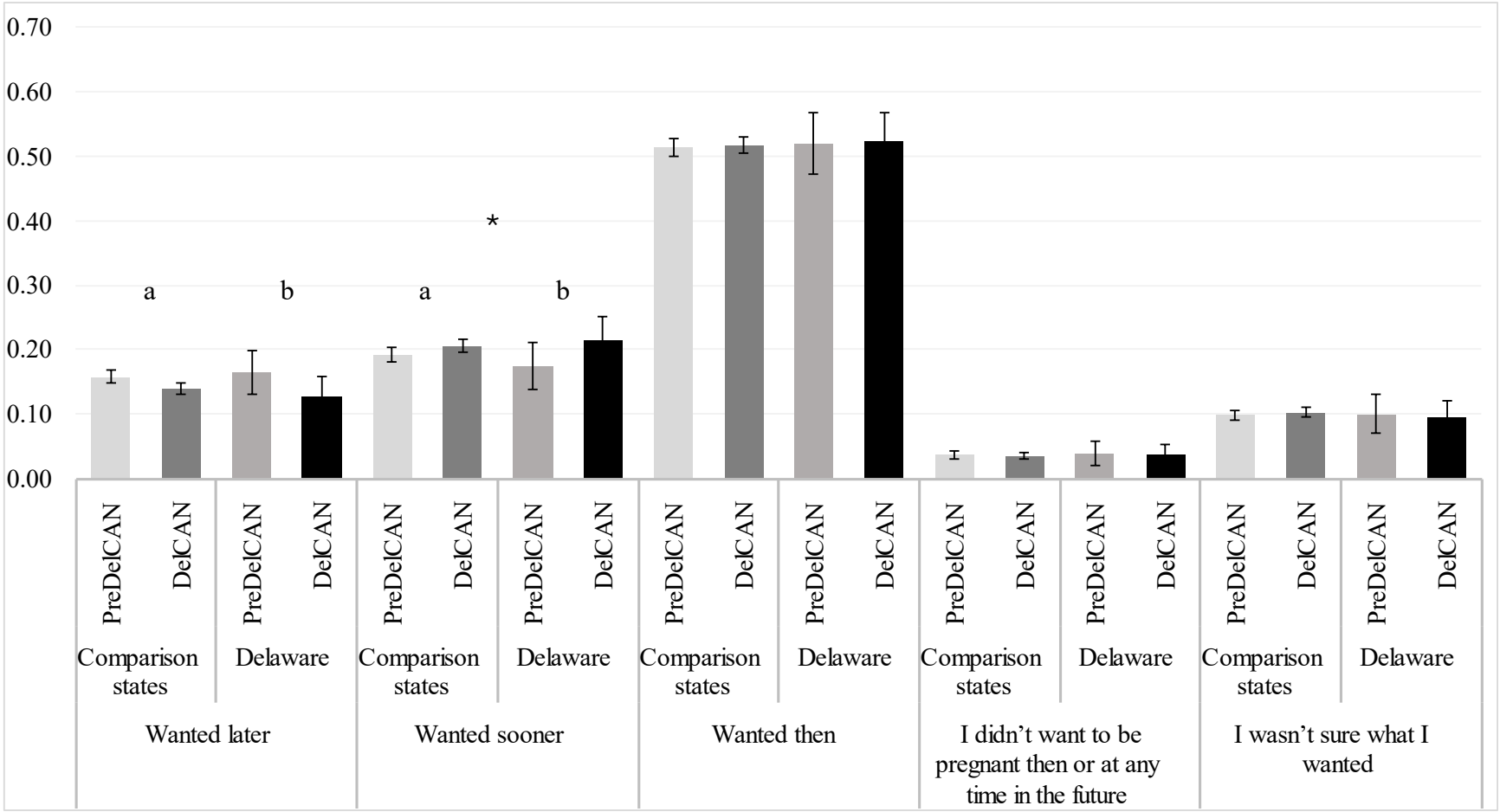
Notes: Weighted. Number of observations: all births = 93,174; non-Medicaid births = 53,293; Medicaid births= 39,881.

Figure 3. Pregnancy intentions: Average predicted probabilities for pre-DelCAN or DelCAN years, Delaware and Comparison states.

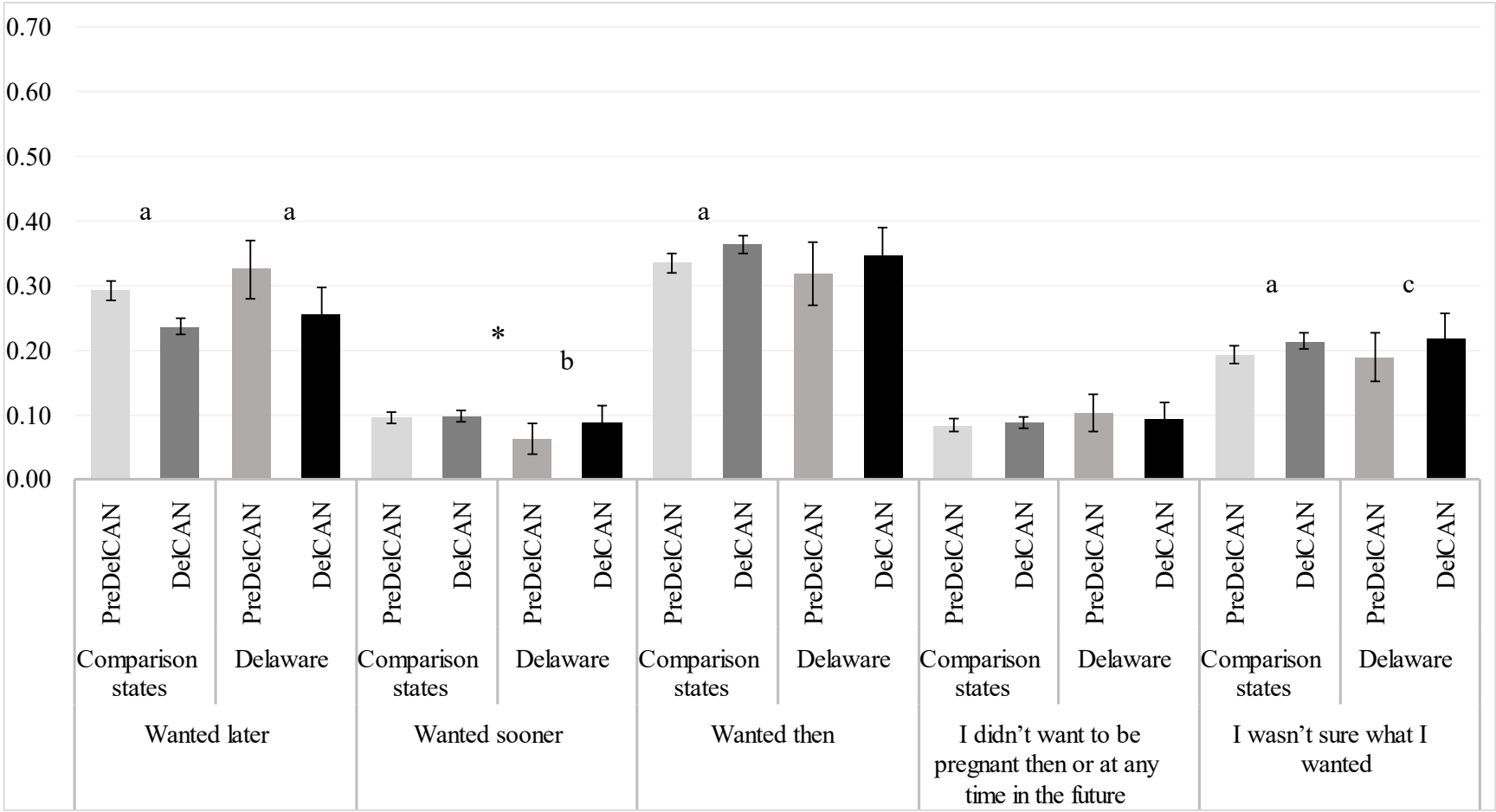
A. All Births (unweighted N=144,867).



B. Non-Medicaid births (unweighted N=78,138).



C. Medicaid births (unweighted N=66,729).



Source: 2012-2020 PRAMS. Comparison states are AK, IL, ME, MD, MA, MO, NJ, NM, NYC, PA, UT, WA, WI and WY.

Notes: 'pre-DelCAN' =years 2012-2015, 'DelCAN'= years 2016-2020.

Weighted estimates. Models include Delaware, DelCAN-period, Delaware x DelCAN-period, race/ethnicity, education, marital status, pregnant, parity, single delivery, number of months after the birth, and mother's age. Model for 'all births' includes Medicaid birth.

a $p \leq 0.001$; b $p \leq 0.01$; c $p \leq 0.05$..

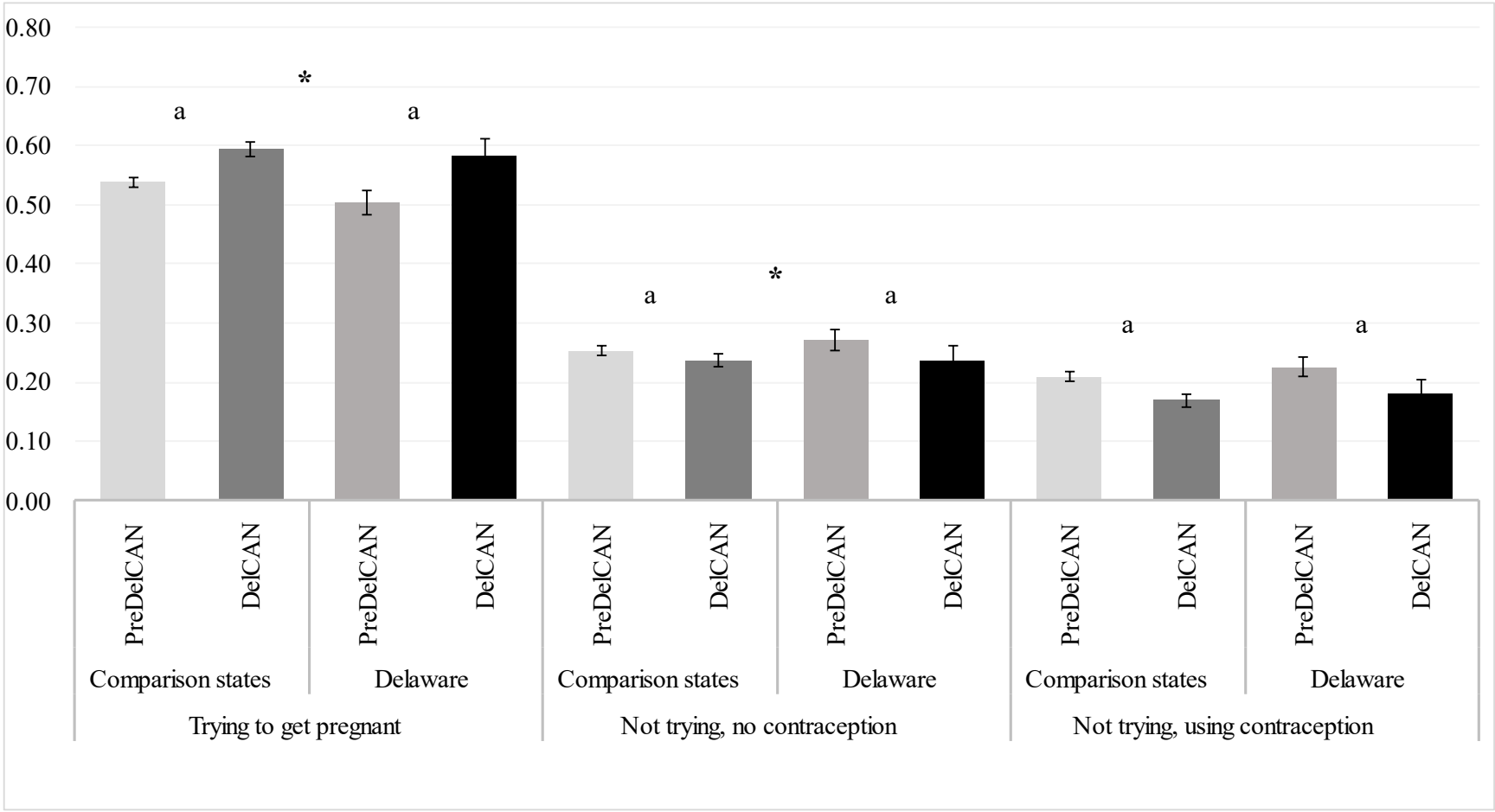
a, b, c = difference between pre and post DelCAN years.

* $p \leq 0.05$

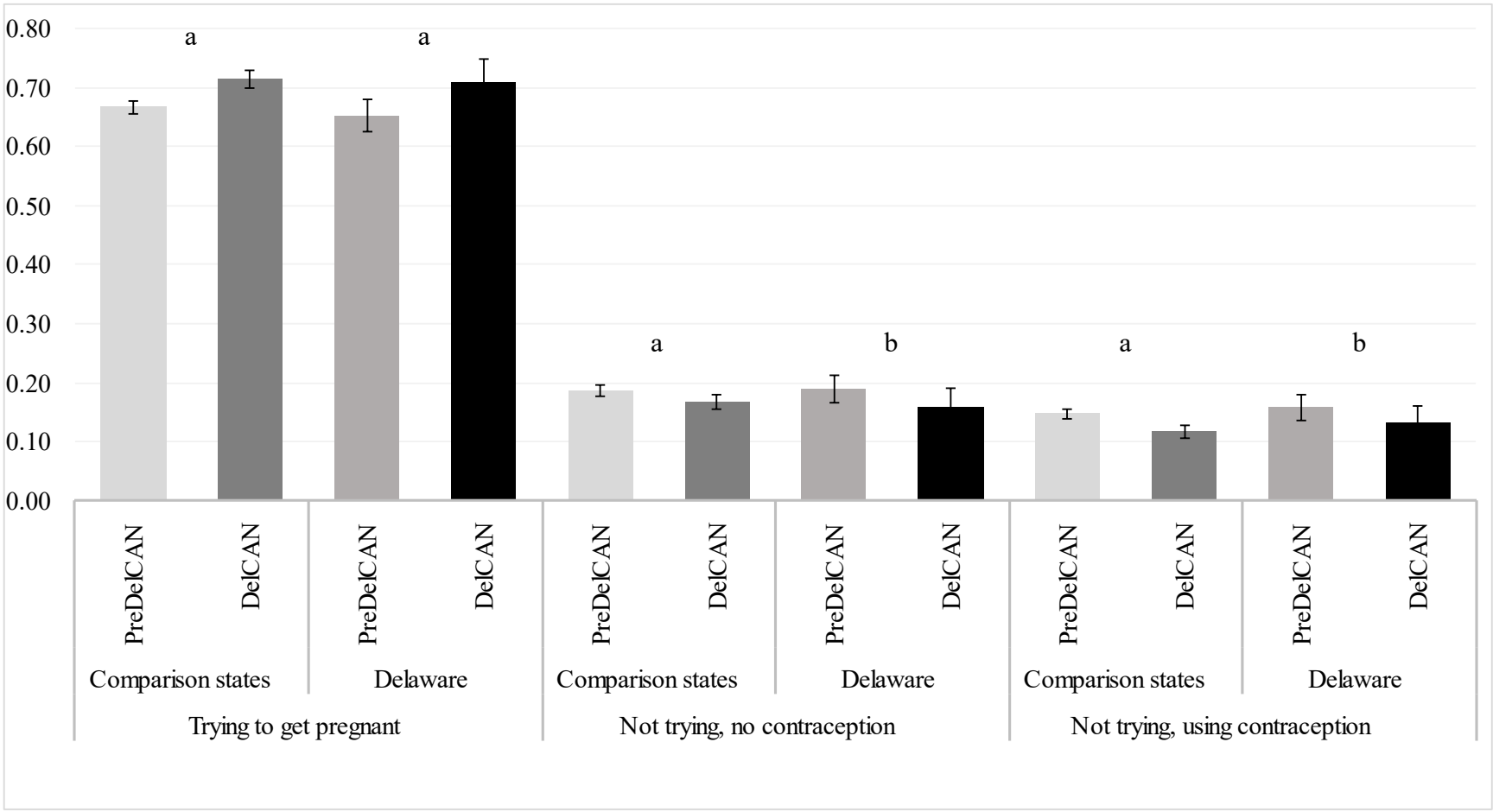
* = difference-in-difference between pre-DelCAN to DelCAN change in Delaware and pre-DelCAN to DelCAN change in Comparison states.

Figure 4. Birth Planning: Average predicted probabilities for pre-DelCAN or DelCAN years, Delaware and Comparison states.

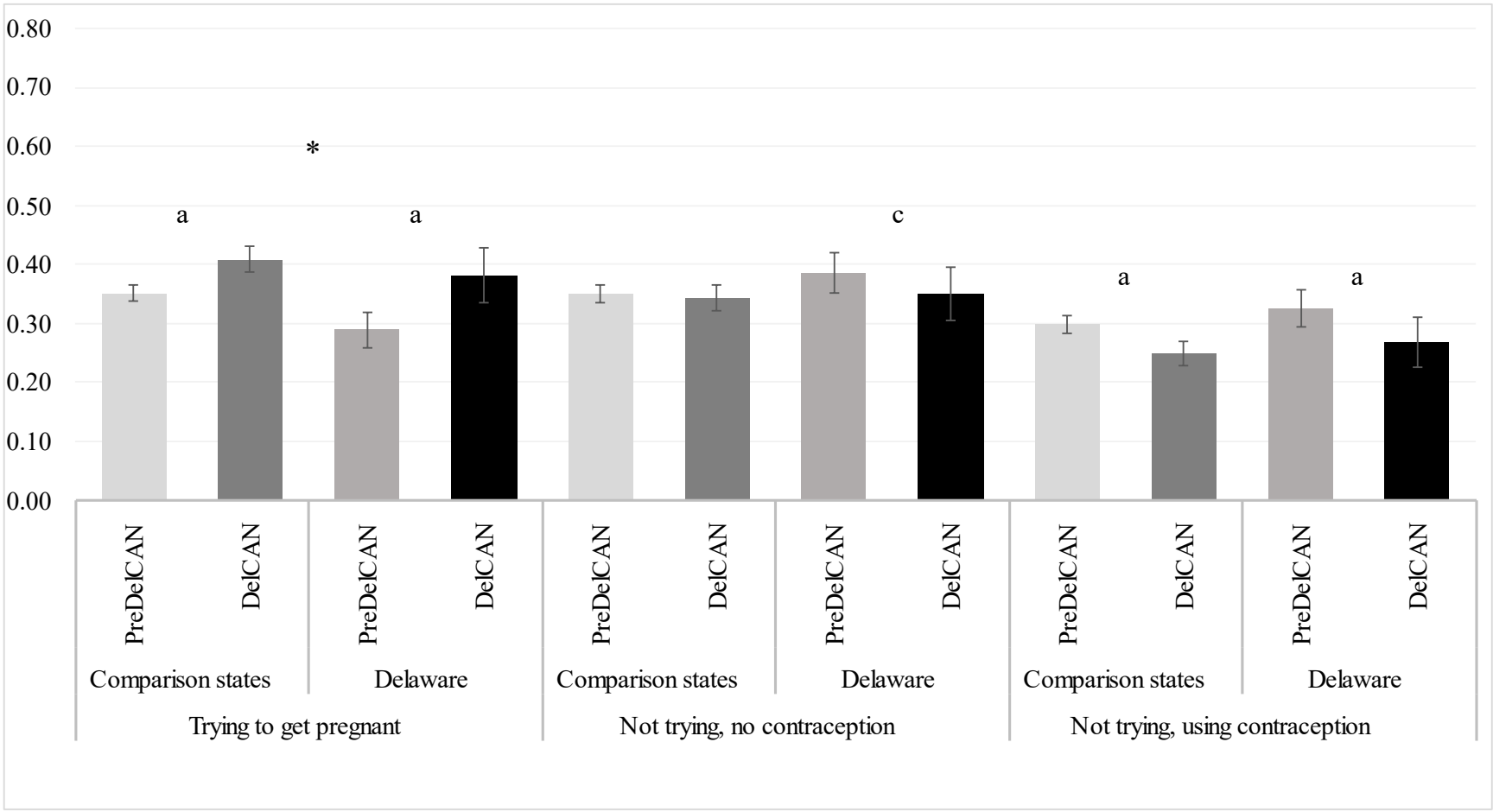
A. All births (unweighted N=109,971).



B. Non-Medicaid births (unweighted N= 62,318).



C. Medicaid births (unweighted N= 47,653).



Source: 2007-2020 PRAMS. Comparison states are IL, ME, MA, NJ, PA and WA.

Notes: 'pre-DelCAN' = years 2007-2015, 'DelCAN'= years 2016-2020.

Weighted estimates. Models include Delaware, DelCAN-period, Delaware x DelCAN-period, race/ethnicity, education, marital status, pregnant, parity, single delivery, number of months after the birth, and mother's age. Model for 'All births' includes Medicaid birth.

a $p \leq 0.001$; b $p \leq 0.01$; c $p \leq 0.05$.

a, b, c = difference between pre and post DelCAN years.

* $p \leq 0.05$.

* = difference-in-difference between pre-DelCAN to DelCAN change in Delaware and pre-DelCAN to DelCAN change in Comparison states.